A Joint Initiative of

सत्यमेव जयते

Government of India

Government of Himachal Pradesh

Power for All

Himachal 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, industrial and agricultural consumer access to electricity, round the clock. The 'Power for All' program is a major step in this direction.

Himachal Pradesh being situated in the northern Himalayas is blessed with rich hydro resources and natural beauty. The state is one of the popular tourist destinations in the country. As a result of developmental policies of the state government, the state has witnessed rapid industrial growth.

This joint initiative of Government of India and Government of Himachal 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 Himachal Pradesh in bringing uninterrupted quality power to each household, industry, commercial business, small & medium enterprise and establishment, any other public needs and adequate power to agriculture consumer as per the state policy.

Foreword

Virbhadra Singh
Chief Minister
Himachal Pradesh

The economic growth of Himachal Pradesh is linked to the development of power sector in the State. Continued growth of power sector and availability of reliable and affordable power in the State of Himachal Pradesh has helped to boost the industrial activity and economic growth in the State.

The State has made significant progress in reducing its loss level and expanding access and availability of electricity to the households over the past years and has been able to achieve near 100% electrification. However, the State Government wants to improve the quality and reliability of supply to all categories of the consumer in the State.

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The Government of Himachal Pradesh is committed to provide electricity access to the remaining un-electrified households in the State by FY17. The State Government shall make necessary investments in the power generation, transmission and distribution infrastructure in order to provide affordable and quality power to each consumer in the State

The proposals outlined in this “Power for All” (PFA) document aim to achieve this goal. The State Government will provide all necessary support to the power utilities in achieving the various milestones and targets outlined in this PFA Roadmap.

I would like to thank the Government of India, Hon’ble Prime Minister and Hon’ble Union Minister of State for Power, for supporting Himachal Pradesh towards implementation of ‘Power for All’ program.

Joint Statement

सत्यमेव जयते
Government of India

हिमाचल प्रदेश सरकार

24X7 Power for All Program for Himachal Pradesh will be implemented by the Government of Himachal 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 FY16 to FY19.

The Government of Himachal 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.

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 four years to review and monitor the progress on the rollout plan and strive to achieve the objectives of the program by taking the necessary steps as envisaged in the PFA document

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

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Additional Chief Secretary (MPP and Power)
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List of Abbreviations

Abbreviation	Full Form
ARR	Aggregate Revenue Requirement
AT&C	Aggregate Technical & Commercial
BPL	Below Poverty Line
CAGR	Compound Annual Growth Rate
CKM	Circuit Kilometers
CoD	Commercial Operation Date
DDG	Decentralized Distributed Generation
DDUGJY	Deendayal Upadhyaya Gram Jyoti Yojana
DPR	Detailed Project Report
DSM	Demand Side Management
DT/ DTR	Distribution Transformer
EBIDTA	Earnings Before Interest Depreciation Taxes and Amortization
ECBC	Energy Conservation Building Code
EE	Energy Efficiency
EPC	Engineering, Procurement and Construction
EPS	Electric Power Survey
ER	Eastern Region
FY	Financial Year
GoHP	Government of Himachal Pradesh
GoI	Government of India
GSS	Grid Substation
GWp	Giga Watt Peak
HH	Household
HP	Himachal Pradesh
HPERC	Himachal Pradesh Electricity Regulatory Commission
HPPCL	Himachal Pradesh Power Corporation Ltd.
HPPTCL	Himachal Pradesh Power Transmission Corporation Ltd.
HPSEBL	Himachal Pradesh State Electricity Board Ltd.
IPDS	Integrated Power Development Scheme
IPP	Independent Power Producer
ISTS	Inter State Transmission System
LED	Light-emitting Diode
LILO	Loop In Loop Out

Abbreviation	Full Form
LT	Low Tension
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	Power Grid Corporation Of India Limited
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
USTDA	US Trade & Development Agency
VGF	Viability Gap Funding
YoY	Year on Year

1. Executive Summary

1.1. Introduction

The Power for All (PFA) program is a joint initiative of Government of India (GoI) and Government of Himachal Pradesh (GoHP), aiming to achieve availability of 24X7 reliable power to all households, industries, commercial establishments and all other electricity consuming entities by the end of FY19. This document sets a roadmap to achieve the underlying objective of the PFA Program in the State of Himachal Pradesh.

The State undertook structural reforms in 2010 wherein the erstwhile Himachal Pradesh State Electricity Board (HPSEB) was unbundled into Himachal Pradesh Power Transmission Corporation Ltd. (HPPTCL- Transmission company) and Himachal Pradesh State Electricity Board Limited (HPSEBL – Generation and Distribution company). Additionally, State Load Despatch Centre was established as an independent entity in the form of 'Himachal Pradesh State Load Despatch Society' in 2010. A separate Generating Company 'Himachal Pradesh Power Corporation Limited' (HPPCL) was established by the State Government for planning, promotion and development of hydro power projects within the state.

1.2. Connecting the unconnected

The State of Himachal Pradesh, having achieved near 100% electrification has a balance of 14,088 Households which are proposed to be electrified by FY2016-17. These households are spread across 35 villages and HPSEBL plans to electrify all remaining households by FY17 under the DDUGJY scheme of Government of India.

The State utility is working towards providing 24X7 quality and reliable power to the consumers and the addition of several hydro plants have helped in reducing the peak deficit from 7% in FY11 to NIL in FY15

In addition to having achieving near 100% electrification, the State has also been able to ensure 24X7 supply to all consumers on account of various hydro power capacities in the State as well as equity share of HP Government in SJVN and Rampur projects. With the focus on improvement in reliability and quality of supply, the energy sales in the State is expected to increase from 7,867 MU in FY15 to nearly 9,219 MU in FY19, translating into a total peak power requirement of 1,622 MW in FY19 for the State.

1.3. Available generation capacity

The state is endowed with rich hydro resources which has helped in meeting its power requirement to a large extent. HPSEBL owns 22 operational hydro power plants with a total installed capacity of 487 MW and one plant of 100 MW is under construction. Apart from the state owned hydro capacity, other sources of power include IPPs, allocation from Central Generating Stations, equity share of power from projects in the State of HP, allocation from shared generating stations, etc. which contribute towards meeting the total requirement.

The addition of new hydro stations in the recent years have helped the State in meeting the peak and energy demand-supply deficit. During FY15, the peak and energy deficit during was NIL and 0.9% respectively. Due to the large quantum of hydro stations, HPSEBL enjoys abundant supply of power during summer months. However, the availability of power from these stations during the winter months is substantially reduced resulting in demand-supply deficit. The utility has been able to manage the deficit by entering into banking arrangements and utilization of unallocated quota of power from central generating stations.

A number of hydro stations of HPSEBL are very old and under shutdown indicating requirement for adequate R&M activities. Currently, R&M of Rong-Tong and Rukti stations are under implementation. Rehabilitation work of Bhabha power plant and Scheme of R&M and life extension for Giri power plant is also in progress. Periodic R&M activities of the hydro stations including regular de-silting activities would enable smooth functioning and adequate availability of power from these stations.

Allocated power from upcoming central generating stations for HPSEBL is projected to increase by 180 MW as the new plants get commissioned in the subsequent years up to FY19. Also, HPPCL's generating stations with a total capacity of 856 MW are under construction and expected to come up in phases during the next 3-4 years. Energy from these stations and currently not tied-up and the State is required to take adequate steps to enter into PPAs for off-take of power from these stations.

There are number of IPPs under various stages of construction which shall further add 529 MW of additional capacity available to HPSEBL during FY16-19. On an annual basis HPSEBL is expected to have sufficient supply of power from existing and upcoming generating stations. The State may have to review the current mix of generation sources to have uninterrupted availability of power through-out the year and avoid large demand-supply deficits.

1.4. Transmission plan

The planning and development of intra-state transmission system in the state is undertaken by HPSEBL and HPPTCL. While HPSEBL continues to retain and expand its intra-state transmission system, HPPTCL's role is for development and strengthening of transmission network for evacuation of the power from existing and upcoming small hydro power plants in the state.

Presently, HPSEBL operates and maintains a transmission network of 3,448.85 ckt kms of Extra High Voltage Transmission lines along with 45 sub-stations (220/132/66 kV) having total transformation capacity of 3,831 MVA. In addition to the HPSEBL transmission system, HPPTCL network comprise of 15 transmission lines with a total line length of 239.34 ckt kms.

While the State has sufficient availability of power, the existing transmission network in the state requires strengthening and augmentation in order to meet the increasing demand in the State and providing reliable power the consumers. The transmission plan proposed to be implemented by HPSEBL aims at ensuring adequacy of transmission infrastructure by addition of 16 new substations with a capacity of 1,055 MVA and augmentation of 15 substations by 550 MVA.

Also, HPPTCL has proposed various transmission works for evacuation of power from the upcoming hydro stations within the State. This various schemes shall add 780 ckt kms of line length and 24 substations with a capacity of 3508 MVA by FY19.

The inter-state transmission system comprise of about 3,349 ckt kms of transmission line and 4 sub-stations with a total transformation capacity of 1890 MVA. PGCIL is strengthening the inter-regional and inter-state transmission systems by focusing on capacity augmentation of existing substations and transmission lines in view of the upcoming hydro generation capacity additions in the northern region. This augmentation of the inter-state transmission capacity is being undertaken by PGCIL as well as under the Tariff Based Competitive Bidding 'TBCB'. The ongoing schemes shall enable augmentation of the inter-state transmission capacity by 1,680 MVA.

1.5. Distribution plan

State Government owned HPSEBL is the sole distribution licensee in the State responsible for development and management of the distribution network and supply of power in the state. HPSEBL is already suppling 24X7 power to all the consumers in the State. However, the existing distribution infrastructure of HPSEBL is old with limited additions in the past years. The investment plan of the HPSEBL is focused towards augmentation and improvement of distribution infrastructure in order to cater to the growing demand as well as provide reliable and quality power to the consumers in the State.

HPSEBL, has proposed a total investment of Rs. 2047 Cr. from FY16 to FY19. The proposed capital expenditure shall be funded through a mix of borrowings from PFC/ REC, equity and grants. The capital investment includes Central government sponsored schemes (DDUGJY, R-APDRP and IPDS) with a total investment of Rs. 664 Cr.

HPSEBL's AT&C loss for 14.91% for FY2014-15 is better that many other states in spite of a difficult hilly terrain where the households are spread far across. One of the major reasons for achievement of the loss levels is the favorable HT and LT sales mix in the state where HT consumption forms approx. 60% of the total HPSEBL's sales.

With the proposed investments in distribution infrastructure and various other initiatives being undertaken by the licensees, it is expected that reliable power supply to all the consumers will be achieved and HPSEBL shall be able to further reduce its AT&C losses.

1.6. Renewable energy and energy efficiency

State has ensured the development of small hydro power plants by providing the required impetus in terms of enabling policy and regulatory framework. GoHP made allotment of project sites to private companies for development of hydro projects. Currently, small hydro projects with a total installed capacity of 371 MW are operational and an additional 1078 MW of hydro projects are under development. An addition of 530 MW is envisaged to be added during the period FY16-FY19.

Apart from the hydro potential, the National Institute of Solar Energy has calculated the solar potential of 34,000 MW in the state of HP. HPERC has already initiated mapping of the solar potential sites and services of Aryabhat Centre of the Science & Technology Department and NIT Hamirpur are being availed for this purpose. Himurja expects to add 215 MW of solar capacity during the period FY16 to FY19. HPSEBL has proposed to undertake 10 solar projects with a capacity of 5.7MW. The projects are currently under investigation stage and implementation shall be subject to approval of the Board of HPSEBL.

The State is also implementing a number of energy efficiency schemes through Directorate of Energy (DoE) and HPSEBL. DoE is currently implementing several projects including Demonstration Project – Street Lighting, LED Village Campaign, Installation of Solar Water Heaters at Govt. Buildings, Municipal Demand Side Management, etc.

Also, HPSEBL has signed an agreement with M/s EESL for the implementation of DELP scheme which has been launched by the Hon'ble Chief Minister on 7th August, 2015. Under the scheme, HPSEBL has planned to distribute approx. 1.25 Cr. LED bulbs by end of March 2016 of which 40.27 lac bulbs have already been distributed until Jan 12, 2016.

Another energy efficiency scheme, 'Rajiv Gandhi Illuminating Scheme For Hill Town Advancement (RISHTA) project' was launched by GoHP for replacement of 63,484 street light fixtures in all the ULB's to achieve 45-55% energy savings. First phase of the scheme shall cover Shimla, Dharamshala, Sundernagar, Paonta Sahib, Ghumarwin and Manali.

Also in addition to DELP and Street Lighting projects, HPSEBL is undertaking preparation of a DSM master plan for 5 years. HPSEBL has signed a MoU with the Bureau of Energy Efficiency (BEE), for the capacity building and preparation of DSM Action Plan. A few potential measures have been identified for implementation as part of the study. However, the detailed DSM Action Plan is yet to be framed and finalized.

1.7. Financial turnaround

HPSEBL has been rated B+ (Moderately Operational and Financial Performance Capability) as per the Third Annual Integrated Ratings of State Power Distribution Utilities report 2015 released by MoP. The rating is based on low AT&C loss levels, collection efficiency, progress on reform activities, adoption of MYT framework, 100% consumer metering, etc. However, concern with respect to low cost coverage ratio, non-receipt of subsidy, high employee cost have resulted in lower rating than previous year.

HPSEBL's accumulated losses has been increasing from Rs.886 Crores in FY11 to Rs. 2,000 Crores in FY15. However, the annual financial losses have reduced over the past five years from Rs. 380 Cr. in FY11 to Rs. 125 Cr. in FY15. Going forward, expansion in consumer base, increased energy requirement and proposed infrastructure investments under the PFA program are expected to translate into a tariff implication of Rs.0.21/kWh in FY16, Rs.0.74/ kWh in FY17, Rs.1.03/ kWh in FY18 and Rs. 1.28/kWh in FY19. This considers achievement of AT&C loss trajectory and full availability of grants as per HPSEBL's plan.

Despite the proposed reduction in AT&C losses from 14.51%% in FY15 to 10.00% in FY19, the annual financial losses of HPSEBL are projected to increase to Rs.1,066 Cr. in FY19 in the absence of tariff increase and power purchase rationalization initiatives. It is estimated that over and above the pass-through of actual increase in power purchase costs, an additional tariff increase of nearly 6.5% YoY is required for turnaround of HPSEBL by FY19.

On the basis of above considerations, a plan to achieve '24x7 Power for All' along with a proposed rollout plan has been formulated and detailed in this document.

2. Background

2.1. The State of Himachal Pradesh

Himachal Pradesh is a state in Northern India bordered by Jammu and Kashmir on the north, Punjab on the west, Haryana on the south-west, Uttarakhand on the south-east and by Tibet Autonomous Region on the east. Since its formation in 1971, the state has been successful in making enormous strides towards attaining holistic development- social and economic. It has outperformed other states in reducing the poverty level in the state and becoming the second highest per-capita income state in the country. The key highlights of the State are presented in Table 1.

The Economic Survey of Himachal Pradesh, 2014-15 estimates the Gross State Domestic Product (GSDP) at current prices in 2013-14 to be Rs.85,841 Cr. as against the 2012-13 GSDP of Rs.76,259 Cr. The per capita income at current prices stands at Rs. 95,852 in the year 2013-14. Rural poverty has dropped from 36.8% in 1993-1994 to 8.5 in 2011. The state has the record of highest educational attainment as well as the highest number of women workforce in the nation. Himachal has emerged as a leading economy in the sub-continent and also a model for other hill-states.

The State has been able to achieve substantial progress in sectors like power, industries, horticulture, agriculture etc. The economy has witnessed a shift where agriculture is losing its share of contribution to the economy to the growing industrial sector. But, it can be observed that the performance of the agricultural sector has widespread impact on the State's economy. It is a major contributor to the State's GDP owing to its overall impact on other sectors via input linkages, employment and trade etc. Besides industries and agriculture, tourism forms the major contributor to the economy of the state.

Blessed naturally with the Himalayan Mountains, the state has immense potential for tourism and power generation. The state has been able to tap these resources efficiently and effectively for the development of its economy and people.

The primary sector which comprises of Agriculture, Forestry, Mining & Quarrying contributed to 19.28 percent of the GSDP of 2013-14. Concurrently, the other sectorial contributions were as follows- Secondary sector (37.87%), Community and Personal services (19.21%), Transport, Communications and Trade (15.29%) and Finance and Real Estate (8.35%)

Over the last decade the State has witnessed a burgeoning economy, with the growth rate pegged at 5.7%, which is at par with the national level. The per-capita NSDP of the state has also been substantially higher than the national average as can be observed from Figure 2.

Table 1: Key Highlights of State: Himachal Pradesh

Parameter	Information
Year of Creation	Established on 25th January, 1971
Population & Demographics	Total Population at 68,64,602 as per 2011 census • 79.96% Rural, 20.13% Urban • 12.95% Decadal population growth
Area	55,673 square kilometers (1.69% of country) • Forest cover – 11059.97 sq kms (0.33% of country) • Total cropped area – 9405.97 sq kms (0.28%of country)
Rivers	Sutlej , Beas , Ravi , Chenab and Yamuna
Administrative Set-up	• 12 Districts • 52 sub-divisions

Parameter	Information
	• 20,118 Villages (100 % Electrified)
Natural Resources	• Vast Forest Resources with diverse range of Flora & Fauna • Other Resources: limestone, gypsum, iron, copper, uranium, rock salt, manganese, lead, silver etc.
Neighboring States	• North: Jammu & Kashmir • West: Punjab • South: Haryana & Uttarakhand
HHs	• Rural 13.4 lacs (~99% Electrified) • Urban 5.2 lacs (100% Electrified)

Figure 2: Per Capital Himachal Pradesh vs National Average

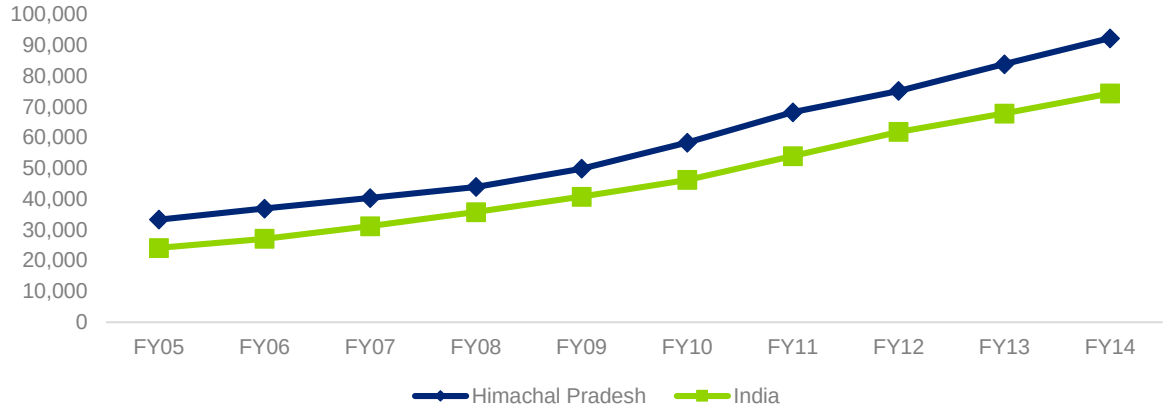
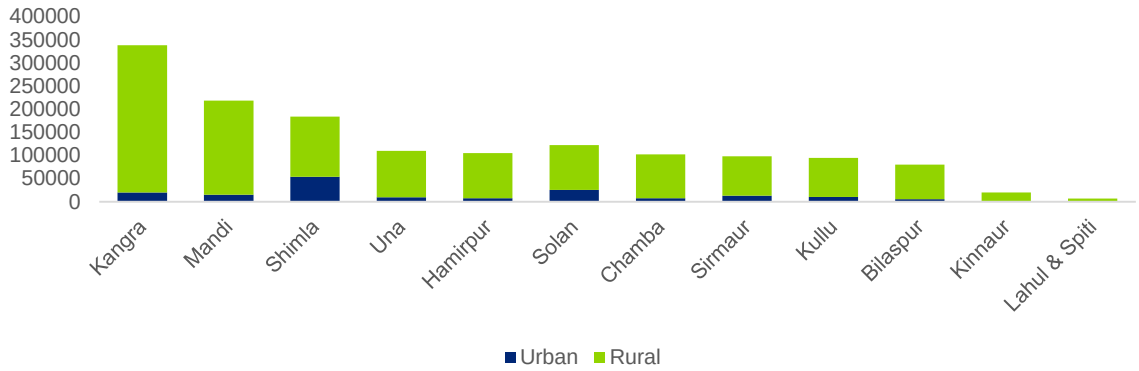


Figure 1: District Wise Urban and Rural Divide: No. of HHs (2011 Census)



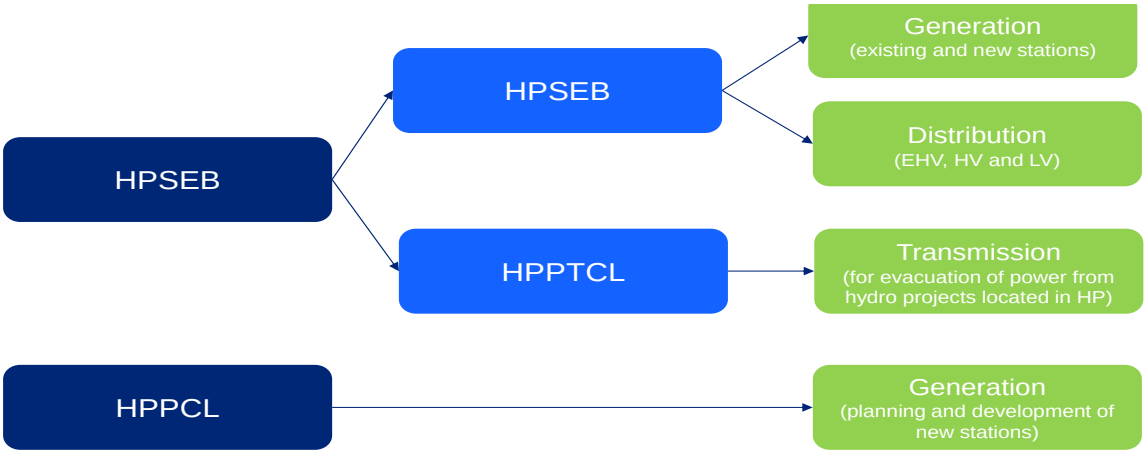
As per the 2011 census, majority of the population i.e. 89% stays in the rural areas. The district-wise share of rural and urban population in Himachal Pradesh is highlighted in Figure 1 .

2.2. Himachal Pradesh power sector at a glance

Power sector in Himachal Pradesh is characterized by recent restructuring of the state electricity board, which unbundled its transmission function and retained the generation and distribution functions under the same roof. The Government of Himachal Pradesh signed a Memorandum of Understanding with the Ministry of Power to undertake reforms in the power sector.

The reform process in Himachal Pradesh commenced in 2008 with the decision to unbundle the erstwhile Himachal Pradesh State Electricity Board and institute a separate transmission

Figure 3: Power Sector in Himachal Pradesh



company. The reforms resulted in the following entities

- Himachal Pradesh State Electricity Board Limited: Integrated utility with generation, distribution and trading function in the State.
- Himachal Pradesh Power Transmission Corporation Limited: to manage and operate the transmission system within the state

In addition to the new companies formed as a result of unbundling of HPSEB, the Government had also established a company in the name Himachal Pradesh Power Corporation Limited (HPPCL) in 2006 for planning, promoting and organizing the development of all hydroelectric power projects on behalf of Government of Himachal Pradesh (GoHP) and Himachal Pradesh State Electricity Board (HPSEB) in the state.

The Himachal Pradesh Electricity Regulatory Commission (HPERC) was constituted in December 2000 under the Electricity Regulatory Commission Act, 1998 and started functioning with effect from 6th January, 2001. The Commission comprise of a single member i.e. Chairman. The key highlights of the power sector in the State are presented in Table 2.

