

A JOINT INITIATIVE OF



सत्यमेव जयते

Government of India



Government of West Bengal

Power for All

West Bengal



Foreword



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Minister of State
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सत्यमेव जयते
Government of India

Electricity consumption is one of the most important indices for measuring the development level of a nation. The Government of India is committed to improving the quality of life of its citizens by ensuring adequacy of electricity availability. The aim is to provide each household access to electricity, round the clock. The 'Power for All' program is a major step in this direction.

West Bengal, which stands for its cultural heritage, folk traditions, is a land of literary stalwarts and diverse natural beauty. The State not only contributes to 6.51% of India's GDP but is also home to the social and cultural wealth of the nation.

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

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

Foreword



Mamata Banerjee

Chief Minister

West Bengal



Government of
West Bengal

West Bengal is the cultural capital of India, representing progressive values bounded with rich traditions and a promising landscape for growth. One of the key elements of growth and mass development is the availability of electricity to light up the dreams of millions of citizens of the State.

The electricity sector has been of great significance to the State Government. The State Government has already taken initiatives to increase the electricity access in leaps and bounds and has added nearly 80 Lac consumers over the last 4 years. The State is committed to live up to the challenges and extend electricity access to the remaining unconnected households and provide all the households with 24X7 electricity.

The utilities in West Bengal have already lined up various programs of investments to achieve the objectives of the 24X7 Power for All Program.

The State Government will provide all necessary support to the power utilities in achieving the various milestones and targets outlined in this PFA Roadmap.

I would like to thank the Government of India, Hon'ble Prime Minister and Hon'ble Union Minister of State for Power, for supporting West Bengal towards implementation of 'Power for All' program.



सत्यमेव जयते

Government of India

Joint Statement



Government of
West Bengal

24X7 Power for All Program for West Bengal will be implemented by the Government of West Bengal with active support from the Government of India. The Program aims at providing 24X7 supply to all electricity consumers and providing electricity access to all unconnected households in the State.

The Government of West Bengal shall continue to support the power sector through targeted capital subsidy schemes aimed at supporting the poor and marginal consumers and elimination of regional disparities in the State.

The State Government is committed to support the utilities and other development agencies engaged in the power sector in implementation of the various measures and targets considered in the PFA Roadmap.

The State Government will put in place appropriate/ suggested State level governance mechanisms for periodic review and monitoring of the PFA Roadmap implementation.

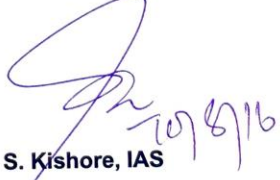
This PFA Roadmap document highlights all-encompassing power sector interventions including generation, transmission, distribution, renewable energy and energy efficiency/ DSM measures proposed to be implemented during FY16 to FY19.

The Ministry of Power, GoI would supplement the efforts of State on various issues to be dealt with at the Central Government level including those listed in this document. The MoP, GoI shall also endeavor to support the State in availing concessional financing arrangements for power utilities in the State.

The State Government shall endeavor to support utilities in improving/ maintaining their financial sustainability and credit worthiness.

The Central and State Governments would meet regularly over the next three years to review and monitor the progress on the rollout plan and strive to achieve the objectives of the program by taking the necessary steps as envisaged in the PFA Roadmap.


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List of Abbreviations

Abbreviation	Full Form
ARR	Aggregate Revenue Requirement
AT&C	Aggregate Technical & Commercial
BPL	Below Poverty Line
CAGR	Compound Annual Growth Rate
CKM	Circuit Kilometers
CoD	Commercial Operation Date
DDG	Decentralized Distributed Generation
DDUGJY	Deendayal Upadhyaya Gram Jyoti Yojana
DPR	Detailed Project Report
DSM	Demand Side Management
DT/ DTR	Distribution Transformer
EBIDTA	Earnings Before Interest Depreciation Taxes and Amortization
ECBC	Energy Conservation Building Code
EE	Energy Efficiency
EPC	Engineering, Procurement and Construction
EPS	Electric Power Survey
ER	Eastern Region
FY	Financial Year
Gol	Government of India
GSS	Grid Substation
GWp	Giga Watt Peak
HH	Household
IPDS	Integrated Power Development Scheme
IPP	Independent Power Producer
ISTS	Inter State Transmission System
LED	Light-emitting Diode
LILO	Loop In Loop Out
LT	Low Tension
MNRE	Ministry of New and Renewable Energy
MoC	Ministry of Coal
MoEF	Ministry of Environment & Forests, Government of India

Abbreviation	Full Form
MoP	Ministry of Power, Government of India
MU	Million Unit of Electricity (in kWh)
MVA	Mega Volt Ampere
MW	Mega Watt
NAD	Need Assessment Document
NESCL	NTPC Electric Supply Company Limited
NHPC	National Hydroelectric Power Corporation
NTPC	National Thermal Power Corporation
O&M	Operation & Maintenance
PAT	Profit After Taxes
PBT	Profit Before Taxes
PFA	Power For All
PFC	Power Finance Corporation
PGCIL	Power Grid Corporation Of India Limited
PLF	Plant Load Factor
PMA	Project Monitoring Agency
PPA	Power Purchase Agreement
PPP	Public-private Partnership
PSS	Power Sub-station
R&M	Renovation & Modernization
RE	Renewable Energy
REC	Rural Electrification Corporation
RGGVY	Rajiv Gandhi Grameen Vidyutikaran Yojana
ROW	Right of Way
RPO	Renewable Energy Purchase Obligation
SCADA	Supervisory Control and Data Acquisition
SHR	Station Heat Rate
SLDC	State Load Dispatch Center
SPV	Special Purpose Vehicle
T&D	Transmission & Distribution
TBCB	Tariff Based Competitive Bidding
ToR	Terms of Reference
TPS	Thermal Power Station
UMPP	Ultra Mega Power Project
USTDA	US Trade & Development Agency
WBERC	West Bengal Electricity Regulatory Commission
WBSEDCL	West Bengal State Electricity Distribution Company Limited
WBPDC	West Bengal Power Development Corporation Limited
WBREDA	West Bengal renewable Energy Development Agency
YoY	Year on Year

1. Executive Summary

1.1. Introduction

24x7 Power for All (24x7 PFA) is a joint initiative of the Government of India (GoI) and State Governments, aiming to achieve 24x7 availability of reliable power to all households, industrial, commercial and all other electricity consuming entities by the end of FY19. This document sets a roadmap to achieve the underlying objective of the PFA Program in the State of West Bengal.

Situated in the eastern part of India, West Bengal shares its borders with Jharkhand, Bihar, Odisha, Sikkim and Assam. The State also shares international borders with Nepal, Bhutan and Bangladesh.

The State has five distribution licensees viz. WBSEDCL, CESC, DPL, DPSC and DVC.

1.2. Power supply scenario

West Bengal is the 10th largest consumer of electricity accounting for nearly 4.38% of total energy consumption in India. Owing to significant improvement in power supply, the State witnessed only 0.5% energy shortfall in FY15, which is considerably lower than the national average energy shortfall of 3.6%. In terms of peak power requirement as well, the State has performed significantly better than the national average, as the peak deficit has been below 1% over the last 4 years.

Considering the State has already achieved significant level of electrification over the past 5 years, the remaining urban and rural consumers are likely to be connected by FY17. As on Oct 2015, the number of un-electrified HHs stands at 7,47,410. Further, the utilities in the State are already supplying 24x7 power to all categories of consumers.

The energy sales for WBSEDCL is expected to increase by about 20%, from 22,509 MUs in FY15 to 26,955 MUs in FY19.

Similarly, for other utilities the expected growth in sales varies from 5-8%. At the State level, the overall energy requirement is projected to grow from existing 52,358 MU in FY15 to 62,926 MU in FY19, representing an annual growth of 5% during the period. This translates into increase in peak demand from existing 7,544 MW in FY15 to 11,172 MW in FY19.

1.3. Generation plan

West Bengal's power demand is mostly met by the State's own sources. The State's own generation sources from WBPDC, WBSEDCL and DPL contribute to more than 64% of the total installed capacity in the State. WBPDC with 4,364 MW of installed capacity contributes to bulk of the State's generation capacity. WBSEDCL owns thirteen hydro power plants totaling 1,067 MW except Rammam (51 MW) and Purulia Pumped Storage Plant (900 MW), all the plants are under 25 MW capacity.

Upcoming State Sector generation capacity addition mainly comprises of WBPDC's 1,000 MW Sagardighi power plant, of which 500 MW has been recently commissioned. Further, another 300 MW from Hydro power plants in Bhutan and about 387 MW from Central Generating Stations are expected to be available to WBSEDCL by FY19. These capacity additions would result in increase in allocated capacity to 10,131 MW by FY19 which will increase peak power availability to 7,798 MW. As the peak demand of WBSEDCL in FY19 is expected to be 6,351 MW, the projected peak availability shall be sufficient to meet the expected demand.

Other utilities like CESC, DPL, DPSC and DVC have arranged for sufficient capacity to cater to the increase in demand during the period FY16 to FY19.

1.4. Transmission plan

WBSETCL operates and maintains a transmission network of 12,042.54 ckt. kms of Extra High Voltage

Transmission lines along with 113 sub-stations (400/220/132/66 kV) having total transformation capacity of 23,580.8 MVA as on 31.03.2015, spread over the entire stretch of the State of West Bengal. In accordance with the 5 year long term rolling transmission system investment plan, WBSETCL is working on a number of transmission projects. 42 new substations proposed for addition during the period FY16 to FY19. Out of the 42 proposed substations, ongoing schemes for 12 sub-stations and 1,025.5 kms of transmission lines are scheduled to be completed progressively by FY16 and FY17. Approved schemes for 18 sub-stations and 399.6 kms of transmission lines are to be completed progressively from the year FY17 onwards. The remaining schemes are being taken up for approval and necessary funding arrangements by the WBSETCL.

With regards to the inter-state transmission systems connecting West Bengal to the ER and the rest of the country, expansion of network is under progress. PGCIL has proposed to add about 3,863 ckm (1,000ckm – 765 kV & 2,863 ckm – 400 kV) of ISTS lines and augmentation of about 9,435 MVA transformation capacity including two new 765/400kV substations (Jeerat - 3000 MVA and Medinipur – 3000 MVA) and two new 400/220 kV substations (Rajarhat – 1000 MVA and Alipurduar – 630 MVA) in West Bengal. The proposed capacity additions are sufficient to cater to the requirement of State.

1.5. Distribution plan

The distribution companies in the State have prepared plans for capacity addition to cater to the growing demand of the State. WBSEDCL has proposed to invest about Rs. 9,056 Cr. during FY16 to FY19. This includes Rs. 7,108 Cr from IPDS and DDUGJY schemes. The proposed investments are targeted towards feeder segregation, reduction of technical and commercial losses etc.

CESC has proposed a capital expenditure of Rs. 4,046 Cr including Rs. 373.73 Cr proposed under IPDS for implementing reliability and strengthening works in its supply area.

DPL has proposed a capital expenditure plan of Rs. Rs. 58.26 Cr under IPDS for implementing reliability and strengthening works in its supply area. The utility expects the balance funds (40%) to be made available through State Government.

The proposed capacity additions by WBSEDCL will increase its PSS to 660 in FY19 from 525 in FY15. Similarly, the addition in lines is expected to improve the HT:LT ratio from existing 1:1.78 to 1:1.57. These investments along with actions to curb commercial losses will facilitate the utility to achieve the targeted AT&C loss of 22.5% by FY19.

1.6. RE and EE

West Bengal's Renewable Energy (RE) sources mostly comprise of Small and Mini Hydro power generation sources in the North Bengal region. The state utility, WBSEDCL, is also procuring renewable energy from other sources to fulfill its RPO requirements. Similarly, CESC is also procuring renewable energy to meet its RPO requirements. A total of 545 MW of additional RE capacity is expected through Ultra Mega Solar Parks in Purba Medinipur, Bankura and Paschim Medinipur.

The State is undertaking implementation of DELP, LED street lighting, promotion of star rated equipment and various other programs under EE/ DSM initiatives.

1.7. Financial sustainability

Considering that the WBERC will allow for tariff increases for liquidation of regulatory assets, the state utility (WBSEDCL) may not require a tariff hike due to investments proposed under the PFA Roadmap. Further, as the investments in network are mainly through the capital grants provided by Central and State Governments, there is negligible effect on Cost of Supply due to these investments.

WBSEDCL may need to focus on the achievement of loss reduction targets envisaged in the PFA Roadmap to meet its financial targets. If WBSEDCL reduces the AT&C losses from current level of 29% to 22.5% by FY19, the projected PAT for FY19 is Rs. 40 Cr.

2. Background

2.1. The State of West Bengal

Situated in the eastern part of India, West Bengal shares its borders with Jharkhand, Bihar, Odisha, Sikkim and Assam. The State also shares international borders with Bangladesh, Bhutan and Nepal. It is the 14th largest state in terms of area and 4th largest in terms of population. The key highlights of the State are presented in Table 1.

West Bengal is India's sixth largest state in terms of GSDP¹, being the largest producer of rice (share of 27.8%, 15.4 million tonnes in 2014-15) and second largest tea producer in India (share of 27.8%, 329.3 million Kg). Further, the capital city of Kolkata is known to be the prime center for India's jute industry, with the State accounting for 79.6% of India's total jute production. West Bengal is also a leading exporter of leather and has about 500 tanneries accounting for 55% of India's leather goods exports. Nearly 22-25% of India's tanning activity is undertaken in Kolkata.

In terms of mineral production, the State of West Bengal stands third largest state accounting for 1/5th of total mineral production of the country.

Agriculture accounts for nearly 18.8% of the GSDP², while tertiary sector has the highest contribution of 60.2% in GSDP. The manufacturing sector has lowest share of ~15% in GSDP and as compared to primary and tertiary sector growing at CAGR of 10.8% and 12.1%, respectively over the last decade ending FY15, the secondary sector has witnessed a slower growth at 7.7% only.

Over the last decade the State has witnessed a burgeoning economy, with GSDP at constant prices growing at a CAGR of 5.48%, which is slightly higher than the national average of 5.43%. However, despite being rich in mineral and natural wealth, the State's per capita income has remained lower than the national average, as can be seen in Figure 1.

Table 1: Key Highlights of State: West Bengal

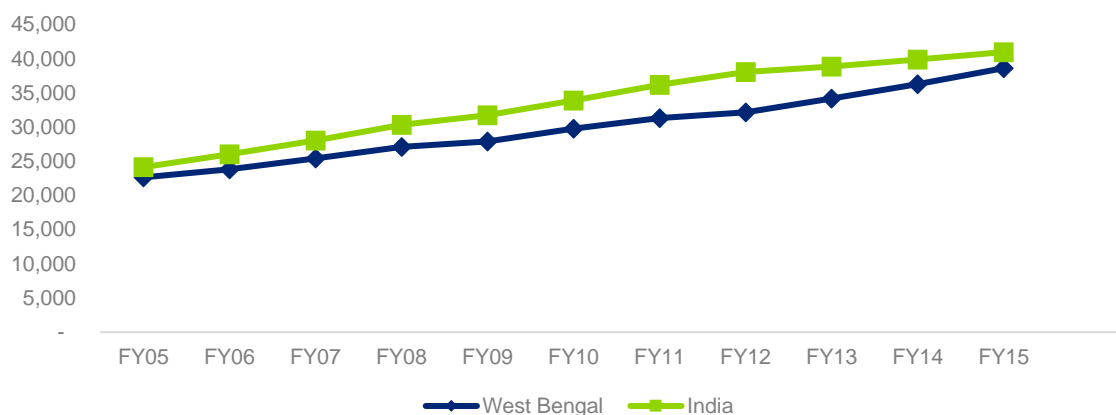
Parameter	Information
Year of Creation	1947, Final Reorganization in 1956
Population & Demographics	Total Population at 9,13,47,736 as per 2011 census <ul style="list-style-type: none"> 68% Rural, 32% Urban Decadal population growth: 13.93%
Area	88,752 square kilometers (2.67% of country) <ul style="list-style-type: none"> Forest cover – 15.52% Total cropped area – 62%
Administrative Set-up	<ul style="list-style-type: none"> 3 Divisions – Burdwan, Jalpaiguri and Presidency division 20 Districts 68 sub-divisions 375 Towns 40,782 Villages (Census 2011)
Natural Resources	<ul style="list-style-type: none"> Crude oil 7952 TMT (Energy Statistics 2015)

¹ US \$ 132.86 billion in 2014-15, source: www.ibef.org

² Contribution of primary sector in GSDP is 24.9% in FY15

Parameter	Information
	<ul style="list-style-type: none"> Coal 31.32 MT (Energy Statistics 2015) Natural gas 0.6 mmscmd (MoP&G)
Neighboring States	<ul style="list-style-type: none"> North: Sikkim West: Bihar and Jharkhand East:: Assam South: Odisha
HHs	<p>As per Census, 2011 Total 2,00,67,299 HHs (55.7% Electrified)</p> <ul style="list-style-type: none"> Rural 1,37,17,186 (41.5% Electrified) Urban 63,50,113 (86.4% Electrified) <p>As per Survey by WBSEDCL in its licensee area (31.10.2015)</p> <p>Total HH: 1,95,03,531 (96.17% Electrified)</p> <p>Rural HH : 1,31,53,418 (94.32% Electrified)</p> <p>Urban HH : 63,50,113 – WB as a whole, WBSEDCL – 29,14,655 (100% Electrified)</p>

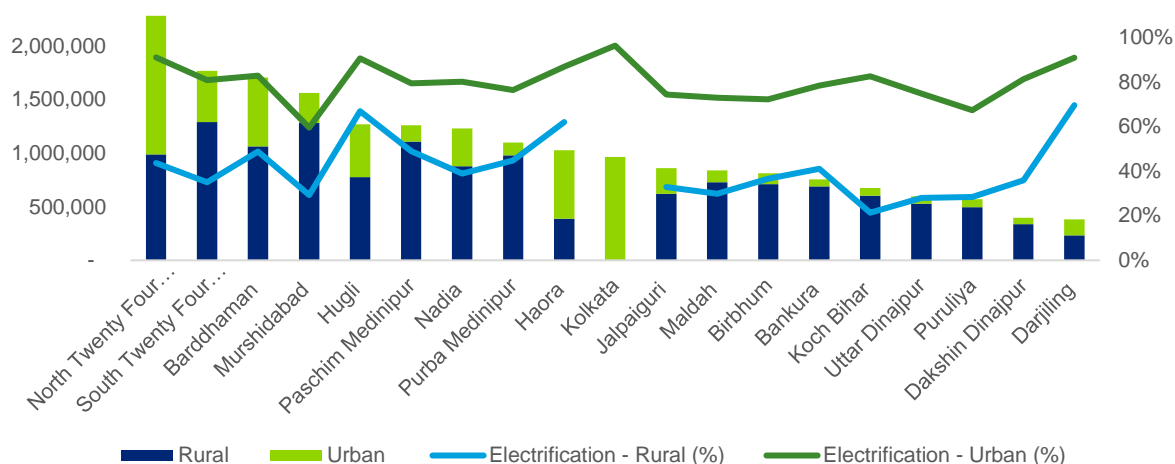
Figure 1: Per Capita Income West Bengal v National Average



The demographic division of West Bengal is almost in line with the national average, with share of rural population being around 68% and urban at 32% for

the Country. The district-wise share of rural and urban population in West Bengal is highlighted in Figure 2.

Figure 2: District Wise Urban and Rural Divide: No. of HHs (2011 Census)



West Bengal has achieved 100% village electrification albeit the access to electricity in rural areas is only limited to 42% HHs (2011 Census). As can be seen in Figure 2, electrification in about 6 districts was only to the extent of 1/3rd of total rural HHs, while urban electrification in most of the districts was beyond 80% in 2011.

- West Bengal State Electricity Distribution Company Ltd. (WBSEDCL) –Distribution Company
- West Bengal State Electricity Transmission Company Ltd. (WBSETCL) (Transmission Company)

2.2. West Bengal power sector at a glance

Power sector in West Bengal is characterized by restructured State Electricity Board, presence of multiple distribution utilities, including privately owned and those owned by State and Central Governments. All five distribution utilities have their own power generation plants/ sources. The State has been amongst the few to successfully implement the power sector reforms and the financial statements of the distribution utility (WBSEDCL) reflect that it has garnered profits over the last few years.

The process of reforms in power sector in West Bengal began in 2005, with restructuring of erstwhile West Bengal State Electricity Board (WBSEB) into the following Transmission and Distribution utilities in 2007:

The generation function of erstwhile state utility has been organized under a separate entity, West Bengal Power Development Corporation Ltd. (WBPDC). Established in 1985, WBPDC is responsible for thermal power generation in the State, while hydro generation was being undertaken by the then WBSEB till the time of unbundling and currently transferred of hydro assets to WBSEDCL.

Power distribution is also carried out by 4 other licensees in the State, apart from WBSEDCL which supplies power to nearly 1.84 Cr consumers in the State (as on Sep, 15).

The State regulatory commission, West Bengal State Electricity Regulatory Commission (WBERC) was established in year 1999 by the State Government under Section 17 of the Act 14 of 1998, and the Commission consists of three Members including the Chairperson. The key highlights of the power sector in the State are presented in Table 2.

Table 2: West Bengal Power Sector at a Glance

Aspect		Key Highlights			
Demand Position	Supply	As compared to national figures, the State has had lower demand and supply deficit. The FY15 power supply position is shown in the table below (CEA Figures):			
		Item	Peak (in MW)		Energy (in MUs)
		Demand/Requirement	7,544		46,157
		Availability	7,524		45,909
		Surplus/(Deficit)	(20)		(248)
Generation	West Bengal Power Development Corporation Ltd., is the state generating company, owning and operating thermal power generating stations. In addition to WBPDC, remaining thermal power generating capacity is owned and operated by private players viz. CESC,HEL, IPCL and central generating stations owned by NTPC, NHPC and DVC etc. and also some IPPs (MPL, APNRL etc.).				
	(As per CEA)				
	Mode	Thermal	Hydro	RE	Total (MW)
	State	5,320	977	92	6,389
	Private	1,941	0	40	1,981
	Central	922	271	0	1,194
Total	8,183	1,248	132	9,564	
Transmission	West Bengal State Electricity Transmission Company Ltd. (WBSETCL) is the State Transmission Utility, responsible for developing and operating transmission systems in the State. An overview of inter and intra-state transmission system available to the state is provided in the table below:				
	Mode	Voltage		MVAs	
	Intra-state	400 kV		3,780	
		220 kV		9,880	
		132 kV		9,674.5	
	Inter-state	66 kV		246.3	
		400/220 kV		4,595	
		220/132 kV		890	
Distribution	There are 5 distribution utilities operating in the State, with 2 being private licensees, 2 owned by State Government and one owned by Central Govt., as detailed below:				
	<ul style="list-style-type: none">WBSEDCL - West Bengal State Electricity Distribution Company Limited is a State Govt. owned utility responsible for electricity distribution in the State with consumer base of about 1.53 Crore.				
	<ul style="list-style-type: none">CESC – CESC Limited is a fully integrated private utility, owning and operating distribution system with total area of 567Sq. Km in Kolkata and Howrah, serving over 29 lac consumers.				
	<ul style="list-style-type: none">IPCL (Formerly DPSC) – India Power Co. Ltd. is a privately owned utility which owns and operates distribution system in region spread over 618 Sq. Km in coal rich Asansol and Raniganj area.				
	<ul style="list-style-type: none">DPL – Durgapur Projects Ltd. is a State Govt. owned integrated power utility responsible for supplying electricity in the limited geographical area of Durgapur, operating in area of 125 Sq. Km.				

Aspect	Key Highlights					
	<ul style="list-style-type: none">DVC – Damodar Valley Corporation is a Central Govt. owned utility, supplying power at 33kV level and above in the DVC command area spanning across the State of West Bengal and Jharkhand. Nearly 40% of sales of DVC are in the state of West Bengal.					
	Parameters	Unit	WBSEDCL	DPL	CESC	IPCL
	33 kV Lines	ckm	13,926	79	1,479	133
	11 kV Lines	ckm	150,946	386	6,346	752
	LT Lines	Ckm	291,092	960	12,554	19
	33/ 11 kV S/Stn	No.	517	2	108	14
	33/ 11 kV S/Stn	MVA	7,681	948	3,454	349
	DTs	No.	199,289	535	7,906	57
	DTs	MVA	9361.5	104	2,650	9
Financial Position	<p>The financial position of state owned distribution utility (WBSEDCL) has improved considerably over the last few years with WBSEDCL being able to remain profitable for the last 6 years.</p> <p>Favorable tariff structure with recognition of regulatory deficit have contributed to profitability of the Utility.</p> <p>CESC, the largest private power distribution utility in the State has also been profitable by efficiently managing its operations.</p>					

3. Power Supply Scenario

3.1. Power supply position

West Bengal is the 10th largest consumer of electricity accounting for nearly 4.38% of total energy consumption in India. Owing to significant improvement in power supply, the State witnessed only 0.5% energy shortfall in FY15, which is considerably lower than the national average energy shortfall of 3.6%. In terms of peak power requirement as well, the State has performed significantly better than the national average, as the peak deficit has been below 1% in the last 4 years as evident in Table 3 below.

Table 3: Peak demand vs Availability as per CEA (MW and %age)

Particulars	FY12	FY13	FY14	FY15
Peak Demand (MW)	6,592	7,322	7,325	7,544
Peak Available (MW)	6,532	7,249	7,290	7,524
Peak Shortage (%)	0.9%	1.0%	0.5%	0.3%

One of the key objectives of PFA program is to provide 24X7 electricity to all consumers, on which the State has performed well, as WBSEDCL and other distribution utilities are maintaining 24X7 supply to all connected consumers, including rural areas. The supply hours for both rural and urban areas are 24 hours and currently there are no load restrictions being imposed anywhere in the State.

