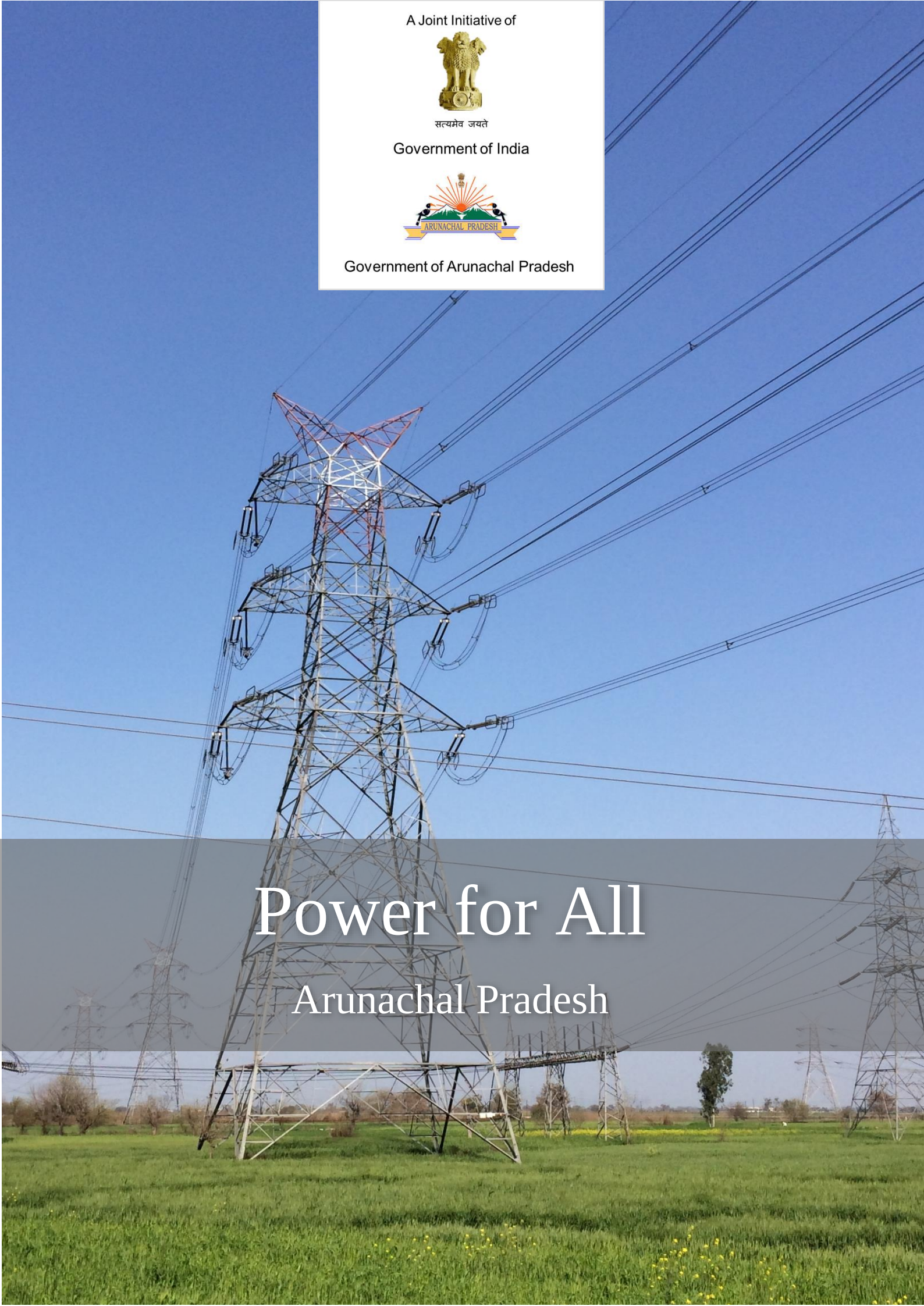
A Joint Initiative of

सत्यमेव जयते

Government of India

Government of Arunachal Pradesh



Power for All

Arunachal Pradesh

Foreword

Piyush Goyal

Minister of State
Power, Coal and Renewable Energy
Government of India

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.

Arunachal Pradesh, which stands for "land of the dawn-lit mountains", is bestowed with diverse forests and magnificent wildlife. The State has the potential to become a hub for tourists and nature lovers as it still remains vastly unexplored. The State is also rich in minerals and has huge potential for hydro power.

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

Foreword

Kalikho Pul

Chief Minister

Arunachal Pradesh

Government of Arunachal Pradesh

Arunachal Pradesh is blessed by mother nature as it is home to beautiful and unexplored territories. The State is also on its way to fast becoming a major power hub of the country. Simultaneously, the state faces a dichotomy where about 75,000 households do not have access to electricity. The situation is further complicated by the fact that Arunachal Pradesh has a very difficult terrain and low population density.

The state government is committed to live up to the challenges and extend electricity access to the unconnected households and provide all the households with 24X7 electricity.

The power departments /agencies in Arunachal Pradesh have lined up various programs of investments to achieve the objectives of the 24X7 Power for All Program.

The State Governments 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 Arunachal Pradesh towards implementation of 'Power for All' program.

सत्यमेव जयते

Government of India

Joint Statement

Government of Arunachal Pradesh

24X7 Power for All Program for the State of Arunachal Pradesh will be implemented by the Government of Arunachal Pradesh 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.

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 FY17 to FY19.

The Government of Arunachal Pradesh 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

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, update 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 document

Jyoti Arora, IAS
Joint Secretary, Ministry of Power
Government of India

16.6.16

Sang Phuntsok, IAS
Special Secretary (Power)
Government of Arunachal Pradesh

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List of Abbreviations

Abbreviation	Full Form
APEDA	Arunachal Pradesh Energy Development Agency
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
DOPAP	Department of Power, Arunachal Pradesh
DPHD	Department for Hydropower Development, Government of Arunachal Pradesh
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
GoArP	Government of Arunachal Pradesh
GoI	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

Abbreviation	Full Form
MNRE	Ministry of New and Renewable Energy
MoC	Ministry of Coal
MoEF	Ministry of Environment & Forests, Government of India
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	Integrated Power Development Scheme
PLF	Plant Load Factor
PMA	Project Monitoring Agency
PPA	Power Purchase Agreement
PPP	Public–private Partnership
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
VGF	Viability Gap Funding
YoY	Year on Year

1. Executive Summary

1.1. The State of Arunachal Pradesh

The Power for All (PFA) program is a joint initiative of the Government of India (GoI) and the Government of Arunachal Pradesh (GoArP), aiming to achieve 24X7 availability of reliable power to all households, industrial, commercial establishments and 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 Arunachal Pradesh.

Arunachal Pradesh is rich in flora, fauna, power and mineral reserves but the State has not been able to foster these resources to their full potential. From being an agricultural driven economy, the State's is gradually moving towards becoming a power surplus and forest products and tourism industry based economy. The status of the State's power sector is evident from lower level of rural electrification which stands at 55.5% (2011 Census) and nearly 44.5% of the HHs connected to electricity receives only up to 12 hours of power supply.

The State is managed by two government departments – Department of Power (DoPAP), responsible for managing the transmission and distribution systems and Department of Hydro Power Development (DHPD), responsible for management and development of hydro power plants in the State. Arunachal Pradesh State Electricity Regulatory Commission (APSERC) is constituted as a one-member body designated to function as an autonomous authority responsible for regulation of the power sector in accordance with the provisions of Electricity Act, 2003.

The energy and power requirement for the State have grown with a CAGR of 7.3 % and 8.3 % over the past five years. The supply side situation has improved over the last 5 years which has resulted in reduction of peak deficit from 15.8% in FY11 to 10.3% in FY15. The State has achieved 96% electrification in case of urban areas; nonetheless the supply has been constrained to only about 18 hours.

1.2. Connecting the Unconnected

In terms of electrification, the State has a target to electrify nearly 75,128 rural HHs beginning FY 16, Under DDUGJY scheme 478 UE villages having 14,648 HHs are to be connected through grid and about 1,078 UE villages having 14,210 rural HHs are to be connected through off-grid projects in the state. All the UE villages are targeted to be electrified by December 2016. The remaining HH in the state are proposed to be electrified by FY19 upon completion of the Comprehensive Scheme being carried out by PGCIL.

The State has also planned to ensure 24 hours supply to all the connected consumers by FY19, leading to an increase in energy sale from 322 MU in FY15 to 642 MU in FY19, with HHs accounting for about 53% of the total consumption by FY19. The peak demand is expected to increase from 155 MW in FY15 to 312 MW in FY19.

1.3. Power Generation and Supply Adequacy

The existing allocated capacity including central sector allocations for DoPAP stands at 210 MW which includes 67 MW from the State Sector (DHPD & APEDA) projects. Since all the State

Sector projects and most of the Central Sector projects are hydel, the State faces power crunch during lean hydro periods. Consequently, there is an urgent need to restructure the State's energy mix to include thermal projects which will enable the State to provide 24X7 electricity to consumers throughout the year.

DoPAP has allocations of 426.67 MW from upcoming Central Generating Stations. Another 110 MW of capacity is expected from State Sector projects which are likely to be commissioned during the next four years. In Private sector, Dikshi and Palsi SHEPs with total capacity of 48 MW is expected in FY19. Of the above, only 37 MW is available from thermal sources. Indicating that the state may need additional capacities during low hydro periods.

The peak demand of the State is projected to increase from 155 MW in FY15 to 312 MW in FY19. Since significant upcoming capacities are expected to become available by FY19, the peak power available is expected to be adequate to cater to the State's demand. This may lead to availability of surplus power (in peak hydro seasons) which can be sold outside the State.

1.4. Adequacy of Transmission Network

DoPAP, responsible for the transmission function in the State has 3 intra-state transmission lines and 7 sub-stations at 132 KV and above level with an installed capacity of 167 MVA, which are inadequate to meet the existing demand. As the demand for power is projected to increase in the coming years, significant investments will be required in the intra-state transmission systems.

In order to meet the expected demand growth and to build in adequate redundancies in the system, DoPAP has planned various augmentations and new schemes, which would cumulatively increase the total intrastate transmission system sub-station capacity at various voltage levels to 529 MVA and the transmission lines to increase to 2,017 ckm by FY19. A total capital expenditure of Rs.3,199.45 of which 2,527.88 Cr. is expected to be incurred by FY19. Bulk of the transmission capacity addition are covered under the Comprehensive Scheme sanctioned by the Ministry of Power, Government of India.

In the inter-state transmission systems, PGCIL plans to develop 10 transmission lines and 3 substations to facilitate evacuation of power from upcoming hydroelectric projects being developed by NEEPCO, NHPC and also to wheeling in additional power from upcoming central generating stations located outside State.

The NER region is expected to become surplus in next five to ten years. The surplus power in the NER region will have to be wheeled outside to ER/ NR regions will calls for significant investments in the inter-state/ regional transmission network.

1.5. Adequacy of Distribution Network

In order to ensure that Arunachal Pradesh achieves the objectives of "24X7 Power For All", the Department of Power has proposed a total investment of Rs. 1,259 Cr. in the distribution systems which shall be funded through various Govt. of India schemes including DDUGJY and IPDS.

With the proposed investments in distribution infrastructure, introduction of IT under the RAPDRP Part-A program and various other initiatives being undertaken by DoPAP, the AT&C losses are expected to reduce from 62.65% in FY15 to 39.26% in FY19, including the impact of increase in collection efficiency from 76% to 86% over the same period.

Funding is available against the total proposed investment of Rs. 1,259 Crs. However, the department may need additional funds for urban infrastructure strengthening and achieving 100% metering. The DoPAP needs to explore alternative sources of funding for bridging the fund availability gap for distribution infrastructure investments.

1.6. Clean Energy & Energy Efficiency

Department of Hydro Power Development (DHPD) is the body for developing Hydro power stations in the state. DHPD is presently constructing 29 projects with a total proposed installed capacity of 54.04 MW. Additionally, DHPD has proposed to initiate construction works for additional 35 small/ micro hydel projects with a total installed capacity of 35.47 MW. Investigation and survey works on additional sites is being pursued which are expected to yield a total of up to 145 MW in future. DHPD's total investment required during FY17 to FY19 is 1,007 Crs.

APEDA has also proposed various interventions including 8 MW of mini/ micro hydel projects; 70 water mill projects; 280 kW wind projects; solar PV program totaling 12.85 MW, 16,359 solar LED street lighting systems; 50 solar water pumping units 2,500 unnat challah etc. at a total proposed investment of Rs. 319 Crs.

Two SHPs developed by Private investors – 24 MW Diksi and 24 MW Palsi are expected to be operational by FY19.

Initial estimates on the DELP program implementation for about 1.71 lakh domestic consumers in the State would result savings of 10.27 MW peak saving, annual energy saving of 13.12 MW and annual power procurement cost saving of Rs. 4.76 Crs.

1.7. Financial Impact

Considering the impact of capital expenditure laid out in this roadmap. Major tariff hikes are required for the department to become financially independent. The objectives of the PFA roadmap can only be achieved if the state government continues revenue support by means of targeted subsidy to the consumers and achieving the loss reduction trajectory laid out in the roadmap.

2. Background

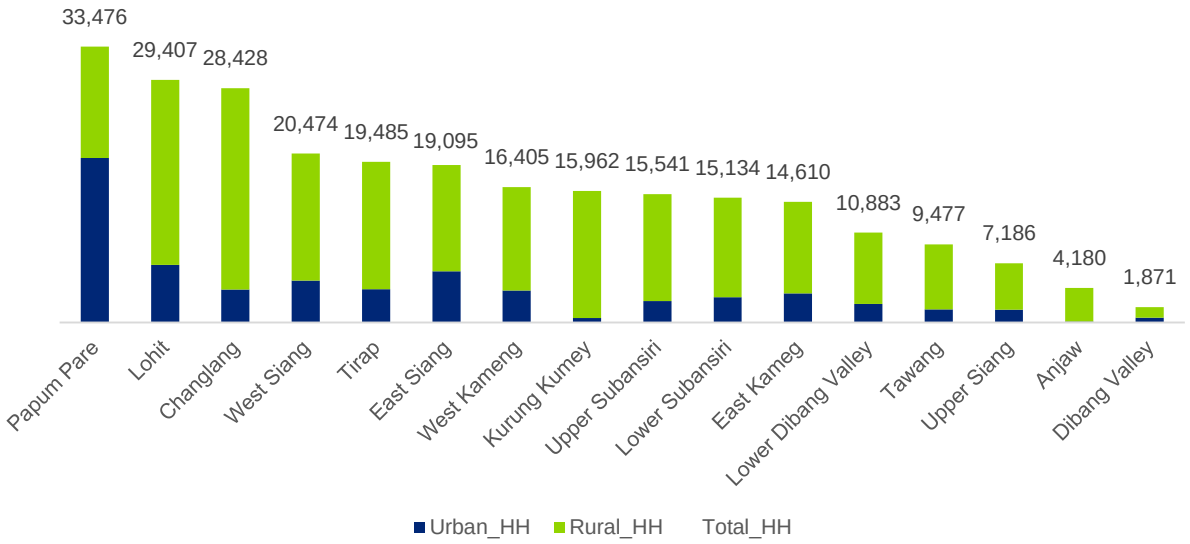
2.1. The State of Arunachal Pradesh

Arunachal Pradesh is one of the 7 states in the North Eastern Region (NER) of India. It lies on the North-East extremity, bordering the Indian states of Assam and Nagaland in the south and sharing international borders with Bhutan, Myanmar and China. Arunachal Pradesh, with an area of 83,743 sq km, is the largest State in the NER.. Table 1 presents a high-level overview of the State. The pace of urbanization in Arunachal Pradesh has been relatively slow with urban areas accounting for only 22.9% of State's population in 2011. The population living in urban areas has increased marginally from 20.8% in year 2001 to approx. 23% in 2011, which remains considerably below the national average of 31.2% in 2011. In terms of HHs, Papum Pare is the largest district with 33,476 HH (2011 Census). The district wise urban and rural division of HH in Arunachal Pradesh is shown in Figure 1. The State has lower HH level electrification in rural areas, with only 55.5% rural HHs having access to electricity, according to Census 2011 data. The poor level of electricity access is due to several factors including difficulties associated with large sections of the HHs being located in the hilly terrains which are not easily reachable. The State faces unique challenge of low population density combined with dense forest areas and rivers making electrification programs difficult to execute.

Table 1: Key Highlights of State: Arunachal Pradesh

Parameter	Information
Established	20 February 1987 previously NEFA (North East Frontier Agency)
Population & Demographics	Total Population at 1,383,727 as per 2011 census Rural -77.06% (10,66,358), Urban-22.9% (3,17,369) Decadel population growth: 26%
Area	83,743 square kilometers (2.54% of country) Forest cover – 80.39% Total cropped area – 278 Hectare
Administrative Set-up	20 Districts 36 sub-divisions 57 Blocks 5,589 Villages
Kay Natural Resources	Dolomite, Graphite, Coal, Quartzite, Limestone, Crude Oil, Natural Gas, Yellow Ochre and Marble
Neighboring States	South: Assam & Nagaland
International Boundary	Bhutan, China, Myanmar
HHs (2011 census)	Total 2,61,614 HHs (65.7% Electrified) Urban 65,891 (96% Electrified) Rural 1,95,723 (55.5% Electrified)

Figure 1: District wise Urban and Rural Divide of HH (2011 Census)



2.2. Arunachal Pradesh Power Sector At a Glance

Table 2 provides an overview on the present status of the power sector in the State. Power sector is broadly managed by two State Government departments – Department of Power, Arunachal Pradesh (DoPAP) and Department of Hydro Power Development (DHPD). The Department of Power is a deemed licensee as per section 14 of Electricity Act 2003, responsible for managing the transmission and distribution systems in the State. The Department of Hydro Power Development (DHPD) is another government department responsible for management and development of hydro power plants in the State.

Established to ensure Development & Management of Electricity Industry, Arunachal Pradesh State Electricity Regulatory Commission (APSERC) with its head office in Naharlagun has been functional w.e.f from March, 2011. The Commission is constituted as a one-member body designated to function as an autonomous authority responsible for regulation of the power sector in the State of Arunachal Pradesh as per the provisions of Electricity Act 2003.

Table 2: Arunachal Pradesh Power Sector at a Glance

<table>
<tr><th>Parameter</th><th>Key Highlights</th></tr>
<tr><td>Demand Supply Position</td><td>The state has had more than national average peak deficit. The FY15 demand supply situation is highlighted in the table below:

<table><tr><th>Item</th><th>Peak (MW)</th><th>Energy (MU)</th></tr><tr><td>Demand/ Requirement</td><td>155</td><td>677</td></tr><tr><td>Met/ Availability</td><td>139*</td><td>664*</td></tr><tr><td>Gap</td><td>-10.3%</td><td>-2.0 %</td></tr></table>* As per State numbers
(Variation between state and CEA figures is due to non-functional RTUs in the state)</td></tr>
<tr><td>Per Capita Consumption</td><td>Per capita consumption (At generation bus bar including all losses) in kWh for last five years
(Source: CEA)
<table><tr><th></th><th>FY11</th><th>FY12</th><th>FY13</th><th>FY14</th><th>FY15</th></tr><tr><td>Arunachal Pradesh</td><td>582</td><td>683</td><td>719</td><td>503</td><td>525</td></tr></table></td></tr>
</table>

<table>
<tr><th>Parameter</th><th>Key Highlights</th></tr>
<tr><td>Generation</td><td>State Thermal Generation of 16 MW are DG sets operational only occasionally.
<table>
<tr><th>Mode</th><th>Thermal</th><th>Hydro</th><th>RE</th><th>Total Available Capacity (MW)</th></tr>
<tr><td>State</td><td></td><td>-</td><td>67.25</td><td>67.25</td></tr>
<tr><td>Private</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Central</td><td>45</td><td>98</td><td>-</td><td>143</td></tr>
<tr><td>Total</td><td>45</td><td>98</td><td>67.25</td><td>210</td></tr>
</table>
(CEA Power allocations Dec 2015 and State Data)</td></tr>
<tr><td>Transmission</td><td>
<table>
<tr><th rowspan="2">Voltage</th><th colspan="2">Transmission lines</th><th colspan="2">Transformation Capacity</th></tr>
<tr><th>No.</th><th>In KM</th><th>S/Stn. No.</th><th>MVA</th></tr>
<tr><td colspan="5">Intra state Network</td></tr>
<tr><td>132 kV</td><td>3</td><td>184</td><td>7</td><td>167</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="5">Inter-state Network</td></tr>
<tr><td>400 kV</td><td>1</td><td>332</td><td>0</td><td>0</td></tr>
<tr><td>220 kV</td><td>1</td><td>19</td><td>1</td><td>133</td></tr>
<tr><td>132 kV</td><td>4</td><td>179</td><td>3</td><td>50</td></tr>
<tr><td>Total</td><td>6</td><td>530</td><td>4</td><td>183</td></tr>
</table>
</td></tr>
<tr><td>Distribution</td><td>The Department of Power, Arunachal Pradesh (DoPAP) is responsible for carrying out the function of distribution of electricity in the entire State. Key highlights of the Distribution systems are:
a) Consumers: 2.13 Lakhs (FY15)
b) Distribution Network:
<table>
<tr><th>Particulars</th><th>UOM</th><th>As on FY15</th></tr>
<tr><td>33 kV Line</td><td>Ckt Kms</td><td>4,516</td></tr>
<tr><td>33 kV SS</td><td>MVA</td><td>243</td></tr>
<tr><td>33 kV SS</td><td>No’s</td><td>81</td></tr>
<tr><td>11 kV Lines</td><td>Ckt Kms</td><td>19,026</td></tr>
<tr><td>DT</td><td>No’s</td><td>5,507</td></tr>
<tr><td>DT</td><td>KVA</td><td>270</td></tr>
<tr><td>LT Lines</td><td>Ckt Kms</td><td>10,550</td></tr>
</table>
c) AT&C Losses: 63% (FY15)</td></tr>
<tr><td>Financial Position</td><td>Utility wise accumulated profits/ losses as at end of FY15 are as below:
<table>
<tr><th>Department</th><th>Accumulated Profits/ Losses</th></tr>
<tr><td>DoPAP</td><td>(-) Rs. 1,897 Cr.
(As per PFC report and State ARP for FY16)</td></tr>
</table>
</td></tr>
</table>

3. Power Supply Scenario

3.1. Power Supply Position

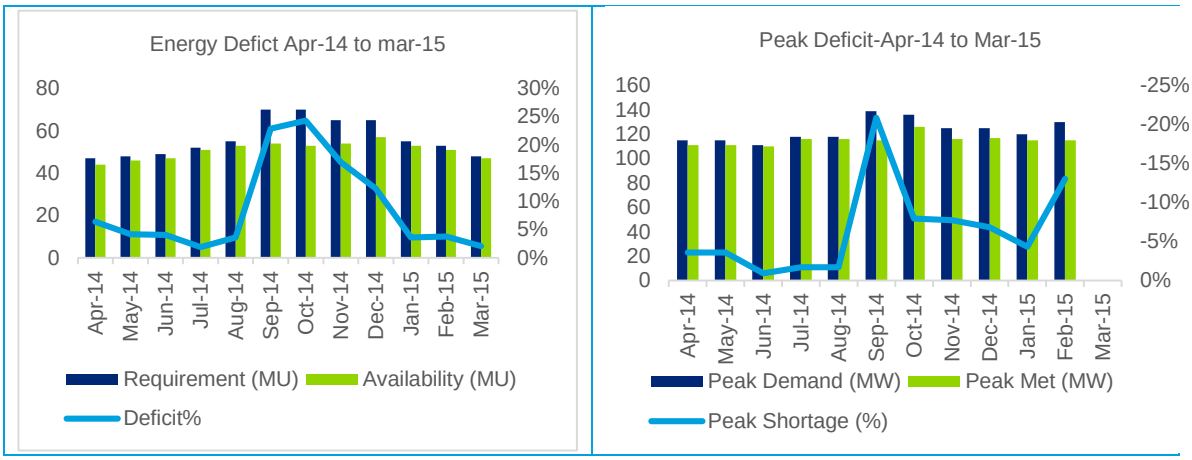
The peak demand for Arunachal Pradesh has grown by 55% during the period FY 11 to FY 15. In contrast the availability has grown by about 61% in the same period. This has led to fluctuating peak shortages. This is primarily due to the fact that the peak demand is restricted as the available capacity in 132 kV level is limited and the system has already reached its peak utilization. There is a need for increased available capacity in the 132 kV level so that more power can be transferred from the generation sources. In addition the high T&D loss level (50%) prevailing in the state has added to the complexity of managing the demand. Further, the peak demand met figures as obtained from NERLDC are not accurate due to defective/non-functional RTU's in Arunachal Pradesh. This indicates that the peak demand of Arunachal Pradesh may be higher than what is recorded in the CEA/SLDC/NERLDC figures.