Table 2: Himachal Pradesh Power Sector at a Glance

<table>
<tr><th>Aspect</th><th>Key Highlights</th></tr>
<tr><td>Per Capita Consumption</td><td>Per capita consumption (At generation bus bar including all losses) in kWh for last five years is provided in the table below:
<table>
<tr><th>Particulars</th><th>FY11</th><th>FY12</th><th>FY13</th><th>FY14</th><th>FY15</th></tr>
<tr><td>Per capita Consumption (kWh)</td><td>1251</td><td>1289</td><td>1380</td><td>1348</td><td>1336</td></tr>
</table></td></tr>
<tr><td>Demand Supply Position</td><td>The state has a stable power supply-demand scenario with deficits almost negligible. The FY15 demand supply situation is highlighted in the table below: (CEA Figures):
<table>
<tr><th>Item</th><th>Peak (in MW)</th><th>Energy (in MUs)</th></tr>
<tr><td>Demand/Requirement</td><td>1,422</td><td>8,807</td></tr>
<tr><td>Availability</td><td>1,422</td><td>8,728</td></tr>
<tr><td>Surplus/(Deficit)</td><td>0%</td><td>(0.9)%</td></tr>
</table></td></tr>
<tr><td>Generation</td><td>Himachal Pradesh State Electricity Board Ltd. is a vertically integrated utility owning and operating 22 hydro generating stations with a combined capacity of 487.45 MW</td></tr>
</table>

<table>
<tr><th>Aspect</th><th>Key Highlights</th></tr>
<tr><td></td><td>Further, Himachal Pradesh Power Corporation Ltd. is developing 6 hydro projects in the State which are in various stages of construction.
<table>
<tr><th>Mode</th><th>Thermal</th><th>Nuclear</th><th>Hydro</th><th>RE</th><th>Total (MW)</th></tr>
<tr><td>State</td><td>0</td><td>0</td><td>394</td><td>257</td><td>650</td></tr>
<tr><td>Private</td><td>0</td><td>0</td><td>1,748</td><td>498</td><td>2,246</td></tr>
<tr><td>Central</td><td>214</td><td>34</td><td>1,280</td><td>0</td><td>1,528</td></tr>
<tr><td>Total</td><td>214</td><td>34</td><td>3,422</td><td>755</td><td>4,424</td></tr>
</table></td></tr>
<tr><td>Transmission</td><td>Himachal Pradesh Power Transmission Co Ltd. is the state transmission utility, responsible for planning and development of transmission network in the state. Himachal Pradesh State Electricity Board Ltd. also owns and operates EHV and HV lines and substations in the state.
<table>
<tr><th>Mode</th><th>Voltage level</th><th>Line Length (ckt kms)</th><th>Transformation Capacity (MVAs)</th></tr>
<tr><td>Intra-state (HPSEBL)</td><td>200 KV</td><td>536</td><td>1,723</td></tr>
<tr><td></td><td>132 KV</td><td>2,321</td><td>1,417</td></tr>
<tr><td></td><td>66 KV</td><td>592</td><td>690</td></tr>
<tr><td>Intra-state (HPPTCL)</td><td>220 kV</td><td>131.24</td><td>-</td></tr>
<tr><td></td><td>132 kV</td><td>41.75</td><td>-</td></tr>
<tr><td></td><td>66 kV</td><td>66.35</td><td>-</td></tr>
<tr><td>Inter-state</td><td>400 kV</td><td>2,221</td><td>1,890</td></tr>
<tr><td></td><td>220/132 kV</td><td>1,128</td><td>-</td></tr>
</table></td></tr>
<tr><td>Distribution</td><td>Himachal Pradesh State Electricity Board Ltd. is the only distribution utility in the state. It caters to the power demand of approximately 2.2 million customers
<table>
<tr><th>Parameters</th><th>Unit</th><th>HPSEBL</th></tr>
<tr><td>33kV Feeders</td><td>ckm</td><td>3,107</td></tr>
<tr><td>22kV & 15kV Feeders</td><td>ckm</td><td>7,209</td></tr>
<tr><td>11kV Feeders (including 2.2kV)</td><td>ckm</td><td>21,625</td></tr>
<tr><td>LT Feeders</td><td>Ckm</td><td>60,700</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>33/11 kV substations</td><td>No.</td><td>159</td></tr>
<tr><td>33/11 kV substations Capacity</td><td>MVA</td><td>1,102</td></tr>
<tr><td>11/0.4kV LT Distribution Transformer</td><td>No.</td><td>27,013</td></tr>
<tr><td>11/0.4kV LT Distribution Transformer</td><td>MVA</td><td>2,323</td></tr>
</table></td></tr>
<tr><td>Financial Position</td><td>The financial position of the utility has been improving over the last three years. Even though the utility is booking losses each year during FY12, FY13 and FY14, the magnitude of losses has been decreasing over the period.

The utility on account of its lower power purchase cost and approved tariff revisions has been able to reduce the gap between ABR and ACS and generate adequate revenues to meet its expenses for operations.</td></tr>
</table>

3. Power Supply Scenario

3.1. Power Supply Position

Over the last five years, the demand supply position in the state has improved considerably. The State has benefitted by the significant capacity additions of hydro power plants and increase in allocations from central generating stations, the state has been able to meet its peak demand in FY15 and the deficit was 0% as compared with the national average of 4.7%. As can be seen in the Table 3, the power supply in state has increased at a CAGR of 4% leading to steep decline in the peak deficit. In terms of energy requirement and available, the State has witnessed improvement over the last 5 years and the annual energy shortfall has decreased from 3% in FY11 to 1% in FY15, as presented in Table 3

While the annual peak and energy deficit in the State is negligible owing to the large capacity of hydro generating stations, there are large variations in monthly peak and energy shortage as can be observed in the Figure 6. This is primarily due to the State's dependence on hydro power which is abundant during the summer season while the supply is severally affected during winter season. The State has to therefore rely on banking arrangements and unallocated quota of power from central generating stations for meeting its demand during winter months. The seasonal trend of peak and energy shortages for the period of April, 14 to March, 15 can be seen in Figure 4 and Figure 5 below.

Table 3: Peak Demand vs Supply (MW) and Energy Requirement vs Availability (MU)- HPSEBL

Particulars	FY11	FY12	FY13	FY14	FY15
Peak demand and supply (MW)					
Peak Demand (MW)	1,278	1,397	2,116	1,561	1,422
Peak Available (MW)	1,187	1,298	1,672	1,392	1,422
Peak Shortage (%)	7%	7%	21%	11%	0%
Energy requirement and availability (MU)					
Energy Requirements (MUs)	7,626	8,161	8,992	9,089	8,807
Energy available (MUs)	7,364	8,107	8,744	8,883	8,728
Energy Shortage (%)	3%	1%	3%	2%	1%

Figure 4: Monthly Peak Demand and Supply

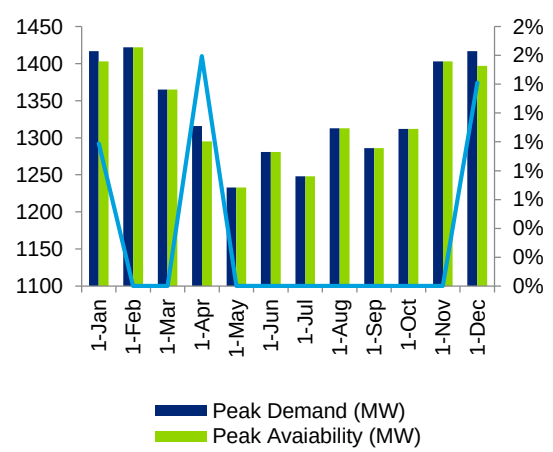
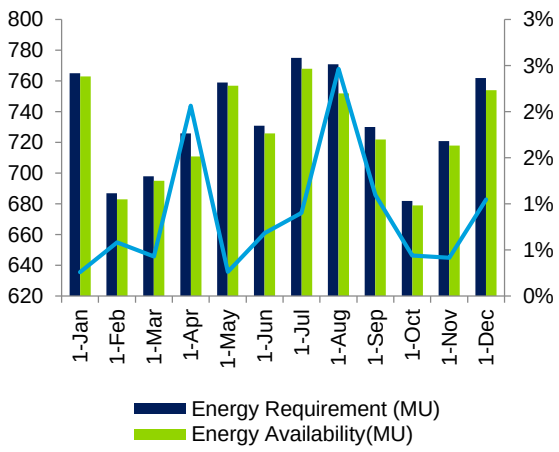


Figure 5: Monthly Energy Demand and Supply



As already discussed, the prime factor for large seasonal variation is on account of high dependence of hydro power in the generation mix, which not only includes the HPSEBL generation capacity of 487 MW but also allocation of hydro power from various central generating stations and IPPs. Hydro power comprise approx. 80% of the total power supply in the State. Figure 6 below reflects the demand-supply surplus during the summer months and demand-supply deficit during the winter months excluding the banking and short-term power purchase undertaken by HPSEBL during FY14-15. The surpluses during the months of July - August are to the tune of 550 MUs indicating supply of more than 75% of the total requirement during these months while the deficit during Dec-Feb is to the tune of 45% of the requirement.

It is important to note that despite the seasonal demand supply mismatch, HPSEBL was able to provide 24 hours supply to all categories of consumers, both urban and rural areas, during FY15 in the state. This is primarily on account of the power purchase planning and banking arrangements being undertaken by HPSEBL due to which the energy as well as peak deficit have broadly remained within 1%.

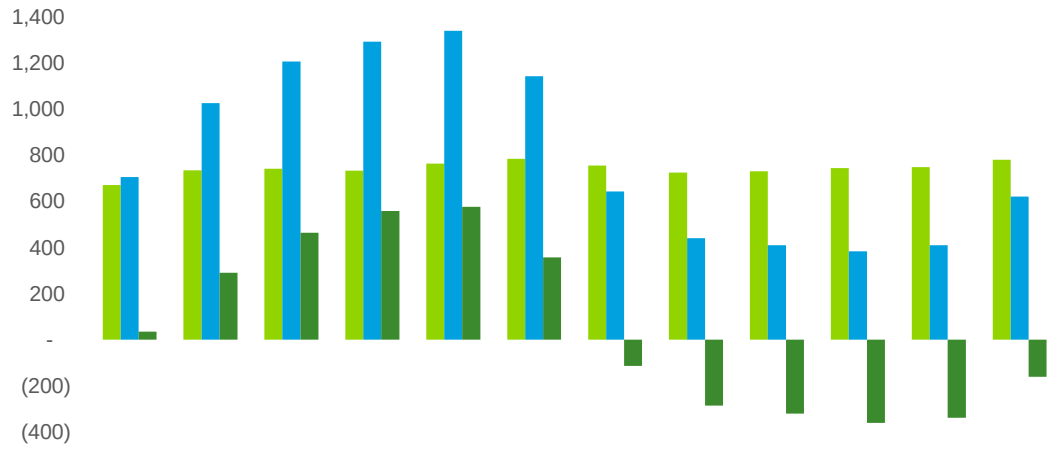
As per the information of HPSEBL, it is observed that the state has connected almost all the households excluding 14,088 HHs spread across 35 villages. HPSEBL has plans to electrify these households by FY2016-17 under the DDUGJY scheme of Government of India. Therefore, one of the major milestone under the PFA program of providing connection to all households in the State shall be achieved once these 14,088 HHs are electrified. Further, as per the CEA data there are no peak shortages while the energy shortage is a negligible 0.9%. This is reflective of the State utility's performance of providing adequate energy to the households and achievement of one of the key objective of PFA program, i.e. to provide 24X7 electricity to all consumers.

Therefore, the objective of state is to provide uninterrupted reliable power to the consumers at affordable cost for which it intends to overhaul its transmission, sub-transmission and distribution infrastructure.

3.2. Consumer and sales mix

The State's sole distribution licensee i.e. HPSEBL had a consumer base of over 2.2 million at the end of FY15. The sales and consumer mix of HPSEBL for FY15 is provided in Figure 8 & Figure 7 below. The domestic consumers constitute around 85% of the total consumer base while their share in the overall sales stand at approx. 24% for FY15. While Industrial consumers, being 2% of total consumer base, contributed the largest share i.e. 60% of the total sales of HPSEBL. In 2003, excise and income-tax holiday provided under the industrial policy led to development of several industrial belts in the State. These industrial consumers contribute significantly to the overall power off-take and economic development in the State.

Figure 6: Month-wise Energy Requirement and Energy Available to HPSEBL for FY15



	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Energy Reqd. for Sales	671	736	742	734	765	785	757	726	731	745	749	781
Net Energy Available	707	1028	1207	1294	1342	1143	644	441	410	384	411	621
Surplus/ (Deficit)	35	292	465	559	577	358	(113)	(285)	(321)	(361)	(338)	(160)

Figure 8: Sales Mix of HPSEBL for FY15

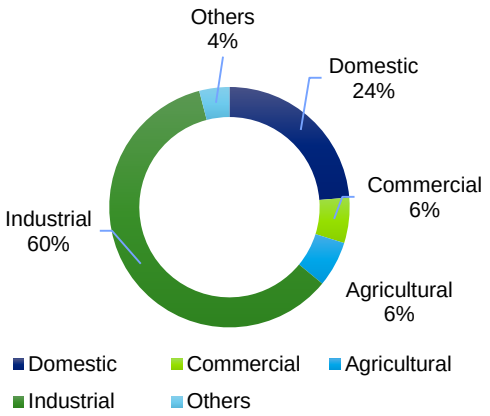
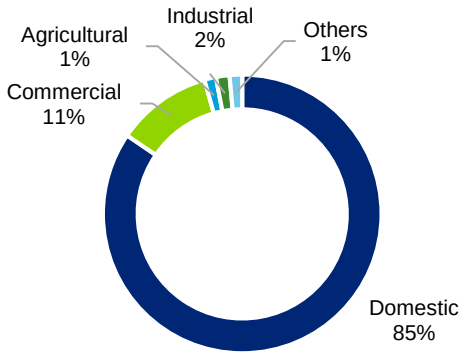


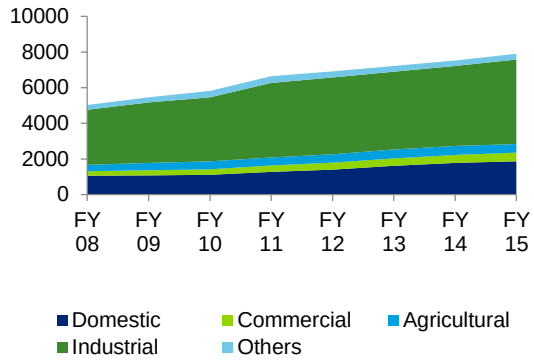
Figure 7: Consumer Mix of HPSEBL for FY15



The consumption of domestic as well as commercial consumers have grown at CAGR of 11.2% and 9.1%, respectively in the last five years. With respect to industrial consumption, the increase during the period FY08 to FY11 was significant. However, in the recent years the growth in sales to industrial consumers has remained in the range of 2-3% due to completion of tax holiday period in 2013 and shift of large industrial consumer for procurement under open access. The growth in sales to various categories of consumers is illustrated in the Figure 9 below.

The share of industrial consumption in the overall sales mix is one of the important aspects for HPSEBL to be able to maintain its T&D losses in the range of 15% in spite of having a hilly terrain in the State.

Figure 9: Category-wise Sales (MU) Growth Trend - HPSEBL



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 rest of the consumer categories a growth rate based on HPSEBL's estimation of the expected growth along with a review/ validation with the past trend has been considered. The following steps detail out the approach adopted for estimation of energy requirement for the State.

Estimation of rural and urban electrified and un-electrified HHs

Based on the available census data for 2011, extrapolated with past 10 years CAGR Estimation of number of rural and urban HHs are done.

In addition to the level of electrification in rural areas as per 2011 census data, the actual rural HHs electrified since 2011 has been considered to arrive at the present level of electrification. In case of urban areas, the same level of access as in 2011 census (in percentage terms) has been assumed on the estimated HH numbers to arrive at the number of existing un-electrified HHs. Also actual data of electrification is considered into the calculation. It is noteworthy that the state has already achieved near 100% electrification of both urban and rural households with the balance of 14088 households which are proposed to be electrified by FY2017 under the DDUGJY scheme of Government of India. Therefore, the requirement for additional energy demand from the electrification of un-electrified HHs shall be only corresponding to the electrification of 14,088 HHs, newly constructed HHs and increase in per HH consumption.

The estimated urban and rural HHs along with the status of electrification as at the end of FY15 is provided in Table 4.

Table 4: Estimated Un-electrified Households (as on 31st march 2015)

Particulars	Urban	Rural	Total
Total HHs	520,916	1,339,500	**1,860,416**
Electrified	520,916	1,325,412	**1,846,328**
Balance (covered under DDUGJY)	-	14,088	**14,088**

Estimation of Energy Requirement from HHs

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

a) Latent demand from existing HHs on account of increase in specific consumption (kwh/HH/day) for each of the electrified HH due to life style advancements and natural growth;

b) Additional energy requirement due to electrification of un-electrified HHs;

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

Latent demand growth from already electrified HHs has been estimated based on expected increase in consumption levels in accordance with the objectives of the PFA program. Such growth would not only include the increased energy requirement due to elimination of power shortages and network constraints but also the natural growth in consumption levels due to lifestyle changes. It is expected that the daily HH consumption in urban areas will increase from 6.09 kWh in FY15 to 6.85 kWh by FY19. Similarly, daily rural HH consumption will increase from 1.54 kWh in FY15 to 1.87 kWh by FY19. The urban and rural per day HH consumption has been computed considering the savings on account of DELP scheme implemented by the State.

Table 5: Per HH per day consumption (kWh)

Particulars	FY15	FY16	FY17	FY18	FY19
Urban	6.09	6.27	6.46	6.65	6.85
Rural	1.54	1.61	1.69	1.78	1.87

Since 100% household electrification has been achieved in the State (except the 14,088 HHs which are required to be electrified under the DDUGJY scheme), additional energy requirement of HPSEBL is limited to electrification of newly constructed household or increase in average monthly consumption levels of the existing households.

In order to estimate the energy requirement for newly constructed HHs, the expected number of newly constructed HHs has been estimated to be increase at 2.5% as per the last five year trend. The corresponding energy requirement from new HHs is estimated based on the estimated per HH per day consumption detailed above in Table 5.

Estimation of Energy Requirement from Other Consumer Categories

The energy requirement projections from other consumer categories have been done factoring the expected natural growth considering the past trend. As per the energy and peak deficit data it is observed that HPSEBL has been able to meet the energy and peak requirement in FY15 and therefore no additional growth in demand is envisaged on account of increased availability of electricity in accordance with the objectives of the PFA Roadmap.

For projection of sales to various consumer categories, CAGR of past five years have been considered. The projected demand for different consumer categories is discussed in the following sub-section.

3.4. Demand Projections – HPSEBL

Based on above steps, the energy sales for HPSEBL is expected to increase by about 17%, from 7867 MUs in FY15 to 9,219 MUs in FY19, as presented Figure 10. Based on the projections and considering the fact that there are only 14,088 un-electrified households in the State, the growth in the sales and electricity requirement is expected to remain broadly in line with past year growth. The percentage share of energy sales to domestic households is expected to increase marginally from 24% in FY15 to 28% in FY19 on account of increased consumption per household per month as well as addition of new households. The share of electricity sales to other than domestic category is expected to decline owing to the reduced growth in sales to industrial consumers in recent past.

PFA Projected Energy Req./Sales (MU) is summarized in Figure 10. The energy requirement from both urban and rural HHs is projected to increase in the future led by higher consumption levels. The mix of rural sales is expected to increase in the total domestic sales in view of improvement in per HH consumption per day as can be seen in Figure 11: Rural Vs Urban Sales (MU)

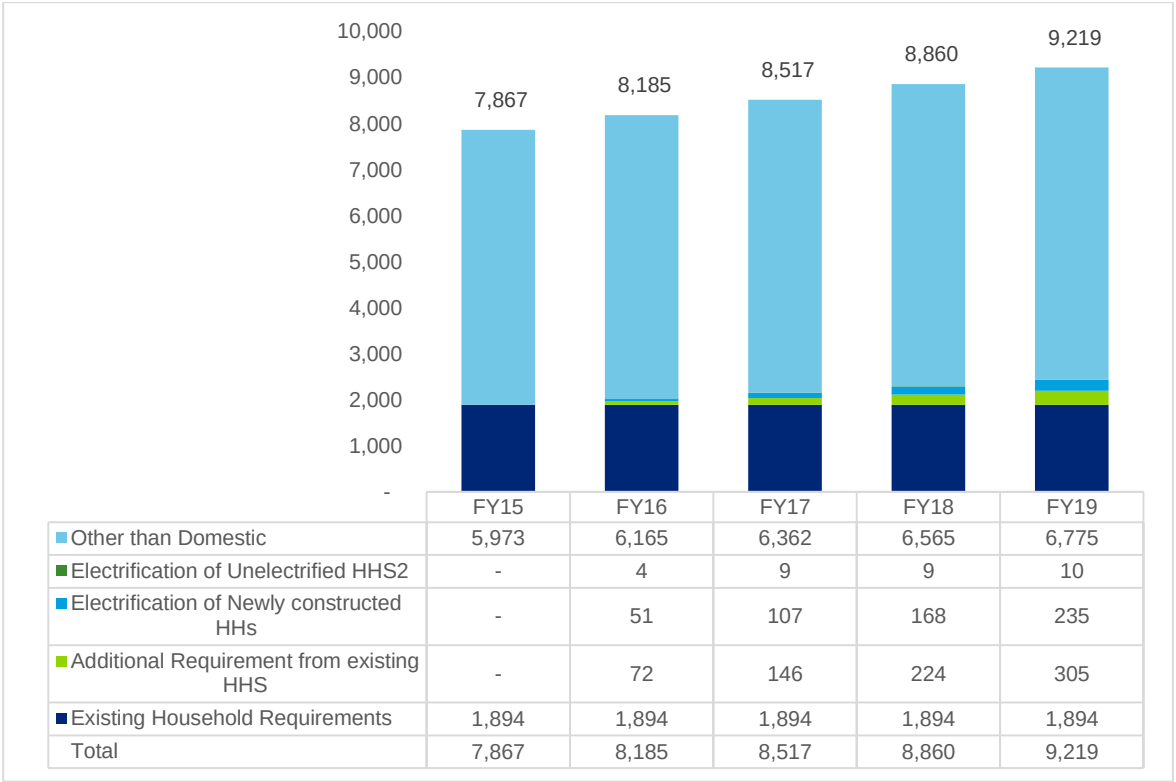
In order to estimate the energy input requirement at the state periphery, T&D losses and intra-state transmission losses have been considered. The energy consumption estimated above translates into higher energy requirement, as can be seen in Table 6.

The energy requirement at the State periphery is likely to increase from 8,527 MU in FY15 to 10,091 MU in FY19. Peak demand is derived from the average load factor of previous two years (FY 14 and FY15). Peak demand is expected to grow from 1,422 MW in FY15 to 1,622 MW in FY19.

In view of reduced growth in sales to the other than domestic consumer categories during the past few years, the projected energy requirement in MU terms is expected to fall short of the 18th EPS estimates for all the years. Also, the projected peak demand in MW is expected to fall short of the 18th EPS estimates for FY15 to FY19. The variation in the peak demand projections is partially also on account of the difference in the load factor used in the 18th EPS (at 64.5% in FY15) vis-à-vis the actual load factor witnessed (70% in FY15).

A comparison of the projected energy requirement and peak demand figures under the PFA Roadmap vis-à-vis the 18th EPS is shown in the bar chart in Figure 12.

