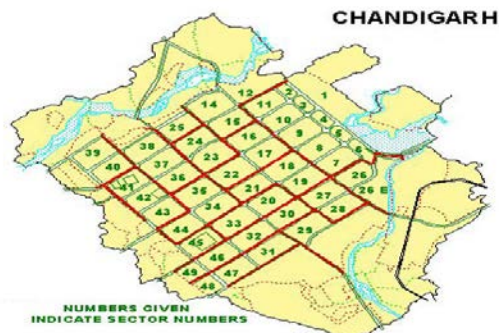

24X7 POWER FOR ALL

A JOINT INITIATIVE OF GOVERNMENT OF INDIA AND UT OF CHANDIGARH



AUGUST 2016



सत्यमेव जयते

Government of India



Piyush Goyal

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

Foreword

Electricity consumption is one of the most important indicators and tool to achieve rapid economic growth and socio-economic development that decides the development level of a nation. The Government of India is committed to improve 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.

Chandigarh is uniquely placed among the Union Territories of India as being state capital to two of the most developed states of the country – Punjab & Haryana and also, the first planned city of the country with high class infrastructure facilities already in place. Having no issues like providing connectivity to all House-holds, etc. the Union Territory should now usher into era of upgrading to smart distribution practices and providing affordable and quality power to its consumers. Re-looking into power purchase costs and transforming its infrastructure into a world class model in terms of monitoring and rapid fault neutralization etc. should be taken as its future targets.

This joint initiative of Government of India and Administration of Chandigarh aims to enhance the satisfaction levels of the consumers and improve the quality of life of people through 24x7 power supply at affordable cost. This would lead to rapid economic development of the Union Territory in primary, secondary & tertiary sectors resulting in inclusive development.

I compliment the Administration of Chandigarh and wish them all the best for implementation of this programme. The Government of India will complement the efforts of Administration of Chandigarh in bringing uninterrupted quality power to all households, industries, commercial businesses, public needs & any other electricity consuming entities and adequate power to agriculture as per the Union Territories policy.



Union Territory of Chandigarh



Prof. Kaptan Singh Solanki

Administrator- UT of Chandigarh

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. The availability of reliable, quality and affordable power can ensure growth of all sectors of economy including commercial, industrial and others.

Chandigarh can boast the legacy of quality infrastructure and well informed citizens. Union Territory does not have issues like unconnected population, poor financial health and agricultural load variation, and thus enjoys a natural leading status.

The state is committed to capitalize on this lead and leverage this advantage to showcase a modern and world class electricity distribution setup which could in turn serve as a model for states/Union Territories to follow in future.

It is at this juncture that “**24x7 Power for all**” programme plays 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 Administration of Chandigarh, I would like to thank Government of India, Hon’ble Prime Minister and Hon’ble Minister of Power for implementation of this programme.



सत्यमेव जयते

Government of India

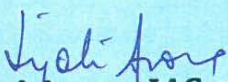


Union Territory of Chandigarh

Joint Statement

The Union Territory of Chandigarh is committed to provide quality life to people of state. Electricity supply serves as an important means to achieve this. The programme of "24x7 power for all" is an important step in this direction and this programme will be implemented by Union Territory of Chandigarh with the objective to connect the unconnected in phased manner by FY 2018-19 to ensure supply of quality, reliable and affordable power to all category of consumers on 24x7x365 basis.

Union Territory of Chandigarh would ensure that all the necessary steps outlined in the PFA document are taken up in terms of capacity addition, power procurement, strengthening the required transmission and distribution network, encouraging renewable, demand side management & energy efficiency measures, 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 state government schemes.


Jyoti Arora, IAS
Joint Secretary
Minister of Power (GoI)

Government of India (GoI) would supplement the efforts of Union Territory of Chandigarh by fast tracking resolution of key issues pertaining to generation, expediting the additional interstate connectivity and ensuring optimum allocations in various distribution schemes, as per the provisions of applicable policies.

Union Territory of Chandigarh would endeavour to implement the programme within the targeted time frame of FY 2018-19 or even earlier than the targeted date.

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

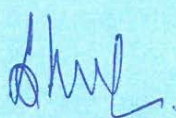

Sarvjit Singh, IAS
Secretary (Engineering & Finance),
Union Territory, Chandigarh.

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POWER MAP OF CHANDIGARH



EXECUTIVE SUMMARY

24x7 Power for All (24x7 PFA) is a Joint initiative of Government of India (GoI) and State Governments/Union Territories (UTs) with the objective to ensure availability of 24x7 power supply to all households, industries, commercial businesses, public needs & any other electricity consuming entities and adequate supply to agriculture consumers as per their policies by FY 2018-19.

This roadmap document aims to meet the above objectives for the UT of Chandigarh. Chandigarh is a Union Territory in the northern part of the country and is also the capital of the States of Punjab and Haryana. Electricity Department of UT of Chandigarh is the distribution licensee for distribution of electricity in the UT of Chandigarh. Electricity Department of Chandigarh is already providing 24 Hrs power supply to all consumers in the UT and there is also no un-electrified household in the UT. The per capita consumption of power in Chandigarh was 1394 unit in FY 2014-15 which was higher than the National average of 1010 units observed during the same year.

SUPPLY SCENARIO AND DEMAND GROWTH

The UT of Chandigarh does not have any generation capacity of its own and most of the power / energy requirement is being met from the allocation of central generating stations. The energy and peak demand is well managed in the UT of Chandigarh as there is no shortage observed in peaking or energy requirement from last many years.

The annual energy demand of the UT has been estimated to grow from level of 1734 MU in FY 2014-15 to 2328 MU by FY 2018-19 with prevailing rate of demand growth. During the same period the peak demand is likely to increase from 395 MW in FY 2014-15 to 473 MW by FY 2018-19.

SUPPLY ADEQUACY

The available capacity for the UT of Chandigarh as on 31st March 2015 was 339.67 MW from Central generating stations and IPPs. In order to meet the estimated increased demand for providing 24x7 power supply in the UT, the UT

has already planned additional capacity availability of 157.27 MW by FY 2018-19 through allocations from central generating stations, purchases from IPPs and through renewable energy sources in a phased manner. Out of the additional capacity availability, 39.00 MW is proposed to be added through non-conventional energy sources (Solar) and balance 118.27 MW through conventional sources till 2018-19.

It is to be noted that after consideration of PFA – 24 x 7 requirements, UT of Chandigarh would be in peak power deficit in the range of 22 % to 38 % during the period FY 2015-16 to FY 2018-19. However, in terms of energy, the UT will face deficit of about 6.06% and 10.98% in FY 2015-16 and FY 2016-17 respectively but would be surplus for years FY 2017-18 & FY 2018-19 to the tune of 8.62 % and 4.02 % respectively. As the UT's share of generation capacity is heavily dependent on hydro sources (about 60% to 74%), the surplus energy scenario may change slightly on year to year basis depending upon monsoon scenario of the country.

As the UT is expected to be an energy surplus during the period FY 2017 – 18 to FY 2018-19, it is required to firm up plan for banking of surplus energy with other states having different seasonal load pattern. However, UT is required to procure power to meet the shortage in peak by effectively planning through comprehensive power procurement initiatives on short term basis and look for procurement of power either through competitive bidding or through other sources.

The peak power & energy requirement of the UT may also be effectively reduced through proper implementation of DSM & energy efficiency measures in the UT.

ADEQUACY OF TRANSMISSION NETWORK

The UT of Chandigarh is receiving power from 400/220 KV Nalagarh S/S of Power Grid Corporation of India Limited (PGCIL), from Mohali S/S of Punjab State Transmission Corporation Limited (PSTCL) and from Dhulkote S/S of BBMB.



The existing receiving capacity at 220/66 KV level is 525 MVA. The existing 220 KV and 66 KV system of UT of Chandigarh is well planned and existing system capacity is just meeting the present power requirement.

UT has already undertaken/ planned a number of transmission works for further strengthening & augmenting the capacity and to ensure better connectivity of Chandigarh Grid with National Grid for meeting the projected power demand of Chandigarh by FY 2018-19 for 24x7 power for all in the UT. For meeting the projected load in UT, PGCIL is constructing a new 220/66 KV, 2x160 MVA S/S at Chandigarh under regional Plan which shall increase the capacity at 220 KV level to 845 MVA by FY 2018-19. Keeping in view the power evacuation of about 473 MW by FY 2018-19 at 220 kV and 66 KV level within the Union Territory, the capacity addition plan as envisaged which would be adequate to meet the projected power demand of 473 MW by FY 2018-19.

ADEQUACY OF DISTRIBUTION NETWORK

The Local Distribution of electricity in Chandigarh was taken over by the Chandigarh Administration from the PSEB on 2nd May, 1967. Chandigarh Electricity Department is responsible for Transmission and Distribution of power supply in the UT and is already supplying 24 hrs. supply to all consumers in the UT. The Electricity Department is presently serving about 2 Lakh consumers, out of which about 86.5% consumers are domestic consumers.

UT of Chandigarh has 100% metering & billing efficiency and the present AT&C losses in the UT is 15.37% (including 3% intrastate transmission losses). It is expected that the AT&C losses in the UT would be reduced to 13.82% (including 3% intrastate transmission losses) by 2018-19.

The Ministry of power had decided that the smaller States/UT's shall share the Data Centre and Data recovery centre with the neighboring States. However, due to operational and financial difficulties in sharing of the Data Centre and Data Recovery Centre with Punjab /Haryana, the implementing agency could not be finalized. As such, the RAPDRP part-A (IT) project in Chandigarh was not awarded within the timeline of 5 years, the RAPDRP projects for UT of Chandigarh have been cancelled by MOP. Recently, Chandigarh Electricity department has submitted the DPR of Rs. 201.58 Crores under IPDS for augmentation of distribution system in the city. A Smart Grid pilot project is also proposed to be taken up in some identified Divisions of UT at an Estimated cost of Rs. 49.52 Crores covering about 29,000 consumer. After studying the results of pilot, the same would be replicated in whole city in a phased manner.

Keeping in view the existing & proposed capacities at sub-transmission and distribution level, the distribution system in UT of Chandigarh would be adequate to meet the projected load of the UT by FY 2018-19.

FINANCIAL POSITION

As the total power supply responsibility in the UT is solely with the Electricity Department of UT Administration of Chandigarh (a deemed licensee under section-14 of the Electricity Act 2003), no separate financial accounts for electricity business are prepared. It is seen that at present, the financial position of Electricity Department of Chandigarh is at par with no profit no loss. However based on tariff orders of FY 2015-16, the financial viability scenario has been worked out and it is expected that tariff hikes in the range of 1.5% to 4.5% would be required to mitigate the expected losses and achieving turn around by FY 2018-19. The true up for FY 2011-12 to FY 2014-15 is under consideration which may impact the tariff hike in the subsequent years.



Access to electricity on 24x7 basis for all its citizens means much more than merely an act of infrastructure development to any nation as this has direct co-relation with the socio economic development of the nation. Thus this issue has acquired significant dominance on the national as well as States/UT agenda. Endeavour to perk-up the growth in electricity consumption to stand in pace with global benchmark, 24x7 power for all program is to be taken up with top most priority in the country. The UT of Chandigarh has attained full connectivity in past. Therefore, in the specific context of Chandigarh, this initiative can be reinterpreted as targeting supply of reliable, quality and affordable power to all consumers of Chandigarh.

Under the Indian Constitution, electricity is a concurrent subject and distribution of electricity falls under the purview of the respective State Govt. / UT.

As per Electricity Act 2003, it is the duty of a distribution licensee to develop and maintain an efficient, co-ordinated and economical distribution system in his area of supply and to supply electricity in accordance with the provisions contained in the Act. The respective State/Joint Electricity Regulatory Commissions have to specify and enforce standards with respect to quality, continuity and reliability of service by licensees. Accordingly, Joint Electricity Regulatory Commission (JERC for UTs and Goa) has notified the Standards of Performance specifying maximum allowable time for restoration of supply due to forced breakdowns and Supply Code specifying the supply voltages & frequency etc, to be followed by licensees. JERC also monitors the performance of distribution licensees on the basis of notified Performance of Standards.

OBJECTIVES OF THE 24X7 POWER FOR ALL – JOINT INITIATIVE

To supplement the efforts of UT of Chandigarh, Government of India and Administration of UT have taken a joint initiative to provide 24 X 7 reliable power in the UT to all consumers. This

initiative aims at ensuring uninterrupted supply of quality power to existing consumers and providing access to electricity to all unconnected/upcoming consumers by FY 2018-19.

The initiative of 24x7 Power supply to all encompasses mainly the following:

- i. To provide reliable & quality 24X7 power supply to the existing consumers within a period of three years from the date of commencement of the programme.
- ii. To ensure adequate tie ups for power from various sources at affordable price to meet the projected increase in power demand for future in a cost effective manner.
- iii. To strengthen the Transmission and Distribution network to cater to the expected growth in demand of existing as well as forthcoming consumers.
- iv. Monitoring the timely commissioning of various transmission and distribution infrastructure to meet the expected growth in demand.
- v. To put in place a strategy to ensure reduction of AT&C losses for the UT and methodology and steps required to be taken at every level of distribution.
- vi. Overall Power Supply Improvement – To be achieved by undertaking measures such as having more PPAs and banking arrangements.
- vii. To take financial measures including investment rollout plans and undertaking analysis to assess the impact of 24x7 PFA investments on Licensee's finances.
- viii. To introduce modern technologies to monitor reliable supply like sub-station automation, providing adequate communication infrastructure, GIS, Reliability, Centralised Network Analysis and Planning tools, SAP driven ERP systems, DMS (Distribution Management Systems), OMS (Outage Management System), etc.



- ix. To take essential measures for meeting the performance standards as described by JERC (State of Goa and UTs).

An action plan would be drawn to achieve the above aims and objectives. The plan will be executed by the UT of Chandigarh with the support of Government of India, wherever necessary, as per their approved plans, schemes and policies. This joint initiative of Government of India and Administration of Chandigarh aims to enhance the satisfaction levels of consumers, improve the quality of life of people, and increase the economic activities resulting into inclusive development of the UT.

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

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

- 1) Projecting the annual energy requirement by aggregating the requirement of all consumer categories and applying an appropriate load factor.

The CAGR has been considered based on the past trends as specified in Business Plan for MYT Control Period: FY 2016-17 to FY 2018-19 prepared by Chandigarh Electricity Department (CED) under the following classification:

- Domestic consumers
- Commercial
- Large Supply
- Small Power
- Medium Supply
- Agriculture
- Public lighting
- Bulk Supply
- Others-Temporary Supply

- 2) This is added up to arrive at the projected annual energy requirement (MUs) for UT of Chandigarh as a whole.
- 3) Prepare a broad plan to meet/manage power demand in future through import/export arrangements.
- 4) Assess the financial implications on utilities for procuring additional energy to meet the energy requirement of all segments of consumers. Assess the adequacy of the network - both inter-state and intra-state transmission as well as distribution so as to meet the projected power requirement of all consumer categories of the UT.
- 5) Conduct sensitivity analysis on various parameters namely tariff and AT&C loss reduction, etc. in order to assess the impact thereof on viability.

Set monitorable 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 CHANDIGARH



Chandigarh, with a geographical spread of only 114 km² is placed at 33rd position in terms of area and at 29th position by population (as per census 2011) with total population of 1.05 Millions in the country.

Chandigarh is a Union Territory in the northern part of India and is also the capital of the States of Punjab and Haryana. This city is governed by the Union Government and is not part of either States. It stands in first position in the country in the Human Development Index & is also counted amongst the “Wealthiest Town” of India. The Rock Garden in Chandigarh founded by Shri Nek Chand is very famous for sculptures made by waste materials.

Chandigarh being a UT with negligible rural areas and agricultural activities, the thrust on energy front in Chandigarh is mainly to have uninterrupted power supply and to take care of increasing power demand owing to growth of population and also commercial activities.

Union Territory of Chandigarh came into existence on 01/11/1966 after re-organization of erstwhile State of Punjab. After its formation,

the Local Distribution of electricity was taken over by the Chandigarh Administration from the PSEB which is now responsible for Transmission and Distribution of power supply. This UT does not have its own generating capacity and the power demand is being met through allocation from central generating Stations. It receives 40% of its power through Mohali (PSEB), about 9% through Dhulkote (BBMB) and remaining 51% through Nalagarh (PGCIL).

The Electricity Operation Circle is headed by Superintending Engineer along with four Executive Engineers with the employees strength of approx. 1014 nos. The Chandigarh Electricity Department (CED) is not yet corporatized.

The brief profile of the UT is as follows:

Table-2.1

Brief Profile of Chandigarh

Sl. No.	Description	
1.	Area (Sq. Km.)	114
2.	Population (Persons as per 2011 census)	1054686
3.	Per Capita income at current prices-FY 2013-14 (in Rs.)	15695
4.	UT GDP growth rate (FY 2013-14)	5.60%
5.	Per Capita Electricity Consumption (kWh) in FY 2014-15	1394

*Ministry of Informatics & Programme Implementation, PIB

**Other source is Wikipedia & UT data.



The power supply scenario in UT of Chandigarh is well managed and there is no peak shortage and energy shortage from last many years except 6% & 12% energy shortages in last two years. The Power Supply Scenario in Chandigarh (as per UT data) from the FY 2009-10 to FY 2014-15 has been shown as here under:

As Chandigarh does not have any generating capacity, the energy and peak requirements of

the UT is met through allocation from Central generating Stations, short term purchases and UI. It also has banking arrangement with Jammu & Kashmir for 30 MW. Thus, Chandigarh has been successfully able to meet the peaking demand as well as energy demand of the UT every year.