The annual energy shortfall/ peak deficit is lower than the monthly demand supply deficit due to the differences in the actual instantaneous peak deficit recorded. This is particularly relevant in the case of states like Arunachal Pradesh which have a considerable share of hydro generation in their energy mix which creates wide seasonal variations in supply availability situation. The Figure 2 shows the monthly trend of peak and energy shortages for the period April, 2014 to March, 2015.

Table 3: Power Supply Position for Arunachal Pradesh, FY11 to FY15 (Source – CEA, DOPAP)

Particulars	FY11	FY12	FY13	FY14	FY15
Peak Demand (MW) (Source CEA)	101	121	116	125	139
Peak Demand (MW) (Source: DoPAP)	100	140	145	150	155
Peak Met (MW) (Source NERLDC)	85	139	123	130	137
Peak Surplus / (Shortage) (%)	(15.8)%	(0.7%)	(15.2%)	(13.3%)	(10.3)%
Energy requirement and supply					
Energy Requirement (MU)) (Source CEA)	511	600	589	552	677
Energy Available (MU))	473	572	576	573	664
Energy Surplus / (Shortage) (%)	(7.4)%	(4.7)%	(2.1)%	3.8%	(2.0)%

Figure 2: Peak and Energy deficit trends in Arunachal Pradesh during FY15



In addition to dependence of the State on hydro generation capacities leading to dependence on UI/ short-term power, availability of power is also severely affected by network constraints (both inter and intra-state). This has been discussed in detail in the transmission plan and distribution plan chapters of this document.

3.2. Consumer & Sales Mix

The Department of Power, Arunachal Pradesh serves electricity to over 2.13 Lakh consumers in the State, with domestic consumers accounting for over 87% of total number of consumers in FY15. The mix in terms of number of consumers and energy sales for the predominant consumer categories is provided in Figure 3.

In terms of the energy sales mix, domestic consumers contribute 36% of the sales which is followed by industrial category accounting for nearly 25%. During the last 5 years, overall energy sales in the State has grown at a CAGR of about 14.7%, with growth in sales to domestic category being highest contributor with a CAGR of 15.8% over the same period. The State has added a significant number of (around 34,498) domestic HH consumers during the last 4 years (from 2011 to March 2015), primarily under the RGGVY scheme. Further, owing to increasing industrial demand in the State, sales to industrial consumers had steady growth over the last 5 years with a CAGR of about 9.3%, as can be inferred from Figure 4 .

Figure 3: Consumer & Energy Sales Mix (FY15)

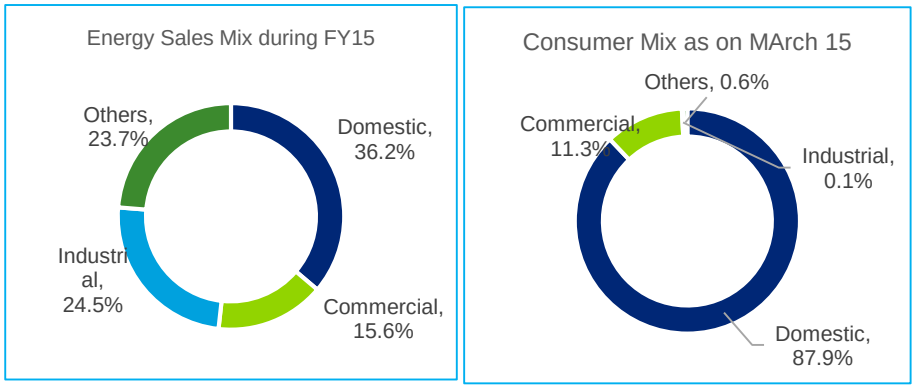
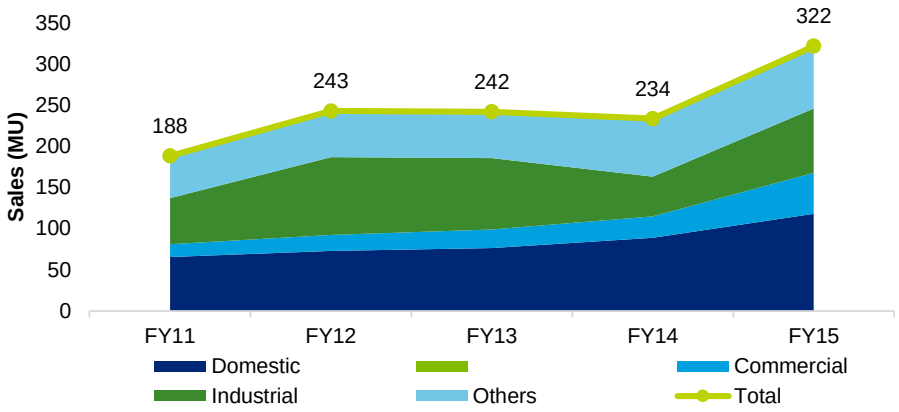


Figure 4: Category Wise Sales Growth Trend, DoPAP



It is important to note that the State did not have agricultural consumers of electricity till FY14 as irrigation is dependent on rainfall/ natural precipitation for irrigation purposes. Only two Agriculture consumers were added during FY15.

3.3. 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. For the rest of the consumer categories a growth rate based on the DoPAP's estimation of expected annual growth rate of 10% has been considered. The following steps detail out the approach adopted for estimation of energy demand for the State.

Estimation of Rural and Urban electrified and un-electrified HHs

The total number of rural and urban HHs in the State as available in census data for 2011, have been extrapolated at the expected CAGR to arrive at the estimated HHs for FY15. As per the Census 2011, the CAGR for urban and rural HHs are estimated at 3.2% and 1.8%, respectively. However, DoPAP has estimated urban and rural household at the level of 82,970 and 2,14,015.

In addition to the level of electrification in rural areas as per 2011 census data, the actual number of rural and urban HHs electrified since 2011 has been utilized to arrive at the present level of electrification. The estimated urban and rural HHs along with the status of electrification as at the end of FY15 is provided in Table 4.

As per the latest estimates of UE HH (March 2016) the total UE HH in the state is 75,128

Table 4: Estimated Un-electrified Households (end of FY15)

Particulars	Urban	Rural	Total
Total HHs	82,970	2,14,015	2,96,985
Electrified	82,970	1,38,887	2,21,857
Balance	0	75,128	75,128

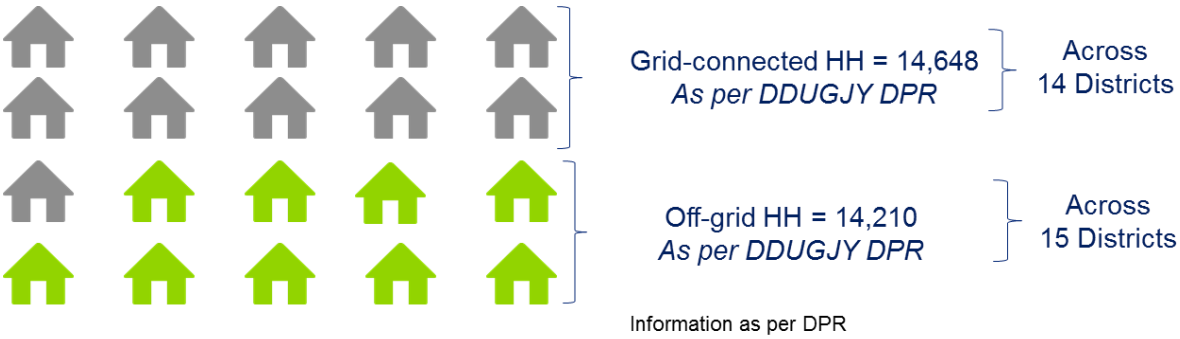
Estimation of energy demand from HHs

The energy demand from HHs has been estimated under the following three broad categories:

a) Latent energy requirement from existing HHs on account of increase in energy availability;
b) Additional energy requirement due to electrification of un-electrified HHs; and
c) Additional energy requirement due to construction of new urban and rural HHs.

Latent energy requirement from already electrified HHs has been estimated based on expected increase in consumption levels in accordance with the objectives of the PFA program. Such growth would not only include the increase in demand due to elimination of power shortages and network constraints but also the

Figure 5: HH electrification targets under DDUGJY



Information as per DPR

natural growth in consumption levels due to lifestyle changes and increase in billing efficiency. It is expected that the daily per HH consumption in urban areas will increase from 2.9 kWh in FY15 to 6.01 kWh in FY19. Similarly, daily rural per HH consumption in rural areas will increase from 0.7 kWh in FY 15 to 1.69 kWh in FY19. Table 5 provides year on year expected increase in per HH per day demand from both rural and urban HHs.

In addition to the latent demand, the demand from newly electrified HHs is expected to form a considerable part of total demand. DoPAP has plans to electrify 28,868 HH out of 75,128 un-electrified HHs by December, 2016 under the DDUGJY scheme. Remaining HH are expected to be electrified by FY19 upon completion of the Comprehensive Scheme taken up by PGCIL. In this regard, a detailed survey needs to be undertaken to assess the remaining Urban Electrified households in each district. The annual electrification plan considered for the purpose of power supply projections is summarized in Table 6.

Further, as time progresses the change in demographics will lead to construction of new HHs in both rural and urban areas. This increase of new rural and urban HHs have been estimated based on the past CAGR of 1.8% and 3.2% for rural and urban areas respectively. The growth rates are based on census data. The corresponding energy requirement from new HHs is estimated based on the benchmarked daily average HH of FY 15 consumption shown in Table 5.

Estimation of energy demand from other consumer categories

The energy requirement projections for other than domestic category consumers has been done factoring in the expected growth based on the past trend. While the CAGR of sales growth from other than domestic consumers has been nearly 14.1% over the last 5 year period (FY 11 to FY 15), an annual growth rate of 10% has been considered to project energy sales for the period FY16 to FY19, in accordance with the estimates of the DoPAP. The high growth of FY 11 to FY 15 is due to lower base and hence a normalized growth rate of 10% for FY16 to FY18 and an additional 2% in FY 19 is expected due to improvement in supply conditions and expected industrial and commercial growth in the state.

Table 5: Per HH per day sales - Urban & Rural HHs (kWh)

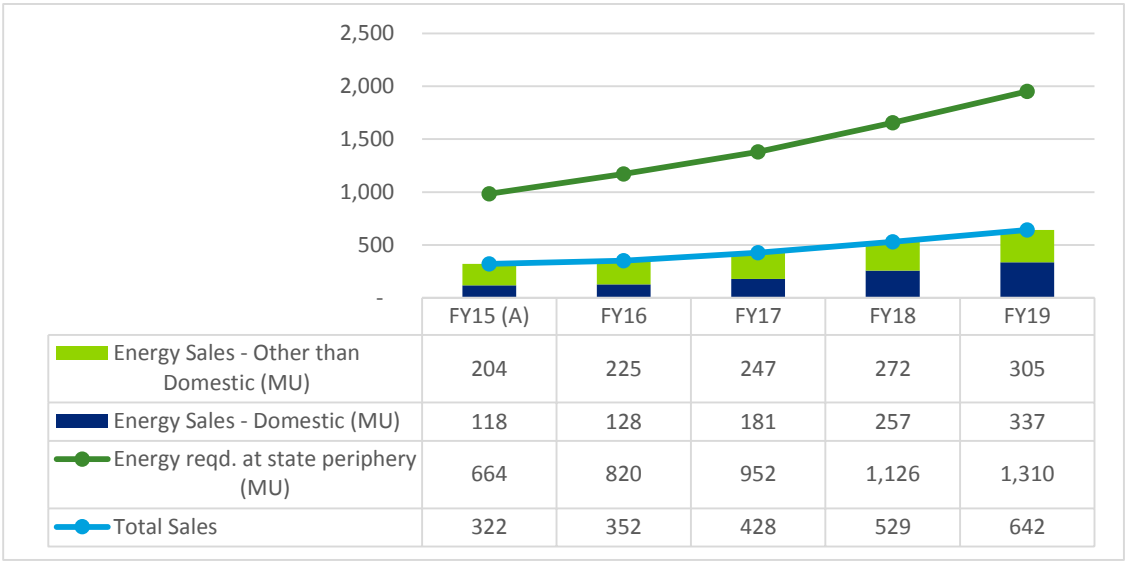
Particulars	FY15 (A)	FY16	FY17	FY18	FY19
Urban	2.9	3.1	3.9	5.0	6.0
Rural	0.7	0.80	1.02	1.34	1.69

Table 6: Electrification Plan (Urban & Rural HHs Nos.)

Particulars	FY16	FY17	FY18	FY19
Urban				
Opening Un-electrified HHs				

Particulars	FY16	FY17	FY18	FY19
Newly Constructed HHs	2,573	2,655	2,740	2,827
HHs Electrified (Existing + New)	2,573	2,655	2,740	2,827
Balance Un-electrified HHs	0	0	0	0
Rural				
Opening Un-electrified HHs	75,128	75,128	46,260	19,214
Newly Constructed HHs	3,752	3,818	3,884	3,953
HHs Electrified (Existing + New)	3,752	32,686	30,931	23,166
Balance Un-electrified HHs	75,128	46,260	19,214	-

Figure 6: Projected Energy Sales (MU)



	FY15 (A)	FY16	FY17	FY18	FY19
Energy Sales - Other than Domestic (MU)	204	225	247	272	305
Energy Sales - Domestic (MU)	118	128	181	257	337
Energy reqd. at state periphery (MU)	664	820	952	1,126	1,310
Total Sales	322	352	428	529	642

3.4. Demand Projections

Based on above, the energy sales for State is expected to increase from nearly 322 MU in FY15 to 642 MU in FY19, as shown in the Figure 6.

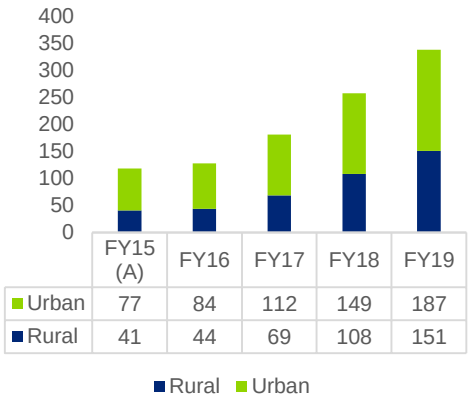
Also as can be seen from the Figure 6, the share of energy sales to other than domestic category consumers is projected to reduce from about 63% in FY15 to about 47% in FY19

The share from urban and rural HHs, in the energy sales mix, is projected to change in future in accordance with the increase in access levels in rural areas. The share of rural HHs energy sales is expected to increase from 34.5% in FY15 to 44.6% in FY19.

Energy input requirement at the State periphery has been calculated after applying transmission and distribution losses, as shown in Table 7.

The T&D loss targets used for the purpose of energy input requirement assessment has been taken as per the targets set by DoPAP in line with the Ministry of Power targets (from FY 17 to FY 19), as shown in Table 7.

Figure 7: Share of energy sales - Urban Vs Rural (MU)



	FY15 (A)	FY16	FY17	FY18	FY19
Urban	77	84	112	149	187
Rural	41	44	69	108	151

Rural Urban

Peak demand has been derived using the

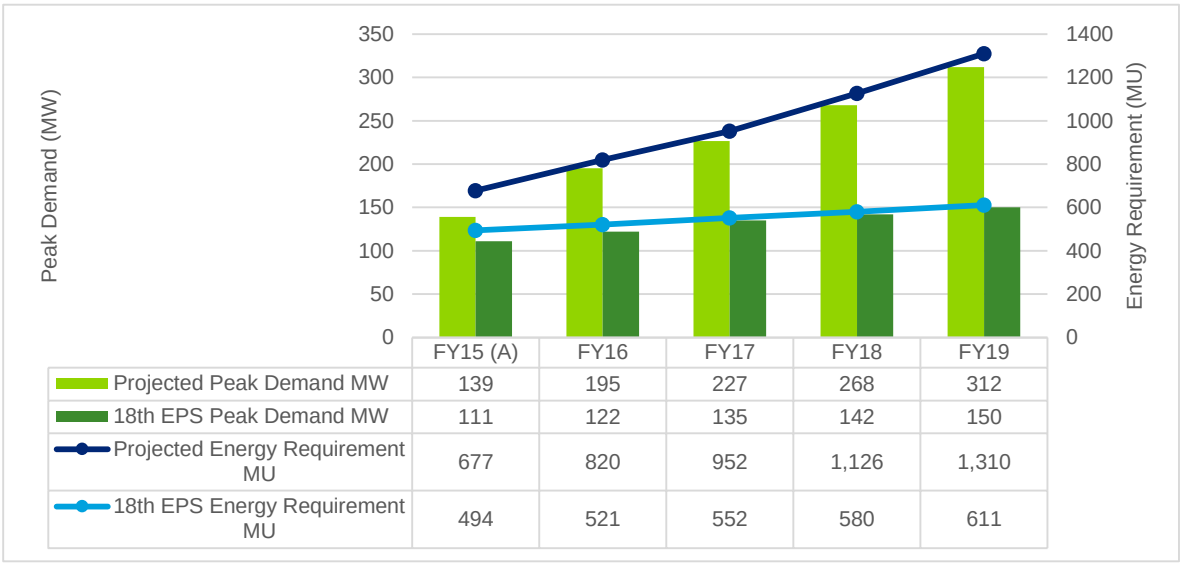
average load factor (state's data) which is 48.0%. The peak demand for the State is expected to increase from 155 MW in FY15 to 215 MW in FY19.

The consideration of rapid increase in electrification levels and the improved power availability position in the state has enhanced the projected energy requirement and the peak demand projections up to the period FY19 by almost 1.4 times of the 18th EPS projections. A comparison of the projected figures under the PFA Roadmap vis-à-vis the 18th EPS is shown in the Figure 8.

Table 7: Energy Requirement & Peak Demand Projections

Particulars	Units	FY15 (A)	FY16	FY17	FY18	FY19
Energy Demand/ Sales	MU	322	352	428	529	642
Transmission & Distribution Losses	%	50.9%	57.0%	55.0%	53.0%	51.0%
Energy Input Requirement	MU	655	820	952	1,126	1,310
Load Factor	%	48.3%	48.0%	48.0%	48.0%	48.0%
Peak Demand	MW	155	195	227	268	312

Figure 8: Comparison of PFA Roadmap Projected Energy Requirement & Demand with 18th EPS Projections



4. Generation Plan

4.1. Generation Capacity Requirement

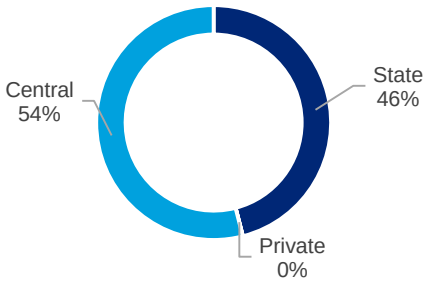
The electricity requirement in terms of energy requirement and peak demand Arunachal Pradesh is expected to increase from the present level of 677 MU and 155 MW in FY15 to 1,310 MU and 312 MW in FY19, respectively. This chapter elaborates on the aspect of adequacy of the tied-up and upcoming generation capacities for the state and identifies the key action points to address the identified gaps therein.