Figure 10: PFA Projected Energy Sales (MU)



	FY15	FY16	FY17	FY18	FY19
Other than Domestic	5,973	6,165	6,362	6,565	6,775
Electrification of Unelectrified HHS2	-	4	9	9	10
Electrification of Newly constructed HHs	-	51	107	168	235
Additional Requirement from existing HHS	-	72	146	224	305
Existing Household Requirements	1,894	1,894	1,894	1,894	1,894
Total	7,867	8,185	8,517	8,860	9,219

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Figure 11: Rural Vs Urban Sales (MU)

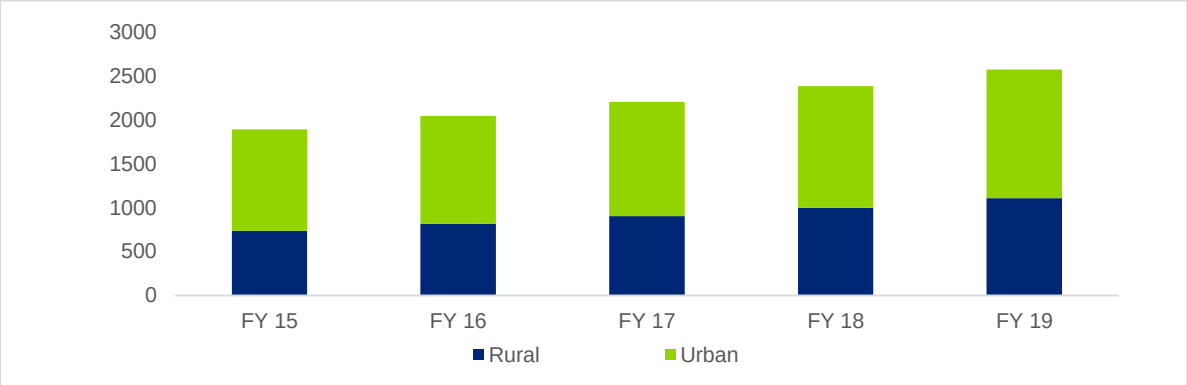
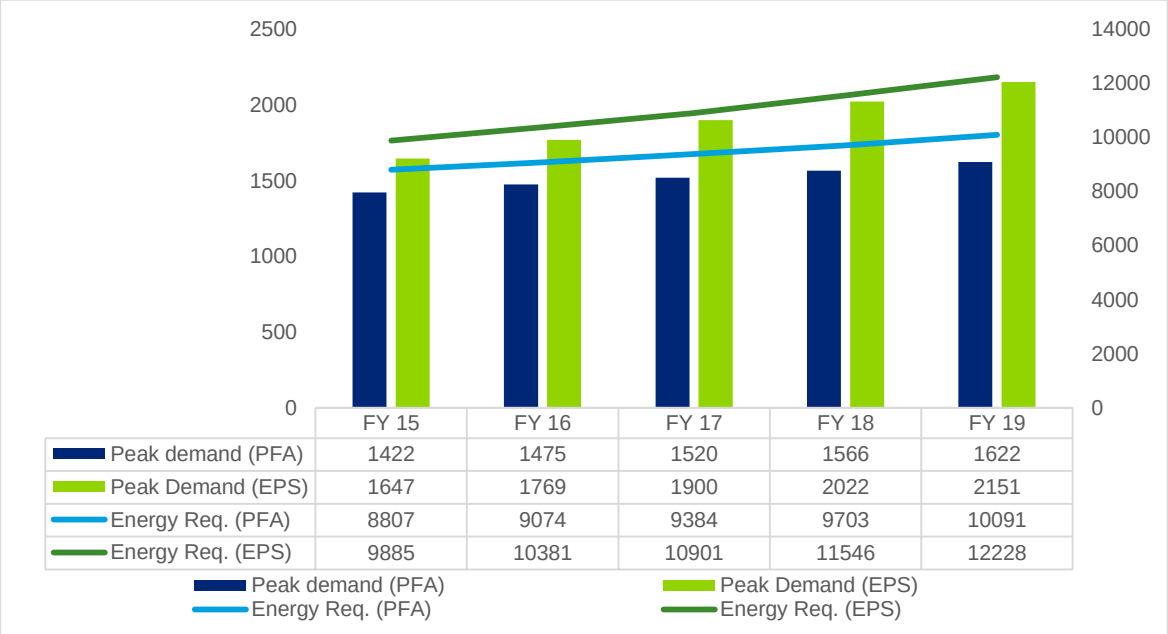


Table 6: Energy Requirement & Peak Demand Projections- HPSEBL

Particulars	Units	FY16	FY17	FY18	FY19
Energy requirement/ Sales	MU	8,185	8,517	8,860	9,219
AT&C losses	%	12.5%	11.5%	10.5%	10.0%
Collection Efficiency	%	97.01%	97.51%	98.01%	98.51%
T&D losses	%	9.81%	9.24%	8.69%	8.64%
Energy Input Requirement	MU	9,074	9,384	9,703	10,091
Load Factor (PFA)	%	70.25%	70.50%	70.75%	71.00%
Load Factor (EPS)	%	67.0%	65.5%	65.2%	64.9%
Peak Demand (PFA)	MW	1,475	1,520	1,566	1,622

Figure 12: PFA Projected Energy Req. & Demand vs 18th EPS Projections



4. Generation Plan

4.1. Generation Sector in Himachal Pradesh

The State of Himachal Pradesh is well endowed with hydro resources which also helps the state in meeting its power requirement through hydro generating stations located within the state. Post unbundling of the Himachal Pradesh State Electricity Board, the power generation function was retained with the distribution licensee i.e. Himachal Pradesh State Electricity Board Limited (HPSEBL). Currently, HPSEBL operates 22 generating stations aggregating to a generation capacity of 487.45 MW which is useful in meeting the energy requirement in the State. In addition, the state also relies upon the allocation of power from Central Generating Stations (NTPC, NHPC, SJVN, THDC, BBMB), Independent Power Producers, and Govt. of HP share of free power in the plants located within the State.

During the period FY16 to FY19 the peak demand and energy requirement is expected to increase from 1,475 MW and 9,074 MU to 1,622 MW and 10,091 MU in FY19. As HPSEBL has access to several power sources including the Government of HP free share in generating stations being developed in the State, it is important that the planning is done carefully keeping in view the issues faced by the licensee as well as the cost of procurement from these alternative sources.

This chapter evaluates adequate power availability for meeting the projected power demand in the period FY16 to FY19. Further, the details of upcoming capacity addition and the issues faced by the State due to its generation mix have been identified herein.

4.2. Existing generation capacity- HPSEBL

Himachal Pradesh State Electricity Board Ltd. (HPSEBL), which is the distribution licensee in State, has also been entrusted with the generation of electricity. Currently, HPSEBL has 23 power plants aggregating to a capacity of 587.45 MW of which 22 are operation and one plant i.e. 100 MW UHL-III is under construction and is expected to commission by FY2016-17. The details of HSPEBL's power stations are listed in Table 7.

Table 7: Details of HPSEBL's Plants

Name of Plant	Capacity (MW)	Allocation (%)	Allocated Capacity (MW)
Plants >25MW			
Larji	126.00	88.00%	110.88
Bhaba	120.00	100.00%	120.00
Bassi	66.00	100.00%	66.00
Giri	60.00	100.00%	60.00
Uhl III (Upcoming)	100.00	88.00%	88.00
Total	**472.00**		**444.88**
Plants <25MW			
Ghanvi-I	22.50	88.00%	19.80
Andhra	16.95	100.00%	16.95
Khauli	12.00	88.00%	10.56
Baner	12.00	88.00%	10.56
Gaj	10.50	88.00%	9.24
Binwa	6.00	100.00%	6.00
Gumma	3.00	100.00%	3.00
Nogli	2.50	100.00%	2.50
Chaba	1.75	100.00%	1.75
Thirot	4.50	100.00%	4.50
Rukti	1.50	100.00%	1.50
Rong Tong	2.00	100.00%	2.00
Chamba	0.45	100.00%	0.45
Sal-II	2.00	100.00%	2.00
Holi	3.00	100.00%	3.00
Killar	0.30	100.00%	0.30
Bhaba Aug.	4.50	100.00%	4.50
Ganvi-II	10.00	88.00%	8.80
Total	**115.45**		**107.41**
HPSEBL Total	**587.45**		**552.29**

In addition to the above existing and under construction projects, HPSEBL also have been allocated 5 small HEPs (<25 MW capacity) which are currently in planning and clearance approval stage. These HEPs are projected for commissioning post FY2018-19. Details of the new allocated small HEPs to HPSEBL are provided in Table 8 below:

Table 8: HEPs allocated to HPSEBL for development

Name	Capacity (in MW)	Cost (Rs. Cr.)
Devi Kothi	16.00	134.97
Sai Kothi-I	15.00	133.63
Sai Kothi-II	16.50	152.26
Hail	18.00	171.41
Raison	18.00	146.50

More than 20% of the Himachal Pradesh's energy requirement is met by the HPSEBL's owned hydro power plants. Including the share of IPPs and GoHP share of free power being sourced by HPSEBL, the State is able to meet its electricity requirement by more than 50% from power being generated within the State. Going forward HPSEBL shall have availability of power from the various hydro stations being developed by HPPCL, IPPs and Central generating companies details of which are discussed in subsequent sub sections.

4.3. Generation capacity- HPPCL/ IPPs

In order to harness the rich hydro potential in the state, the Government of Himachal Pradesh in the past had signed a number of MOUs with the Independent Power Producers (IPPs). As a result, the commissioned IPP projects contribute to about 27% of the available capacity for HPSEBL.

GOHP had allocated 655 Small Hydro Electric Projects (SHEP) with a capacity upto 5MW aggregating to 1,596.805 MW capacity until 31st October, 2015. Out of these 67 projects with an aggregate capacity of 262.55 MW have been commissioned. Of the total projects allocated to IPPs, 13 projects aggregating to a capacity of 16.87 MW have been allotted to Himachal Pradesh Energy Development Agency (HIMURJA) for development in State Sector.

Table 9: Power Availability from IPPs within the State

Project Name	Installed Capacity (MW)	Allocation	Available Capacity (MW)
Baspa-II HEP	300	88%	264
Existing (>5 MW)	119	86%	103
Existing Plants (<5 MW)	247.55	100%	247.55
Total	**667**		**614**

The Government of Himachal Pradesh with an aim to develop and promote hydro power also incorporated a company by the name of Himachal Pradesh Power Corporation Limited (HPPCL) in 2006. HPPCL is owned by GoHP (60%) and HPSEBL (40%). Currently, HPPCL is developing five hydro projects aggregating to a total capacity of 856 MW. The details of HPPCL projects under construction are provided in Table 10.

Table 10: Power projects under construction stage being developed by HPPCL

Project Name	Capacity (MW)	Expected Commissioning	Project Cost (Rs. Cr.)
Sawra Kuddu	111	2017	559
Kashang I	65	2016	478
Kashang II & III	130	2018	488
Sainj	100	2016	725
Shongtong Karcham	450	2020	2,808
Total Capacity	**856**		**5,058**

The funds for the above stations are tied-up with ADB which is providing $800 million towards the Kashang (I, II & III), Sainj, Swarn Kuddu and Shongtong Karchan hydro projects. Additional funds amounting to Euro150 million have been tied-up with KfW for electro-mechanical works of Shongtong Karchana HEP.

Further to the projects under construction, HPPCL also has 16 additional projects with an aggregate capacity of 2,255 MW which are currently under investigation and pre-feasibility stage. Therefore, power from these projects is not expected to be available during the period FY16-FY19.

HPPCL is also setting up a 5MW solar power project at Berra Dol, Bilaspur district for which the DPR has been prepared and forest clearance has been obtained. Funding tie-up for the project is under finalization. In addition to Berra Dol Solar Project HPPCL is also exploring possibilities of setting up another Solar Project approximately 5 MW at Dabat, Distt. Bilaspur (HP).

Himachal Pradesh also has the first IPP project BASPA –II in the country with a capacity of 300 MW which was developed and operated by Jaiprakash Power Ventures Ltd. The entire capacity from BASPA-II is procured by HPSEBL under a PPA excluding the GOHP 12% share of free power from the station.

Apart from the above hydro-stations located within the state, there are several Central Generating Stations (CGS) being operated by NHPC and SJVN in Himachal Pradesh. While the GOHP has free share of power from these generating stations, there is firm as well as unallocated quantum of power which is assigned by MoP to HPSEBL. The total generation capacity in the State of HP is 10,264 MW including 7,457 MW of Central/ Joint Sector Projects. As per CEA, the total installed capacity of Utilities in the State including allocated share in IPPs, Joint and Central Sector plants is 4,424 MW of which 3,422 MW is from Hydro Power Stations. Private projects form the largest contributor to the allocated capacity in the state (i.e. 50.8%). The details of energy allocated from various sources is provided at Table 11.

While the State has access to substantial power availability from its hydro resources during summer season, limited water flow in the rivers during winter season impacts its power availability leading to demand-supply deficits. The allocation of 228MW from central thermal generating stations is highly insufficient considering the peak demand of 1300-1400 MW during the winter season. HPSEBL is able to cover this shortfall by entering into banking arrangements with neighboring states and the balance shortfall is met through a combination of unallocated share of power from CGS and short-term arrangements. It is observed that the demand-supply shortfall during winter season is a recurrent situation and HPSEBL should undertake long-term measures for addressing this issue.

4.4. Generation plan

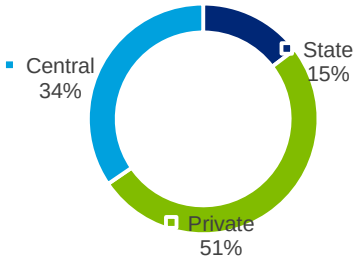
The generation plan for the state envisages the proposed capacity additions by the state along with the allocated share of upcoming central and IPP generating stations. The generation capacity addition and power procurement plans have been aligned with the energy requirement and power demand assessed in the earlier sections of this report.

Inter-state/ central sector projects

The central sector allocation for Himachal Pradesh are from the NTPC thermal stations including coal and gas based stations and contribute only 10% of the allocated capacity. Further, HPSEBL has allocations from the hydro projects of central generating plants i.e. NHPC, THDC and SJVN as well as shared hydro projects of BBMB, UJVNL, PSEB, etc. nt and *Central Sector Utilities*

Table 12 provides the central sector allocations of the state.

Table 11: Installed Capacity* (MW) of Power Utilities in the State as on July 2015 (CEA Executive Summary)

Share	Sector	Thermal	Nuclear	Hydro	RE	Total
	State	0	0	394	257	650
	Private	0	0	1,748	498	2,246
	Central	214	34	1,280	0	1,528
	Total	**214**	**34**	**3,422**	**755**	**4,424**

**including allocated share in IPPs, Joint and Central Sector Utilities*

Table 12: Plant wise details of allocated capacity from Central sector (As per CEA power supply position report for November 2015 and HPSEBL)

Sources	Installed Capacity (MW)	%	Available Capacity (MW)
NHPC Stations			
Chamera-I	540	2.90%	16
Chamera-II	300	3.67%	11
Chamera-III	231	3.36%	8
Tanakpur	120	3.84%	5
Salal	690	0.99%	7

Sources	Installed Capacity (MW)	%	Available Capacity (MW)
Uri	480	2.71%	13
Dhauliganga	280	3.67%	10
Parbati-III	520	3.36%	17
Total	**3,661**		**86.63**
NTPC Stations			
Rihand-I	1,000	3.50%	35
Rihand-II	1,000	3.30%	33
Rihand-III	1,000	3.37%	34
Unchahar-I	420	1.67%	7
Unchahar-II	420	2.86%	12
Unchahar-III	210	3.80%	8
Kahalgaon -II	1,500	1.53%	23
Anta Gas	419.33	3.58%	15
Auraiya Gas	663.36	3.32%	22
Dadri Gas	829.78	3.01%	25
Singrauli Bundled	15	100%	15
Total	**11,457.47**		**228.67**
NPCIL Stations			
Narora (NAPP)	440	3.18%	14
RAPS (5&6)	440	3.41%	15
Total	**880**		**29.00**
Shared Stations			
Bhakra old HP share		1.2LU/day	10
Bhakra complex	1,478.73	7.19%	106
Dehar	990	7.19%	71
Pong	396	7.19%	28
UJVNL	546.69	25%	131.57
PSEB	110	Fixed	9.57
Total	**3,521.42**		**357.12**
Other CGS			
Nathpa Jhakri SOR(SJVNL)	1,500	2.47%	37.05
Nathpa Jhakri Equity	1,500	22.00%	330.00
Tehri HEP (THDC)	1,000	2.80%	28.00
Koteshwar (THDC)	400	2.01%	8.04
Rampur Equity	412	26.10%	107.53
Rampur HEP	412	2.81%	11.58
Total	**5,224**		**522.2**
Grand Total	**24,743.89**		**1,223.61**

In addition to the above, the state draws power from the unallocated shares of central stations during winters to meet the shortfall in the state. As on Nov 2015, 160 MW of unallocated share of NTPC stations was assigned to Himachal Pradesh.

There are several upcoming central generating stations from which power is allocated to HPSEBL. The expected commissioning details along with power allocated from these upcoming central generating stations are provided at Table 16.

Intra-state/ state sector projects

During the period FY16 to FY19 only one project of HPSEBL with a capacity of 100 MW (i.e. UHL-III) is under construction and the plant is expected to be in operation by September 2016.

Generation plan of HPPCL

Currently five projects of HPPCL aggregating to a total capacity of 856 MW are under various stages of construction. Few plants i.e. Kashang I, Sawra Kuddu are in advanced stages of completion and are expected to commission by end of FY17. Further to the projects under construction, HPPCL also has 16 additional projects with an aggregate capacity of 2,255 MW are currently under investigation and pre-feasibility stage. However, the PPA/ tie-up for sale of power from these stations have not been executed.

The proposed expenditure with respect to these stations is as provided in Table 13 below:

Generation plan of IPPs

Since there are a large number of small and mini hydro IPP plants with a combined capacity of approx. 530 MW which are in various stages of construction. Details of the capacity addition of State Sector / IPPs is provided in the Table 14.

Power from these stations shall be procured by HPSEBL and therefore, availability of power from these stations have been considered as provided in Table 48 of the RE Chapter.

Table 13: Proposed Capital Expenditure on under construction projects of HPPCL

Project Name	Expected Commissioning	Estimated Cost	Funding Agency (Debt: Equity 70:30)	FY 16 (Estimated)	FY 17	FY18	FY19
Sawra Kuddu	2017	1,359	ADB	57	136		
Kashang I	2016	717	ADB	79	155	75	70
Kashang II & III	2018	438					
Sainj	2019	1,143	ADB	108	100		
Shongtong Karcham	2020	2,808	ADB/KfW	174	255	330	330
Total Expenditure				**418**	**646**	**405**	**400**

Table 14: Upcoming HPSEBL and IPP plants

Capacity (MW)	FY16	FY17	FY18	FY19	Total
Uhl III – BVPCL	-	100	-	-	100
Upcoming IPPs (<5 MW)	111	131	111	176	529
Total Allocations	**111**	**231**	**111**	**176**	**629**

Table 15: Existing and Upcoming Plants of HPSEBL

Plant	Owner	Installed Capacity	Allocation to HPSEBL	Current Status
HPSEB owned Plants (>25 MW)				
Larji	HPSEBL	126.00	111	Operational
Bhaba	HPSEBL	120.00	120	Under Shut-down
Bassi	HPSEBL	66.00	66	Operational
Giri	HPSEBL	60.00	60	Operational
Uhl III - BVPCL	HPSEBL	100.00	88	Under Construction
HPSEB owned Plants (<25 MW)				

Plant	Owner	Installed Capacity	Allocation to HPSEBL	Current Status
Ghanvi-I	HPSEBL	22.50	19.8	Operational
Andhra	HPSEBL	16.95	16.95	Operational
Khauli	HPSEBL	12.00	10.56	Operational
Baner	HPSEBL	12.00	10.56	Operational
Gaj	HPSEBL	10.50	9.24	Operational
Binwa	HPSEBL	6.00	6	Operational
Gumma	HPSEBL	3.00	3	Under Shut-down
Nogli	HPSEBL	2.50	2.5	Operational
Chaba	HPSEBL	1.75	1.75	Operational
Thirot	HPSEBL	4.50	4.5	Operational
Rukti	HPSEBL	1.50	1.5	Under R & M
Rong Tong	HPSEBL	2.00	2	Under R & M
BSPH Chamba	HPSEBL	0.45	0.45	Operational
PSKCM Sal-II	HPSEBL	2.00	2	Under Shut-down
Holi	HPSEBL	3.00	3	Under Shut-down
Killar	HPSEBL	0.30	0.3	Operational
Bhaba Aug.	HPSEBL	4.50	4.5	Operational
Ganvi-II	HPSEBL	10.00	8.8	Operational
Total HPSEBL owned		**587.45**	**552.29**	

Table 16: Upcoming Central Generating Stations

Source	Fuel	Owner	Capacity (MW)	Allocated Capacity in MW	Expected CoD	Status
RAPP (VII & VIII)	Nuclear	NPCIL	1,400	26.60	Dec/16	Under Construction
Parbati II	Hydro	NHPC	800	35.04	Sep/18	Under Construction
Tapovan Vishnugarh	Hydro	NHPC	520	18.72	Sep/18	Under Construction
Kishanganga	Hydro	NHPC	330	12.01	Sep/16	Under Construction
Meja STPP	Thermal	NTPC	1,320	19.01	Jan/18	Under Construction
Vishnugarh Pipulkoti	Hydro	NHPC	444	11.99	Sep/18	Under Construction
Unchahar IV	Thermal	NTPC	500	24.50	Feb/18	Under Construction
Tanda TPP	Thermal	NTPC	660	32.34	Nov/18	Under Construction
Total Allocations				**180.21**		

4.5. R&M Program

HPSEBL is currently undertaking R&M of two of its plants i.e. Rong-Tong (2MW) and Rukti (1.5MW) which is likely to be completed by FY2015-16. The R&M cost for the two projects are being met through 13th Finance Commission Grants.

Additionally, HPSEBL has plans to undertake R&M of its 60 MW Giri and 120 MW Bhabha hydro generating stations. The rehabilitation works of Bhaba Power House is also in progress and the power station is expected to be re-commissioned during June, 2016. The Scheme for R&M and Life Extension of Giri Power house is also approved for implementation within three years. Complete shutdown of Giri plant shall be avoided as much as possible and works will be planned in a manner that, one machine (of the two) is available during implementation period.

In case of other hydro power plants which are currently under shutdown i.e. Gumma and Holi, HPSEBL is undertaking R&M works for re-commissioning of the plant. For Sal-II HEP which is under shut down since 10.3.2015, a scheme is under preparation and appropriate board approvals shall be taken.

The details of R&M cost and funding tie-up is summarized in table below:

Table 17: Details of R&M Schemes

Name of Power Station	Estimated Cost (Rs. Cr.)	Funding
Rukti	4.75	Grant from 13th Finance Commission
Rong-Tong	5.00	
120 MW Bhabha	76.03	PFC approved scheme 80:20 debt-equity
60 MW Giri HEP	139.80	Approved by PFC. Re-posted for additional funds
Gumma Power House	3.40	PFC approved scheme 80:20 debt-equity
Holi	0.19	Internal funding
Sal II	15.00	Scheme to be approved by Board
Total	**244.17**	

In view of the financial health of HPSEBL and limited availability of funds from the State Government, Central Government assistance/ schemes shall help in timely implementation of the R&M measures envisaged for the older plants of HPSEBL. A scheme for providing assistance to old hydro power plants for renovation and modernization shall encourage the state owned generating utilities to undertake such schemes in a timely manner.

4.6. Anticipated Power Availability Position- HPSEBL

During FY16 to FY19, HPSEBL is expecting capacity additions of 100 MW through its own hydro generating station UHL-III. Additionally, power from 530 MW of small and micro HEPs which are expected to commission during the period FY16 to FY19 shall be procured by HPSEBL. Allocation of approximately 180 MW from various thermal, nuclear and hydro central generating stations shall also boost the availability of power to HPSEBL.

However, the majority of energy is expected from hydro stations (100 MW from UHL-III, 530 MW from SHPs and 78 MW from CGS allocation) which may have limited benefit for HPSEBL considering that the deficit period is during winter season when the contribution of hydro stations is minimal.

While the projections for peak demand requirement and availability show shortfall during the initial years, HPSEBL is expected to meet the projected peak demand by FY19 from the various sources of power available. Similarly in energy terms HPSEBL is projected to be able to meet the energy requirement in the years FY16-FY19 owing to the new stations coming on stream and allocation of power from central generating stations. The sufficiency of energy is on an annual basis and therefore HPSEBL will have to undertake banking and other bilateral arrangement for meeting the seasonal deficits. Also, the unallocated share of HPSEBL in the central generating stations and access to GoHP share of free power from various generating stations located within the State would enable the utility to meet the winter deficits. The seasonal variation on account of peak and off-peak hydro power availability can be observed from the Figure 16.

The following figure shows the available capacity from various sources for HPSEBL which is detailed in Table 19.