Table-3.1

Power Supply Scenario

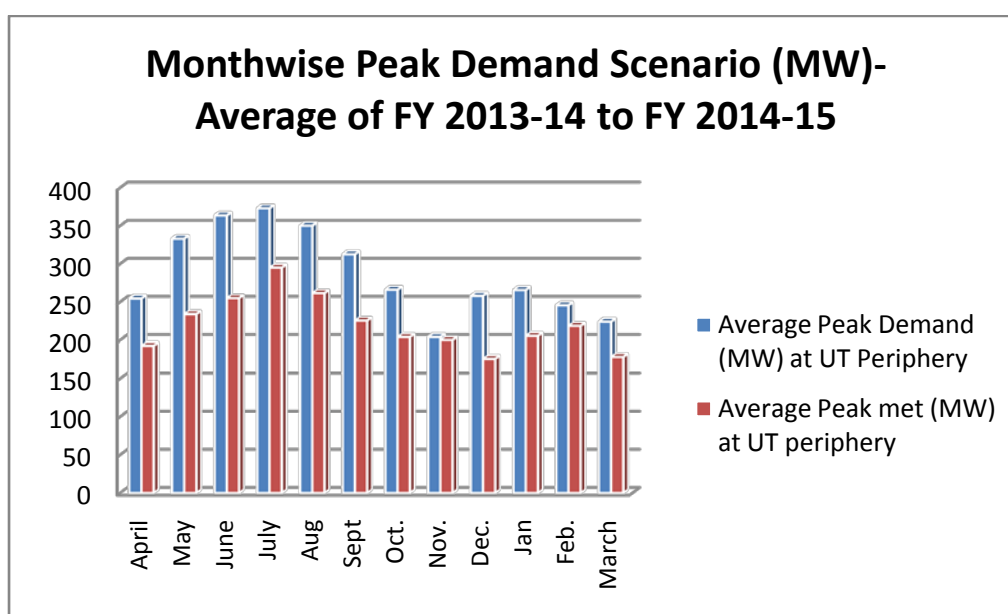
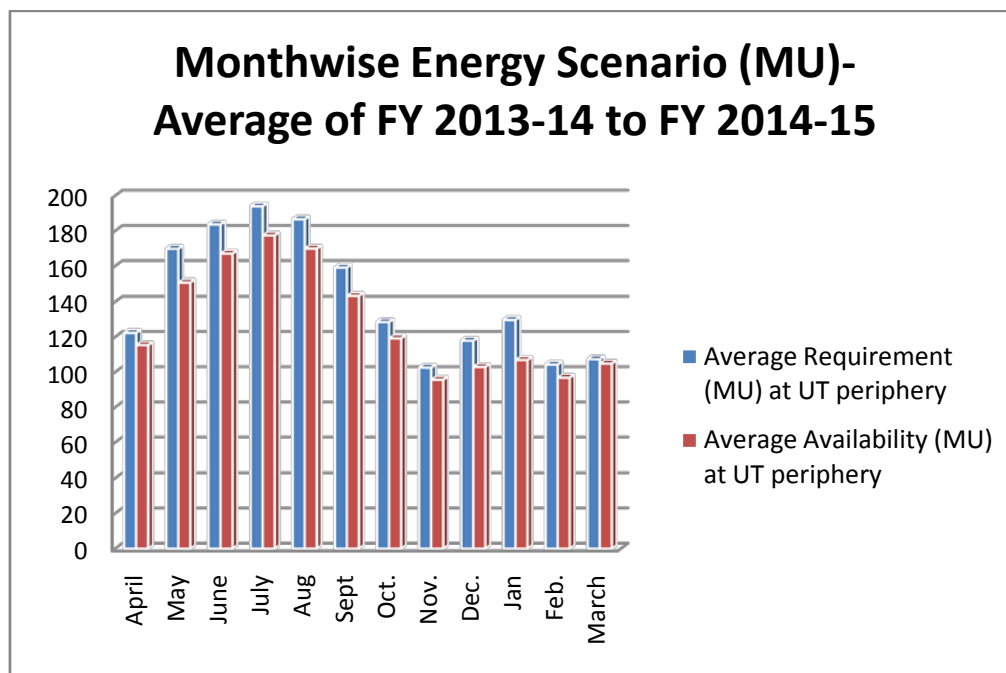
Period/Items	Unit	FY 2009-10	FY 2010-11	FY 2011-12	FY 2012-13	FY 2013-14	FY 2014-15
Peak Demand at UT periphery	MW	298	323	315	363	353	395
Peak Met	MW	298	323	315	363	353	395
- Met through PPAs and Short Term Tenders arrangement (MW)	MW	205	235	225	263	243	250
- Met through Bilateral Arrangement from J&K (MW)	MW	30	30	30	30	30	30
- Met through UI/Power Exchange (MW) etc	MW	63	58	60	70	80	115
Peak Deficit (-)/ Surplus (+)	MW	0	0	0	0	0	0
Peak Deficit (-)/ Surplus (+)	%	0.00	0.00	0.00	0.00	0.00	0.00
Energy Requirement at UT periphery	MU	1507	1588	1685	1738	1676	1734
Energy Availability at UT periphery	MU	1507	1588	1685	1738	1575	1525
Energy Deficit (-)/Surplus (+)	MU	0	0	0	0	-100	-210
Energy Deficit (-)/Surplus (+)	%	0.00	0.00	0.00	0.00	-6%	-12.1%

Source: UT Power Department.

It may be seen that the energy shortage and peaking shortage in the UT has been met through PPAs, Bilateral Arrangement from J&K and UI/Power exchange etc. In order to have an insight of typical seasonal demand availability pattern of Chandigarh, month wise demand availability scenario has also been analyzed. The

demand surge during the months of May to September and its subsequent decline in rest of the months of year based on average figures for FY 2013-14 to FY 2014-15 has been graphically represented as hereunder:

Month-wise load pattern- Chandigarh



It can be visualized from the above that during months of May to September, the demand remains very high, which is met through UI/ power exchanges.

Per Capita consumption (consumption of Units/ Year)

Based on the data available, the per capita consumption of power in the UT of Chandigarh was 1394 units/ year during FY 2014-15 which

was higher than the National average of 1010 units/ year during the year 2014-15

DEMAND PROJECTIONS

The base year for the purpose of beginning the future assessment has been considered as year FY 2014-15 which has an aggregated requirement of energy of 1.7 Billion Units (BU) and peak demand of 395 MW at UT periphery.



Demand Estimation Methodology

The electricity department of Chandigarh (CED) is responsible for supply of uninterrupted & quality power to all categories of consumers in the UT. It procures power from Central Sector

Generating Stations (CSGS) in Northern Region to meet its energy demand. It also purchases short term power to meet the peak shortages and also manages the O&M of the infrastructure for providing uninterrupted power in the UT

The household status of UT is shown as follows:

Table-3.2

Sl. No.	Particulars	Census 2001	Census 2011	Difference	CAGR	Total H/H by 2015 as per CAGR	Total H/H by 2015 as per UT
1	Total Households	201878	235061	33183	1.53%	250715	187687*
2	Rural Households	21302	6785	-14517	-10.81%	0	0
3	Urban Households	180576	228276	47700	2.37%	250715	187687

* The anomaly in figures has been re-discussed with UT. The number of House-holds as 187687 has been reconfirmed by UT as per their records and thus the same has been considered for demand projection purpose.

Table-3.3

Sl. No.	Particulars	Units	FY 2014-15	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19
1	Annual domestic energy consumption	MU	719.63*	791.59	870.75	957.83	1053.6
2	Number of Households	Nos.	187687**	192135	196689	201350	206122
3	Daily consumption per H/H	kWh.	10.50	11.29	12.13	13.03	14.00

* As per Business Plan.

** State Data.

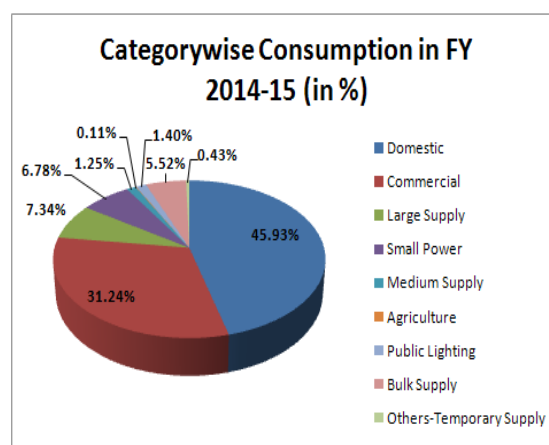
As per Chandigarh data, the average daily per household consumption for UT works out as 10.5 units.

Since Chandigarh region has attained a matured level of urbanization with almost nil rural population, it is assumed that normal growth rates (CAGR's) based on past trends would be representative.

For the purpose of estimation, power consumers have been broadly classified into the following segments and their individual growth trend has been worked out:

- Domestic consumers
- Commercial
- Large Supply
- Small Power
- Medium Supply
- Agriculture
- Public lighting
- Bulk Supply
- Others-Temporary Supply

The consumption profile of various segments in Chandigarh is shown as follows:



As seen from above figure, that domestic consumers (45.93%) and commercial consumers (31.24%) share major chunk of total consumption in the UT.



The category wise growth in consumers from FY 2007-08 to FY 2014-15 is furnished in Annexure-I.

Projection for Annual energy requirement

For the purpose of demand calculation, the category wise CAGRs in year-on-year basis has been considered as per the “**Business Plan for MYT Control Period: FY 2016-17 to FY 2018-19**” prepared by CED. As per the above mentioned classification demand of consumers aggregated to arrive at the projected annual energy requirement (MUs) for Chandigarh UT as a whole.

Looking at the past trend, increase in consumption is envisaged in domestic and commercial categories being 10% and 5%

respectively. On the other hand, there has been stagnation or declination in industrial sector due to land constraints in Chandigarh.

The summary of energy calculation at consumer level and the UT periphery is summarized in the subsequent Para.

Annual energy requirement at UT periphery & Peak Demand

The table below shows projected energy requirement at the UT periphery considering Distribution and intra UT transmission losses for the years FY 2015-16 to FY 2018-19 and Peak demand is arrived at by using average load factor of 56.22% derived from UT data for previous years from FY 2009-10 to FY 2014-15.

Table-3.4

Annual energy requirement at UT periphery & Peak Demand

Sl. No.	Description/Year	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19
a.	Energy requirement as per demand projections	1665	1772	1888	2014
b.	Distribution Losses (%)	12.37%	11.86%	11.34%	10.82%
c.	Intra-state transmission losses (%)	3.00%	3.00%	3.00%	3.00%
d.	Energy requirement at UT periphery	1959	2072	2195	2328
e.	Peak Demand Calculated (MW) at Average load factor of 56.22%	398	421	446	473

The detailed calculation of category-wise demand projections for FY 2015-16 to FY 2018-19 is given in Annexure-II.

Consequent upon projections made above, the energy requirement at consumers end is estimated as 2.014 BU which corresponds to 2.328 BU at UT periphery for all categories of consumers after accounting for losses by 2018-19. The consequent maximum demand requirement of the UT is projected to increase from 398 MW in FY 2015-16 to 473 MW by FY 2018-19. For projecting the UT demand, average load factor has been calculated from average of actual data for last 6 years.

As per projections made in 18th EPS of CEA, the projected energy demand and peak load for the UT of Chandigarh is 2.414 BU and 475

MW in FY 2018-19 as against the now calculated energy demand of 2.328 BU (-3.77%) and peak load of 473 MW (-0.42%) in FY 2018- 19.

The adoption of various energy efficiency measures like energy efficient lighting (use of LEDs), adopting other demand side management initiatives like introduction of Time of Day (TOD) tariff etc., or by adopting accelerated AT & C loss reduction targets would also help in containing the demand growth increasing in view of 24x7 PFA initiatives.

However, an assessment of the adequacy of Transmission and Distribution infrastructure has been made in the subsequent chapters to meet the projected demand of 473 MW of the UT and the same are covered in the subsequent chapters.



Study of generation plan will ensure adequate capacity addition planning & tie ups for power from various sources at affordable price to meet the projected increase in power demand for future. The generation plan includes:

- Existing Generation / Tie ups
- Future Generation Plans / Tie ups
- Year-wise capacity addition plan from renewable source (separately for Solar, waste to energy etc.) and Tie ups
- Generation capacity/tie ups required to meet Peak Demand.
- Power procurement costs – Firm allocation and unallocated share.
- Action plan of the UT
- Fund Requirements.
- GoI/ Chandigarh Administration Interventions

Existing Generation Capacity / Availability of Power (As on 31.03.15)

The UT of Chandigarh does not have any generation capacity of its own excluding roof top solar PVs. Most of the power / energy requirement are met from the allocation of central generating stations and through necessary tie ups.

Total availability of power for UT of Chandigarh as on 31.03.2015 was 339.67 MW. Out of total available power, 70.73 % is from Hydro, 12.42 % is from Coal based Thermal, 7.49% is from Gas Based Thermal, 7.79% is from nuclear and balance 1.57% is from Renewable Energy Sources.

In terms of ownership, the share of Central Sector Allocation is largest i.e. 98.43 % and the share of IPP Sector is 1.57% (including Renewable Energy Scheme). The details of existing generating capacity available for the UT of Chandigarh are shown in Table-4.1 below:

Table-4.1

Existing Generation Capacity / Availability of Power (As on 31.03.15)

Ownership/ Sector	Mode-wise Breakup (MW)							Grand Total (MW)
	Thermal				Nuclear	Hydro	RES (MNRE)	
	Coal	Gas	Diesel	Total				
State	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Private/ IPPs	0.00	0.00	0.00	0.00	0.00	0.00	5.32	5.32
Central	42.19	25.45	0.00	67.64	26.45	240.26	0.00	334.35
Total :	42.19	25.45	0.00	67.64	26.45	240.26	5.32	339.67

Future plan for augmentation of generation capacity / availability of power:

As per generation plan, UT of Chandigarh has already tied up for supply of additional capacity of around 118.27MW by FY 2018-19 (allocation from Central Sector and IPP Projects) through conventional energy sources. In addition, 39MW, through non-conventional energy sources is also tied up.

As such the total available capacity by FY 2018 – 19 is expected to be 496.94MW (452.62MW – conventional and 44.32MW – Renewable).

Year wise Summary of Generation Capacity / Availability of Power, upto FY 2018-19 is indicated in Table-4.2 below :

Table -4.2

Sl. No.	Particulars	Year wise Existing & Likely Capacity to be added (MW)-Cumulative				
		As on March 2015	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19
A.	State Sector					
a.	Thermal	0.00	0.00	0.00	0.00	0.00
b.	Hydro	0.00	0.00	0.00	0.00	0.00
c.	RES (MNRE)	0.00	0.00	0.00	0.00	0.00
B.	Private/PPPs					
a.	Thermal	0.00	0.00	0.00	0.00	0.00
b.	Hydro	0.00	0.00	0.00	0.00	0.00
c.	RES (MNRE)	5.32	6.32	18.32	30.32	44.32
C.	Central Generating Station (CGS)					
a.	Thermal	67.64	67.64	67.64	129.16	129.16
b.	Hydro	240.26	280.26	280.26	297.01	297.01
c.	RES (MNRE)	0.00	0.00	0.00	0.00	0.00
d.	Nuclear	26.45	26.45	26.45	26.45	26.45
	Total :	339.67	380.67	392.67	482.94	496.94

Break up & details of capacities likely to be added year wise is indicated in Annexure- III.

Peaking & Energy Availability to Meet Peak & Energy Demand

Year wise peaking power availability has been worked out based on the peaking availability & auxiliary power consumption norms of each plant as per National Electricity Plan (Vol.-I) for 12th five year Plan. However for solar power plant, 8% peaking availability has been considered for estimation of Peak demand.

Similarly the energy availability in each year has also been worked out based on the PLF & auxiliary power consumption norms of each plant as per National Electricity Plan and as per the information provided by the UT of Chandigarh. The availability of peaking capacity and energy availability have been worked out up to FY 2018-19 and shown in Table-4.3 below:

Table-4.3

Sl. No.	Particulars		FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19
1	Total Capacity (MW)		380.67	392.67	482.94	496.94
2	Estimated Peak Availability at UT Periphery (MW)		303.34	304.30	365.21	366.32
3	Estimated Energy Availability at UT Periphery	Energy from all sources (MU)	1,847.11	1,867.06	2,402.18	2,425.47
		Energy from Renewable sources(MU) (included above)	10.51	30.46	50.41	73.69

Based on the deliberation in the previous text, the scenario in the Union Territory emerges as shown in the Table-4.4a below.

It could be seen from Table-4.4a that the peak demand of UT of Chandigarh would be about 473 MW by FY 2018-19 considering the additional power requirement for providing 24x7 power supply to the UT. The expected energy requirement at UT periphery for FY 2015-16 is about 1959MU which is likely to increase to 2328 MU by FY 2018-19. It is also observed from Table-4.4a that the UT will have a deficit in the range of 22% to 38 % in terms of

Peak demand during the period of study (i.e. from FY 2015-16 to FY 2018-19). In terms of energy, the UT will face deficit of about 6.06% and 10.98% in FY 2015-16 and FY 2016-17 respectively. However the situation on energy front is expected to improve during FY 2017-18 and FY 2018-19 when the UT is likely to have surplus energy to the tune of 8.62% and 4.02% respectively. Therefore, the UT of Chandigarh will remain peak power deficit territory during the entire study period.