4.2. Existing Generation Capacity

Presently, the total installed capacity (as on March 31, 2016, including share allocated to Arunachal Pradesh) stands at 209MW. The break-up of the installed capacity by ownership and fuel mix is provided in Table 8.

The Department of Hydro Power Development (DHPD), created in November 2003, is responsible for development and management of small/mini/micro hydro power projects in the State. It owns 119 small/mini/micro hydel plants of various capacities with total installed capacity of 62.615 MW. As DHPD is involved in RE generation only, the details of the State sector generation are covered under Renewable Energy plan of this document. The proposed capacity additions by State and allocated share of upcoming central and IPP generating stations have been considered to develop the generation plan for Arunachal Pradesh, discussed in the following sub-sections. The generation capacity addition and power procurement plans have been aligned with the energy requirement and power demand assessed in view of the 24X7 PFA objectives in the previous chapter on power supply scenario.

Table 8: Installed Capacity (MW) as on March 2016

Share	Sector	Thermal	Hydro	RE	Total
	State		-	67.25	67.25
	Private	-	-	-	-
	Central	45	98	-	143
	Total	45	98	67.25	210

4.3. Generation Plan

Inter-State/ Central Sector Projects

In addition to the State owned generating plants, stations situated in NER (owned by NEEPCO and NHPC and NTPC) have allocations to the State.

The State has an allocated share of generation capacities from the following operating Central Sector projects as outlined in Table 9.

The State is expected to add 426.11 MW of additional generation capacity from the Central Sector Stations for meeting the increased demand as detailed in Table 10. While the construction works on the Subhansiri project has been stalled as of now, the allocation of 294 MW from the project is assumed to be commissioned by December 2020, which is beyond the period covered under the PFA Roadmap, as anticipated commissioning date.

Table 9: Plant wise details of allocated capacity from Central sector projects (As per Tariff Order for FY 2015-16)

Plant Name	Fuel	Capacity (MW)	Allocated Capacity (MW)
NEEPCO Plants			***115***
Kopili – I	Hydro	200	10
Kopili - II	Hydro	25	2
Khangdong	Hydro	50	2
Ronganadi (RHEP)	Hydro	405	74
Doyang (DHEP)	Hydro	75	5
Kathalguri	Gas	291	17
Agartala GT	Gas	84	5
Other Central Sector Stations			***34***
NHPC, Loktak	Hydro	90	5
OTPC, Palatana (Unit-1,2)	Gas	726.6	22
Agartala GPS	Gas	97	7
Total		***6,889***	***143***

Table 10: Status of upcoming Central Sector projects (Source CEA)

Plant Name	Fuel	Capacity (MW)	Allocated (MW)	Expected CoD	Status
NTPC Bongaigaon	Coal	750	24.67	U1: Sept 2015	One Unit is Ready, 2 units are under construction
NEEPCO Kameng	Hydro	600	83	Dec,2017	Under Construction
NHPC Subansiri	Hydro	2000	294	Dec 2020 (unlikely)	Works stopped since 2011 due to Agitations. Commissioning likely to be delayed further.
Pare HEP	Hydro	110	21	Mar, 2017	Under Construction
Turial HEP	Hydro	60	4	Oct, 2016	Under Construction
Total			426.11		

New Projects under – Department of Hydro State Sector Projects

DHPD, the sole body responsible for development and promotion of hydro power projects in the State, has also proposed a list of 64 new and ongoing projects with a cumulative capacity of 89.51 MW. All of these proposed projects are below 25 MW (SHPs), thereby the details are covered in the renewable chapter.

4.4. Anticipated Power Availability Position

Considering the project specific availability of existing and likelihood of commissioning of the tied-up projects expected to be commissioned in future, the total installed capacity available for the State is likely to increase from 224 MW in FY16 to over 520 MW by the end of FY19.

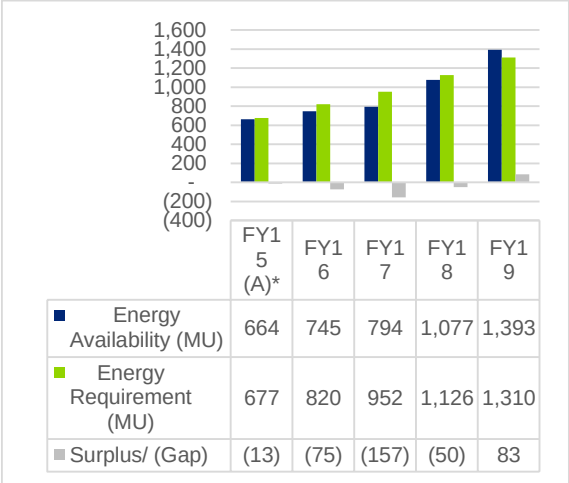
Considering the appropriate availability factor for the existing projects (as per regulatory approvals/ targets) that being complete availability for upcoming thermal and 50% PLF for upcoming Hydro projects, the total power availability position vis-à-vis the expected peak load demand upto FY19 is presented in the Figure 10. The PLF/ availability of power from DHPDs existing and upcoming plants have been considered based on the past PLF performance of its operating plants.

The hydro stations in NER (owned by NEEPCO and NHPC) will contribute to the bulk of peak availability of the state. The chart beside presents the source wise power availability for the State.

The energy balance of the State for the period FY16 to FY19 shows similar increasing surplus for the state during the period, as presented in the Figure 9. However, as the majority of generating capacity is based on hydro, the actual energy generated is bound to vary seasonally depending upon the various hydrological factors. Accordingly, DoPAP may need to continue to depend on short-term/ market power for adequately meeting its peak demand requirements in all seasons. Such strategy may also include entering into power banking arrangements with surplus availability during lean hydro/ winter months. As can be seen in Figure 9, the State is likely to become significantly energy and peak surplus from FY16 onwards, which may be considered as an opportunity to optimize the power purchase cost and generate additional revenue by way of sale of power outside the State. A good mix of long-term agreements as well as short term sale (over exchanges) will help the DoPAP to recover its costs effectively. In such a scenario, the need for a power trading cell for inter-state cell becomes essential for the Department.

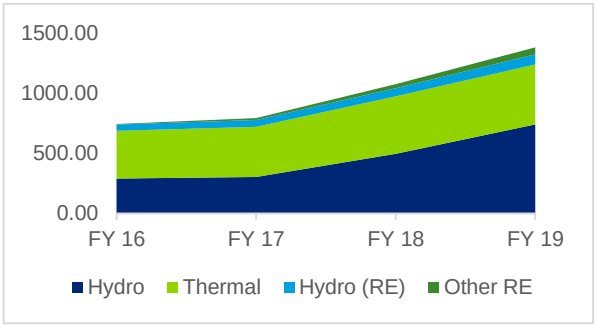
The contribution in total energy available from

Figure 9: Projected Energy Requirement & Availability Position



	FY15 (A)*	FY16	FY17	FY18	FY19
Energy Availability (MU)	664	745	794	1,077	1,393
Energy Requirement (MU)	677	820	952	1,126	1,310
Surplus/ (Gap)	(13)	(75)	(157)	(50)	83

Figure 10: Source wise Energy availability (MU)



Hydro sources (NEEPCO and NHPC) will be the major source of energy for the State by FY 19. The contribution of RE Sources (Micro and Mini HEPs of the State) will increase by FY19; this will result in reduction of contribution of thermal generation from current level of 59% to 46% in FY19. Table 11 shows the source-wise energy availability from various sources.

4.5. Fund Requirement

The funding for inter-state projects with capacity allocations to the State are being taken care of by the respective agencies i.e. NHPC and NEEPCO. The fund requirement for State Sector projects is detailed in the RE Chapter of this document.

4.6. Generation Planning Issues

The State of Arunachal Pradesh is endowed with large hydro potential with an estimated capacity of more than 58,149 MW. A total of 159 projects have been identified in order to harness this huge amount of energy, out of which 15 projects were dropped after basin study due to feasibility issues. As of now, projects totaling 46,454 MW have been allotted to different developers and the projects are going to be carried out in the upcoming years. Details of the 144 projects with a total installed capacity of 46,454 MW in different river basins are summarized in Table 12.

Table 11: Source wise Generation (MU)

Particulars	State	CGS –NER	CGS –ER	Total
FY 16				
Hydro	0.00	291.10	0.00	291.10
Thermal	0.00	349.31	48.13	397.44
Hydro (RE)	52.25	0.00	0.00	52.25
Other RE	4.12	0.00	0.00	4.12
Total	56.37	640.41	48.13	744.90
FY 17				
Hydro	0.00	304.24	0.00	304.24
Thermal	0.00	368.96	48.00	416.95
Hydro (RE)	57.16	0.00	0.00	57.16
Other RE	15.86	0.00	0.00	15.86
Total	73.02	673.19	48.00	794.21
FY 18				
Hydro	0.00	497.00	0.00	497.00
Thermal	0.00	430.26	48.00	478.26
Hydro (RE)	67.62	0.00	0.00	67.62
Other RE	33.69	0.00	0.00	33.69
Total	101.32	927.26	48.00	1,076.58
FY 19				
Hydro	0.00	741.38	0.00	741.38
Thermal	0.00	450.92	48.00	498.92
Hydro (RE)	84.26	0.00	0.00	84.26
Other RE	57.97	0.00	0.00	57.97
Total	142.22	1,192.30	48.00	1,382.52

As per the Hydro Electric Power Policy of the Government of Arunachal Pradesh, the State is entitled to at least 12% free power from the HEPs to be developed in the State. Given the quantum of hydro potential and the various projects under development, the free power allocation to the State holds the potential of making it a majorly power surplus State in the years to come. Such free power allocation can be sold outside the state by the State/ or any of its agencies to make power sector a net contributor to the State's finances.

The quantum of free power allocated to state from identified 144 upcoming hydro projects is 5,872.45 MW. The status of clearance / NOC obtained for these projects is shown in Table 12

The project wise allocation of free power to Arunachal Pradesh is shown in Annexure 2.

Due to uncertainties associated with development of HEPs and the anticipated commissioning date of the projects under development, the state has not relied upon free power from HEPs for developing its power sourcing plan for the time horizon of until FY19 covered under the PFA Roadmap.

Nevertheless, in order to be able to appropriately deal with the free power expected to become

available, the State needs to start building its strategy, institutional arrangements and processes for dealing with the same in the best interest of the State's finances and the electricity consumers in the State.

The State also needs support and assistance from multiple agencies for ensuring timely development of the HEPs that have already been entrusted to various developers (including Government agencies). The immediate focus is on fast tracking the following 13 projects with a proposed installed capacity of 13,611 MW which are facing difficulties.

Table 12: Basin wise Details of Hydro Potential & Allotted Projects

Name of the River / Basin	Project Identified		Project Allotted	
	Nos.	Potential in MW	Nos.	Potential in MW
Tawang	13	2,792	13	2,792
Kameng	55	6,454	46	3,920
Subansiri	30	11,738	24	11,442
Dikrong	9	423	9	423
Siang	47	18,653	39	11,536
Dibang	18	10,093	14	9,068
Lohit	14	7,884	12	7,221
Tirap	3	113	2	53
Total	**189**	**58,149**	**144**	**46,454**

Table 13: Status of Upcoming Hydro Projects (Clearance/NOC Obtained)

Status of Projects – Clearance/NOC Obtained	Quantity
Environmental Clearance	14
FC-I	10
FC-II	3
Ministry of Defence	33
Ministry of Home Affairs	57
Balance	27

4.7. Action Plan & Support Required

Out of these 144 projects allotted to different developers, the State has an equity share in 39 projects with equity share ranging from 11% to 26% in each of these projects. In terms of MW equity share works out to be 7,393.15 MW. The total estimated requirement of State's equity share for implementation of these projects is about Rs 16,333 Cr. spread over a period of 10 years. The State Government's equity participation will have long term benefits. Details of the plants and the estimated equity share are provided in the Annexure 5.

It is expected that on completion, all allotted projects in the State will earn annual revenue of Rs 7,804.2 Cr. from free power (assuming tariff of Rs 3.01/ unit). In addition to the revenue from free power, the State government is expected to earn Rs 7,127 Cr from equity participation after loans are paid off. However, because of State's constrained economic condition, the State Government feels that for the purpose of its equity subscription, the Central Government may consider funding this equity under the available mechanisms.

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

Table 14: Action Points & Timelines

Stakeholder	Action Points
Central Government	• Expedite the commissioning of central generating stations by providing faster clearances and required financial and technical support. • Facilitating in settling issues with state run NGO's of Assam to restart Subansiri Project as delays are making the project commercially unviable. • Consider financial support for funding generation projectsunder available mechanisms.
MOEF&CC	• Speedy Environmental & Forest clearance based on basin study reports. • Reconsidering provisions like 1 km free flow stretch in order to make projects commercially viable. • Reassessing basin study and E flow reports based on scientific study and accurate facts. • Review the revised ToR for RoR projects.
MOWR	• Discussion on flood moderation cost and funding of the same as projects recommended by STC, GoI.

5. Transmission Plan

5.1. Transmission capacity requirement

While the inter-state transmission for the State of Arunachal Pradesh is has so far being taken up mainly by PGCIL, the intra-state transmission of power is handled by the Department of Power, Arunachal Pradesh. A well planned and strong transmission system will not only ensure optimal utilization of transmission capacities but also of generation facilities and further facilitate in achieving the ultimate objective of cost effective delivery of reliable power to end consumers.

Presently, only 5 out of 20 districts of Arunachal Pradesh are connected to transmission network at 132/220 KV. The 33 KV system is the backbone of power distribution system in the State. Due to low population density spread over its geographical area of 83,743 sq.km, power demand in Arunachal Pradesh is scattered over large distances. Hence, it is necessary to provide 132 KV connectivity in the State for proper voltage management and to lower technical losses.

The requirement of electricity in energy and peak demand terms for the State are expected to increase from the present level of 677 MU and 155 MW in FY15 to 1,310 MU and 312 MW in FY19.

The combined peak demand of all the states in the NER region was recorded at 2,528 MW during FY15 and growing load demand is expected to be met from proposed hydro generation projects in NER or from neighboring regions. This would call for commensurate transmission infrastructure for inter-state and inter-region evacuation of power from the NER. Provision of adequate transmission infrastructure for evacuation of power from the inter-state/inter regional boundary would ensure optimal utilization of the generating system by serving end consumers located across various geographies.

5.2. Existing Transmission System

Intra State Transmission System

The State has 3 intra-state transmission lines and 7 sub-stations at 132 KV and above level with an installed capacity of 167 MVA. The abstract of the intra-state transmission network is provided in Table 15.

Table 15: Existing Intra – State transmission Network

Particulars	Quantity	Capacity
Transmission Lines	**No.**	**In KM**
132 kV	3	184
Substation	**No.**	**MVA**
132/33 kV	7	167

The details of existing intra-state transmission system is shown in Annexure 3.

Inter-state Transmission System

At present, the inter-state transmission system has about six transmission lines totaling 458 ckms and four sub-stations with a total transformation capacity of 850 MVA. The voltage wise break-up of the existing inter-state transmission systems available to the State of Arunachal Pradesh at various voltage levels is summarized in Table 16.

Table 16: Inter- state Transmission System

Voltage	Transformation Capacity (MVA)	Line Length (KM)
400 KV	720	260
220 KV	0	19
132 KV	130	179
Total	**850**	**458**

The details of existing inter-state transmission system are provided in Table 17.

5.3. Intra-state Transmission Plan

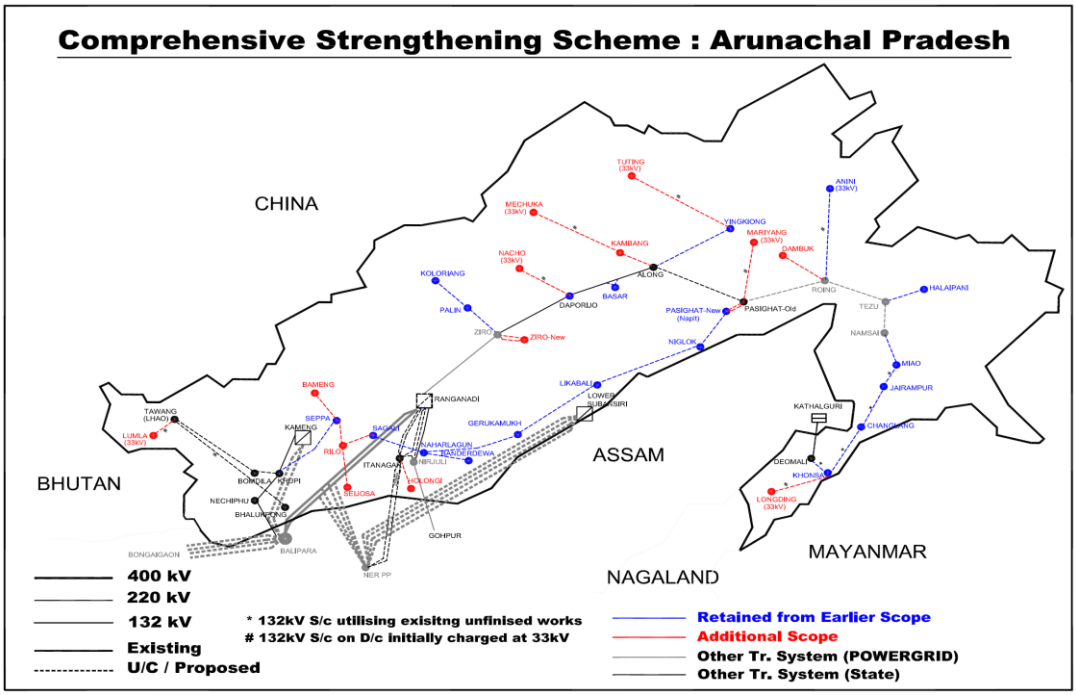
Comprehensive Scheme for Strengthening of Transmission and Distribution System (CSST&DS) in Arunachal Pradesh - PGCIL

Owing to the perpetuated weak intra-state T&D systems in the NER states of the country, the CEA has developed the Comprehensive Scheme for Strengthening of Transmission & Distribution Systems (CSST&DS also referred to as 'Comprehensive Scheme') in consultation with the concerned State Governments and the PGCIL.

The Government of India, on 10th October, 2014 has sanctioned an estimated cost of Rs. 4,754.42 crores for the states of Arunachal Pradesh and Sikkim under a new Central Sector Scheme of the MoP.

Table 17: List of Inter- state Transmission System

Details Inter state lines	**Owner**	**Line Length (ckm)**
132 KV Khupi to Balipara	NEEPCO	70
132 KV Nirjuli to Gohpur	PGCIL	42
132 KV RHEP to Nirjuli	PGCIL	22
132 KV RHEP to Ziro	PGCIL	45
220 KV Katalguri to Deomari	DoPAP	19
400 KV RHEP to Biswanath Chariali	PGCIL	260
Total		**458**
Details Inter-state Substations	**Owner**	**Capacity (in MVA)**
132/33 KV Nirjuli	PGCIL	2x50
132/33 KV Ziro	PGCIL	15
132/33 KV Khupi	NEEPCO	15
400/132 kV Ranganadi	NEEPCO	2x360
Total		**850**



An amount of Rs. 3,199.45 crores has been sanctioned for the State of Arunachal Pradesh which covers proposed investments totaling Rs. 2,527.88 crores in intra-state transmission infrastructure and Rs. 670.04 crores in sub-transmission (distribution) network upto 33/11 kV substation level.

The proposed investments under the Comprehensive Scheme would provide a reliable State grid providing required connectivity to the upcoming load centers which includes provision for 132 KV sub-stations in all the districts of the State.

The proposed systems also provide necessary connectivity and access for construction powerto the upcoming Hydro Projects, which will not only benefit the State but ultimately benefit the other states who would source power from the upcoming projects.

A summary of the proposed intra-state transmission works under the Comprehensive Scheme is provided in Table 18

The details of Intra State transmission works under CSST&DS scheme is shown in Annexure 4-9.

Table 18: Ongoing CSST&DS for Intra – State transmission Network

Particulars	Quantity	Capacity
Transmission Lines	**No.**	**In KM**
132 kV	33	1,917
Substation	**No.**	**MVA**
132/33 kV	24	529

State Schemes by DoPAP

The ongoing projects being executed by DoPAP are outlined in Table 19

Table 19: Intra State projects by DoPAP - Ongoing

	Target Completion	Status
132 KV S/C Aalo to Pasighat (77 ckm)	Dec 16	Under construction
132 KV D/C RHEP to Itanagar (32 ckm)	Dec 16	Under construction
132 KV D/C LILO of one circuit of RHEP – Itanagar at Pare HEP	Dec 16	Under construction

In addition to the same, the projects outlined in Table 19 have been planned by DoPAP in order to strengthen the transmission network in the State.