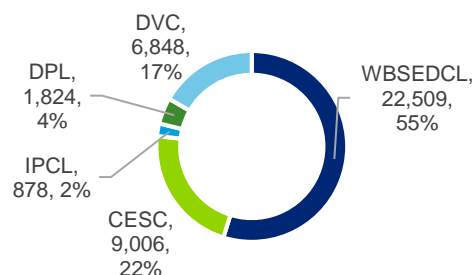
The utilities have also been able to adequately cater to the seasonal change in demand. The month on month energy shortfall and peak deficit during FY15 has been lower than 1.0%, as depicted in Figure 4

As mentioned earlier, there are five (5) distribution licensees engaged in supplying electricity to the consumers of West Bengal. Amongst the 5 utilities, WBSEDCL being the State owned entity, is

responsible for providing electricity to all domestic consumers across State, except Kolkata (CESC).

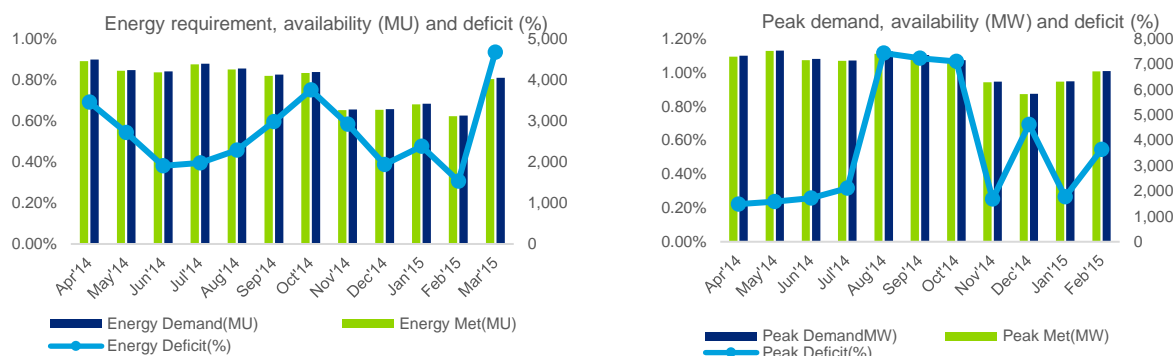
As evident from Figure 3, out of the total energy sales of 41,065 MU in FY15, WBSEDCL accounted for nearly 55%. This was followed by CESC, which supplies power to the regions of Kolkata and Howrah and accounted for nearly 22% of energy sales in the State. DVC contributed to 17% of sales and supplies mainly to industrial consumers and other distribution licensees in the State. In terms of consumers, the other State owned utility, DPL supplies mainly in the limited geography of industrial township of Durgapur and residential colonies thereof, accounting for nearly 4% of energy sales in the State. The other privately owned utility, DPSC supplies power to the regions of Asansol and Raniganj coal producing area, largely to industrial consumers and accounts for nearly 2% of the total sales.

Figure 3: Share of distribution utilities by sales (MU. FY15)



In terms of energy sold to different categories of consumers, WBSEDCL accounts for over 2/3rd of total domestic sales and about 41% of total industrial sales in the State. Majority, nearly 61% of the total sales in the State to commercial consumers pertains to WBSEDCL. DVC has second largest share (38.3%) of energy sales to industrial consumers, followed by CESC (8.0%) and DPL (7.9%). DVC supplies most of its power to HT industrial consumers having a load of 1 MVA and above. DVC also supplies energy to WBSEDCL (2% of energy sold) and DPSC (11.6%

Figure 4: Peak and Energy Deficit (FY 15, CEA)



of energy sold) at various interconnection points. It is pertinent to mention that WBSEDCL is the sole supplier of electricity to nearly 2.41 Lac agricultural consumers, accounting for nearly 6.63% of its total sales during FY15. The share of different utilities in total sales is shown in Figure 5

Out of the total 1.84 crore domestic consumers in the State, WBSEDCL supplies electricity to nearly 83% of total, followed by CESC (16.5% share) and DPL (0.31% share). The details of category wise consumers served by different utilities is presented in Table 4.

It is pertinent to mention that all 4 utilities, other than WBSEDCL, operating within their limited

geography, have achieved 100% electrification and 24X7 power availability. Thus, the significance of PFA program increases for WBSEDCL, which is operating across the State and is yet to achieve 100% electrification and 24X7 supply to its consumers. Accordingly, the projections of latent energy requirement from existing HHs and additional energy requirement from newly constructed HHs and newly electrified HHs have been prepared keeping WBSEDCL in focus. It is expected that the un-electrified HHs and newly constructed HHs shall be provided electricity access by WBSEDCL and the required T&D infrastructure shall be developed within the next four years.

Figure 5: Sales mix of WBSEDCL (MU, FY15)

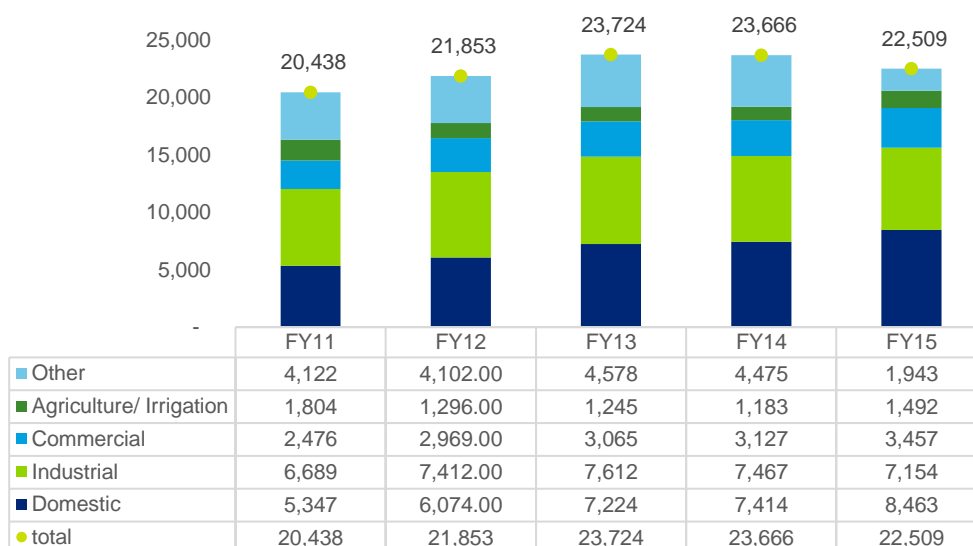


Table 4: Category wise number of consumers served by utilities in West Bengal as on Sep, 2015

Consumer Category	WBSEDCL (No.)	CESC (No.)	DPSC (No.)	DPL (No.)	DVC (No.)
Domestic	16,068,073	2,475,182	834	45,964	NIL
Industrial	96,909	65,107	788	356	
Commercial	1,192,000	361,357	299	5,665	NIL
Other	1,93,038	18,399	0	581	2 Licensees
Total	17,356,982	25,58,688	192121	52,566	

3.2. Methodology for demand projections

In line with the objective of PFA program, to provide 24X7 power to all HHs, the demand projection has been done separately for electrified and un-electrified rural and urban HHs. whereas, for rest of the consumer categories a growth rate based on WBSEDCL's estimation of the expected growth along with a review/ validation with the past trend has been considered. The following steps detail out the approach adopted for estimation of energy requirement.

Estimation of rural and urban electrified and un-electrified HHs

The estimated urban and rural HHs as per survey by WBSEDCL in its licensee area along with the status of electrification as on October 31, 2015 is provided in Table 5.

Table 5: Estimated Un-electrified Households in WB area (As on 31.10.2015)

Particulars	Urban	Rural	Total
Total HHs	63,50,113	1,31,53,418	1,95,03,531
Electrified	63,50,113	1,24,06,008	1,87,56,121
Balance (covered under PFA)	0	7,47,410	7,47,410

Estimation of energy requirement from HHs

The energy requirement from domestic category consumers (HHs) has been estimated using the end use method under the following broad categories:

- Latent demand from existing HHs on account of increase in specific consumption (kWh/HH/day) for each of the electrified HH due to life style advancements and natural growth;
- Additional energy requirement due to electrification of un-electrified HHs;

- Additional energy requirement due to construction of new urban and rural HHs;

Latent demand growth from already electrified HHs has been estimated based on expected increase in consumption levels in accordance with the objectives of the PFA program. Since the consumers in State already have access to 24X7 electricity and with the proposed DELP program, per HH per day consumption may not see a significant increase. It's only the natural growth in consumption levels due to lifestyle changes, which are expected to increase per HH per day consumption. The average per HH per day consumption of rural and urban HHs has been considered based on the consumption trend and expected impact of DELP program is detailed in Table 6.

Table 6: Per HH per day consumption for WBSEDCL (kWh)

Particulars	FY16	FY17	FY18	FY19
Rural	1.06	1.28	1.50	1.72
Urban	3.14	3.36	3.58	3.80

Considering the State has already achieved significant level of electrification over the past 5 years, the remaining urban and rural consumers are likely to be connected by FY17, as detailed in Table 7 the corresponding energy requirement from newly connected HHs is estimated based on per HH per day consumption as listed in Table 6.

The increase in new rural and urban HHs has been estimated based on the past CAGR of 3.38% and 2.08% for urban and rural areas respectively, based on census data. The corresponding energy requirement from new HHs is estimated based on the estimated per HH per day consumption.

Estimation of energy requirement from other consumer categories

The energy requirement projections from other consumer categories have been done based on projections of WBSEDCL.

The other than domestic category includes industrial, commercial, public lighting, agriculture, public water works and sales to other licensees. The sales to other licensees forms a significant

proportion of the retail sales and in future this is expected to reduce. Due to this the overall sales to other than domestic category is expected to reduce from FY17 onwards.

Table 7: Year wise electrification plan for WBSEDCL (HH Nos) FY 15 to FY 19

Particulars	FY15 (A)	FY16	FY17	FY18	FY19
Urban					
Opening Un-electrified HHs	0	0	0	0	0
Electrification of Newly Constructed HHs	92,612	92,612	92,612	92,612	92,612
Electrification of Existing UE HHs (Opening of FY15)	0	0	0	0	0
Balance Un-electrified HHs	0	0	0	0	0
Rural					
Opening Un-electrified HHs	39,86,110	21,86,110	1,66,110	0	0
Electrification of Newly Constructed HHs	2,47,659	2,47,659	2,47,659	2,47,659	2,47,659
Electrification of Existing UE HHs (Opening of FY15)	18,00,000	20,20,000	1,66,110	0	0
Balance Un-electrified HHs	21,86,110	1,66,110	0	0	0

Figure 6: Projected Energy sales for HH and Other categories (MU) for WBSEDCL

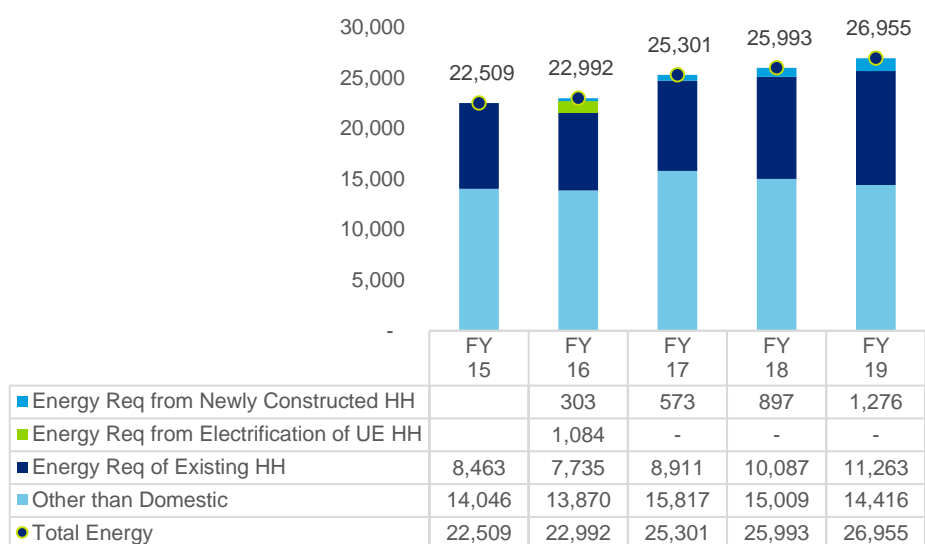
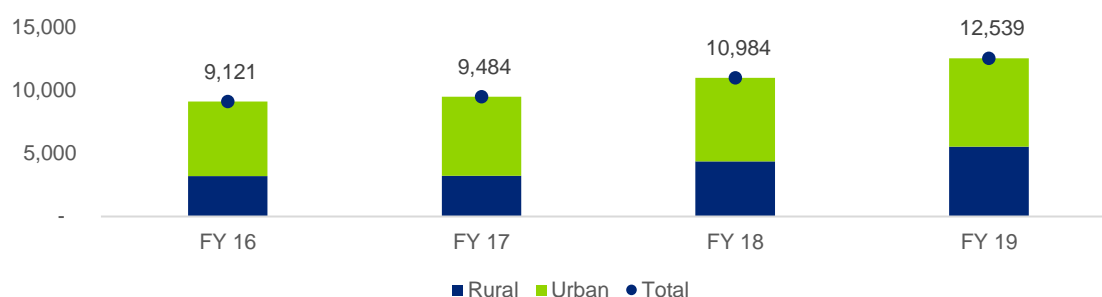


Figure 7: Rural Vs Urban Sales (MU) for WBSEDCL



3.3. Demand projections – WBSEDCL

Based on above steps, the energy sales for WBSEDCL is expected to increase by about 20%, from 22,509 MUs in FY15 to 26,955 MUs in FY19, as presented in Table 8. Owing to electrification of nearly 38 lac un-electrified HHs and increase in HHs in the State, the share of energy sales to domestic consumers is expected to increase from 37.6% in FY15 to nearly 44% in FY19.

It can also be observed from Figure 6, despite an increasing growth trajectory, the share of energy requirement from other than domestic category consumers is expected to reduce from 62% in FY15 to 56% in FY19, impacting the sales mix of the utility.

The share of energy requirement from urban and rural HHs is projected to grow significantly in the future due to the quantum leap in the access to energy in rural areas. The share of rural HH sales in the sales to domestic consumers, which stands at 38% in FY15 is expected to increase to 44% in FY19 as can be seen in Figure 7. As presented in the Table 8, the energy requirement of WBSEDCL is likely to increase from 32,184 MU in FY15 to 34,925 MU, with reduction in AT&C losses from present 29.8% to 22.5% in FY19. The projected energy requirement translates into increase in peak demand from 5,321 MW in FY15 to 6,351 MW in FY19.

3.4. Demand projection – Other utilities

The projected energy requirement and peak demand for other distribution licensees, as estimated by the respective licensees is presented in Table 9. It may be important to note that other utilities have projected the energy requirement based on the historical growth rates.

3.5. Overall demand projection – State

At the State level, the overall energy requirement is projected to grow from existing 52,358 MU in FY15 to 62,926 MU in FY19, representing an annual growth of 5% during the period. This translates into increase in peak demand from existing 7,544 MW in FY15 to 11,172 MW in FY19. It is important to note that the projections for peak demand are done considering the total energy requirement by all utilities and the average load factor as achieved in last two years. Additionally, an improvement in Load Factor is assumed to accommodate the impact of DSM measures planned by the utilities.

The projected energy requirement and peak demand up to the period FY19 are expected to remain slightly lower than the 18th EPS projections. A comparison of the projected figures under the PFA Roadmap vis-à-vis the 18th EPS is shown in the bar chart in Figure 8.

Table 8: Energy Requirement & Peak Demand Projections - WBSEDCL

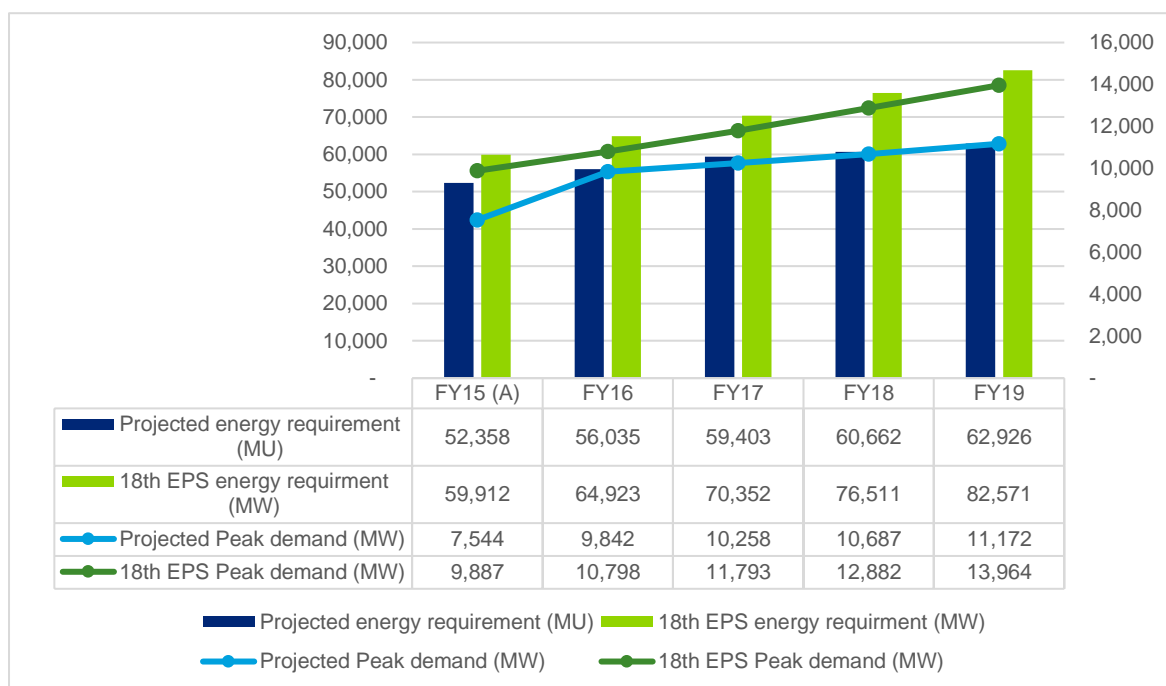
Particulars	Units	FY15 (A)	FY16	FY17	FY18	FY19
Energy requirement/ Sales	MU	22,509	22,992	25,301	25,993	26,955
AT&C losses	%	29.8%	28.0%	25.8%	23.5%	22.5%
Distribution Losses	%	27.60%	25.77%	23.45%	21.13%	20.10%
Transmission Losses	%	3.4%	3.4%	3.4%	3.4%	3.4%
Energy Input Requirement	MU	32,184	32,065	34,217	34,118	34,925
Load Factor	%	69.0%	69.3%	64.6%	63.3%	62.8%
Peak Demand	MW	5,321	5,282	6,047	6,152	6,351

Table 9: Estimation of energy requirement and peak demand for other utilities (FY 15 to FY 19)

Particulars	Units	FY 15	FY 16	FY 17	FY 18	FY 19
CESC						
Energy Requirement	MU	10,207	11,058	11,490	11,959	12,452
Peak Demand	MW	2,042	2,035	2,110	2,220	2,320

Particulars	Units	FY 15	FY 16	FY 17	FY 18	FY 19
DVC						
Energy Requirement	MU	7,068	7,726	8,417	9,175	10,006
Peak Demand	MW	1,117	1,423	1,550	1,689	1,828
DPSC						
Energy Requirement	MU	901	956	1,031	1,142	1,256
Peak Demand	MW	167	169	171	172	174
DPL						
Energy Requirement	MU	1,979	4,230	4,249	4,268	4,287
Peak Demand	MW	320	378	380	454	499
Total Other utilities						
Energy Requirement	MU	20,155	23,970	25,187	26,544	28,001
Peak Demand	MW	3,646	4,005	4,211	4,535	4,821

Figure 8: PFA Projected Energy Req. & Demand vs 18th EPS Projections



4. Generation Plan

4.1. Generation sector in West Bengal

The West Bengal Power Development Corporation Limited (WBPDC), a company owned by the Government of West Bengal, is entrusted with the responsibility to carry on the business of thermal power generation in the State. In addition, the state draws power from Durgapur Projects Limited, DVC, NTPC, NHPC and IPPs besides cross-border projects in Bhutan. The details of existing installed state owned generating capacity and available capacity from other generators are provided in Section 4.2 and Section 4.3 of this report.

The total power generation capacity available to the state (WBSEDCL), as on Sep 31, 2015, is 9,564 MW including allocation from Central Generating Stations. The share of thermal stations in the installed capacity stands at 85%. The State sources contribute to 67% of installed capacity, followed by the private sector which contribute to 21% of the installed capacity. Break-up of the installed capacity by ownership and source is provided in Table 10.

During the period FY15 to FY 19 the peak demand and energy requirement is expected to increase from 7,544 MW and 52,358 MU to 62,926 MU and 11,172 MW in FY19. In order to meet the increase in power demand, the state needs to carefully plan for either developing its own generation capacity or tie up with central generating stations/ IPPs. This chapter evaluates the readiness of the state for meeting the projected power demand scenario and highlights the steps required and the way forward in view of the gaps and issues identified therein.

4.2. Existing generation capacity- State sector

West Bengal's power demand is mostly met by the State's own sources. The State's own generation sources contribute to more than 64% of the total installed capacity, as shown in Table 11. WBPDC with 4,364 MW of installed capacity contributes to bulk of the State's generation capacity. WBSEDCL owns thirteen hydro power plants totaling 1,067 MW. Except Rammam (51 MW) and Purulia

Pumped Storage Plant (900 MW) all other the plants owned by WBSEDCL are under 25 MW capacity. Therefore, these plants are considered for discussion in the Renewable Energy plan under small hydro plants. The power stations of WBPDC and WBSEDCL (more than 25 MW) are listed in Table 12.

4.3. Existing generation capacity (other licensees)

In addition to power stations of WBPDC and WBSEDCL generating power in the state, other entities viz. CESC, IPCL and DVC also own and operate power generation projects in the state.

CESC caters to the city of Kolkata as an integrated utility. The company has its own 1,125 MW of installed capacity for serving the energy needs of the city. Thus, licensed area demand is partly met through three thermal power plants of CESC: Budge Budge, Titagarh and Southern. The existing plants of CESC are shown in Table 12. Further, 600 MW Haldia thermal power Plant owned by Haldia Energy Limited is dedicated to cater to the demand of CESC area. However, due to variations in demand there are occasional shortfalls which the licensee manages by means of short-term power purchases, apart from above long-term arrangements. Further, the company buys power from RE sources to meet its demand. The details of the present RE solar sources of the company are discussed in the Renewable Energy Plan chapter of this document.

DPSC is a distribution licensee catering to Asansol-Raniganj areas of West Bengal. Its generating stations at Chinakuri and Dishergarh are facing coal availability issues. IPCL's project in Haldia (3x150 MW) is expected to commence its operations in 2016 but does not have any present allocation with the State/ WBSEDCL.

DPL is a licensee operating in the colony of Durgapur Projects Limited. The licensee is managing its demand from a power plant of 660 MW capacity installed in its premises.

During the period FY15 to FY19 the peak demand and energy requirement for DVC is expected to increase from 1,117 MW and 7,068 MU to 1,828 MW and 10,006 MU in FY19. Damodar Valley Corporation (DVC) was entrusted with the responsibility of powering industrial growth in the resource rich Damodar Valley region and has been undertaking generation and transmission of power for more than 50 years. It has a total installed capacity of 6,357.2 MW in West Bengal and Jharkhand out of which a capacity of 3,753.2 MW is installed in West Bengal as outlined in Table 12.

4.4. Generation plan

The generation plan for the State envisages the proposed capacity additions by the state agencies along with the allocated share of upcoming central

and IPP generating stations. The generation capacity addition and power procurement plans have been aligned with the energy requirement and power demand assessed in the earlier sections of this Roadmap document.

Inter-state/ central sector projects

The Central Sector allocation for West Bengal are mostly from the NTPC's thermal stations (Farakka and Talcher). Further, WBSEDCL has allocations from the hydro projects of NHPC and hydro projects in Bhutan. The projects in Bhutan contribute to more than 80% of the total upcoming hydro allocation for the State. Table 11 provides the Central Sector allocations of the State. WBSEDCL has allocation of 50 MW from Meija V and VI of DVC

Table 10: Installed Capacity for WBSEDCL (MW) as on July 2015 (CEA Executive Summary)

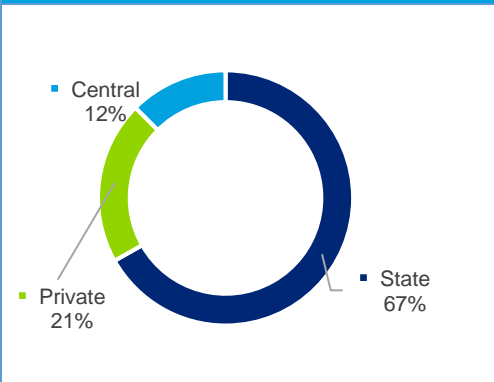
Share	Sector	Thermal	Hydro	RE	Total
 <p>Central 12%</p> <p>Private 21%</p> <p>State 67%</p>	State	5,320	977	92	6,389
	Private	1,941	0	40	1,981
	Central	922	271	0	1,194
	Total	8,183	1248	132	9,564

Table 11: Plant wise details of allocated capacity from Central sector and Bhutan projects (As per CEA power supply position report for August 2015 and WBSEDCL)

Sl.	Source	Owner	Capacity (MW)	%Allocation	Allocated Capacity (MW)
	Thermal				
1	Farakka (Unit 1 to 5)	NTPC	1,600	30.54	489
2	Farakka (Unit 6)	NTPC	500	29.44	147
3	Talcher	NTPC	1,000	9.10	91
4	Meija V and VI	DVC	1,000	5%	50
	Total Thermal				777
	Hydro Stations				
1	Rangit HPS	NHPC	60	28.34	17
2	Teesta-V HPS	NHPC	510	23.98	122
3	Chukha HPS	Bhutan	270	27.04	86
4	Kurichu HPS	Bhutan	60	41.67	30

Sl.	Source	Owner	Capacity (MW)	%Allocation	Allocated Capacity (MW)
5	Tala HPS	Bhutan	1,020	38.25	390
6	Teesta Low Dam III	NHPC	132	100	132
	Total Hydro				7777
	Solar Power				
1	Kahalgao Bundled Solar	NTPC	35		35
	Total Hydro				35
	Total Firm Allocations				1,589

In addition to the above, the State draws power from the unallocated shares of Central Generating Stations. As on Aug 2015, 35 MW of unallocated share of NTPC stations was assigned to West Bengal.