Figure 13: Energy Available from Central, State, Private and Other Sources

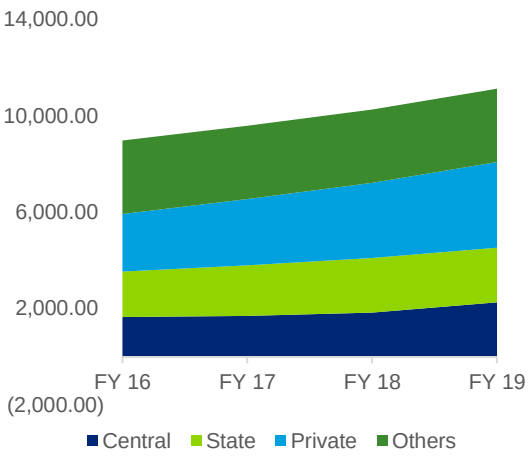
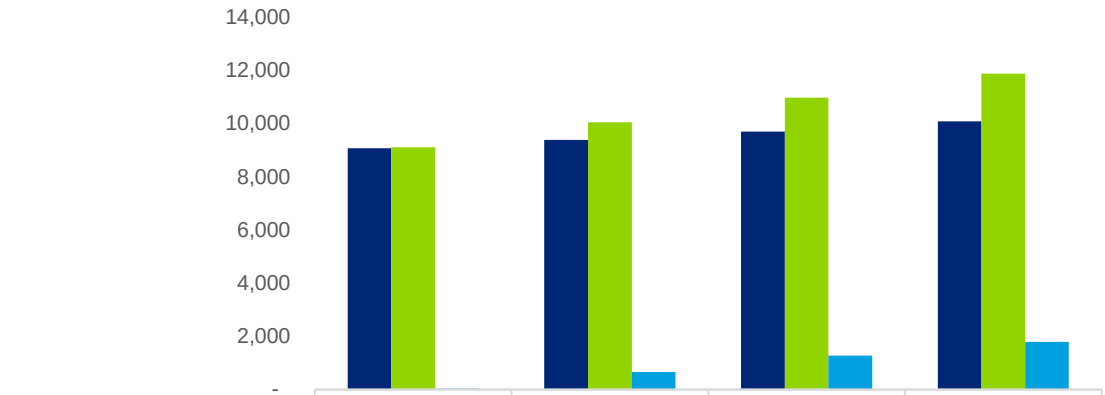
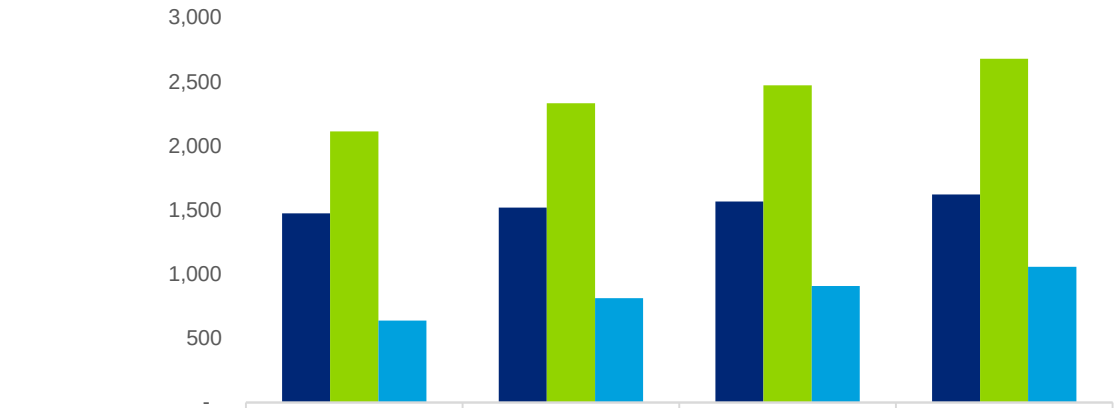


Figure 14: Anticipated Energy Availability (MU) for HPSEBL



	FY16	FY17	FY18	FY19
Total Energy Required (MU)	9,074	9,384	9,703	10,091
Total Energy Availability (MU)	9,108	10,046	10,973	11,876
Surplus/Deficit (MU)	34	662	1,271	1,785

Figure 15: Anticipated Peak Availability Position of HPSEBL (MW)



	FY16	FY17	FY18	FY19
Total Demand (MW)	1,475	1,520	1,566	1,622
Total Availability (MW)	2,112	2,332	2,472	2,680
Surplus/Deficit (MW)	638	813	907	1,058

Table 18: Anticipated Power Availability Position for Himachal Pradesh

Parameter	Unit	FY16	FY17	FY18	FY19
Himachal Pradesh - State					
Energy requirement	MUs	9,074	9,384	9,703	10,091
Ex-Bus Energy available	Mus	9,288	10,228	11,159	12,077
Energy availability at State Periphery (after inter-state losses)	MUs	9,108	10,046	10,973	11,876
Surplus/ (Deficit)	MUs	34	662	1,271	1,785
Peak demand	MW	1,475	1,520	1,566	1,622
Peak Availability	MW	2,112	2,332	2,472	2,680
Surplus/ (Deficit)	MW	638	813	907	1,058

Figure 16: Peak & Off-peak Power Requirement and Availability

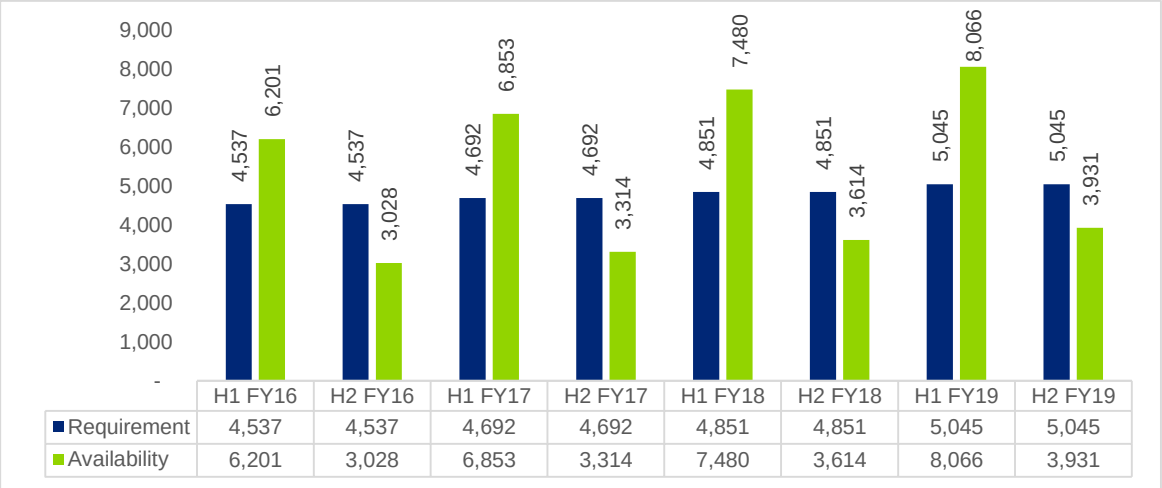


Table 19: Ex-Bus Energy from various sources (MU) for FY16 to FY19

Source	State	Central	Others	Private/ IPPs	Total
FY16					
Hydro	1,145	331	3,528	1,144	**6,149**
Thermal		1,320			**1,320**
Hydro (RE)	402			1,393	**1,796**
Solar		23			**23**
Total	**1,548**	**1,674**	**3,528**	**2,538**	**9,288**
FY17					
Hydro	1,569	352	3,519	1,142	**6,582**
Thermal		1,345			**1,345**
Hydro (RE)	473			1,804	**2,278**
Solar		23			**23**
Total	**2,042**	**1,721**	**3,519**	**2,946**	**10,228**
FY18					
Hydro	1,948	375	3,519	1,142	**6,984**
Thermal		1,457			**1,457**
Hydro (RE)	475			2,219	**2,693**
Solar		25			**25**
Total	**2,423**	**1,858**	**3,519**	**3,360**	**11,159**
FY19					
Hydro	1,948	563	3,519	1,142	**7,171**
Thermal		1,696			**1,696**
Hydro (RE)	475			2,710	**3,185**
Solar		25			**25**
Total	**2,423**	**2,284**	**3,519**	**3,852**	**12,077**

4.7. Key Issues

Most of the existing generating stations of HPSEBL are over 25 years old and require extensive R&M activities on regular intervals. However, the R&M activity is delayed (mostly due to funding constraints) leading to lower generation and procurement of power from alternative sources which may be expensive.

Also, one of the most important issue is with regard to arrangement of power during the winter months

as the availability from hydro generating stations reduces significantly. While the HPSEBL has been planning its power procurement in a way to meet the demand-supply gap created during these months by way of banking arrangements, sourcing power from unallocated quota of central generating stations, procurement of short-term power, etc. However, the demand-supply gap shall occur each year due to the dependence on hydro power, HPSEBL may consider options which may resolve the issue for a longer term.

With respect to the generation capacity being developed by HPPCL, there are no PPAs in place for off-take of the power. Few of the plants are expected to commission in FY16 (65MW Kashang HEP Stage-I and FY17 (111MW Sawra Kuddu HEP) for which no long-term or mid-term arrangements are in place. Since these are hydro plants, the available capacity may not be required by HPSEBL and therefore it is important that HPPCL undertakes adequate measures for sale of power from these stations to avoid any revenue loss.

HPPCL has also indicated other issues including local agitation, delays in forest clearances, lack of road connectivity to the land lock/ remote areas as the major concerns for undertaking the hydro projects.

4.8. Fund Requirement

Ongoing R&M activities on Rong Tong and Rukti are financed through grants from 13th Finance Commission. Funding for R&M of Bhabha and Giri plants are financed from PFC. Therefore, the fund requirement for planned R&M of the various stations are tied-up. However, in view of the deteriorating financial health of the board and limited availability of state government funds, there is considerable delay in undertaking the R&M activities. Number of HPSEBL plants are under shut-down or are witnessing frequent break-downs resulting in loss of electricity generation. Therefore, financial assistance from the Central Government for undertaking adequate R&M activity of the old stations shall help the utility in overcoming the frequent shutdowns of its old generating stations.

In case of hydro generating stations which are under construction the funds are tied-up with the ADB and therefore no support is required. For other projects which are under pre-feasibility and investigation, HPPCL has proposed to take up funding with multilateral agencies i.e. ADB, World Bank, JICA, BRICS, etc.

Further, with respect to the Renukaji Dam project which is one of the project of national importance funded by the Government of India, there is an urgent requirement for funds to be released by the Central Government for land acquisition, R&R, forest clearances, etc. In view of the resentment of the locals, any delay in land acquisition may result in starting the process of land acquisition afresh and may result in large delays.

4.9. Key Issues

Few of the generation related issues highlighted are as below:

- Himachal Pradesh is a hydro rich state with numerous small generation capacities. Power from these stations are being sold outside the state as well. While the provisions of the IEGC, 2010 allows for a requisition for revision of schedule of a generator with capacity of 100 MW and above in case of forced outage of a unit for a short term bilateral transaction, there is no provision for any such instances in case the generator is below 100 MW. Since there are large number of small capacities in the state and owing to the uncertainty with respect to hydro power availability, the State has to bear the burden of penalties for overdrawl of power as well as imposing of unscheduled power cuts within the State. An amendment in the IEGC 2010 to allow all generators including those with capacity below 100 MW to revise their schedule shall resolve the additional financial burden on the State.

- Also owing to the dependency on the hydro power, the State has to rely on various mechanism including banking, bilateral procurement, etc. which leads to additional transmission and scheduling costs for the utility and the State. A suitable policy for swapping of such hydro power with thermal power during few months in year would ensure uninterrupted power at the most reasonable cost to the consumers in the State.

4.10. Action Plan & Support Required

The action points and support requirements for generation are covered in Table 20 below:

Table 20: Action points for Generation Plan

Agency	Action Plan
State Government	• Undertake measures for tie-up of power from the HPPCL stations which are expected to commission during FY16 and FY17
HPPCL	• To ensure timely execution of ongoing projects as per the schedule. • Ensure tie-up of the capacity for the plants which are expected to be commissioned in near future in order to prevent any delay in commissioning • Relook procurement and contractual processes for award of EPC works to ensure comprehensive agreement and clarity on various terms and conditions with the objective of minimizing disputes/ delays and ensuring smooth execution of works in future.
HPSEBL	• Periodical maintenance and repairs of its generating stations • Long-term arrangements for meeting the demand –supply gap during winter months
MoP/ CEA	• Develop a scheme for renovation and modernization of old hydroelectric plants with capacity of more than 25 MW to encourage utilities to undertake proper maintenance activity in hydro plants
PFC	• To evaluate the renovation and modernization schemes proposed by HPSEBL for old hydro stations and provide required funding
Government of India	• Assistance in form of financial support for undertaking R&M and upgradation of old hydro plants of HPSEBL. • Timely release of funds to maintain the pace of work at the hydro projects of national importance Develop a policy to allow swapping of equivalent share of hydro energy/ capacity with thermal energy/ capacity by way of reallocation for part of the year in order to maintain an ideal thermal-hydro mix in the country. This shall also enable states with high dependence on hydro power to meet the deficits during the winter months. • Amendment in the IEGC 2010 to allow all generators including those with capacity below 100 MW to be able to requisition of revision of schedule

5. Transmission Plan

5.1. Transmission capacity requirement

The planning and development of intra-state transmission system in the state is undertaken by Himachal Pradesh State Electricity Board Limited (HPSEBL) and Himachal Pradesh Power Transmission Corporation Limited (HPPTCL). A well planned and strong transmission system will ensure not only optimal utilization of transmission capacities but also of generation facilities and would further facilitate achieving ultimate objective of cost effective delivery of reliable power to end consumers.

The requirement of electricity in energy and peak demand terms for the State are expected to increase from the present level of 8,807 MU and 1,422 MW in FY15 to 10,091 MU and 1,622 MW in FY19.

The state's generation plan as detailed in Section 4 of this report outlines the upcoming projects in the state in addition to the allocation from central stations and other licensees. It is evident that a total of 850 MW is expected to be added to the existing system by FY19. The transmission plan proposed in this chapter aims at ensuring adequacy of transmission infrastructure for evacuation of such power from the inter-state boundary/ proposed generating plants within the State, to the end consumers located across various geographies of the State.

5.2. Existing transmission system

Intra-state transmission system

Post the unbundling of Himachal Pradesh State Electricity Board by the Government on 10th June 2010, a separate transmission company Himachal Pradesh Power Transmission Corporation Ltd. (HPPTCL) was formed for undertaking the operation and maintenance of the transmission network in the state of HP. However, majority of the transmission infrastructure has been retained by the HPSEBL with only 15 transmission lines being transferred to the HPPTCL. Therefore, HPSEBL continues to retain and expand its intra-state transmission system while HPPTCL's role is for development and strengthening of transmission network for evacuation of the power from existing and upcoming small hydro power plants in the state.

As on 31st March 2015, HPSEBL operates and maintains a transmission network of 3,448.85 ckt. kms of Extra High Voltage Transmission lines along with 45 sub-stations (220/132/66 kV) having total transformation capacity of 3,831 MVA, spread over the entire stretch of the State of Himachal Pradesh. The existing transformation capacity and line length (220kV,132 kV and 66 kV) of HPSEBL network is summarized in Table 21.

Table 21: Intra-state Transmission System of HPSEBL as on 31st March 2015

Voltage	Line Length (ckt kms)	No. of Substations	Transformation Capacity (MVA)
220 kV	535.95	7	1,723
132 kV	2,320.56	26	1,417
66 kV	592.34	12	690
Total	**3,448.85**	**45**	**3,831**

In addition to the HPSEBL transmission system, the HPPTCL network comprise of 15 transmission lines (220/132/66 kV) details of which are provided in table below:

Table 22: Intra-state Transmission System of HPPTCL as on 31st March 2015

Voltage	Line Length (ckt kms)
220 kV	131.24
132 kV	41.75
66 kV	66.35
Total	**239.34**

The existing capacity of intra-state transmission system requires further strengthening and augmentation for meeting the demand in the State and also for the purpose of evacuation of power from the various upcoming hydro generating stations within the state of HP. The availability of

HPSEBL's transmission system is at par with other leading state transmission utilities in the country.

Inter-state transmission system

The energy requirement of Himachal Pradesh is predominantly met from generating station situated within the State. However, there is transmission infrastructure requirement for evacuation of power from the hydro generating stations located within the state as well as for banking of power to the neighboring states. Currently, four number of inter-state pooling sub-stations located at Nalagarh, Hamirpur, Chamera & Parbati with an aggregate transformation capacity of 1890 MVA acts as the interconnection point for the State.

At present, the inter-state transmission system has about 3,349 ckt kms of transmission line with a total transformation capacity of 1,890 MVA, with the following voltage wise break-up shown in Table 23.

Table 23: Inter-State Transmission System

Voltage	Transformation Capacity (MVA)	Line Length (cKM)
400 kV	4 Nos. 1,890 MVA	2,221
220 / 132 kV	-	1,128
Total	**1,890**	**3,349**

5.3. Intra-state Transmission Plan

Proposed schemes

HPSEBL is working on a number of transmission projects to improve the network infrastructure and to ensure reliability and quality of supply to end consumers.

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

a) Meet demand for power arising from existing and future end-consumers in various load centers/ pockets in the state;

b) Providing connectivity for evacuation of power from various upcoming intra and inter-state power plants and for onward delivery of such power to load centers/ drawl points;

c) Improving the availability and reliability of the intra-state transmission systems in the State; and

d) Improving efficiency by way of reducing technical losses in the intra-state transmission systems.

For meeting the power requirement during winter months, HPSEBL have to depend upon power flows from outside the State. Therefore, in order to transmit the available power from periphery to load centers for further distribution to consumers and industrial areas like Baddi, Barotiwala, Kala Amb, Paonta etc., HPSEBL has meticulously planned its EHV Distribution Network for intra sub-station transfer of power. It has proposed a 220kV ring interconnecting all the seven 220kV sub stations in the HP system in a phased manner along with construction of 400kV transmission line from Nalagarh (PGCIL's sub-station to link Nalagarh) to Kunihar with 400/220kV sub-station at Nalagarh. This 220kV ring along with 400kV system will strengthen the existing power delivery system in a big way to the extent of 500 MW from one corner to another corner in the State within minimum lines.

The summarized list of planned schemes and proposed capacity additions at various voltage levels is summarized in Table 24.

Table 24: Proposed schemes of HPSEBL

Parameter	FY16	FY17	FY18	FY19	Total
No. of Lines	3	2	7	4	**16**
Ckt kms	59	51	109	34	**254**
No. of new S/s	5	3	6	2	**16**
Capacity (MVA)	285	73	369	328	**1,055**
No. of augmentation S/s	8	4	1	2	**15**
Capacity Addition (MVA)	295.5	162.9	68.5	23.5	**550.4**

The proposed transmission investment shall add 16 new substations with a total capacity of 1055 MVA and augmentation of 15 existing substations by approx. 550 MVA.

In addition to the above intra-state transmission schemes being undertaken by HPSEBL for strengthening and augmentation of the transmission network within the state, there are various transmission schemes/ works being undertaken by HPPTCL for evacuation of power from remotely located hydro power plants within the state. The details of proposed transmission augmentation by HPPTCL is summarized in table below:

Table 25: Proposed schemes of HPPTCL

Parameter	FY16	FY17	FY18	FY19	Total
No. of Lines	-	12	5	7	**24**
Ckt kms	-	274	206	300	**780**
No. of sub-stations	-	8	7	9	**24**
Capacity (MVA)	-	635.5	1,213	1,660	**3,508**

The commissioning of transmission lines and substations planned by HPPTCL may defer up to FY20 considering the geographical difficulties, lower working season, lengthy and unpredictable forest clearance procedures.

5.4. Inter-state Transmission System Plan

Ongoing schemes.

In view of the upcoming hydro generation capacity additions in the northern region, PGCIL has started strengthening the inter-regional and inter-state transmission systems and is also focusing on capacity augmentation of existing substations and transmission lines. Augmentation of the inter-state transmission capacity is being undertaken by PGCIL as well as under the Tariff Based Competitive Bidding "TBCB". The details of augmentation projects which are currently under development are provided in Table 26.

Table 26: Augmentation of Inter-state Transmission Substation

Details	Expected Completion	Works
Augmentation of Transformation capacity in Northern Region for 2016-17	Mar'16	ICT Aug. at Hamirpur 400kV S/s - 3x105 MVA 2 nos. of 220kV line bays
NRSS-XXXII	June'16	400/220 kV ICT at Parbati pooling station - 7x105 MVA(Phase-1: 630MVA) and two nos. of 220 kV line bays.
Transmission System associated with Northern region System strengthening Scheme-XXXI-Part-A	July'17	7Xl05MVA(Ph-1 : 630MVA), 400/220 kV GIS substation at Kala Amb LILO of both circuits of Karcham Wangtoo – Abdullapur 400 kV D/c (Quad Moose) line at Kala Amb - 5km
SVC at Nalagarh	2017-18	+200 MVAR STATCOM
		alongwith 2x125 MVAR Capacitor and 2x125 MVAR Reactor at Nalagarh Substation

The above schemes shall enable augmentation of the inter-state transmission capacity by 1680 MVA which shall enable evacuation of power from small and large hydro stations in the region.

Proposed New Schemes

A number of new hydro generation projects are planned in the upper region of Himachal Pradesh which mainly cover upper part of Satluj Basin including Spiti Valley and Chandrabhaga basin. For implementation of transmission system, there are severe right-of-way constraints and the terrain is very tough and the area is snow bound. The transmission system for upper part of Satluj Basin, Spiti Valley (Satluj Basin), Chandrabhaga Basin and Beas Basin in Himachal Pradesh was decided through a Task Force having representatives from Govt. of HP, HPPCL, HPPTCL, CEA and POWERGRID to identify the availability of corridors, location of proposed pooling stations, feasibility of construction of lines, progress of generation projects etc.

The master plan for these various hydro projects in Himachal Pradesh was identified and discussed in the Standing Committee Meeting of Northern region Constituents. However, implementation of the transmission system shall be taken up after receipt of long -term applications from the generators.

The detailed list of planned transmission system is given at Annexure 2.

5.5. Adequacy of Transmission Planning:

The intra-state transmission plan prepared by HPSEBL and HPPTCL is adequate to meet the projected demand within the State up to FY19 as well as the requirement for evaluation of power from generating stations being developed in the State. The total capacity (including existing Substations and Lines) after implementation of all schemes is shown in Table 31 and Table 32.

With the expected peak demand of 1,622 MW in FY19, the ongoing/ proposed projects for capacity additions and augmentations will be adequate to cater to the increasing load and also improve

reliability of the system by building in redundancies in the system. With the proposed capacity additions it is envisaged that there shall not be any bottlenecks in transmission of power from outside the State to the distribution network of HPSEBL at the time of demand-supply deficit.

5.6. Fund Requirement (Intra-state only)

The requirement of funds for development of ongoing and planned transmission systems of HPSEBL is as provided in Table 27. It is observed that a total fund requirement of Rs. 1,187 Cr is envisaged for transmission development within the state of which fund requirement to the tune of approx. Rs. 400 Cr. is currently un-tied.

Table 27: Year-wise fund requirement for HPSEBL Planned Intra-state Transmission System (Rs. Crs.)

Item	FY16	FY17	FY18	FY19
Estimated Fund Requirement	371	296	292	227

The details of various funding options available and balance un-tied funding is provided in table below:

Table 28: Funding for HPSEBL Proposed Transmission Capital Expenditure

Item	FY16	FY17	FY18	FY19
Estimated Fund Requirement	371	296	292	227
Sources of Funding				
Multilateral funding (KFW)	-	39.03	39.03	19.52
FI (REC)	272.96	204.72	204.72	-
FI (PFC)	135.59	135.59	67.79	-
Total Tied Up	**272.96**	**243.75**	**243.75**	**19.52**
Balance fund to be arranged	**98.42**	**52.69**	**48.15**	**207.91**

Similarly for the various transmission works being undertaken by HPPTCL, the envisaged capital expenditure is provided in Table below:

Table 29: Year-wise Fund Requirement for HPPTCL Planned Transmission System (Rs. Cr.)