Table 20: Intra State projects by DoPAP - Planned

	Target Completion	Status
132 KV S/C transmission line from Bomdila to Tenzingaon (46 KM) i/c 4 x 5 MVA 132/33 KV Sub Station at Kalaktang with 132 KV Bay extension at Bomdila.	2020	Not yet Sanctioned / Details sent to DoNER Ministry
132KV S/C on DC Structure Khupi to Tawang vial Bomdila i/c 4 x 10 MVA 132/33 KV S/S at Bomdila & 4 x 10 MVA at Tawang (160. 731 km)	2019	Initially envisaged under DONER Revised DPR under preparation for funding through MoP.
LILO Sub Station at Bhalukpong	2018	Under construction
132 KV S/C Transmission line from Rupai to Manmow (Namsai) i/c 2 No.132 KV Bay along with 2x5 MVA, 33/11 KV Power S/Stn at Namsai	2019	Under construction
Development of SLDC at Itanagar	2018	Planned / Not yet Sanctioned
Establishment of Test & Diagnostic Lab	2020	Planned / Not yet Sanctioned
Special repair of Existing 220 KV &132 KV Lines and S/Stn	2016	Planned / Not yet Sanctioned
Creation of Electrical Inspectorate Unit	2016	Planned / Not yet Sanctioned
Other Works (Construction of Staff Qtr. Colony, Procurement of Vehicles, Monitoring software, etc.)	2017	Planned / Not yet Sanctioned

5.4. Transmission System Plan

Following schemes are under implementation in Arunachal Pradesh to strengthen the inter-state transmission system

Transmission System Associated with Kameng & Subansiri (HEPs)

The ongoing schemes cover for evacuation arrangements related to the upcoming 600 MW Kameng Project being undertaken by NEEPCO and the 2,000 MW Lower Subansiri project being undertaken by NHPC. While Kameng is scheduled for commissioning in FY17, the Lower Subansiri project is scheduled for commissioning in FY19. Both these projects have 50% of their power allocated to NER states while the remaining 50% is allocated to states in the NR/ WR.

The following inter-state transmission systems, catering to the evacuation arrangements from the Kameng and Lower Subansiri projects,are proposed in the State of Arunachal Pradesh:

- Kameng – Balipara 400 kV D/C line
- LILO of Ranganadi – Balipara 400 kV D/C line at Biswanath Chariyali - commissioned
- Lower Subansiri – Biswanath Chariyali 400 kV, 2 X D/C lines

While the Kameng – Balipara is progressing well and is expected to be commissioned during FY17, works on the Lower Subansiri – Biswanath Chariyali line have been stalled owing to the local agitations against the construction of the dam associated with the upcoming hydro project.

Transmission System Associated with Palatana and Bongaigon (TPPs)

During lean hydro period, Arunachal Pradesh along with other NER states continues to face power shortages due to lack of commensurate thermal generating stations within the region. Inter-state transmission system to ensure evacuation of the upcoming/ existing thermal generating stations within the NER to the respective states are essential for addressing this issue.

The proposed inter-state transmission systems for evacuation of power from 726 MW Palatana of OTPC and 750 MW Bongaigaon of NTPC for the State of Arunachal Pradesh are summarized in the table below:

- Pasighat – Roing 132 kV S/C Line (on D/C tower) – 102 KM

- Roing – Tezu 132 kV S/C Line (on D/C tower) – 73 KM
- Tezu – Namsai 132 kV S/C Line (on D/C tower) – 96 KM

Further, three 132/33 kV Substations with a proposed capacity of 30 MVA each are proposed in Roing, Tezu & Namsai.

The above lines and substations are scheduled to be commissioned by June 2016.

NER System Strenghening Scheme - II

The NERSS-II proposed to be implemented by PGCIL and through Tariff Based Competitive Bidding (TBCB) route includes the following elements in the State of Arunachal Pradesh:

Through TBCB Route
• Biswanath Chariyali (PG) – Itanagar 132 kV D/C line

In addition to above there is one 132 KV D/C line from Rupai to Namsai to be executed by DoPAP. This line will connect Rupai in Assam and Namsai in Arunachal Pradesh. The project will benefit Assam and Arunachal Pradesh increasing supply reliability.

5.5. Adequacy of transmission planning:

As per the STU, the proposed transmission systems are considered appropriate for meeting "Power For All" Programme in the State of Arunachal Pradesh.

The total capacity (including existing GSS and Lines) after implementation of all schemes which are expected to be completed by end of FY19 are tabulated in Table 21.

The Comprehensive Scheme has been formulated and finalized by PGCIL/ CEA based on various studies and estimates. Based on discussions held with the State, for the purpose of representation in this Roadmap Document, the proposed works in Year 5 in the original CSST&DS DPR have been clubbed in Year 4 to cover all proposed works by FY19 i.e. during the period covered under the PFA Roadmap.

Since the above scheme has already been approved/ sanctioned by the Government of India there is no funding gap anticipated in respect of the investments required in the intra-state transmission systems during the period covered under the PFA Roadmap.

Table 21: Total intra-transmission capacity (in MVAs) post implementation of schemes

Particulars	Existing (As on March 2015)	Additions after implementation of Schemes (from FY16 to FY19)	Proposed (As on March 19)
Grid Substations (Nos)	7	24	31
Grid Substations (MVA)			
132/33 KV	167	529	696
Transmission Lines			
132 KV	164	2,075	2,239
Sub Total	164	2,075	2,239

Table 22: Year-wise fund requirement/ availability (Rs. Cr.)

Name of Intra State Scheme	FY17	FY18	FY19	Total
Comprehensive Scheme	758.4	758.4	1011.2	2,528
Gap	0	0	0	0

5.6. Transmission Issues

The State has faced severe constraints due to lack of adequate inter and intra-state transmission capacities in the past, including the following:

- The links with other states in the NER need strengthening for seamless integration amongst the NER states.
- The intra-state transmission networks have constraints and limited spread within the State thereby creating difficulty in meeting the demand for power in several pockets/ regions.
- The Khupi-Tawang 132 kV line with SS Bomdila and Tawang (4x10 MVA each) was initially proposed to be funded through the DONER ministry. However, DONER has expressed its inability to fund the above line. This line is the connecting line for operationalization of Tawang-Lumla 33 kV line to be constructed under the Comprehensive scheme. The State seeks funding from Ministry of Power for commissioning of this line. Transmission wing of DoPAP has prepared a revised estimate of the project at Rs. 452.18 Cr.

The State also needs to plan and prepare for addressing the evacuation needs for the large scale development of hydroelectric projects totaling an anticipated capacity of over 46,454 MW from about 144 projects which are currently at various stages of development. Over 21 HEP developers having total capacity of over 14,700 MW under development have applied for LTOA/ connectivity. From these only 2 projects in the Kameng basin with a total capacity of 309 MW have been given LTOA so far. While the master plan for evacuation of power from HEPs in Arunachal Pradesh has already been evolved by the CEA, project specific systems are being finalized based on progress achieved on respective generation projects. The State requests the CEA to finalize these plans/ projects expeditiously to avoid any delays in development of the upcoming hydro projects.

The other major issues to be dealt with by the State include the following:

Segregation of SLDC/ STU Functions

- The DoPAP is presently undertaking functions of both STU and Distribution Licensee for the State.
- The State needs to segregate the STU and SLDC functions into a separate entity in compliance with the provisions of the Electricity Act, 2003.

Strengthening of SLDC/ Load Despatch

- Load Despatch needs significant strengthening including investments in RTUs/ Data-ogging/ Communications Systems/ setting up of a fully enabled control room etc.
- Given the network configuration in the STate, complete visibility at 33kV level is a must for ensuring effective load despatch within the State.

5.7. Action Plan & Support Required

In line with the proposed transmission plan, the following action points have been identified for respective stakeholders to be able to make suitable arrangements for making adequate power transmission arrangements for the state in accordance with the requirements of the PFA Roadmap.

Table 23: Action Points & Timelines

Stakeholder	Action Points
DoP, AP	• To finalize plan for segregation of STU/ SLDC functions in compliance with the provisions of the Electricity Act, 2003 within 3 months. • To prepare roadmap and investment plan for strengthening of load despatch and SLDC function.
PGCIL	• Timely award and execution of intra-state transmission works proposed under the Comprehensive Scheme. • Quarterly reporting of the various intra-state works being undertaken by PGCIL under the Comprehensive Scheme.
MoP	• Financial Support for construction of Khupi-Tawang 132 kV Line

6. Distribution Plan

6.1. Objectives of the Distribution Plan

Department of Power, Arunachal Pradesh, the sole distribution licensee is responsible for the management of sub-transmission and distribution infrastructure in the State. The significant increase in the access and availability of electricity proposed under the PFA Roadmap and the consequent increase in power demand to be catered from 155 MW in FY15 to 312 MW in FY19, would require commensurate investments in the sub-transmission and distribution infrastructure by the Department.

The objectives of this distribution plan, in accordance with the 24X7 PFA objectives, include the following:

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

b) Ensuring provision of electricity access to additional 28,868 rural UE HH by Dec 2016 under DDUGJY Scheme and remaining 46,260 HH to be electrified by FY19 under the Comprehensive Scheme taken up by PGCIL ;

c) Provision of 24X7 supply to meet demand growth from existing consumers and that arising from new consumer growth in the state; and

d) Making system improvements for reducing AT&C losses in accordance with the targets agreed with the MoP; and

e) Adopting appropriate technologies and systems to support RE integration and EE/ DSM measures in the state.

The distribution plan encompasses an appraisal of the existing distribution system, assessment of additional infrastructure requirements, investment needs and different schemes – ongoing and proposed, to fund such expansion. It also lays down the level as well as nature of intervention required from the State and Central governments to ensure adequate infrastructure is developed to meet the PFA program objectives.

6.2. Existing Distribution System

The DoPAP's network comprises of 33 KV sub-transmission systems which forms the distribution backbone at the district level and 11 KV and LT distribution systems which deliver electricity to the majority of the end consumers. An overview of Department's network infrastructure in terms of installed transformation capacity and line lengths of feeders at various voltage levels is provided in Table 24.

Table 24: DoP, Arunachal Pradesh- Existing Network Details (March, 2015)

Particulars	Capacity
Transformation Capacity	
33 KV / 11 KV Substations (MVA)	243
33 KV / 11 KV Substations (No.)	81
11 KV/ LT Distribution Transformers (MVA)	270
11 KV/ LT Distribution Transformers (No)	5,507

Particulars	Capacity
Lines	
33 KV Feeders (ckt kms.)	4,516
11 KV Feeders (ckt kms.)	19,026
LT Feeders (ckt kms.)	10,550

One of the primary challenges of Department of Power will be to provide access and electricity to the un-electrified rural HHs in the State. As many as 9 out of 20 districts in the State have less than 70% rural HH electrification and 3 out of these 8 districts namely Lohit, Namsai and East Kameg have less than 50% HH electrification. Urban areas of the State have an average electrification of 92% and it would not take much effort to provide electricity access to the rest of the urban population. The Figure 11 reflects the district wise electrification scenario in the State.

DT failure is not monitored but events are high in theft prone and far-flung/ rural areas which are faced with unbalanced and over loading of the transformers. Also, the outage time in such areas is on the higher side as the maintenance team needs time to reach out to such remote/ far-flung areas.

Despite a reduction of over 16% during the last 5 years, AT&C losses in the State continue to remain considerably higher than the national average. The projected loss level for the State even by the end of FY19 is expected to remain higher than the current national average loss level. The Figure 12 depicts the historical and projected loss levels for the DOPAP.

Figure 11: Electrification status in Arunachal Pradesh (Census, 2011)

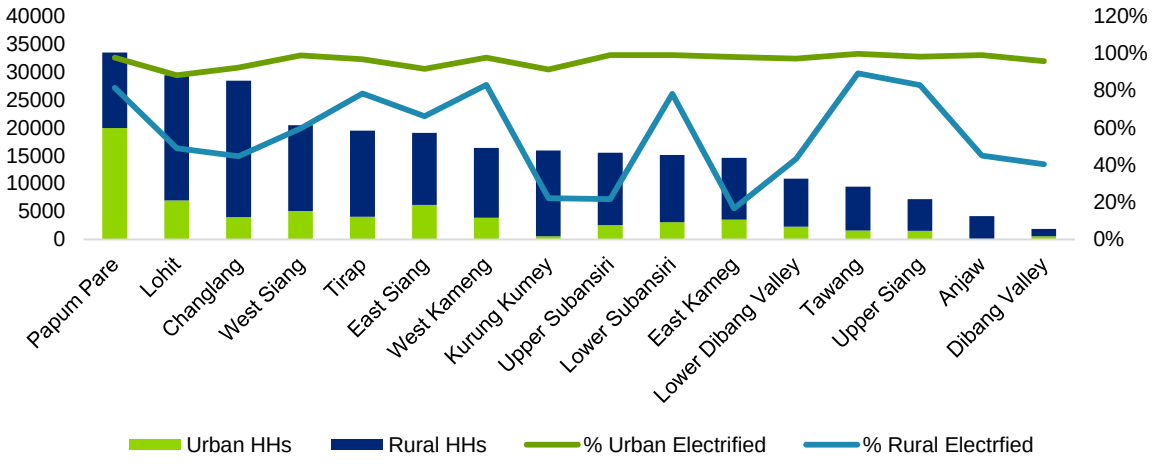


Figure 12: AT&C Losses Historical & Projections

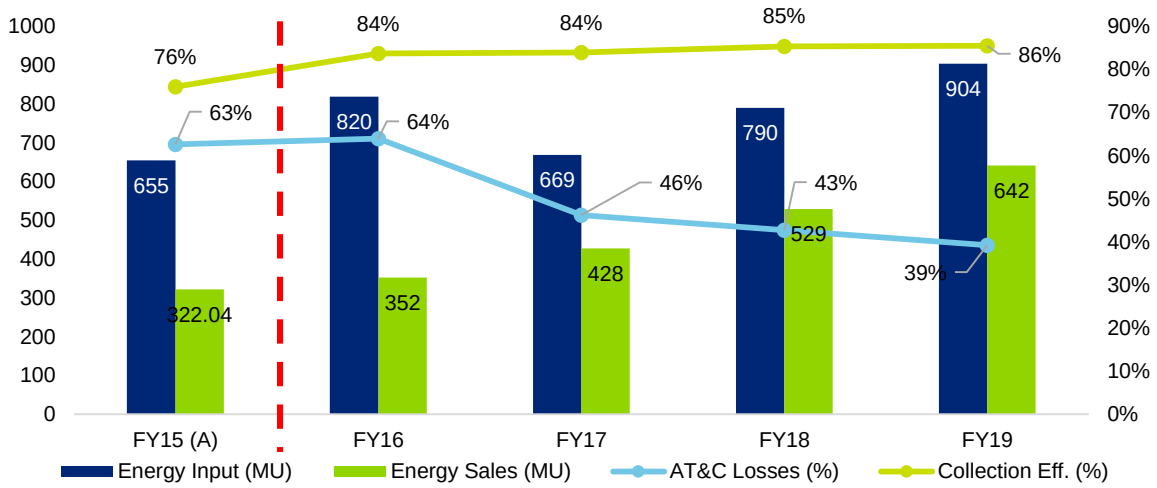


Table 25 provides the details of AT&C losses in 20 division of the State, the loss figures go as high as 97%. One of the main goals under the PFA program for the State is to reduce the losses which would play a vital role in ensuring 24x7 reliable supply of power and financial viability of the sector.

Table 25: Division Wise AT&C Losses (%)

Division	FY 11	FY 12	FY 13	FY 14	FY 15
Tawang	52.5	63.3	58.2	36.9	40.3
Bomdila	53.2	48.5	58.3	60.8	26.17
Seppa	79.0	78.8	77.7	83.7	86.3
Capital	80.0	67.5	64.8	56	58.9
Naharlagun	41.4	47.8	56.5	49.1	53.8
Sagalee	-	-	-	94.9	96.7
Ziro	85.5	86.5	88.4	82.5	84.0
Daporijo	56.5	49	51.7	63.1	84.1
Kurung Kumey	73.6	69.3	76.6	79.7	68.9
Aalo	52.7	65.6	48.2	45.1	47.2
Basar	73	69.2	45.1	51.7	49.7
Rumgong	44.9	37.8	38.7	26.5	31.5
Pasighat	25.3	35.4	44.8	44.8	60.6
Yingkiong	56.0	43.0	48.0	60.0	66.0
Deomali	85.4	86.5	85.6	88.9	90.5
Anini	-	-	-	69.4	60.9
Roing	67.3	70.3	58.1	56.1	64.5
Miao	69.5	65.3	63.6	62.1	63.7
Hayuliang	71.4	64.7	57.4	50.8	49.4
Namsai	66.0	70.9	75.6	74.3	83.4

39% consumers in the State are metered while 24% continue to be un-metered authorized consumers of the DoPAP rest 37% consumers have defective energy meters as at the end of FY15. The State has planned to achieve 100% consumer metering and replace all defective meters by FY19. In rural areas all of the meter replacement and shifting activities would be funded through the DDUGJY scheme. Similarly for urban areas, meter replacement and shifting activities are planned under the IPDS scheme for nine towns. The state may need additional funds for the towns in which there are no investments approved.

6.3. 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, which not only provide the funding assistance but also aim towards enhancing the technical capacity of utilities.

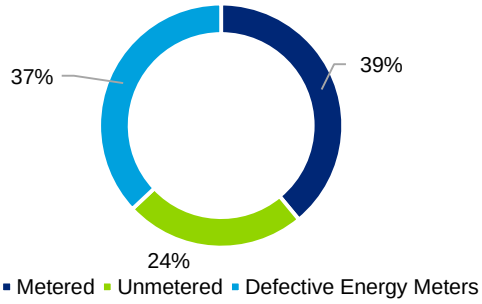
RGGVY and DDUGJY

The state has taken up a total of 16 schemes/ projects under the RGGVY scheme so far, including Phase-II under the XI Plan providing free electricity connection to over 51 thousand BPL HHs in the state. The status of achievements under the RGGVY scheme is highlighted in Table 26.

The State has completed all works taken up previously under RGGVY scheme and all physical outcome targets have already been achieved while release of balance funds is yet to be achieved.

Arunachal Pradesh has the lowest level of village electrification amongst all states and UTs, including islands in the country. Out of 5,258 inhabited villages in the state only 3,680 (70%) have been electrified as of November 2015. As per the latest estimates (Jan 2016) for DDUGJY scheme by Arunachal Power Development Agency 1,536 Villages are remaining to be electrified in the state. Out of these 1,058 villages are proposed to be electrified by off-grid schemes and 478 villages are proposed to be connected through extension of grid.

Figure 13: Metering Status (FY15)



The State aims to achieve 100% rural HH electrification. The DDUGJY scheme is being pursued by Arunachal Power Development Agency (APDA). As per the latest DPRs under preparation the State aims to electrify 28,868 rural HH by Dec 2016 under the scheme. The remaining 46,260 HHs are expected to be electrified by FY19 after completion of the Comprehensive Scheme taken up by PGCIL. In this regard, a detailed survey needs to be undertaken to assess the remaining Un-electrified households in each district.

A total amount of Rs. 397 Cr. have been sanctioned against DDUGJY projects. Under the grid connected projects, 16 DPR's have been sanctioned under DDUGJY for Rs. 267.20 Cr. towards electrification of 478 UE villages and 3 SAGY villages. The bifurcation for this amount includes Rs. 199.22 Cr for UEV Electrification works, Rs. 58.21 Cr for Metering, Rs. 8.44 Cr. for SAGY and Rs. 1.33 Cr. for PMA. Under the Off-grid connected projects, Rs. 151.73 Cr. have been sectioned entailing electrification of 1,176 UE Villages. Projects are yet to be awarded by the Power Department.

Table 26: RGGVY Status (as on July, 2015)

Particulars	Units	Plan	Actual	Achievement	Balance
Projects/ Schemes	Numbers	16	16	100%	0
Electrification of Un-electrified Villages (UEV)	Numbers	2,090	2,090	100%	0
Intensive Electrification of Villages (IEV)	Number of Villages	1,306	1,306	100%	0
BPL HH Electrification	Number of HHs	39,223	39,223	100%	0
New Sub-stations	Numbers	19	19	100%	0
Augmentation of Sub Stations	Numbers	3	3	100%	0
Financial	Rs. Cr.	1,025.50	913.39	89.07%	112.1

The DPRs for achieving the electrification plan and hence the infrastructure roll out under DDUGJY have been approved and the state has already started tendering the projects

R-APDRP and Integrated Power Development Scheme (IPDS)

RAPDRP scheme covers 10 towns for implementation of Part-A of the scheme. Appointment of supervision consultants and IT implementing agency was completed in June, 2011. An amount of Rs. 37.7 Crores was sanctioned for Part-A, out of which Rs. 11.3 Crores is disbursed so far.

DOPAP has setup a Customer Care Center for management of complaint management on maintenance works and billing and collection of revenues in 10 towns under Scheme. Further initiatives such as implement MDAS and GIS system to improve system visibility are being planned. The progress made so far under the Scheme is provided in Table 27.

The State proposes to cover 17 towns under the IPDS scheme. DoPAP has prepared and submitted the DPRs for these 17 towns having a total fund layout for Rs. 302 Cr. Against this requisitioned amount the nodal agency for IPDS has sanctioned Rs. 150.8 Cr covering 7 towns only. The scope and cost for the proposed works in 17 towns is summarized in Table 28.

Table 27: Progress on RAPDRP scheme (March 2016)

Sl.	Particulars	Achievement	Town Covered
1	Ring Fencing Meter 33 & 11 kV	100%	10
2	Third party inspection	100%	10
3	D.T. Meter	70%	10
4	Feeder Meter	100%	10
5	Consumer Indexing	30%	10
6	Network Survey (Mapping)	50%	10
7	Customer Care Centre	100%	1
8	Base Line AT&C data	80%	10

Table 28: IPDS Scheme – City Wise Project Proposed Cost (Rs. Lakhs) for Arunachal Pradesh

	33 kV Transformers (new +Aug)	33 kV Feeder Works	11 kV Feeder Works	LT Line	Metering	DT	Others	Total
Tawang	1,086	218	87	-	119	404	333	2,248
Dirang	-	-	397	35	191	279	312	1,212
Bomdila	685	-	210	43	211	205	153	1,507
Sagalee	11	-	48	161	34	91	30	374

	33 kV Transformers (new +Aug)	33 kV Feeder Works	11 kV Feeder Works	LT Line	Metering	DT	Others	Total
Basar	133	-	309	193	233	210	313	1,390
Boleng	318	-	53	43	50	40	151	655
Yingkiong	631	1,374	382	193	170	93	243	3,086
Changlang	47	-	62	53	82	115	134	492
Jairampur	94	386	87	42	235	216	149	1,209
Miao	141	554	70	42	136	193	123	1,260
Deomali	1,021	437	262	285	113	78	1,106	3,303
Khonsa	1,021	296	327	555	133	114	1,290	3,735
Longding	659	656	288	350	78	99	866	2,995
Koloriang	-	62	569	524	222	92	-	1,470
Anini	-	-	435	-	121	482	300	1,338
Roing	255	-	1,109	337	43	-	611	2,355
Hawai	-	-	215	135	50	53	1,142	1,595
Total	6,101	3,984	4,908	2,991	2,220	2,763	7,256	30,223
Share	20%	13%	16%	10%	7%	9%	24%	100%

DoPAP may require additional funding to achieve the above infrastructure strengthening targets for urban areas given the reduction in availability of funds against the proposed works.