The State has been allocated a share of 1,114 MW from the upcoming Central Generating Stations and projects in Bhutan. This includes 586 MW of Hydro power from NHPC and Bhutan and 528 MW from the ongoing NTPC projects. The details are provided in Table 13. Further, regarding the Teesta Basin Investigation projects, Govt. of West Bengal has allotted four projects in West Bengal to NHPC namely Teesta Low dam V (80 MW), Teesta Low Dam I & II combined (81 MW), Teesta Intermediate (84 MW) and Rammam Stage I (48 MW) for which Memorandum of Agreement has been signed.

State sector projects

During the period FY16 to FY19 two additional units (Sagardighi 2X500 MW Unit III and IV) owned by

the WBPDCCL are expected to be commissioned. Unit III of the plant has already been commissioned and Unit IV is expected to be commissioned by July, 2016.

Generation plan of DVC

Targeted capacity addition program for 12th plan includes an addition of 3,520 MW out of which Raghunathpur TPS (Phase-1: 2x600 MW & Phase -2: 2x660 MW) are to be installed in West Bengal.

Generation plan of IPPs

WBSEDCL has an allocation of 300 MW from Maithon Power Plant and 100 MW from Adhunik Power and Natural Resources Limited. Further, the state buys 100 MW from Bagliar HEP through PTC. IPCL's Haldia (3x150 MW) is expected to commence its operations in FY16-17.

Table 12: Existing Plants in the State and Private Sector

Plant	Owner	Installed Capacity (MW)	Status
Kolaghat (6x210 MW)	WBPDCCL	1,260	In operation
Bakreswar (5x210 MW)	WBPDCCL	1,050	In operation
Bandel (4x60 MW+ 1x210 MW)	WBPDCCL	455	Unit 5 capacity increased to 215 MW after R&M
Santalidhi (2x250 MW)	WBPDCCL	500	In operation
Sagardighi (2x300 MW)	WBPDCCL	600	In operation
Sagardighi (new) (2X500MW)	WBPDCCL	1,000	U3 500 MW commissioned, U4 500 MW is expected by Jul 2016
Jaldhaka (3X9 MW)	WBSEDCL	27	In Operation
Rammam (4 x 12.75 MW)	WBSEDCL	51	In operation
PPSP (4 x 225 MW)	WBSEDCL	900	In operation
Chinakuri	IPCL	30	Idle, land lease expired, The issue is under consideration
Dishergarh	IPCL	12	Operational, awaiting FSA from CIL.
Budge Budge Generating Station	CESC	750	In operation
Titagarh generating Station	CESC	240	In operation
Southern Generating Station	CESC	135	In operation

Plant	Owner	Installed Capacity (MW)	Status
Haldia	HEL	600	In operation
Mejia Thermal Power Station	DVC	2,340	In operation
Durgapur Thermal Power Station	DVC	350	In operation
Maithon Hydel Station	DVC	63.2	In operation
Durgapur Steel Thermal Power Station	DVC	1,000	In operation
Durgapur Projects Limited	DPL	660	In Operation
Total		11,523.2	

Table 13: Upcoming Central Generating Stations

Source	Fuel	Owner	Capacity (MW)	Allocated Capacity for WBSEDCL in MW	Expected CoD	Status
Teesta low Dam IV	Hydro	NHPC	160	160	Sept 2016	Under Construction One unit of 40 MW already commissioned and spinning of another unit done)
Teesta IV	Hydro	NHPC	520	121	August 2022	Under Clearance
New Nabinagar (NTPC)	Thermal	NTPC	1,980	179	July 2017	Under Construction (WBSEDCL has cancelled PPA)
North Karanpura (NTPC)*	Thermal	NTPC	1,320	99 (312 As per CEA)	July 2017	Under Construction (WBSEDCL has cancelled PPA)
Katwa	Thermal	NTPC	1,320	1,122	Beyond FY 19	Under Construction
Darlipalli(NTPC)*	Thermal	NTPC	1,600	250	June 2016	Under Construction
Bhutan						
Punatsangchhu-II HEP (1020 MW)	Hydro	Bhutan	1,020	106	June 2017	Under Construction (Expected Slippage in COD)
Mangdechhu HEP (720 MW)	Hydro	Bhutan	474	75	Sept 2017	Under Construction (Expected Slippage in COD)
Punatsangchhu I (1200 MW)	Hydro	Bhutan	1,200	124	Dec-2018	Under Construction (Expected Slippage in COD)
Total Allocations				1,114 (By FY 19)		

4.5. R&M Program

WBPDCL is undertaking R&M of Bandel Thermal Power Station (BTPS) Unit 5 of 210 MW. The capacity of this unit is expected to increase by 5 MW after the works are completed. This is a part of the World Bank financing of “Coal Fired Generation Rehabilitation Project-India” for demonstrating Energy Efficiency Rehabilitation & Modernization (EE R&M) at coal fired generating units through rehabilitation of 640 MW of capacity across three states – West Bengal, Haryana and Maharashtra. The total estimated cost of R&M project is around USD 107.38 Million comprising of loan of around USD 59 Million and GEF Grant of around USD 12.45 Million.

Further, as a measure to reduce the environmental impact of the thermal power plant, R&M works are proposed for rest of the units which are running since 1965. The expected cost of these works are Rs. 652 cr.

4.6. Anticipated power availability position- WBSEDCL

During FY16 to FY19 WBSEDCL is expecting capacity additions of 1,114 MW through thermal and hydro sources. Additionally, in the period FY 16 to FY 19 a total of 585 MW is expected from Renewable Energy sources. During the period FY16 to FY19, bulk of energy is expected from thermal sources (75% of the total volume available)

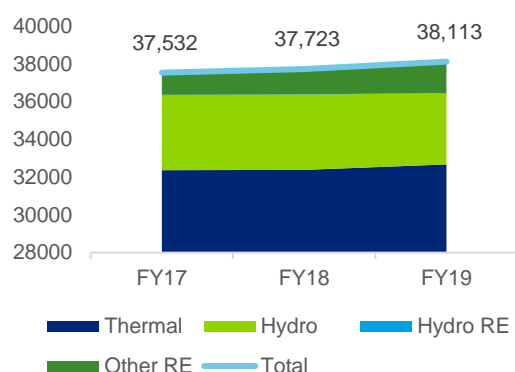
while the share of Renewables is expected to be 2%.

These capacity additions mean that the allocated capacity is expected to increase to 9,637 MW by FY19. With this allocated capacity maximum peak demand that may be catered is 7,798 MW. As the peak demand of WBSEDCL in FY19 is expected to be 6,351 MW, the utility is expected to be in a comfortable power availability situation. The following figure shows the available capacity for WBSEDCL. Similarly in terms of energy WBSEDCL may have a surplus of 9,706 MU in FY19. The expected surplus is about 25% of the total energy requirement.

It may be noted that, as a practice, additional peak and energy available to WBSEDCL is traded, sold to other utilities in the state and exported to Bangladesh. Consequently, WBSEDCL may witness an increase in revenues from trading of power over the coming years.

Energy available from various sources are estimated by using data provided by WBSEDCL.

Figure 9: Energy Available from Thermal, Hydro and RE Sources for WBSEDCL



4.7. Anticipated Power Availability Position- Other Licensees

CESC

The projected demand for CESC is 2,320 MW by FY19. Accordingly, the utility has plans for adequate power generation/procurement for meeting this demand. This indicates that the utility does not expect shortfall in terms of energy requirement or peak demand during the period FY16 to FY19.

DPSC

The projected demand for DPSC is 174 MW by FY19. The installed capacity of the two thermal power plants of DPSC is 42 MW. One of the thermal plants has been retired from service and the company has only 12 MW of capacity remaining under operating condition. This installed capacity is not sufficient to cater to the expected demand in FY19 therefore, the company has planned for new/additional tie-ups till FY19 in a manner that the utility will not have any shortfall in terms of energy requirement or peak demand by FY 19.

This may include entering into a PPA with the IPCL's upcoming thermal generating plant in Haldia 450 MW (3x150 MW).

DPL

The projected demand for DPL is 499 MW by FY19. The company has an installed capacity of 660 MW which is sufficient for meeting its future demands till FY19. This indicates that the utility is not expecting shortfall in terms of energy requirement or peak demand by FY19.

It can be seen that the utilities including WBSEDCL are expected to have sufficient allocations/tie-ups to meet the anticipated demand by FY19. Table 14 shows the consolidated availability position in terms of peak demand and energy requirement for the period FY16 to FY19.

4.8. Key Issues

The state generating company WBPDCCL owns five thermal power plants having installed capacity of 3,865 MW and another unit of 1,000 MW of thermal capacity (Sagardighi) is expected to be commissioned by FY17. The company has allocations of 14.6 MMT from six coal fields. However, the company is awaiting coal allocation from Kasta East coal field from Ministry of Coal.

DPSC is awaiting coal allocations from ECL for its new 12.2 MW plant at Dishergarh. Further, the Chinakuri 3X10 MW plant is idle after the lease for coal expired in March 2012. DPSC was awaiting allocations of quality fuel at suitable price for these two stations.

Figure 10: Anticipated Energy Availability (MU) for WBSEDCL

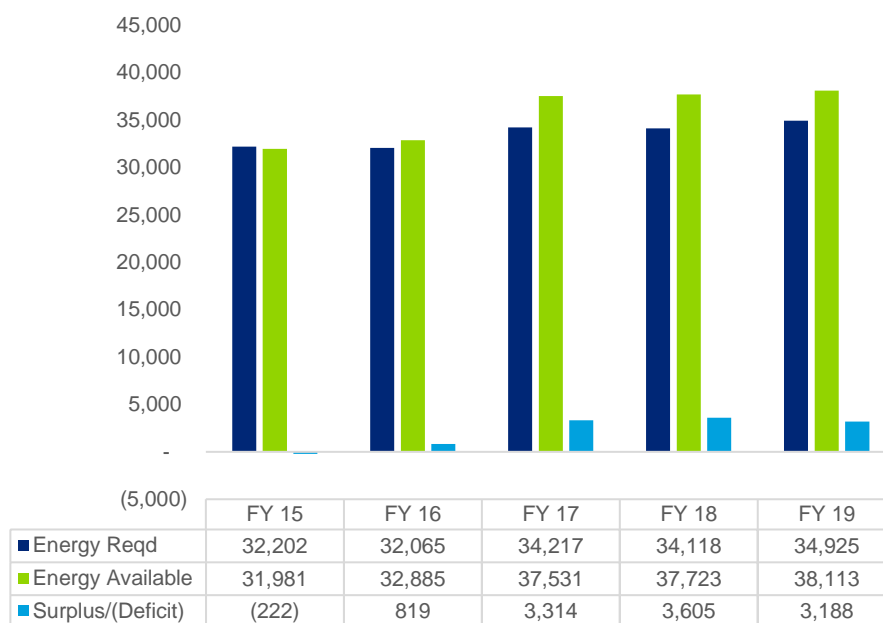


Figure 11: Anticipated Peak Availability Position of WBSEDCL (MW)

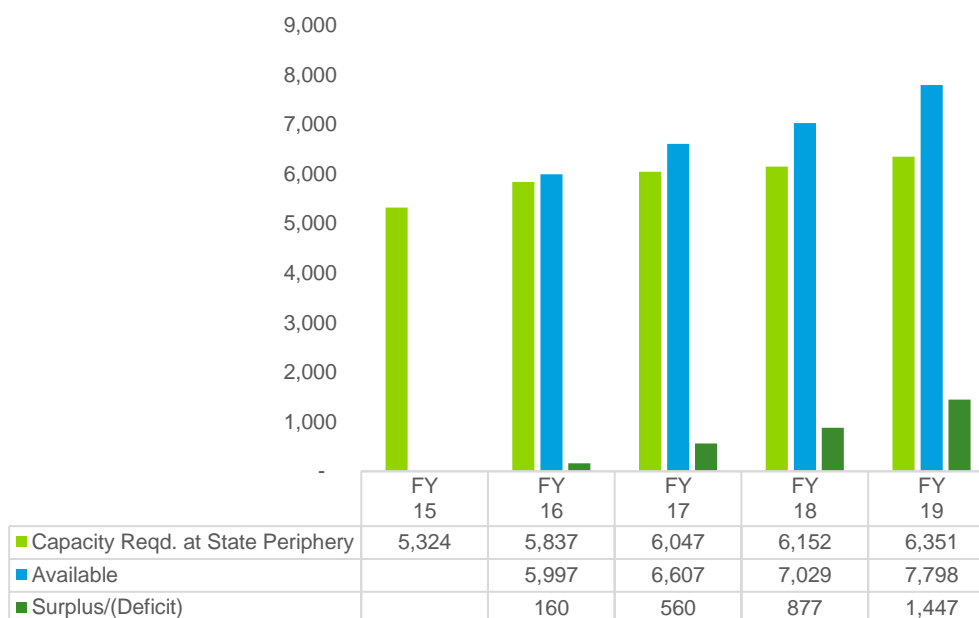


Table 14: Anticipated Power Availability Position for West Bengal

Parameter	Unit	FY16	FY17	FY18	FY19
WBSEDCL					
Energy requirement	MUs	32,065	34,217	34,118	34,925
Energy availability	MUs	32,885	37,531	37,723	38,113
Surplus/ (Deficit)	MUs	819	3,314	3,605	3,188
Peak demand	MW	5,837	6,047	6,152	6,351
Peak Availability (Incl. Renewables)	MW	5,997	6,607	7,029	7,798

Parameter	Unit	FY16	FY17	FY18	FY19
Surplus/ (Deficit)	MW	160	560	877	1,447
Other Utilities					
Energy requirement	MUs	23,970	25,187	26,544	28,001
Energy availability	MUs	23,970	25,187	26,544	28,001
Surplus/ (Deficit)	MUs	0	0	0	0
Peak demand	MW	4,005	4,211	4,535	4,821
Peak Availability (Incl. Renewables)	MW	4,005	4,211	4,535	4,821
Surplus/ (Deficit)	MW	0	0	0	0
West Bengal - State					
Energy requirement	MUs	56,035	59,403	60,662	62,926
Energy availability	MUs	56,854	62,718	64,267	66,114
Surplus/ (Deficit)	MUs	819	3,314	3,605	3,188
Peak demand	MW	9,842	10,258	10,687	11,172
Peak Availability	MW	10,002	10,818	11,564	12,619
Surplus/ (Deficit)	MW	160	560	877	1,447

4.9. Power purchase cost

WBSEDCL's power purchase cost for the last few years has been varying between 3.83 Rs./kWh to 4.12 Rs./kWh during FY13 to FY15. The rise in average power purchase rate was partly driven by the rise in variable cost of generation. The utility has been able to reduce the cost by 26 paisa/ kWh during FY15 with the following steps:

- Increase in generation by state's own sources by 44.9% in FY15 over FY14. This helped in reducing the variable power purchase cost.
- Restructuring of Long term procurement plan by avoiding costly PPA's.
- Using the Day Ahead Market (DAM) to procure cheaper power. The utility increased the quantum of energy bought by about 34% in FY15.
- Economic operation of Purulia Pumped Storage Station helped the utility to avoid peak power purchases.
- The utility has focused on buying power from short-term market. Buying varying quantum of

power instead of Round The Clock (RTC) purchases has enabled the utility to avoid fixed costs and reduction in back down charges.

- Lastly, the utility has used wheeling and banking arrangements to efficiently to manage the power purchase costs.

4.10. Fund Requirement

R&M works at BTPS totaling Rs. 652 cr. are being funded through World Bank and PFC. For the upcoming Sagardighi TPS Rs 5,340 Cr, which is in advanced stages of construction, financing arrangements have already been secured. As such, there is no funding gap for investments proposed under the state sector during the period covered under the PFA Roadmap.

4.11. Action Plan & Support Required

The action plan and support requirements for generation plan for the state are covered in Table 15.

Table 15: Action points for Generation Plan

Agency	Action Plan
WBPDC	To prepare R&M plan for old units of BTPS (units 1, 2 and 3)
CIL	Address the coal allocation issues of WBPDC and DPSC
WBSEDCL	Make arrangements for alternate power sources for the period of R&M of BTPS

5. Transmission Plan

5.1. Transmission capacity requirement

The planning and development of intra-state transmission system in the state is undertaken by WBSETCL. A well planned and strong transmission system will ensure not only optimal utilization of transmission capacities but also of generation facilities and would further facilitate achieving ultimate objective of cost effective delivery of reliable power to end consumers.

The requirement of electricity in energy and peak demand terms for the State are expected to increase from the present level of 52,358 MU and 7,544 MW in FY15 to 62,926 MU and 11,172 MW in FY19.

The state's generation plan as detailed in previous Chapter of this report outlines the upcoming projects in the state in addition to the allocation from Central Generating Stations and other generators. A total of 2,401 MW is expected to be added to the existing system by FY19. The transmission plan proposed in this chapter aims at ensuring adequacy of transmission infrastructure for evacuation of such power from the inter-state boundary/ proposed generating plants within the State, to the end consumers located across various geographies of the State.

5.2. Existing transmission system

Intra-state transmission system

The Govt. of West Bengal w.e.f 1st April 2007 unbundled West Bengal State Electricity Board into two Companies viz. West Bengal State Electricity Distribution Company Limited (WBSEDCL) and West Bengal State Electricity Transmission Company Limited (WBSETCL). Under the West Bengal Power Sector Reforms Transfer Scheme 2007, activities relating to Transmission and Load Dispatch business of WBSEB were transferred to West Bengal State Electricity Transmission Company Limited (WBSETCL).

As on 31st March 2015, WBSETCL operates and maintains a transmission network of 12,042.54 ckt. kms of Extra High Voltage Transmission lines along with 113 sub-stations (400/220/132/66 kV) having total transformation capacity of 23,580.8 MVA, spread over the entire stretch of the State of West Bengal. The existing transformation capacity and line length (400kV, 220kV, 132 kV and 66 kV) of WBSETCL network is summarized in Table 16.

Table 16: Intra-state Transmission System

Voltage	Transformation Capacity (MVA)	Line Length (ckt kms)
400 kV	3,780.0	1,644.70
220 kV	9,880.0	2,941.50
132 kV	9,674.5	7,035.34
66 kV	246.3	421.0
Total	23,580.8	12,042.54

The existing capacity of intra-state transmission system requires further strengthening for meeting the growing demand for power in the State. The availability of WBSETCL's transmission system is at par with other leading state transmission utilities in the country.

Inter-state transmission system

Energy requirement of West Bengal is around 40% of the total energy required by the eastern region states. The state grid operates at a maximum voltage of 400 kV and is connected at 400kV level to the ER systems with neighboring states in the Region. At present, the inter-state transmission system has about 8,266 ckt kms of transmission line with a total transformation capacity of 5,485 MVA, with the following voltage wise break-up shown Table 17.

Table 17: Inter- state Transmission System

Voltage	Transformation Capacity (MVA)	Line Length (cKM)
400 kV	4,595	6,980
220 kV	890	1,162
132 kV	-	124

Voltage	Transformation Capacity (MVA)	Line Length (ckm)
Total	5,485	8,266

The inter-state EHV substations connecting West Bengal to the ER are listed in Table 18.

In addition to this, the Berhampur – Bheramara 400 kV D/c, Tala HEP – Binaguri 2xD/c (with LILO of one ckt. at Malbase) lines are inter-country lines connecting West Bengal to Bangladesh & Bhutan and being used for cross border trade of electricity.

Detailed list of Inter State Transmission Lines is shown in Table 19.

Inter-state transmission system - DVC

At present, 4 substations of DVC are connected to ISTS network. Raghunathpur, Mejia, Maithon and Durgapur. The total length (ckm) of 400 kV transmission lines stand at 166 ckm. 2,236.36 ckm lines are maintained by the Transmission Department at 220 kV level and a total of 3,384.45 ckm lines at 132 kV level. The details are provided in Annexure 10, 11 & 12.

Table 18: Inter- state Substations in West Bengal

Name of sub-station	Transformation ratio (kV)	Capacity (MVA)
Maithon	400/220	630
Malda	400/220	630
New Siliguri (Binaguri)	400/220	630
Subhasgram	400/220	1,760
Durgapur	400/220	630
Farakka	400/220	315
Malda	220/132	370
Birpara	220/132	260
Siliguri	220/132	260
Total MVA		5,485

Table 19: Inter-state and Inter-country Transmission lines Connecting West Bengal to ER/ other States

Name of transmission line	Voltage level	Route Length (km)	Type
Farakka STPS - Sagardighi 400kV S/c	400 kV	68	Intra state
Farakka STPS - Berhampur 400 kV S/C	400 kV	72	Intra state
Sagardighi TPS - Subhasgram 400 kV S/C	400 kV	259	Intra state
Berhampur - Jeerat 400 kV SIC	400 kV	168	Intra state
Berhampur - Bheramara (Bangladesh) 400 kV D/C	400 kV	100	Inter country
Sagardighi TPS - Berhampur 400 kV D/C	400 kV	35	Intra state
Jeerat - Subhasgram 400 kV SIC	400 kV	60	Intra state
Farakka STPS - Parulia 400 kV D/C	400 kV	150	Intra state
Farakka STPS - Malda 400 kV D/C	400 kV	37	Intra state
Farakka STPS - Kahalgaon 400 kV D/C	400 kV	95	Inter state
Farakka STPS - Kahalgaon 400 kV D/C	400 kV	95	Inter state
Tala HEP - Binaguri 400 kV D/C	400 kV	150	Inter country
Tala HEP - Binaguri 400 kV SIC	400 kV	160	Inter country
Tala HEP - Malbase - Binaguri 400 kV S/C	400 kV	170	Inter country
Teesta V HEP - Rongpo - Binaguri 400 kV D/C	400 kV	110	Inter state
Malda - Purnea 400 kV D/C	400 kV	125	Inter state

Name of transmission line	Voltage level	Route Length (km)	Type
Binaguri - Purnea 400 kV D/C	400 kV	160	Inter state
Binaguri - Purnea 400 kV D/C	400 kV	160	Inter state
Bongaigaon - Binaguri 400 kV D/C	400 kV	218	Inter state
Parulia - Jamshedpur 400 kV S/C	400 kV	180	Inter state
Parulia - Maithan 400 kV D/C	400 kV	70	Inter state
Kharagpur - Baripada 400 kV S/C	400 kV	100	Inter state
Birpara - Shalakati 220 kV D/C	220 kV	160	Inter state
Birpara - Chukha HEP 220 kV D/C	220 kV	127	Inter Country
Birpara - Singaigaon- Chukha HEP 220 kV S/C	220 kV	135	Inter Country
Birpara - Binaguri 220 kV D/C	220 kV	81	Intra state
Binaguri - Siliguri 220 kV D/C	220 kV	6	Intra state
Siliguri - Dalkhola 220 kV D/C	220 kV	119	Intra state
Dalkhola - Malda 220 kV D/C	220 kV	116	Intra state
Dalkhola - Purnea 220 kV D/C	220 kV	50	Inter state
STPS - Chandil 220 kV S/C	220 kV	74	Inter state
Siliguri - Kurseong 132 kV S/C	132 kV	40	Intra state
Siliguri - Melli 132 kV SIC	132 kV	90	Inter state
Kurseong - Rangit HEP 132 kV SIC	132 kV	80	Inter state
Rammam HEP -II - Rangit HEP 132 kV SIC	132 kV	40	Inter state

5.3. Intra-state transmission plan

Ongoing schemes

In accordance with the 5 year long term rolling transmission system investment plan, WBSETCL is working on a number of transmission projects, without any financial assistance from the Government of West Bengal and Government of India, to improve the network infrastructure and to ensure reliability and quality of supply to end consumers. The projects are being funded from WBSETCL's internal accruals and domestic borrowings from financial institutions.

WBSETCL has identified such projects in order to meet the following requirements:

- Meet demand for power arising from existing and future end-consumers in various load centers/ pockets in the state, considering distinct district wise load growth projections;
- Providing connectivity for evacuation of power from various upcoming intra and inter-state power plants and for onward delivery of such power to load centers/ drawl points;

- Improving the availability and reliability of the intra-state transmission systems in the State; and
- Improving efficiency by way of reducing technical losses in the intra-state transmission systems, using in-house system studies.

The plan covers system for intra-state transmission network strengthening as well as evacuation of power from State owned generating stations. The summarized list of ongoing, approved and proposed capacity additions at various voltage levels is summarized in Table 21.

The substation and line wise details of ongoing, approved and proposed intra-state transmission systems have been provided in Annexure 7, 8 and 9.

Out of the 42 proposed substations, the ongoing schemes for 12 sub-stations and 1,025.5 kms of transmission lines are scheduled to be completed progressively by FY16 and FY17. The approved schemes for 18 sub-stations and 399.6 kms of transmission lines are to be completed progressively from the year FY17 onwards. The remaining 12 substations and 569.5 kms of

transmission lines will be reviewed annually and will be taken up for construction at the earliest. All those schemes are to be completed progressively by FY22. The above investment plan is rolling in nature and is subject to change on account of variations in load flows through the transmission network elements that may result from deviations in load growth projection vis-a-vis actual load growth.

WBSETCL is focusing on efficient operation and maintenance practices to provide stable and quality power with maximum transmission system availability and minimum transmission system losses.

5.4. Inter-state transmission system plan

It has been planned to add about 3,863 ckm (1,000 ckm - 765kV & 2,863 ckm – 400 kV) of ISTS lines along with augmentation of about 9,435 MVA transformation capacity including creation of two new 765/400kV substations (Jeerat-3,000 MVA and Medinipur-3,000 MVA) and two new 400/220kV substations (Rajarhat-1,000 MVA and Alipurduar-630 MVA) in West Bengal.