Source	FY17	FY18	FY19
ADB Tranche-1 (Total 113 Million USD)	67.08	204.49	
ADB Tranche- 2 (Total 110 Million USD)	37.05	183.76	
ADB Tranche-3 (Total 127 Million USD)	-	47.84	
KfW	250.00	450.00	210.00

For the various intra-state lines being implemented by HPPTCL, the funding of the various works to be carried out are being funded by REC, ADB and KfW. The funding of the various schemes are as per the debt to equity provided in Table 30 below:

Table 30: Funding of HPPTCL Planned Transmission System

Item	Debt	Equity	Others
ADB Tranche I	80%	20%	
ADB Tranche II	75%	25%	
ADB Tranche III	To be finalized		
KfW (GEC Scheme)	40%	20%	40% (NCEF Grant)
REC	90%	10%	

Table 31: Total Transmission Capacity of HPSEBL (in MVAs) post implementation of schemes

Particulars	Existing	Additions after implementation of Schemes				Cumulative Capacity
		FY16	FY17	FY18	FY19	
S/S capacity						
400kV	**-**	-	-	-	315	**315**
220kV	**1,724**	400	74	393	-	**2,590**
132kV	**1,417**	110	82	-	24	**1,632**
66kV	**690**	70	80	45	13	**899**
Total	**3,831**					**5,436**
Line Length						
400kV	**-**	-	-	-	34	**34**

Particulars	Existing	Additions after implementation of Schemes				Cumulative Capacity
		FY16	FY17	FY18	FY19	
220kV	**536**	8	-	62	-	**606**
132kV	**2,321**	34	27	33	-	**2,414**
66kV	**592**	17	24	15	-	**649**
	3,449					**3,702**

Table 32: Total Transmission Capacity of HPPTCL (in MVAs) post implementation of schemes

Particulars	Existing	Additions after implementation of Schemes				Cumulative Capacity
		FY16	FY17	FY18	FY19	
Grid Substations (Nos)	**NIL**	-	8	7	9	**24**
Transformation Capacity (MVA	**NIL**					
400 KV		-	315	630	945	**1,890**
220 KV		-	226	500	463	**1,189**
132 KV		-	94.5	63	252	**409.5**
66 kV		-	-	20	-	**20**
Sub Total	**NIL**	**-**	**635.5**	**1,213**	**1,660**	**3,508.5**

5.7. Transmission Planning Related Issues

In the past there has been limited addition in the intra-state transmission network of the State. However, with the growing demand and requirement for evacuation of power from the hydro stations located within the state, the need to augmentation and strengthening of the transmission network has been realized and both HPSEBL and HPPTCL are focused on developing the EHV network in the state. However, the utilities have identified number of issues with respect to planning and implementation of the transmission projects in the State. Some of the issues are as below:

- Inordinate delay in the obtaining forest clearances leading to delay in implementation of projects
- Disruptions by the local public during construction activities inspite of payment of adequate compensation leading to unwarranted delays in implementation
- Current procedures for land acquisition and right of way are cumbersome

Further, issues with respect to evacuation of power from the renewable and hydro power plants in the Kaza region (located in the Lahaul and Spiti district) have been highlighted by HPSEBL for which necessary support may be required from the PGCIL.

Incidence of higher Transmission Charges

One of the major concerns that the State of HP is facing with respect to bearing of double transmission charges and losses with respect to the sale of surplus energy being sold by the GoHP. Upto Feb 2006, the State was able to sell its surplus power to neighbouring states by way of reallocation of capacity. Accordingly, the PowerGrid charges which were otherwise borne by GoHP were also re-allocated to the utilities whom the capacities were re-allocated for the period of re-allocation. However, from 2007 onwards this re-allocation of capacity was stopped after objection from few states. Therefore, GoHP had to sell the surplus power through short-term open access which resulted in levy of double transmission losses viz. from Generator terminal to HPSEB under long-term open access regulations & thereafter from HPSEB periphery to buyer utilities under short-term open access procedure. This mechanism has resulted in additional transmission charges for the GoHP. Besides, short-term open access does not permit simultaneous revision of schedule to buying utility in the event of revision in generation schedule and/or shutting down of the plant by hydro generator. This has resulted in high implication to

the state under Unscheduled Interchange (UI) Mechanism.

Therefore, the procedure being resorted to for sale of power to utilities other than local discom has defeated the very purpose of compensating the state for distress caused to them by setting-up of the hydroelectric plant. A suitable procedure/ mechanism needs to be framed which may enable the state to sell its surplus power without any additional financial burden by way of double transmission charges or penalty under UI due to uncertainty over hydro generation.

5.8. Action Plan & Support Required

In view of the proposed transmission plan, the action points shown in Table 33 have been identified for respective stakeholders to be able to make suitable arrangements for development of adequate transmission system in the State.

Table 33: Action Points & Timelines

Stakeholder	Action Points
State Government	• Continued administration support for acquisition of land for the substations
HPSEBL / HPPTCL	• Ensure timely implementation of the various transmission schemes proposed to be implemented by FY19
Government of India	• Framing of suitable procedure/ mechanism for sale of surplus power by the State without attracting any additional financial burden by way of double transmission charges or any penalty under the UI mechanism on account of uncertainty over hydro generation • Assist HPSEBL in arranging funds from World Bank/ External Agencies for the transmission schemes which are currently un-tied
CEA/ PGCIL	• Conduct a study in the next 3 months to deliberate options for transmission of power from the solar and hydro power plants being planned in the Kaza region

6. Distribution Plan

6.1. Introduction

State Government owned Himachal Pradesh State Electricity Board Ltd. (HPSEBL) is the sole distribution licensee responsible for development and management of the distribution network and supply of uninterrupted and quality power to the various consumer categories in the State of Himachal Pradesh. HPSEBL is supplying power to the various categories of consumers through a network of transmission, sub-transmission and distribution lines.

6.2. Objectives of the distribution plan

The energy requirement and peak demand for Himachal Pradesh is expected to increase from 8,807 MU and 1,422 MW in FY15 to 10,091 MU and 1,622 MW in FY19 respectively. Since the State is close to 100% household electrification, the increase in sales is primarily on account of natural increase in demand from the present consumer base and improvement in lifestyle. However, considering the limited investment in the distribution infrastructure in the past years, HPSEBL is required to undertake commensurate investments in the sub-transmission and distribution infrastructure in order to provide continuous and reliable power to the consumers in the State.

Accordingly, the objectives of the distribution plan, in accordance with the 24X7 PFA objectives, includes 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 the remaining 14,088 rural unconnected households in the State;

c) Provision of 24X7 supply to cater to increase in demand from existing consumers and increase in demand owing to new consumer growth in the State;

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

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

6.3. Existing distribution system- HPSEBL

The existing distribution network of HPSEBL comprises of transmission, sub-transmission and distribution system required for meeting the load requirement within the state. The area of HPSEBL's distribution network is divided in three zones i.e. North, South and Central which are further sub-divided into 12 operational circles which cover the 12 districts of the state. As part of unbundling of the State Electricity Board in 2010, a large part the EHV and HV lines were retained by HPSEBL and therefore management of the transmission network is also primarily undertaken by HPSEBL.

This section discusses the sub-transmission and distribution network and systems spread across the various districts of Himachal Pradesh. The existing distribution infrastructure of HPSEBL is very old with limited additions in the past years. As a result, the distribution network is showing signs of ageing and may lead to deterioration of performance of HPSEBL if adequate and timely steps are not taken for replacement and further augmentation of the system.

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 34 below

.

Table 34: Existing Distribution Network of HPSEBL (March 2015)

Particulars	Unit	Capacity
Transformer		
33/11 kV substations	Nos	159
33/11 kV substations Capacity	MVA	1,102
11/0.4kV LT Distribution Transformer	Nos	27,013
11/0.4kV LT Distribution Transformer	MVA	2,323
Lines		
33kV Feeders	Ckt. Kms	3,107
22kV & 15kV Feeders	Ckt. Kms	7,209
11kV Feeders (including 2.2kV)	Ckt. Kms	21,625
LT Feeders	Ckt. Kms	60,700

In spite of a difficult hilly terrain, HPSEBL has been able to achieve near 100% HH electrification. Therefore, the focus of the utility is now towards providing reliable and cost effective power. In view of the old distribution network and growing loading of transformers and distribution lines in urban and industrial areas, requirement for network augmentation and improvement is most critical. Also, addition of close to 40-50k consumers each year is putting additional pressure on the distribution infrastructure.

DTR Failure Rate

DT Failure Rate in the HPSEBL supply area has been 4.84% in FY15 which has deteriorated from 4.50% in FY12. Solan, Nahan and Rohru had DTR failure rates at over 6% while Hamirpur and Una recordered the lowest DTR failures of 2.1% and 2.3%. Solan and Nahan which are primarily industrial areas accounting for significant energy sales, recorded very high DTR failure rates during FY15. HPSEBL is investing in its network though the R-APDRP and IPDS projects to bring down the DTR failure rates.

AT&C Loss

The overall AT&C loss for 14.91% for FY2014-15 is better that many other states in India in spite of a difficult hilly terrain where the households are spread far across. The lower AT&C loss can partially be attributed to the favorable HT and LT

Table 35: Circle-wise DTR Failure Rates for FY2014-15

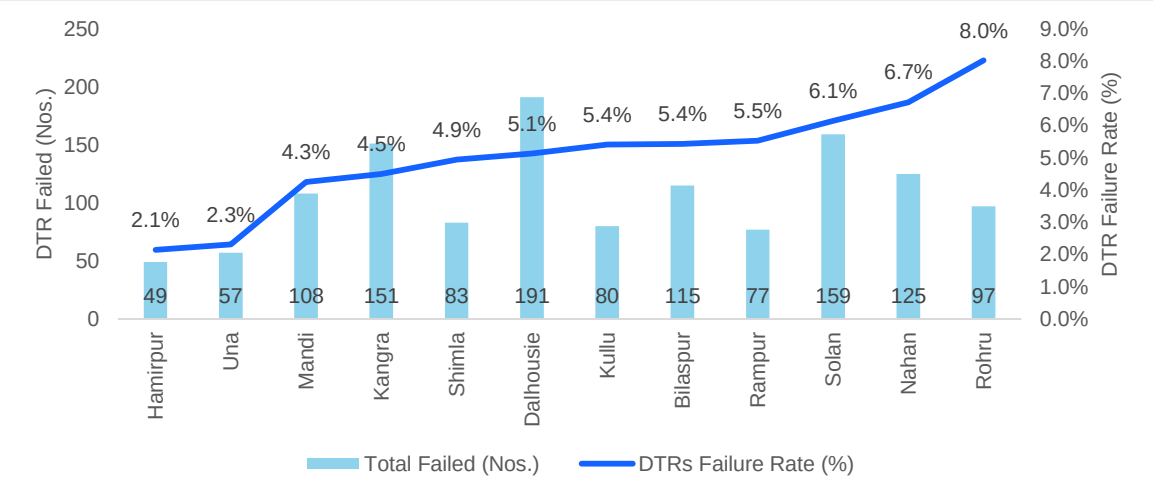


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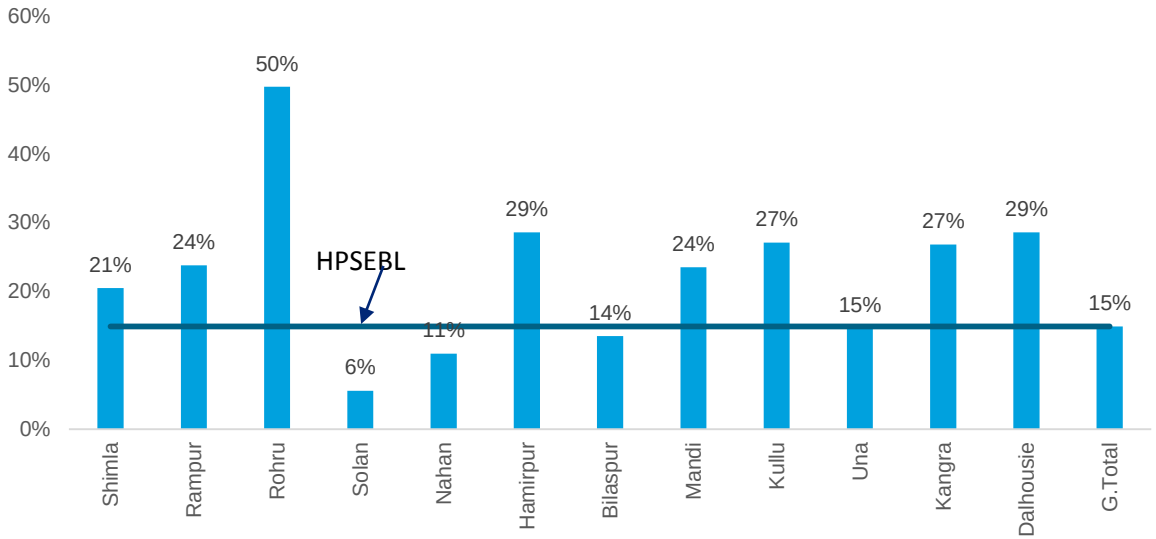
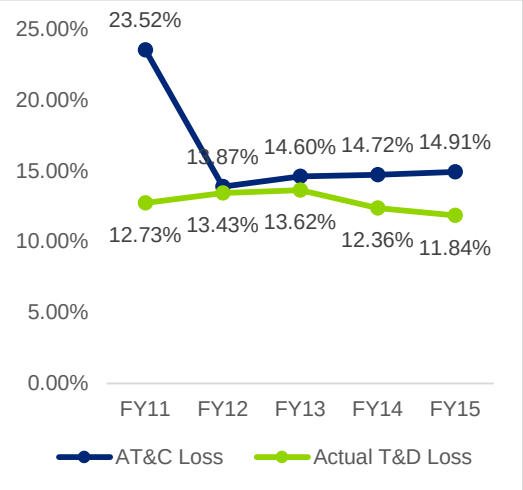
Table 36: Circle-wise AT&C Loss for HPSEBL (FY15)



mix in the state where HT consumption forms approx. 60% of the total HPSEBL's sales.

However, based on the information of district-wise AT&C losses for FY14-15, it is observed that there are few districts i.e. Rohru, Hamirpur, Kangra, Dalhousie, Kullu where the AT&C loss is still at significantly higher levels as compared with the average for the state. There is significant scope for improvement in these circles which would help the utility in meeting the AT&C target of 10% by FY19. On the other hand industrial belt of Solan and Nahan which contributes 43% and 13% of the overall energy sales has an AT&C loss of 5.58% and 10.96% for FY2014-15 which is lower than the overall AT&C loss of 14.91% for FY2014-15

Figure 17: AT&C Loss and T&D loss of HPSEBL during FY11 to FY14



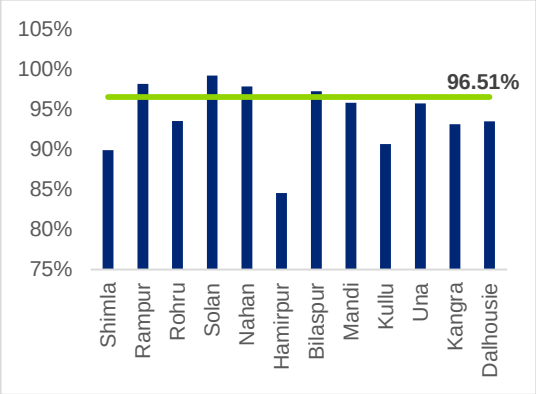
As can be observed from the above graph, the AT&C loss of HPSEBL have become range bound and has been increasing in the past four years primarily on account of deterioration in collection efficiency. The collection efficiency which was 99.49% during FY12 has reduced to 96.51% in FY15. However, the T&D loss of the utility has continued to improve in the last three years from 13.62% in FY13 to 11.84% in FY15. One of the reasons for improvement in loss levels is the high level of DT and Feeder level metering which is indicated in Table 37 below.

Table 37: DT and Feeder Level Metering of HPSEBL

Particulars	Total DTs/ Feeders	Meters Installed	Metering Percentage
33 kV Feeders	223	220	98.65%
22 kV Feeders	156	156	100.00%
15 kV Feeders	3	3	100.00%
11 kV Feeders	987	987	100.00%
2.2 kV Feeders	4	4	100.00%
DTRs	2,7774	2,7376	98.57%

The circle –wise collection efficiency for FY15 indicates higher collection efficiency in industrial circles of Solan (99.20%) and Nahan (97.84%) which contribute to over 57% in total sales. On the other hand, the collection efficiency of a number of circles including Shimla, Hamirpur, Kullu, Kangra and Dalhousie remain below the average collection efficiency of HPSEBL as shown in the Figure 18 below:

Figure 18: Circle-wise Collection Efficiency of HPSEBL for FY15



While HPSEBL has proposed several schemes for improvement in both technical and commercial performance, it is important that the schemes are timely and efficiently implemented in order to get the benefits in the desired timeframe.

Some of the measures envisaged for reducing the AT&C loss and achieving the targets set by MoP are:

i. Energy Audit: Energy audit for 2013-14 has been completed in case of eight operation circles and reports have been sent back to the respective circles. Feeders having high losses are being identified for detailed engineering and adoption of remedial measures. Targets for Circle-wise voltage-wise losses and division- wise / voltage-wise losses have been fixed for next five years beyond FY2013-14 as per directions of HPERC.

ii. Strengthening of Sub-Transmission System: The sub-Transmission system has been strengthened by erection and commissioning of 33kV sub-stations, reconductoring of HT/LT feeders and providing new HT lines and Distribution substations under R-APDRP scheme.

iii. System improvement schemes: No. of system improvement schemes (for 33kV and below system) in respect of different operation circles have been sanctioned for procurement of materials like poles, conductor, distribution transformers and electronic meters.

iv. Replacement of Dead Stop/ Defective energy meters: Replacement of defected meters is being undertaken regularly. New energy meters (Static meter only) are being procured. Report on feeders where energy loss is high with respect to normative level and replacement of defective meters, is being sought from all circles regularly.

v. Automatic Meter Reading: Providing AMR or remote metering in the industrial areas and improving the metering efficiency across HPSEBL.

vi. Improvement of Billing Efficiency: Appointment of billing franchise under the scheme RGGVY has been done.

vii. Checking of thefts & Pilferage of energy: Flying squads have been formed which conducts raids/ checks at various consumer premises to detect theft of energy and other irregularities.

With a view to supplement the various measures undertaken by HPSEBL for reduction of AT&C loss, the investment plans of HPSEBL should be targeted in such a manner which not only helps in reducing the high AT&C losses of the select areas but also maintain/ lower the losses in high consumption areas as well.

6.4. Central and State Government Schemes

The collective objective of all the Central/ State Government schemes has been to enhance the reach, reliability and quality of electricity to end consumers and to improve the financial position of utility by way of reducing the AT&C losses. The following schemes are presently underway and are at various stages of implementation in Himachal Pradesh, which shall not only help HPSEBL in augmentation of the distribution network but also aim towards enhancing the technical capacity.

Deen Dayal Upadhyaya Gram Jyoti Yojana

Under the RGGVY, HPSEBL has proposed various network extension, strengthening and augmentation works in order to develop a robust sub-transmission and distribution infrastructure in rural areas.

Himachal Pradesh being a special category state, the condition of coverage for villages and habitations has been relaxed. The project covers 12 districts of Himachal Pradesh having a total layout of Rs. 341.86 Cr. HPSEBL has incurred an

expenditure of Rs. 296 Cr. against the sanctioned amount by the Government of India.

Majority of the work under RGGVY is complete and only 5% works are remaining which are based in remote and tribal areas of the State.

To complete the electrification process HPSEBL has got approval for Rs. 159.12 Cr under the DDUGJY scheme for implementation of projects to extend grid connectivity to 14,088 rural HHs

The main objectives of the investments under the DDUGJY scheme is to strengthen the existing network in rural areas and improve reliability of system while improving the quality of supply.

The proposed network addition in this scheme is shown in Table 38 below.

Integrated Power Development Scheme (IPDS) and R-APDRP

Under the R-APDRP scheme, Himachal Pradesh has planned extensive improvements for its sub-transmission and distribution infrastructure in its 14 towns including Nahan, Paonta Sahib, Shimla, Baddi, Bilaspur, Chamba, Dharamshala, Hamirpur, Kullu, Mandi, Sundernagar, Una & Yol with a total investment of Rs. 322 Cr. An expenditure of Rs. 54.17 Crores has been incurred by HPSEBL in the 14 towns of HP as on 31.10.2013. Major works under this scheme include construction of new sub-stations, augmentation of transformers having loading more than 70%, reduction of lengthy HT/LT lines by installation of new DTRs, spotting of faults through Fault Passage Indicators (FPIs), etc. The outlay under this scheme was further revised to Rs. 589.47 Cr. of which Rs. 339 Cr. is proposed to be implemented during FY16-FY18 by HSPEBL.

Further, under the IPDS scheme, HPSEBL has proposed for strengthening its network in its 12 circles which shall include development of 2 sub-stations, 220 ckt kms of 11/22 kV lines, 217 ckt kms LT lines and 390 distribution transformers. In this regard, projects amounting to Rs. 110.60 Cr. has been approved. Circle wise proposed infrastructure addition under the IPDS scheme is provided in Table 39 below.

Table 38: Circle-wise Infrastructure addition program under DDUGJY

Sl. No.	Circle	Project Cost (Rs. In Cr.)	New Substation (Nos.)	Augmentation Of Power T/F (Nos.)	Additional Power T/F (Nos.)	New HT Line (Km)		New LT Line (km)	New Distribution Transformer (Nos.)
						33 KV	11/22 KV		
1	Una	8.99	1	0	-	3	13.15	92.89	6
2	Kullu	10.51	1	0	-	3	37.62	50.36	21
3	Mandi	33.6	5	6	-	22.5	66.42	293.31	76
4	Chamba	11.93	2	4	-	10	30.7	78.6	1
5	Kangra	31.71	6	9	-	32.2	128.99	97.4	2
6	Solan	8.78	0	4	-	0	30	98.99	29
7	Shimla	32.42	1	0	-	4	78.6	240.7	61
8	Kinnaur	6.52	0	0	-	0	73.19	59	11
9	Lahaul spiti	0.12	0	0	-	0	0.5	2.3	0
10	Sirmour	9.72	0	4	-	0	7	167.74	0
11	Bilaspur	2.23	0	2	-	0	4	31.1	0
12	Hamipur	1.9	0	0	-	0	0	39.4	0
	Total	**158**	**16**	**29**	**-**	**74.70**	**470.17**	**1,251.79**	**207**

Table 39: Circle-wise Infrastructure addition program under IPDS

Sl. No.	Circle	Project Cost (Rs. In Cr.)	New Substation (Nos.)	Augmentation Of Power T/F (Nos.)	Additional Power T/F (Nos.)	New HT Line (Km)		New LT Line (km)	New Distribution Transformer (Nos.)
						33 KV Line	11 KV / 22 KV Line		
1	Bilaspur	8.83					18.38	25.50	20
2	Dalhousie	3.63					5.60	8.12	11
3	Hamirpur	3.96					9.05	15.41	20
4	Kangra	14.27	1			3.500	26.12	34.10	43
5	Kullu	14.09	1			0.500	25.00	15.20	79
6	Mandi	4.89					7.40	9.84	14
7	Nahan	3.00					9.00	5.50	8
8	Rampur	10.81					45.40	7.89	34
9	Rohru	13.21					10.00	41.40	21
10	Shimla	7.56					10.70	9.48	19
11	Solan	14.22					28.99	13.70	60
12	Una	12.13					24.27	30.96	61
	Total	**111**	**2**	**0**	**0**	**4**	**220**	**217**	**390**

Table 40: Circle-wise Infrastructure addition program under R-APDRP

Sl. No.	Circle	Project Cost (Rs. In Cr.)	New Substation (Nos.)	Augmentation Of Power T/F (Nos.)	Additional Power T/F (Nos.)	New HT Line (Km)		New LT Line (km)	New Distribution Transformer (Nos.)
						33 KV Line	11 KV / 22 KV Line		
1	Bilaspur	8.63					11.880	11.875	230
2	Dalhousie	2.93						9.43	18
3	Hamirpur	6.46					13.240	4.780	22
4	Kangra	17.28				6.000	25.530	47.765	67
5	Kullu	7.4					10.900	4.622	58
6	Mandi	19.24	1	1			38.080	3.880	58
7	Nahan	42.70	1	1		5	104.520	42.896	243
8	Shimla	120.34	7	1	1	29.63	124.356	5.633	124
9	Solan	106.68	1	2	3	88.75	111.400	35.900	230
10	Una	7.31					16.300	16.91	69
	Total	**339**	**10**	**5**	**4**	**129**	**456**	**184**	**1,119**

Table 38, Table 39 and Table 40 above provides a summary of the infrastructure works proposed under various Central Government sponsored schemes i.e. DDUGJY, IPDS and R-APDRP to be taken up by HPSEBL in the state.