Comprehensive Scheme for Strengthening of Transmission and Distribution System (CSST&DS) in Arunachal Pradesh

The Comprehensive Scheme, as detailed in the Transmission Plan chapter, also covers investments in sub-transmission (distribution) network infrastructure in the State with an approved outlay of Rs. 671 crores.

The coverage of distribution systems is limited to construction/ strengthening of 33 kV feeders and 33/11 kV substations forming the sub-transmission network backbone in the State. The following table shows details of proposed 33 kV lines, 33/11 kV substations/ transformation capacities and 11kV outgoing feeders from such substations under the Comprehensive Scheme.

Table 29: Capacity Addition plan under Comprehensive Scheme

District	No of SS (New + Aug.)	33 kV Bay	33/11 KV Transformation Capacity (MVA)	No. of 11 kV O/G Feeder	33 kV Feeder Length (km)
Anjaw	4	4	20	6	115
Changlang	6	10	35	12	150
Dibang Valley	2	4	10	4	-
Upper Subansiri	1	-	5	2	-
East Kameng	2	4	10	4	55
East Siang	10	32	60	24	279
Kurung Kumey	2	4	10	4	90
Lohit	4	4	35	12	60
Lower Dibang Valley	4	4	30	8	82
Lower Subansiri	4	6	30	12	56
Papum Pare	7	14	55	24	92

District	No of SS (New + Aug.)	33 kV Bay	33/11 KV Transformation Capacity (MVA)	No. of 11 kV O/G Feeder	33 kV Feeder Length (km)
Tawang	4	7	20	8	105
Tirap	4	5	30	12	95
Upper Siang	5	10	25	10	150
Upper Subansiri	6	12	30	12	158
West Kameng	1	2	5	2	60
West Siang	7	17	35	14	299
Total	73	121	445	170	1581

According to MoP, the target of AT&C losses for the State of Arunachal Pradesh is 39.26% by FY19 which requires reduction of over 23.4% over next four years from existing level of about 62.65% in FY15. Timely implementation of the proposed investments would be pivotal in achieving the set targets.

6.4. Overall Infrastructure Addition

Thus, in view of the significant increase in power demand to fulfill the 24X7 PFA objectives, the DoPAP has planned to undertake a comprehensive distribution system capacity addition, encompassing significant increase in the existing infrastructure. The summary of proposed capacity additions, discussed under various central and state government schemes above, is provided in Table 30.

Given the demand growth expected by the FY19 under the projections, the proposed investments will be adequate for addressing the access and power availability concerns in accordance with the objectives of the 24X7 PFA Program.

6.5. Connecting the un-connected

The State has proposed to provide electricity access to all 75,128 (Estimated) UE HHs in the State by FY19. 28,868 HH are proposed to be electrified by Dec 2016 under the DDUGJY

Table 30: Proposed Yearly Distribution Network Capacity Additions for Arunachal Pradesh

Particulars	UOM	As on FY16	Total additions proposed	Yearly Additions Proposed under PFA				Cumulative (End of FY19)	% Inc.
				FY17	FY18	FY19	Total		
33 kV Line	Ckt Kms	6,097	9	4	4	0	9	6,106	48%
33 kV SS	MVA	688	12	6	6	0	12	700	193%
33 kV SS	No's	154	4	2	2	0	4	158	96%
11 kV Lines	Ckt Kms	19,026	1,215	1,095	119	0	1,215	20,241	1%
LT Lines	Ckt Kms	10,550	698	629	69	0	698	11,248	2%
DT	No's	5,507	814	674	141	0	814	6,321	5%
DT	KVA	270	42,187	28,242	13,945	0	42,187	42,457	10%
Meters IPDS	No.		23,908	11,954	11,954	0	23,908	23,908	
DT Meter DDUGJY	No.		1,839	1,839	0	0	1,839	1,839	
Feeder Meter DDUGJY	No.		413	413	0	0	413	413	
Consumer Meter DDUGJY	No.		107,229	107,229	0	0	1,07229	107,229	

scheme of the Government of India.

The State shall also consider electrifying such HHs in such villages through the MNRE's Scheme for Solar Home Lighting which has provision for Central Financial Assistance.

6.6. Fund Requirement

The scheme wise funding plan totaling over Rs. 1,242 crores over the next four years for the proposed distribution capacity additions is summarized in Table 31

While the investment proposals under the Comprehensive Scheme has already received necessary approvals, the proposals under IPDS Scheme are yet to be sanctioned by the respective Nodal Agencies/ Government of India.

The REC has approved Rs. 419 Cr. for the electrification plan (28,865 HH) against the initial DPR's totaling Rs. 3,632 Crs (64,357 HHs) submitted by the State. The state may need to prepare fresh plans for electrifying the remaining HH in the state. The power department will make plans for electrifying these HH after completion of the comprehensive scheme project.

Out of the 26 towns in The State, only 9 towns have been covered under IPDS. The State may need further funds for strengthening of network in these towns. The remaining 17 towns where there are no investments in IPDS, will not be able to achieve 100% feeder metering, DT metering and consumer metering.

The State requests Central Government assistance for

- Achieving 100% metering in urban areas, especially for town where IPDS investments have not been approved.
- Carrying out system strengthening, metering and IT implementation of the remaining 17 towns in the state.

6.7. Key issues in distribution planning

One of the major factors impacting planning of the distribution network for the state of Arunachal Pradesh is its geo-climatic peculiarity. The state comprises of dense forests and hilly terrains which explain the lowest population density in Arunachal Pradesh amongst all states in the country. The terrain poses great challenges in distribution planning as the investment required (on per consumer or per kW of load served basis) for establishing the network for rural and urban areas are much higher than the national average.

Adding to the above, the viability of DDG/ Micro-Grids is also poor in the State due to significant seasonal variations and other technical difficulties associated with distributed/ RE sources of generation such as SHP, Solar etc. leaving such options improper for HH/ residential usage.

6.8. District Wise Action Plan

District/ Circle Wise Rollout Plan

The circle wise physical rollout plan of the proposed infrastructure additions under the PFA Roadmap comprising all works proposed under various schemes is outlined in Table 32

Table 31: Fund Requirement and Availability Position for Distribution Investments (Rs. Cr.)

Sl.	Name of Scheme	Fund Requirement					Fund Availability/ Sanction
		FY16	FY17	FY18	FY19	Total	
1	Rural Investments (DDUGJY- Approved)		419	0	0	419	**419**
2	Urban Investments (IPDS- DPR cost)		75	76	0	151	**151**
3	Sub-transmission Strengthening - Comprehensive Scheme (CSSTDS)	134	269	269	0	**672**	**672**
4	Non IPDS Towns			76	75	**151**	**151**

Sl.	Name of Scheme	Fund Requirement					Fund Availability/ Sanction
		FY16	FY17	FY18	FY19	Total	
	Total	**134**	**763**	**421**	**75**	**1,393**	**1,393**
	Funds Available	**134**	**763**	**345**	**0**	**1,242**	**1,242**
	Gap	**0**	**0**	**76**	**75**	**151**	**151**

Table 32: District Wise Infrastructure Rollout Plan

Sl.	Circle Name	33 kV line Ckt Kms	11 kV line Ckt Kms	LT line Ckt Kms	33/11 kV S/S		11/0.4 kV S/S	
					No.	MVA	No.	MVA
Urban Investments – (Including IPDS) Approved portion only								
1.	Itanagar	8.50	35.00	45.00	1.00	10.00	47.00	0.00
2.	Naharlagun	0.00	71.00	0.00	0.00	0.00	86.00	11.10
3.	Seppa	0.00	10.80	5.30	0.00	0.00	15.00	1.30
4.	Ziro	0.00	45.15	9.00	1.00	0.00	25.00	3.21
5.	Daporijo	0.00	32.00	21.00	0.00	0.00	17.00	2.70
6.	Aalo	0.00	12.00	18.40	1.00	0.00	20.00	3.51
7.	Pasighat	0.00	26.00	21.60	1.00	2.00	33.00	3.37
8.	Tezu	0.00	7.00	8.50	0.00	0.00	7.00	1.10
9.	Namsai	0.00	0.00	9.00	0.00	0.00	31.00	1.60
Sub-transmission Backbone Investments (Comprehensive Scheme)								
1.	Anjaw	115			4	20		
2.	Changlang	150			6	35		
3.	Dibang Valley	-			2	10		
4.	East Kameng	107			5	30		
5.	Upper Subansiri	-			1	5		
6.	East Siang	279			10	60		
7.	Kurung Kumey	90			2	10		
8.	Lohit	60			4	35		
9.	Lower Dibang Valley	82			4	30		
10.	Lower Subansiri	56			4	30		
11.	Papum Pare	92			7	55		
12.	Tawang	105			4	20		
13.	Tirap	95			4	30		
14.	Upper Siang	150			5	25		
15.	Upper Subansiri	158			6	30		
16.	West Kameng	60			1	5		
17.	West Siang	299			7	35		
Capacity addition under DDUGJY								
18.	Anjaw		14.38	2.7			14	0.104
19.	Changlang		69.44	32.82			24	0.857
20.	Dibang Valley		0.5	1			2	0.016
21.	East Kameng		7.7	10			7	0.317
22.	East Siang		16	7.5			3	0.113
23.	Kurung Kumey		75.9	63.9			40	1.036
24.	Lohit		51.9	41.48			36	1.075

Sl.	Circle Name	33 kV line Ckt Kms	11 kV line Ckt Kms	LT line Ckt Kms	33/11 kV S/S No.	33/11 kV S/S MVA	11/0.4 kV S/S No.	11/0.4 kV S/S MVA
25.	Lower Dibang Valley		133.84	61.6			66	1.256
26.	Lower Subansiri		105	82.35			78	3.59
27.	Papum Pare		248.1	136.55			138	3.217
28.	Tawang		19.46	11.6			13	0.665
29.	Tirap		12.25	14.75			8	0.158
30.	Upper Siang		30	9.1			8	0.304
31.	Upper Subansiri		174.72	57.6			79	1.5
32.	West Kameng							
33.	West Siang		16.55	27.3			17	0.393

As per the overall schedule of investment proposals, an indicative year wise phasing of the rollout plan would be 17%, 66%, 33% and 0% during FY16, FY17, FY18 and FY19, respectively. It may be noted that the phasing of infrastructure rollout may vary from one circle to another depending on the extent of coverage of various circles under respective schemes and implementation schedule thereof. DoPAP shall work out a detailed district wise quarter wise physical rollout plan by May, 2016.

District Wise Plan for Increased Access

The district wise rollout targets for electrification of Rural and Urban UE HH's, proposed to be taken up by the DoPAP under the PFA Roadmap is outlined in Table 33.

District Wise Loss Reduction Plan

DoPAP has made a circlewise loss reduction plan in accordance with the Ministry of Power, Government of India prescribed overall State Level AT&C loss targets.

6.9. Capacity Building

Due to the absence of an in-house training facility, training and capacity building amongst DoPAP/ DHPD/ APEDA staff has had limited reach in the past. Presently, employees/ staff are sent outside the State to various training institutes or to the training programs sponsored by GoI, MoP etc.

As part of its capacity building program, DoPAP intends to proactively send its employees outside the State to various institutes for managerial and technical trainings. It is proposed to cover 25% employees every year until the establishment of

Table 33: District Wise Electrification Plan under DDUGJY(HH Nos) - Rural

Districts	FY 17 Q1	FY 17 Q2	FY 17 Q3	FY 17 Q4	FY 18 Q1	FY 18 Q2	FY 18 Q3	FY 18 Q4	Total
Anjaw	26	39	39	26	26	26	39	39	260
Changlang	137	205	205	137	137	137	205	205	1,368
DibangValley	16	25	25	16	16	16	25	25	164
EastKameng	258	386	386	258	258	258	386	386	2,576
EastSiang	4	6	6	4	4	4	6	6	40
KurungKumey	665	997	997	665	665	665	997	997	6,648
Lohit	133	200	200	133	133	133	200	200	1,332
LowerDibang Valley	241	361	361	241	241	241	361	361	2,408
LowerSubansiri	387	580	580	387	387	387	580	580	3,868
PapumPare	387	581	581	387	387	387	581	581	3,872
Tawang	41	62	62	41	41	41	62	62	412
Tirap	25	38	38	25	25	25	38	38	252

Districts	FY 17 Q1	FY 17 Q2	FY 17 Q3	FY 17 Q4	FY 18 Q1	FY 18 Q2	FY 18 Q3	FY 18 Q4	Total
UpperSiang	43	64	64	43	43	43	64	64	428
UpperSubansiri	373	560	560	373	373	373	560	560	3,732
WestKameng	31	47	47	31	31	31	47	47	312
WestSiang	119	178	178	119	119	119	178	178	1,188
Total	**2,886**	**4,329**	**4,329**	**2,886**	**2,886**	**2,886**	**4,329**	**4,329**	**28,860**

a fully functional training institute within the State. Such institute/ facility will also be used to invite experts from outside the State to undertake various technical and managerial trainings/ workshops. Nevertheless, training for office procedures will continue to be provided by the Department of Personnel and Administrative Reform, Naharlagun.

The State/ Central Government is requested to provide adequate funds for setting up of the proposed power training center within the State at Itanagar. Annual fund requirement for the period FY16 to FY19 on training and capacity building related interventions is provided in Table 34.

Table 34: Fund Requirement of Trainings & Capacity Building

Particulars	Annual Training Cost (Rs Cr.)	Total Cost for FY17-19
DHPD	0.63	1.89
DoPAP	1.80	5.4
APEDA	0.11	

6.10. Action Points & Support Required

In line with the proposed distribution plan, the following action points have been identified for respective stakeholders:

Table 35: Action Points & Timelines

Stakeholder	Action Points
State Government	• State Government to arrange for equity component and counter-part funding (for central schemes and the CSSP) in accordance with the investment plan proposed under the PFA Roadmap.
DoP, AP	• The DoPAP to set-up a district wise Committee's for monitoring of electrification rollout and various other works proposed under the PFA Roadmap. • Survey for preparation of DPRs for remaining unelectrifed HH in the state.
Government of India	• Assist the State in identifying alternative funding mechanisms for the fund availability towards the various distribution related investments proposed under the PFA Roadmap.
PGCIL	• Timeline award and execution of intra-state transmission and sub-transmission works proposed under the Comprehensive Scheme. • Quarterly reporting of the various intra-state works being undertaken by PGCIL under the Comprehensive Scheme.

7. Renewable Energy Plan

7.1. Renewable Energy (RE) sector in Arunachal Pradesh

Arunachal Pradesh's RE generation is currently dominated by the Mini and Micro Hydro Power Plants. The total RE potential in the State (including solar energy) is estimated at about 10,236 MW as shown in Table 36.

Table 36: Renewable Energy Potential in the State

Source of Energy	Potential in State (MW)
Solar (MWp)	8,650
Small Hydro	1,341
Biomass	8
Wind	236
Total	**10,236**

APSERC has introduced RPO Regulations in 2012 providing suitable environment for development of renewable energy in the State. The RPO targets are provided as minimum quantum of purchase (in percentage terms) from RE sources of total energy consumption in the State. DHPD owns 119 mini/micro hydro stations. Consequently, DoPAP is able to meet its non-Solar RPO obligations through the energy purchased from State owned hydro stations. However, due to lack of solar stations the APDoP is unable to meet its solar RPO requirement. The year wise RPO targets set by the APSERC for the preceding 3 years is shown in Table 37.

Table 37: Year wise RPO Targets for DoPAP

Year	RPO Target (Total)	Non- Solar RPO	Solar RPO
FY13	4.2%	4.10%	0.10%
FY14	5.6%	5.45%	0.15%
FY15	7.0%	6.80%	0.20%

RPO targets for the FY15 specified above apply for the period FY16 to FY19 as well, until revised targets are notified by APSERC.

In addition to RPO targets set by APSERC, the State Government has introduced Small Hydro Power Policy in 2008 which aims at providing an enabling environment for development of the SHPs in the State. APSERC has also introduced Feed-in-Tariff (FIT) Regulations for various RE sources/ technologies like mini-micro hydel, MSW, Biomass, wind etc. The State is presently working on a Solar Power Policy to promote investments in solar power generation projects.

Arunachal Pradesh Energy Development Agency (APEDA), established in 1996, is the State Nodal Agency for New & Renewable Energy development in the State. APEDA has been pursuing various interventions for harnessing of mini/ micro hydro, biomass, solar and wind based renewable energy in the State.

7.2. MNRE Target

As part of planned 175 MW capacity addition from RE sources in the country, MNRE has proposed addition of 589 MW of RE capacity for Arunachal Pradesh as per the technology wise break-up provided in Table 38.

Table 38: MNRE Capacity Addition Target For Arunachal Pradesh (Till FY22)

Source	Target (MW) till 2022
Solar Power	39
Roof Top	50
Others	0
SHP	500

The DHPD and APEDA shall plan for RE capacity additions beyond FY19 in accordance

with MNRE capacity addition targets for the period up to FY22.

7.3. RE Installed Capacity

The current installed power generation capacity of State comprises of 240 projects totaling 65.73 MW. This includes 119 small and micro hydel plants commissioned by the DHPD with a total installed capacity of 62.615 MW. Details of these plants are provided in Annexure 1. Additionally, APEDA has commissioned 102 projects with a total installed capacity of 3.87 MW comprising of micro hydel, biomass gassifier, SPV and wind solar hybrid projects spread across the State. However, only 1.48 MW of this installed capacity is currently under operation. The total installed capacity of RE generation is summarized in Table 39.

7.4. RE Development Plan

Department of Hydro Power Development (DHPD)

The DHPD is undertaking construction of 29 small hydro-electric projects of varying capacities with a total capacity of 54.04 MW, expected to be commissioned by FY19.

Additionally, the State/ DHPD has also planned for 35 new small hydro-electric projects which are under preparatory/ development stages. The expected capacity addition on account of these projects is 35.47 MW by FY19. Table 40 provides year wise summary of on-going and new projects.

Additionally, DHPD presently pursuing survey and investigation on about 25 potential projects. Survey and investigation for additional 108 projects is proposed to be commenced/ undertaken during FY17 to FY19. Such new projects being developed are expected to have potential generation capacity in excess of 145.20 MW which can be realized in future.

Table 39: Current Installed Capacity of RE Sources of Generation in Arunachal Pradesh (Dec 2015)

	Mini/ Micro Hydel		Solar (SPV)		Wind Solar Hybrid		Total	
Description	No's	MW	No's	MW	No's	MW	No's	MW
DHPD	119	62.62					119	62.62
APEDA	102	3.87	4	0.26	3	0.02	122	3.87
Total	220	66.49	4	0.26	3	0.02	240	67.25

Table 40: Capacity Addition Plan of DHPD

Description	FY 16	FY 17	FY 18	FY 19	Beyond FY 19	Total
Ongoing Projects						
Capacity (MW)	2.94	12.75	9.80	24.55	4	54.04
No of Plants	7	9	6	6	1	29
New Projects - Under Development						
Capacity (MW)				23.47	12	35.47
No of Plants				30	5	35
Overall – DHPD						
Capacity (MW)	2.94	12.75	9.8	48.02	16	89.51
No of Plants	7	9	6	36	6	64

Table 41: R&M Plan of DHPD (Rs. Crs.)

Plant	Capacity	FY 17	FY 18	FY 19	Total (Rs Cr.)
Tah Ahfra MHP	2 x 50 KW	0.50	0.61	0.00	1.11
Sikut MHS	2 x 50 kW	0.50	0.54	0.00	1.04
Awapani Ph-II MHP	2 x 250 kW	0.70	0.80	0.00	1.50
Charju MHP	3 x 200 kW	1.50	2.0	0.00	3.50
Tissue MHS	4 x 100 kW	1.00	1.62	0.00	2.62
Thiratju MHS	4x 250 kW	2.00	3.85	0.00	5.85
Kitpi SHP Ph-I	3 x 500 kW	4.00	5.92	0.00	9.92
Nuranang SHP	3 x 2000 kW	0.00	7.00	8.00	15.00
Sessa MHS	3 x 500 kW	0.00	5.00	5.83	10.83
Patte Nallah MHS Tali	1 x 30 kW	0.30	0.37	0.00	0.67
Sirnyuk MHS	2 x 1000 kW	0.00	5.00	6.70	11.70
Echi Afra MHS	2 x 200 kW	1.00	1.35	0.00	2.35
Yapak Nallah MHS	2 x 100 kW	1.00	1.35	0.00	2.35
Sippi SHP	2 x 2000 kW	0.00	7.00	8.00	15.00
Kopu MHS at Tuting	1 x 250 kW	2.00	2.15	0.00	4.15
R&M Domkhrong MHS	2 x 250 kW	3.00	3.50	0.00	6.50
Mai Ph 1 MHS	4 x 500 kW	2.00	2.35	0.00	4.35
Total (Rs. Crs.)		19.50	50.41	28.53	98.44

Additionally, 17 HEPS of DHPD with an installed capacity 21.08 MW are proposed to be taken up for Renovation and Modernization (R&M) works in FY17 to FY19 with a total expenditure of Rs. 98.44 Cr. A summary of the proposed R&M projects are shown in Table 41.