A summary of the proposed works under ISTS is shown in Table 20:

Table 20: ISTS Capacity Addition Plan

Voltage	Transformation Capacity (MVA)		Line Length (ckm)	
	Present	In 2019	Present	In 2019
765kV	-	6,000	-	1,000
400 kV	4,595	7,910	6,980	9,843
220 kV	890	1,010	1,162	1,162
132 kV	-	-	124	-
Total	5,485	14,920	8,266	12,005

With a focus to meet the State Generation deficit and seasonal variability, the strengthening of the inter-regional and inter-state transmission systems in the Eastern Region has gained importance and is focused on capacity augmentation of existing interconnecting substations and transmission lines with the assistance of CTU.

Table 21: Ongoing, approved and proposed schemes of WBSETCL

Parameter	Ongoing	Approved	Proposed	Grand Total
Substations (Numbers)	12	18	12	42
Transformation Capacity (MVA)	3,769	3,007	4	10,399
400/220 kV	1,260	315	1,260	2,835
220/132 kV	1,920	1,280	1,600	4,800
220/33 kV		160		160
132/33 kV	589	1,252	763	2,604
Lines (RL Kms)	1,026	400	570	1,995
400 kV	353	53	150	556
220 kV	201	82	153	436
132 kV	472	265	267	1,003

Ongoing schemes (PGCIL)

ERSS-V

- Establishment of 400/220 kV, 2x500 MVA new substation at Rajarhat
- LILLO of Subhashgram - Jeerat 400kV S/c line at Rajarhat
- Rajarhat-Purnea 400 kV D/c line (with triple snowbird conductor) with LILLO of one circuit at Gokarna (WBSETCL) and other circuit at Farakka (NTPC)

Transmission Line is of length 906 ckm of 1,000 MVA capacity and is expected to be commissioned by Apr-2016.

ERSS-IX

- Transformation Augmentation: Replacement of 400/220kV, 2x315MVA ICT with 2x500MVA at Maithon S/s (370MVA). Expected date of commissioning is June 2016

ERSS-XII

- Augmentation of Transformation Capacity at Farakka: 1x315MVA, 400/220kV 2nd ICT
- Replacement of existing 100 MVA, 220/132kV ICTs with 1X160 MVA, 220/132 kV ICT at Siliguri 220/132 kV sub-station of POWERGRID
- Replacement of existing 100 MVA, 220/132kV ICTs with 1X160 MVA, 220/132 kV ICT at Birpara 220/132 kV sub-station of POWERGRID. Expected date of commissioning is Nov, 2016.

ERSS-XIII

- Re - conducting of Farakka-Malda 400kV D/c line with high capacity HTLS conductor, Line Length is 80 ckm, Expected date of commissioning is Nov, 2016.

Transmission System for development of pooling station in Northern part of West Bengal and transfer of power from Bhutan to NR/WR.

- New 2x315MVA, 400/220kV AC & HVDC sub-station with ± 800 kV, 3,000 MW converter module at Alipurduar and 3,000 MW inverter module at Agra.
- Lhamoizingkha (Bhutan Border) – Alipurduar 400kV D/c with Quad Moose Conductor (128 ckm)
- LILO of Bishwanath Chariali – Agra HVDC line at Alipurduar for parallel operation of the HVDC station (24 ckm)
- LILO of Bongaigaon – Siliguri 400kV D/c line (quad) (under pvt. Sector) at Alipurduar (14ckm)
- LILO of Birpara-Salakati 220kV D/c line at Alipurduar (8 ckm)

Transmission System: One Substation (630 MVA); Line: 174 ckm, Commissioning: Dec-2016.

On-going transmission system (TBCB)

ERSS-VII

- Purulia PSPP - Ranchi 400 kV D/c line (280 ckm)
- Chaibasa - Kharagpur 400 kV D/c line (340 ckm)

Transmission Line length - 620 ckm

Future transmission system (PGCIL)

Transmission System for evacuation of power from Punatsangchhu-I (1,200 MW), Punatsangchhu II (990 MW), Mangdechhu (720 MW) and Wangchhu (570 MW) HEPs in Bhutan (POWERGRID Portion)

- Jigmeling - Alipurduar 400kV D/C line with Quad moose conductor (Indian Portion) (397 ckm); commissioning: Mar-2018

ERSS-XV

- Farakka – Behrampur 400 kV D/c line (160ckm)
- Removal of existing LILO of Farakka- Jeerat S/C line at Behrampur
- LILO of above Farakka-Jeerat 400 kV S/C line at Sagardighi TPS

- LILO of Sagardighi TPS-Subhashgram 400 kV S/C line at Jeerat

Transmission System : 208ckm

ERSS-XVII

- Transformation Augmentation: Replacement of 400/220 kV, 2x315 MVA ICT with 2x500 MVA at Malda S/s & Installation of 400/220 kV, 315 MVA ICT each at Durgapur and New Siliguri S/s (1,000MVA)

Future transmission system (TBCB)

ERSS-XVIII:

765kV System

- Establishment of 765/400kV, 2x1500MVA new substations at Medinipur and Jeerat (New)
- Ranchi (New) – Medinipur 765kV D/c line (600ckm)
- Medinipur – Jeerat (New) 765kV D/c line (400 ckm)

400kV Interconnection

- Medinipur – Haldia New (NIZ) (WBSETCL) 400kV D/c line (quad/HTLS) (260 ckm)
- LILO of Chandithala – Kharagpur 400kV D/c line at Medinipur (40 ckm)
- Jeerat (New) – Subhasgram 400kV D/c line(quad/HTLS) (240 ckm)
- Jeerat (New) – Jeerat 400kV D/c line (quad/HTLS) (20 ckm)
- LILO of Jeerat (WBSETCL) – Subhasgram (POWERGRID) 400 kV S/c line at Rajarhat (POWERGRID) (8 ckm)

Transmission Line length is 1,568 ckm, and Transformation Capacity: 6,000 MW

Transmission System for evacuation of power from Punatsangchhu-I (1,200 MW), Punatsangchhu II (990 MW), Mangdechhu (720 MW) and Wangchhu (570 MW) HEPs in Bhutan (TBCB Portion in West Bengal).

- Alipurduar – Siliguri 400kV D/c line with Quad moose conductor (300 ckm)

5.5. Adequacy of transmission planning

The intra-state transmission plan prepared by WBSETCL is adequate to meet the projected demand by FY19. The total capacity (including

existing GSS and Lines) after implementation of all schemes is shown in Table 23.

With the total anticipated demand for power reaching 11,172 MW in FY19, the ongoing/ proposed projects for capacity additions and augmentations will be adequate to cater to the increasing load and also improve reliability of the system by building in redundancies in the system. With the proposed capacity additions, it is envisaged that there should not be any bottlenecks in transmitting power from various generating stations up to 132 kV network of WBSETCL, provided the identification of sub-station locations has been done in accordance with the detailed

district/ area wise load growth assessments prepared by WBSEDCL.

5.6. Fund requirement (Intra-state only)

The requirement of funds for development of ongoing and planned transmission systems of WBSETCL is provided in Table 22.

A total fund requirement of Rs. 3,500 Cr is envisaged for transmission development within the state.

Table 22: Year-wise fund requirement for Ongoing & Planned Intrastate Transmission System (Rs. Crs.)

Item	FY16	FY17	FY18	FY19
Estimated Fund Requirement	609	1011	1034	846

Table 23: Total Intra-Transmission Capacity (in MVAs) Post Implementation of Schemes

Particulars	Existing	Additions after implementation of Schemes			Cumulative Capacity
		Ongoing	Approved	Proposed	
Grid Substations (Nos)	113	12 (New 8 Upgrade 4)	18 (New 16, Upgrade 2)	12 (New 10, Upgrade 2)	147
Transformation Capacity (MVA)					
400 KV	3,780	1,260	315	1,260	6,615
220 KV	9,880	1,920	1,440	1,600	14,840
132 KV	9,674.5	589	1,252	763	12,278.5
66 kV	246.3				246.3
Sub Total	23,580.3	3,769	3,007	3,623	33,979

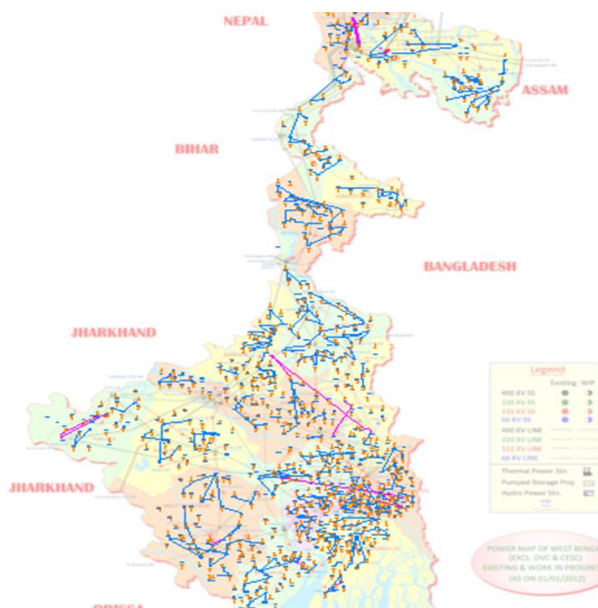
5.7. Transmission planning related issues

WBSETCL has been using system studies (using Mi Power and PSS/E power system simulation tools) for planning transmission augmentation and strengthening schemes. The transmission system planning is a continuous process as it is progressively aligned with the supply and demand forecast of the utilities in the state.

Key transmission system planning related issues in the State includes the following:

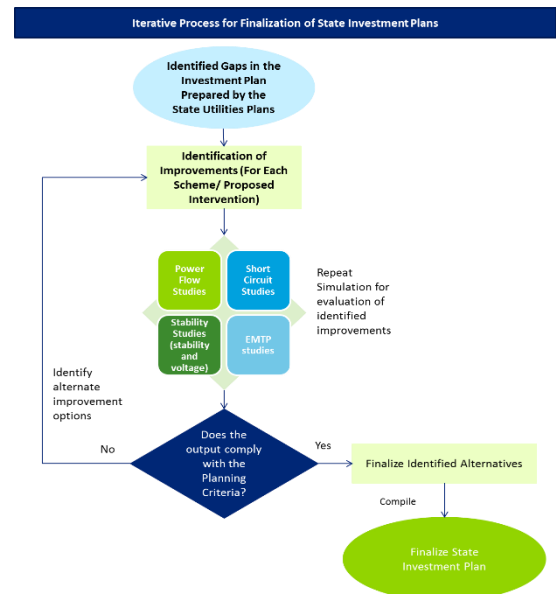
- a) The intra-state transmission networks have constraints in meeting the demand for power in several pockets/ regions within the State of West Bengal. The network elements are reasonably loaded to their design capacities as planning studies are being carried out to mitigate the immediate network constraints in terms of over loading with focus on network contingencies and limited focus on network redundancies.
- b) As per the existing transmission system rolling plan, there is requirement of more 220 kV substations in the transmission system, which would relieve overloading in different network pockets. However, in view of limitations in RoW availability, there is a need to plan more substations/ interconnections with higher power transfer capacity to fulfil the future load growth. After implementation of ongoing, approved and proposed substations, the quantity of substations at 400, 220 and 132 kV will increase from existing 4, 21 and 80 to 9, 34 and 98 respectively.

Figure 13: West Bengal Transmission Network



- c) Suitable mechanism may be introduced to take care of RoW issues so that the constructions and commissioning activities of sub-stations and associated transmission

Figure 12: Algorithm to analyze West Bengal network



lines are aligned. Absence of such alignment results in stranded capacities leading to cost overruns for the associated projects and delay in realization of benefits from investments.

During FY 2014-15, the World Bank in consultation with MoP provided technical assistance (TA) to the transmission and distribution utilities of West Bengal State. The scope of the TA included review of Transmission and Distribution system investment plans for the State of West Bengal with focus on gap analysis and development of investment proposals to eliminate identified gaps in the already envisaged investment plan upto FY 2018-19. The scope also included preparation of DPR guidelines and sample DPRs, review of procurement manuals and development of distribution planning criteria.

An integrated T&D network planning approach was adopted and the transmission and sub-transmission network of the West Bengal State was modelled from 400kV level to 11kV level. The district wise loads were modeled at 11kV bus level to have accurate estimates of area wise load growth and corresponding need for network development. The integrated network modelling approach was adopted for the first time in any of the Indian power utility which ensures efficient power system

planning with an objective of technical loss reduction at all the voltage levels.

A comprehensive load flow study was conducted using power system simulation software tool (PSS/E) so as to replicate actual steady state network for summer peak loading scenario. After verification of the base case network, year on year modelling/super-imposition of T&D investment plans, as prepared by the West Bengal utilities was done and load flow analysis was conducted for the planning horizon (FY 2015-16 to FY 2018-19) to identify key network constraints and improvements in load flow output parameters vis-à-vis base case. Gaps were then identified in the FY 2018-19 West Bengal T&D system which could not be addressed due to already proposed investments by WBSETCL/WBSEDCL. A feed forward/feedback approach was used for analyzing the West Bengal network as shown in the algorithm in Figure 12.

With an objective to remove all the network constraints by FY 2018-19, additional investment proposals have been developed as per CEA transmission planning manual. A consultation was undertaken with the West Bengal utilities on the new investment proposals developed so that the same may be considered while planning future year investment proposals. The outcome of the study was also disseminated before CEA/World Bank. The summary of the already proposed and new proposals is shown in tables below:

Table 24: Comparison of original and proposed T&D Lines

Transmission & Distribution Lines		
Voltage level (kV)	Length (RL kms)	
	Original Proposal	Additional Proposed
400	1,103	111

220	426	76
132	1,999	186
33	60,289	5,265

Table 25: Comparison of original and proposed capacity of sub-stations

Sub-stations		
Transformation Ratio (kV)	Capacity (MVA)	
	Original Proposal	Additional Proposed
400/220	3,150	315
400/132	1,000	400
220/132	5,280	960
220/33	320	0
132/33	4,401	1,197
33/11	30,389	2,730

5.8. Action plan & support required

In line with the proposed transmission plan, the action points shown in Table 26 have been identified for respective stakeholders to be able to make suitable arrangements for making adequate power transmission systems available for the State in accordance with the requirements of the PFA Roadmap:

In order to meet the growing demand of Kolkata, additional import point(s) are planned by CESC. A 400/220 kV Substation has been envisaged by CESC at Rajarhat with 400 kV connectivity with PGCIL Rajarhat SS. CESC has sought government help/ intervention in this context.

Table 26: Action Points & Timelines

Stakeholder	Action Points
State Government	<ul style="list-style-type: none"> Consideration of funding support for the intra-state transmission projects to be taken up by WBSETCL under appropriate arrangements with JICA/ ADB/ World Bank.
WBSETCL	<ul style="list-style-type: none"> Exploring avenues for broad based funding from financial institutions Organize training of personnel for network diagnostic analysis and planning using PSS/E tool to be made available to WBSETCL. Setting up a team for evaluating the suitability of 765 kV transmission systems in the state. Evaluate Smart Grid related interventions and prepare phased introduction plan in view of the emerging needs of the State.

Stakeholder	Action Points
Government of India	<ul style="list-style-type: none"> Support WBSETCL in securing financing for the remaining schemes proposed under the PFA Roadmap from suitable multilateral/ bilateral donor funding organizations.
PGCIL	<ul style="list-style-type: none"> Quarterly reporting of the various inter-state works being undertaken by PGCIL

6. Distribution Plan

6.1. Introduction

Distribution of electricity in the state is managed by the five distribution licensees viz. WBSEDCL, DPSC, CESC, DVC and DPL. The following provides a snapshot on the areas served by the four distribution licensees.

Table 27: Areas served by Distribution Licensees

Utility	Areas Served
WBSEDCL	All the districts of State Except Kolkata.
CESC	Kolkata and Howrah (567 Sq. km)
DPL	Durgapur Projects Township
DPSC	Asansol-Raniganj Industrial area
DVC	DVC Command Area in West Bengal

6.2. Objectives of the distribution plan

The energy requirement and peak demand for West Bengal is expected to increase from 52,358 MU and 7,544 MW in FY15 to 62,926 MU and 11,172 MW in FY19, respectively. This is due to natural increase in demand from the present consumer base and more importantly because of the initiatives proposed under this PFA Roadmap which aims to achieve 100% electrification in urban as well as rural areas of the State and provision for 24X7 supply to all consumers. This would require commensurate investments in the sub-transmission and distribution infrastructure.

Accordingly, the objectives of the distribution plan, in accordance with the 24X7 PFA objectives, includes the following:

- Making provision for 24X7 supply to all connected consumers through capacity augmentations and building redundancies in the upstream network for improving reliability of supply;

- Ensuring provision of electricity access to the remaining 7,47,410 rural unconnected households in the State;
- Provision of 24X7 supply to cater to increase in demand from existing consumers and increase in demand owing to new consumer growth in the State;
- Making system improvements for reducing AT&C losses in accordance with the targets agreed with MoP; and
- Adopting appropriate technologies and systems to support RE integration and EE/DSM measures in the State.

6.3. Existing distribution system-WBSEDCL

The distribution network of WBSEDCL comprises of 33 kV and 11 KV sub-transmission system. This forms the distribution backbone at the district level while LT distribution systems deliver electricity to majority of the end consumers. An overview of WBSEDCL's network infrastructure in terms of installed transformation capacity and line lengths of feeders at various voltage levels is provided in Table 28 below.

Table 28: Existing Distribution Network of WBSEDCL (April 2015)

Particulars	Unit	Capacity
Transformer	MVA	7,681
33/11 kV substations	Nos	517
11/0.4kV LT Distribution Transformer	MVA	9,361
11/0.4kV LT Distribution Transformer	Nos	1,99,289
Lines		
33kV Feeders	Ckt. Kms	13,926
11kV Feeders	Ckt. Kms	1,50,946
LT Feeders	Ckt. Kms	2,91,092

West Bengal has made significant improvement in HH electrification levels since 2011 (shown in Figure 14). The state has provided electricity

connections to about 80,00,000 un-electrified HHs during the period FY11 to FY15. As per 2001 Census data about 91,32,176 HH were un-electrified. However, a survey conducted by

WBSEDCL has revealed that only about 7,47,410 HH remain as un-electrified in the state as on October, 2015.

Figure 14: District wise Rural & Urban HH Electrification Levels – West Bengal (2011 Census)

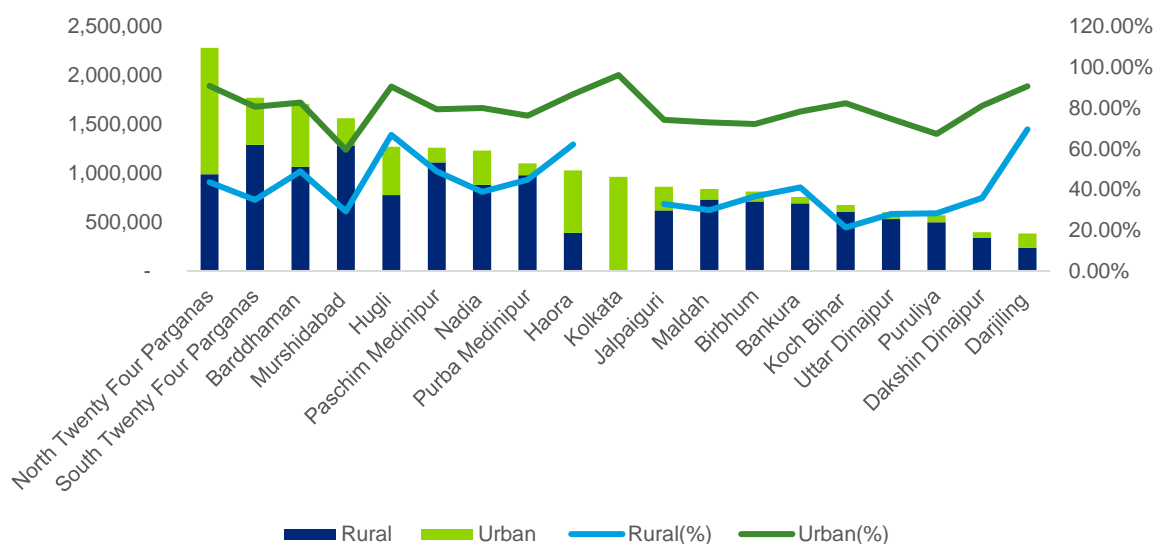


Figure 15: DT Failure Rate – WBSEDCL (Apr'15 – Sep'15)

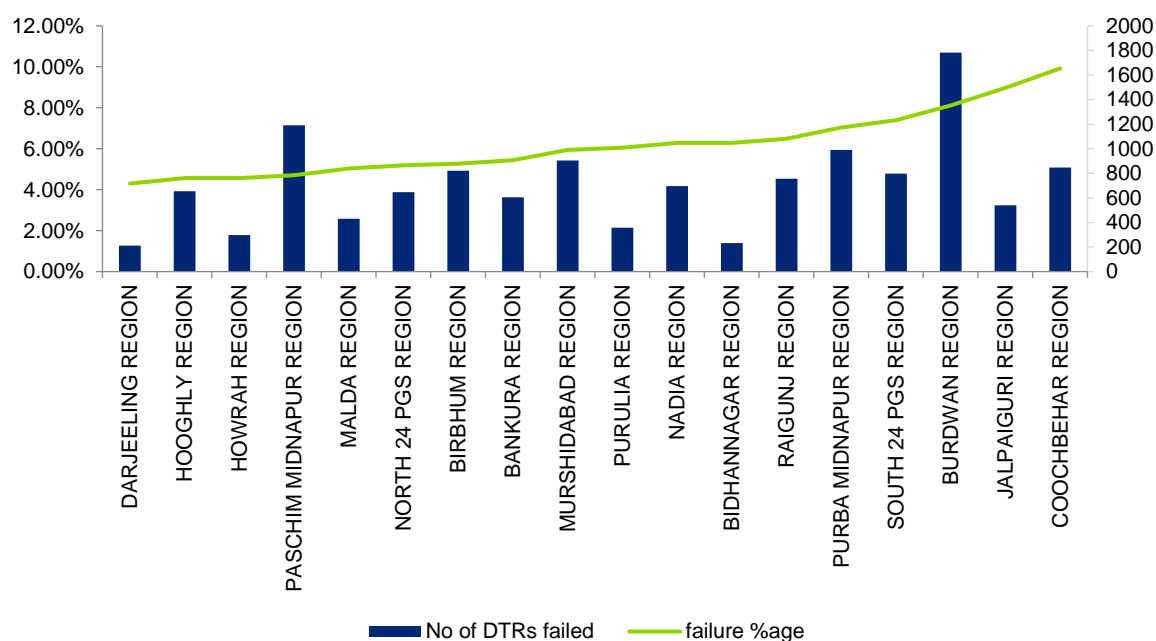
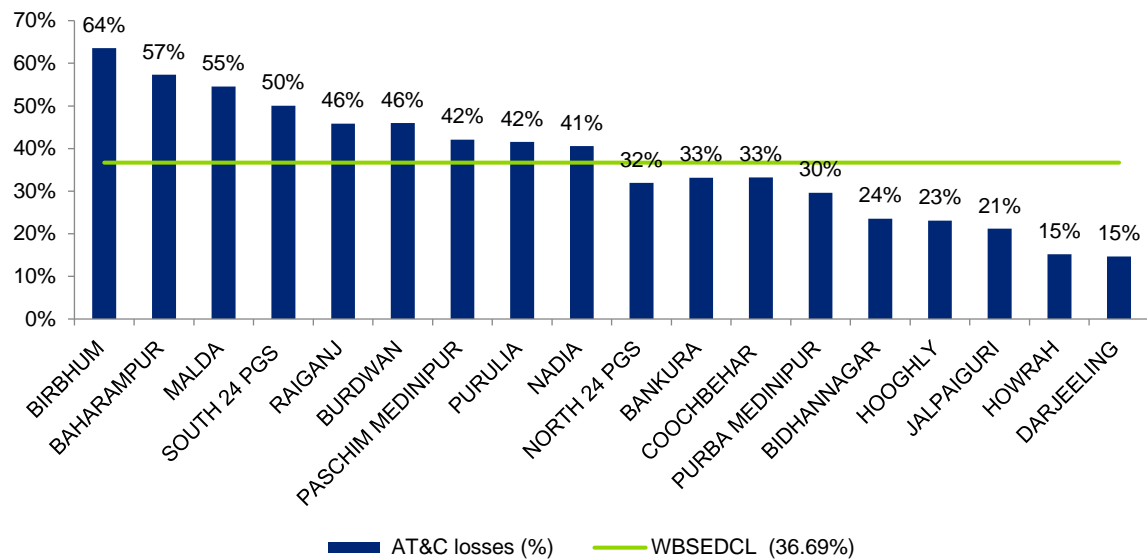


Figure 16: Region wise AT&C Loss for WBSEDCL (Sep, 2015)



DTR failure rates

DT Failure Rate (shown in Figure 15) for FY16 (Apr 15 to Sep 15) in all the regions of WBSEDCL was between 4% and 10%. Hoogly and Darjeeling had the lowest DTR failure rates at around 4% while Coochbehar and Jalpaiguri region had the highest DTR failure rates at 9.92% and 8.98%, respectively. Most urban areas like Hoogly have lower DTR failure rates while predominantly rural areas have higher DTR failure rates. WBSEDCL is investing in its network through the RAPDRP and IPDS projects to bring down the DTR failure rates in urban areas.

AT&C loss

AT&C loss levels (shown in Figure 16) across regions of WBSEDCL suggests that Birbhum, Baharampur and Malda have the highest AT&C losses at 64%, 57% and 55% respectively. Whereas, Howrah and Darjeeling have AT&C loss below 20%.

WBSEDCL's investment plans are targeted towards bringing AT&C loss to 22.5% by FY19. This includes shortening of lengthy HT feeders, introduction of AB Cables etc.

CESC Limited, operational since 1897, is the oldest distribution licensee in India and supplies electricity to about 567 sq km of areas spread across Kolkata and Howrah regions.

The existing distribution network of CESC is shown in Table 29.