Table-4.4a

Sl. No.	Power Supply Position	Unit	Year wise Figures			
			FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19
1	Estimated Peak Requirement	MW	398.00	421.00	446.00	473.00
2	Estimated Availability of Peak/ Maximum Demand as per Generation Plan of UT	MW	303.34	304.30	365.21	366.32
3	Peak Surplus (+)/Deficit(-)	MW	(-)94.66	(-)116.70	(-)80.79	(-)106.68
4	Surplus(+)/Deficit(-)	%	(-)31.21	(-)38.35	(-)22.12	(-)29.12
5	Estimated Energy Requirement at UT Periphery	MU	1959.00	2072.00	2195.00	2328.00
6	Estimated Energy Availability at UT Periphery as per Generation Plan of UT	MU	1847.11	1867.06	2402.18	2425.47
7	Energy Surplus (+)/ Deficit(-)	MU	(-)111.89	(-)204.94	(+)207.18	(+)97.47
8	Energy Surplus (+)/ Deficit(-)	%	(-)6.06	(-)10.98	(+)8.62	(+)4.02

Further as the UT is heavily dependent on hydro source (about 60%-74% during the study period), the above scenario may change slightly on year to year basis depending upon monsoon scenario in the country. In poor monsoon years the availability of energy from Hydro Power Plants is also likely to be poor.

In order to mitigate the above situation, UT of Chandigarh would have to effectively plan through comprehensive power procurement initiatives on short term basis and look for procurement of power either through competitive bidding or through other sources. Further, the peak power & energy requirement of the Union Territory can also be effectively reduced through proper implementation of DSM & energy efficiency measures.

In addition, Chandigarh Administration also has an arrangement for getting additional power during summer seasons through banking of

power with J&K having different seasonal load pattern.

In view of the above scenario, UT of Chandigarh should plan in the following manner

- Request GOI for allocation of additional firm power from upcoming central generating station to overcome the deficit.
- Unallocated share / Comprehensive power procurement on short term basis shall be carried out to meet the remaining deficit in peak availability of power.
- To meet up with the shortages of power , the delegation of power be sanctioned to the Administrator UT Chandigarh upto Rs. 100 Crore to purchase short term power as per the guidelines circulated by MoP.

The generation mix for UT of Chandigarh as per the proposed generation plan is shown in Table-4.4b.

Table -4.4b**Generation Mix**

Sl. No.	Description	FY 2014-15	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19
a.	Thermal	19.91%	17.77%	17.23%	26.74%	25.99%
b.	Hydro	70.73%	73.62%	71.37%	61.50%	59.77%
c.	RES (MNRE)	1.57%	1.66%	4.67%	6.28%	8.92%
d.	Nuclear	7.79%	6.95%	6.74%	5.48%	5.32%



ACTION PLAN – Administration of UT of Chandigarh: To monitor the Central Sector & IPP projects as per following Roll out Plan given in Table-4.5:

Table -4.5

Sl. No.	Power For All (Roll Out Plan)	Year wise Addition (MW)				Total (MW)
		FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	
A.	State Sector					
a.	Thermal	0.00	0.00	0.00	0.00	0.00
b.	Hydro	0.00	0.00	0.00	0.00	0.00
c.	RES (MNRE)	0.00	0.00	0.00	0.00	0.00
B.	Private Sector					
a.	Thermal	0.00	0.00	0.00	0.00	0.00
b.	Hydro	0.00	0.00	0.00	0.00	0.00
c.	RES (MNRE)	1.00	12.00	12.00	14.00	39.00
C.	Central Generating Station					
a.	Thermal	0.00	0.00	61.52	0.00	61.52
b.	Hydro	40.00	0.00	16.75	0.00	56.75
c.	RES (MNRE)	0.00	0.00	0.00	0.00	0.00
d.	Nuclear	0.00	0.00	0.00	0.00	0.00
	Total	41.00	12.00	90.27	14.00	157.27

The UT of Chandigarh is required:

- To firm up and implement plan to reduce the peak demand and energy demand through demand side management and by adopting energy efficiency measures.
- From the month wise load pattern shown in Chapter 3.0 based on FY 2013-14 & FY 2014-5 data, it can be seen that during the month of May to Sept, the demand remains very high. The deficit in meeting Peak Demand and Energy Requirement is observed in each month even after power purchase through power exchange. It is also observed that the deficit is high during the month from May to Sept and Dec to Jan. The month wise projection of load pattern for the FY 2016-17 to FY 2018-19 is enclosed as Annexure-IV. From the future projection, it could be seen that the scenario is more or less going to be same as that prevailing now. In view of this, Chandigarh Electrical Department (CED) should firm up plan for purchasing power through short term tender and by banking with J&K/ Power exchange during the period of May to

September. For other months sourcing of power may be done through Power exchange / short term tender.

Power Purchase Planning

The UT of Chandigarh need to carry out power purchase planning in the following manner:

Carry out demand supply analysis in a continuous manner in order to assess the actual requirements based on projections made as per actual scenario. Accordingly, planning to be done to purchase power either through competitive bidding or request MoP for more allocation from CGS.

The UT will work towards institutionalizing and strengthening the Power Purchase Planning and Procurement Cell, which will dedicatedly work on the short / medium / long term power purchase planning and work on the procurement of power on cost effective basis.

This cell will also work on the monthly power availability from already tied up sources (on the basis of annual schedules provided by these



sources) and accordingly work out the requirement for tying up power through competitive bidding route keeping into consideration variation in availability & requirement of energy from various sources across the year.

Government of India (GOI) Intervention Required

UT of Chandigarh is dependent on allocation of Central Generating Station for its Power and energy requirements. It has signed /planning to sign many PPAs with Central generating station to meet the peak requirement (473 MW) as well

as energy requirement (2328 MU) of Chandigarh by FY 2018-19. Even after that, there is expected to be shortage in meeting peaking requirement. In view of this:

- GoI is requested for additional allocation of power from unallocated quota for UT of Chandigarh to meet the expected shortages in future.
- GOI is requested to sanction delegation of power upto Rs. 100 Crore to the Administrator UT Chandigarh for purchase of short term peak power as the guidelines issued by MoP/GoI.



CHAPTER – 5 : TRANSMISSION PLAN

The peak power demand and energy requirement of Chandigarh at UT periphery during FY 2015-16 is 398 MW and 1959 MU respectively. The above requirement in the coming years is expected to increase significantly due to various factors i.e. increased uses of various electrical appliances in domestic sector, increase in commercial activities etc. in the UT. Taking into account all the above factors and with an objective to provide 24x7 power supply to all, the expected power demand of Chandigarh by FY 2018-19 would be 473 MW with annual energy requirement of 2328 MU. To meet this growing demand, existing transmission system would be strengthened both at Inter state level as well as Intra state level with proper planning to cater to the future demand in a reliable manner. The connectivity with central grid has been shown in the Power Map of the 220 kV & 66 kV Grid Network which is attached in the report after Annexure.

Existing Inter State Transmission System (ISTS)

UT of Chandigarh is getting supply through 220 KV and 66 KV sub stations at the periphery of UT. At present, the City is receiving 40% of its

power through Mohali (PSEB), about 9% through Dhulkote (BBMB) and remaining 51% through Nalagarh.

Presently, there are about 108 ckt. Km(54 km D/C) of 220 kV EHV transmission line and 123.6 ckt km(44.8 S/C & 39.4 D/C) of 66 KV lines which are feeding three (3) numbers of Grid sub-stations with total transformation capacity of 525 MVA (500 MVA at 220 KV level and 25 MVA at 66 KV level). Power supply to the Chandigarh is being received mainly at 3 substations through the following three lines:

- a) At 220 kV Manimajra Substation through 220 kV double circuit Nalagarh-Chandigarh line from 400/220 kV Nalagarh S/S(Power Grid).
- b) At 66 kV Sector-56/52 and Sector-39 substations through 66 kV Mohali-Chandigarh line.
- c) At Sector 28(BBMB) Sub-station through 66 KV Dhulkote- Chandigarh line

The details of existing ISTS Grid sub-stations are as mentioned below:

Table-5.1

Details of existing Grid sub-station (220/66 kV)

Sl. No.	Name of GSS	Voltage Ratio	No. of Transformers	MVA capacity	Total Transformer capacity (MVA)
400/220 kV Grid substation at Nalagarh (PGCIL), 66 kV GSS Mohali (PSTCL), 66 kV Dhulkote (BBMB) are the main feeding source to Chandigarh UT					
1	Kishangarh Manimajra	220/66kV	3	3X100	300
2	PSTCL Mohali	220/66 kV	2/3 rd Share from 3 no. 100 MVA T/Fs	2/3 * 300	200
3	BBMB(Dhulkote)	220/66 kV	1* 60 MVA	Due to restricted load from BBMB Dhulkote	25
				Total (PGCIL+ PSTCL+ BBMB)	525



In order to facilitate the drawl of power by Chandigarh and to meet the projected peak load of 473 MW by FY 2018-19, inter-state transmission system (ISTS) would be required. The present transformation capacity at Manimajra 220/66 kV level is 300 MVA and 225 MVA capacity is available from PSTCL Mohali & BBMB (Dhulkote) with a total capacity 525 MVA and it is proposed to increase to 845 MVA by FY 2018-19 after implementation of 220/66 KV , 2x160 MVA ongoing scheme.

The total receiving transformation capacity of UT would increased to 845 MVA by FY 2018-19.

The ongoing transmission project are outlined below:

On-going /planned ISTS projects:

New GSS & Transmission lines

One number of new grid 220/66 kV, 2 x 160 MVA GIS Substation at UT of Chandigarh along with 220 kV D/C line from 400/220 kV Panchkula (PGCIL) substation has been approved under regional plan. PGCIL is constructing this S/S under Regional Plan and it is expected to be completed by FY 2018-19. Here it may be mentioned that commissioning of the substation with 320MVA transformation capacity would help in meeting the long term power requirement of Chandigarh. The planned 220kV D/c would be able to meet (n-1) outage criteria.

Table-5.2

NEW 220 KV GSS

Project	Voltage Level	Unit	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19
Inter-State Transmission Network	220/66 kV	No./ MVA	-	-	-	2x160 MVA

On-going Tariff Based Competitive Bidding (TBCB) Schemes:

- Presently no scheme is under implementation in this head.

Plan for evacuation of power from existing and upcoming Renewable Energy sources

The renewable energy generation of UT including UT's Micro Grid Projects & Solar Roof Top Projects would be evacuated at distribution level of 11 kV.

The year wise proposed physical plan of New Grid sub-station, augmentation & Transmission lines is as follows:

Table-5.3

Project	Voltage Level	Unit/ Substation	Existing as on March 2015 *	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19
Transmission system	220kV	No./Total MVA	3/300				
		Ckt km					
	220 kV (PGCIL)	No./Total MVA					2/320
	220 kV (ISTS-Mohali)	No./Total MVA	2/200	-	-	-	-
		Ckt km					-
	220 kV (BBMB Dhulkote)	No./Total MVA	1/25	-	-	-	-
		Ckt km					



Adequacy to meet Power Transfer requirement of the UT by FY 2018-19

The year wise peak power demand of UT, vis-a-vis transmission system available at 220 kV & 66 kV level for Chandigarh is tabulated as below:

Table- 5.4

Year	Peak Power Demand(MW)		Minimum Transformation capacity required(MVA) for 80% loading to meet full load	Minimum Transformation capacity required(MVA)* with N-1 contingency (Assuming 50% more capacity)	Transmission System existing/Planned at 220/66 kV, 66/33 kV (MVA)**	
	Addition	Total			Addition	Total
FY 2015-16	0	398	553	663	0	525
FY 2016-17	23	421	585	702	0	525
FY 2017-18	25	446	619	743	0	525
FY 2018-19	27	473	657	788	320	845

* Minimum Transformer capacity in MVA=Peak Power Demand at distribution level ((in MW/0.9)x1.5)

** Projected transmission capacity based on planning

From the above, it may be seen that presently, the feeding capacity of 525 MVA of UT of Chandigarh is barely meeting the peak load and in case, any one transformer is faulty, the UT would have to resort to load shedding as it would not be able to get the full load feed at input substations. After completion of planned 220/66 KV 2x160 MVA S/S at Chandigarh, the UT would be more comfortable to meet the expected load by FY 2018-19.

Initiatives Taken by the UT on SCADA & SUBSTATION AUTOMATION

- DPR for Substation automation with SMART GRID initiation has already been prepared for Rs. 49.52 Crores under NSGM. .
- The CED intends to develop unified load dispatch centre in UT of Chandigarh for which the matter has been taken up with M/S PGCIL who has requested to choose the option as to whether the investment is to be made by CED or the investment is to be made by PGCIL itself. However, in the recent scenario, it has been decided by the Ministry of power that the SCADA at 66 kV and above level shall be developed by M/s PGCIL and the SCADA 66 kV and below shall be developed. The matter is being taken up with the CEA as mostly all the Grid S/Stns. in the UT Chandigarh are 66 and 33 kV level.

Year wise fund requirement for development of Planned Transmission system:

As PGCIL is constructing the planned 220/66 KV, 2x160 MVA S/S under regional Plan, there would not be any expenditure on the 220 KV System by the UT. Total estimated investment for 66 KV works of about Rs 2694.11 lakhs from FY 2014-15 to FY 2018-19 has been envisaged and Details of the same are indicated in Annexure-V

Action Plan - CTU (Central Transmission Utility, PGCIL)

- Ongoing schemes (New Substation & Transmission line) might be implemented as per schedule by PGCIL for ensuring robust transmission system for UT.

Action Plan - CED (Electricity Department of Chandigarh)

- Electricity Deptt. of Chandigarh should take a decision for operationalisation of load dispatch center in UT.
- The ongoing scheme needs to be implemented as per proposed plan for ensuring 24x7 power supply in UT. Financial approval shall be expedited timely for completion of the project in time.
- UT of Chandigarh may explore the possibility for establishing a underground sub-station in consultation with PGCIL.



Chandigarh is a union territory in the northern part of India that serves as the capital of the states of Punjab and Haryana. The Local Distribution of electricity in Chandigarh was taken over by the Chandigarh Administration from the PSEB on 2nd May, 1967. Chandigarh Electricity Department is the distribution licensee in the UT and is responsible for providing quality and reliable power supply to all the consumers of UT. At present, electricity is being provided round the clock 24 Hours in the UT.

For operational purposes, the whole UT area has been divided into 4 divisions. The Electricity Operation Circle is headed by Superintending Engineer along with four Executive Engineers with the employee strength of 1014 (As of 31.03.15).

The power demand of the UT is expected to increase from 398 MW in 2014-15 to 473 MW by FY 2018-19 due to increase in demand from the present consumer base, addition of new households and more commercial activities in the UT. The objectives of this Roadmap for supplying 24X7 Power For All (PFA) to all consumers can be achieved through capacity augmentations, building redundancies in the

upstream network, adopting appropriate technologies and efficient systems for reliable & quality power for end consumers in the UT of Chandigarh.

Existing Distribution system

Presently, the distribution network of Chandigarh is consisting of 1262 Ckt Kms low tension lines, 896 Ckt Kms 11 kV lines, 28 Ckt Kms 33 kV lines and 123.6 ckt km(44.8 S/C & 39.4 D/C) of 66 KV lines with HT to LT ratio 0.71. There are 18 numbers of Power Sub-Station (consisting of 66/11kV & 33/11kV) and 1939 numbers of distribution transformers in the UT. The total installed capacity of 66/11 kV and 33/11 kV power transformers is 701 MVA, whereas, the installed capacity of 11/0.415kV distribution transformers is 608 MVA as on 31st March 2015.

The failure rate of Distribution Transformers in the UT is about 5.29% and reliability indices of 11 kV feeder is 99.9% during 2014-15.

The details of existing distribution system in FY 2014-15 are furnished below in Table-6.1.

Table-6.1

Sl. No.	DESCRIPTION	Unit	STATUS
1.	Total Length of 66 KV lines	Ckt Kms	123.6
2.	Total length of 33kV lines	Ckt Kms	28
3.	Total No. of 66/11KV & 33/11kV PSS	Nos.	18
4.	Total capacity of 66/11KV & 33/11kV PSS	MVA	701
5.	Total No. of Distribution transformers	Nos.	1939
6.	Total Capacity of Distribution transformers	MVA	608
7.	Total length of 11kV lines	Ckt Kms	896
8.	Total length of LT Lines	Ckt Kms	1262

CATEGORY WISE CONSUMER

At present, there are about 2.04 Lakhs of electricity consumers in the UT, out of which only 125 consumers are under agriculture

category. The category wise number of consumers and energy being consumed at the end of FY 2014-15 is furnished in Table below :



Table- 6.2

Sl. No.	Category of Consumer	Number	Consumption in MU
1.	Domestic	1,76,913	729.83
2.	Commercial	22,391	489.4
3.	Large supply	105	115.03
4.	Small power	1,311	106.3
5.	Medium supply	1,236	19.57
6.	Agriculture	125	1.67
6.	Public Lighting	944	21.88
7.	Misc/Bulk Supply/Traction	534	86.51
8.	Temporary supply	941	6.78
TOTAL :		2,04,500	1566.77

On Going Scheme

For augmentation of distribution system in UT to provide reliable power, Chandigarh Electricity Department is in process of implementing the following Distribution schemes of Government of India :

R-APDRP

Ministry of Power, Govt. of India, has launched the Restructured Accelerated Power Development and Reforms Program (R-APDRP) in the XIth Five Year Plan as a Central Sector Scheme to cover urban areas - towns and cities with population of more than 30,000 as per Census of 2001. Power Finance Corporation Limited (PFC) has been designated by GoI as the Nodal Agency for the program. The continuation of RAPDRP for 12th & 13th plan has been subsumed in the newly launched IPDS scheme in Dec. 2014.

The programme was divided into two (2) parts Part - A and Part - B. Part - A included projects for establishment of baseline data and IT applications like Meter Data Acquisition, Meter Reading, Billing, Collections, GIS, MIS, Energy Audit, New Connections, Disconnections, Customer Care Services, Web self-service, etc. & verification of baseline AT&C losses as well as implementation of SCADA/DMS (Supervisory Control And Data Acquisition/Distribution Management System).