Government of Himachal Pradesh Schemes

The Government of HP each year provides funds for distribution infrastructure planning in tribal and schedules cast areas. An outlay of Rs. 3.25 Cr and Rs. 4 Cr. was planned by under Tribal Area Sub-Plan and Schedule Case Sub-Plan, respectively for FY2013-14 by HPSEBL.

Rural electrification and RE & System Improvement Plans

HPSEBL has proposed to cover remaining areas including all villages, households and hemlets and strengthening of existing unwieldy lengthy HV/LV

network. Also, HPSEBL has proposed RE & System Improvement plans where emphasis shall be given on strengthening the Sub-Transmission and Distribution System for mitigating the low voltage problem through the following works:

a) 33kV new Substations and its associated lines

b) Augmentation of 33kV Sub Stations

c) Renovation & Modernization of 33/22/11kV Substations equipment

d) HVDS, replacement of meters, poles, GI Wire etc.

Consumer Service and Electrification (Circle-wise)

For improving the consumer service and reliability of power in the 12 operational cirlces, HPSEBL has proposed the following works to be undertaken upto FY19:

a) 11/22kV new lines augmentation & re-organization.

b) New DTRs 11/.4kV 22/.4kV & 33kV augmentation& new capacitor banks etc.

c) New LT, augmentation, re-organization/conversion of LT to HT

d) New Service connection.

e) Replacement, augmentation, re-organization or services

f) Metering of LT & HT

g) Any major T&P

ALDC, System Operation, Communication systems, etc.

Establishment of ALDC and upgradation of system operations and communication systems is planned to be implemented with a total expenditure of Rs 41.97 Cr.

New Building

HPSEBL has been facing difficultly in the absence of its own buildings both residential as well as non-residential. Therefore, HPSEBL has planned an outlay of Rs. 5.00 Cr. for providing adequate office and residential accommodation to the staff of the Board at all places considering the increased activities of the Board.

IT Projects

HPSEBL also has plans for undertaking major IT initiatives for bringing about transparency in their operations. These initiatives shall include a mix of new and innovative technologies to provide quality power and services to the consumers and assist HPSEBL to maximize its revenue and improve its collection efficiency. Some of the IT initiatives planned as part of the capital expenditure are:

Existing Initiatives

- Computerized Billing
- GIS/GPS
- R-APDRP
- ERP

New IT Initiatives

- Smart Grid
- Expansion of AMR
- Expansion of Computerized Billing
- GIS/GPS updation in Non RAPDRP area
- SCADA/DMS
- R-APDRP Next Phase

A summary of the capital expenditure planned by HPSEBL under the distribution function is summarized in Table 41.

Table 41: Capital expenditure in Rs. Cr. under various schemes for HPSEBL

Scheme	FY16	FY17	FY18	FY19	Total
Distribution Schemes - OP North	36.30	41.40	45.00	37.20	159.90
Distribution Schemes - OP Central	40.20	24.90	21.60	10.40	97.10
Distribution Schemes - OP South	51.20	50.30	42.10	36.20	179.80
Consumer Services & Electrification Schemes	93.90	118.00	124.00	125.30	461.20
Centrally Sponsored Schemes	162.55	408.51	92.50	-	663.57
IT Works	79.70	86.10	80.42	66.83	313.02

Scheme	FY16	FY17	FY18	FY19	Total
GoHP Schemes	6.37	5.64	4.84	3.54	20.39
New Buildings	14.00	13.00	9.60	8.90	45.50
Minor works	13.40	16.10	17.00	18.80	65.30
ALDC Works	18.00	23.50	-	-	41.50
TOTAL	**515.41**	**787.38**	**436.96**	**307.01**	**2,046.77**

6.5. Funding Plan- HPSEBL

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

Table 42: Fund Requirement in Rs. Cr. under various schemes for HPSEBL

Particulars	FY16	FY17	FY18	FY19	Total
Total Capex	**515**	**787**	**437**	**307**	**2,047**
(KFW)	-	36	36	18	90
(IPDS/DDUVGY)	15	230	25	-	270
R-APDRP Part-B	136	136	68	-	339
R-APDRP Part-A	12	43			55
Financial Institutions (REC)	144	87	58	-	289
Total Available	**307**	**531**	**186**	**18**	**1042**
Balance	209	256	251	289	1005

The total fund requirement for the distribution system works in the state is about Rs. 2,047 Cr, a significant proportion of close to 50% is currently un-tied. Rs. 663.57 Cr. is to be funded through the Central Government Schemes (R-APDRP, DDUGJY and IPDS). Also, since the State has already achieved 100% electrification, funds from various Central Government sponsored schemes like R-APDRP, DDUGJY and IPDS are limited.

It may be noted that the proposed investment plan is drawn from the business plan prepared by HPSEBL as part of submissions to HPERC at the beginning of the 3rd Control Period i.e. FY2014-15 to FY2018-19. The funds availability and gap information will under-go a change once the proposed projects are implemented by HPSEBL and funding is sought from various financial institutions.

6.6. Other initiatives

Other initiatives and AT&C Loss reduction Measures for HPSEBL are as follows:

Computerized Billing and Energy Accounting: Computerized Billing and Energy Accounting Package (IT Package) was implemented under the 'Accelerated Power Development and Reform Program (APDRP)' launched by Ministry of Power. The package included computerization of various activities of the sub-divisions. The project has been implemented in 132 subdivisions of 27 divisions and 12 circles covering more than 12 lakh consumers. Centralized data center and call center has also been established at Vidyut Bhawan, Shimla.

GIS/GPS Based Asset Mapping: HPSEBL has decided to carry out GIS/GPS based asset mapping including consumer indexing and valuation of assets for the whole HPSEB, which will be used as the base for computerization of billing, energy accounting, electrical network management and to create fixed assets registers with its present value for its three wings namely Generation, Transmission and Distribution after proper reconciliation with latest balance sheet of the Board. Pilot project has since been completed for operation circle Shimla. For remaining 11 circles, field related activities of the project have been completed and approval of data by HPSEBL is in progress. Updation of GIS/GPS data in 14 R-APDRP towns has been awarded for next five years as per the requirement of R-APDRP project.

Implementation of ERP: HPSEBL has awarded the work of implementation of ERP(SAP) to M/s TCS which shall cover the following modules: Financial Management and Accounting, Human Resource Management including payroll, Project Management, Materials Management, Maintenance Management, and Availability Based Tariff. The first phase of the implementation is already complete which covers the head-office and operational circle of Shimla.

SCADA/ DMS: HPSEBL has prepared a pilot project for the control and monitoring of all un-manned 33kV and above substations being commissioned in the State. The control center is envisaged to be setup at the DR Center Paonta.

Employee Information System: Web based system for displaying the Personal, Posting, Promotion Information of Gazetted Employees.

Data Center at Shimla: A data center has been developed at Shimla which is functional and modems have been installed at 14 towns for sourcing of real-time information.

Smart Grid Pilot project: HPSEBL has proposed to implement Smart Grid Pilot in Kala Amb to improve the system performance by reduction in peak power by 6 MVA, reduce outages, improve consumer engagement and satisfaction. The DPR of this pilot project has been approved by the Govt. of India of which Ministry of Power shall bear Rs. 8.92 Crores and the balance funding has to be arranged by HPSEBL through financial institutions like REC.

Data Center at Shimla: A data center has been developed at Shimla which is functional and modems have been installed at 14 towns for sourcing of real-time information.

6.7. Rollout Plan

Table 43 shows the distribution infrastructure roll-out plan for HPSEBL. Addition of 3,338 kms of HT lines and 3,339 kms of LT lines is proposed which shall marginally improve the HT:LT line ratio from 1:1.9 to 1:1.8.

6.8. Action Plan & Support Required

In view of the proposed distribution plan, the action points shown in Table 44 have been identified for respective stakeholders to be able to make suitable arrangements for development of adequate distribution system in the State.

Table 43: Distribution Infrastructure rollout plan for HPSEBL

Item	Unit	Capacity at the end of FY15	Addition				FY 19 Capacity
			FY 16	FY 17	FY 18	FY 19	
Substation / Transformer							
33/11 kV Substations	Nos	**159**	19	16	14	6	**214**
33/11 kV Capacity	MVA	**1,102.0**	139.9	113.8	102.3	66.1	**1,524.1**
11/0.4kV LT Distribution Transformer	Nos	**27,013**	833	930	958	982	**30,716**
11/0.4kV LT Capacity	MVA	**2,323.0**	75.0	83.7	86.2	88.4	**2,656.3**
Lines							
33kV Feeders	Ckt. Kms	**3,107**	115	99	86	38	**3,446**
22/15/11 kV Feeders	Ckt. Kms	**28,834**	713	735	753	799	**31,835**
LT Lines	Ckt. Kms	**60,700**	785	809	829	916	**64,040**

Table 44: Action Points & Timelines

Stakeholder	Action Points
HPSEBL	• Skill upgradation and training to be imparted to employees for using modern technologies like SCADA/ AMR/ Smart Meters etc. • Identify training needs of employees in various functions of the distribution business and prepare a training calendar. • Preparation of plan to reduce AT&C losses in high loss circles (greater than 20% AT&C losses) by September 2016 • Program monitoring/ Project Management cell of capex schemes provided in the PFA documents • Updation of all 11kV feeder data on the PFC portal including non R-APDRP towns • Roll out of IT systems (metering, billing, collection, energy audit, etc.) created under R-APDRP to other non-RAPDRP areas
Government of India/PFC/REC	• Funds for the unapproved/unfunded capex schemes of HPSEBL

7. Renewable Energy Plan

7.1. Introduction

The state of Himachal Pradesh is endowed with vast resources of hydro potential and it has ensured that small hydro power development is provided the required impetus in terms of enabling policy and regulatory framework. This has resulted in a sizeable amount of capacity development in the Small Hydro Power (SHP) segment i.e. hydro plants with capacity less than 25 MW in the state. Currently the state boasts of having an installed capacity of 371.45 MW of SHPs through more than 80 projects. (Details of the installed SHPs is provided in Table 52.) HPSEBL also has 18 SHPs with a total installed capacity of 115.45 MW that qualify for renewable power.

The state equally has a strong potential of solar power development and is geared up for significant capacity additions in the solar segment. The National Institute of Solar Energy has calculated the solar potential of 34,000 MW in H.P. With rapid technological development in solar generation, it shall be the most competitive in future and therefore capacity creation within the State should be catalyzed.

Generation capacity additions in both the segments of SHP and Solar Power has enabled the state in meeting its growing RPO requirements. The renewable capacity addition proposed over the next five (5) years i.e. 2014-19 is listed in Table 48.

7.2. RPO Obligations

The Hon'ble Himachal Pradesh Electricity Regulatory Commission notified the HPERC (Renewable Power Purchase Obligations and its compliance) Regulations in 2010. The regulations paved the way for determining the solar and non-solar RPO requirements through minimum quantum of purchase (in %) from renewable sources (in terms of kWh) of total consumption of energy in the state. The RPO obligations were specified for three (3) years starting 2010-11.

Considering the state's potential to develop in a major renewable energy producer and with the growing renewable capacity addition in the state, the Hon'ble Commission amended the RPO regulations in 2011 and provided a comprehensive trajectory of solar and non- solar RPOs to be met by the state over the next ten (10) years. The RPO obligations are listed in Table 45.

Table 45: RPO Targets for Himachal Pradesh

Year	Total RPPO %age*	Minimum Solar RPPO %age of the total purchase*
2011-12	10.01	0.01
2012-13	10.25	0.25
2013-14	10.25	0.25
2014-15	10.25	0.25
2015-16	11.25	0.25
2016-17	12.25	0.25
2017-18	13.50	0.50
2018-19	14.75	0.75
2019-20	16.00	1.00
2020-21	17.50	2.00
2021-22	19.00	3.00

**Minimum Quantum of Purchase (in %*) from renewable sources (in terms of energy in kWh) of total consumption*

7.3. Solar Energy Development

Himachal Pradesh, being a hilly State, has generally clear sky and average solar radiation levels which favors commercial as well as domestic generation of solar power. The Commission has directed HPSEBL to procure solar PV power considering factors like access to grid, closeness to load centres, least cost of land, least infrastructure cost like road, water, transportation etc. and ease of operation and maintenance, to meet its RPO requirement, under feed in tariff FIT), for project capacities upto 5 MW.

HPERC has also initiated mapping of the solar potential sites and services of Aryabhat Centre of

the Science & Technology Department and NIT Hamirpur are being availed for this purpose. HPSEBL is required to procure solar PV power of about 250 MW by FY2021-22 to meet out its solar RPOs. However this capacity may go upto 800 MW due to ambitious target of 1 Lac MW by the year 2021-22 set by Govt. of India.

The Solar purchase obligations as notified by the Hon'ble Commission are listed in Table 45. Subsequently, HPERC has now notified the HPERC (Rooftop Solar PV Grid Interactive based on Net Metering) Regulations 2015 enabling the state consumers to opt for Net Metering solar rooftop systems and avail commercial benefits.

7.4. Other renewable sources

To promote generation of renewable power within the State, the Commission in its Himachal Pradesh Electricity Regulatory Commission (Promotion of Generation from the Renewable Energy Sources and Terms and Conditions for Tariff Determination) Regulation, 2012 technical and commercial principles for determination of tariff from various non-renewable power plants. As per the regulations, tariff for plants with capacity of less than 5 MW shall be determined based on the capital cost determined by CERC in the RE Regulations, 2012 while for capacities above 5 MW, competitive bidding route is to be followed.

Being a hydro dominant state, HP has a number of small hydro plants qualifying under the renewable energy. HPSEBL itself has 18 SHPs with an installed capacity of 115.45 MW while 371 MW is with private developers.

7.5. HIMURJA

Himurja, the State Nodal Agency for implementation of Non – Conventional Energy Programs in the state of Himachal Pradesh has been spearheading the SHP project development.

The agency has outlined an investor friendly SHP development programme over the last ten (10) years and till 31st Oct. 2015 small SHPs (upto 5 MW capacity) with an aggregate capacity of 1596.805 MW have been allotted. Three (3) projects of total 2.70 MW have also been commissioned in private sector through UNDP-GEF Programme. Thirteen projects with aggregate capacity of 16.87 MW have been allotted to HIMURJA for development in state sector. Out of these 10 Nos. mini micro hydel projects of total capacity 2.37 MW have been commissioned in the interior part of Himachal Pradesh. *(Source: HIMURJA website)*

7.6. Renewable Energy Plan

In order to meet the MNRE target for solar energy, the State has made amendments to its Solar Policy with an objective to make it more lucrative for solar plant developers and roof-top solar power plant developers. The State is also promoting the central government scheme "Solar Power Scheme for Unemployed Youths and Farmers" and HPSEBL shall procure power at Commission approved tariff from such power producers who wish to install distributed grid connected Solar Projects in the State of Himachal Pradesh with capacities starting 50 kW up to 5 MW.

Himurja shall be the state nodal agency for the scheme. It is expected that a capacity of 84 MW shall be installed under this scheme. Additionally, there are applications pending for 60-70 MW solar power plants to be installed in the State apart from the 10 MW solar capacity planned by HPPCL and solar projects planned by the HPSEBL.

HPSEBL has formed a JV company with Solar Energy Corporation of India in the equity ratio of 74:26 i.e. Himachal Pradesh Solar Power Corporation Private Limited for execution of a 2.5 MW hybrid (2.0MW Solar+0.5 MW Wind) at Kaza. The cost of the project is estimated to be Rs. 30.72 Cr. and application for land acquisition is under process with forest department.

Further HPSEBL has proposed to undertake 10 solar projects with a total capacity of 5.7 MW at its various power houses and substations during the next financial year. The projects are currently under investigation stage and implementation shall be subject to approval of the Board of HPSEBL. The details and estimated cost of the planned solar projects are provided in Table 46

Table 46: Proposed Solar Projects to be developed by HPSEBL

Sl.	Location	Capacity	Estimated Project Cost (Rs. Cr.)
1	Bassi Power House	1 MW	9.00
2	Giri Power House	500 kW	4.50
3	132/33/11 KV sub-Station Gondpur Paonta	500 kW	4.50
4	220/66 kV GSS at Uperla Nangal, Nalagarh Solan	2 MW	18.00

Sl.	Location	Capacity	Estimated Project Cost (Rs. Cr.)
5	Land near reservoir of Uhl-III Project	0.75 MW	6.75
6	Palakwah, Haroli, Una	400 kW	3.60
7	HPSEBL 132/33 SS, Gagret	400 kW	3.60
8	HPSEBL 132/33/11 KV SS, Amb, Una	60 kW	0.54
9	33/11 kV, 2810 MVA SS Tahliwal, Haroli, Una	50 kW	0.45
10	HPSEBL 33/11 KV SS, Haroli, Una	40 kW	0.36
	Total	**5.7 MW**	**51.30**

The projected year-wise commissioning of solar power plants in the State are summarized in table below:

Table 47: Proposed Solar Capacity Addition (FY16-FY19)

Year	Proposed Capacity Addition (MW)
2015-16	-
2016-17	50
2017-18	65
2018-19	100
Total	**215**

For harnessing the vast potential of the hydro power in the State, the State Government has made allotment of project sites to private companies for development of hydro generating projects. Currently, SHPs with a total installed capacity of 371 MW is already operational as shown in Table 52 and an additional 1078 MW of hydro projects are under various stages of development. The projected year-wise commissioning of SHPs capacity in the State are summarized in table below:

Table 48: SHPs Capacity Addition (FY16-FY19)

Year	Proposed Capacity Addition (MW)
2015-16	111.94
2016-17	131.10
2017-18	111.65
2018-19	176.09
Total	**530.78**

Apart from solar and small hydro power, projects, Himurja also expects small capacities of biomass-waste plants to come up during the period FY16 to FY19. The projected year-wise commissioning of biomass capacity in the State is summarized in table below:

Table 49: Biomass-waste Capacity Addition (FY16-FY19)

Year	Proposed Capacity Addition (MW)
2015-16	-
2016-17	1.50
2017-18	3.00
2018-19	2.125
Total	**6.625**

7.7. Funding requirement

The majority of the investments is from private developers and therefore the funding requirement cannot be determined with certainty. However, based on the capital expenditure assumption of Rs. 6.5 Cr. per MW for solar plants and Rs. 8.5 Cr. per MW for hydro power plants, the requirement for funds for renewable power has been computed as below:

Table 50: Funding Requirement for RE Projects (FY16-FY19)

Year	Fund for SHP	Fund for Solar Plant	Total
2015-16	951	-	951
2016-17	1,114	325	1,439
2017-18	949	423	1,372
2018-19	1,497	650	2,147
Total	**4,512**	**1,398**	**5,909**

7.8. RE plan-Issues

The issues with respect to the achievement of MNRE renewable targets is contingent on a number of factors highlighted below:

Solar based Projects:

- In order to address the gaps in the existing Solar Policy (2014) and make it lucrative for investors, the State Govt has come out with draft amendment that is expected to address the concerns and issues raised by the solar power developers. However, the amendments are still in draft stage and an early notification of the amendments shall assist in early implementation of the solar projects in the state.

- Further, as per the present Central Government policy, the solar energy park status is provided for solar capacity installation of 500MW and above. However, considering the topography of the state, it is impractical to have such vast continuous areas of land for solar installations. Therefore the state had made representation to the Government of India for relaxation in the capacity requirement. A prompt approval on the matter by the Central Government shall enable installation of solar parks in the state of HP.
- Some of the large areas of land identified for the installation of large solar projects are in the regions far away from the intra-state grid and therefore shall require building long-distance transmission lines for evacuation of power from such solar stations. Central Government may consider channelizing resources through CTU or any other scheme for development of such network.
- For development of solar projects, diversion of forest land may be required that requires clearance from the central agencies and takes up considerable time.

Small Hydro Projects:

- Amendments in 2012 to the Forests Rights Act 2006, has led to several difficulties in obtaining forest clearance for various sites. Post the amendments, the clearance is required to be granted at various levels starting from village level committee, district level committee, state level committee resulting in further delays.
- Also, as part of amendments, the transmission line width has been increased from the earlier 3.5 mt to 15 mt leading to financial unviability for providing connectivity. Considering the special category of the state and its topography, the Central Government should relax the requirement of 15 mt for the state.
- With respect to small hydro plants requiring limited land (i.e. 1-2 hectare), clearance permissions may be vested to the State Government. This would facilitate timely approvals and implementation of the small SHPs.

Introduction of HPPOs to promote Hydro Power Plants

To encourage more investments in remote hydro regions and to tap the total available hydropower (1.45 lac MW) potential of the country, the concept of Hydro Power Purchase Obligations (HPPOs) need to be ensured immediately by Government of India. This needs to be structured for both existing and future hydro Power Projects. It is imperative that the Discoms necessarily procures a percentage of its total consumption from run-of-the-river hydro power plants on the lines of the Renewable Power Purchase Obligation (RPPO) mechanism. This would also provide a safety net for hydro power developers by guaranteeing the purchase of electricity. The concept would also enable the hydro developers to be able to secure financial closure for development of their hydro plants easily.

7.9. Action plan items

The action points and support requirements for renewable energy are covered in Table 51 below:

Table 51: Action points for Renewable Energy Plan

Agency	Action Plan
State Government	• Timely finalization of Solar Policy 2014 amendments • Single window for grant of approvals and clearances to the renewable project developer
Himurja	• Continue to provide assistance and support to the private developers
HPSEBL	• Periodical maintenance and repairs of its generating stations • Long-term arrangements for meeting the demand –supply gap during winter months
Government of India	• Approval for relaxing the minimum capacity requirement for grant of solar energy park status

Agency	Action Plan
	• Relaxation to hilly regions for obtaining forest clearance • Vesting of forest clearance permissions with the State government for small projects having limited land requirement • Introduction of policy for Hydro Power Purchase Obligations (HPPOs) in line with the Renewable Power Purchase Obligation for promotion of run of the river hydro plants and harnessing the hydro potential in the country

Table 52: Details of SHPs in Himachal Pradesh

Sl.	SHP	Capacity in MW	Sl.	SHP	Capacity in MW
1	Raskat	0.80	43	Jirah (4.00 MW)*	4
2	Titang	0.90	44	IQU-I (4.5 MW)	4.5
3	Dehar	5.00	45	Rakchad (5.00 MW)	5
4	Baragran	4.90	46	Chirchand	5
5	Maujhi	4.50	47	Timbi	3
6	Ching	1.00	48	Binua Parai	5
7	Manal/Chandni	6.00	49	Dehar-II	1.5
8	Aleo	3.00	50	Tarella-III	5
9	Manjhal	1.00	51	Sach	0.9
10	Salag	0.15	52	Rukti-II	5
11	Jiwa Kothari	1.00	53	Sechi	4.5
12	Marhi	5.00	54	Chakshi	2
13	Kothi	0.20	55	Belij	5
14	Juthed	0.10	56	Balsio	5
15	Taraila	5.00	57	Suman Sarwari	2.5
16	Gharola	0.10	57	Suman Sarwari	2.5
17	Bramganga	5.00	58	Masli	5
18	Sahu	5.00	59	Dunali	5
19	Sarbari -1	4.50	60	Panwi	4
20	Upper Awa	5.00	61	Dikleri	2
21	Purthi	0.10	62	Binwa-IV	4
22	Sural	0.10	63	Hamal	2
23	Lingti	0.40	64	Kotlu	1.8
24	IKU-II	5.00	65	Tulang	3
25	Shyang	3.00	66	Belij Ka Nallah	3.5
26	Tarella-II	5.00	67	Billing*	0.4
27	Luni-III	5.00	68	Jogini-II	5
28	Andhra Stage-II	5.00	69	Aleo-II	4.8
29	Lower Baijnath Kuhl	1.00	70	Kalm	2
30	Upper Tarella	5.00	71	Ubharah	2.4
31	Luni-II	5.00	72	Kurtha	5
32	Baner-III	5.00	73	Neogal II	4.5
33	Manglad	4.50	74	Patikari	16

Sl.	SHP	Capacity in MW	Sl.	SHP	Capacity in MW
34	Drinidhar	5.00	75	Toss	10
35	Sainj (5 MW)	5.00	76	sarwari -II	5.4
36	Gurahan (1.5 MW)	1.50	77	Uppper Joiner	12
37	Maujhi-II (5.00 MW)	5.00	78	Sumez	14
38	Palor-I (3.00 MW)	3.00	79	Beas Kund	9
39	Tangling(5.00 MW)*	5.00	80	Neogal	15
40	Gaj-II (1.5 MW)	1.50	81	Kurmi	8
41	Brahal (4.00 MW)	4	82	Jogni	16
42	Upper Khauli (5 MW)	5	83	Nanti	14
Total					**371.45**

8. Energy Efficiency Plan

8.1. Energy Efficiency Plan

The Directorate of Energy (DoE) in Himachal Pradesh was created in 2009 with an objective to look after various activities related to power sector assigned by the Govt. of HP. Amongst the number of functions entrusted to the Directorate of Energy, one of the important function is for Implementation of Energy Efficiency in the State of HP. Further, the Directorate of Energy has also been entrusted to act as the State Designated Agency and proactively fulfill all the mandates of Electricity Act in co-ordination with BEE, State Government and other stakeholders.