Plans under inception stage: Based on reconnaissance pre-feasibility survey and investigation carried out by the Department of Hydro Power Development, 89 (eighty nine) Nos. small /mini hydro power projects with an installed capacity of 35.82 MW has been identified to meet up the power requirement of the un-electrified/partially electrified administrative Headquarters and remote villages along the International border covering most of the districts of Arunachal Pradesh as capacity addition plan. The project cost is inclusive of Civil works, Electro-Mechanical components & Transmission Distribution component from source to Load Centre.

Arunachal Pradesh Energy Development Agency (APEDA)

APEDA's capacity addition plan includes projects being pursued under various schemes of the State and Central Government. The RE technologies proposed by APDEA includes small hydel projects, solar projects under JNNSM, wind solar hybrid systems etc.

Mini and Small Hydel Projects: APEDA has planned to develop the following hydro power projects with a total capacity of 8 MW during the year from FY16 to FY19:

a) *1 MW at Ayungmuring in Upper Subansiri:* Project will provide power supply to villages in Siyum Circle, Limiking Circle, Nacho circle & Taksing Circle of Upper Subansiri District. (Target Completion by FY18).

b) *2 MW at Padusa in West Siang District:* Project will provide power supply to villages in Tato circle, Monigong Circle, Padusa Circle & Mechuka circle in West Siang District. (Target Completion by FY19)

c) *1 MW Jaw Kro MHP in Upper Subansiri District*

d) *2 MW Talo MHP Kra Daadi District*

e) *2 MW Pain MHP I at Kra Daadi District*

Apart from the above schemes, APEDA has proposed to conduct survey & investigation works at 16 potential sites to assess the feasibility of setting up of hydro power plants. Some of the potential sites are Puyu SHP (2MW), Doni Kro (2MW), Palin (2MW), Papum (5MW).

Water Mills: APEDA has planned to install 70 water mills with electro-mechanical output systems of different capacities to cover HHs and small hamlets with very few houses in the State.

Wind projects: The various interventions proposed by APEDA with regard to development of wind based projects in the State are:

a) To conduct feasibility study on 24 sites to find out potential of wind energy in the state by putting up monitoring stations.

b) To put up a total of 280 KW of wind solar hybrid systems ranging from 5 kW to 10 KW capacity per site.

c) To set up a wind firm of 5x0.9 MW capacity is in the pipeline to take up on 50:50 joint venture basis by APEDA with a wind turbine manufacturer namely Powerwind Ltd. of Gurgaon. The estimated cost of the project is about Rs. 40 Cr.

SPV Program: The list of planned SPV projects by APEDA is shown below:

a) 1 MW solar power plant at Itanagar;

b) 4 MW at Industrial Growth Centre, Niglok

c) 150 KW solar power plant at Vijay Nagar;

d) 50 KW rooftop at Vidyut Bhavan;

e) 16 x 10 Solar power plant at District Hospital for blood bank;

f) 1 MW Solar Roof top plants at different places;

g) Solar Street (LED) Lighting Systems – 16,359 units to be installed in border villages;

h) Solar water pumping systems – 50 units;

i) Unnat Chullah – 2,500 units;

The plan for addition in renewable energy development, including RE generation capacity addition and various other initiatives of the State Nodal Agency over FY16 to FY19 period is shown in Table 42.

7.5. Fund Requirement

DHPD

The DHPD has proposed a total investment of Rs. 1,105 crores over the period FY15 to FY19 for pursuing the proposed capacity addition and R&M works to be commissioned/ completed by FY19. The yearly fund requirement is summarized in Table 43:

Table 42: Capacity Addition plan in RE for Arunachal Pradesh

Sl.	Source of Energy	RE Physical Targets					
		Unit	FY 16	FY 17	FY 18	FY 19	Total
A	**Capacity Additions**						
1	Mini/ Small Hydel Projects	MW			3	5	**8**
2	Wind Solar Hybrid System	MW	0.03	0.05	0.1	0.1	**0.28**
3	SPV Power Plant	MW	5.86	0.5	0.5	0.5	**7.36**
4	Wind Farm	MW		4.5			**4.5**
	Total Addition in Grid	**MW**	**5.89**	**5.05**	**3.6**	**5.6**	**20.14**

Sl.	Source of Energy	RE Physical Targets					
		Unit	FY 16	FY 17	FY 18	FY 19	Total
B	**Others**						
1	Water Mill	No's	10	10	20	30	**70**
2	Family type biogas plant	No's	100	100	100	150	**450**
3	Solar Street Lighting Systems	No's	4,090	4,090	4,090	4,089	**16,359**
4	Solar Water Pumping System	No's	10	10	10	20	**50**
5	House Hold – Unnat Chulha	No's	500	500	500	1,000	**2,500**

Table 43: DHPD's Proposed Investment Plan (Rs. Cr.)

Description	FY16	FY17	FY18	FY19	Total
Projects under Construction (Group 1)	37	119	122	35	313
Projects under development stage (Group 2)	0	207	354	108	669
Survey & investigation – new sites	1	4	3	-	9
R&M	69	20	17	8	114
Total DHPD Fund Requirement	107	350	497	151	1,105

The R&M works proposed by the DHPD are proposed to be funded with 26% support from MNRE and the rest 74% from the State Government.

DHPD has planned to avail funding support from the State Government and various applicable schemes of the MNRE to meet its proposed investment requirements.

In addition to above DHPD is also working on preparation of DPRs for 89 SHPs as off-grid systems with a cumulative capacity 35.82 MW in various districts of the state. The total fund requirement of these projects including associated evacuation systems is about Rs. 767 Cr.

APEDA

APEDA's proposed solar based projects, including setting-up of solar power projects, with a projected capital expenditure of Rs. 199 Cr. whereas, the wind and biogas projects are planned at Rs. 31 Crs. The total layout of the RE investment plan is Rs. 319 Cr. The year wise plan of proposed investment by the APDEA is shown in Table 44.

APEDA has proposed to meet the projected funding requirement through assistance from the Central and State Governments, in the ratio 51%:49%, as per the schedule shown in Table 45.

Table 44: APEDA's Proposed Investment Plan (Rs. Cr.)

Description	FY16	FY 17	FY 18	FY 19	Total
Mini and Small Hydel projects , S&I of MHP and Water Mills	14.27	44.2	37.32	15.45	111.24
SPV Program	45.07	13.9	13.9	14.56	87.43
Wind Projects	7.29	7.29	7.29	7.29	29.16
Other Biogas Plants	0.5	0.5	0.5	0.5	2
Total	**67.13**	**65.89**	**59.01**	**37.8**	**319**

Table 45: APEDA's Proposed Funding Plan (Rs. Cr.)

Description	FY16	FY 17	FY 18	FY 19	Total
Central Government	20.95	53.30	49.79	38.63	162.71

Description	FY16	FY 17	FY 18	FY 19	Total
State Government	20.12	51.21	47.83	37.12	156.33
Total	**41.07**	**104.50**	**97.62**	**75.75**	**319.04**

Table 46: Action Points for RE Plan

Stakeholder	Action Points
State Government	• State Government to arrange funding towards R&M projects of DHPD • Arranging counterpart funding for APEDA projects including equity for 4.5 M
DHPD	• The DHPD and APEDA shall plan for RE capacity additions beyond FY19 in accordance with MNRE capacity addition targets for the period up to FY22 • Preparation of DPRs for 89 SHPs (35.82 MW) by December 2016 • Prepare physical and financial roll out plan of 89 SHPs by December 2016
MNRE/GoI	• Explore funding options for development of 89 SHPs for off-grid electrification.

8. Energy Efficiency Plan

8.1. Introduction

This chapter highlights the ongoing and proposed energy efficiency and DSM measures by in the State of Arunachal Pradesh along with an estimation of the anticipated benefits, funding requirement, action plan and support required etc.

APEDA is the designated SNA and SDA for RE/ EE in the State of Arunachal Pradesh. The State has constituted Arunachal Pradesh State Energy Conservation Fund (APSECF) as per the provisions of EC Act, 2001. Further, a State Level Steering Committee headed by the secretaries of Power, Planning and Finance has been formed to provide guidance, support and approve the annual budgets for carrying out the Energy Conservation Activities by the SDA.

8.2. Proposed schemes

Table 47 shows the proposed schemes in the areas of Energy Efficiency by the State:

Table 47: Proposed and ongoing Activities of EE in the state

Activity	Details
Mandatory Notifications	• Mandatory use of energy efficient lighting systems in Government Buildings and villages. • Mandatory Use of Star Labelled room air conditioners and frost free refrigerators in Govt. buildings/Govt. aided institutions and bodies, Boards, Corporations.
LED based Solar Street Lighting System-	• APEDA has proposed to install 16,359 Solar based LED Street Lamps in border areas, the detailed plan regarding the same has already been covered in the RE Chapter.
DSM measures at consumer end	• Replacement of incandescent lamps by LED/CFL at subsidized rates, as per the Domestic Efficient Lighting Program (DELP) scheme being undertaken with support from EESL in various other states of the country. • APEDA proposes to replace 60 W Incandescent bulbs with 8,61,184 nos. of 8W LED bulbs in 79070 nos.of rural households of Arunachal Pradesh and for Urban area it proposes to replace 20W CFL by 3,16,280 nos.of 12W LED bulbs
DSM at the utility	• Smart meters and energy efficient transformers are planned to be used in future investment plans of the APEDA. The cost benefit analysis of the same shall be carried out and submitted to the APSEC for necessary approvals.

8.3. DELP Program

Penetration of energy efficient lighting systems in HH sector is constrained by initial high cost barrier. The incandescent lamps are available at Rs. 10-15 per unit while LED based lamps cost around Rs. 400 – Rs. 500 per unit. EESL has developed and implemented a scheme called Domestic Efficient Lighting Program (DELP) to provide energy efficient LED lighting fixtures to grid-connected consumers in the domestic sector across several states in the country. LED bulbs are given to HHs at an affordable price to encourage investments in EE. The large-scale replacement of incandescent lamps with LEDs results in significant savings in peak power for distribution licensees and also helps HHs in lowering their electricity consumption.

The DELP scheme is supported by an independent mechanism for monitoring and verification of savings.

A 7 Watt LED can replace a 60 Watt incandescent lamp and a 14 Watt CFL. Through distribution of 2 LEDs under DELP in the HH sector of Arunachal Pradesh considering all domestic consumers avail of the scheme, the estimated overall reduction of demand is estimated at 10.27 MW and the annual energy savings are estimated at 13.12 MU. The scheme is expected to result in an annual power procurement cost reduction of Rs. 4.86 Crs.

DOPAP may consider carrying out the load research activities funded by BEE under capacity development of utilities to identify the energy savings potential of the state. Further, the department is expected to consider proposals made by EESL towards national level DSM measures like DELP.

Coverage

- 1.71 lakh Domestic consumers covered under this scheme

Scheme

- To provide two LEDs of 7 W to each participating consumer

Benefits

- Annual savings of 13.12 MU which may save Rs 4.86 Cr.

9. Financial Position of utilities

9.1. Introduction

DoPAP functions as a vertically integrated utility for the State of Arunachal Pradesh. The DoPAP operates as a State Government Department and maintains its financial statements in Annual Resource Plan formats, as applicable to such Departments, and is on cash basis only. Due to this reason the losses/ gap reflected in the ARP statements of the DoPAP do not reflect its true performance on commercial accounting principles.

The DoPAP's estimated financial losses for FY15 have been Rs. 39.74 Cr and the accumulated losses are estimated around Rs. 1,897.57 Cr at the end of FY15.

Apart from the operational inefficiencies, the majority of financial losses are due to significantly high AT&C losses of over 63%, which is more than twice as much as the national average. The commercial position of DoPAP is further affected by inadequate tariff hikes and high level of disallowances in ARR/ tariff approvals. The following sections discuss in detail, the commercial viability of the DoPAP under the current circumstances and the impact of the investments proposed under the 24X7 PFA Roadmap.

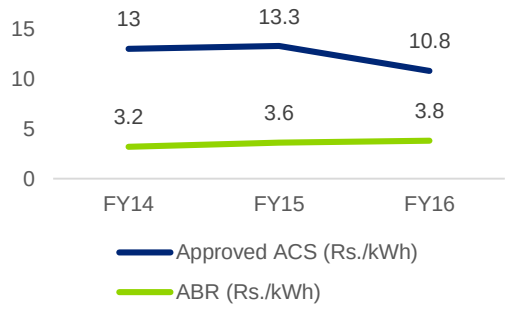
9.2. Commercial Viability

On one hand the DoPAP is faced with an abnormally high Cost of Supply (CoS) due to higher asset and employee base in relation to the energy sales volumes handled by it, on the other hand the retail tariff levels are abysmally low, thereby leaving it a wide revenue gap. The gap between the approved CoS and the retail tariff has remained above Rs. 7/ kWh over the last three years. It is pertinent to note that the CoS and realization shown in Figure 14 are as approved by the APSERC, the actual CoS and therefore the actual gap is even higher.

Continuance of high levels of AT&C losses has been one of the major contributors to the poor financial viability of the DoPAP. According to the latest tariff order issued by APSERC, the average cost of supply for FY16 is Rs. 10.83 /kWh as against the proposed CoS of Rs. 23.65 / kWh by the DoPAP. In contrast, the average billing rate is merely Rs. 3.8 /kWh Indicating a gap of 70%. There is a regulatory gap (on approved ARR) of Rs. 281.01 Cr. for FY16 vis-à-vis the proposal submitted by the DoPAP.

Going forward, during the period from FY16 to FY19, owing to significant planned electrification, the volume of energy handled is expected to increase from 677 MU in FY15 to 1,310 MU in FY19. As the energy handled increases, the T&D loss levels approved and achieved will be a key factor in ensuring viability of the utility.

Figure 14: ACS vs ABR (Rs./kWh)



9.3. Financial Performance

Since DoPAP operates as a department within the Govt. of Arunachal Pradesh, the system of account keeping is on cash basis. Accordingly,

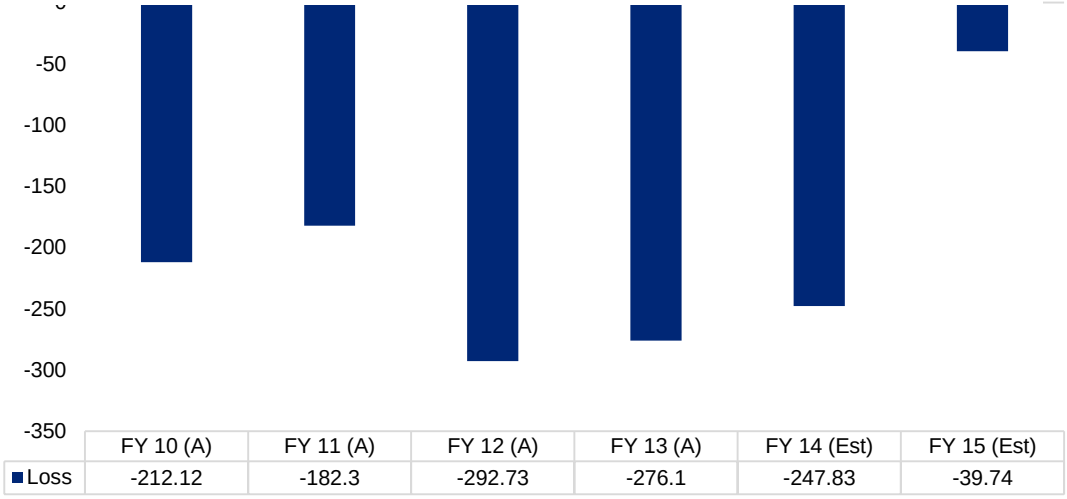
commercial accounts on accrual basis comprising of statements such as balance sheet, profit & loss, cash flow etc. are not maintained by the DoPAP.

DoPAP being a State Government Department, does not maintain financial accounts, the financial analysis is of the department is being done solely based on the ARP and ARR/ tariff petitions filed by the DoPAP, ARR/ Tariff Orders approved by the APSERC and the available Annual Resource Plans.

As per the ARP statements, DoPAP has posted net deficit for last 5 financial years, as presented in Figure 15. The annual net deficit posted by the DoPAP has reduced over past few years. Current estimate of the net deficit for FY15 is at Rs 39.74 Cr.

In order to estimate the impact of PFA program on the financials of the DoPAP, it is pertinent to assess the incidental cost of the program vis-à-vis the potential of generating additional revenue due to increase in energy sales. As the DoPAP 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 impact of PFA program on tariff as well as financials of the DoPAP. The underlying assumptions outlined inTable 48 form the basis for such projections.

Figure 15: Net Revenue Deficit (Rs. Cr.) FY10-15



	FY 10 (A)	FY 11 (A)	FY 12 (A)	FY 13 (A)	FY 14 (Est)	FY 15 (Est)
Loss	-212.12	-182.3	-292.73	-276.1	-247.83	-39.74

Table 48: Key Common Assumptions underlying financial analysis

Particulars	Assumptions
Power purchase	• The allocation from the Central Generating Stations shall remain at current levels over the period of projection. • Commissioning of new plants in State sector assumed as per State's projections • Commissioning of new plants of central sector as per CEA's projections • Any shortfall in energy available during the four year's period is expected to be met through medium term and short term power purchase with a limit of 10% of total power purchase portfolio for short term power purchase
Power Purchase Rate	• Power purchase rate for existing sources based on the actual power purchase rate for FY15 • Transmission charges are included in the power purchase rate as provided by utility. • Power purchase rate from upcoming plants considered at Rs. 4.5/kwh for thermal, Rs. 4/kwh for Hydro and Rs. 6/kWh for solar and cost of upcoming state sector plants is considered to be nil as suggested by the DoPAP. Also cost of 12% power received from IPPS is also not considered as it is free power received by State as royalty.
Sales growth and revenue	• Sales growth of domestic consumer is based on the increase in per HH per day consumption for Rural and Urban HHs, electrification of un-electrified HHs and newly constructed HHs in the State. • Energy sales growth of other than domestic consumers is considered at 10% YoY and for FY 16 to FY 18 and additional 2% in FY 19. • The average billing rate (ABR) for different consumer categories has been considered based on the actual ABR for FY15, as per annual accounts available in the resource plan. • Other income considered to have annual increase of 5% on baseline of FY15.
AT&C losses	• T&D loss projections, including intra-state transmission losses, as per MoP targets (39% AT&C loss by FY19). • Collection efficiency trajectory, as provided by the utility, expected to reach 86% by FY19.
Employee cost, R&M, A&G costs	• Employee expenses and A&G cost, escalated at a rate of 10.0% and 6%, respectively for FY16 onwards based on CPI and WPI index. • R&M cost for existing assets based on the actual percentage of GFA as per past year. • R&M cost for new assets as 1% of GFA.
Depreciation	• Depreciation for existing assets based on the existing actual depreciation • Depreciation for new assets based on DOPAP rate of 5.28%p.a.
Capex & capitalization	• Capex as per budgeted plans of the utility • Capitalization within two years (60% in first and 40% in second year)
Funding of capex, debt and equity	• Approved grants under various schemes are considered for funding of capital expenditure. • For un-approved part of capital expenditure schemes, funding by way of debt and equity in the ratio of 70:30 has been considered. • Debt repayment schedule of 10 years with 14.75% annual rate of interest • Existing debt has been considered, in line with the tariff order of FY16
Working capital and interest	• Working capital as per regulatory provisions • Working capital loan assumed at 14.75%
Past Losses	• The accumulated losses have not been considered for recovery in the financial projections.
Financial Statements	• Presently, DoPAP financial statements for FY14 or FY15 are not available as financial accounts have not been prepared. • The profit and loss statement has been prepared based on projected energy requirement and power purchase cost as per energy availability. Other items have been calculated by escalating past values of FY15.

Considering the assumptions in Table 48, the impact of PFA program on the overall financial health of the DoPAP can be gauged from the impact on tariff due to incidental power purchase and additional capital expenditure to be incurred. The details of additional capital expenditure, sources of funding and incidental costs of such expenditure are provided in

Table 49.

The DoPAP has prepared capital expenditure plans according to the need and adequacy of network for achieving the HH electrification and consumption targets set under the 24X7 PFA roadmap. The base case assumes that the funding from State/ Central Government Schemes in the form of grants will be available but for any unapproved Scheme, the DoPAP will arrange its own funds by means of borrowings from banks, including NBFCs, commercial and multilateral institutions. The debt to equity ratio is considered to be 70:30, considering that the DoPAP will be able to arrange equity from the State Government.

In addition to above, the DoPAP is eligible for additional grant of 50% of the debt portion in case it achieves milestones as listed in the respective schemes. The capital expenditure related cost, other revenue and expenditure related parameters considered for base case are summarized in Table 50.

Based on the parameters outlined, the incidental cost of providing additional power and revenue generated due to increase in energy sales, is estimated to assess the likely impact of PFA program on the tariff in the State, as summarized in Table 51.

The impact on tariff due to PFA capital expenditure is expected to be in the range of (0.17) Rs./kWh in FY16 to (0.33) Rs./kWh in FY19.

For the base case, the profit and loss statement of DoPAP has been prepared considering that the existing power purchase cost and existing tariff shall remain at the present levels only, while the impact of additional capital expenditure and the increase in O&M cost as per the assumptions in Table 48 is being considered

Table 49: Impact of Asset Additions (Rs. Crs.)