Part-B of RAPDRP included regular distribution strengthening projects i.e. renovation, modernization and strengthening of 11kV lines and substations, Re-conductoring of lines at 11kV level and below, Load Bifurcation, Feeder Separation, Load Balancing, HVDS (11kV), Aerial Bunched Conductor in dense areas, replacement of electromagnetic energy meters with tamper proof electronic meters, installation of capacitor banks & mobile service centers, etc.

Status of R-APDRP projects in UT

The Ministry of power had decided that the smaller States/UT's shall share the Data Centre and Data recovery centre with the neighboring States. However, due to operational and financial difficulties in sharing of the Data Centre and Data Recovery Centre with Punjab /Haryana, the implementing agency could not be finalized. As such, the RAPDRP projects for UT of Chandigarh have been cancelled by MOP. M/s PFC vide letter no 02:10: RAPDRP (P-A): II: 2009: CED/31996 dated 03.09.2015 has informed that in the 4th Monitoring committee meeting held on dated 06.08.2015, it has been decided to cancel the sanction of RAPDRP part-A (IT) in Chandigarh as work could not be awarded to the implementation agency within 5 years timeline for completion of part -A (IT).. Hence, SCADA and Part B projects have also not been approved for UT of Chandigarh under RAPDRP.



On Going Scheme :

For augmentation of distribution system in UT to provide reliable & quality power, Chandigarh Electricity Department is in process of implementing the following

schemes for system improvement. The table shows the details of the project cost of schemes and expenditure which has already been incurred on these schemes up to FY 2014-15.

Table-6.3

Sl. No.	66 kV Ongoing Works	Original Project Cost (Rs. Lakhs)	Expenditure up to FY 2014-15
1.	Execution of 66 KV Transmission Line from T-off point to the proposed 66 KV Grid Substation in Institutional Area, Village Sarangpur, Chandigarh.	311.75	194.76
2.	Execution for 2 Nos. 66 KV Line bays at 66/11 KV Grid Substation in Institutional Area, Village Sarangpur, U.T., Chandigarh	117.75	17.66
3.	Providing 2x20MVA 66/11KV Grid Sub-Station in the Institutional Area of Village Sarangpur in UT of Chandigarh.	989.01	948.0
4.	Providing 2x20MVA, 66/11KV Grid Sub-Station at Raipur Kalan	974.15	895.97
5.	Up-gradation of Transformation Capacity at 66/11 KV S/ Stn. by replacing existing 2X12.5 MVA with 2 X 20 MVA T/F, 66/11 KV T/F and shifting and re- installation of 2X12.5 MVA T/S at existing 66/11 KV S/Stn. at Civil Sectt. Sec. 1 and Sec.12. Chandigarh	712.1	656.81
6.	Up-gradation of existing 33 KV Grid Sub Station to 66 KV voltage level by providing 1 X 30 MVA, 66/11 KV power transformer alongwith associated transmission line Sec. 34-C Chandigarh	722.11	626.74
7.	Prov. New 66/11 KV 16/20 MVA Power Transformer on existing bay at 66Kv/11KV Grid S/Stn. Sector-47, Chandigarh.	302.47	220.47
8.	Providing 11KV automatic capacitor bank at various existing 66KV Grid S/Stn., in Chandigarh.	979.65	901.31
9.	Conversion of existing 66 kV S/C Transmission Line and Underground Cable from 220 kV Substation, Kishangarh to Sector-12, Chandigarh to D/C Transmission Line.	737.11	200
Total :		5846.10	4461.72

Proposed Distribution Works for 24x7 Power for All

To provide 24x7 quality & reliable power to the consumers in the UT, Chandigarh Electricity Department have formulated a plan for augmentation of distribution system in urban areas. The estimated cost of proposed works 201.58 Crores for the UT . The works of 66KV system, System Strengthening,, establishment of new PSS, augmentation of existing PSS, new 66 & 11 kV lines, LT lines & metering are proposed to be implemented in the UT by FY 2018-19. The fund requirement is given in table-6.4.

Table- 6.4**The Fund Requirement for the Urban****(In Rs Cr.)**

Sl. No.	Name of Scheme/ Project	Fund Requirement
1.	Urban Areas	201.58 Crores
	Total Distribution	201.58 Crores

The details of the works are given at Table- 6.9

Integrated Power Development Scheme (IPDS)

The Central Government has launched "Integrated Power Development Scheme" (IPDS) on 3rd December, 2014 for urban area for:

- Strengthening of sub-transmission and distribution networks in the urban areas.



- (ii) Metering of distribution transformer/ feeders/ consumers in the urban areas.
- (iii) IT enablement of distribution sector and strengthening of distribution network for completion of the targets laid down under R-APDRP for 12th and 13th Plans by carrying forward the approved outlay of R-APDRP to IPDS.

The components at (i) and (ii) above will have an estimated outlay of Rs. 32,612 crores including a budgetary support of Rs. 25,354 crores from Government of India during the entire implementation period.

The scheme of R-APDRP as approved by CCEA for continuation in 12th and 13th Plans has been subsumed in this scheme as a separate component relating to IT enablement of distribution sector and strengthening of distribution network [component (iii) above] for which CCEA has already approved the scheme cost of Rs. 44,011 crores including a budgetary support of Rs. 22,727 crores. This outlay will be carried forward to the new scheme of IPDS in addition to the outlay indicated above. PFC is the nodal agency for the operationalization of IPDS in the country.

Under IPDS, Govt. of Chandigarh has the requirement with an estimated cost of 201.58 Crores consisting of new 66KV works 85.54 Crores, 66KV Transmission line 19.57 crores & System Strengting works 96.47 crores. The summary of items & bill of quantities for IPDS for Chandigarh is at Annexure-VI.

The final amount under IPDS for UT of Chandigarh would be sanctioned by Monitoring Committee and in case, whole amount was not sanctioned, the balance amount of the proposed works would have to be arranged by UT itself.

REDUCTION IN AT&C LOSSES

The projected AT & C losses of UT are summarized below :

Table-6.5

AT & C Losses Trajectory

Year	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19
Distribution losses	12.37	11.86	11.34	10.82
Intrastate Transmission losses	3.00	3.00	3.00	3.00

Schemes Being Undertaken For Reduction of AT & C Losses

Smart Grid Pilot Project

A Smart Grid pilot project is proposed to be undertaken by Electricity Department of UT in the identified division. . Under DPR, smart grid pilot is proposed to be undertaken in sub division no. 5 of Chandigarh ED which consists of Sector-29,31,47,48, Industrial Area Phase-I & Phase-II, Ram Darbar Phase-I and Phase-II, Village Hallomajra, Behlana, Raipur, Bairmajra, Faidan, Makhanmajra, BRD air force station..

Objectives & Scope:

The report has been prepared with following objectives:

- Propose Smart Grid technologies, which would facilitate efficient, accurate & effective online recording & monitoring of the energy exchanges in distribution system to reduce operational errors viz. reading error, bias error, typographical errors etc. caused by involvement of human element.
- Timely raising of bills.
- Empowerment of consumers to participate in the energy management process .
- Implement technologies that will help in proper monitoring of assets for extended life.
 - Efficient system operation by better load management
 - Tamper and alarms monitoring
 - Online energy audit to overcome theft problem
 - Enable high level of customer satisfaction and increased awareness
 - Planning for new electricity connections
 - Utilization of renewable resources towards sustainability & green energy benefits by net metering

Smart Meters and communication systems with AMI would be installed for 29,433 consumers under DPR and IT infrastructure consisting of Servers, MDAS, MDAM and SCADA software etc.



shall be installed in control centre for monitoring, collection of data, storage and analysis. Scope for control centre building & civil works has not been considered in this report, which have to be finalized before taking up the project.

Cost Estimate

Estimated cost of implementation of Advanced Metering Infrastructure and various Specific Activities of Smart Grid as detailed below:

Table- 6.6

Cost Estimates of Smart Grid Initiatives

Sl. No.	Particulars	Estimated Cost in Rs. Cr. In DPR
1	AMI DTMU & RTU	36.52
2	IT system	5.77
3.	Annual Maintenance Charges (for 3 years)	1.73
4.	Consumer Awareness and Capacity Building	1.00
	Subtotal (in Rs. Cr)	45.02
5	Project Management and consultancy Charges (@ 10%)	4.50
	Total (in Rs. Cr.)	49.52

Benefits & Key Performance Indicators

- Smart Grid project is being done as an initiative to embed new technologies in distribution system in small scale and successful implementation would draw the way forward for large scale implementation.
- The estimated benefit by implementing smart-grid attributes in the project area would be about Rs. 10.5 Crore per year in DPR which shows that the estimated payback period of the project would be about 4.5 years under DPR. Key Performance Indicators (KPIs) have been identified to evaluate success of Smart Grid project as below:

Table-6.7

Smart Grid Attribute	KPI	DPR	
		Present Value	Target
AMI inclusive of Net Metering	Reduction in AT&C Losses	14.64%	8%
	Manual connection/disconnection for defaulters	0.5% of total consumers per month	100%
Improvement Load Factor	Ratio of average demand and maximum demand	0.64	0.71
Distribution Transformer Monitoring Unit	Failure of DTs	25 nos. out of 402 (around 6.2 %)	100% reduction

Implementation Strategy & Way Forward

Considering the prevailing power supply scenario in Chandigarh area, it is proposed that Smart Grid technologies may be implemented for garnering benefits not only from financial aims but also for better customer relationship, their engagement in energy management process, green energy benefits and operational excellence through increased efficiency, better visualization for fast decision making, optimized work flow, reduced operational cost etc.

It is proposed to complete Smart Grid implementation in 18 months. Successful implementation of Smart grid project at this area would draw plan for implementation of similar projects in other areas of UT of Chandigarh.

Performance Monitoring Mechanism in Chandigarh Electricity Department

In order to implement appropriate reform measures and meet the objective, baseline parameters needs to be verified and established and hence it is proposed that a Third Party Audit should be carried out for establishing the baseline parameters for the KPI indicated below and thereafter following performance parameters needs to be monitored at the DISCOM Corporate level.

Table- 6.8

Benefits & Key Performance Indicators

Corporate Strategic Objectives	KPI	UOM
Sustain AT&C loss level & achieve further reduction	AT&C Losses	%
	Collection Efficiency	%
	Billing Efficiency	%
Monitoring Distribution Cost	Establishment Cost	Rs. Crores
	R&M Cost	Rs. Crores
	A&G Cost	Rs. Crores
	Power Purchase Cost	Rs./unit
Enhancing Customer Satisfaction	CSI Overall	Index
	Total Consumer Complaints/ '000 consumers	Nos.
	New initiatives to enhance customer convenience	Nos.
	Addition in regards to Payment Avenues	Nos.
	PA Compliance Index	Index
Operational Efficiency	No. of customers served /employee	Ratio
System Reliability	SAIDI	Hrs
	SAIFI	nos.
	DTR Failure Rate	%
	PADCI (Project Av. Duration Closure Index)	Months
	No of Accidents (Fatal/ Non Fatal)	Nos.

Table-6.9

Fund Requirement for Proposed Schemes

(In Rs Lakhs)

Sl. No.	Name of Scheme/ Project	FY 2014-15	FY 2016-17	FY 2017-18	FY 2018-19	Total
	66 kV New schemes					
1.	Turnkey Execution for 2 Nos. 66 KV Line bays at 66/11 KV Grid Substation in Institutional Area, Village Sarangpur, U.T., Chandigarh.	17.66	27.2	27.2	46.03	117.75
2.	Providing 1x30MVA 66/11KV additional Power TF At 66kv Grid Sub Station Sec-39 UT Chandigarh		300	222.61		522.61
3.	Replacement of 14 Nos. MOCB with SF6, Breakers at 66KV Grid Substation Sector-52 and Sector -12 UT Chandigarh		400	114		514
4.	Conversion of existing 33KV Sub Station Sector-18 to 66KV Sub Station Sector-18 by Providing GIS 2x20MVA, 66/11KV Power Transformer along with 66 kV associated 66 kV T/L with underground cable from 66 kV Sector-26 to 66 kV Sector 18		409	1364	956	2729
5.	Providing 2x20MVA, 66 / 11KV Gas Insulated Sub Station at Sector-26 UT Chandigarh along with 66 KV D/C line from 66 kV I.T park to		554	1849	1295	3698



Sl. No.	Name of Scheme/ Project	FY 2014-15	FY 2016-17	FY 2017-18	FY 2018-19	Total
	66KV Grid Sub Station Sector-26 UT Chandigarh					
6.	Turnkey execution of 66 KV Transmission Line from T-off point to the proposed 66 KV Grid Substation in Institutional Area, Village Sarangpur, Chandigarh.		250	250	250	750
7.	Conversion of existing 66 KV S/C Transmission Line and Underground Cable from 220 KV Substation, Kishangarh to Sector -12, Chandigarh to D/C Transmission Line.	200	200	337.11		737.11
	66 kV Transmission Line					
8.	Providing 66 KV Transmission Line along with associated 66 KV Grid Substation at Raipur Kalan UT of Chandigarh.		165	551	387	1103.00
9.	Providing 66 kV Transmission line with underground cable from Sector-32 Grid Sub Station to Sector 34 Grid Sub Station.		256.2	341.6	256.6	854.00
	System Strengthening Works					
10.	New 11 KV feeders-New/Bifurcation/Augmentation		500	500	795.22	1795.22
11.	Distribution Transformer-New		500	500	284.40	1284.40
12.	Capacity enhancement of LT sub-station		200	223.66		423.66
13.	LT Line : New Feeder/ Feeder Bifurcation/Augmentation/R&M		100	100	53.50	253.50
14.	Aerial Bunched Cables		300	300	339.66	939.66
15.	Under-ground cables		200	200	155.99	555.99
16.	Metering - Feeder/Boundary Point/DT/ Consumer		125.86	100	100	325.86
17.	Prepaid / smart meters in Govt. Establishment		50	50		100
18.	IT Applications-as per R-APDRP Part-A scope of work including ERP		750	750	635.57	2135.57
19.	IT Applications-Customer Care Services		500	500	219.40	1219.40
20.	National Optical Fiber Network (NOFN)		50	50		100.00
	Total Distribution Estimates	217.66	5837.26	8330.18	5774.37	20158.73

Assessment of Adequacy of Distribution System

Advanced metering Infrastructure, Integrated Communication System outage Management System, Power Quality Management initiation

has already in process for improvement of Chandigarh Electricity network system.

The distribution network growth in Chandigarh as planned by EDC under various ongoing and forthcoming schemes is furnished in table-6.10.



Table-6.10

The Network Growth as Planned by Chandigarh under Various Ongoing and Forthcoming Schemes

Sl. No.	Particulars	Status of FY 2014-15	During FY 2015-16	During FY 2016-17	During FY 2017-18	During FY 2018-19	Cumulative Up To FY 2018-19
1	Total length of 66 & 33 lines in ckt. Kms	28		0	2(*)	21(*)	51
2	Total No. of 66/11KV & PSS	18		0	4	3	25
3	Total capacity of 66/11 KV& 33/11 KV PSS in MVA	701		0	150	110	961
4	Total No. of Distribution transformer	1939		100	100	60	2128
5	Total Capacity of Distribution transformers in MVA	608		31.5	31.5	19.0	690
6	Total length of 11kV lines in ckt. Kms	896		0	4	5	905
7	Total length of LT Lines in ckt. Kms	1262		5	5	10	1282
8	Distribution Losses		12.37	11.86	11.34	10.82	

(*) – 66 kV Lines

From the above table, it is evident that the transformation capacity at 66/11kV & 33/11KV is projected to grow from 701 MVA in FY 2014-15 to 961 MVA in FY 2018-19 and distribution transformation capacity at 11/0.415kV level is projected to grow from 651 MVA in FY2014-15 to 690 MVA in FY 2018-19.

The Projected peak demand of the UT including demand of Industrial consumers has been projected at 473MW in FY 2018-19 which corresponds to 525 MVA considering a power factor of 0.9. Against this peak requirement at 66/11kV and 33/11 KV level, the installed capacity in FY 2018-19 is projected at 961MVA. This shows that the sub transmission system would be adequate for meeting the projected demand and average loading of the system would be around 54% on 66/11kV and 33/11 KV transformers under peak demand condition.

Similarly, based on the present condition, the projected load of 11 kV consumers in FY 2018-19 would be about 28 MW and the corresponding demand at 11 kV and below would be around 445 MW (473 MW-28 MW) which corresponds to 494 MVA considering a power factor of 0.9. Against this peak requirement, the installed distribution transformation capacity at 11/0.415kV level would be around 690 MVA by 2018-19 which shows that the Distribution transformation capacity planned at DT level for FY 2018-19 would be adequate for meeting the projected demand by 2018-19 and average loading of DTs would be around 71% under peak demand condition.

Any other issues/ Achievements

- Tender is being floated to Corporatize the Electricity Department as per directions of the regulatory commission.



Action Point-For Administration of UT of Chandigarh

1. To complete all the distribution works necessary for providing 24x7 quality power supply to all the connected consumers
2. To meet the agreed trajectory for reduction of AT&C losses through initiatives as described earlier under sub heading **“Reduction in AT&C losses”**
3. To introduce modern technologies to monitor reliable supply like sub-station automation, adequate communication infrastructure, GIS, Reliability, Centralized Network Analysis and Planning Tools, SAP driven ERP systems, DMS (Distribution Management Systems), OMS (Outage Management System), etc.
4. To arrange the balance funds in case whole amount under IPDS is not approved by MOP.

UT would take necessary steps to meet the Performance Standards specified by JERC. Proper mechanism of monitoring Key Performance Index (KPI) as described under sub heading “Performance Monitoring Mechanism” needs to be taken up.

GOI Intervention

- Sanction of posts as approved by Regulatory Commission which has already send to GOI in the month of August 2015 for recommendations is still awaited.
- Enhancement of delegation of power for purchase of power.