Table 29: CESC: Existing Distribution System

Particulars	Unit	Value
Distribution Stations		
No. of Stations	No	108
Transformer Capacity	MVA	3,454
LT Substations		
AC Substations	Nos	7,906
Transformer Capacity	MVA	2,650
Distribution Network (Ckt km)		
33 kV UG	ckt. Km	1,387
33 kV OH	ckt. Km	92
20 kV UG	ckt. Km	50
HT Distribution		
11 & 6 kV UG	ckt. Km	6,259
11 & 6 kV OH	ckt. Km	87
3.3 kV UG	ckt. Km	21

CESC presently operates at highly efficient levels of AT&C loss, particularly considering its primary network at 6 kV (not 11 kV) due to legacies, existence of overhead distribution lines, deteriorating LT:HT ratio, decrease in load centre generation and evacuation of power through distant

6.4. Existing distribution system- other utilities

CESC

routes . The Company is fairly efficient in handling the commercial losses.

CESC has achieved 100% electrification of households in the supply area and is supplying 24X7 power to its consumers.

The utility has installed meters for all the consumers except a few municipal street light connections. Further, as part of its improvement initiatives in energy accounting and auditing, the company has planned to achieve 100% metering of all the distribution transformers in its area by March, 2016 from the current level of 90%.

The DT failure rate of CESC was at 0.46% during FY15.

DPL

Distribution Infrastructure of DPL is shown below:

Table 30: Existing Distribution infrastructure of DPL

Description	Unit	Value
33 kV Feeders	Nos	15
33 kV Lines (incl UG)	kms	78.5
33 kV SS	Nos	2
Power Transformers	MVA	948
11 kV Feeders	Nos	96
11 kV Lines	km	385.5
LT Lines	km	960

DPL's DT failure rate is 3.55%, while the reliability indices are 99.98% at 11 kV feeder level and 98.5% at consumer level.

DPSC

Distribution Infrastructure of DPSC is shown below:

Table 31: Existing Distribution infrastructure of DPSC

Description	Unit	Value
33 kV Feeders	Nos	10
33 kV Lines (incl UG)	kms	133
33 kV SS	Nos	14

Description	Unit	Value
Power Transformers	MVA	549
11 kV Feeders	Nos	121
11 kV Lines	km	752
3.3 kV Feeders	km	16
LT Lines	km	42

6.5. Central and state government schemes

The collective objective of all the Central/ State Government schemes has been to enhance the reach, reliability and quality of electricity to end consumers and to improve the financial position of utility by way of reducing the AT&C losses. The following schemes are presently underway and are at various stages of implementation in West Bengal , which not only provide the funding assistance but also aim towards enhancing the technical capacity of WBSEDCL.

Deen Dayal Upadhyaya Gram Jyoti Yojana- WBSEDCL

Under the DDUGJY scheme, WBSEDCL has proposed various network extension, strengthening and augmentation works in order to develop a robust sub-transmission and distribution infrastructure in rural areas. The project covers 18 districts of West Bengal with a total layout of Rs. 4,241 Cr.(excluding PMA and Consultancy charges) The abstract of the proposed plan is highlighted in Table 32Table 32 and the details of the same is provided in the Annexure 1b.

The main objective of DDUGJY project is Agricultural feeder separation, electrification of UE and PE villages in the district of South 24 Parganas.

Integrated Power Development Scheme (IPDS) and R-APDRP- WBSEDCL

Under the IPDS scheme, West Bengal has planned extensive improvements for its sub-transmission and distribution infrastructure in each of the 18 districts of its licensee area. Table 32 provides a summary of the infrastructure works proposed under IPDS. Details of the same are provided in Annexure- 1a. The total value of investment is Rs. 2,867 Cr. The funding layout is shown in Table 34

Table 32: Infrastructure addition program under various schemes for WBSEDCL

	New Substation (No.)	Augmentation Of Power T/F (Nos.)	Additional Power T/F (Nos.)	HT Line (km)	New LT Line(km)	New Distribution Transformer (Nos.)
DDUGJY	80	98	14	27,676	8,510	25,141
IPDS	45	102	26	4,448	1,746	4,270
RGGVY	4	9	2	3,410	10,990	7,353
RAPDRP	6	2	11	706	256	2,637
Total	135	211	53	36,240	21,502	39,401

R-APDRP- WBSEDCL

Under the R –APDRP scheme WBSEDCL has proposed projects worth Rs. 885.6 Cr. These projects cover 65 Towns in the State. The Scheme covers SCADA works worth Rs. 33 Cr, Part A works worth Rs. 171 Cr and Part B works worth Rs. 714.61 Cr. including SCADA compatibility.

As per the latest data (Dec 2015) about 312.09 Cr of the R APDRP amount is disbursed by the nodal agency.

IPDS – CESC

CESC has proposed an investment of Rs. 373.73 Cr. in its licensee area. These investments are targeted towards improving reliability and strengthening of the distribution network of the utility.

IPDS – DPL

Under the IPDS, DPL proposes to invest Rs. 58.26 Cr. While in-principle approval is provided by PFC, the utility is awaiting approval from the DEC.

All the consumers in the command area of DPL are metered. Further, as a part of the improvement drives the company plans to replace the existing electromagnetic meters and provide prepaid and AMR meters to consumers.

The company is also planning to segregate the domestic and industrial feeders to achieve greater reliability.

DPL plans to add the following infrastructure for achieving the targets of 24X7 Power for All roadmap in its area:

Table 33: Proposed Distribution network of DPL

Description	Unit	Proposed Quantity
Total Number of 33 kV Feeders	Nos.	7
Total Length of 33 kV Feeders (Overhead)	Km	55
Total Length of 33 kV Feeders (Under-ground)	km	12
Total Number of 33/11 kV Sub-stations feeding the Project Area	Nos.	3
Total Number of Power Transformers	Nos.	7
Total Capacity of Power Transformers	MVA	62.6
Total Number 11 kV Feeders	Nos.	13
Number of Metered 11 kV Feeders	Nos.	109
Total Length of 11 kV Feeders (Overhead)	kM	71
Total Length of 11 kV Feeders (Under-ground)	kM	108
Total Length of LT Lines (Overhead)	kM	90
Total Length of LT Lines (Under-ground)	kM	70
HT/LT Ratio	...	0.54
Total Number of Distribution Transformers	Nos.	120
Total Capacity of Distribution Transformers	MVA	26.036
Un-electrified Villages	Nos.	NIL

6.6. Funding plan- WBSEDCL

The following table shows the funding requirement for the distribution plans of WBSEDCL described above.

Table 34: Fund Requirement in Rs. Cr. under various schemes for WBSEDCL

Scheme	FY16	FY17	FY18	FY19	Total
IPDS Approved	0	860	1,433	574	2,867

Scheme	FY16	FY17	FY18	FY19	Total
DDUGJY Approved	0	1,685	1,614	942	4,241
BRGF	500	224	0	0	724
RGGVY	224	400	67	0	691
R APDRP	220	205	78	30	533
Total	944	3,374	3,192	1,546	9,056

The total fund requirement for the distribution system works by WBSEDCL is about Rs. 9,056 Cr, a significant proportion (94%) of which is expected to be funded through the Central Government Schemes (R-APDRP, RGGVY, DDUGJY and IPDS).

It may be noted that the above capital investment plan is already approved from respective nodal agencies. Further, the counterpart funding for centrally sponsored scheme is provided by The West Bengal Government as capital grants. This indicates that the entire capital investment plan of WBSEDCL is funded through grants.

6.7. Funding plan- CESC

CESC has proposed a capital expenditure plan of Rs. 4,046 Cr including Rs. 373.73 Cr proposed under IPDS for implementing reliability and strengthening works in its supply area.

The proposed investments by the CESC are expected to be funded through appropriate mix of debt and equity, as per the past practice. The year wise phase of investments proposed by CESC are shown in Table 35.

Table 35: Fund Requirement for CESC (Rs. Cr.)

Scheme	FY16	FY17	FY18	FY19	Total
Total Fund Required	853	893	1,100	1,200	4,046

6.8. Funding plan- DPL

DPL has proposed a capital expenditure plan of Rs. Rs. 58.26 Cr under IPDS scheme for implementing reliability and strengthening works in its supply area. The utility expects its own share of funds (40%) to be made available through capital subsidy support from the State Government.

6.9. Other initiatives

WBSEDCL

Other initiatives for improved quality and reliability of supply and reduction of AT&C Losses, being undertaken by WBSEDCL, are as follows:

Mobile Maintenance Units: Mobile maintenance units are engaged for quick restoration of power in 64 distribution divisions in West Bengal.

Condition Monitoring for preventive maintenance: Condition monitoring cells are functional at headquarters and at five distribution zones. The substations are inspected at a fixed schedule (twice a year).

Transformer Transaction Management System (TTMS): TTMS is an MIS made for analysis of transactions, failure records, outage records and preparation of action plans for improvement of transformer performance.

Spot Billing: Spot Billing was introduced in 2009 and covers 471 Customer Care Centers (CCC). This covers all the domestic and commercial consumers.

Prepaid metering system: Currently 1,306 consumers in Bidhannagar Div-I are under the prepaid scheme.

AT&C Loss reduction measures

Feeder Length reduction: WBSEDCL has reduced lengths of 622 numbers of 11 kV feeders in the State. Further actions are planned for reducing feeder lengths under the DDUGJY scheme in rural areas of the state.

Feeder Segregation: Segregation of agricultural feeders are proposed under DDUGJY scheme proposed by WBSEDCL.

Amorphous Core DTR: WBSEDCL has already started installing amorphous core transformers. These transformers will help WBSEDCL to reduce the technical losses in the network.

Re-conductoring: WBSEDCL is replacing the 33 kV feeders where the existing technical losses are more than 4%.

AB Cables: Around 26,755 kms of AB Cables are planned to be added in the projects under DDUGJY. This will help in reducing pilferage and accidents.

Meters: Around 18 lakhs defective and hybrid meters are being proposed to be replaced by static meters for reduction of AT&C losses.

In addition to the above actions, the following actions are planned to reduce the commercial losses by WBSEDCL:

- **Billing:** Spot Billing is being extended to all CCCs. Additionally, pilot project for smart metering is also under execution and shall be extended based on experience and learning.
- **Payment:** WBSEDCL has introduced multiple choices of Energy Bill Payment by Consumers viz. payment at Counters, Collection Kiosk, VLEs, e-Payment, RTGS for high end consumers etc.
- **Focus on metering activities:** Feeder Metering 100%, DTR Metering 30%, DTR wise Consumer Mapping 90% have already been achieved. Further DTR metering is envisaged under DDUGJY and IPDS.
- **Restructuring of the field offices for efficient management:** Presently there are 485 CCCs & 65 Divisions – however for better monitoring and supervision some more CCCs and Divisions are being created by WBSEDCL.
- **Consumption analysis:** Consumption analysis is being done by S&LP wing using HVCMS & LVCMS.
- Agricultural cases considered in restricted manner – can be thought of for all segments.

CESC

CESC has been carrying out the following initiatives in its supply area as a part of improvement process and optimization of its operational efficiency:

- Smart Grid project is being carried out with the association of USTDA in the city of Kolkata;
- 80% of the distribution stations are covered by SCADA;
- SCADA & Distribution Management System (DMS) are exploited to the fullest to manage the distribution system, extensive asset management & asset replacement strategy to ensure prevention of outage.

- CESC has utilized Asset management software 'DREAMS' to capture operating age, loading, outage and maintenance history and provide input for planning process.
- Proactive and automated network outage alerts for trouble call management, Zero interruption for critical services through automation.
- One of the highlights of the operational standards is the successful Islanding during the North India grid failure of July 2012 –CESC maintained own generation and even supplied black-start power to the grid.

DPL

DPL proposes the following activities for reducing AT&C losses in its command area

- Electro mechanical type single phase & 3 phase meters have been replaced by static meters
- DPL provides static meters to all new consumers
- DPL has completed installation of 100% network metering at HT side and 100 % metering will be installed further on LT side, so that DPL can measure the power input at all HT & LT points to measure the loss.
- Plastic anti tamper & security seal which have already been introduced in DPL system, would be widely used. C.T's of some consumers are required to be replaced and DPL will take action to replace the same for recording energy accurately.
- Systematic raid program to curb the theft of power and chasing for dues.
- H.T/LT ratio will be improved after implementation of the said IPDS project by (a) increasing 33 KV line nearer to the load center; and (b) Decreasing 11 KV line loads.

6.10. Rollout plan

Table 36 shows the infrastructure roll-out plan for WBSEDCL.

6.11. Action items

The action items for distribution plan are shown in Table 37.

Table 36: Distribution Infrastructure rollout plan for WBSEDCL

Item	Capacity at the end of FY 15	FY 16	FY 17	FY 18	FY 19	Total	FY 19 Capacity
Substations (nos)	525	14	27	41	54	135	660
HT Line (km)	1,65,647	3,623	7,247	10,870	14,494	36,234	2,01,881
LT Line(km)	2,95,404	2,154	4,308	6,462	8,616	21,540	3,16,944
Distribution Transformer (nos)	2,03,766	4,010	8,020	12,031	16,041	40,102	2,43,868

Table 37: Action items for Distribution Plan

Stakeholder	Action Item
WBSEDCL	Prepare plans for reduction of commercial losses in the system. Monitoring and MIS for reduction in unbilled energy in rural areas. System studies for estimation of technical and commercial losses to be done every six months
State Govt/WBSEDCL	Project monitoring cell to ensure timely completion of capital investment programs.
PFC	Funding arrangement for DPL and CESC under IPDS.

7. Renewable Energy Plan

7.1. Introduction

West Bengal's Renewable energy sources comprise of Small and Mini Hydro power generation sources in the North Bengal region. The state utility, WBSEDCL, is also procuring renewable energy from other sources to fulfill its RPO obligations as mandated in 'Cogeneration and Generation of Electricity from Renewable Sources of Energy Regulations' notified in 2013. The RPO obligations for the distribution licensees in the state are shown in Table 38.

Table 38: RPO Targets for West Bengal

Year	Solar RPO	Non-Solar RPO
FY 14	0.10%	4.0%
FY 15	0.15%	4.5%
FY 16	0.20%	5.0%
FY 17	0.25%	5.5%
FY 18	0.30%	6.0%

WBREDA formed in 1993, is the State Nodal Agency for implementation of Non – Conventional Energy Programs in the State of West Bengal.

Further, West Bengal Green Energy Development Corporation Limited was formed in 1993 to promote different grid-connected renewable energy based power projects through PPP mode.

The state has a RE potential of 19,071 MW. This includes 16,800 of Solar and 2,271 MW from other RE sources.

Renewable Energy Policy was notified by the State in 2012. The policy aims to attain 2,706 MW of generation capacity from renewable energy sources including co-generation by the year 2022. The targets under the RE Policy for the state are presented in Table 39.

Table 39: Targets under State RE Policy

Source	2017 Target (MW)	2022 Target (MW)
Wind Power	75	450
Mini & Small Hydro	220	394
Co-generation	355	600
Biomass	240	662
Waste to Energy	50	100
Solar	100	500
Total	1,040	2,706

As a part of the MNRE's 175 GW RE addition plan for the country, West Bengal has been provided a target of 5,386 MW by 2022. In this context, the State Government/ SNA may have to revise the above targets provided in RE policy of 2012 and prepare a roll out plan to include the revised targets within next three months of signing of this document.

7.2. WBSEDCL – existing sources

WBSEDCL has 9 (nine) Small Hydro Plants (<25 MW IC) with a total installed capacity of 89.55 MW as shown Table 40.

Table 40: WBSEDCL Existing SHP

Plant Name	Capacity (MW)
Jaldhaka Stage-II (2 x 4 MW)	8
TCF-I (3 x 7.5 MW)	22.5
TCF-II (3 x 7.5 MW)	22.5
TCF-III (3 x 7.5 MW)	22.5
Rinchington(2x1 MW)	2
Little Rangit (2x1 MW)	2
Mongpu Kalikhola (3x1MW)	3
Sidrapong (3x.2 MW)	0.6
Fazi (2x.4+1x.448+1x1.2 MW)	2.448
Massamjor	4
Total	89.548

The total generation from these plants in FY15 was 185.07 MUs. In addition to these stations, WBSEDCL sources a quantum of 162.2 MW

renewable energy from other sources as shown in Table 41. It can be seen that the utility has tied up about 154 MW of overall RE capacity for power purchase.

7.3. CESC

There is an installed capacity of 789 kWp of rooftop solar projects in CESC's area. Table 42 shows the details of the Rooftop solar projects in the license area of CESC.

7.4. WBREDA – existing sources

WBREDA, formed in the year 1993, is the State Nodal Agency (SNA) for West Bengal. WBREDA's mandate is to promote Renewable Energy Technologies and create an environment conducive to their commercialization through innovative projects.

WBREDA has promoted various technologies in the state. Under the Biomass Gasifier project for Village

Table 41: RE procurement by WBSEDCL (Other Sources)

Name of Entity	Location	Type	Cap (MW)	CoD/Status
Rashmi Cement Ltd. (RCL)	Jitusole, Jhargram (18 MW)	Co-Gen	18	Jan, 2011/PPA To be terminated by WBSEDCL
Bengal Energy Ltd.	Makrampur, Paschim Medinipur (40)	Co-Gen	36	Apr, 2012
Himadri Chemicals and Industries Ltd. CPP	Haripal, Hooghly	Co-Gen	12	Feb, 2012
M/s Tata Power Company Ltd.	Haldia, East Midnapore, W.B. (120)	Co-gen	20	Jun,2008
M/s Ennore Coke Ltd.	Alichak, Haldia, East Midnapur, W.B. (12)	Co-Gen	10.8	Dec,2012
Electro steel	Haldia (12)	Co-Gen	10.8	in operation since 2006
CONCAST	Bankura	Co-Gen	4.8	Aug,2013
Ramsarup Loha Udyog	Kharagpur, West Midnapur, W.B. (22)	Co-Gen	20	Shutdown
Nippon Power Limited	Linsebong, Darjeeling (3 MW)	Small Hydro	2.7	Mar,2007
M/S Neora Hydro Ltd.	Neora, Darjeeling, W.B. (3)	Small Hydro	2.7	Apr,2006
WBREDA	Frejergunj, South 24 Pargana, W.B. (2)	Wind	2	Jul,2001 and Apr,2008
M/s Amrit Bio-Energy & Industries Ltd.	Bankati, Bankura, W.B. (10)	Bio-mass	9.1	Mar,2010 (Shutdown)
M/s Kamarhati Co. Ltd.	Raina, Burdwan, W.B. (6)	Biomass	5.3	Jun,2008 (Shutdown)
Himadri Chemicals and Industries Ltd. CPP	Haripal, Hooghly (8 MW)	Co-Gen	8	In operation
Total			162.2	

Table 42: Existing RE generation sources (Solar) in CESC's area

Sl.	Name of the Project	Capacity (kWp)	District
1	Gurudas College	5	Kolkata
2	Ramakrishna Mission Vidyamandir	153	Kolkata
3	Raj Bhavan, Kolkata	50	Kolkata
4	Ramakrishna Mission Seva Pratisthan (Shishu Mangal)	7	Kolkata
5	Sir Nripendranath Girl's High School	3	Kolkata
6	CSIR - Central Glass & Ceramic Research Institute	38	Kolkata
7	Seva Kendra Calcutta	18	Kolkata
8	Saroj Gupta Cancer Centre and Research Institute	50	Kolkata
9	BRWS	5	Kolkata
10	KMC	15	Kolkata
11	Auckland Jute Mill	250	Kolkata
12	Garden Reach Shipbuilders & Engineers Limited	100	Kolkata
13	Hooghly River Bridge Commissioners	35	Kolkata
14	T Kumari (Financiers) Limited	60	Kolkata

Electrification, a total of 1,400 kW of generation capacity has been made available to three villages in the state. Further, to provide power in commercial establishments, a total of 199 rice husk based gasifier plants have been installed with a total capacity of 64 MW. Following table shows the bio mass projects of WBREDA

Table 43: Biomass projects of WBREDA

Location of the project	Capacity	Date of commencement	No. of consumers
Gosaba	500 kW	Jun-97	1,200
Chhoto Mollakhali	500 kW	Jun-01	375
Herembo Gopalpur	400 kW	Mar-06	50

WBREDA has installed 8X 250 kW wind energy turbines in Freserganj. In addition, WBREDA has also installed Wind-Diesel Hybrid and Wind Solar Hybrid systems in West Bengal.

7.5. RE plan- WBSEDCL

WBSEDCL has proposed to add another 545 MW to its contracted capacity through RE sources by FY19. Table 45 shows the upcoming RE capacities for WBSEDCL. It can be seen that the upcoming RE capacities are from Solar Parks only.

Rooftop solar PV power plants of total capacity of 5 MW with Net Metering are proposed to be installed at various Government buildings in urban areas. These installations will be done under the provisions of the IPDS scheme.

A Canal Bank Solar PV Power Plant of 10 MW capacity is proposed to be installed on Teesta Canal bank adjacent to Teesta Canal Fall stage II Power Plant in Uttar Dinajpur District. WBSEDCL has already completed the tendering process for this and the LOA has been placed on Ujas energy Limited.

Ultra-Mega Solar Parks of 500 MW is planned in the districts of Purba Medinipur, Paschim Medinipur and Bankura districts. In-principle approval for the solar

parks has been received. Currently, land for 210 MW only has been identified. The same is at DPR preparation and approval stage. For balance 290 MW land identification has not been made yet.

Also, WBSEDCL is planning to implement 3 solar PV based projects of 10 MW in Puruila and Bankura district with an estimated fund required of Rs 6.6 Cr/ MW.

7.6. RE Plan-WBREDA

WBREDA is implementing a number of schemes and programs with financial assistance from the Central and State Governments. The major programs and schemes are as follows:

- Solar PV Programme:
- Solar Thermal Programme
- Bio-energy Programme
- Wind Energy
- Battery Operated Vehicle
- Rabi Rashmi Abasan
- Energy Park
- Tidal Energy
- Mini- Micro Hydel
- Publicity and Awareness

These programs have been formulated into the following different interventions being pursued by the WBREDA:

- Village electrification through Solar PV Systems
- Village electrification through decentralized generation like Biomass Gasifier, Solar PV etc,
- Wind Farm Project at Freserganj
- Wind-Diesel- Gasifier Hybrid Project at Ganga Sagar
- Electrification of schools through renewable energy systems
- Establishment of Energy Parks
- Promotional activity for the rice mills in generating power from rice husk
- Installation of Bio-gas plants for households
- Promotional activities in popularizing uses of solar hot water systems
- Tidal Energy Project
- Popularizing Battery Operated Vehicle

Table 44: Existing Wind projects of WBREDA

Location	Technology	Capacity	Status
Freserganj	Wind	8X250 MW	One machine is under repair
Various Locations (6 Villages)	Wind-Diesel Hybrid	4X50 kW, 2X180 kW, 1X150 kW	Working

Location	Technology	Capacity	Status
Six Schools in Sagar Block in Sundarban	Wind-Solar	3 kW Aero Generator and 3 kW PV in each of the location	Working

Table 45: Proposed RE Capacity of WBSEDCL

Sl.	Name of Entity	Location	Type	Contracted capacity (MW)
1	WBSEDCL	Uttar Dinaipur	Canal SPV	10
2	WBSEDCL	Various Govt Buildings	Rooftop SPV	5
3	WBSEDCL	Ultra Mega Solar Park at Purba Mednipur, Bankura and Paschim Medinipur	SPV	500
4	WBSEDCL	Purulia and Bankura	SPV	30
	Total			545

7.7. Funding requirement

Funding for 3 solar plants of 10 MW are to be arranged for WBSEDCL. Based on the current prices of Solar PV the total fund layout is about Rs. 198 Cr.

Most of the other projects, including the Solar UMPP etc. are proposed to be taken up under the PPP route.

7.8. RE plan-Issues

WBSEDCL

As per the latest amendments in the National tariff Policy, by 2022 8% of the electricity consumption shall be from solar energy sources. WBSEDCL may have to redesign its RE-plan in order to meet these targets. Currently less than 5% of the total energy

consumption (power purchase) is from solar sources.

CESC

Problem of urban licensees like CESC are more acute, as limited license area does not permit development of adequate RE generating capacities. Renewable energy at an affordable tariff through Viability Gap Funding and / or Bundling scheme should be made available on a priority basis to such urban licensees. National Clean Energy Fund may be released to states contributing through Clean Energy Cess in creation of such fund. It is felt that the REC mechanism is not the most effective solution to address the issue of RPO obligation since actual procurement of green energy is not taking place even after significantly higher incurring transaction costs.

Table 46: Action items for RE Plan

Stakeholder	Action Item
WBREDA/WBSEDCL	Develop roll out plan for Targets under MNRE's 175 GW RE capacity 40 GW solar rooftop capacity national program. Totaling 5,386 MW by 2022
MNRE	Explore funding options to help urban private licensees in their renewable energy procurement.
Distribution Companies	Re-align power procurement plan to achieve 8% solar energy penetration by 2022.

8. Energy Efficiency Plan

8.1. Energy efficiency plan

WBSEDCL is the State Designated Agency (SDA) to co-ordinate, regulate and enforce the Energy Conservation Act 2001 within the State of West Bengal. The role of SDA is to create general awareness among masses about benefits of energy conservation measures and to institutionalize the energy efficiency project implementation in domestic, commercial and industrial segments.