Particulars	FY16	FY17	FY18	FY19
Capital expenditure		830	488	75
Grants		756	404	25
Debt		74	61	28
Equity	-	-	23	23
Incidental cost of capital expenditure due to PFA				
Depreciation on additional assets	-	1	4	8
Interest on debt – corresponding to PFA capex	-	5	13	18
Return on equity - corresponding to PFA capex	-	-	2	5
Total capex related Cost	**-**	**6**	**20**	**31**

Table 50: Parameters for Base Case

Particulars	Units	FY16	FY17	FY18	FY19
Energy related parameters					
Energy requirement	MU	820	669	790	904
Sales	MU	352	428	529	642
Distribution losses	%age	57.01%	36.00%	33.00%	29.00%
AT&C Losses	%age	64.00%	46.26%	42.76%	39.26%

Particulars	Units	FY16	FY17	FY18	FY19
Average Power purchase cost (inc transmission charges)	Rs./kWh	2.98	3.07	2.85	2.48
Revenue & expenditure parameters					
Tariff Increase	%age	0.0%	0.0%	0.0%	0.0%
Collection efficiency	%age	83.7%	84.0%	85.4%	85.5%
Average billing rate - Domestic	Rs./kWh	4.84	4.84	4.84	4.84
Average billing rate - Other than domestic (weighted avg.)	Rs./kWh	4.99	4.99	4.99	4.99
Employee cost escalation	%age	10.0%	10.0%	10.0%	10.0%
A&G cost escalation	%age	6.0%	6.0%	6.0%	6.0%

Table 51: Impact on tariff due to PFA

Particulars	Derivation	FY 16	FY 17	FY 18	FY 19
Additional recovery due to incremental energy sales (Rs. Cr.)	A	0	37.01	86.29	141.23
Incremental power purchase cost (inc. transmission charges and incremental transmission cost due to PFA program (Rs. Cr.)	B	(6.32)	(11.04)	52.12	91.32
Add: Cost related to capital expenditure (interest, depreciation and equity return, Rs. Cr.)	B1	0	6.09	19.55	31.19
Gap of additional cost and additional recovery	C=(B+B1-A)	(6.32)	(41.96)	(14.61)	(18.72)
Energy sales (MU)	D	366.93	418.73	485.89	568.04
Impact on tariff (Rs./kWh)	**CX10/D**	(0.17)	(1.00)	(0.30)	(0.33)

Table 52: Projected profit and loss statement – Base Case (Rs. Cr.)

Profit and Loss statement	Projected			
	FY16	FY17	FY18	FY19
Revenue				
Revenue from Sale of Power	174	211	260	315
Revenue from Sale of Power outside State	-	41	95	161
Others	1	1	1	1
Total revenue	**174**	**253**	**355**	**477**
Expenditure				
Power Purchase cost	248	244	307	346
O&M Cost	247	268	293	320
Employee cost	215	236	260	286
A&G expenses	2	2	2	2
R&M expenses	30	30	31	32
Fuel cost	6	6	6	7
EBIDTA	**(326)**	**(265)**	**(250)**	**(195)**
Depreciation	150	266	301	326
Interest and finance charges	8	198	269	311
PBT	(484)	(432)	(431)	(388)
Provision for tax	-	-	-	-
PAT	**(484)**	**(432)**	**(431)**	**(388)**

As can be seen in the P&L statements the financial losses are likely to remain in the range of Rs. 388 - 484 Cr.over the period of FY16 to FY19.

9.4. Scenario Analysis

Any change in tariff or under achievement of AT&C loss trajectory 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 DoPAP. Therefore, the following three scenarios have been analyzed.

a) Increase in tariff to ensure that DoPAP becomes viable by FY19;

b) 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; and

c) Under achievement of AT&C loss targets: Only 2% annual reduction in T&D losses to reach AT&C loss level of 42.86% in FY19.

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

Table 53 summarizes the key parameters considered for scenario 1.

In order to achieve financial viability by FY19, the utility requires an annual tariff increase an annual tariff increase from the current level of 5.4 Rs./kWh to 8.2 Rs./kWh by FY19. The resultant P&L account under this scenario is presented in following Table 54.

.

Table 53: Parameters for Scenario 1 (Tariff increase)

Particulars	Units	FY16	FY17	FY18	FY19
Energy related parameters					
Energy requirement	MU	820	669	790	904
Sales	MU	352	428	529	642
Distribution losses	%age	57.01%	36.00%	33.00%	29.00%
AT&C Losses	%age	64.00%	46.26%	42.76%	39.26%
Average Power purchase cost (inc transmission charges)	Rs./kWh	2.98	3.07	2.85	2.48
Revenue & expenditure parameters					
Tariff Increase	%age	0.0%	0.0%	51.0%	51.0%
Collection efficiency	%age	83.7%	84.0%	85.4%	85.5%
Average billing rate - Domestic	Rs./kWh	4.84	4.84	7.30	11.03
Average billing rate - Other than domestic (weighted avg.)	Rs./kWh	4.99	4.99	7.54	11.38
Employee cost escalation	%age	10.0%	10.0%	10.0%	10.0%
A&G cost escalation	%age	6.0%	6.0%	6.0%	6.0%

Table 54: Profit and Loss statement - Scenario 1

Profit and Loss statement	Projected			
	FY16	FY17	FY18	FY19
Revenue				
Revenue from Sale of Power	174	211	393	719
Revenue from Sale of Power outside State	-	41	95	161
Others	1	1	1	1
Total revenue	**174**	**253**	**488**	**880**

Profit and Loss statement	Projected			
	FY16	FY17	FY18	FY19
Expenditure				
Power Purchase cost	248	244	307	346
O&M Cost	247	268	293	320
Employee cost	215	236	260	286
A&G expenses	2	2	2	2
R&M expenses	30	30	31	32
Fuel cost	6	6	6	7
EBIDTA	**(326)**	**(265)**	**(118)**	**208**
Depreciation	150	266	301	326
Interest and finance charges	8	198	269	311
PBT	(484)	(432)	(302)	6
Provision for tax	-	-	-	-
PAT	**(484)**	**(432)**	**(302)**	**4**

Scenario 2: Non-Availability of grants (funding of capital expenditure through debt and equity)

The dependence of DoPAP on funding of the proposed schemes through various State/ Central government schemes can be assessed by the impact on utility's finances if grant funding is not available. In order to assess the impact on tariff in case of non-availability of grants from the upcoming Central Government schemes including IPDS and DDUGJY and various other schemes, the total grant availability has been considered as nil. Table 55 summarizes the key parameters underlying the analysis.

As the burden of arranging the funds for capital expenditure in form of commercial borrowings and equity contribution increases, the financial position of utility is likely to see an adverse impact. Table 56 presents the projected profit and loss statement for DoPAP under this scenario.

As can be seen in following tables, the annual financial losses of DoPAP is expected to increase to Rs. 456 Cr. in FY19 as against Rs. 388 Cr. under the base case.

Further, as the utility's cost of funding increases due to un-availability of grants, the required annual tariff increase to achieve financial viability is likely to be from the current level of 5.4 Rs./kWh to 8.5 Rs./kWh by FY19 as against annual tariff increase of 5.4 Rs./kWh to 8.2 Rs./kWh by FY19 required in base case.

Table 55: Parameters for Scenario 2 (Non-Availability of grants)

Particulars	Units	FY16	FY17	FY18	FY19
Energy related parameters					
Energy requirement	MU	820	669	790	904
Sales	MU	352	428	529	642
Distribution losses	%age	57.01%	36.00%	33.00%	29.00%
AT&C Losses	%age	64.00%	46.26%	42.76%	39.26%
Average Power purchase cost (inc transmission charges)	Rs./kWh	2.98	3.07	2.85	2.48
Revenue & expenditure parameters					
Tariff Increase	%age	0.0%	0.0%	0.0%	0.0%
Collection efficiency	%age	83.7%	84.0%	85.4%	85.5%
Average billing rate - Domestic	Rs./kWh	4.84	4.84	4.84	4.84

Particulars	Units	FY16	FY17	FY18	FY19
Average billing rate - Other than domestic (weighted avg.)	Rs./kWh	4.99	4.99	4.99	4.99
Employee cost escalation	%age	10.0%	10.0%	10.0%	10.0%
A&G cost escalation	%age	6.0%	6.0%	6.0%	6.0%

Table 56: Profit and Loss statement - Scenario 2 (Rs. Cr.)

Profit and Loss statement	Projected			
	FY16	FY17	FY18	FY19
Revenue				
Revenue from Sale of Power	174	211	260	315
Revenue from Sale of Power outside State	-	41	95	161
Others	1	1	1	1
Total revenue	**174**	**253**	**355**	**477**
Expenditure				
Power Purchase cost	248	244	307	346
O&M Cost	247	270	296	324
Employee cost	215	236	260	286
A&G expenses	2	2	2	2
R&M expenses	30	32	35	37
Fuel cost	6	6	6	7
EBIDTA	**(326)**	**(267)**	**(254)**	**(200)**
Depreciation	150	266	301	326
Interest and finance charges	8	198	269	311
PBT	(484)	(458)	(491)	(456)
Provision for tax	-	-	-	-
PAT	**(484)**	**(458)**	**(491)**	**(456)**

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

One of the key assumptions in the base case analysis, scenario 1 and scenario 2 is the achievement of AT&C loss trajectory by the utility. However, in case the utility misses T&D loss reduction and achieves only 2% yearly reduction to reach at T&D loss level of only 46% by FY19, the impact on financial position is going to be significant. Table 57 summarizes the key parameters underlying the analysis of Scenario 3.

It may also be important to note that in this scenario, the capital expenditure is assumed to be funded through grants and unapproved part through debt and equity.

As can be seen Table 58, the annual financial losses of utility are expected to increase to nearly Rs.521 Cr. in FY19 vis-à-vis Rs. 388 Cr. in FY19 under base case, thus emphasizing the need for focusing on reduction in AT&C losses

Table 57: Parameters for Scenario 3 (Under-achievement of T&D losses)

Particulars	Units	FY16	FY17	FY18	FY19
Energy related parameters					
Energy Requirement	MU	820	952	1,126	1,310
Sales	MU	352	428	529	642
Distribution losses	%age	57.01%	55.01%	53.01%	51.01%

Particulars	Units	FY16	FY17	FY18	FY19
AT&C Losses	%age	64.00%	62.22%	59.85%	58.09%
Average Power purchase cost (inc transmission charges)	Rs./kWh	2.98	3.07	2.85	2.48
Revenue & expenditure parameters					
Tariff Increase	%age	0.0%	0.0%	0.0%	0.0%
Collection efficiency	%age	83.7%	84.0%	85.4%	85.5%
Average billing rate - Domestic	Rs./kWh	4.84	4.84	4.84	4.84
Average billing rate - Other than domestic (weighted avg.)	Rs./kWh	4.99	4.99	4.99	4.99
Employee cost escalation	%age	10.0%	10.0%	10.0%	10.0%
A&G cost escalation	%age	6.0%	6.0%	6.0%	6.0%

Table 58: Profit and Loss statement - Scenario 3 (Rs. Cr.)

Particulars	Units	FY16	FY17	FY18	FY19
Revenue					
Revenue from Sale of Power	Rs. Cr.	174	211	260	315
Revenue from Sale of Power outside State	Rs. Cr.	-	-	-	27
Others	Rs. Cr.	1	1	1	1
Total revenue	**Rs. Cr.**	**174**	**211**	**261**	**343**
Expenditure					
Power Purchase cost	Rs. Cr.	248	305	324	346
O&M Cost	Rs. Cr.	247	268	293	320
Employee cost	Rs. Cr.	215	236	260	286
A&G expenses	Rs. Cr.	2	2	2	2
R&M expenses	Rs. Cr.	30	30	31	32
Fuel cost	Rs. Cr.	6	6	6	7
EBIDTA	**Rs. Cr.**	**(326)**	**(368)**	**(362)**	**(329)**
Depreciation	Rs. Cr.	150	266	301	326
Interest and finance charges	Rs. Cr.	8	198	269	311
PBT	Rs. Cr.	(484)	(533)	(541)	(521)
Provision for tax	Rs. Cr.	-	-	-	-
PAT	**Rs. Cr.**	**(484)**	**(533)**	**(541)**	**(521)**

9.5. Actions Points for GoAP/ DoPAP

The action points listed below, are suggested for ensuring long-term financial viability of the power sector in the State of Arunachal Pradesh:

a) Corporatization of DoPAP is a must for enthusing commercial accounting practices. Commercial accounting will ensure reflection of true financial/ viability position of the utility and will also be helpful in making reliable information in ARR/ Tariff petitions to the APSERC. Given the Arunachal Pradesh is amongst the last states to undertake structural reforms it is recommended that the State should take all necessary steps for implementing the same within the next 6 months. The State may make use of PFC's vast experience in helping States/ SEBs in undertaking such exercises.

b) While full financial independence should be the ultimate goal, the current level of gap between CoS and ARR makes it difficult to achieve the same in the immediate to medium term. The utility,

in all likelihood, continue to rely on State Support for meeting its expenses. It is proposed that a mechanism be developed for fare, transparent and upfront determination of revenue gap funding by the State before the commencement of each financial year.

c) The proposed free share of power from upcoming hydro projects in the State holds promise for making the sector a net contributor to its ex-chequer. The State may consider evolving institutional and transactional structures for future trading of such surplus power proceeds from which can then be partially used for limiting the CoS/ ARR for energy sold to consumers within the State

10. Roll Out Plan

Particular	Unit	Existing ending	Year wise addition				Total
		FY 15	FY 16	FY 17	FY 18	FY 19	Till FY19
GENERATION							
State (RE)	MW	66.0	2.6	13.6	22.1	63.9	168.2
Thermal (Central)	MW	43.0	73.5	73.5	73.5	73.5	337.1
Hydro	MW	98.0	85.4	106.7	106.7	178.8	575.5
Other RE		0.0	0.9	2.7	5.0	8.2	16.9
Total IC including Allocation	**MW**	**207.0**	**162.4**	**196.5**	**207.4**	**324.4**	
Peak Demand	**MW**	155	178	159	185	210	
TRANSMISSION							
Grid Substations (Nos)	**No.**	7	8	6	10		31
Intra-State Lines addition							
132 KV	**cKm**	184	383.4	383.4	575.1	575.1	2,101
Total	**cKM**						-
Intra-State Capacity Addition							-
132 KV	**MVA**	167	105.8	105.8	158.7	158.7	696
Total	**MVA**		**106**	**106**	**159**	**159**	529
DISTRIBUTION							
33 kV Line	**Ckt Kms**	4,516	403.1	1194.2	587.7	0	6,701
33 kV SS	**MVA**	243	94.04	235.10	141.06	0	713
33 kV SS	**No's**	81	15.60	38.50	23.90	0	159
11 kV Lines	**Ckt Kms**	19,026	25	203	25	0	19,280
DT	**No's**	5,507	29	234	29	0	5,800
DT	**KVA**	270	2.6242	20.9936	2.6242	0	296
LT Lines	**Ckt Kms**	10,550	18	148	18	0	10,735

10.1. Monitoring of PFA 24X7

A strong monitoring framework is essential to ensure the success of "Power for All" scheme. The following structure shown in Table 59.

Table 59 is being proposed to undertake regular monitoring of the progress of all initiatives being undertaken in this Roadmap.

Table 59: Institutional arrangement for monitoring 24x7 PFA scheme

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

11. Annexure

Annexure 1:List of exsiting DHPL hydel Plants

Sl.	Name of Hydel	Installed capacity (in kW)
1	Kitpi Ph-I	1,500
2	Nuranang	6,000
3	T.Gompa	50
4	Chellankang Ph-I MHS	30
5	Bramdhongchung Ph-I	100
6	Shakti Nallah	100
7	Kitpi MHS Ph-II	3,000
8	Chellengkang Ph-II	30
9	Bongleng	100
10	Thimbu	100
11	Bramdhongchung Ph-II	100
12	Tsechu Nallah	100
13	Khet	100
14	Mago MHS	100
15	Rahung	750
16	Dirang	2,000
17	Sessa	1,500
18	Rupa	200
19	Dokumpani	30
20	Domkhrong	2,000
21	Sinchung	50
22	Ankaling	30
23	Dikshi	30
24	Khadiyabey	200
25	Saktangrong MHS	300
26	Seppa	300
27	Pakke Kessang	30
28	Pacha MHS	3,000
29	Pakoti	100
30	Patta Nallah	100
31	Watte Mame	50
32	Kade Nallah	50
33	Patte MHS at Tali	30
34	Koye	50

Sl.	Name of Hydel	Installed capacity (in kW)
35	Chambang	30
36	Paya MHS at Hiya	100
37	Pappey Nallah	10
38	Mai PH-I	2,000
39	Mai PH-II	1,000
40	Tago	4,500
41	Dulom (Daporijo)	400
42	Maro	30
43	Sippi	4,000
44	Siyum MHS	30
45	Ayingmuri	250
46	Limeking	30
47	Pinto Karo MHS	30
48	Sikin Koro	200
49	Sinyum Koro	100
50	Kojin Nallah	100
51	Pagi(Basar)	100
52	Along	300
53	Ego-Echi (Dali)	400
54	Mechuka	150
55	Yomcha	50
56	Beye	30
57	Kambang	6,000
58	Liromoba	2,000
59	Yingko Sikong at Rapum	50
60	Angu	50
61	Solegomang MHS	50
62	Borung MHS	50
63	Siri Korang	500
64	Yingkiong Ph-I	150
65	Yingkiong Ph-II	200
66	Sikut/Tuting	100
67	Selli at Geku	500
68	Pangkang	125
69	Sirnyuk	2,000
70	Kopu at Tuting	250
71	Silingri	50
72	Singa	30
73	Ngaming	50
74	Sika	15
75	Mayung	5
76	Gosang	500
77	Kote MHS	50
78	Sijen MHS at Adi pasi	50

Sl.	Name of Hydel	Installed capacity (in kW)
79	Pyabung MHS	25
80	Pasighat	200
81	Yembung	2,000
82	Silli	30
83	Rina	2,000
84	Deopani Ph-I	750
85	Deopani Ph-II	750
86	Abhapani	450
87	Theya Ahfra	30
88	Anini/ Awapani Ph-I	150
89	Anini/ Awapani Ph-II	500
90	Awapam	500
91	Tah Ahfra Ph-I & Ph-II	100
92	Chini Afra	250
93	Echi Ahfra	400
94	Echito Nallah	40
95	Rupapani	40
96	Chu Nallah	30
97	Doora Nallah	500
98	Tafragram	250
99	Tissue	400
100	Jongkey Nallah	25
101	Ngonalo at Vijaynagar	100
102	Tinning	60
103	Chicklong	150
104	Thiratju	1,000
105	Charju	600
106	Sumhok Nallah	100
107	Tahin Nallah	100
108	Kaho	10
109	Kebitho	30
110	Mati Nallah	500
111	Yapak Nallah	200
112	Teepani	500
113	Krawti Nallah	100
114	Hathipani	100
115	Tah Nallah	100
116	Maipani	60
117	Ashapani	60
118	Langpani	400
119	Kachopani MHS	200

Annexure 2: Project wise quantum of free power for Arunachal Pradesh

Sl.	Name of Project & IC (MW)	Present I.C. (MW)	Free Power	
A.	**100 MW AND ABOVE**			
I.	**Tawang Basin**			
1	Tawang-I (600 MW)	780.00	12%	93.6
2	Tawang-II (800 MW)	800.00	12%	96
3	Nyamjung chhu (780 MW)	600.00	12%	72
Total		**2,180.00**		**261.6**
II.	**Kameng Basin**			
4	Talong Londa (225 MW)	225.00	14%	31.5
7	Nafra (120 MW)	120.00	12%	14.4
10	Kameng- II (600 MW)	600.00	14%	84
6	Gongri (144 MW)	144.00	12%	17.28
5	Kameng Dam (480 MW)	480.00	14%	67.2
8	Dibbin (120 MW)	120.00	14%	16.8
9	Dinchang (252 MW)	252.00	12%	30.24
11	Utung (100 MW)	100.00	12%	12
12	Kameng (600 MW)	600.00	12%	72
Total		**2,641.00**		**345.42**
III.	**Subansiri Basin / Dikrong Basin**			
13	Kamala (1800 MW)	1,800.00	12%	216
14	Subansiri Lower (2000 MW)	2,000.00	12%	240
15	Subansiri Upper (2000 MW)	2,000.00	12%	240
16	Naba (1000 MW)	1,000.00	12%	120
17	Oju (1800 MW) (Oju-I & Oju-II)	1,800.00	12%	216
18	Nalo (360 MW)	360.00	12%	43.2
19	Dengser (552 MW)	552.00	12%	66.24
20	Niare (800 MW)	800.00	12%	96
21	Ranganadi-I (405 MW)	405.00	12%	48.6
22	Pare (110 MW)	110.00	12%	13.2
23	Kurung Dam	330.00	12%	39.6
Total		**11,157.00**		**1,338.84**
IV.	**Siang Basin**			
24	Siang Lower (2700 MW)	2,700.00	12%	324
25	Siang Upper St-II (3750 MW)	3,750.00	12%	450
26	Yamne St.-I (111 MW)	111.00	12%	13.32
27	Naying (1000 MW)	1,000.00	12%	120
28	Siyom (1000 MW)	1,000.00	12%	120
29	Tato-II (700 MW)	700.00	12%	84
30	Hirong (500 MW)	500.00	12%	60
31	Tato-I (186 MW)	186.00	12%	22.32
32	Heo (240 MW)	240.00	12%	28.8
33	Pauk (145 MW)	145.00	12%	17.4
Total		**10,332.00**		**1,239.84**
V.	**Dibang Basin**			