To approve the whole amount of the projects under IPDS.



CHAPTER – 7 : RENEWABLE ENERGY STATUS AND PLAN

Renewable energy is increasingly becoming an important source of the energy –meeting the twin objectives i.e. energy security and clean energy considerations. Chandigarh has good potential for promotion and development of non- conventional energy projects, particularly in Solar and Waste to Energy areas. Good explorable options exist for power generation in Solar Roof Top and Waste to Energy etc. Administration of UT of Chandigarh and Joint Electricity Regulatory Commission (JERC) has already issued liberal policies for promotion of renewable energy generation.

The Chandigarh Renewable Energy, Science and technology promotion Society (CREST) is keen to tap renewable power potential of the UT of Chandigarh, particularly solar and waste to energy to meet the growing demand of power in

an environmental friendly and sustainable manner. Chandigarh also has been declared as solar city.

The areas of studies are:

- Renewable Energy Plan especially for Solar Photo Voltaic (SPV) based power projects.
- Waste to Energy Plan
- Grid connected Roof Top Solar schemes.
- Action plan of the UT.
- Fund Requirements.
- GoI/ CREST Interventions

Grid Connected Renewable Energy:

The total grid connected renewable Energy (RE) installed capacity (consisting of Solar, Waste to Energy) as on 31.03.15 is given in Table-7.1 below:

Table-7.1

Sl. No.	Ownership/ Sector	Mode wise Breakup (MW)		Grand Total (MW)
		Solar	Waste to Energy	
1	State	0.00	0.00	0.00
2	Private/ IPPs	5.32	0.00	5.32
3	Central	0.00	0.00	0.00
	Total :	5.32	0.00	5.32

The estimate of potential for Non-Conventional Energy in the UT of Chandigarh is estimated to be about 106MW as indicated in Table-7.2 below:

Table-7.2

Sl. No.	Type	Estimated Potential in MW (as per MNRE)
1.	Waste to Energy	6
2.	Solar Roof Top (by 2021-22)	100
	Total	106

Policies & Notifications in place:

The Chandigarh Renewable Energy, Science and technology promotion Society (CREST) shall act as the UT Nodal Agency for any solar energy generating system with a capacity of 1kWp or more. Similarly Joint Electricity Regulatory Commission (JERC) for the State of Goa and Union Territories is regulating Renewable Purchase Obligation (RPO) and Renewable Energy Certificates (REC) in the UT of

Chandigarh. The policies notified by Chandigarh Govt. and JERC are as indicated below:

Solar Power – Grid connected ground mounted and solar roof and metering Regulation – 2015 and solar tariff for development of solar energy.

Administration of UT of Chandigarh Initiatives and Plan

Chandigarh Solar Energy Policy 2015 is under Draft Stage. Many initiatives have been taken and provisions kept in the policy for promoting



use of Solar Energy in the UT. The same are briefly outlined below:

- a) The Solar Power plant will be eligible for the fiscal and other incentives as per New and Renewable Sources Energy(NRSE) policy 2012 of Govt. of India.
- b) **Exemption on open access charges:** There shall be no Open Access Charges during the Operative Period of the Policy if the solar electricity is generated and consumed within the UT.
- c) **Exemption on conversion charges:** The implementation of rooftop solar energy systems shall be permitted by the UT Planning Department, after necessary scrutiny. Residential consumers opting to implement solar plants to sell power to the grid shall be exempted from conversion of house tax to commercial tax.
- d) **Exemption on wheeling and banking charges:** There shall be no wheeling and banking charges for solar energy.
- e) **"Must Run" status:** All solar power systems shall be treated as 'Must Run' power plants and shall not be subjected to Merit Order Rating (MOR) / Merit Order Dispatch (MOD) principles.

f) **Cross subsidy charges:** JERC shall exempt payment of cross-subsidy charges applicable to grid connected Solar PV and solar thermal project.

g) **Transmission charge:** There shall be no Transmission Charges for solar plants commissioned during the Operative Period of the Policy.

As per MNRE program the UT has to plan to develop Grid Connected Roof Top Solar Projects as per the following programme:

Table-7.3

FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	Total
1MW	12 MW	12MW	14MW	39 MW

Renewable Purchase Obligation (RPO):

Every obligated entity, captive users, open access customers etc. shall purchase electricity from RE sources including solar. As per amendment in the tariff policy, revised solar RPO level to reach at least 8% of total consumption of energy, excluding hydro power, by March 2022 or as notified by the Central Government from time to time.

Table-7.4

Financial Year	Solar RPO (as % of total consumption)	Non-Solar RPO (as % of total consumption)	Total RPO (As % of Total Consumption)
FY 2015-16	1.00	2.80	3.80
FY 2016-17	2.00	2.80	4.80
FY 2017-18	3.00	2.80	5.80
FY 2018-19	4.00	2.80	6.80

Year Wise Availability (Cumulative) through proposed capacity addition plan – through RES (grid interactive) is as follows:

Table-7.5

Sl. No.	NRSE Projects	Year wise Existing & Likely Capacity to be added (MW)-Cumulative				
		As on 31 March 2015	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19
a.	Solar	5.32	6.32	18.32	30.32	44.32
b.	Waste to Energy	0	0	0	0	0
	Total Expected MW	5.32	6.32	18.32	30.32	44.32

Project details are attached as annexure – III.



Action Plan of the Union Territory for Grid Interactive NCE/ RES Plants

The UT of Chandigarh has to ensure completion and addition of renewable generating capacity as per the following Roll Out Plan:

Table-7.6

Sl. No.	NRSE Projects	Year wise Addition of Capacities (MW)				Total (MW)
		FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	
a.	Solar	1.00	12.00	12.00	14.00	39.00
b.	Waste Energy	0.00	0.00	0.00	0.00	0.00
	Total	1	12	12	14	39.00

Fund Requirement:

Total fund requirement (Year-wise) for various RE projects for capacity addition is estimated and the same is shown in the table below:

Table -7.7

Sl. No.	NRSE Projects	Year wise Fund Requirement (Rs. In Crores)				Total (Rs in Cr.)
		FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	
a.	Solar	10	120	120	140	390
b.	Waste to Energy	0	0	0	0	0
	Total	10	120	120	140	390

Intervention by Administration of UT of Chandigarh

- CREST may submit their proposal to MNRE for VGF funding as per norms of the scheme.
- Set up single window clearances mechanism to expedite clearances of NCE / NRSE projects.
- To provide solar energy generation based rebate in electricity bills for motivating consumers to install solar power plants.

Intervention by GOI

- Viability Gap Funding (VGF) as applicable for various Solar Projects in the UT.
- Central Financial Assistance, as applicable, shall be provided in the beginning of financial year.



With increasing importance being given to low carbon growth these days, the cheapest and more affordable option to overcome the energy deficit is Demand Side Management (DSM) and implementation of energy efficiency measures in various sectors such as Agriculture, Domestic, Commercial, Street Lighting & Industries etc. The DSM has been traditionally seen as a means of reducing peak electricity demand. In fact, by reducing the overall load on an electricity network, DSM has various beneficial effects, including mitigating electrical system emergencies, reducing the number of blackouts and increasing system reliability. Possible benefits can also include reducing dependency on expensive imports of fuel, reducing energy cost, and reducing harmful emissions to the environment.

Finally, DSM has a major role to play in deferring high investments in generation, transmission and distribution networks. Thus DSM applied to electricity systems provides significant economic, reliability and environmental benefits. Opportunities for reducing energy demand are numerous in all sectors and many are low-cost, or even no cost, items that most enterprises or individuals could adopt in the short term, if good energy management is practiced.

Going by the experience of other states, the most common measures of DSM, as applicable to the UT of Chandigarh, is given in Table-8.1. The table also includes average normative approximate savings for each measure.

Table-8.1

Sector	DSM Technique	Energy saving Potential as % of total consumption	Investment/MU of savings (INR Crores)
Domestic	Replacement of ICLs with LED bulbs	23%	0.8
Commercial	Retrofitting of Energy efficient equipment	15%	1.5
Street lighting	Replacement of existing street light with LEDs	51%	2.0

Application of the above provides substantial energy savings per year. In Street lighting, the saving potential is maximum, because in this sector DSM can be planned and implemented by the Municipal Corporation of Chandigarh and Engineering Department of Chandigarh Administration. In other sectors, serious awareness campaign through stakeholders' consultation is required to achieve and enhance the desired energy savings.

Enlisted below are some of the DSM measures and energy efficiency initiatives to be taken up by the UT of Chandigarh.

- Mandatory use of LED in Govt. buildings / Govt. aided institutions / Boards / Corporations.
- Promotion of Solar water heating system in domestic sector
- Solar Water Heating System to be made mandatory in industries where hot water is required for processing, hospitals and nursing homes, Govt. hospitals, hotels,

motels and banquet halls, jail barracks, canteens, housing complexes set up by Group Housing Societies/ Housing Boards, all Govt. buildings, Residential Schools, Educational Colleges, Hostels, Technical/ Educational Institutes, District Institute of Education and Training, Tourism Complexes etc.

- Use of star rated pumps to be mandated for PWW / PHED / Agriculture sector/ Horticulture Department.

Administration of UT of Chandigarh Initiatives:

To encourage Energy Efficiency (EE) and DSM, the Chandigarh Administration has taken up initiatives as indicated below:

a) Replacement of Street Light

UT is implementing new energy efficient street lighting schemes in various locations of Chandigarh.



b) Replacement of existing ICL/CFL with energy efficient LED light fittings

Administration of UT has been in the process of replacement of existing lights by LED lights in all Govt. Offices in a phased manner.

Policy and notification in Place

Energy Conservation Building Code (ECBC) has been launched by Bureau of Energy Efficiency, MOP, GOI on 27th May, 2007 to be implemented on voluntary basis. The code is applicable to buildings/ building complexes that have a connected load/ contract demand of 100 kW/ 120 KVA and more or having conditioned area of 500 sq meters or more.

Agency responsible for DSM:

The office of SE (Electrical) of Chandigarh Electricity Department (CED) has been designated as State Designated Agency (SDA) to coordinate, enforce and implement the Energy Conservation Measures in the UT in accordance with the provisions contained in the Energy Conservation Act-2001 (Central Act 52 of 2002), in consultation with Bureau of Energy Efficiency (BEE), Ministry of Power, GoI.

Objectives and suggested Interventions

The domestic sector accounted for about 45.93% (719.63 MUs) of the UT's total energy consumption (1566.77 MUs) during 2014-15. Substantial saving potential (about 23% i.e. about 165.5 MUs) exists in this sector through replacement programmes by energy efficient lighting and by promoting use of other energy efficient electrical appliances. In order to stimulate investments in energy efficient lighting projects, high quality LED lamps are proposed to be given to households at the cost of incandescent lamps (ICLs) to encourage them to invest in energy efficiency under the Domestic Efficient Lighting Program (DELP).

The Domestic Efficient Lighting Programme (DELP) seeks to promote high quality LED lighting in the domestic sector by overcoming the high first cost barrier. DELP will enable sale of LED bulbs from designated places at a cost that is much less than the market price of Rs. 350-450 as replacements of Incandescent Lamps (ICLs). The programme is expected to

DELP KEY FEATURES

- LED at cost of Rs. 95-105 as against a market price of Rs 350-450
- Consumer take LED bulb at Rs. 10/-, Balance paid by DISCOM from energy savings or by consumer in 8-12 months installment.
- 3 years free replacement warranty
- No impact on tariff
- Total upfront investments by EESL
- Benefits sharing approach

reduce installed load approximately by 11.95 MW and will lead to approximate annual energy consumption reduction of the UT by more than 12.56MU. The saved energy can be sold to better paying consumers like Industry and Commercial, which will provide additional revenue stream to the CED.

ICLs are extremely energy inefficient form of lighting. In contrast, LEDs consume a fraction of energy used by ICLs to provide better light output. A single LED outlasts about 30 ICLs, and hence on life cycle cost effectiveness it fares better than ICL and CFL. However, the penetration of LEDs is very low because of their high first cost. To overcome this barrier, Energy Efficiency Services Limited (EESL), has been implementing programmes in several UTs to provide high quality LEDs as replacements to ICLs and CFLs at a cost of Rs. 95-105 each to residential consumers.

EESL procures the LEDs bulbs and provides to consumers at an initial rate of Rs. 10 each (balance by CED from energy savings or by consumer in installment) as against their market price of Rs. 350-450.

Approach / Strategy

All the above interventions involve replacement of inefficient equipment / appliances with energy efficient ones for the domestic, commercial buildings and Street Lighting Sectors. **These can be undertaken by the UT Administration at no upfront cost by using the Energy Service Company (ESCO) model.** The model is based on the concept of promoting Performance Contract mode where the company invests in any project by entering into a contract agreement with the facility owner which is recovered through the savings accrued due to reduced electricity bills.



Future Plans of Administration of UT of Chandigarh

Future Planning of UT of Chandigarh for DSM and implementation of Energy Efficiency measures are given in the Table-8.2 below.

Table-8.2

Sl. No.	Particulars	Details
1.	No of ICL's to be replaced with LED Bulbs	5.43 Lakhs
2.	Expected annual energy savings	12.56 MU's
3.	Expected reduction of installed load	11.95 MW
4.	Estimated Capital Expenditure	Rs 5.71 Cr.
5.	Estimated cost savings to CED per year	Rs 4.30 Cr.

Actions Point

The sector-wise Central Government and Administration of UT of Chandigarh actions envisaged to facilitate implementation of energy efficiency measures as mentioned above are detailed below:

Central Government

- BEE may consider formulation of specification for LED bulbs and introducing star label scheme for LED bulbs.
- Energy Efficiency Services Limited (EESL) to take up project design and project development.
- To expedite provision of fund to the UT Administration for implementation of DSM and Energy Efficiency Measures.

Administration of UT of Chandigarh

- Ensure formulation of a detailed time line in consultation with concerned departments for implementation of DSM and Energy Efficiency Measures in the UT.
- Ensure establishment of a payment security mechanism so that the company making investments under the ESCO mode recovers the same through the savings accrued due to reduced electricity bills.

Central Government

- BEE may provide technical support for effective enforcement of ECBC and

promotion of ESCO based retrofitting works in Government buildings. BEE can provide support for capacity building of UT department through establishment of ECBC cells for compliance of ECBC and retrofitting in Government buildings.

- Energy Efficiency Services Limited (EESL) to take up project design and project development for retrofitting in commercial buildings.

Administration of UT of Chandigarh

- Administration of UT of Chandigarh has to adopt ECBC Directives for new commercial building design and mandated energy audit of existing commercial building once in a three-year period. Effective enforcement of ECBC compliance and mandating retrofitting in energy-audited buildings may result in reduction of electrical consumption from commercial sector. Government of Chandigarh may consider mandatory retrofitting in Government buildings with an objective of reduction of electricity bills, which UT Administration is paying against electricity bill of these buildings. This would also demonstrate impact of ESCO based retrofitting projects to private building owners to adopt the same.
- As per the Planning Commission's projection; residential building are becoming one of the largest consumers of electricity in the country by 2030. BEE is introducing design guidelines for energy efficient multi storey residential apartments including in the composite and hot & dry climatic zone. UT Administration may mandate compliance of these guidelines through institutional framework in the UT.
- For residential buildings, the UT could adopt the star labeling scheme prepared by BEE for multi-storey residential apartment buildings.

In addition to the above, Joint Electricity Regulatory Commission (JERC) may be requested to issue directives for creation of DSM funds by Utilities of the UT so that DSM activities can get extra emphasis. Such funds can be utilized for meeting incremental cost of efficiency improvement.



Financial Viability

Based on the road map discussed in the previous chapters, various scenarios have been prepared to visualize the profitability from operating the business as per the roadmap laid down and sensitivity thereof with changes in important input parameters like tariff and AT&C losses. However, the analysis has been restricted up to FY 2018-19 being the analysis framework for 24x7 PFA initiatives.

The following scenarios have been detailed in subsequent sections:

- At targeted growth rate and other parameters as per “24x7 Power for All” Road Map (Base case).
- Same as (a) and tariff hikes for viability, if required.
- Non-Adherence to AT & C Loss Reduction Trajectory and subsequent dependence on higher tariff hike for viability.
- At targeted growth and loss reductions as per roadmap and all fundings including those under GOI schemes as per Debt equity ratio of 70:30.
- Scenario considering measures to reduce AT&C losses up-to 6% to 8% by FY 2018-19 under Smart Grid Project for Chandigarh as a whole.

Common Assumptions

- Average cost of power purchase has been considered as Rs. 3.96 per unit. The details are given as hereunder:

Table-9.1

FY 2015-16

Sl. No.	Description	Unit	Total
A	Units Purchased		
1.	Total power purchased	MU	1875.87
2.	Less PGCIL Losses	MU	56.28
3.	Net power purchased (At UT periphery)-A	MU	1819.59
B	Power purchase cost		
1	-Total power purchase cost	Rs Cr.	683.79
2	NRLDC F & C charges	Rs Cr.	0.35
3	Reactive Energy Charges	Rs Cr.	0.06
4	-PGCIL charges	Rs Cr.	35.79
5	Total cost of purchase-B	Rs Cr.	719.99
	Average purchase cost (At UT periphery) (B/A)	Rs/ kWh	3.96

Source: Tariff Order for FY 2015-16

- No change in power purchase cost, as any change in the power purchase cost will be taken care by the Fuel and Power Purchase Cost Adjustment mechanism.
- Escalation towards O&M cost (excl employees cost) and administrative and General expenses has been considered @ 6% p.a. in line with average changes in WPI :

Table-9.2

Month/ Year	WPI Indices	CPI Indices
Average 2012-13	168	215
Average 2013-14	178	236
Increase	5.95%	9.8%
Say	6.0%	10%

Source: eaindstry.gov.in

- Escalation towards Employee Cost considered @ 10% p.a. based on CPI Indices.
- Purchase Demand considered as forecasted in previous chapters.
- Grant, Loan and Equity ratio has been considered as 60%:30%:10% (IPDS). All other investments have been considered for funding as per Debt equity ratio 70:30. Additional grant of 15% of IPDS has been taken from 3rd year onwards.
- Interest computation has been done as per the existing loan profiles of Electricity Department, Union Territory of Chandigarh. Interest on future long term loan and Working Capital loan has been calculated @ 12% p.a. and interest on consumer security deposit has been calculated @ 8.50% p.a. as per Tariff Order for FY 2015-16.
- The existing average billing rate is Rs 4.79/kWh in FY 2015-16 based on Tariff Order for FY 2015-16. However, from FY 2015-16 to FY 2018-19, the average billing rate has been considered based on weighted average ABR, as shown hereunder:

Table-9.3

Year	Rs./kWh
FY 2015-16	4.79
FY 2016-17	4.76
FY 2017-18	4.75
FY 2018-19	4.73



The details of weighted average billing rate is given in Annexure-VII.