WBSEDCL has carried out the following activities in FY 14 and FY 15 in the area of energy conservation and energy efficiency:

- a) LED Street lighting project for 52 points in Rudranagar under Kakdwip Division has been completed.
- b) Work of replacement of all conventional equipment/system/installation by LED streetlights (6 nos.), LED Bulbs (53 nos.), Tube lights (102 nos.) and energy efficient equipments as per BEE approved, 5 Star rated Ceiling fans (77 nos.) and monoblock pump motor sets (03 nos.) at Blind School Siliguri and Welfare Association at Jalpaiguri under Jalpaiguri Division, has been completed.
- c) The baseline audit and implementation of Investment Grade Energy Audit Project (IGEA) was done at 7th floor Vidyut Bhawan. In the project, 35 nos. of Hitachi make 5 Star ACs, 520 LED Tube lights of Phillips make and 188 Energy Efficient Ceiling Fans were installed.
- d) All the 17 nos. Designated Consumers under PAT Cycle – I of West Bengal were invited on 12.12.15 to conclude regarding submission of necessary documents.
- Dissemination Programme for the 26 nos. Designated Consumers of PAT Cycle – II scheme from the sectors of Textile (2 nos.), Iron & Steel (19 nos.), Fertilizer (1 no.), Cement (1 no.) and Thermal Power Plant (3 nos.) will be held in the month of March, 2016.
- The Electricity Distribution Companies (DISCOMs), whose AT&C Losses are equal to or greater than 1000 MU have been included by BEE as Designated Consumers of PAT Cycle – II.
- e) A workshop for undertaking Municipality Demand Side Management (MuDSM) was organized in July, 2014. In the workshop representatives of 17 nos. municipalities participated. Rajpur – Sonarpur Municipality agreed to implement the MuDSM programme. The Chairman, Rajpur-sonarpur Municipality held one meeting on last week of December, 2015 and agreed to submit data to prepare the final scheme.
- f) 18 nos. awareness programme amongst school students, industrial and commercial sectors at Siliguri, Medinipur and Burdwan has been conducted.
- Awareness programme for domestic consumers of WBSEDCL was carried out on National Energy Conservation Day i.e. 14th December, 2015 by displaying flex banners in all the site offices including Head Quarters of WBSEDCL & WBSETCL mentioning tips on energy conservation in local language.

- g) Impact assessment of three energy conservation activities was carried out for (i) LED Street lighting, (ii) LED village campaign and (iii) IGEA at 7th floor of Vidyut Bhawan. It was found that those three activities resulted in an annual savings of 0.44 MU.
- h) WBSEDCL will take up an “investment grade energy audit” plan for replacement of existing tube lights with LED tube lights from ground floor to sixth floor of Vidyut Bhawan. The fund requirement for this project is Rs. 56.0 Lakh which will be met up from the State Energy Conservation Fund already disbursed by BEE.

8.2. Energy efficiency action plan

Domestic Efficient Lighting Program (DELP) for domestic consumers in West Bengal is expected to be initiated by December 2015 end. EESL plans to invest about Rs. 590 Cr for DELP program in West Bengal. The total anticipated annual energy saving is around 3,007 MU.

EESL will be implementing the DELP program in West Bengal in coordination with Government of West Bengal and 3 DISCOM's. A total of 564 Lakh LED bulbs are expected to be distributed to household consumers in WBSEDCL and 7.2 lakh LED bulbs are expected to be distributed to household consumers in CESC Kolkata. The key features of the program are:

- Domestic Consumer shall have the option to opt either for On-Bill Financing Option or Upfront Payment Option.
- Under On-Bill Financing Option, Consumer shall make upfront payment of INR 10/- per LED Bulb and thereafter the programme balance cost per LED bulb shall be recovered through consumer's electricity bill over 10 equal monthly instalment,

subject to maximum of INR 10, for each LED bulb.

- Under the Upfront Payment Option, Consumer shall make upfront payment of Program Cost per LED Bulb as determined less adjustment for Cost of Capital and corresponding Service tax.
- One meeting held on 1st February, 2016 with EESL and it is decided that a fresh proposal will be sent by EESL within a short period.

8.3. Issues

WBSEDCL has also planned to take up Agricultural Demand Side Management (AgDSM) and Municipal Demand Side Management (MuDSM) programme in West Bengal.

WBSERC will be approached for issue of mandate for using BEE 5-Star rated pumps by farmers for each agricultural connection, for which Rs. 1700/- per pump will be provided by BEE as subsidy.

WBSEDCL proposes to check the efficiency of pumps used by Municipalities across states for use of pumping water. Further, the Municipal authorities will be approached for replacement of low-efficiency old pumps by BEE 5-Star rated pumps.

Table 47: Action Points for Energy Efficiency programs

Stakeholder	Action Item
WBSEDCL	<ul style="list-style-type: none"> Prepare plans for improving energy efficiency of pumps used for Public Water Works (Municipalities) Roll out of DELP program within next three months.
BEE/ MNRE	<ul style="list-style-type: none"> Explore funding options for AG DSM and MuDSM measures. Implementation of the star rated Agricultural pumps in the State.

9. Financial Position of Utility (WBSEDCL)

9.1. Introduction

With the unbundling of WBSEB in March, 2007, two new entities were created – WBSEDCL and WBSETCL which came into effect in April 1, 2007 under the provisions of the West Bengal Power Reform Scheme, 2007. During the transfer scheme, the past loan burden and losses were wiped out and the utility was provided with a clean slate. WBSEDCL has been able to sustain itself as a financially viable entity with negligible accumulated losses. Although, the existence of considerable amount of regulatory assets and highly leveraged balance sheet makes it imperative for the utility to exercise financial prudence in further expansion of asset base.

In the latest (2015) rating of state utilities, WBSEDCL has been rated as “B+” by ICRA, indicating “Moderate Operational and Financial Performance Capability”. The rating is attributed to limited dependence on State Government subsidy. The short term bank facilities have been assigned A2+ rating and the recent Rs.1,000 Cr. long term bond program has been rated as BBB+ (Stable). These ratings derive their support from the 100% ownership of the Government of West Bengal, wide distribution network, favorable consumption mix, satisfactory collection efficiency and regulated nature of operations with cost-plus based tariff supported by operationalization of Monthly Variable Cost Adjustment (MVCA) for pass-through of increase in power purchase cost.

9.2. Commercial & Financial Viability

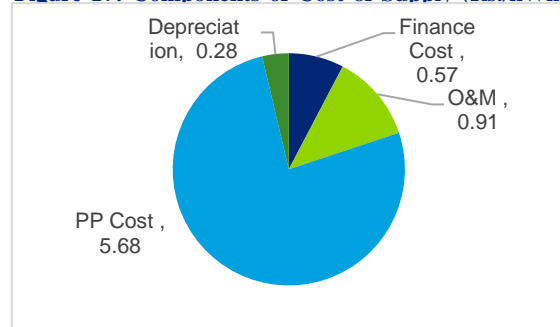
The health of power sector largely depend upon the performance of distribution utilities as the entire cash

flows accrue to them. One of the key indicator of commercial health and resultant financial position of a distribution utility is the gap between average cost of supply (ACS) and average billing rate (ABR).

The ABR for WBSEDCL including the regulatory assets FY 15 is 7.5 Rs./kWh. The ABR for retail sales approved by WBSERC for FY 16 is 6.58 Rs./kWh.

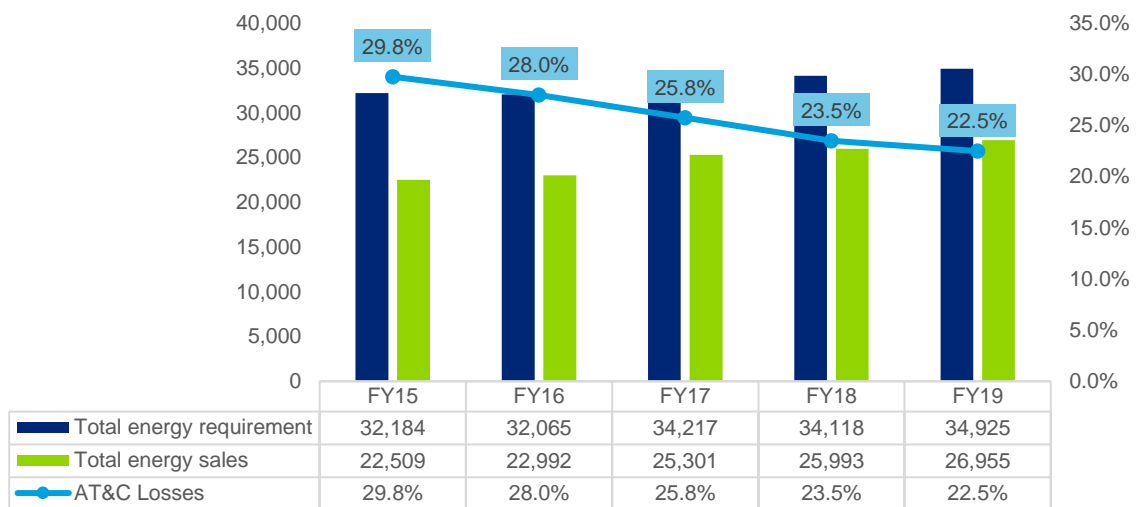
A significant part of the above gap between ABR and ACS can be attributed to the increase in T&D losses over the last few years from 24.88% in FY12 to 27.6% in FY15 and shows an improvement from 27.96% in FY14. The utility has also accumulated considerable amount of regulatory assets on account of power purchase cost increase. However,

Figure 17: Components of Cost of Supply (Rs./kWh)



WBSEDCL has attempted to reduce these losses by undertaking various measures, such as, installation of capacitor banks, extension of LT mains, security and loss prevention cells in every region, monthly energy audits etc. Figure 18 shows the proposed/estimated AT&C losses, T&D losses, energy input and sales

Figure 18: Projected Sales (MU) and AT&C Loss (%) for WBSEDCL FY 15(A) to FY 16

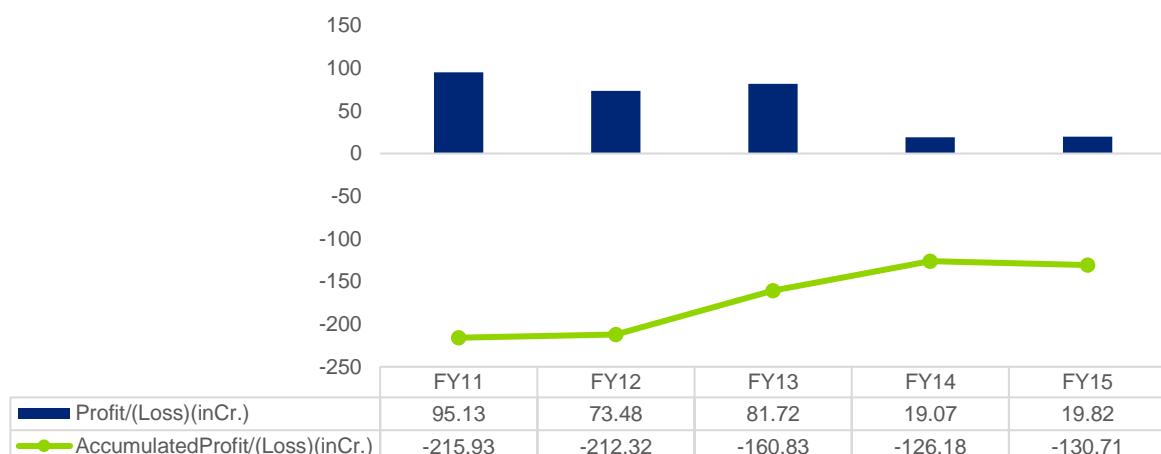


during the period from FY16 to FY19. In the last few years, WBSEDCL has embarked upon a massive electrification drive to reach 100% electrification in the State. It has added 50 lakh consumers in last 4 years and the total number of consumers have increased from 1.06 crore in FY12 to 1.53 crore in FY15. One of the ways utility has achieved this was by way of reducing the entry level costs for new consumers, especially small enterprises and households. Earlier, small enterprises had to pay within a range of Rs.16,596 to Rs.40,615 for a 6kw connection, depending on the distance of the pole. This rate was brought down to Rs.10,000 in FY12. For households, the rate for 0.2kw was brought down to Rs.200 as against Rs.3,346 to Rs.4,146 earlier, depending on the distance of the pole.

Considering the past achievements, the utility has set an ambitious target of electrifying all urban HHs and almost all rural HHs in the State in the current financial year itself.

As a result of HH electrification programs, the sales mix of utility has altered and the share of domestic sales has increased from 26% in FY11 to 38% in FY15 growing at a CAGR of 12.2% over the period. This is the highest growth recorded amongst all consumer categories. While the sales to industrial consumers during the same period has grown only at 1.7% YoY, thus straining the financial position of utility. Despite the increase in domestic sales, WBSEDCL has demonstrated strong financial sustainability without any support from the State government. It has consistently recorded profits during the last few years and the accumulated losses

Figure 19: Annual and Accumulated profit/ (loss) in Rs. Cr.



have been brought down from Rs. 216 Cr. in FY11 to Rs.130.7 Cr. in FY15. Figure 19 presents the YoY profits recorded and reducing accumulated losses of WBSEDCL.

However, the above profitability of WBSEDCL must be seen in light of the burgeoning regulatory assets and income receivable under regulatory mechanism being booked in its financial statements. The Table 48 below provides the year on year buildup of regulatory assets and revenue being booked under regulatory mechanism, which is yet to be realized.

Table 48: Regulatory assets and revenue under regulatory mechanism (Rs. Cr.)

Particulars (Rs. Cr.)	Regulatory Assets	Revenue booked under Regulatory mechanism
FY11	3,320.1	328
FY12	5,396.7	2,077
FY13	6,132.7	736
FY14	8,895.3	2,763
FY15	10,892.8	1,997

As can be seen, the amount of regulatory assets in FY15 have increased to Rs.10,892.8 Cr. from Rs. 3,320 Cr. in FY11. A significant part, Rs. 5,838.7 Cr., of the above regulatory assets have been now classified under non-current assets, which are realizable beyond a period of one year. The increase in regulatory asset during FY15 has been to the tune of Rs. 1,997 Cr. majority of which is on account of arrears of power purchase cost and under-recovery vis-à-vis regulatory allowance. This substantial build-up of regulatory assets pertaining to terminal liabilities, fuel and power purchase cost adjustments and increases in employee costs due to pay revision pose a significant risk to the financial sustainability.

A delay in the realization of the cost of these assets could exert pressure on the utility's liquidity profile. Further, during the past few years, WBSEDCL has committed significant capital expenditure for its network expansion. The utility has resorted to significant market borrowings, with long term debt increasing from Rs.4,850 Cr. in FY11 to Rs.7,597 Cr. in FY15. Due to higher reliance on long term as well as short term funds to meet capital and revenue account deficits, there has been a sharp rise in interest burden from Rs.5.69 Cr in FY11 to Rs.1,362 Cr. in FY15, resulting in weakening of debt service indicators. Table 49 shows the crystallization of Regulatory Assets from FY12 to FY15.

Going forward WBSEDCL not only faces a challenge of crystallization of significantly high regulatory assets but also achieving high levels of efficiency to minimize disallowances to adequately meet its ACS. It is imperative that these factors may be considered carefully for the projections of financial statement of WBSEDCL, which are discussed in the following sub-section.

9.3. Financial Projections

In order to estimate the impact of PFA program on the financials of a utility, it is pertinent to assess the incidental cost of the program vis-à-vis the potential of generating additional revenue due increase in energy sales. As the utility progresses on achieving reduction in AT&C losses, the gap between average cost of supply and average realization is expected to shrink. In line with above, an analysis has been carried out to assess the cost impact of PFA program on tariff as well as financials of the utility. Table 50 presents the assumptions which form the basis for such projections.

Table 49: Regulatory assets created and crystalized (Rs. Cr.)

Particulars	FY 12	FY 13	FY 14	FY 15
Amount Realisable from tariff and APR and FPPPA (For Previous Years)	2,760	2,091	3,388	2,991
Crystallisation of RA	684	1,355	625	994
Net Amount	2,077	736	2,763	1,998

Table 50: Key Common Assumptions underlying financial analysis

Particulars	Assumptions															
Power purchase	<ul style="list-style-type: none">The firm allocation from the Central Generating Stations shall remain stable at current levels (July 2015) over the period of projection (FY16 to FY19)Energy Projections as per WBSEDCL's projectionTransmission charges for FY16 to FY 19 is as per projections by WBSETCL															
Power Purchase Rate	<ul style="list-style-type: none">Power purchase rate as projected by WBSEDCL as per the following:<table><tr><th></th><th>2016-17</th><th>2017-18</th><th>2018-19</th></tr><tr><td>Power purchase rate projected (Rs./kWh)</td><td>3.43</td><td>3.47</td><td>3.58</td></tr></table>		2016-17	2017-18	2018-19	Power purchase rate projected (Rs./kWh)	3.43	3.47	3.58							
	2016-17	2017-18	2018-19													
Power purchase rate projected (Rs./kWh)	3.43	3.47	3.58													
Surplus power purchase and sale	<ul style="list-style-type: none">Power available beyond the requirement has been considered to be sold outside State (Including sales to other licensees and Bangladesh) at the rate of 2.71 (Considering the impact of back down costs of surplus power)															
Revenue and Sales growth	<ul style="list-style-type: none">Revenue calculations based on average billing rate approved by commission for FY16 for domestic, BPL and other than domestic & BPL consumers.Sales growth of domestic consumer and BPL consumers is as per projections in Power Supply Scenario (Chapter 2)Energy sales growth of other than domestic consumers is 5% (YoY)															
Losses (%)	<ul style="list-style-type: none">Losses projections as per following trajectory:<table><tr><th>Particulars</th><th>FY16</th><th>FY17</th><th>FY18</th><th>FY19</th></tr><tr><td>AT&C Loss (%)</td><td>28.0%</td><td>25.8%</td><td>23.5%</td><td>22.5%</td></tr><tr><td>Intra State transmission loss</td><td>3.4%</td><td>3.4%</td><td>3.4%</td><td>3.4%</td></tr></table>	Particulars	FY16	FY17	FY18	FY19	AT&C Loss (%)	28.0%	25.8%	23.5%	22.5%	Intra State transmission loss	3.4%	3.4%	3.4%	3.4%
Particulars	FY16	FY17	FY18	FY19												
AT&C Loss (%)	28.0%	25.8%	23.5%	22.5%												
Intra State transmission loss	3.4%	3.4%	3.4%	3.4%												
Capex & capitalization	<ul style="list-style-type: none">Capex as per budgeted plans and requirement to fulfill PFA targets of WBSEDCLCapitalization based on capitalization plan provided by WBSEDCL															
Employee cost, R&M, A&G costs and Other costs	<ul style="list-style-type: none">Employee cost: Based on employee cost for FY15 with escalation of 10% YoY over the period of projection (FY 16 to FY19) considering the CPI.A&G cost: Based on A&G cost for FY15 with escalation of 6% p.a over the period of projection (FY 16 to FY19)R&M cost:<ul style="list-style-type: none">For existing assets: Based on the actual R&M cost as percentage of GFA (Past 2 years Average has been considered)For New Assets – 1% of GFA															
Depreciation	<ul style="list-style-type: none">For existing assets: Based on the existing rate of depreciationFor new assets: 5.28%															
Funding of capital expenditure and financing terms	<ul style="list-style-type: none">Capital expenditure to be funded through grant, debt & equity based on schemes under which it has been proposed.Under DDUGJY and IPDS, 85% upfront grant is considered (60% PFC/REC and additional 25% from Govt. of West Bengal), remaining 15% is considered as debt, convertible to grant on achievement of AT&C loss targets.Unapproved capital expenditure under proposed schemes to be funded through debt equity in the ratio of 70:30.For other ongoing schemes, funding is based on the tied up debt, equity and envisaged grant portion. For any untied expenditure, debt and equity in the ratio of 70:30 has been considered.Repayment schedule of 10 yearsInterest on existing debt is considered to be based on weighted average existing interest rate, estimate to be 10%Interest on new debt considered to be 12.5%, considering the present rating of WBSEDCL and corresponding lending rates of PFC.Debt to Equity ratio assumed at 70:30 under no grants scenario, only for schemes under which funds have already not been tied up, such as DDUGJY and IPDS															
Working capital and cash deficit loan	<ul style="list-style-type: none">Working capital as per regulatory provisionsWorking capital loan at 11% as per submission by WBSEDCL															

Particulars	Assumptions
	<ul style="list-style-type: none">Cash deficit during the year is assumed to be funded from short term loan @ 10.8%p.a.
Other income	<ul style="list-style-type: none">Based on values for FY15 with escalation of 3% YoY over the period of projection (FY 16 to FY19)
Miscellaneous Expenses	<ul style="list-style-type: none">For FY 16 to FY 19 miscellaneous expenses considered in proportion to the O&M costOther prior period expenses have not been considered in the financial projections
Regulatory parameters	<ul style="list-style-type: none">No disallowance in power purchase or any other cost elementCrystalized amount for FY 16 considered. For the period FY 17 and FY 18, crystalisation allowed by the WBERC is considered.New regulatory assets added every year (Rs. Cr.)

The utility's profit margins are largely dependent on the recovery of regulatory assets. Further, as there is no significant impact of capital investment on tariff due to availability of capital grants from both central and state governments, the role of AT&C loss becomes significant in determining the profitability of the utility.

In the base case, the financial statements of WBSEDCL have been prepared considering that the

per unit power purchase cost and tariff shall remain at the present levels, while the impact of other incidental cost is accounted.

As can be seen in the P&L statement, there is a positive PAT for each of the year during FY 16 to FY 19, registering profits of Rs. 40 Cr. in FY 19. Hence, there is exists no requirement of tariff increase as the utility has already achieved financial viability.

Table 51: Impact of Asset addition (Rs Cr.)

Particulars	FY 16	FY 17	FY 18	FY 19
Capital expenditure	1,250	3,129	3,150	1,526
Grants	1,067	2,668	2,839	1,727
Debt	182	462	312	(201)
Equity	-	-	-	-
Incidental cost of capital expenditure due to PFA				
Depreciation on additional assets	56	175	321	462
Interest on debt – corresponding to PFA capex	10	45	84	80
Return on equity - corresponding to PFA capex	-	-	-	-
Total capex related Cost	67	221	405	542

Table 52: Parameters for base case

Particulars	Units	FY 16	FY 17	FY 18	FY 19
Energy related parameters					
Sales	MUs	22,992	25,301	25,993	26,955
T&D Losses	%age	25.8%	23.5%	21.1%	20.1%
AT&C Losses	%age	28.0%	25.8%	23.5%	22.5%
Power purchase cost (inc transmission charges)	Rs./kWh	3.50	3.43	3.47	3.58

Particulars	Units	FY 16	FY 17	FY 18	FY 19
Revenue & expenditure parameters					
Tariff Increase	%age	0.0%	0.0%	0.0%	0.0%
Collection efficiency	%age	97%	97%	97%	97%
Average billing rate - Domestic	Rs./kWh	5.29	5.29	5.29	5.29
Average billing rate - Other than domestic (weighted avg.)	Rs./kWh	6.64	6.64	6.64	6.64
Employee cost escalation	%age	10.00%	10.00%	10.00%	10.00%
A&G cost escalation	%age	6.00%	6.00%	6.00%	6.00%

Table 53: Profit and Loss Account (Rs.Cr.) for Base Case

	FY16	FY17	FY18	FY19
Revenue				
Revenue from Sale of Power within State	14,038	15,523	15,780	16,208
Revenue from Sale of Power Outside State	222	898	977	864
Income on account of regulatory assets	3,986	2,550	2,603	2,700
Others	699	720	742	764
Total revenue	18,945	19,691	20,101	20,536
Expenditure				
Power Purchase cost	14,607	15,017	15,181	15,471
O&M Cost	1,740	1,898	2,074	2,264
Employee cost	1,253	1,379	1,517	1,668
A&G Expenses	167	177	188	199
R&M Expenses	319	342	369	396
EBIDTA	2,598	2,776	2,846	2,802
Depreciation	654	699	731	741
Interest and finance charges	1,407	1,458	1,423	1,349
Interest on working capital	591	601	609	616
Interest on cash deficit loan	-	-	-	-
Interest - Long term	817	857	814	733
Miscellaneous	500	545	596	651
PBT	37	73	97	61
Provision for tax	13	25	33	21
PAT	24	48	64	40

9.4. Scenario Analysis

Any change in tariff or under achievement of AT&C losses considered for the base case or non-availability of funding in form of grants will translate into additional impact on the financial position of the utility. The impact of existing accumulated losses of WBSEDCL or the impact of purchase and sale of surplus power available to WBSEDCL also need to be evaluated. Therefore, analysis under following scenarios have been carried out:

1. Increase in tariff to ensure that utility becomes viable by FY19

2. Non-Availability of grants under the schemes where DPRs are not finalized (available only to the extent approved as per DPR) to fund the capital expenditure.
3. Under achievement of AT&C loss targets: considering the utility misses the MOP targets by 1% every year.
4. Impact of the Ujwal Discom Assurance Yojna (UDAY) scheme (transfer of outstanding liabilities to State Government)

Scenario 1: Increase in tariff required for the utility to become viable

As the power purchase cost is likely to decline from Rs. 3.7/kWh to Rs. 3.58/kWh from FY15 to FY19, the utility is expected to remain viable.

Thus, in such a scenario, no tariff hike may be required as the utility is expected to be financially viable having positive PAT (YoY) by FY17. The key parameters and the resultant P&L statement under this scenario shall remain same as the base case provided in Table 52 and Table 53, respectively.

Scenario 2: Non-Availability of grants (funding of capital expenditure through grants under various government schemes)

The dependence of utility on funding of the proposed investments through various State and Central Government schemes can be assessed by the impact on utility's finances under a scenario where grant funding is not available. Under this scenario, the grant availability for the upcoming Central Government schemes including IPDS and DDUGJY, where the DPRs have not been finalized, has been considered to be nil. While, for the ongoing schemes where the funds have already been committed by the State or Central Government, the grants are considered to be as envisaged in the respective schemes Table 54 summarizes the key parameters of this scenario.

Table 54: Parameters for Scenario 2 (Non-Availability of grants)

Particulars	Units	FY 16	FY 17	FY 18	FY 19
Energy related parameters	MU				
Sales	MUs	22,992	25,301	25,993	26,955
T&D Losses	%age	25.8%	23.5%	21.1%	20.1%
AT&C Losses	%age	28.0%	25.8%	23.5%	22.5%
Power purchase cost	Rs./kWh	3.50	3.43	3.47	3.58
Revenue & expenditure parameters					
Tariff Increase	%age	0.0%	0.0%	0.0%	0.0%
Collection efficiency	%age	97%	97%	97%	97%
Average billing rate - Domestic	Rs./kWh	5.29	5.29	5.29	5.29
Average billing rate - Other than domestic (weighted avg.)	Rs./kWh	6.64	6.64	6.64	6.64
Employee cost escalation	%age	10.00%	10.00%	10.00%	10.00%
A&G cost escalation	%age	6.00%	6.00%	6.00%	6.00%

Table 55: Profit and Loss statement - Scenario 2 (Rs. Cr.)