In addition to the activities undertaken by DoE, the State Discom is required to undertake various DSM activities for balancing the load requirement. In order to give thrust to the energy efficiency mechanism in the State, the Himachal Pradesh Electricity Regulatory Commission (HPERC) had notified DSM Regulations on 30-09-2011 under which HPSEBL was required to prepare a DSM Master Plan for 5 years and undertake implementation of the same on year to year basis after approval of the Commission.

In view of above, HPSEBL had signed a Memorandum of Understanding (MoU) with the Bureau of Energy Efficiency (BEE), Govt. of India, New Delhi on 9th May, 2014 for the capacity building of Discom Programme under DSM Scheme of BEE. Against this scheme, BEE shall provide training to the DISCOM officials, provide financial support for organizing capacity building workshops and engagement of Consultants for aforesaid activities as well for preparation of DSM Action Plan, etc.

Accordingly, BEE has assigned the responsibility of technical assistance and consultancy support to the M/s Energy Efficiency Services Ltd. (EESL), an entity of Ministry of Power Govt. of India and deputed two consultants to HPSEBL for the purpose. As per the above MoU, load survey, load research, load strategies & development of DSM action plan is to be done by M/s EESL which is currently under process.

8.2. Proposed Schemes

As per the information provided by the Directorate of Energy, GoHP, the energy efficiency projects are being implemented in the state of Himachal Pradesh as per the Annual plan of BEE or the project finalized in the State Level Steering Committee (SLSC). Since the projects under both the agencies/ committees are being finalized only for one year, the planning for energy efficiency projects is restricted to only one year. The details of the projects which are presently under execution are detailed below:

Table 53: Proposed Energy Efficiency Projects in State of HP

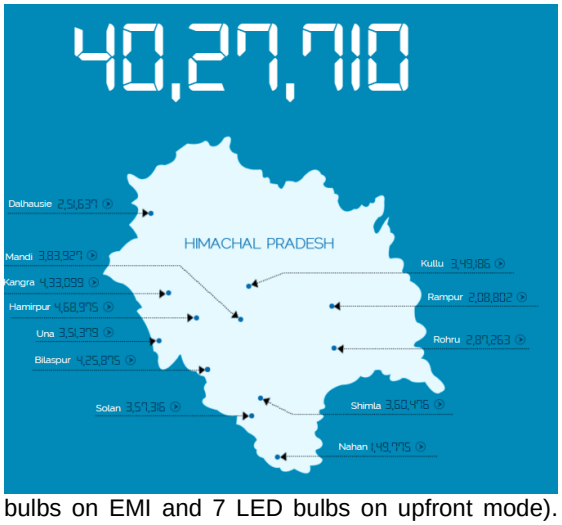
Activity	Fund Requirement (Rs. Lacs)	Source of Funding	Details of the Project	Likely Completion
Demonstration Project – Street Lighting	50	100% Central Govt. Financial Assistance	Street lighting at Municipal Council, Dharamshala, under which 244 no. of inefficient street lights will be retrofitted.	2015-16
LED Village Campaign	20	100% Central Govt. Assistance	Two Rural Panchayats (GP- Drogra in Basantpur block and GP- Bathmana-Jabri in Mashobra Block) in district Shimla has been selected for the LED Village Campaign which shall include distribution of 7 LED Lamps/ bulbs to every household	2015-16
Installation of Solar Water Heaters at Govt. Buildings	30	67% Central & 33% State Govt. Assistance	The SDA Himachal has finalized a project of Rs. 30 Lakh wth Himurja, Shimla for installation of solar water heating systems at six no. of	2015-16

Activity	Fund Requirement (Rs. Lacs)	Source of Funding	Details of the Project	Likely Completion
			Government Buildings including colleges, hospitals, jails etc. The total water heating capacity of this project is 9200 LPD. An advance of Rs 15 Lacs has been released to Himurja on 16/03/2015.w	
Municipal Demand Side Management (MuDSM)	138	90% Central & 10% Municipal Council/State Govt.	Finalized for implementation in Municipal Council, Sundernagar. Concent for sharing the 10% project cost has also been submitted by the respective Municipal Council.	2016-17
Agriculture Demand Side Management (AgDSM)	106	64% Central & 36% Irrigation & Public Health/State Govt.	Upgradation (as per new energy efficient technology) of four no. of drinking water pumping Scheme	2016-17
Incentive Scheme for SMEs	50	67% Central & 33% State Govt. Financial Assistance	Promotion of energy audit and energy conservation and efficiency for all SMEs located in HP	2016-17

Domestic Efficient Lighting Programme (DELP)

HPSEBL has signed an Agreement with M/s EESL on 4th July, 2015 for the implementation of DELP in the state of Himachal Pradesh. Approval for the programme has also been granted by the Hon'ble HPERC vide order HPERC/ MYT3 APR1/ HPSEBL/ 2015-16/-330 dated 29.04.2015. The scheme was launched by the Hon'ble Chief Minister on 7th August, 2015. Under the scheme, each domestic consumer can avail up to ten LED bulbs of 7 Watt each (3 LED bulbs on EMI and 7 LED bulbs on upfront mode). Also, each non-domestic consumer can avail up to fifteen LED bulbs of 7 watt each (3 LED bulbs on EMI and 12 LED bulbs on upfront mode) at a price of Rs. 105/- per LED bulb under EMI and Rs. 100/- per LED bulb on upfront payment mode.

Figure 19: DELP Progress Snapshot of HP's Dashboard(Jan 2016)



Under the scheme, HPSEBL has planned to distribute approx. 1.25 Cr. LED bulbs by end of March 2016. Of the targeted 1.25 Cr. LED bulbs, 40.27 lac bulbs have already been distributed until 12 Jan, 2016.

Urban Smart Street Lighting Project "RISHTA" in Himachal Pradesh

GoHP on 20 August 2015 launched the Rajiv Gandhi Illuminating Scheme For Hill Town Advancement (RISHTA) project, an efficient smart led based street lighting project. The project is being implemented by collaboration of State Urban Development Department and M/s EESL. As part of the project 63,484 street light fixtures in all the ULB's would be replaced by LEDs to achieve 45-55% energy savings besides savings of Rs 3.20 crore per annum in monetary terms.

First phase of the scheme shall cover Shimla, Dharamshala, Sundernagar, Paonta Sahib, Ghumarwin and Manali. While the upfront capital investment shall be undertaken by EESL for implementation of project, the municipalities shall pay back this investment to EESL over a period of 7 years from the energy and cost savings that shall accrue as a result of installation of energy efficient led lights.

Other Energy Efficiency Schemes

In addition to the DELP scheme, as part of the DSM Action Plan which is currently under preparation, a few potential measures have been identified for implementation. Since the DSM Action Plan is yet to be framed and finalized, therefore the

implementation period and funding requirement for the various activities shall be available post completion of the DSM Action Plan.

The category-wise potential measures identified as part of the DSM Action Plan is summarized in Table 54.

8.3. Energy Efficiency Action plan

The preparation of 5 year DSM Action Plan is under process. Therefore, the action plan for implementation and funding requirement for the various activities proposed under the plan shall be available post finalization.

8.4. Fund Requirement

The fund requirement for the activities planned by DOE are summarized in Table 53 above while the fund requirement for HPSEBL DSM/ EE activities shall be available post finalization of the DSM Action Plan.

Table 54: Potential DSM Measures for the State of HP

Consumer Category	DSM Measures	Present System	Proposed System
Domestic	Replacement of T12, T8 with 16W LED	Based on sample data, it was observed that 70% of the domestic consumers are utilizing T12 and T8 Fluorescent Tube Light.	Replacement of FTL with 16W LED will give considerable load reduction of about 50%.
	Promotion of Energy efficient 5 star rated Fan in place of existing Fans	Based on sample data it was observed that 58% of the domestic consumers are utilising ceiling fan	Replacement of Ceiling fan with BEE 5 star rated fans/Super-efficient fans will give considerable load reduction, 5 star rated fans consume 67% of conventional 75W ceiling fans.
	Promotion of Energy efficient 7W LED lighting in place of existing Incandescent bulb	Based on sample data it was observed that 65% of the domestic consumers are utilising Incandescent Bulb	Replacement of Incandescent Bulb with LED lights will give considerable load reduction, as LED lights consume only 12% of conventional 60W Incandescent Bulb
Commercial	Replacement of T12, T8 with 16W LED	Based on sample data it was observed that 65% of the commercial consumers are utilising T12 and T8 Fluorescent Tube Light	Replacement of FTL with 16W LED will give considerable load reduction of about 50%
	Promotion of Energy efficient 5 star rated Fan/Super efficient fans in place of existing Fans	From the sample data collected it was observed that 61% of the commercial consumers are utilising ceiling fan	Replacement of Ceiling fan with BEE 5 star rated fans will give considerable load reduction, 5 star rated fans consume 67% of conventional 75W ceiling fans.
	Promotion of Energy efficient 7W LED lights in place of existing 60W Incandescent Bulb	From the sample data collected it was observed that 41% of the commercial consumers are utilising Incandescent Bulbs (IB).	Replacement of IB with LED lights will give considerable load reduction, as LED lights consume one third of conventional 60W IB used generally
Industry	Promoting Installation of Capacitor Banks to improve Reactive Power Management	Around 25% of industries have installed the capacitor and rest of the industries has insufficient capacitors / no capacitors. Installation of capacitors is important for reactive power management and increasing the plant capacities.	Installation of Capacitor Banks on 11 kV feeders and Substation Bus will reduce the utility demand Per substation and 11 kV feeders from the transformers. The installation of capacitor will improve the system power factor and reduce the system kVA demand.
Agriculture & WPS	Replacement of old in-efficient Agriculture Pumps with new BEE 5 star rated Pumps	Based on the observation and feedbacks during field survey it is observed that the agriculture and WPS category are mostly using old pumps.	Replacement of the old pumps with energy efficient pumps shall reduce the demand in this category
Street Lighting	Installation of Timer controller in Street lights	Based on sample study, no timer controller was installed for switching the Street lights	Installation of timer controller in street lights

9. Financial Position of Utility (HPSEBL)

9.1. Introduction

Consequent to the unbundling activity in 2010, the functions of generation, distribution and trading of electricity was entrusted to the Himachal Pradesh State Electricity Board Limited (HPSEBL). All assets and liabilities of the erstwhile electricity board were transferred to HPSEBL barring inter-state transmission lines and transmission infrastructure that are not part of the distribution system. Therefore, the financial health of HPSEBL in effect shall indicate the position of the power sector in the state of HP.

While the accumulated losses of the HPSEBL have increased from Rs. 886 Crores in FY2010-11 to Rs. 2,000 Crores in FY2014-15, the year on year losses have shown a declining trend over the period. The year-on-year losses of HPSEBL have reduced from Rs. 380 Cr. in FY11 to Rs. 125 Cr. in FY15.

As per the Third Annual Integrated Ratings of State Power Distribution Utilities report 2015 released by PFC, HPSEBL has secured a rating of B+ (Moderately Operational and Financial Performance Capability). The report points out some of the key strengths of HPSEBL in terms of low AT&C loss levels, collection efficiency, progress on reform activities, adoption of MYT framework, 100% consumer metering and other initiatives like setting up of call centre, etc. However, concerns highlighted in the report leading to a deterioration of grade over the previous year's rating is reduced cost coverage ratio from 0.94 in FY13 to 0.89 in FY14, non-receipt of subsidy, high employee cost, etc.

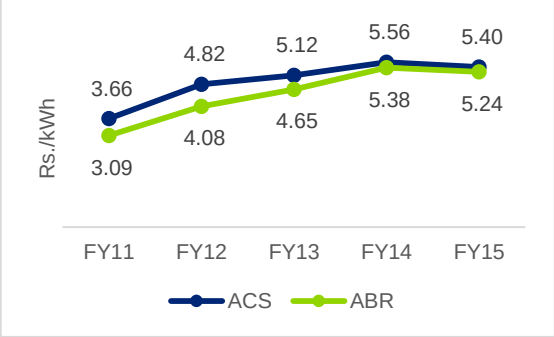
The following sub-sections discuss the existing as well as projected financial position of HPSEBL, considering the impact of PFA program.

9.2. Commercial & Financial Viability

The commercial viability of power sector largely depends on the performance of the distribution utilities as the cash flow of the transmission and generation utilities ultimately depend on its technical and commercial performance.

One of the key indicators of commercial health and resultant financial position of a distribution utility is the gap between average cost of supply (ACS) and average billing rate (ABR). In case of HPSEBL, the difference in ABR and ACS has declined from Rs.0.57/kWh in FY11 to Rs.0.16 /kWh in FY15. While the tariff realized has not been sufficient to meet the average cost of supply in the past five years, the trend indicates improvement in tariff realized.

Figure 20: ABR vs ACS for HPSEBL



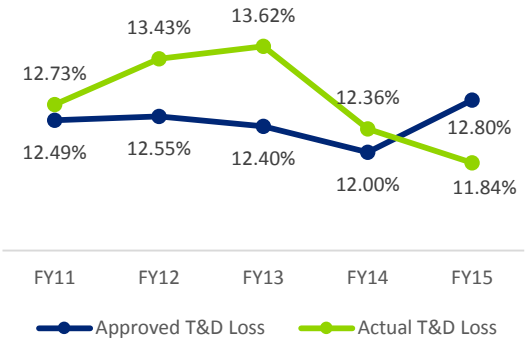
Note: ABR and ACS figures computed as per annual accounts of HPSEBL

The reduction in financial losses of HPSEBL is primarily on account of regular tariff increase, allowed by the Regulatory Commission in the past years excluding FY15. Additionally, the increased revenue from other income including wheeling charges as well as revenue from sale of surplus power has resulted in higher revenue each year.

The operation performance of the utility is better than the neighboring states. While the state has been able to maintain the T&D loss below 15% levels, the deviation from the commission approved T&D loss for the respective years have been in the range of 0.24% - 1.22% during FY11-FY14, resulting in limited disallowance on account of power purchase cost in the tariff orders. For FY15, HPSEBL has been able to overachieve the target T&D loss set by the Regulatory Commission by approximately 1%.

The approved and actual T&D loss of HPSEBL for the past five years is provided in Figure 21 below:

Figure 21: HPSEBL Actual and Approved T&D Loss

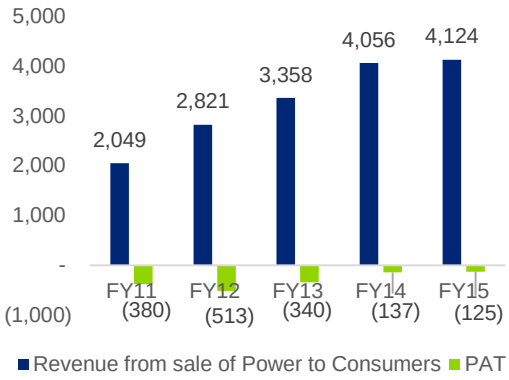


9.3. Present Financial Performance

Over the last five years, HPSEBL has been posting financial losses. However, the quantum of loss has reduced from Rs. 380 Cr. in FY11 to Rs. 125 Cr. in FY15 primarily on account of increase in revenue realization due to tariff increases as illustrated in Figure 23.

While the energy sales of the utility have increased at a steady rate of 4-4.5% in the last five years, the revenues from sale of power to consumers within the state have increased on an average growth of 20% y-o-y. The regular tariff increase provided by the Regulatory Commission has largely helped the utility in achieving lower level of financial losses.

Figure 23: HPSEBL's Revenue vs PAT in Rs. Cr.

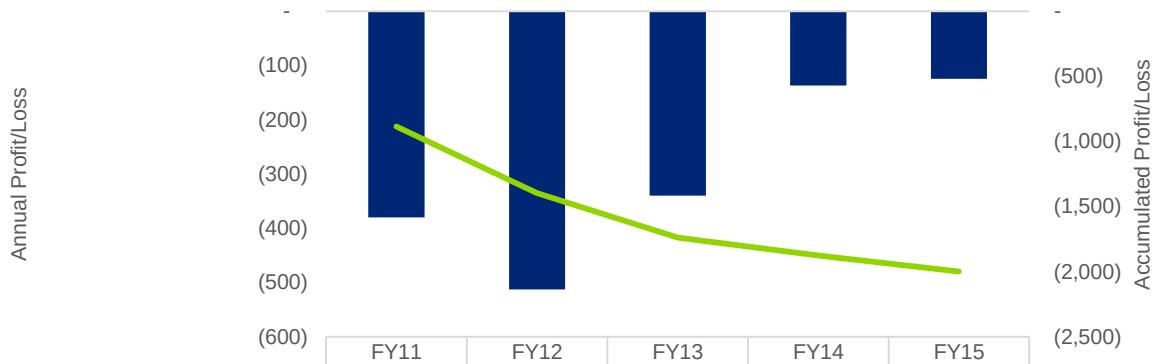


The details of tariff increase effected each year by the HPERC is summarized below:

FY11	Average Tariff increase of 12.3%
FY12	Average Tariff increase of 8.7%
FY13	Average Tariff increase of 13.5%
FY14	Average Tariff increase of 15.0%
FY15	No Tariff Increase. Rationalization of Industrial Tariff

HPSEBL's accumulated losses have been increasing since FY11. While the increase of the accumulated losses has been restricted in FY14 & FY15 in view of the tariff increases, HPSEBL had added losses of over Rs. 1,200 Cr. during FY11-FY13. These losses are also due to payments of arrears to central generating stations which were paid by HPSEBL during this period. Also, delays in preparation of

Figure 22: Financial Performance of HPSEBL



	FY11	FY12	FY13	FY14	FY15
Profit/ (Losses) in Crores	(380)	(513)	(340)	(137)	(125)
Accumulated Losses	(886)	(1,398)	(1,739)	(1,876)	(2,000)

audited accounts have resulted in late approval by the Commission on account of truing-up for the respective years. The year on year financial losses and accumulated losses of HPSEBL are provided in Figure 22.

9.4. Financial Projections

In order to estimate the impact of PFA program on the financials of a utility, it is pertinent to assess the incidental cost of the program vis-à-vis the potential of generating additional revenue due increase in energy sales. As the utility progresses on achieving reduction in AT&C losses, the gap between average cost of supply and average realization is expected to shrink. In line with above, an analysis has been carried out to assess the cost impact of PFA program on tariff as well as financials of the utility. Table 55 presents the assumptions which form the basis for such projections.

Table 55: Key Common Assumptions underlying financial analysis

<table>
<tr><th>Particulars</th><th>Assumptions</th></tr>
<tr><td>Power purchase</td><td>• The firm allocation from the Central Generating Stations shall remain stable at current levels (Nov 2015) over the period of projection (FY16 to FY19).
• Generation from HPSEBL plants based on projections for each year as proposed by HPSEBL in view of the R&M measures proposed for generating plants.
• Commissioning of new plants in State sector assumed as per State's projections.
• Commissioning of new plants of central sector as per CEA's monitoring reports.
• Transmission and scheduling charges for FY16 is considered to be Rs. 0.24/kWh, based on charges as per the actual for six months during FY16. An increase of 5% y-o-y has been applied for projection in future years.</td></tr>
<tr><td>Power Purchase Rate</td><td>• The present stations have been projected at actual Power Purchase Rate incurred during FY15.
• New power stations are projected at Rs. 4.50/kWh.
• Allocation from un-allocated capacity of CGS has not been considered</td></tr>
<tr><td>Surplus power purchase and sale</td><td>• Power available beyond the requirement has been considered to be sold outside State at the rate of Power Purchase for the respective year.</td></tr>
<tr><td>Revenue and Sales growth</td><td>• Revenue calculations based on average billing rate as per Tariff Order for FY16.
• Sales growth of domestic consumers is as per projections in Power Supply Scenario (Chapter 3).
• Energy sales growth of other than domestic consumers is 3.2% (YoY) in line with the recent 4-5 trend.</td></tr>
<tr><td>Losses (%)</td><td>• Losses projections as per following trajectory:
<table>
<tr><th>Particulars</th><th>FY16</th><th>FY17</th><th>FY18</th><th>FY19</th></tr>
<tr><td>AT&C Loss (%)</td><td>12.50%</td><td>11.50%</td><td>10.50%</td><td>10.00%</td></tr>
<tr><td>T&D loss</td><td>9.81%</td><td>9.24%</td><td>8.69%</td><td>8.64%</td></tr>
</table></td></tr>
<tr><td>Capex & capitalization</td><td>• Capex as per budgeted plans and requirement to fulfill PFA targets of HPSEBL.
• Capitalization has been considered as 60% in the first year and 40% in the subsequent year.</td></tr>
<tr><td>Employee cost, R&M, A&G costs</td><td>• Employee cost: Based on employee cost for FY15 with escalation of 10% YoY over the period of projection (FY 16 to FY19) considering the CPI, except for FY17, where an additional 15% escalation has been considered to account for impact of 7th Pay Commission.
• A&G cost: Based on A&G cost for FY15 with escalation of 6% p.a over the period of projection (FY 16 to FY19)
• R&M cost:
  • For existing assets: Based on the actual R&M cost as percentage of GFA (Past 2 years Average has been considered)
  For New Assets – 1% of GFA in line with the Regulations.</td></tr>
<tr><td>Depreciation</td><td>• For existing assets: Based on the existing rate of depreciation.
• For new assets: Depreciation rate of 5.28% with maximum allowed depreciation of 90%</td></tr>
<tr><td>Funding of capital expenditure and financing terms</td><td>• Capital expenditure to be funded through grant, debt & equity based on schemes under which it has been proposed.</td></tr>
</table>

Particulars	Assumptions
	• Under DDUGJY and IPDS, the ratio of grant, debt and equity is 85%, 10% and 5%, and additional 5% grant if the utility meets its distribution loss trajectory, utilized towards retiring debt • Unapproved capital expenditure under proposed schemes to be funded through debt equity in the ratio of 90:10 as per the details provided by HPSEBL. • For other ongoing schemes, funding is based on the tied up debt, equity and envisaged grant portion. For any untied expenditure, debt and equity in the ratio of 70:30 has been considered. • Repayment schedule of 10 years. • Interest on existing debt is considered to be based on weighted average existing interest rate, estimate to be 12.40% based on provisional accounts provided for FY15. • Interest on new debt considered to be 12.5%. • Debt to Equity ratio assumed at 70:30 under no grants scenario, for schemes under which funds have been tied up under the Central Govt. schemes like R-APDRP, DDUGJY and IPDS.
Working capital and cash deficit loan	• Working capital as per regulatory provisions • Working capital loan assumed at 13.5% • Cash deficit during the year is assumed to be funded from short term loan @ 13.5%p.a.
Other income	• Based on values for FY15 with YoY escalation of 5% over the period of projection (FY 16 to FY19)
Regulatory parameters	• No disallowance in power purchase or any other cost element • No regulatory assets of past have been considered

Considering the above assumptions, the impact of PFA program on the overall financial health of the sector can be gauged from the impact on tariff due to incidental power purchase and additional capital expenditure to be incurred by HPSEBL. The details of additional capital expenditure, sources of funding and incidental costs of such expenditure are provided in Table 56.