9. The interstate sale of surplus energy has been considered at the rate of 3.00 Rs/kWh. Average rate for sale of power through power trading exchange is in the range of Rs 2-4/kWh, hence an average of Rs 3/kWh has been adopted.
10. Depreciation has been computed @ average 4.93% for existing assets and 5.28% for new incoming assets.

Scenario A: Targeted Growth Rate as per 24x7 Road Map (Base Case)

Assumptions

- ✓ No tariff hike and change in power purchase cost.
- ✓ AT&C losses as per MoP targeted trajectory.

Table-9.4

Financial Position of the Utility (Scenario A)

Assumptions	SCN-A				
Description	Units	2015-16	2016-17	2017-18	2018-19
Total unrestricted energy required	MU	1665	1772	1888	2014
Requirement at state periphery	MU	1959	2072	2195	2328
Collection efficiency	%	100.0%	100.0%	100.0%	100.0%
T&D Losses		15.0%	14.5%	14.0%	13.5%
Power purchase cost	Rs/Unit	3.96	3.96	3.96	3.96
Energy available at state periphery	MU	1847	1867	2402	2425
Shortage/Surplus of Power	MU	-112	-205	207	97
State's Own Generation	MU	0	0	0	0
Purchased Power	MU	1959	2072	2402	2425
Revenue Parameters					
Average billing rate	Rs/Unit	4.79	4.76	4.75	4.73
Tariff increase	%	0%	0%	0%	0%
Effective Average billing rate	Rs/Unit	4.79	4.76	4.75	4.73
Energy sold within state	MU	1665	1772	1888	2014
Energy sold to other states	MU	0	0	207	97
Expense					
Employ cost escalation	%	10%	10%	10%	10%
Repair & Maintenance escalation	%	6%	6%	6%	6%
Administrative & General escalation	%	6%	6%	6%	6%
Financial position of Utility					
Description	Units	2015-16	2016-17	2017-18	2018-19
Net sales-Power	Rs Crores	798	843	959	982
Other income like meter rent, theft recovery etc	Rs Crores	0	0	0	0
Revenue, Subsidies & Grants	Rs Crores	0	0	0	0
Other income	Rs Crores	18	20	22	24
Total Income		815	863	980	1005
Expenditure					
Power Purchase	Rs Crores	776	821	951	960
Generation of Power	Rs Crores	0	0	0	0
Employee cost	Rs Crores	60	66	73	80
R & M Cost	Rs Crores	11	12	13	13
Admn. & General expenses	Rs Crores	2.7	2.9	3.1	3.3
Others	Rs Crores	0	0	0	0
Total expenses		850	902	1040	1057
Gross Profit	Rs Crores	-35	-39	-60	-52
Interest	Rs Crores	12	21	33	50
Depreciation	Rs Crores	4	5	10	14
Profit before tax	Rs Crores	-51	-65	-103	-115
Tax	Rs Crores	0	0	0	0
Net Profit after taxes		-51	-65	-103	-115

Note: The true up petition for FY 2011-12 to FY 2014-15 has been filed before the Hon'ble JERC which may impact the tariff hike in the subsequent years.



The projected scenario exhibits the continuation of loss making situation in the forthcoming period and tariff hikes would be required if turnaround is to be achieved.

Scenario B: Targeted Growth Rate as per 24x7 Road Map and Turnaround with Tariff Hikes.

Assumptions

- ✓ All other assumptions as per Base-case(Scenario-A)
- ✓ Turnaround considering tariff hike.

Table-9.5

Assumptions for Scenario B

Assumptions	SCN-B				
Description	Units	2015-16	2016-17	2017-18	2018-19
Total unrestricted energy required	MU	1665	1772	1888	2014
Requirement at state periphery	MU	1959	2072	2195	2328
Collection efficiency	%	100.0%	100.0%	100.0%	100.0%
T&D Losses		15.0%	14.5%	14.0%	13.5%
Power purchase cost	Rs/Unit	3.96	3.96	3.96	3.96
Energy available at state periphery	MU	1847	1867	2402	2425
Shortage/Surplus of Power	MU	-112	-205	207	97
State's Own Generation	MU	0	0	0	0
Purchased Power	MU	1959	2072	2402	2425
Revenue Parameters					
Average billing rate	Rs/Unit	4.79	4.76	4.75	4.73
Tariff increase	%	0%	4%	4%	3%
Effective Average billing rate	Rs/Unit	4.79	4.95	5.14	5.24
Energy sold within state	MU	1665	1772	1888	2014
Energy sold to other states	MU	0	0	207	97
Expense					
Employ cost escalation	%	10%	10%	10%	10%
Repair & Maintenance escalation	%	6%	6%	6%	6%
Administrative & General escalation	%	6%	6%	6%	6%
Financial position of Utility					
Description	Units	2015-16	2016-17	2017-18	2018-19
Net sales-Power	Rs Crores	798	877	1032	1085
Other income like meter rent, theft recovery etc	Rs Crores	0	0	0	0
Revenue, Subsidies & Grants	Rs Crores	0	0	0	0
Other income	Rs Crores	18	20	22	24
Total Income		815	897	1054	1109
Expenditure					
Power Purchase	Rs Crores	776	821	951	960
Generation of Power	Rs Crores	0	0	0	0
Employee cost	Rs Crores	60	66	73	80
R & M Cost	Rs Crores	11	12	13	13
Admn. & General expenses	Rs Crores	2.7	2.9	3.1	3.3
Others	Rs Crores	0	0	0	0
Total expenses		850	902	1040	1057
Gross Profit	Rs Crores	-35	-5	13	51
Interest	Rs Crores	12	21	29	36
Depreciation	Rs Crores	4	5	10	14
Profit before tax	Rs Crores	-51	-31	-25	1
Tax	Rs Crores	0	0	0	0
Net Profit after taxes		-51	-31	-25	1

Note: The true up petition for FY 2011-12 to FY 2014-15 has been filed before the Hon'ble JERC which may impact the tariff hike in the subsequent years.



The scenario exhibits the extent of tariff hikes required to make turnaround of situation as shown under scenario –A. The tariff hike to the tune of 4% in FY 2016-17, 4% in FY 2017-18 and 2.5% in FY 2018-19 would be able to make turnaround by FY 2018-19.

Scenario C: Non-Adherence to Performance Parameters (Loss Reduction Trajectory) and subsequent dependence on Higher Tariff Hike.

Assumptions

- ✓ AT&C losses higher by 1% than the targeted trajectory.
- ✓ All other assumption same as in base case (Scenario-A).

Table-9.6

Financial Position of the Utility (Scenario C)

Assumptions	SCN-C				
Description	Units	2015-16	2016-17	2017-18	2018-19
Total unrestricted energy required	MU	1665	1772	1888	2014
Requirement at state periphery	MU	1981	2096	2220	2355
Collection efficiency	%	100.0%	100.0%	100.0%	100.0%
T&D Losses		16.0%	15.5%	15.0%	14.5%
Power purchase cost	Rs/Unit	3.96	3.96	3.96	3.96
Energy available at state periphery	MU	1847	1867	2402	2425
Shortage/Surplus of Power	MU	-134	-229	182	70
State's Own Generation	MU	0	0	0	0
Purchased Power	MU	1981	2096	2402	2425
Revenue Parameters					
Average billing rate	Rs/Unit	4.79	4.76	4.75	4.73
Tariff increase	%	0%	0%	0%	0%
Effective Average billing rate	Rs/Unit	4.79	4.76	4.75	4.73
Energy sold within state	MU	1665	1772	1888	2014
Energy sold to other states	MU	0	0	182	70
Expense					
Employ cost escalation	%	10%	10%	10%	10%
Repair & Maintenance escalation	%	6%	6%	6%	6%
Administrative & General escalation	%	6%	6%	6%	6%
Financial position of Utility					
Description	Units	2015-16	2016-17	2017-18	2018-19
Net sales-Power	Rs Crores	798	843	951	974
Other income like meter rent, theft recovery etc	Rs Crores	0	0	0	0
Revenue, Subsidies & Grants	Rs Crores	0	0	0	0
Other income	Rs Crores	18	20	22	24
Total Income		815	863	973	997
Expenditure					
Power Purchase	Rs Crores	785	830	951	960
Generation of Power	Rs Crores	0	0	0	0
Employee cost	Rs Crores	60	66	73	80
R & M Cost	Rs Crores	11	12	13	13
Admn. & General expenses	Rs Crores	2.7	2.9	3.1	3.3
Others	Rs Crores	0	0	0	0
Total expenses		859	911	1040	1057
Gross Profit	Rs Crores	-44	-48	-67	-60
Interest	Rs Crores	12	22	36	53
Depreciation	Rs Crores	4	5	10	14
Profit before tax	Rs Crores	-60	-76	-112	-127
Tax	Rs Crores	0	0	0	0
Net Profit after taxes		-60	-76	-112	-127

Note: The true up petition for FY 2011-12 to FY 2014-15 has been filed before the Hon'ble JERC which may impact the tariff hike in the subsequent years.



The scenario exhibits that non adherence to AT & C Loss reduction trajectory would compound the losses further and tariff hike to the tune of 4.5% in FY 2016-17, 4% in FY 2017-18 and 3% in FY 2018-19 may be required to observe a turn around by FY 2018-19.

Scenario D: Targeted Growth Rate as per 24x7 Road Map and Considering all funding including GoI Schemes in the Debt Equity Ratio of 70:30.

Assumptions

- ✓ At targeted growth rates and loss reduction as per road map.
- ✓ Considering all funding including GoI Schemes in the Debt Equity Ratio of 70:30.

Table-9.7

Financial Position of the Utility (Scenario D)

Assumptions	SCN-D				
Description	Units	2015-16	2016-17	2017-18	2018-19
Total unrestricted energy required	MU	1665	1772	1888	2014
Requirement at state periphery	MU	1959	2072	2195	2328
Collection efficiency	%	100.0%	100.0%	100.0%	100.0%
T&D Losses		15.0%	14.5%	14.0%	13.5%
Power purchase cost	Rs/Unit	3.96	3.96	3.96	3.96
Energy available at state periphery	MU	1847	1867	2402	2425
Shortage/Surplus of Power	MU	-112	-205	207	97
State's Own Generation	MU	0	0	0	0
Purchased Power	MU	1959	2072	2402	2425
Revenue Parameters					
Average billing rate	Rs/Unit	4.79	4.76	4.75	4.73
Tariff increase	%	0%	0%	0%	0%
Effective Average billing rate	Rs/Unit	4.79	4.76	4.75	4.73
Energy sold within state	MU	1665	1772	1888	2014
Energy sold to other states	MU	0	0	207	97
Expense					
Employ cost escalation	%	10%	10%	10%	10%
Repair & Maintenance escalation	%	6%	6%	6%	6%
Administrative & General escalation	%	6%	6%	6%	6%
Financial position of Utility					
Description	Units	2015-16	2016-17	2017-18	2018-19
Net sales-Power	Rs Crores	798	843	959	982
Other income like meter rent, theft recovery etc	Rs Crores	0	0	0	0
Revenue, Subsidies & Grants	Rs Crores	0	0	0	0
Other income	Rs Crores	18	20	22	24
Total Income		815	863	980	1005
Expenditure					
Power Purchase	Rs Crores	776	821	951	960
Generation of Power	Rs Crores	0	0	0	0
Employee cost	Rs Crores	60	66	73	80
R & M Cost	Rs Crores	11	12	13	13
Admn. & General expenses	Rs Crores	2.7	2.9	3.1	3.3
Others	Rs Crores	0	0	0	0
Total expenses		850	902	1040	1057
Gross Profit	Rs Crores	-35	-39	-60	-52
Interest	Rs Crores	12	22	36	55
Depreciation	Rs Crores	4	6	10	15
Profit before tax	Rs Crores	-51	-66	-106	-122
Tax	Rs Crores	0	0	0	0
Net Profit after taxes		-51	-66	-106	-122

Note: The true up petition for FY 2011-12 to FY 2014-15 has been filed before the Hon'ble JERC which may impact the tariff hike in the subsequent years.



This scenario exhibits that absence of grant funds would make dent on overall profitability and tariff hike to the tune of 4.5% in FY 2016-17, 4% in FY 2017-18 and 2.5% in FY 2018-19 would have to be resorted to in order to see turnaround by FY 2018-19.

Scenario E: Scenario with reduced AT&C losses between 6%-8% considering additional investment for Smart Grid in the Debt Equity Ratio of 70:30.

Based on the cost amounting to Rs 50 Crores estimated for pilot project for 29000 consumers, the tentative estimated cost of bringing remaining areas of Chandigarh UT under smart grid for reduction of AT&C losses to less than 8% by 2018-19 works out to be Rs 217.48 Crores whose phasing has been considered at the rate of 30%, 40% & 30% from FY 2016-17 to FY 2018-19.

T&D LOSS REDUCTION AFTER IMPLEMENTATION OF SMART GRID

The T&D loss reduction trajectory has been adopted as shown below:

Description/ Year	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19
Distribution Losses (%)	12.37%	10.37%	8.37%	6.37%
Intra-state transmission losses (%)	3.00%	3.00%	3.00%	3.00%

Assumptions

- ✓ AT&C losses trajectory reduced to 6.37% by FY 2018-19 under Smart Grid Project.
- ✓ All other assumption same as in base case (Scenario-A).



Table-9.8

Financial Position of the Utility (Scenario E)

Assumptions	SCN-E				
Description	Units	2015-16	2016-17	2017-18	2018-19
Total unrestricted energy required	MU	1665	1772	1888	2014
Requirement at state periphery	MU	1959	2038	2124	2218
AT&C losses	%	12.37%	10.37%	8.37%	6.37%
Collection efficiency	%	100.0%	100.0%	100.0%	100.0%
T&D Losses		15.00%	13.06%	11.12%	9.18%
Power purchase cost	Rs/Unit	3.96	3.96	3.96	3.96
Energy available at state periphery	MU	1847	1867	2402	2425
Shortage/Surplus of Power	MU	-112	-171	278	207
State's Own Generation	MU	0	0	0	0
Purchased Power	MU	1959	2038	2402	2425
Revenue Parameters					
Average billing rate	Rs/Unit	4.79	4.76	4.75	4.73
Tariff increase	%	0%	0%	0%	0%
Effective Average billing rate	Rs/Unit	4.79	4.76	4.75	4.73
Energy sold within state	MU	1665	1772	1888	2014
Energy sold to other states	MU	0	0	278	207
Expense					
Employ cost escalation	%	10%	10%	10%	10%
Repair & Maintenance escalation	%	6%	6%	6%	6%
Administrative & General escalation	%	6%	6%	6%	6%
Financial position of Utility					
SCN-E					
Description	Units	2015-16	2016-17	2017-18	2018-19
Net sales-Power	Rs Crores	798	843	980	1015
Other income like meter rent, theft recovery etc	Rs Crores	0	0	0	0
Revenue, Subsidies & Grants	Rs Crores	0	0	0	0
Other income	Rs Crores	18	20	22	24
Total Income		815	863	1002	1039
Expenditure					
Power Purchase	Rs Crores	776	807	951	960
Generation of Power	Rs Crores	0	0	0	0
Employee cost	Rs Crores	60	66	73	80
R & M Cost	Rs Crores	11	12	13	13
Admn. & General expenses	Rs Crores	2.7	2.9	3.1	3.3
Others	Rs Crores	0	0	0	0
Total expenses		850	888	1040	1057
Gross Profit	Rs Crores	-35	-25	-38	-19
Interest	Rs Crores	12	23	41	62
Depreciation	Rs Crores	4	7	15	23
Profit before tax	Rs Crores	-51	-56	-95	-105
Tax	Rs Crores	0	0	0	0
Net Profit after taxes		-51	-56	-95	-105

This scenario exhibits that modest improvements in profitability could be achieved in overall profitability and tariff hike to the tune of 4 % in FY 2016-17, 4% in FY 2017-18 and 1.5% in FY 2018-19 would have to be resorted to in order to see turnaround by FY 2018-19. Thus there is an improvement in required tariff hike in FY 2018-19 only as compared to base case

UDAY SCHEME

Financial implication of UDAY Scheme has not been considered in view of MoP Office Memorandum No.06/02/2015-NEF/FRP(Pt.) dated 13th January 2016. However, Electricity Department of UT Chandigarh may sign MoU with MoP on efficiency parameters stated in UDAY Scheme.



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 DISCOM

for looking at activities of overall communication strategy.

The financial situation in Chandigarh makes it imperative to raise tariffs while other initiatives including 24X7 supplies are implemented. Such tariff increases would inevitably impact consumers and meet with resistance. To address this, the utilities would clearly communicate their plans on implementing the reliable 24X7 supply scheme along with the other reliability and efficiency improvement measures that they are implementing. A high level of involvement of the Government of Chandigarh will also be required.