	FY16	FY17	FY18	FY19
Revenue				
Revenue from Sale of Power within State	14,038	15,523	15,780	16,208
Revenue from Sale of Power Outside State	222	898	977	864
Income on account of regulatory assets	3,986	2,550	2,603	2,700
Others	699	720	742	764
Total revenue	18,945	19,691	20,101	20,536
Expenditure				
Power Purchase cost	14,607	15,017	15,181	15,471
O&M Cost	1,740	1,898	2,074	2,264
Employee cost	1,253	1,379	1,517	1,668
A&G Expenses	167	177	188	199
R&M Expenses	319	342	369	396
EBIDTA	2,598	2,776	2,846	2,802
Depreciation	671	781	916	1,033
Interest and finance charges	1,440	1,606	1,738	1,844
Interest on working capital	591	601	609	616

	FY16	FY17	FY18	FY19
Interest on cash deficit loan	-	-	-	60
Interest - Long term	849	1,004	1,130	1,169
Miscellaneous	500	545	596	651
PBT	(13)	(156)	(404)	(726)
Provision for tax	-	-	-	-
PAT	(13)	(156)	(404)	(726)

As can be seen above, in FY 19 there are losses of around Rs 726 Cr in this scenario as compared to the base case where the profits for FY 19 is Rs. 40 Cr. The required tariff increase to achieve the financial viability is likely to increase to 1.4% p.a. as against no tariff increase required in base case.

The projected cash flow statement & balance sheet till FY19 is provided in Annexure 3.

Scenario 3: Under achievement of AT&C loss reduction trajectory

Base case analysis, scenario 1 and scenario 2 assumes the achievement of AT&C loss trajectory by the utility. However, in case the utility misses T&D loss reduction and it remains at 1% higher than the MoP targets, the impact on financial position is

significant. Table 56 summarizes the key parameters underlying the analysis in scenario 3. Due to additional cost and under-achievement of T&D loss trajectory there is an adverse impact on the financials of the utility, as presented in Table 57. As can be seen in Table 57 there are losses of around Rs 129 Cr. In this scenario thus emphasizing the need for focusing on reduction in AT&C losses.

It may also be important to note that in this scenario, the funds available as grants under centrally sponsored schemes (IPDS, DDUGJY) are restricted to 60% of project value.

The required tariff increase to achieve the financial viability is likely to increase to 0.3% p.a. as against no tariff increase required in base case.

Table 56: Parameters for Scenario 3 (Under-achievement of T&D losses)

Particulars	Units	FY 16	FY 17	FY 18	FY 19
Energy related parameters					
Sales	MUs	22,992	25,301	25,993	26,955
T&D Losses	%age	26.8%	24.5%	22.2%	21.1%
AT&C Losses	%age	29.0%	26.8%	24.5%	23.5%
Power purchase cost (inc. transmission charges)	Rs./kWh	3.50	3.43	3.47	3.58
Revenue & expenditure parameters					
Tariff Increase	%age	0.0%	0.0%	0.0%	0.0%
Collection efficiency	%age	97%	97%	97%	97%
Average billing rate - Domestic	Rs./kWh	5.29	5.29	5.29	5.29
Average billing rate - Other than domestic (weighted avg.)	Rs./kWh	6.64	6.64	6.64	6.64
Employee cost escalation	%age	10.00%	10.00%	10.00%	10.00%
A&G cost escalation	%age	6.00%	6.00%	6.00%	6.00%

Table 57: Profit and Loss statement - Scenario 3 (Rs. Cr.)

Particulars	FY16	FY17	FY18	FY19
Revenue				
Revenue from Sale of Power within State	14,038	15,523	15,780	16,208
Revenue from Sale of Power Outside State	100	772	854	740
Income on account of regulatory assets	3,986	2,550	2,603	2,700
Others	699	720	742	764
Total revenue	18,823	19,564	19,979	20,413

Particulars	FY16	FY17	FY18	FY19
Expenditure				
Power Purchase cost	14,607	15,017	15,181	15,471
O&M Cost	1,740	1,898	2,074	2,264
Employee cost	1,253	1,379	1,517	1,668
A&G Expenses	167	177	188	199
R&M Expenses	319	342	369	396
EBIDTA	2,476	2,649	2,724	2,678
Depreciation	654	699	736	769
Interest and finance charges	1,405	1,456	1,429	1,387
Interest on working capital	588	599	606	613
Interest on cash deficit loan	-	-	-	-
Interest - Long term	817	857	823	774
Miscellaneous	500	545	596	651
PBT	(83)	(52)	(37)	(129)
Provision for tax	-	-	-	-
PAT	(83)	(52)	(37)	(129)

Scenario 4: Impact of UDAY Scheme

Under the Ujjwal Discom Assurance Yojna (UDAY) scheme of the Govt. of India it is envisaged that the respective State Government will take over the debt of the State owned Discoms. This will reduce the interest cost of the utility. Further, with the impact of schemes aimed towards improving operational efficiency of the utilities, it is expected that the state utilities will be reduce their cost elements. Fiscal discipline along with the remedial actions for reducing Power Purchase cost and aligning the AT&C losses are a part of this scheme. This scenario evaluates the impact of this scheme on the financials of the utility.

In this scenario it is assumed that the state will take over 75% of the outstanding debt in two years (50% in FY 16 and 25% in FY 17). This will result in reduction of Interest cost for the discom.

The opening outstanding liabilities WBSEDCL is Rs. 9,298 Cr as per the half yearly accounts of FY 16. The impact on the financial statements are shown in the following tables. It can be seen that the profits of Utility are expected to increase to Rs. 354 Cr in FY 19.

Table 58: Parameters for Scenario 4 (UDAY)

Particulars	Units	FY 16	FY 17	FY 18	FY 19
Energy related parameters					
Sales	MUs	22,992	25,301	25,993	26,955
T&D Losses	%age	25.8%	23.5%	21.1%	20.1%
AT&C Losses	%age	28.0%	25.8%	23.5%	22.5%
Power purchase cost (inc. transmission charges)	Rs./kWh	3.50	3.43	3.47	3.58
Revenue & expenditure parameters					
Tariff Increase	%age	0.0%	0.0%	0.0%	0.0%
Collection efficiency	%age	97%	97%	97%	97%
Average billing rate - Domestic	Rs./kWh	5.29	5.29	5.29	5.29
Average billing rate - Other than domestic (weighted avg.)	Rs./kWh	6.64	6.64	6.64	6.64
Employee cost escalation	%age	10.00%	10.00%	10.00%	10.00%
A&G cost escalation	%age	6.00%	6.00%	6.00%	6.00%

Table 59: Scenario 4 (UDAY): Profit and Loss Statement (Rs.Cr.)

Particulars	FY16	FY17	FY18	FY19
Revenue				
Revenue from Sale of Power within State	14,038	15,523	15,780	16,208
Revenue from Sale of Power Outside State	222	898	977	864
Income on account of regulatory assets	3,986	2,550	2,603	2,700
Others	699	720	742	764
Total revenue	18,945	19,691	20,101	20,536
Expenditure				
Power Purchase cost	14,607	15,017	15,181	15,471
O&M Cost	1,740	1,898	2,074	2,264
Employee cost	1,253	1,379	1,517	1,668
A&G Expenses	167	177	188	199
R&M Expenses	319	342	369	396
EBIDTA	2,598	2,776	2,846	2,802
Depreciation	654	699	731	741
Interest and finance charges	1,153	962	892	874
Interest on working capital	591	601	609	616
Interest on cash deficit loan	-	-	-	-
Interest - Long term	562	360	284	259
Miscellaneous	500	545	596	651
PBT	292	569	627	536
Provision for tax	99	193	213	182
PAT	192	376	414	354

The utility may consider reduction in the govt support to the extent of profits booked as a result of this scheme, or it may also pass on the benefits of higher profits vis-à-vis the Base Case, by reducing the overall tariff (Average Billing Rate) in the State. It is estimated that the incremental profit before tax, if passed on to consumers in form of relief in tariff, there may be a reduction in tariff in the range of Rs.0.11/kWh to Rs.0.20kWh, as detailed in Table 60.

WBSEDCL has been providing 24x7 service to its existing consumers and reporting book profit continuously since inception. Under the above circumstances participation in UDAY scheme is

still under consideration by State Govt. for improvement of operational efficiency only.

Table 60: Expected Tariff Impact of UDAY

Particulars	FY16	FY17	FY18	FY19
Base Case PBT (Rs. Cr.)	37	73	97	61
UDAY scenario PBT (Rs. Cr.)	292	569	627	536
Differential PBT (Rs. Cr.)	255	496	530	475
Per unit impact (Rs./kWh)	0.11	0.20	0.20	0.18

Action Items for WBSEDCL

1. **Affordability:** The utility is taking adequate steps for reducing the cost of connection for marginal consumers. Earlier, small enterprises had to pay within a range of Rs.16,596 to Rs.40,615 for a 6kw connection, depending on the distance of the pole. This rate was brought down to Rs.10,000 in FY12. For households, the rate for 0.2kw was brought down to Rs.200 as against Rs.3,346 to Rs.4,146 earlier, depending on the distance of the pole. Further, as an ongoing effort the state government has funded the initial service connection charges for rural consumers.
2. **Achievement of AT&C Loss targets:** The financial scenarios clearly show that the utility's profitability is hampered to a large extent if it fails to achieve the AT&C loss targets. Adequate actions must be taken to monitor the AT&C losses. Further, efforts may be taken to increase the billing efficiency and collection efficiency which stands at 72% and 97% respectively.
3. **Realisation of Regulatory Assets:** One of the essential pre-requisites of financial sustainability is recovery of the regulatory assets. WBSEDCL, GoWB and WBERC may initiate discussions for recovery of the accumulated regulatory assets which are currently standing close to Rs. 10,000 Cr.

10. Roll out Plan

Particular	Unit	Existing ending	Year wise addition				Total Till FY 19
		FY 15	FY 16	FY 17	FY 18	FY 19	
GENERATION							
State Sector	MW	4,619	500	500	-	-	5,619
Central Sector Allocations	MW	1,091	60	220	274	407	2,051
Private Sector	MW	1,151	64	29	203	521	1,967
Total IC including Allocation	MW	6,861	624	748	477	928	9,638
Peak Demand	MW	5,324	5,837	6,047	6,152	6,351	6,351
TRANSMISSION (INTRA STATE)							
Grid Substations (Nos)	No.	113	New 4 Upgrade 2	New 8 Upgrade 2	New 10 Upgrade 2	New 10 Upgrade 1	147
Transformation Capacity (MVA							
400 KV	MVA	3,780	1,984.5	1,984.5	1,984.5	661.5	6,615
220 KV	MVA	9,880	4,452	4,452	4,452	1,484	14,840
132 KV	MVA	9,674.5	3,683.55	3,683.55	3,683.55	1227.85	12,278.5
66 kV	MVA	246.3	73.89	73.89	73.89	24.63	246.3
Sub Total	MVA	23,580.3	10,193.7	10,193.7	10,193.7	3,397.9	33,979
DISTRIBUTION							
Substations	Nos	525	14	27	41	54	660
HT Line	Ckt km	1,65,647	3,623	7,247	10,870	14,494	2,01,881
LT Line(km)	Ckt km	2,95,404	2,154	4,308	6,462	8,616	3,16,944
Distribution Transformer	Nos	2,03,766	4,010	8,020	12,031	16,041	2,43,868

11. Institutional Arrangement for monitoring

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

Table 61: Institutional Arrangement for Monitoring

Sl.	Institutional arrangement	Responsibilities	Monitoring frequency
1	Government of India (GOI) Committee	It is proposed that this committee will review the overall progress of the scheme and provide necessary support to ensure a coordinated response from Central Government – where necessary. This committee may be constituted with the following members – PFC, REC, CEA, SECI, EESL, BEE, Ministry of Coal, MNRE, MoPNG and Ministry of Power.	Quarterly
2	State Government Level Committee	It is proposed that a State level committee headed by the Secretary (Power) will be formed to review the progress of the scheme. This Committee will monitor the progress of the works undertaken as a part of the scheme and issue directions to enable faster execution.	Quarterly
3	Department Level Committee	It is proposed that a department level committee headed by Nodal Officer will be formed which shall undertake steps required to ensure the projects are progressing as per the action plan.	Monthly
4	Circle Level Committee	It is proposed to constitute a circle level committee headed by GM to take action that is necessary to ensure the projects are completed in a timely manner.	Monthly
5	Project Monitoring Unit (PMU)	A PMU shall be set up for monitoring the progress of works being undertaken under this scheme. The PMU will operate under Secretary (Power) and shall be operated by an independent agency.	Weekly

12. Annexures

Annexure 1a :IPDS Planned Capacity Addition

Sl.	District	Project Cost (Rs. Crs.)	New Substation	Augmentation of Power T/F	Additional Power T/F	HT Line	LT Line	100 KVA DTC
1	Nadia	186.43	0	3	5	166	260	841
2	North 24 Parganas	497.38	7	14	5	584	85	500
3	Bankura	74.86	0	0	0	48	1	25
4	Malda	93.98	1	4	0	215	103	170
5	South 24 Parganas	216.68	2	20	0	456	336	248
6	Bidhannagar	263.14	10	10	0	355	275	110
7	Birbhum	69.62	3	1	0	131	30	181
8	Burdwan	261.37	4	12	0	428	133	375
9	Darjeeling	154.52	4	7	0	214	35	163
10	Hoogly	229.95	4	5	1	415	142	485
11	Howrah	125.72	2	2	4	271	87	243
12	Murshidabad	174.1	4	7	4	315	5	300
13	Paschim Midnapur	180.36	0	4	3	255	109	635
14	Purbo Midnapur	83.88	1	7	3	184	79	204
15	Purulia	29.36	1	1	0	11	35	35
16	Raiganj	100.5	1	4	1	171	38	184
17	Coochbehar	78.36	1	4	0	135	37	172
18	Jalpaiguri	46.55	0	1	0	94	2	33
Total		2866.76	45	106	26	4448	1792	4904

Annexure 1b :DDUGJY Planned Capacity Addition (excluding PMA Charges)

SL NO	DISTRICT	PROJECT COST	NEW SUBSTATION	AUGMENTATION OF POWER T/F	ADDITIONAL POWER T/F	NEW HT LINE (km)	NEW LT LINE(km)	NEW DISTRIBUTION TRANSFORMER
		Rs. In Cr.	No	No	No	33 KV LINE	11 KV LINE	No.
1	24-PARGANAS(S)	344.51	4	3	1	108	1,773	2,236
2	HOWRAH	121.60	4	4	4	71	360	384
3	HOOGHLY	266.74	3	1	1	39	1,563	1,450
4	PURBA MEDINIPUR	249.78	4	8	0	83	903	2,187

SL NO	DISTRICT	PROJECT COST	NEW SUBSTATION	AUGMENTATION OF POWER T/F	ADDITIONAL POWER T/F	NEW HT LINE (Km)	NEW LT LINE(km)	NEW DISTRIBUTION TRANSFORMER	
5	MURSHIDABAD	294.05	4	8	3	94	2,416	516.87	1,066
6	DAKSHIN DINAJPUR	140.74	3	3	0	70	911	350	554
7	PACHIM MEDINIPUR	463.94	6	7	0	200	4,218	1,500	3,023
8	COOCHBEHAR	102.94	5	6	0	81	281	343	460
9	UTTAR DINAJPUR	142.47	4	8	0	92	727	334	623
10	BIRBHUM	286.89	5	5	1	87	2,259	244	2,040
11	24-PARGANAS(N) including Bidhannagar	329.97	3	7	0	131	1,805	769.39	1,692
12	MALDA	261.04	8	4	1	272	1,572	94	1,929
13	NADIA	268.05	4	7	2	86	1,723	198	1,544
14	BARDHAMAN	390.70	10	2	0	156	2,759	516	2,766
15	BANKURA	225.91	3	13	0	90	1,238	440.8	1,764
16	PURULIA	104.51	1	0	0	27	287	164.92	442
17	JALPAIGURI (Including Alipurduar)	135.08	5	6	0	170	546	496	575
18	DARJEELING	112.00	4	6	1	112	366	149	406
Total:		4,240.9	80	98	14	1,969	25,707	8,510.31	25,141

Annexure 2 :Projected Cash Flow (Base case)

The projected Balance Sheet & Cash Flow till FY19 under base case and Scenario 1 is presented below. (Fig in Rs. Cr.)

Cash flow statement	FY 16	FY 17	FY 18	FY 19
Cash from Operations				
Revenue	18,524	19,225	19,628	20,050
Operating Costs	-16,847	-17,461	-17,851	-18,385
Miscellaneous expenses				
Increase in Short term capital requirements	-1,950	-98	-64	-64
Tax	-13	-25	-33	-21
Net Cash from Operations	-285	1,642	1,680	1,580
Cash from Investment Activities				
Capex	-1,250	-3,129	-3,150	-1,526
Net Cash from Investment Activities	-1,250	-3,129	-3,150	-1,526
Cash from Financing Activities				
Equity Investments	1,899	462	312	-201
Debt Drawn	-778	-920	-865	-845
Loan Repayment	1,950	98	64	64
Increase in working capital loan	0	0	0	0
Payment of past current liabilities	1,067	2,668	2,839	1,727
Grants	0	0	0	0
Interest on cash deficit loan	0	0	0	0
Interest on Loans	-817	-857	-814	-733
Interest on Working Capital Loan	-591	-601	-609	-616
Net Cash from Financing Activities	2,730	850	926	-604
Net Cash Balances				
Cash BF	1,494	2,689	2,051	1,507
Cash Flow during the year	1,195	-638	-544	-550
Cash	2,689	2,051	1,507	957

Balance Sheet statement (Rs. Cr.)	FY 16	FY 17	FY 18	FY 19
Assets				
Current Assets				
Cash @ Bank	2,689	2,051	1,507	957
Short term loan and advances	131	131	131	131
Other Current Assets	5,478	5,478	5,478	5,478
Stocks – Stores	697	719	743	774
Receivables	9,295	9,885	10,427	10,986
Total Current Assets	18,291	18,264	18,286	18,326
Non-current Assets				
Gross Fixed Assets	17,566	19,944	23,086	25,262
Less: Accumulated Depreciation	1,273	1,972	2,703	3,444
Other current assets	6,161	6,161	6,161	6,161
Loans and Advances	236	236	236	236
Capital Works in Progress	500	1,252	1,260	611
Net Fixed Assets	23,190	25,620	28,040	28,825
Total Assets	41,481	43,884	46,325	47,151
Liabilities				
Long Term Debt	8,717	8,259	7,706	6,660
Long Term Liabilities	8,418	8,418	8,418	8,418
Working Capital Loan/ Short term borrowings	5,370	5,468	5,532	5,596
Cash deficit loan	0	0	0	0
Trade payables	5,245	5,292	5,321	5,361
Short term provisions	2,833	2,833	2,833	2,833
Current Liabilities	2,580	2,580	2,580	2,580
Total	33,163	32,851	32,389	31,447
Equity				
Share Capital	2,257	2,257	2,257	2,257
Grants	1,067	3,735	6,574	8,301
Consumer Contributions				
Capital Liabilities				
Retained Earnings	4,969	4,994	5,042	5,105
Total	8,318	11,033	13,936	15,703
Total Liabilities	41,481	43,884	46,325	47,151

Annexure 3 :Projected Cash Flow (Scenario 1)

The projected Balance Sheet & Cash Flow till FY19 under scenario 1 is presented above in Annexure 2.

Annexure 4 :Projected Cash Flow (Scenario 2)

The projected Balance Sheet & Cash Flow till FY19 under scenario 2 is presented below. (Fig in Rs. Cr.)

Cash flow statement	FY 16	FY 17	FY 18	FY 19
Cash from Operations				
Revenue	18,524	19,225	19,628	20,050
Operating Costs	-16,847	-17,461	-17,851	-18,385
Miscellaneous expenses				
Increase in Short term capital requirements	-1,950	-98	-64	-64
Tax	0	0	0	0
Net Cash from Operations	-273	1,667	1,713	1,601
Cash from Investment Activities				
Capex	-1,250	-3,129	-3,150	-1,526
Net Cash from Investment Activities	-1,250	-3,129	-3,150	-1,526
Cash from Financing Activities				
Equity Investments	299	826	870	345
Debt Drawn	2,468	2,007	2,056	844
Loan Repayment	-835	-1,131	-1,251	-1,336
Increase in working capital loan	1,950	98	64	64
Payment of past current liabilities	0	0	0	0
Grants	198	297	225	337
Interest on cash deficit loan	0	0	0	-60
Interest on Loans	-849	-1,004	-1,130	-1,169
Interest on Working Capital Loan	-591	-601	-609	-616
Net Cash from Financing Activities	2,641	491	225	-1,589
Net Cash Balances				
Cash BF	1,494	2,612	1,640	427
Cash Flow during the year	1,119	-972	-1,213	-1,515
Cash	2,612	1,640	427	-1,087

Balance Sheet statement (Rs. Cr.)	FY 16	FY 17	FY 18	FY 19
Assets				
Current Assets				
Cash @ Bank	2,612	1,640	427	0
Short term loan and advances	131	131	131	131
Other Current Assets	5,478	5,478	5,478	5,478
Stocks – Stores	697	719	743	774
Receivables	9,295	9,885	10,427	10,986
Total Current Assets	18,214	17,853	17,206	17,369
Non-current Assets				
Gross Fixed Assets	17,566	19,944	23,086	25,262
Less: Accumulated Depreciation	1,290	2,071	2,986	4,020
Other current assets	6,161	6,161	6,161	6,161
Loans and Advances	236	236	236	236
Capital Works in Progress	500	1,252	1,260	611
Net Fixed Assets	23,172	25,521	27,756	28,249
Total Assets	41,387	43,375	44,962	45,618
Liabilities				
Long Term Debt	9,230	10,106	10,910	10,419
Long Term Liabilities	8,418	8,418	8,418	8,418
Working Capital Loan/ Short term borrowings	5,370	5,468	5,532	5,596
Cash deficit loan	0	0	0	1,087
Trade payables	5,245	5,292	5,321	5,361
Short term provisions	2,833	2,833	2,833	2,833
Current Liabilities	2,580	2,580	2,580	2,580
Total	33,676	34,697	35,594	36,294
Equity				
Share Capital	2,556	3,382	4,252	4,596
Grants	198	495	720	1,057
Consumer Contributions				
Capital Liabilities				
Retained Earnings	4,969	4,956	4,800	4,397
Total	7,711	8,678	9,368	9,324
Total Liabilities	41,387	43,375	44,962	45,618

Annexure 5 :Projected Cash Flow (Scenario 3)

The projected Balance Sheet & Cash Flow till FY19 under scenario 3 is presented below. (Fig in Rs. Cr.)