Sl.	Name of Project & IC (MW)	Present I.C. (MW)	Free Power	
34	Etalin (3097 MW)	3,097.00	12%	371.64
35	Attunli (680 MW)	680.00	12%	81.6
36	Emra-I (275 MW)	275.00	18%	49.5
37	Emra-II (390 MW)	390.00	18%	70.2
38	Amulin (420 MW)	420.00	15%	63
39	Emini (500 MW)	500.00	15%	75
40	Mihumdon (400 MW)	400.00	15%	60
41	Dibang Multipurpose (3000 MW)	3,000.00	12%	360
42	Sissiri (100 MW)	100.00	12.40%	12.4
Total		**8,862.00**		**1,143.34**
VI.	**Lohit Basin**			
43	Kalai-II (1200 MW)	1,200.00	18%	216
44	Demwe Upper (1080 MW)	1,080.00	15%	162
45	Hutong- II (1200 MW)	1,200.00	14%	168
46	Kalai-I (1304 MW)	1,304.00	14%	182.56
47	Anjaw (270 MW)	270.00	15%	40.5
48	Raigam (141 MW)	141.00	12%	16.92
49	Demwe Lower (1750 MW)	1,750.00	15%	262.5
Total		**6,945.00**		**1,048.48**
Total of 100 MW and above(in MW)		**42,117.00**		**5,377.52**
B.	**UP TO 100 MW**			
1	Saskangrong (45 MW)	45.00	12%	5.40
2	Phudung (24 MW)	24.00	10%	2.40
3	Digin (46 MW)	46.00	12%	5.52
4	Meyong (38 MW)	38.00	12%	4.56
5	Nyukcharongchu (96 MW)	96.00	12%	11.52
6	Rho (93 MW)	93.00	12%	11.16
7	Mago Chu (96 MW)	96.00	12%	11.52
8	New Melling (96 MW)	96.00	12%	11.52
9	Jameri (90 MW)	90.00	12%	10.80
10	Khuitam (66 MW)	66.00	12%	7.92
11	Simang-II (66 MW)	66.00	12%	7.92
12	Simang-I(67 MW)	67.00	12%	8.04
13	Pachuk- I (84 MW)	84.00	12%	10.08
14	Tsa - Chu - II (90 MW)	90.00	12%	10.80
15	Pakke Bung-I (40 MW)	40.00	12%	4.80
16	Marjingla (60 MW)	60.00	12%	7.20
17	Pachuk- II (60 MW)	60.00	12%	7.20
18	Tsa-Chu-I Lower (50 MW)	50.00	10%	5.00
19	Marjingla Lower (48 MW)	48.00	12%	5.76
20	Pachuk-II Lower (45 MW)	45.00	12%	5.40
21	Tsa - Chu - I (24 MW)	24.00	12%	2.88
22	Pakke Bung-II (15 MW)	15.00	12%	1.80
23	Pakke Bung -III (24 MW)	24.00	10%	2.40

Sl.	Name of Project & IC (MW)	Present I.C. (MW)	Free Power	
24	Pakke Bung -IV (15 MW)	15.00	10%	1.50
25	Pema selphu (96 MW)	96.00	12%	11.52
26	Rapum (80 MW)	80.00	12%	9.60
27	Kangtangshiri (80 MW)	80.00	12%	9.60
28	Panyor (80 MW)	80.00	12%	9.60
29	Gimliang (80 MW)	80.00	12%	9.60
30	Tidding-I (98 MW)	98.00	12%	11.76
31	Kamlang (24.9 MW)	24.90	10%	2.49
32	Tidding-II (68 MW)	68.00	12%	8.16
33	Sepla (21 MW)	21.00	12%	2.52
34	Pichang (12 MW)	12.00	12%	1.44
35	Tarang Warang (36 MW)	36.00	12%	4.32
36	Tagurshit (74 MW)	74.00	12%	8.88
37	Yamne Stage-II (96 MW)	96.00	12%	11.52
38	Tenga (12 MW)	12.00	12%	1.44
39	Turu (63 MW)	63.00	12%	7.56
40	Par (54 MW)	54.00	12%	6.48
41	Dardu (63 MW)	63.00	12%	7.56
42	Ithun - I (84 MW)	84.00	10%	8.40
43	Ithun - II (48 MW)	48.00	10%	4.80
44	Ithipani (22 MW)	22.00	10%	2.20
45	Pango (96 MW)	96.00	12%	11.52
46	Sippi (96 MW)	96.00	12%	11.52
47	Jidu (92 MW)	92.00	12%	11.04
48	Phanchung (56 MW)	56.00	12%	6.72
49	Papu (90 MW)	90.00	12%	10.80
50	Papu Valley (48 MW)	48.00	12%	5.76
51	Lower Yamne Stage - I (75 MW)	75.00	12%	9.00
52	Lower Yamne Stage - II (87 MW)	87.00	12%	10.44
53	Tirap (45 MW)	45.00	12%	5.40
54	Taiyong (56 MW)	56.00	12%	6.72
55	Adum Panyor (25 MW)	25.00	12%	3.00
56	Pareng (14.5 MW)	14.50	10%	1.45
57	Tagurshit Stage-II (27.5 MW)	27.50	12%	3.30
58	Badao (70 MW)	70.00	12%	8.40
59	Para (55 MW)	55.00	12%	6.60
60	Lachung (41 MW)	41.00	12%	4.92
61	Rebby (31 MW)	31.00	12%	3.72
62	Keyi (23 MW)	23.00	5%	1.15
63	Ankaling (18 MW)	18.00	8%	1.44
64	Dikshi (24 MW)	24.00	12%	2.88
65	Siken (8 MW)	8.00	2.50%	0.20
66	Rego (70 MW)	70.00	12%	8.40
67	Panyor Lepa Middle (21 MW)	21.00	10%	2.10

Sl.	Name of Project & IC (MW)	Present I.C. (MW)	Free Power	
68	Dibri (3.2 MW)	13.40	5%	0.67
69	Papumpam (21 MW)	21.00	10%	2.10
70	Pein (10 MW)	10.00	2.50%	0.25
71	Rima (8 MW)	8.00	5%	0.40
72	Pitgong-I (15 MW)	15.00	10%	1.50
73	Pitgong-II (10 MW)	10.00	8%	0.80
74	Upper Ngorgum (9 MW)	9.00	8%	0.72
75	Dengzi (18 MW)	18.00	10%	1.80
76	Lower Ngorgum (18 MW)	18.00	10%	1.80
77	Simen (21 MW)	21.00	10%	2.10
78	Sichi (24 MW)	24.00	12%	2.88
79	Pacha (18 MW)	18.00	8%	1.44
80	Jaswantgarh Stage-I (4.5 MW)	14.50	10%	1.45
81	Paikangrong (2.4 MW)	2.40	10%	0.24
82	Panyi (24 MW)	24.00	10%	2.40
83	Senkhi (2 MW)	2.00	0%	
84	Palin (6 MW)	6.00	2.50%	0.15
85	Anonpani (23 MW)	23.00	10%	2.30
86	Thingbu Chu (60 MW)	60.00	12%	7.20
87	Chomi (80 MW)	80.00	12%	9.60
88	Chela (75 MW)	75.00	12%	9.00
89	Phurchi (5 MW)	5.00	0%	
90	Pei (5 MW)	5.00	0%	
91	Yammeng (20 MW)	20.00	10%	2.00
92	Ashupani (30 MW)	30.00	12%	3.60
93	Pith (5 MW)	5.00	0%	
94	Papum (15 MW)	15.00	10%	1.50
95	Tengapani(5 MW)	5.00	0%	
Total of up to 100 MW		**4,296.20**		**494.93**

Annexure 3: Details of Existing Intra state transmission system

Existing Intra Transmission System	
Line Name	**Line Length (in ckm)**
132 KV S/C Ziro - Daporijo	87
132 KV S/C Daporijo - Aalo	82
132 KV S/C Lekhi - Itanagar	15
Total	**184**
Sub Station Name	**Capacity (MVA)**
132/33 KV S/S Daporijo	2x5 MVA
132/33 KV S/S Aalo	3x5 MVA

Existing Intra Transmission System	
132/33 KV S/S Pasighat	2x5 MVA
132/33 KV S/S Itanagar	2x20 MVA
132/33 KV S/S Lekhi	(1x20 + 1x15) MVA
132/33 KV Deomali	2x16 MVA
132/33 KV Bhalukpong	1x25 MVA
Total	**167**

Annexure 4: Details of Ongoing CSST&DS

Sl.	Transmission line	Ckt.type	Km.
1	132 KV Niglok - Pasighat New	S/c on D/c	30
2	132 KV Pasighat New (Napit) - Pasighat Old	D/c	15
3	132 KV Khupi - Seppa	S/c on D/c	60
4	132 KV Seppa - Rilo	S/c on D/c	50
5	132 KV Rilo - Sagali	S/c on D/c	55
6	132 KV Sagali - Naharlagun	S/c on D/c	45
7	132 KV Naharlagun - Gerukamukh	S/c on D/c	90
8	132 KV Gerukamukh - Likabali	S/c on D/c	60
9	132 KV Likabali - Niglok	S/c on D/c	75
10	132 KV Deomali - Khonsa	S/c	40
11	132 KV Khonsa - Changlang	S/c	45
12	132 KV Changlang - Jairampur	S/c	60
13	132 KV Jairampur - Miao	S/c	40
14	132 KV Miao - Namsai (PG)	S/c on D/c	45
15	132 KV Tezu (PG) - Halaipani	S/c on D/c	100
16	132 KV Naharlagun - Banderdewa	S/c on D/c	25
17	132 KV Chimpu (Itanagar) - Holongi	S/c on D/c	20
18	132 KV Ziro - Palin	S/c on D/c	50
19	132 KV Palin - Koloriang	S/c on D/c	75
20	132 KV LILO of Daporijo - Along 132kV S/c at Basar	D/c	5
21	132 KV Roing (PG) - Anini	S/c on D/c	125
22	132 KV Along - Kambang	S/c on D/c	40
23	132 KV Kambang -Mechuka	S/c on D/c	130
24	132 KV Along - Yingkiong	S/c on D/c	100
25	132 KV Yingkiong - Tuting	S/c on D/c	125
26	132 KV Ziro (PG) - Ziro New	D/c	2
27	132 KV Tawang - Lumla	S/c on D/c	40
28	132 KV Daporijo - Nacho	S/c on D/c	85
29	132 KV Khonsa - Longding	S/c on D/c	45
30	132 KV Roing - Dambuk	S/c on D/c	40
31	132 KV Passighat Old - Mariyang	S/c on D/c	80
32	132 KV Rilo - Seijosa	S/c on D/c	60
33	132 KV Sappa - bameng	S/c on D/c	60
TOTAL			**1917**

Sl.	Sub-Station	No. of T/F	T/F Capacity (MVA)	Total Capacity (MVA)
New Sub Stations				
1	132/33 Niglok	2	31.5	63
2	132/33 Passighat New (Napit)	2	10	20
3	132/33 Sappa	4	5	15
4	132/33 Rilo	4	5	15
5	132/33 Sagali	4	5	15
6	132/33 Naharlagun	2	31.5	63
7	132/33 Gerukhamukh	4	5	15
8	132/33 Likabali	4	5	15
9	132/33 Khonsa	4	5	15
10	132/33 Changlang	4	5	15
11	132/33 Jairampur	4	5	15
12	132/33 Miao	4	5	15
13	132/33 Halaipani	4	5	15
14	132/33 Banderdewa	2	31.5	63
15	132/33 Holongi	2	10	20
16	132/33 Palin	4	5	15
17	132/33 Koloriang	4	5	15
18	132/33 Basar	4	5	15
19	132/33 Yingkiong	4	5	15
20	132/33 Kambang	4	5	15
21	132/33 Ziro New	4	5	15
22	132/33 Dambuk	4	5	15
23	132/33 Seijosa	4	5	15
24	132/33 Bameng	4	5	15
Augmentation				
1	132/33 Dapirijo	4	5	15

Annexure 5: Approved IPDS parameters

Sl.	Name of Town	33KV line Ckt. KM.	11KV line Ckt. KM.	L.T. line Ckt. KM.	33/11KV S/S		11/0.4KV S/S	
					No	MVA	No	MVA
1	Itanagar	8.50	35.00	45.00	1.00	10.00	47.00	0.00
2	Naharlagun	0.00	71.00	0.00	0.00	0.00	86.00	11.10
3	Seppa	0.00	10.80	5.30	0.00	0.00	15.00	1.30
4	Ziro	0.00	45.15	9.00	1.00	0.00	25.00	3.21
5	Daporijo	0.00	32.00	21.00	0.00	0.00	17.00	2.70
6	Aalo	0.00	12.00	18.40	1.00	0.00	20.00	3.51
7	Pasighat	0.00	26.00	21.60	1.00	2.00	33.00	3.37
8	Tezu	0.00	7.00	8.50	0.00	0.00	7.00	1.10
9	Namsai	0.00	0.00	9.00	0.00	0.00	31.00	1.60
	Total	**8.50**	**238.95**	**137.80**	**4.00**	**12.00**	**281.00**	**27.89**

Annexure 6: Equity Share

Sl.	Name of HEP	Installed capacity (MW)	Estimated cost (Rs. In Crore)	State Equity Share	Tentative amount of State Equity (Rs. In Crore)
1	Gongri	144	1,436.27	26%	112.03
2	Nafra	120	848.22	26%	66.16
3	Demwe Lower	1,750	13,144.91	26%	838.00
4	Dibbin	120	728.54	11%	24.04
5	Nyamjangchu	780	6,268.26	26%	488.92
6	Hirong	500	5,532.63	11%	182.58
7	Tato-II	700	5,616.2	11%	185.33
8	Naying	1,000	9,301.11	11%	306.94
9	Siyom	1,000	12,100.00	11%	399.30
10	Etalin	3,097	25,296.95	26%	1,973.16
11	Siang Lower	2,700.00	19,990.74	11%	659.69
12	Talong Londa	225.00	2,172.88	12%	65.19
13	Siang Upper St-II	3,750.00	30,000	26%	2,340.00
14	Hutong- II	1,200.00	11,490.89	11%	379.20
15	Kalai-I	1,304.00	12,322.34	11%	414.08
16	Kameng- II (Bharali-II)	600.00	1,698.35	11%	56.05
17	Kameng Dam	480.00	3,201.21	11%	105.64
18	Emra-II	390.00	2,564.5	24%	184.64
19	Emra-I	275.00	1,809.50	24%	130.28
20	Kalai-II	1,200.00	10,804.32	24.99%	810.00
21	Amulin	420.00	4,201.68	24.99%	315.00
22	Emini	500.00	5,002.00	24.99%	375.00
23	Mihumdon	400.00	4,001.6	24.99%	300.00
24	Sissiri	100.00	1,614.38	25%	121.25
25	Demwe Upper	1,080.00	6,891.97	26%	537.57
26	Tato-I	186.00	1,057.00	26%	82.45
27	Kamala	1,800.00	6,539.4	26%	510.07
28	Attunli	680.00	2,725.26	26%	212.57
29	Dinchang	252.00	2,212.00	26%	172.54
30	Subansiri Upper	2,000.00	14,545.23	26%	1134.53
31	Heo	240.00	1,558.00	26%	121.52
32	Pauk	145.00	957.00	26%	74.65
33	Anjaw (3rd stage of Demwe)	270.00	2,233.91	26%	174.24
34	Naba	1,000.00	4,399.89	26%	343.19
35	Oju (Oju-I & Oju-II)	1,800.00	14400	26%	1,123.20
36	Dengser	552.00	3,945.09	26%	307.72
37	Niare	800.00	3498.55	26%	272.89
38	Nalo	360.00	2922.14	26%	227.93
39	Kurung	330.00	2640	26%	205.92
Grand Total					16,333.47

Annexure 7: Ongoing CSST&DS-Transmission plan

Sl.	District	Name of Substation	Capacity (MVA)	Length (ckm)
1	Anjaw	Halaipani	5	
2	Anjaw	Hawai	5	30
3	Anjaw	Wallong	5	50
4	Changlang	Changlang	10	
5	Changlang	Diyun	5	45
6	Changlang	Kharsang	5	40
7	Changlang	Khimiyong	5	40
8	Changlang	Manmao	5	25
9	Dibang Valley	Anini	5	
10	Dibang Valley	Etalin	5	
11	East Kameng	Bana	5	2
12	East Kameng	Seijosa	10	
13	East Kameng	Rilo	5	
14	East Kameng	Khenwa	5	25
15	East Kameng	Pipu	5	30
16	East Siang	Koreng	5	23
17	East Siang	Boleng	5	40
18	East Siang	Mebo	10	10
19	East Siang	Ngopok	5	30
20	East Siang	All India Radio, Passighat	5	7
21	East Siang	Oyan	5	25
22	East Siang	Koyu	5	77
23	East Siang	Napit	10	2
24	East Siang	Nari	5	40
25	East Siang	Ruksin	5	25
26	Kurukumey	Tali	5	60
27	Kurukumey	Nyapin	5	30
28	Lohit	Choukham	10	25
29	Lohit	Namsai	10	10
30	Lower Dibang valley	Bijari	5	45
31	Lower Dibang valley	Bolung	5	30
32	Lower Subansiri	Hapoli	10	6
33	Lower Subansiri	Yazali	10	35
34	Lower Subansiri	Raga	5	15
35	Lower Subansiri	Gerukamukh	5	
36	Papumpare	AP Secretariate	5	9
37	Papumpare	Raj Bhawan	10	8
38	Papumpare	Gohpur Tinali	5	5
39	Papumpare	Jote	10	22
40	Papumpare	Pappu Nallah	10	10

Sl.	District	Name of Substation	Capacity (MVA)	Length (ckm)
41	Papumpare	Doimukh	10	10
42	Papumpare	Leporiang	5	28
43	Tawang	Klimtao(Bumla)	5	40
44	Tawang	Thimbu	5	45
45	Tawang	Mukta	5	20
46	Tawang	Lumla	5	
47	Tirap	Deomali	10	
48	Tirap	Kanubari	5	50
49	Tirap	Khonsa	10	
50	Tirap	Longding	5	45
51	Upper Siang	Geku	5	45
52	Upper Siang	Jeying	5	40
53	Upper Siang	Tuting	5	
54	Upper Siang	Maryang	5	35
55	Upper Siang	Jengging	5	30
56	Upper Subansiri	Maro	5	45
57	Upper Subansiri	Sippi	5	18
58	Upper Subansiri	Thalia	5	35
59	Upper Subansiri	Giba	5	30
60	Upper Subansiri	Nacho	5	
61	Upper Subansiri	Murimugli	5	30
62	West Kameng	Thriziono	5	50
63	West Kameng	Balemu	5	60
64	West Siang	Mechuka	5	
65	West Siang	Tirbin	5	47
66	West Siang	Likabali	5	
67	West Siang	Kaying	5	40
68	West Siang	Gensi	5	35
69	West Siang	Rumgong	5	25
70	West Siang	Igo	5	152

Annexure 8: Existing Distribution assets

DIVISIONAL OFFICES	33 KV Line (KM)	11 KV Line (KM)	LT Line (KM)	DTs		33/11 KV S/S		
				Nos. (Transformers)	(MVA)	Nos. (Transformers)	S/S Nos.	(MVA)
Tawang	293.36	786.51	510.52	327	16.45	11	4	18.83
Bomdila	779.30	897.30	813.50	485	18.80	14	13	15.65
Seppa	208	1401.83	359.54	33	12.138	8	5	5
Capital	52.85	315.00	518.83	309	49.59	5	3	24.20
Naharlagun	121.41	310.50	372.90	349	37.71	12	5	40.55
Sagalee	119.10	486.69	141.50	128	3.80	3	2	4.20
Ziro	425.20	511.25	726.70	232	17.56	8	4	19.85
Daporijo	129.00	1931.97	752.60	547	12.64	4	2	14.15
Kurung Kumey	243.18	2275.16	744.73	457	11.88	7	4	6.50

DIVISIONAL OFFICES	33 KV Line (KM)	11 KV Line (KM)	LT Line (KM)	DTs		33/11 KV S/S		
				Nos. (Transformers)	(MVA)	Nos. (Transformers)	S/S Nos.	(MVA)
Aalo	194.00	673.50	360.45	223	9.57	7	4	17.00
Basar	122.00	4018.25	148.05	131	4.84	6	5	9.23
Rumgong	313.50	323.62	343.30	116	4.05	3	1	0.15
Pasighat	236.00	469.00	555.60	267	13.40	5	4	14.20
Yingkiong	281.00	398.00	255.00	104	4.76	6	4	3.49
Deomali	90.00	1016.83	959.39	379	15.38	4	4	6.40
Anini	0.00	369.10	126.11	79	2.45	0	0	0.00
Roing	185.00	342.00	963.00	145	7.00	5	3	7.75
Miao	430.71	1024.50	1060.14	494	16.31	22	6	15.20
Hayuliang	134.25	845.70	171.60	288	4.75	3	1	2.00
Namsai	158.00	629.00	666.22	414	7.08	11	7	18.73
Total	**4,515.86**	**19,025.71**	**10,549.68**	**5507**	**270.17**	**144**	**81**	**243.08**

Annexure 9: Lines proposed in NEC - NLCPR program

DIVISIONAL OFFICE	YEAR	33 KV Line (KM)		11 KV Line (KM)		LT Line (KM)	
		NEW	Aug	NEW	Aug	NEW	Aug
Tawang Electrical Division	2015-16			35		13.75	
Ziro Electrical Division	2016-17	40					
	2017-18		20		15		5
	2018-19	39					
Daporijo Electrical Division	2015-16			52		32	
Yingkiong Electrical Division	2015-16	95					
Deomali Electrical Division	2015-16	40		70		34.5	
	2016-17	30		60		29.5	
	2017-18	20		20		10	
	2018-19	10	0	5	0	10	0
Anini Electrical Division	2015-16	0	0	18.5	0	13.1	0
Roing Electrical Division	2015-16	5	0	15	15	0	0

Annexure 10 Estimated cost of new Mini & Small Hydel projects

Name of Projects	Estimated cost
Padusa SHP (2MW) in West Siang District	21.97
Ayung Muri MHP (1MW) in Upper Subansiri District	12.55
Jaw Kro MHP (1MW) in Upper Subansiri District	14.84
Talo MHP (2MW) in Kra Daadi District	30.00
Pain MHP(2 MW) I Kra Daadi District	30.00
Total	109.36