Table-10.1

Proposed Communication Responsibilities

Communication Objective	Responsibility	Frequency
"Power for all" - Roll Out Plan	Secretary Engineering	Quarterly
Power Supply Position	Chief Engineer	Daily
Energy Savings & Conservation	Chief Engineer	Monthly
Planned Outages & Disruption	Chief Engineer	Daily
Real time feeder-wise Information	Chief Engineer	Daily
Status update on Deliverables	Secretary Engineering	Quarterly
Renewable Power	Director Science & Technology	Quarterly
Transmission Projects – Physical Progress and Achievements	Chief Engineer	Monthly
Distribution – Progress ,Achievements, Losses, Consumer Initiatives etc.	Chief Engineer	Monthly

Information Technology Initiatives

The need to adopt IT in every sphere of utility operation is pervasive. 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.

IT Initiatives is proposed to be carried out by Chandigarh Electricity department through smart grid pilot project in the city. Scope of the report covers preparation of scheme for implementation of AMI, DTMU, Integration of roof top solar through net metering and Sub-station automation system.

These areas which can be improved using Smart Grid technologies:

- Online visualization of energy consumption upto consumer level
- Continuous two way communication facility between utility and consumers
- Monitoring of Outage & Quality of power upto consumer level
- Online information for utilization of assets like distribution transformer, LT lines etc.
- Preventive maintenance of distribution transformer
- Control and monitoring of sub-station equipments

Proposed Smart Grid Initiatives

Following attributes are proposed in Chandigarh area for reliable, secure and economically viable Smart Grid:

- Advanced Metering Infrastructure (AMI)
- Sub-station Automation System(SAS)
- Integration of Roof top solar through net meter
- Distribution Transformer Monitoring Unit



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 under-taken 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 Govt. - where necessary. The committee may be constituted with the following members – PFC, REC, CEA, SECI, EESL, Ministry of Power Ministry of Coal, and MNRE.
- **State Government Level Committee:** It is proposed that a State level committee headed by the Chief Secretary 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. This committee will be constituted with the following Principal Secretaries/ Secretaries of the Power, Finance, Urban Development, Agriculture and other relevant departments along with the CMD/Chairman/MD of state utilities.
- **Department Level Committee:** It is proposed that the Department level committee headed by the Power Secretary will be formed and 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. The committee will be constituted with the following members – Secretary (Power) and CMD of state utilities.
- **District Level Committee** – It is proposed to constitute a district level committee headed by the District Collector 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. The committee will be constituted with the following

members – District Collector and Superintendent Engineer of State utilities.

- **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 in the Generation, Transmission & Distribution system and to meet the expectations of 24 X 7 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 for latest technological developments and to increase the consumer satisfaction. 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 to UT that for serving the consumers in a different way change of mindset of the employees would be required. It is critical that Change Management initiatives are rolled out and institutionalized throughout the DISCOM for achieving better results. The details of the present employee in the Chandigarh Electricity Department are as under:



Table-10.2**Present Employee Strength**

Sl. No.	Particulars	Ensuing Projection FY 2015-16	Ensuing Projection FY 2016-17	Ensuing Projection FY 2017-18	Ensuing Projection FY 2018-19
1.	No. of employees as on 1 st April	1014	1028	1455	1455
2.	No. of employees added during the year	70	463**	35**	36**
3.	Total number of employees (1+2)	1084	1491	1491	1491
4.	Number of employees retired/retiring during the year	56	36	36	42
5.	Number of employees at the end of the year (3-4)	1028	1455	1455	1499

** Recruitment planned by CED in subsequent year of the control period to fill the gap between actual and approved strength.

The details of the 70 posts to be filled in the ensuing year is as follows:

Table-10.3**Recruitment Planned for the Year FY 2016-17**

Sl. No.	Category	No of Posts
1.	Lower Division Clerk (LDC)	42
2.	Steno-Typist	04
3.	Junior Engineer	23
4.	Internal Auditor	01
	Total :	70

MANPOWER TRAINING AND RE-SKILLING

With the rapidly expanding system and advent of new technology, it becomes all the important to develop the skill set of the employees of the transmission and distribution utility. The CED acknowledges the fact that improving knowledge base is an ever evolving process and thus has initiated the process to impart refresher training to its employees. As per the proposal, which is currently in the initial phase, CED shall conduct a training program at National Power Training Institute, Faridabad. The table below presents the estimated cost of the training program:

Table-10.4**Manpower Training Cost**

Sl. No.	Program	Cost (In Rs. Lakhs)
1.	Residential	47.31
2.	Non-Residential	28.34

Safety Measures

In order to ensure safety of its manpower, the safety measures prescribed under Indian

Electricity rules, Safety, Electricity Supply Regulations 2010 notified by CEA and Joint Electricity Regulatory Commission (Distribution Code Regulation 2010) needs to be adhered to by the utility. Accordingly to comply with the safety measures directed by the commission the CED intends to engage consultants to examine all the Rules and Regulations in the force and suggest way forward. The consultant shall require to analyze existing safety standards, tool kits and practices being followed by the department. In coherence with its study and various safety regulation in place the consultant shall come out with suitable safety tool kits/ equipment required to carry out operation and maintenance of distribution network. In this regard the CED has already issued Expression of Interest and intends to complete the process soon.

The proposed expenditure to be incurred on safety measures and procurement of safety materials such as personal protective gear and other equipment other for its manpower is as below:

Table-10.5**Proposed Expenditure on Safety Measures**

Particulars	FY 2016-17	FY 2017-18	FY 2018-19
Proposed Expenditure (in Rs. Lakhs)	15	20	25



CHAPTER – 11 : YEAR WISE ROLL OUT PLAN

DELIVERABLES						
Power for All – Roll Out Plan	Units	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	Total
(A) GENERATION						
State Sector						
Thermal	MW	0.00	0.00	0.00	0.00	0.00
Hydro (Renewable)	MW	0.00	0.00	0.00	0.00	0.00
RES (MNRE)	MW	0.00	0.00	0.00	0.00	0.00
Private Sector						
Thermal	MW	0.00	0.00	0.00	0.00	0.00
Hydro (Renewable)	MW	0.00	0.00	0.00	0.00	0.00
RES (MNRE)	MW	1.00	12.00	12.00	14.00	39.00
Central Generating Station						
Thermal	MW	0.00	0.00	61.52	0.00	61.52
Hydro (Renewable)	MW	40.00	0.00	16.75	0.00	56.75
RES (MNRE)	MW	0.00	0.00	0.00	0.00	0.00
Nuclear	MW	0.00	0.00	0.00	0.00	0.00
Total :	MW	41.00	12.00	90.27	14.00	157.27
(B) TRANSMISSION& DISTRIBUTION						
Total length of 66 lines	ckt. Kms		0	2	21	23
Total No. of 66/11KV & PSS	Nos.		0	4	3	7
Total capacity of 66/11 KV& 33/11 kV PSS	MVA		0	150	110	260
Total No. of Distribution transformer	Nos.		100	100	60	260
Total Capacity of Distribution transformers	MVA		31.5	31.5	19.0	82
Total length of 11kV lines in ckt. Kms	ckt. Kms		0	4	5	9
Distribution losses	%	12.37	11.86	11.34	10.82	
Total length of LT Lines in ckt. Kms	ckt. Kms		5	5	10	20



DELIVERABLES						
Power for All - Roll Out Plan	Units	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	Total
(C) RENEWABLE ENERGY (Already included in Generation under item (A) above)						
Solar	MW	1.00	12.00	12.00	14.00	39.00
Waste Energy	MW	0.00	0.00	0.00	0.00	0.00
Total :	MW	1.00	12.00	12.00	14.00	39.00



CHAPTER - 12 : SECTOR WISE INVESTMENT PLAN & FUND REQUIREMENT

(Rs in Lakhs)

	Sector	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	Total	Remarks
GENERATION							
No investment is proposed in Generation Sector in Chandigarh							
TRANSMISSION & DISTRIBUTION (IPDS)							
66 kV New schemes							
Turnkey Execution for 2 Nos. 66 KV Line bays at 66/11 KV Grid Substation in Institutional Area, Village Sarangpur, U.T., Chandigarh.		-	27.2	27.2	46.03	100.43	
Providing 1x30MVA 66/11KV additional Power TF At 66kv Grid Sub Station Sec-39 UT of Chandigarh		-	300	222.61		522.61	
Replacement of 14 Nos. MOCB with SF6, Breakers at 66KV Grid Substation Sector-52 and Sector -12 UT of Chandigarh		-	400	114		514	
Conversion of existing 33KV Sub Station Sector-18 to 66KV Sub Station Sector-18 by Providing GIS 2x20MVA, 66/11KV Power Transformer along with 66 kV associated 66 kV T/L with underground cable from 66 kV Sector-26 to 66 kV Sector 18		-	409	1364	956	2729	
Providing 2x20MVA, 66 / 11KV Gas Insulated Sub Station at Sector-26 UT of Chandigarh along with 66 KV D/C line from 66 kV I.T park to 66KV Grid Sub Station Sector-26 UT of Chandigarh		-	554	1849	1295	3698	
Turnkey execution of 66 KV Transmission Line from T-off point to the proposed 66 KV Grid Substation in Institutional Area, Village Sarangpur, Chandigarh.		-	250	250	250	750	
Conversion of existing 66 KV S/C Transmission Line and Underground Cable from 220 KV Substation, Kishangarh to Sector -12, Chandigarh to D/C Transmission Line.		-	200	337.11		537.11	
66 kV Transmission Line		-					
Providing 66 KV Transmission Line along with		-	165	551	387	1103.00	



24X7 POWER FOR ALL (CHANDIGARH)

(Rs in Lakhs)

	Sector	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	Total	Remarks
associated 66 KV Grid Substation at Raipur Kalan UT of Chandigarh.							
Providing 66 kV Transmission line with underground cable from Sector-32 Grid Sub Station to Sector 34 Grid Sub Station.		-	256.2	341.6	256.6	854.00	
System Strengthening Works		-					
New 11 KV feeders- New/Bifurcation/Augmentation		-	500	500	795.22	1795.22	
Distribution Transformer-New		-	500	500	284.40	1284.40	
Capacity enhancement of LT sub-station		-	200	223.66		423.66	
LT Line : New Feeder/ Feeder Bifurcation/Augmentation/R&M		-	100	100	53.50	253.50	
Aerial Bunched Cables		-	300	300	339.66	939.66	
Under-ground cables		-	200	200	155.99	555.99	
Metering - Feeder/Boundary Point/ DT/ Consumer		-	125.86	100	100	325.86	
Prepaid / smart meters in Govt. Establishment		-	50	50		100	
IT Applications-as per R-APDRP Part-A scope of work including ERP		-	750	750	635.57	2135.57	
IT Applications-Customer Care Services		-	500	500	219.40	1219.40	
National Optical Fiber Network (NOFN)		-	50	50		100.00	
SMART GRID		-	1651	1651	1650	4952	
Total Distribution Estimates		-	7488.26	9981.18	7424.37	24893.41	
RENEWABLE ENERGY							
Solar		1000	12000	12000	14000	39000	
Waste to Energy		0	0	0	0	0	
Total :		1000	12000	12000	14000	39000	
GRAND TOTAL :		1000	19488.26	21981.18	21424.37	63893.41	



ANNEXURE-I**CATEGORY-WISE GROWTH IN CONSUMPTION**

Consumers	Year-wise figures from FY 2007-08 to FY 2014-15							
	FY 2007-08	FY 2008-09	FY 2009-10	FY 2010-11	FY 2011-12	FY 2012-13	FY 2013-14	FY 2014-15
Domestic	450	433	471.9	518	525.79	586.54	608.24	719.63
Commercial	313	318	440.5	398	417.36	397.54	446.18	489.4
Large Supply	142	145	141.4	140	128.72	137.5	123.94	115.03
Small Power	16	17	20.7	21	22.02	20.11	104.53	106.3
Medium Supply	91	101	116.5	89	103.71	103.84	20.36	19.57
Agriculture	1	1	1	2	1.27	1.4	1.46	1.67
Public Lighting	15	14	15.1	17	17.45	21.98	21.2	21.88
Bulk Supply	33	39	57.7	73	74.67	87.34	86.56	86.51
Others-Temporary Supply	95	124	10.5	27	10.5	8.79	7.68	6.78
Total	1156	1192	1275.3	1285	1301.49	1365.04	1420.15	1566.77

Source : Chandigarh Electricity Department

ANNEXURE-II**DETAILED CALCULATION OF ENERGY DEMAND IN CHANDIGARH UP TO FY 2018-19****(In MUs)**

CONSUMERS	ACTUAL		PROJECTED ENERGY REQUIREMENT			
	FY 2014-15	CAGR	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19
Domestic	719.63	10%	791.59	870.75	957.83	1053.61
Commercial	489.4	5%	513.87	539.56	566.54	594.87
Large Supply	115.03	0%	115.03	115.03	115.03	115.03
Small Power	106.3	1%	107.36	108.44	109.52	110.62
Medium Supply	19.57	0%	19.57	19.57	19.57	19.57
Agriculture	1.67	5%	1.75	1.84	1.93	2.03
Public Lighting	21.88	3%	22.54	23.21	23.91	24.63
Bulk Supply	86.51	0%	86.51	86.51	86.51	86.51
Others-Temporary Supply	6.78	0%	6.78	6.78	6.78	6.78
Total	1566.77		1665.01	1771.70	1887.62	2013.64

Source: "Business Plan for MYT Control Period: FY 2016-17 to FY 2018-19"

ANNEXURE-III

BREAK UP & DETAILS OF CUMULATIVE CAPACITIES EXISTING AND LIKELY TO BE ADDED YEAR WISE

Sl. No	Power Sources/ Generating Stations	Type (Thermal/ Hydro/ RES etc.)	Location of the Plant	As on March 2015 (MW)	Capacity Available as Planned				Remarks
					FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	
					(MW)	(MW)	(MW)	(MW)	
A	IPP (Private Sector Projects)								
A.1	IPP (RES)								
A.1.1	Roof top SPV (5.32 MW)	RES (MNRE)	CH	5.32	5.32	5.32	5.32	5.32	
A.1.2	Roof top SPV (1 MW)	RES (MNRE)	CH	0.00	1.00	1.00	1.00	1.00	1.0 MW will be available from FY 2015-16.
A.1.3	Roof top SPV (12 MW)	RES (MNRE)	CH	0.00	0.00	12.00	12.00	12.00	12.0 MW will be available from FY 2016-17.
A.1.4	Roof top SPV (12 MW)	RES (MNRE)	CH	0.00	0.00	0.00	12.00	12.00	12 MW will be available from FY 2017-18.
A.1.5	Roof top SPV (14 MW)	RES (MNRE)	CH	0.00	0.00	0.00	0.00	14.00	14 MW will be available from FY 2018-19.
	Sub Total - IPP (RES)			5.32	6.32	18.32	30.32	44.32	
B	Central Generating Station (CGS)								
B.1	CGS Thermal								
B.1.1	NTPC - Kahalgaon - II (3x500 MW)	Thermal (Coal)	BR	3.00	3.00	3.00	3.00	3.00	
B.1.2	NTPC - Rihand STPS-I	Thermal (Coal)	UP	11.90	11.90	11.90	11.90	11.90	



Sl. No	Power Sources/ Generating Stations	Type (Thermal/ Hydro/ RES etc.)	Location of the Plant	As on March 2015 (MW)	Capacity Available as Planned				Remarks
					FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	
					(MW)	(MW)	(MW)	(MW)	
	(2x500 MW)								
B.1.3	NTPC - Rihand STPS - Stage II (2x500 MW)	Thermal (Coal)	UP	10.00	10.00	10.00	10.00	10.00	
B.1.4	NTPC - Rihand STPS -III (2x500 MW)	Thermal (Coal)	UP	7.75	7.75	7.75	7.75	7.75	
B.1.5	NTPC, Unchahar - I (2x210MW)	Thermal (Coal)	UP	2.31	2.31	2.31	2.31	2.31	
B.1.6	NTPC, Unchahar - II (2x210MW)	Thermal (Gas)	UP	3.91	3.91	3.91	3.91	3.91	
B.1.7	NTPC, Unchahar - III (210 MW)	Thermal (Coal)	UP	1.47	1.47	1.47	1.47	1.47	
B.1.8	NTPC, Unchahar - IV (1 X 210 MW)	Thermal (Coal)	UP	0.00	0.00	0.00	5.00	5.00	5 MW will be available from FY 2017-18.
B.1.9	NTPC, Tanda (4X110 MW)	Thermal (Coal)	UP	0.00	0.00	0.00	6.00	6.00	6 MW will be available from FY 2017-18.
B.1.10	Singrauli-I STPS (2000MW)	Thermal (Coal)	UP	3.80	3.80	3.80	3.80	3.80	
B.1.11	Dadri - II TPP (980MW)	Thermal (Coal)	UP	1.96	1.96	1.96	1.96	1.96	
B.1.12	Barh STPS -I (1980 MW)	Thermal (Coal)	BR	0.00	0.00	0.00	11.88	11.88	11.88 MW will be available from FY 2017-18.
B.1.13	Barh STPS I	Thermal (Coal)	BR	0.00	0.00	0.00	7.92	7.92	7.92 MW will be