Particulars	FY 16	FY 17	FY 18	FY 19
Cash from Operations				
Revenue	18,402	19,099	19,506	19,927
Operating Costs	-16,847	-17,461	-17,851	-18,385
Miscellaneous expenses				
Increase in Short term capital requirements	-1,929	-98	-65	-64
Tax	0	0	0	0
Net Cash from Operations	-375	1,541	1,590	1,478
Cash from Investment Activities				
Capex	-1,250	-3,129	-3,150	-1,526
Net Cash from Investment Activities	-1,250	-3,129	-3,150	-1,526
Cash from Financing Activities				
Equity Investments	0	0	0	0
Debt Drawn	1,899	462	467	221
Loan Repayment	-778	-920	-881	-903
Increase in working capital loan	1,929	98	65	64
Payment of past current liabilities	0	0	0	0
Grants	1,067	2,668	2,683	1,305
Interest on cash deficit loan	0	0	0	0
Interest on Loans	-817	-857	-823	-774
Interest on Working Capital Loan	-588	-599	-606	-613
Net Cash from Financing Activities	2,712	851	905	-700
Net Cash Balances				
Cash BF	1,494	2,581	1,844	1,188
Cash Flow during the year	1,088	-738	-656	-749
Cash CF	2,581	1,844	1,188	439

Balance Sheet statement (Rs. Cr.)	FY 16	FY 17	FY 18	FY 19
Assets				
Current Assets				
Cash @ Bank	2,581	1,844	1,188	439
Short term loan and advances	131	131	131	131
Other Current Assets	5,478	5,478	5,478	5,478
Stocks – Stores	697	719	743	774
Receivables	9,275	9,864	10,406	10,965
Total Current Assets	18,163	18,036	17,946	17,787
Non-current Assets				
Gross Fixed Assets	17,566	19,944	23,086	25,262
Less: Accumulated Depreciation	1,273	1,972	2,708	3,477
Other current assets	6,161	6,161	6,161	6,161
Loans and Advances	236	236	236	236
Capital Works in Progress	500	1,252	1,260	611
Net Fixed Assets	23,190	25,620	28,035	28,792
Total Assets	41,353	43,656	45,981	46,580
Liabilities				
Long Term Debt	8,717	8,259	7,846	7,164
Long Term Liabilities	8,418	8,418	8,418	8,418
Working Capital Loan/ Short term borrowings	5,349	5,447	5,512	5,575
Cash deficit loan	0	0	0	0
Trade payables	5,245	5,292	5,321	5,361
Short term provisions	2,833	2,833	2,833	2,833
Current Liabilities	2,580	2,580	2,580	2,580
Total	33,143	32,830	32,509	31,931
Equity				
Share Capital	2,257	2,257	2,257	2,257
Grants	1,067	3,735	6,418	7,723
Consumer Contributions				
Capital Liabilities				
Retained Earnings	4,969	4,886	4,834	4,797
Total	8,210	10,826	13,472	14,649
Total Liabilities	41,353	43,656	45,981	46,580

Annexure 6 :Projected Cash Flow (Scenario 4)

The projected Balance Sheet & Cash Flow till FY19 under scenario 4 is presented below (Fig in Rs. Cr.)

particulars	FY 16	FY 17	FY 18	FY 19
Cash from Operations				
Revenue	18,524	19,225	19,628	20,050
Operating Costs	-16,847	-17,461	-17,851	-18,385
Miscellaneous expenses				
Increase in Short term capital requirements	-1,950	-98	-64	-64
Tax	-99	-193	-213	-182
Net Cash from Operations	-372	1,473	1,500	1,419
Cash from Investment Activities				
Capex	-1,250	-3,129	-3,150	-1,526
Net Cash from Investment Activities	-1,250	-3,129	-3,150	-1,526
Cash from Financing Activities				
Equity Investments	0	0	0	0
Debt Drawn	1,899	462	312	-201
Loan Repayment	-18	-64	-330	-309
Increase in working capital loan	1,950	98	64	64
Payment of past current liabilities	0	0	0	0
Grants	1,067	2,668	2,839	1,727
Interest on cash deficit loan	0	0	0	0
Interest on Loans	-562	-360	-284	-259
Interest on Working Capital Loan	-591	-601	-609	-616
Net Cash from Financing Activities	3,745	2,201	1,992	406
Net Cash Balances				
Cash BF	1,494	3,617	4,162	4,504
Cash Flow during the year	2,123	545	342	299
Cash CF	3,617	4,162	4,504	4,803

Balance Sheet statement (Rs. Cr.)	FY 16	FY 17	FY 18	FY 19
Assets				
Current Assets				
Cash @ Bank	3,617	4,162	4,504	4,803
Short term loan and advances	131	131	131	131
Other Current Assets	5,478	5,478	5,478	5,478
Stocks – Stores	697	719	743	774
Receivables	9,295	9,885	10,427	10,986
Total Current Assets	19,219	20,375	21,282	22,171
Non-current Assets				
Gross Fixed Assets	17,566	19,944	23,086	25,262
Less: Accumulated Depreciation	1,273	1,972	2,703	3,444
Other current assets	6,161	6,161	6,161	6,161
Loans and Advances	236	236	236	236
Capital Works in Progress	500	1,252	1,260	611
Net Fixed Assets	23,190	25,620	28,040	28,825
Total Assets	42,409	45,995	49,322	50,997
Liabilities				
Long Term Debt	4,828	2,901	2,883	2,373
Long Term Liabilities	8,418	8,418	8,418	8,418
Working Capital Loan/ Short term borrowings	5,370	5,468	5,532	5,596
Cash deficit loan	0	0	0	0
Trade payables	5,245	5,292	5,321	5,361
Short term provisions	2,833	2,833	2,833	2,833
Current Liabilities	2,580	2,580	2,580	2,580
Total	29,274	27,492	27,567	27,161
Equity				
Share Capital	2,257	2,257	2,257	2,257
Grants	1,067	3,735	6,574	8,301
Consumer Contributions				
Capital Liabilities				
Retained Earnings	4,969	9,811	12,511	12,925
Total	13,135	18,503	21,755	23,836
Total Liabilities	42,409	45,995	49,322	50,997

Annexure 7 :Transmission Projects Planned by WBSETCL

Sl.	Name of EHV Substation	400/220 kV	220/132 kV	220/33 kV	132/33 kV	Completion Target
1	Gokarna	630				FY 2016
2	New Chanditala	630	320			FY 2017
3	Vidyasagar Park		630		100	FY 2016
4	Dharampur		320			Commissioned
5	Sadaipur		320		100	FY 2017
6	Egra		320			FY 2017
7	Alipurduar		320			FY 2017
8	Mathabhanga				63	Commissioned
9	Nazirpur				63	Commissioned
10	Ujanu				63	Commissioned
11	Bajkul				100	FY 2017
12	Domkol				100	FY 2017
	TOTAL (MVA)	1,260	1,920		589	
	GRAND TOTAL (MVA)	3,769				

Route length (kms)					
Sl.	Name of Transmission line	400 kV	220 kV	132 kV	Completion Target
1	Sagardighi - Gokarna 400 KVD/C	44.2			FY 2017
2	Kharagpur - N. Chanditala 400KV D/C	138.5			FY 2017
3	Gokarna - N. Chanditala 400 KVD/C	170.0			FY 2017
4	Kharagpur - Vidyasagar Park 220 KVD/C		30.0		Commissioned
5	Gokarna - Krishnanagar 220 KVD/C		105.3		Commissioned
6	LILO of Bakreswar - Gokarna 220 kV D/C at Sadaipur		3.3		FY 2017
7	Kharagpur (M/C Tower No. AP 16/0) Egra 220 kV D/C		53.5		FY 2017
8	LILO of jeerat - Rishra 220 kV D/C line at Dharampur		2.3		Commissioned
9	Alipurduar-Alipurduar (PG) 220 kV D/C		6.5		FY 2017
10	LILO of Adisaptagram - Belmuri 132 KVD/C line at Singur			16.0	FY 2017
11	132kV D/C from LILO point of KTPS - Uluberia near Bagnan to Foundry park			24.9	FY 2017
12	Food Park to Ambuja Cement 132kV D/C			3.0	FY 2017
13	Coochbehar to Pundibari TSS 132kV S/C			13.0	FY 2017
14	TCF Ph-I to Rangapani TSS 132kV S/C			7.5	FY 2017
15	TCF Ph-III to Gunjaria TSS 132kV S/C			42.8	FY 2017
16	Coochbehar - Mathabhanga 132kV O/C			46.0	FY 2017
17	Mainaguri - Mathabhanga 132kV D/C			54.9	FY 2017
18	Jeerat - Mohispota 132kV D/C (Balance Work)			26.0	FY 2017
19	Domjur - Chanditala 132kV D/C (Balance Work)			22.5	FY 2017

Sl.	Name of Transmission line	Route length (kms)			Completion Target
		400 kV	220 kV	132 kV	
20	132kV DIC Cable over Farakka Bridge between Khejuria and Farakka (UG Cable)			2.6	Commissioned
21	LILO of N.HaLdia - Egra - Contai 132 kV D/C at Bajku!			0.5	FY 2017
22	LILO of Bolpur - Sainthia 132 kV D/C at Sadaipur			17.5	FY 2017
23	Najirpur - Domkol 132 kV D/C			31.2	FY 2017
24	LILO of Domjur-Uluberia 132 kV D/C line at Foundry Park			2.2	FY 2017
25	Subhasgram-Sonakhali 132 kV D/C			41.0	FY 2017
26	Ukhra-Sonepur Bazari 132 kV D/C			15.2	FY 2017
27	Kharagpur- Keshiary 132 kV D/C			25.0	FY 2017
28	Kharagpur-Jhargram 132 kV D/C			44.0	FY 2017
29	Mankar-Panagarh 132 kV D/C			5.5	FY 2017
30	Durgapur-Panagarh 132 kV D/C			30.7	FY 2017
	TOTAL (RLkms)	352.7	200.9	472.0	
	GRAND TOTAL (RLkms)	1,025.5			

Annexure 8: Details of Approved Transmission Scheme of WBSETCL as on 31/08/2015

Sl.	Project Description	kV ratio	MVA	kV	RL (km)	Completion date
1	New PPSP 400 kV GIS					FY 2017 onwards
	LILOf Arambag - PPSP 400 kV D/C Line at New PPSP			400	0.5	
2	Augmentation of 400/220 kV ICT at Kharagpur 400 kV Sub-station	400/220				FY 2017 onwards
3	Barasat 220/132 kV GIS	220/132				FY 2018 Onwards
	LILOf Jeer at - Kasba 220 kV D/C Line at Barasat			220	2.4	
	LILOf Jeerat - Kasba 220 kV D/C Line at Rajarhat (PG)			220	3.5	
4	New Town AA-IIC220/132/33kV GIS	220/132 220/33	320 160			FY 2019 onwards
	Rajarhat (PG) - New Town AA-IIC220 kV D/C			220	12.5	
5	LILOf Howrah - Foundry Park 220 kV D/C Line at New Chanditala			220	8.8	FY 2018 onwards
6	Sagardighi 220/132 kV GIS	220/132	320			FY 2018 onwards
	LILOf Sagar dighi TPS - Gokarna 220 kV D/C Line at Sagardighi			220	5.5	
	132 kV D/C Line from Raghunathgunj - Gokarna			132	4	
	132 kV D/C Line to Sagardighi					
7	Sonakhali 132/33 kV GIS	132/33	63			FY 2017 onwards
8	Sonepur Bazari 132/33 kV GIS	132/33	100			FY 2017 onwards
	Extension of 2 nos. 132 kV Bays at Ukhra 132 kV substation					
9	Keshiary 132/33 kV Sub-station	132/33	100			FY 2018 onwards
10	Panagarh 132/33 kV GIS	132/33	100			FY 2018 onwards
	Extension of 2 nos. 132 kV Bays at Mankar 132 kv Substation					
	Extension of 2 nos. 132 kV Bays at Durgapur 220 kV substation					
11	Subhasgram (PG) - Baruipur 220 kV D/C			220	30	FY 2018 onwards
12	Rejinagar 220/132/33kV SS	220/132 132/33	320 100			FY 2019 onwards
	LILOf Gokarna - Krishnanagar 220 kV D/C Line at Rejinagar			220	3.6	
	LILOf Berhampur - Amtola 132kV D/C Line at Rejinagar			132	9.5	
13	Dinhata 132/33 kV Sub-station	132/33	100			FY 2018 onwards
	LILOf 1 Ckt of Coochbehar - Mathabanga 132 Kv D/C line at Dinhata			132	47	
14	Mohitnagar 132/33 kV GIS	132/33	100			FY 2018 onwards
	LILOf NJP - Moinaguri 132 kV D/C Line at Mohitnagar			132	7.25	
15	LILOf Arambag - Rishra 220 kV S/C Line at New Chanditala			220	15.5	FY 2018 onwards
16	Islampur 132/33 kV Sub-station	132/33	63			FY 2018 onwards
	LILOf TCF-III - Dalkhola 132 kV D/C Line at Islampur			132	0.2	
17	Bhadrapur 132/33 kV GIS	132/33	100			FY 2018 onwards
	132 kV D/C Line from Gokarna – Raghunathgunj			132	15.5	
	132 kV D/C Line to Bhadrapur					FY 2018 onwards
18	Indus 132/33 kV GIS	132/33	100			
	Extension of 2 nos. 132 kV Bays at New Bishnupur 220 kV Sub-station					
	New Bishnupur- Indus 132 kV D/C			132	38	
19	Kamakhyaaguri 132/33kV Sub-station	132/33	63			FY 2018 onwards
	Modification & diversion of existing line					

Sl.	Project Description	kV ratio	MVA	kV	RL (km)	Completion date
20	Debra 132/33 kV GIS	132/33	100			FY 2019 onwards
	Midnapur-Debra 132kV D/C			132	26	
21	Keshiary - Pingla 132kV D/C			132	40	FY 2019 onwards
	Extention of 4 nos. 132 kV Bays at Keshiary & Pingla substations					
22	Kharagpur - Kharagpur (WBIDC) 132 kV D/C			132	8.5	FY 2018 onwards
	Extention of 4 nos. 132 kV Bays at Kharagpur 400 & Kharagpur 132 kV Sub-stations					
23	Jhalda 132/33 kV GIS	132/33	63			FY 2019 onwards
	Extension of 2 nos. 132 kV Bays at Bagmundi 132 kV Sub-station					
	Bagmundi-Jhalda 132kV D/C			132	49	
24	Jagatballavpur 132/33kV GIS	132/33	100			FY 2019 onwards
	LIL Oof Domjur - Foundry Park 132 kV D/C Line at Jagatballavpur			132	18	
	LIL Oof Domjur - Uluberia 132 kV D/C Line at Foundry Park			132	1.5	
	TOTAL		3,007		346.8	

Annexure 9: Details of Proposed Transmission schemes of WBSETCL

Sl.	Project Description	kV ratio	MVA	kV	RL (km)	Completion date
1	Katwa 400/220 kV GIS	400/220	630			FY 2020
	LILOf Gokarna - N.Chanditala 400 kV D/C Line at Katwa			400	10	
	400 kV D/C Line for reconfiguraion of 400 kV connectivity of Jeerat, Bakreswar			400	90	
	LILO of Satgachia - Krishnanagar 220 kV D/C Line at Katwa			220	70	
2	Haldia 400/220 kV GIS	400/220	630			FY 2020
	LILOf KTPS- Kharagpur 400 kV SIC Line at Haldia			400	50	
	LILOf KTPS- New Haldia 220 kV D/C Line at Haldia			220	5	
3	Burdwan 220/132/33 kV SS	220/132 132/33	320 100			FY 2019
	Extention of 4 nos. 132 kV Bays at Raina & Indus 132 kV Sub-stations					
	Katwa - Burdwan 220 kV D/C			220	45	
	Burdwan - Raina 132 kV D/C			132	25	
	Burdwan - Indus 132 kV D/C			132	30	
	LILO of Mankar - Mahachanda 132 kV D/C Line at Burdwan			132	10	
4	Gajol 220/132/33 kV SS	220/132 132/33	320 100			FY 2019
	LILOf Malda (PG) - Dalkhola (PG) 220 kV D/C Line at Gajol			220	3	
	132 kV D/C Lines for re-configuration of existing connectivity of Sarnsi, Raigunj, Balurghat			132	12.5	
5	Baruipur 220/132/33 kV GIS	220/132 132/33	320 100			FY 2019
	Extention of 2 nos. 132 kV Bays at Serakol 132 kV substation					
	Baruipur - Serakol 132 kV D/C			132	15	
6	Raghunathpur 220/132kV GIS	220/132	320			FY 2021
	STPS - Raghunathpur 220 kV D/C			220	20	
7	Ukhra 220/132 kV SS	220/132	320			FY 2022
	Parulia (PG) - Ukhra 220 kV D/C			220	10	
8	LILOf Arambag - Durgapur 400 kV SIC Line at New Chanditala			400	47	FY 2022
9	Shyamnagar 132/33 kV GIS	132/33	100			FY 2019
	Extention of 4 nos. 132 kV Bays at Laxmikantapur 220 & Sonakhali 132 kV Sub-station					
	Laxmikantapur - Shyamnagar 132 kV D/C			132	20	
	Shyamnagar - Sonakhali 132 kV D/C			132	25	
10	Salar 132/33 kV GIS	132/33	100			FY 2018
	LILO of Amtola - Debogram 132 kV D/C Line at Rejinagar			132	8	
	LILO of Katwa - Gokarna 132 kV D/C Line at Salar			132	4	
11	Construction of 4 nos. 132 kV Bays at Rampurhat & Bhadrapur					FY 2022
	Rampurhat - Bhadrapur 132 kV D/C			132	24	
12	Bagula 132/33 kV GIS	132/33	63			FY 2019
	Extension of 2 nos. 132 kV Bays at Krishnanagar 220 kV Sub-station					
	Krishnanagar - Bagula 132 kV D/C			132	20	

Sl.	Project Description	kV ratio	MVA	kV	RL (km)	Completion date
13	Goaltore 132/33 kV GIS	132/33	100			FY 2020
	S/C LILO of OCL –Bishnupur S/C Line at Goaltore			132	40	
	S/C LILO of oke ckt at Bishnupur –Khatra D/C line at Goaltore			132	20	
	LILO of Midnapur (OCL) - Bishnupur 132 kV S/C Line at CK Road			132	5	
14	Bagjola 132/33 kV GIS	132/33	100			FY 2019
	New Town AA-IIC - Bagjola 132 kV D/C UG Cable Line			132	8	
	TOTAL		3,623		616.5	

Annexure 10: Details of transmission lines (400 kV level) of DVC

Sl.	Name of the line, Conductor, No of Towers	Voltage (kV)	No. of ckts.	Total Length (Ckm.)
1	DSTPS-RTPS line no-401, 402-Twin Moose	400	2	138
2	DSTPS-Jamshedpur Line No.: - 403, 404-Twin Moose	400	2	7
3	RTPS-Maithon(PGCIL) line no-405 Twin Moose (LILO of Ranchi(PG)-Maithon(PG))	400	1	10.5
4	RTPS-Ranchi(PGCIL) line no-406 Twin Moose (LILO of Ranchi(PG)-Maithon(PG))	400	1	10.5
	Total			166

Annexure 11: Details of transmission lines (200 kV level) of DVC

Sl.	Name of the line, Conductor, No of Towers	Voltage (kV)	No. of ckts.	Total Length (Ckm.)
1	CTPS (New) -Kalyaneswari line no-201, 202-ACSR Deer, 337T	220	2	283.6
2	CTPS (New) -Dhanbad Line No.: - 203, 204-AAAC Zebra, NA	220	2	91.24
3	CTPS (New) -BTPS"B" line no-205-206-NA, NA	220	2	63.68
4	CTPS (New) -STPS (WBSEB) line no-207-NA, NA	220	1	12.64
5	DTPS-Bidhannagar(WBSEB) line no-209, 210-ACSR Deer, 59T	220	2	34.52
6	DTPS-Parulia line no-211, 212-ACSR Zebra, 12T	220	2	44
7	BTPS"B"-Jamshedpur line no-213, 214-ACSR Zebra, 501T	220	2	306.8
8	Jamshedpur-JSPL-Joda line no-215-ACSR Zebra, 435T	220	1	135
9	Dhanbad-Pithakari(PGCIL) line no-217, 218-AAAC Zebra, NA	220	2	103.64
10	Parulia(DVC)-Parulia(PGCIL) line no-219, 220-ACSR Zebra, 4T	220	2	2
11	MTPS-DTPS line no-221, 222-ACSR Deer, 121T	220	2	84
12	Parulia-Tamla (DSP) line no-223, 224, 225-ACSR Zebra, 53T	220	3	18
13	Parulia-Durgapur line no-226, 227-ACSR Zebra, 56T	220	2	33.76
14	MTPS-Kalyaneswari line no-228-AAAC Zebra, NA	220	1	54.9
15	Kalyaneswari-Burnpur line no-229-AAAC Zebra, NA	220	1	22
16	MTPS-Barjora line no.: - 230, 231-ACSR Zebra, NA	220	2	33.4
17	MTPS-Burnpur line no.: - 232-AAAC Zebra, NA	220	1	58.23
18	Ramgarh-BTPS'B' line No.: - 233, 234-ACSR Zebra, 178T	220	2	109.2
19	MTPS-Durgapur line no.: - 235, 236-AAAC Zebra, 102T	220	2	62.9

Sl.	Name of the line, Conductor, No of Towers	Voltage (kV)	No. of ckts.	Total Length (Ckm.)
20	Kalyaneswari-Pithakari(PGCIL) line no-237, 238-AAAC Zebra, NA	220	2	15.2
21	MTPS-Kalyaneswari line no.: - 239, 240-AAAC Zebra, NA	220	2	158.4
22	Dhanbad- Electrosteel Integrated Ltd. Line #-241, 242-AAAC Zebra, NA	220	2	117.2
23	Burnpur - SAIL ISP line no.: - 243, 244-AAAC Zebra, NA	220	2	2.4
24	CTPS (New) - CTPS (Old) Tie #1 line no :-245-AAAC Zebra, NA	220	1	1.5
25	CTPS (New) - CTPS (Old) Tie #2 line no :-246-AAAC Zebra, NA	220	1	3.5
26	Dhanbad-Giridih line no:-247,248, AAAC Zebra	220	2	88.81
27	Gola-Ramgarh Line No:- 249, 250, AAAC Zebra	220	2	73
28	MTPS-Gola, AAAC Zebra	220	2	406
29	Koderma - Giridih Line No.: -251, 252, AAAC Zebra	220	2	201.84
30	CTPS - BSL Line No: - Line No: -253, 254, AAAC Zebra	220	2	36.05
	Total			2,236.36

Annexure 12: Details of transmission lines (132 kV level) of DVC

Sl.	Name of the line, Conductor, No of Towers	Voltage (kV)	No. of ckts.	Total Length (Ckm.)
1	Jamshedpur- Chandil line no-1,ACSR Lark, NA	132	1	43.74
2	Jamshedpur- Mosabani line no-2, 3-ACSR Lark, 126T	132	2	79
3	Jamshedpur-Gola line no-4-ACSR Lark, 446T	132	1	135.97
4	Chandil Gola line no-5-ACSR Lark, 5T	132	1	86.14
5	CTPS (Old) - Gola line no-6, 7-ACSR Lark, 229T	132	2	133.44
6	BTPS"A"-BTPS"B" line no-8, 9-ACSR Lark, NA	132	2	1.6
7	N'Karanpura-ECR Ray line no-10, 11-NA, NA	132	2	9
8	Putki-Patherdih line no-12, 13-ACSR Lark, 71T	132	2	45
9	Patherdih-MGTS line no-14, 15-AAAC Panther, 78T	132	2	78.4
10	MHS-Kumardhubi line no-16-ACSR Lark, 22T	132	1	4.9
11	MHS-PHS line no-17-ACSR Lark, 53T	132	1	14.5
12	Kalyaneswari-Kalipahari line no-18, 19-ACSR Lark, 128T	132	2	57.6
13	DTPS-Kalipahari line no-20, 21-ACSR Lark, 128T	132	2	79.4
14	Burdwan-Belmuri line no-22, 23-ACSR Lark, 164T	132	2	103
15	Belmuri-Howrah line no-24, 25-ACSR Lark, 162T	132	2	98.6
16	Howrah-Kolaghat line no-26, 27-ACSR Lark, 187T	132	2	114.6
17	Barhi-Biharsarif line no-28-ACSR Lark, NA	132	1	95
18	Barhi-Rajgir line no-29-ACSR Lark, 246T	132	1	80
19	Gola-SER Muri line no-30, 31-NA, NA	132	2	60.58
20	Kalyaneswari-MAL-Impex FerroTech line no-32-NA, NA	132	1	1.5
21	Barjora-Sonic Thermal line no-33-NA, NA	132	1	1.83
22	Maithon-Deoghar line no-34-ACSR Lark, NA	132	1	107.6
23	CTPS (Old)-Putki line no-35, 36-AAAC Panther, 86T	132	2	58
24	Patratu-JSPL line no-37,38-NA, NA	132	2	1
25	Jamshedpur-Purulia line no-39, 40-ACSR Lark, 272T	132	2	174
26	Putki-Balihari line no-41-NA, NA	132	1	0.5
27	Patherdih-Balihari line no-42-NA, NA	132	1	24
28	Barhi-KTPS line no-43, 44-AAAC Panther, NA	132	2	61.2

Sl.	Name of the line, Conductor, No of Towers	Voltage (kV)	No. of ckts.	Total Length (Ckm.)
29	PHS-Ramkanali line no-45, 46-ACSR Lark, 42T	132	2	29
30	Putki-Nimiaghat line no-47, 48-AAAC Panther, 146T	132	2	89.6
31	Patherdih-Sindri line no-49, 50-ACSR Lark, 18T	132	2	6.44
32	DTPS-ASP line no-51, 52-ACSR Lark, 22T	132	2	10
33	CTPS (Old) -MSDS (BSL) line no-53, 54-ACSR Lark, 31T	132	2	20
34	Gola-Ramgarh line no-55, 56-ACSR Lark, 80T	132	2	50.56
35	CTPS (Old) -TPP (BSL) line no-57,ACSR Lark, 20T	132	1	9
36	CTPS (Old) -Purulia line no-58, 59-ACSR Lark, 50T	132	2	119.26
37	CTPS (Old) -Ramkanali line no-60,ACSR Lark, 132T	132	1	70
38	CTPS (Old) -DTPS line no-61,ACSR Lark, 132T	132	1	135.6
39	CTPS (Old) -Rajabera line no-62, 63-ACSR Lark, NA	132	2	9.8
40	CTPS (Old) -Putki line no-64, 65-AAAC Panther, 90T	132	2	60
41	MHS-MGTS line no-66, 67-ACSR Lark, 5T	132	2	3.2
42	MHS-Kalyaneswari line no-68, 69-ACSR Lark, 8T	132	2	3.2
43	Kumardhubi-PHS line no-70,ACSR Lark, 31T	132	1	9.6
44	Kharagpur-Mosaboni line no-71, 72-ACSR Lark, 302T	132	2	190.4
45	Kolaghat-Kharagpur line no-73, 74-ACSR Lark, 216T	132	2	138
46	Burdwan-DTPS line no-75, 76-AAAC Lark, 264T	132	2	138.44
47	Ramgarh-Patratu line no-77,ACSR Lark, NA	132	1	30.4
48	Ramgarh-Patratu line no-78,ACSR Lark, 74T	132	1	25.28
49	Konar-BTPS"B" line no-79,ACSR Lark, 85T	132	1	23.3
50	BTPS"B"-Barhi line no-80,AAAC Panther, 277T	132	1	82
51	Patratu-North Karanpura lin no-81, 82-ACSR Lark, 112T	132	2	64
52	Barhi-Konar line no-83,ACSR Lark, 192T	132	1	61
53	Patratu-PTPS line no-84, 85,NA, NA	132	2	20
54	Nimiaghat-Giridih line no-86, 87-AAAC Panther, 137T	132	2	82
55	Sindri-Pradhankhanta line no-88, 89-ACSR Lark, 58T	132	2	40
56	Ramkanali-Jamuria line no-90,NA, NA	132	1	80
57	DTPS-DPL (Tie) line no-91, 92-NA, NA	132	2	22
58	Barhi-Hazaribagh line no-93, 94-ACSR Lark, 121T	132	2	72
59	Konar-Hazaribagh Rd Rly line no-95, 96-NA, 127T	132	2	70
60	Mosabani-JSEB Dhalbhumgarh line no-97, 98-NA, NA	132	2	21.44
61	Jamuria-DTPS Line No.: - 100,NA, NA	132	1	33
62	KTPS-Koderma Line No.: - 101,102-AAAC Panther, NA	132	2	36.62
63	Dhanbad - Govindpur Line No:- 103-104, AAAC Panther	132	2	48
64	Jamshedpur-Chandil Line No:- 105, ACSR Lark	132	1	46.86
65	Chandil - Gola line no-106, ACSR Lark	132	1	86.74
66	BTPS - ECR Gomia, Line No: 107, 108, AAAC Panther	132	2	13.8
67	CTPS - Biada, Line No: 109, 110, AAAC Panther	132	2	24.2
	Total			3,384.45