Sl. No	Power Sources/ Generating Stations	Type (Thermal/ Hydro/ RES etc.)	Location of the Plant	As on March 2015 (MW)	Capacity Available as Planned				Remarks
					FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	
					(MW)	(MW)	(MW)	(MW)	
	(1320 MW)								available from FY 2017-18.
B.1.14	Giddebaha (2640 MW)	Thermal (Coal)	PB	0.00	0.00	0.00	15.84	15.84	15.84 MW will be available from FY 2017-18.
B.1.15	North Karanpura (1980 MW)	Thermal (Coal)	JH	0.00	0.00	0.00	11.88	11.88	11.88 MW will be available from FY 2017-18.
B.1.16	Singrauli STPS -III (500MW)	Thermal (Coal)	UP	0.00	0.00	0.00	3.00	3.00	3 MW will be available from FY 2017-18.
B.1.17	NTPC - Anta Gas Thermal (419 MW)	Thermal (Gas)	RJ	7.12	7.12	7.12	7.12	7.12	
B.1.18	NTPC - Auraiya Gas Thermal (663 MW)	Thermal (Gas)	UP	7.36	7.36	7.36	7.36	7.36	
B.1.19	NTPC - Dadri Gas Thermal (830 MW)	Thermal (Gas)	UP	7.06	7.06	7.06	7.06	7.06	
	Sub Total -CGS Thermal			67.64	67.64	67.64	129.16	129.16	
B.2	CGS Nuclear								
B.2.1	Narora Atomic Power Station (NAPS) (440 MW)	Nuclear	UP	7.22	7.22	7.22	7.22	7.22	
B.2.2	RAPS- B (440 MW)	Nuclear	RJ	13.99	13.99	13.99	13.99	13.99	
B.2.3	RAPS - C (440 MW)	Nuclear	RJ	5.24	5.24	5.24	5.24	5.24	
	Sub- Total -CGS Nuclear			26.45	26.45	26.45	26.45	26.45	



Sl. No	Power Sources/ Generating Stations	Type (Thermal/ Hydro/ RES etc.)	Location of the Plant	As on March 2015 (MW)	Capacity Available as Planned				Remarks
					FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	
					(MW)	(MW)	(MW)	(MW)	
B.3	CGS Hydro								
B.3.1	NHPC Chamera -II (300 MW)	Hydro (HEP)	HP	3.87	3.87	3.87	3.87	3.87	
B.3.2	NHPC Chamera -III (231 MW)	Hydro (HEP)	HP	2.57	2.57	2.57	2.57	2.57	
B.3.3	NHPC Dhauli Ganga HEP (280 MW)	Hydro (HEP)	UK	3.44	3.44	3.44	3.44	3.44	
B.3.4	NHPC Dulhasti HEP (390 MW)	Hydro (HEP)	JK	3.82	3.82	3.82	3.82	3.82	
B.3.5	NHPC Sewa- II HEP (120 MW)	Hydro (HEP)	JK	1.61	1.61	1.61	1.61	1.61	
B.3.6	NHPC Uri - II HEP (240 MW)	Hydro (HEP)	JK	1.52	1.52	1.52	1.52	1.52	
B.3.7	NHPC Parbati - III HEP (520MW)	Hydro (HEP)	HP	5.77	5.77	5.77	5.77	5.77	
B.3.8	NHPC Bursar HEP (1020MW)	Hydro (HEP)	JK	0.00	0.00	0.00	6.12	6.12	6.12 MW will be available from FY 2017-18.
B.3.9	NHPC Pakaldul HEP (1000MW)	Hydro (HEP)	JK	0.00	0.00	0.00	6.00	6.00	6 MW will be available from FY 2017-18.
B.3.10	Koldam HEP (800 MW)	Hydro (HEP)	HP	10.40	10.40	10.40	10.40	10.40	
B.3.11	Lata Tapovan (171 MW)	Hydro (HEP)	UT	0.00	0.00	0.00	1.03	1.03	1.03 MW will be available from FY



Sl. No	Power Sources/ Generating Stations	Type (Thermal/ Hydro/ RES etc.)	Location of the Plant	As on March 2015 (MW)	Capacity Available as Planned				Remarks
					FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	
					(MW)	(MW)	(MW)	(MW)	
									2017-18.
B.3.12	Rupsiabagar Khasiyabara HEP (261 MW)	Hydro (HEP)	UT	0.00	0.00	0.00	1.60	1.60	1.6 MW will be available from FY 2017-18.
B.3.13	SJVNL Nathpa Jhakri HEP (1500MW)	Hydro (HEP)	HP	13.05	13.05	13.05	13.05	13.05	
B.3.14	SJVNL Rampur HEP (6X68.67 MW)	Hydro (HEP)	HP	1.28	41.28	41.28	41.28	41.28	
B.3.15	THDC Koteswar HEP (400 MW)	Hydro (HEP)	UT	2.80	2.80	2.80	2.80	2.80	
B.3.16	THDC Tehri - I HEP (1000 MW)	Hydro (HEP)	UT	49.40	49.40	49.40	49.40	49.40	
B.3.17	THDC Vishnugad Pipalkoti (444 MW)	Hydro (HEP)	UT	0.00	0.00	0.00	2.00	2.00	2 MW will be available from FY 2017-18.
	Sub Total- CGS Hydro			99.53	139.53	139.53	156.28	156.28	
B.4	CGS BBMB								
B.4.1	Bhakra (3X108 MW+2X126 MW 5X 157MW=1361	Hydro (HEP)	HP	46.38	46.38	46.38	46.38	46.38	
B.4.2	Ganguwal (76.39 MW)	Hydro (HEP)	PB	41.67	41.67	41.67	41.67	41.67	
B.4.3	Kotla (77.65MW)	Hydro (HEP)	PB	4.17	4.17	4.17	4.17	4.17	
B.4.4	Pong	Hydro (HEP)	HP	13.86	13.86	13.86	13.86	13.86	



Sl. No	Power Sources/ Generating Stations	Type (Thermal/ Hydro/ RES etc.)	Location of the Plant	As on March 2015 (MW)	Capacity Available as Planned				Remarks
					FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	
					(MW)	(MW)	(MW)	(MW)	
	(6X66 MW)								
B.4.5	Dehar (6X165 MW)	Hydro (HEP)	HP	34.65	34.65	34.65	34.65	34.65	
	Sub Total- CGS BBMB			140.73	140.73	140.73	140.73	140.73	
	Grand Total(MW)			339.67	380.67	392.67	482.94	496.94	

ANNEXURE-IV

MONTH WISE LOAD PATTERN PROJECTION FOR FY 2016-17 TO FY 2018-19

Description	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	Total
FY 2016-17													
PEAK POWER (in MW)													
Estimated Peak Requirement	270	350	398	421	380	360	280	220	282	290	265	262	421
Estimated Availability as per generation plan	195	253	287	304	274	260	202	159	204	209	191	189	304
Peak Surplus(+)/Deficit(-)	-75	-97	-111	-117	-106	-100	-78	-61	-78	-81	-74	-73	-117
ENERGY (in MUs)													
Estimated Energy Requirement at UT Periphery	140.9	195.6	232.5	236.4	238.1	193.1	152.7	124.1	145.7	159.3	123.3	130.7	2072.0
Estimated Energy Availability at UT Periphery as per generation plan	131.4	178.5	200.3	207.6	201.1	162.2	138.9	119.1	131.1	142.6	123.8	130.1	1867.06
Peak Surplus(+)/Deficit(-)	-9.45	-17.11	-32.14	-28.80	-36.99	-30.86	-13.80	-4.99	-14.59	-16.69	0.50	-0.61	
Proposed Source of Power/Energy to meet the peak demand	Power Exch /Short Term Tender	Power purchase through short term Tender & Banking with J & K/Through Power Exch.					Power Exch /Short Term Tender	Power Exch /Short Term Tender	Power Exch /Short Term Tender	Power Exch /Short Term Tender	Power Exch /Short Term Tender	Power Exch /Short Term Tender	



Description	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	Total
FY 2017-18													
PEAK POWER (in MW)													
Estimated Peak Requirement	280	365	415	446	402	375	310	235	290	312	278	265	446
Estimated Availability as per generation plan	229	299	340	365	329	307	254	192	237	255	228	217	365
Peak Surplus(+)/Deficit(-)	-51	-66	-75	-81	-73	-68	-56	-43	-53	-57	-50	-48	
ENERGY (in MUs)													
Estimated Energy Requirement at UT Periphery	149.3	207.2	246.3	250.4	252.2	204.6	161.8	131.5	154.3	168.8	130.6	138.5	2195.0
Estimated Energy Availability at UT Periphery as per generation plan	169.1	229.6	257.8	267.1	258.7	208.7	178.7	153.3	168.6	183.5	159.3	167.4	2402.18
Peak Surplus(+)/Deficit(-)	19.85	22.44	11.47	16.67	6.51	4.18	16.95	21.78	14.32	14.73	28.66	28.93	
Proposed Source of Power/Energy to meet the peak demand	Power Exch /Short Term Tender	Power purchase through short term Tender & Banking with J & K/ Through Power Exch.					Power Exch /Short Term Tender	Power Exch /Short Term Tender	Power Exch /Short Term Tender	Power Exch /Short Term Tender	Power Exch /Short Term Tender	Power Exch /Short Term Tender	



Description	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	Total
FY 2018-19													
PEAK POWER (in MW)													
Estimated Peak Requirement	292	365	473	430	410	380	300	240	300	320	280	290	473
Estimated Availability as per generation plan	226	283	366	333	318	294	232	186	232	248	217	225	366.32
Peak Surplus(+)/Deficit(-)	-66	-82	-107	-97	-92	-86	-68	-54	-68	-72	-63	-65	
ENERGY (in MUs)													
Estimated Energy Requirement at UT Periphery	158.3	219.8	261.2	265.6	267.5	217.0	171.6	139.4	163.7	179.0	138.5	146.9	2328.0
Estimated Energy Availability at UT Periphery as per generation plan	170.8	231.9	260.3	269.7	261.2	210.8	180.5	154.7	170.3	185.3	160.8	169.1	2425.47
Peak Surplus(+)/Deficit(-)	12.45	12.11	-0.95	4.09	-6.26	-6.20	8.88	15.30	6.61	6.28	22.29	22.16	
Proposed Source of Power/Energy to meet the peak demand	Power Exch /Short Term Tender	Power purchase through short term Tender& Banking with J & K/Through Power Exch.					Power Exch /Short Term Tender	Power Exch /Short Term Tender	Power Exch /Short Term Tender	Power Exch /Short Term Tender	Power Exch /Short Term Tender	Power Exch /Short Term Tender	

Note:- The estimated Peak Requirement and Energy availabilities are calculated on the basis of Table-4.4a of 24X7 power for all and the base has been taken for the FY 2014-15 for calculation.



ANNEXURE-V**INVESTMENT ON EXCLUSIVE TRANSMISSION JOBS**

Sl. No.	New Scheme /Ongoing jobs	Investment Rupees in Lakh
1	66kV Transmission line alongwith associated 66kV line bays to upcoming 66kV GSS at Raipur Kalan, Chandigarh (New Scheme)	1103
2	Execution of laying of 66 kV U/G Cable from Sector 32 GSS to Sector34 GSS, Chandigarh (New Scheme)	854
3	Conversion of existing 66 KV S/C Transmission Line and Underground Cable from 220 KV Substation, Kishangarh to Sector -12, Chandigarh to D/C Transmission Line (Ongoing Scheme)	737.11
	Total cost	2694.11

Note: The above investment has included in Distribution chapter under IPDS Scheme.

ANNEXURE-VI

SUMMARY – ITEMS & BILL OF QUANTITIES FOR IPDS					
Sl. No.	Name of the Project Area:	UT of Chandigarh			Cost proposed under IPDS (Rs Lac)
	Item	Unit	Existing/ Current Position	Qty proposed under IPDS	
1	66 kV Works				
A	New				
i	Turnkey Execution for 2 Nos. 66 KV Line bays at 66/11 KV Grid Substation in Institutional Area, Village Sarangpur, UT of Chandigarh.	1 JOB	0	1	117.75
ii	Providing 1x30MVA 66/11KV additional Power TF At 66kv Grid Sub Station Sec-39 UT of Chandigarh	1 JOB	0	1	522.61
iii	Conversion of existing 33KV Sub Station Sector-18 to 66KV Sub Station Sector-18 by Providing GIS 2x20MVA, 66/11KV Power Transformer alongwith 66 kV associated 66 kV T/L with underground cable from 66 kV Sector-26 to 66 kV Sector 18.	1 JOB	0	1	2729.00
iv	Providing 2x20MVA, 66 / 11KV Gas Insulated Sub Station at Sector-26 UT of Chandigarh alongwith 66 KV D/C line from I.T Grid Sub Station Kishangarh to 66KV Grid Sub Station Sector-26 UT of Chandigarh.	1 JOB	0	1	3698.00
v	Turnkey execution of 66 KV Transmission Line from T-off point to the proposed 66 KV Grid Substation in Institutional Area, Village Sarangpur, Chandigarh.	1 JOB	0	1	750.00
vi	Conversion of existing 66 KV S/C Transmission Line and Underground Cable from 220 KV Substation, Kishangarh to Sector -12, Chandigarh to D/C Transmission Line.	1 JOB	0	1	737.11
	Total A				8554.47
B	66kV Transmission line				
i	Providing 66 kV Transmission Line alongwith associated 66 kV line bays to upcoming 66 KV Grid Substation at Raipur Kalan UT of Chandigarh.	1 JOB	0	1	1103.00
ii	Providing 66 kV Transmission line with underground cable from Sector-	1 JOB	0	1	854.00



SUMMARY - ITEMS & BILL OF QUANTITIES FOR IPDS					
Sl. No.	Name of the Project Area:	UT of Chandigarh			Cost proposed under IPDS (Rs Lac)
	Item	Unit	Existing/ Current Position	Qty proposed under IPDS	
	32 Grid Sub Station to Sector 34 Grid Sub Station .				
	Total B				1957.00
C	System Strengting Work				
i	Replacement of 14 Nos. MOCB with SF6, Breakers at 66KV Grid Substation Sector-52 and Sector -12 UT of Chandigarh.	1 JOB	0	1	514.00
	Total C				514.00
	Total 1				11025.47
2	New 11 KV feeders- New/Bifurcation/Augmentation	Km	900		
2.1	New Feeders / Inter connections				
	(a) 11 KV New Line O/H Circuit (103 Sq mm) (Ckt/Km)			3.4	11.29
	(b) 11 KV New Line 103 Sq mm O/H Conductor for installation of New DTs			9.8	32.54
	(c) 11 KV Way Extension for New Feeders	Nos		32	129.60
	Total 2.1				173.42
2.2	Re-conductoring / Augmentation				
	(a) Replacement of 11 KV VCB/OCB at Grid Sub Station	Nos		306	1621.80
	Total 2.2				1621.80
	Total 2				1795.22
3	Distribution Transformer-New	Nos	1939		
	(a) 315 KVA			260	1284.40
	Total 3				1284.40
4	Capacity enhancement of LT sub-station		0		
4.1	LT Distribution Box	Nos			
	(a) For 300/315 KVA transformer			627	313.50
	Total 4.1				313.50
4.2	Battery and Battery Charger etc.	Each	0	18	110.16
	Total 4.2				110.16
	Total 4				423.66
5	LT Line : New Feeder/ Feeder Bifurcation/Augmentation/R&M				
	LT Panel Replacement	Nos	--	150	253.50
	Total 5				253.50

SUMMARY - ITEMS & BILL OF QUANTITIES FOR IPDS					
Sl. No.	Name of the Project Area:	UT of Chandigarh			Cost proposed under IPDS (Rs Lac)
	Item	Unit	Existing/ Current Position	Qty proposed under IPDS	
6	Aerial Bunched Cables	Km	0		
	HT ABC Cable				
	(b) 11 KV New Line ABC (3X185 mm ²)			16.7	207.08
	(c) Existing 11 line to 185 Sq mm ABC			19.9	246.76
	(d) Existing 11KV line to 120 Sq mm ABC			25.58	119.20
	(a) 11KV new Line with 150 Sq mm ABC for new DTs			31.88	366.62
	Total 6				939.66
7	Under-ground cables	Km	NA		
	(a) 11 KV New Line U/G Cable 3X300Sq mm XLPE			29.6	235.91
	(b) Existing 11KV line to 300 Sq mm XLPE			40.16	320.08
	Total 7				555.99
8	Metering - Feeder/Boundary Point/DT/Consumer	Nos	0		
8.1	System feeder meters	Each		250	16.26
8.2	EHT Consumer Meters	Each		15	4.10
8.3	HT Consumer Meters	Each		375	23.98
8.4	Distribution Transformer Meter with	Each			
a	Resin Cast Ring Type LT CT's (Indoor Type) and Box (Outdoor type)	Each		1010	126.37
b	Resin Cast Ring Type LT CT's (outdoor Type) and Box (indoor type)	Each		1240	155.15
	Total 8				325.86
9	Prepaid / smart meters in Govt. Establishment	Nos	0	1000	100.00
10	IT Applications-as per R-APDRP Part-A scope of work including ERP	1 Job	0	1	2135.57
11	IT Applications-Customer Care Services	1 Job	0	1	1219.40
12	National Optical Fibre Network (NOFN)	1 Job	0	1	100.00
	GRAND TOTAL (IN RS LACS)				20158.73

ANNEXURE-VII**AVERAGE BILLING RATE**

Sl. No.	Description	Rate (Rs/unit)	FY 2015-16		FY 2016-17		FY 2017-18		FY 2018-19	
			MU	Rs. Crores	MU	Rs. Crores	MU	Rs. Crores	MU	Rs. Crores
1	Domestic	4.25	791.59	337	870.75	370	957.83	407	1053.61	448
2	Other than domestic	5.26	873.41	460	900.94	474	929.79	489	960.03	505
	Total		1665	797	1771.69	844	1887.62	896	2013.64	953
	Weighted average ABR	Rs/unit		4.79		4.76		4.75		4.73

ROAD MAP FOR "24x7 POWER FOR ALL" PGCIL (NALAGARH) (50%)