Since HPSEBL has already achieved the key objectives of the PFA program i.e. connection of un-electrified households and supplying 24X7 power to both rural and urban consumers, the capital expenditure plans of the utility are more focused towards providing reliable and quality power as well as upgradation of the sub-transmission and distribution infrastructure to meet the future requirement within the State of HP. The utility has proposed to fund the capital expenditure plan under various Central and State Government schemes and support of FIs and multilateral banks. The base case assumes that the funding from State and Central Government schemes in the form of grants will be available but for any non-grant part of the scheme or un-approved part of those schemes, will be arranged by utility from the financial institutions like REC and PFC. The debt to equity ratio is considered to be 90:10, in line with the recent borrowings and details provided by HPSEBL with respect to funding of capital investment. In addition to above capital expenditure related cost, other revenue and expenditure related parameters considered for base case are summarized in Table 57

Table 56: Impact of Asset addition (Rs Cr.)

Particulars	FY16	FY17	FY18	FY19
Capital expenditure	917	1,189	781	590
Grants	39	246	26	15
Debt	724	767	627	463
Equity	155	176	128	112
Incidental cost of capital expenditure due to PFA				
Depreciation on additional assets	23	77	130	168
Interest on debt – corresponding to PFA capex	41	120	185	223
Return on equity - corresponding to PFA capex	19	45	68	87
Total capex related Cost	**82**	**241**	**383**	**478**

Table 57: Parameters for base case

Particulars	Units	FY16	FY17	FY18	FY19
Energy related parameters					
Sales	MUs	8185	8517	8860	9219
T&D losses	%age	9.8%	9.2%	8.7%	8.6%
Collection efficiency	%age	97.0%	97.5%	98.0%	98.5%
AT&C Losses	%age	12.5%	11.5%	10.5%	10.0%
Energy required	MUs	9,074	9,384	9,703	10,091
Energy available (ex-bus)	MUs	9,288	10,228	11,159	12,077
Energy available at state periphery	MUs	9,108	10,046	10,973	11,876
Energy Surplus /(deficit)	MUs	34	662	1271	1785
Power Purchase Cost	Rs./kWh	2.30	2.25	2.29	2.38
Revenue & expenditure parameters					
Tariff Increase	%age	0.0%	0.0%	0.0%	0.0%
Average billing rate - Domestic	Rs./kWh	4.14	4.14	4.14	4.14
Average billing rate - Other than domestic (weighted avg.)	Rs./kWh	5.47	5.47	5.47	5.47
Employee cost escalation	%age	10%	25%	10%	10%
A&G cost escalation	%age	6%	6%	6%	6%

Based on the above parameters, the per kWh gap of incidental cost of providing additional power and revenue generated due to increase in energy sales is estimated to assess the impact of PFA program on the tariff in the State, as summarized in Table 58.

The impact on tariff due to PFA capital expenditure is expected to remain in the range of Rs. 0.21/kWh in FY16 to Rs.1.28/kWh in FY19 as can be seen in Table 58. The higher impact on the ACS is primarily on account of high capital expenditure planned for augmentation of the distribution network.

The key reason behind the increase in tariff impact is the marginal increase in sales. As the state of HP has already achieved near 100% electrification, the capital expenditure is primarily aimed at providing reliable and uninterrupted power resulting in a higher impact in per unit terms. Also, the higher impact is on account of limited increase in sales as against the other constituents of ACS (other than power purchase cost) which continue to increase in the subsequent years,

Therefore, in the base case, the financial statements of HPSEBL have been prepared considering that the rate of power purchase and tariff shall remain at the present levels, while the impact of other incidental cost is accounted.

As can be seen in the P&L statement in Table 59, the incremental cost due to PFA program may adversely impact the financial position of the utility. The financial losses are likely to increase from Rs. 36 Cr. in FY16 to Rs. 1,066 Cr. in FY19, as the recovery is not expected to be adequate enough to cover the various cost elements and incidental PFA program cost.

Table 58: Impact on tariff due to PFA

Particulars	Units	FY16	FY17	FY18	FY19
Additional recovery due to incremental energy sales (Rs. Cr.)	A	152	313	480	656
Incremental power purchase cost (inc. transmission charges and incremental transmission cost due to PFA program (Rs. Cr.)	B	111	196	300	442

Particulars	Units	FY16	FY17	FY18	FY19
Add: Cost related to capital expenditure (interest, depreciation and equity return, Rs. Cr.)	B1	213	751	1088	1394
Gap of additional cost and additional recovery	C=(B+B1-A)	171	634	909	1180
Energy sales (MU)	D	8185	8517	8860	9219
Cumulative Impact on tariff (Rs./kWh)		**0.21**	**0.74**	**1.03**	**1.28**

Table 59: Profit and Loss Account (Rs. Cr.) for Base Case

Particulars	FY16	FY17	FY18	FY19
Revenue				
Revenue from Sale of Power within State	4,205	4,369	4,538	4,714
Non-Tariff Income	444	447	450	452
Revenue from Sale of Surplus Power	8	149	292	425
Others	145	152	160	168
Total Revenue	**4,803**	**5,117**	**5,439**	**5,760**
Expenditure				
Power Purchase cost	2,339	2,515	2,787	3,125
O&M Cost	1,561	1,940	2,136	2,346
Employee cost	1,446	1,808	1,989	2,188
A&G Expenses	47	50	53	56
R&M Expenses	68	82	95	103
EBIDTA	903	663	516	289
Depreciation	329	383	436	474
Interest and finance charges	610	681	760	881
PBT	**(36)**	**(401)**	**(680)**	**(1,066)**
Provision for tax	-	-	-	-
PAT	**(36)**	**(401)**	**(680)**	**(1,066)**

9.5. Scenario Analysis

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

- Increase in tariff to ensure that utility becomes viable by FY19
- Non-Availability of grants under the schemes to fund the capital expenditure
- Under achievement of AT&C loss targets: considering 1% slippage in the T&D loss level each year, till FY19.
- Impact of the Ujwal Discom Assurance Yojna (UDAY) scheme (transfer of outstanding liabilities to State Government)

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

While the existing gap between average cost of supply and average realization is less i.e. Rs.0.16/kWh, an increase in tariff may be required to maintain the financial position of the utility and prevent it from further deterioration due to additional capital expenditure. In order to achieve financial viability by FY19, the utility requires an annual tariff increase of 6.5%, in addition to a complete pass through of increase in power purchase cost. The key parameters considered for Scenario are presented in Table 60

The assessed tariff impact is expected to cover the change in power purchase cost due to change in purchase portfolio and the utility will be able to become financially viable having positive PAT (YoY) by FY19. The resultant P&L statement under this scenario is presented in Table 61

Table 60: Parameters for Scenario 1

Particulars	Units	FY16	FY17	FY18	FY19
Energy related parameters					
Sales	MUs	8,185	8,517	8,860	9,219
T&D losses	%age	9.8%	9.2%	8.7%	8.6%
Collection efficiency	%age	97.0%	97.5%	98.0%	98.5%
AT&C Losses	%age	12.5%	11.5%	10.5%	10.0%
Energy required	MUs	9,074	9,384	9,703	10,091
Energy available (ex-bus)	MUs	9,288	10,228	11,159	12,077
Energy available at state periphery	MUs	9,108	10,046	10,973	11,876
Energy Surplus /(deficit)	MUs	34	662	1271	1785
Power Purchase Cost	Rs./kWh	2.30	2.25	2.29	2.38
Revenue & expenditure parameters					
Tariff Increase	%age	0.0%	6.5%	6.5%	6.5%
Average billing rate - Domestic	Rs./kWh	4.14	4.41	4.69	5.00
Average billing rate - Other than domestic (weighted avg.)	Rs./kWh	5.47	5.82	6.20	6.60
Employee cost escalation	%age	10.0%	25.0%	10.0%	10.0%
A&G cost escalation	%age	6.0%	6.0%	6.0%	6.0%

Table 61: Profit and Loss statement - Scenario 1 (Rs Cr.)

Particulars	FY16	FY17	FY18	FY19
Revenue				
Revenue from Sale of Power within State	4,205	4,653	5,147	5,695
Non-Tariff Income	444	447	450	452
Revenue from Sale of Surplus Power	8	149	292	425
Others	145	152	160	168
Total revenue	**4,803**	**5,401**	**6,048**	**6,740**
Expenditure				
Power Purchase cost	2,339	2,515	2,787	3,125
O&M Cost	1,561	1,940	2,136	2,346
Employee cost	1,446	1,808	1,989	2,188
A&G Expenses	47	50	53	56
R&M Expenses	68	82	95	103
EBIDTA	903	947	1125	1269
Depreciation	329	383	436	474
Interest and finance charges	610	687	748	784
PBT	**(36)**	**(123)**	**(59)**	**11**
Provision for tax	-	-	-	4
PAT	**(36)**	**(123)**	**(59)**	**7**

The projected cash flow statement till FY19 and projected balance sheet is provide in Annexure 2. It can be observed from the financial statements that with 6.5% tariff increase, the HPSEBL will be able to have a sustained positive PAT from FY19 onwards.

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

The dependence of utility on funding of the proposed investments through various State and Central Government schemes can be assessed by the impact on utility's finances under a scenario where grant funding is not available. Under this scenario, the grant availability for the upcoming Central Government schemes including IPDS and DDUGJY has been considered to be nil. Table 62 on the following page summarizes the key parameters underlying the analysis and the impact on tariff has been detailed in Table 63

Table 62: Parameters for Scenario 2 (Non-Availability of grants)

Particulars	Units	FY16	FY17	FY18	FY19
Energy related parameters					
Sales	MUs	8,185	8,517	8,860	9,219
T&D loss	%age	9.8%	9.2%	8.7%	8.6%
Collection efficiency	%age	97.0%	97.5%	98.0%	98.5%
AT&C losses	%age	12.5%	11.5%	10.5%	10.0%
Energy required	MUs	9,074	9,384	9,703	10,091
Energy available (ex-bus)	MUs	9,288	10,228	11,159	12,077
Energy available at state periphery	MUs	9,108	10,046	10,973	11,876
Energy Surplus /(deficit)	MUs	34	662	1271	1785

Particulars	Units	FY16	FY17	FY18	FY19
Power Purchase Cost	Rs./kWh	2.30	2.25	2.29	2.38
Revenue & expenditure parameters					
Tariff Increase	%age	0.0%	0.0%	0.0%	0.0%
Average billing rate - Domestic	Rs./kWh	4.14	4.14	4.14	4.14
Average billing rate - Other than domestic (weighted avg.)	Rs./kWh	5.47	5.47	5.47	5.47
Employee cost escalation	%age	10.0%	25.0%	10.0%	10.0%
A&G cost escalation	%age	6.0%	6.0%	6.0%	6.0%
Capital expenditure funding					
Capital expenditure	Rs. Cr.	917	1,189	781	590
Grants	Rs. Cr.	26	51	5	4
Debt	Rs. Cr.	741	935	642	475
Equity	Rs. Cr.	163	246	134	112

Table 63: Impact on tariff due to PFA – Scenario 2

Particulars	Derivation	FY16	FY17	FY18	FY19
Additional recovery due to incremental energy sales (Rs. Cr.)	A	152	313	480	656
Incremental power purchase cost (inc. transmission charges and incremental transmission cost due to PFA program (Rs. Cr.)	B	111	196	300	442
Add: Cost related to capital expenditure (interest, depreciation and equity return, Rs. Cr.)	B1	215	773	1133	1441
Gap of additional cost and additional recovery	**C=(B+B1-A)**	**173**	**657**	**953**	**1,228**
Energy sales (MU)	D	8,185	8,517	8,860	9,219
Cumulative Impact on tariff (Rs./kWh)		**0.21**	**0.77**	**1.08**	**1.33**

As can be seen in Table 63, the impact on tariff is expected to increase marginally due to non-availability of grants to fund the capital expenditure. The tariff impact for in such scenario is estimated to range between 0.21 Rs./kWh to 1.33 Rs./kWh as .

against the range of 0.21 Rs./kWh to 1.28 Rs./kWh in base case scenario. Table 64 presents the projected profit and loss statement of HPSEBL under this scenario

Table 64: Profit and Loss statement - Scenario 2 (Rs. Cr.)

Particulars	FY16	FY17	FY18	FY19
Revenue				
Revenue from Sale of Power within State	4,205	4,369	4,538	4,714
Non-Tariff Income	444	447	450	452
Revenue from Sale of Surplus Power	8	149	292	425
Others	145	152	160	168
Total revenue	**4,803**	**5,117**	**5,439**	**5,760**
Expenditure				
Power Purchase cost	2,339	2,515	2,787	3,125
O&M Cost	1,561	1,940	2,136	2,346

Particulars	FY16	FY17	FY18	FY19
Employee cost	1,446	1,808	1,989	2,188
A&G Expenses	47	50	53	56
R&M Expenses	68	82	95	103
EBIDTA	903	663	516	289
Depreciation	329	388	448	489
Interest and finance charges	611	697	812	961
PBT	**(38)**	**(422)**	**(743)**	**(1,162)**
Provision for tax	-	-	-	-
PAT	**(38)**	**(422)**	**(743)**	**(1,162)**

As can be seen above, the annual financial losses of HPSEBL are expected to increase to nearly Rs. 1,162 Cr. in FY19 as against Rs.1,066 Cr. under the base case.

Further, as the utility's cost of funding increases due to non-availability of grants in this scenario, the required tariff increase to achieve the financial turnaround is likely to increase to 6.7% p.a. as against 6.5% tariff increase required in base case.

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

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

Base case analysis, scenario 1 and scenario 2 assumes the achievement of AT&C loss trajectory by the utility. However, in case the utility misses T&D loss reduction targets and it remains at 1% higher than the MoP targets till FY19, the impact on financial position shall increase due to incremental power purchase required to meet the demand. Table 65 summarizes the key parameters underlying the analysis in scenario 3. There is an impact on tariff and is expected to be in the range of 0.24 Rs./kWh to 1.31 Rs./kWh, as against 0.21 Rs./kWh to 1.28 Rs./kWh under the base case. Due to additional cost and under-achievement of T&D loss trajectory there is an adverse impact on the financials of the utility, as presented in Table 66. As can be seen in Table 67 the annual financial losses of utility are expected to increase to nearly Rs. 1,110 Cr. in FY19 vis-à-vis Rs. 1,066 Cr. in FY19 under base case, thus emphasizing the need to remain focused on reduction in AT&C losses.

The required tariff increase to achieve the financial viability is likely to increase to 6.7% p.a. as against 6.5% in base case.

Table 65: Parameters for Scenario 3 (Under-achievement of T&D losses)

Particulars	Units	FY16	FY17	FY18	FY19
Energy related parameters					
Sales	MUs	8,185	8,517	8,860	9,219
T&D loss	%age	10.8%	10.2%	9.7%	9.6%
Collection efficiency	%age	97.0%	97.5%	98.0%	98.5%
AT&C losses	%age	13.5%	12.5%	11.5%	11.0%
Energy required	MUs	9,176	9,489	9,810	10,203
Energy available (ex-bus)	MUs	9,288	10,228	11,159	12,077
Energy available at state periphery	MUs	9,108	10,046	10,973	11,876
Energy Surplus/(deficit)	MUs	(68)	558	1,163	1,673
Power Purchase Cost	Rs./kWh	2.30	2.25	2.29	2.38
Revenue & expenditure parameters					

Particulars	Units	FY16	FY17	FY18	FY19
Tariff Increase	%age	0.0%	0.0%	0.0%	0.0%
Average billing rate-Domestic	Rs./kWh	4.14	4.14	4.14	4.14
Average billing rate-Other than domestic (weighted avg.)	Rs./kWh	5.47	5.47	5.47	5.47
Employee cost escalation	%age	10.0%	25.0%	10.0%	10.0%
A&G cost escalation	%age	6.0%	6.0%	6.0%	6.0%

Table 66: Scenario 3: Impact on tariff – Scenario 3

Particulars	Derivation	FY 16	FY 17	FY 18	FY 19
Additional recovery due to incremental energy sales (Rs. Cr.)	A	152	313	480	656
Incremental power purchase cost (inc. transmission charges and incremental transmission cost due to PFA program (Rs. Cr.)	B	135	221	327	471
Add: Cost related to capital expenditure (interest, depreciation and equity return, Rs. Cr.)	B1	213	751	1088	1,395
Gap of additional cost and additional recovery	**C=(B+B1-A)**	**196**	**659**	**935**	**1,210**
Energy sales (MU)	D	8,185	8,517	8,860	9,219
Cumulative Impact on tariff (Rs./kWh)		**0.24**	**0.77**	**1.06**	**1.31**

Table 67: Profit and Loss statement - Scenario 3 (Rs. Cr.)

Particulars	FY16	FY17	FY18	FY19
Revenue				
Revenue from Sale of Power within State	4,205	4,369	4,538	4,714
Non-Tariff Income	444	447	450	452
Revenue from Sale of Surplus Power	0	126	267	399
Others	145	152	160	168
Total revenue	**4,795**	**5,094**	**5,414**	**5,733**
Expenditure				
Power Purchase cost	2,366	2,515	2,787	3,125
O&M Cost	1,561	1,940	2,136	2,346
Employee cost	1,446	1,808	1,989	2,188
A&G Expenses	47	50	53	56
R&M Expenses	68	82	95	103
EBIDTA	868	639	491	262
Depreciation	329	383	436	475
Interest and finance charges	610	681	766	897
PBT	**(71)**	**(425)**	**(711)**	**(1,110)**
Provision for tax	-	-	-	-
PAT	**(71)**	**(425)**	**(711)**	**(1,110)**

Scenario 4: Impact of UDAY Scheme

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

In this scenario it is assumed that the state will take over 75% of the outstanding debt in two years (50% in FY16 and 25% in FY17). This will result in reduction of Interest cost for the Discom.

The opening outstanding liabilities which shall qualify for this scheme is Rs. 4,048.04 Cr. The impact on the financial statements are shown in the following tables.

It can be seen that the losses in FY19 reduce to Rs. 614 Cr. as compared to Rs 1,066 Cr losses in the base case. The tariff hike required for positive PAT in FY19 is 4.2% as compared to 6.5% in base case.

Table 68: Parameters for Scenario 4 (UDAY)

Particulars	Units	FY 16	FY 17	FY 18	FY 19
Energy related parameters					
Sales	MUs	8,185	8,517	8,860	9,219
T&D losses	%age	9.8%	9.2%	8.7%	8.6%
Collection Efficiency	%age	97.0%	97.5%	98.0%	98.5%
AT&C Losses	%age	12.5%	11.5%	10.5%	10.0%
Energy required	MUs	9,074	9,384	9,703	10,091
Energy available (ex-bus)	MUs	9,288	10,228	11,159	12,077
Energy available at state periphery	Mus	9,108	10,046	10,973	11,876
Energy Surplus /(deficit)	MUs	34	662	1271	1785
Power Purchase Cost	Rs./kWh	2.30	2.25	2.29	2.38
Revenue & expenditure parameters					
Tariff Increase	%age	0.0%	0.0%	0.0%	0.0%
Average billing rate - Domestic	Rs./kWh	4.14	4.14	4.14	4.14
Average billing rate - Other than domestic (weighted avg.)	Rs./kWh	5.47	5.47	5.47	5.47
Employee cost escalation	%age	10.0%	25.0%	10.0%	10.0%
A&G cost escalation	%age	6.0%	6.0%	6.0%	6.0%

Table 69: Scenario 4 (UDAY): Impact on tariff

Particulars	Derivation	FY 16	FY 17	FY 18	FY 19
Additional recovery due to incremental energy sales (Rs. Cr.)	A	152	313	480	656
Incremental power purchase cost (inc. transmission charges and incremental transmission cost due to PFA program (Rs. Cr.)	B	111	196	300	442
Add: Cost related to capital expenditure (interest, depreciation and equity return, Rs. Cr.)	B1	213	751	1,088	1,394
Gap of additional cost and additional recovery	**C=(B+B1-A)**	**171**	**634**	**909**	**1,180**
Energy sales (MU)	D	8,185	8,517	8,860	9,219
Cumulative Impact on tariff (Rs./kWh)		**0.21**	**0.74**	**1.03**	**1.28**

Table 70: Scenario 4 (UDAY): Profit and Loss Statement (Rs.Cr.)

Particulars	FY16	FY17	FY18	FY19
Revenue				
Revenue from Sale of Power within State	4,205	4,369	4,538	4,714
Non-Tariff Income	444	447	450	452
Revenue from Sale of Surplus Power	8	149	292	425
Others	145	152	160	168
Total revenue	**4,803**	**5,117**	**5,439**	**5,760**
Expenditure				
Power Purchase cost	2,339	2,515	2,787	3,125
O&M Cost	1,561	1,940	2,136	2,346
Employee cost	1,446	1,808	1,989	2,188
A&G Expenses	47	50	53	56
R&M Expenses	68	82	95	103
EBIDTA	903	663	516	289
Depreciation	329	383	436	474
Interest and finance charges	397	335	381	428
PBT	**177**	**(55)**	**(301)**	**(614)**
Provision for tax	60	0	0	0
PAT	**117**	**(55)**	**(301)**	**(614)**

9.6. Action plan items

As discussed in this Chapter, while the financials of HPSEBL has been improving over the past few years, the accumulated losses of the past and the excess quantum of short-term loans undertaken by the utility continue to put additional interest cost burden. Therefore, the action plan as highlighted in Table 71 below may assist in improving the short-term and medium-term financial health of HPSEBL:

Table 71: Key Action points

Agency	Action Plan
State Government	• Consider participation in the UDAY Scheme which shall assist in strengthening the financial position of HPSEBL
HPSEBL	• Pursue tariff increase of 5-6% year on year with the Regulatory Commission to cover the capital schemes proposed to be implemented • Consider segment-wise accounting in order to have proper cost allocation between generation and distribution business

10. Annexures

Annexure 1 :Proposed Transmission Network by HPPTCL

The details of proposed schemes by HPPTCL are details below:

ADB Tranche I

Sl.	NAME OF WORK	Project Cost		Awarded Company	Disbursements till Dec 2015 (in Crores)	COD	Ckt Kms	MVA	Power evacuation (MW)
		Mn USD	INR Crores						
1	22/66/220 kV, 31.5 MVA sub station at Bhoktoo with LILO of one circuit of 220 kV Kashang- Bhaba D/C Line	4.330	26.000	L&T	18.85	Dec-15	2	31.5	13
2	220 kV D/C (Twin MOOSE) line from Hatkoti to 220/400 kV Pragati Nagar sub station	10.380	62.280	KEC	26.27	Dec-16	56		554
3	220/400 kV, 1x315 MVA sub station at Pragati Nagar with LILO of both circuits of 400 kV Jhakri-Abdullapur D/C Line	23.930	143.580	ALSTOM	72.33	Dec-16	3	315	
4	66/220/400 kV (66/220 kV, 2x80/100 MVA+220/400 kV, 2x315 MVA) GIS sub station at Wangtoo with LILO of both circuits of 220 kV Kashang-Bhaba and 400 kV Wangtoo-Abdullapur D/C Lines at Wangtoo.	51.650	309.900	L&T	30.988	Aug-17	4	630	420
5	33/132 kV, 2x25/31.5 MVA sub station at Chambi (Shahpur)	8.300	49.800	Shyam Indus Power	0	Nov-16		63	44
6	33/132 kV sub station at Pandoh +LILO of one circuit of 132 kV Bajaura-Kangoo D/C Line	6.300	37.800	Shyam Indus Power	0	Aug-16	1	31.5	44

ADB Tranche II

Sl.	NAME OF WORK	Project Cost		Awarded Company	Disbursements till Dec 2015 (in Crores)	COD	Ckt Kms	MVA	Power evacuation (MW)
		M USD	INR Crores						
1	66 kV Switching station at Urni	4.683	28.10	Alstom	8.64	May-16		0	45

Sl.	NAME OF WORK	Project Cost M USD	Project Cost INR Crores	Awarded Company	Disbursements till Dec 2015 (in Crores)	COD	Ckt Kms	MVA	Power evacuation (MW)
2	66 kV D/C Line from 66 kV Switching station at Urni to Wangtoo Sub station	2.308	13.85	Karni Mata	0.75	May-16	30		
3	33/220/400 kV, (33/220 kV, 50/63 MVA +220/400 kV, 2x315 MVA) P.S at Lahal	38.748	232.49	L&T	23.92	Jun-18		630	793
4	220 kV Line from 33/220 kV Lahal sub station up to 220 kV yard of Budhil HEP	0.802	4.81	MJ Engineering	0.22	Nov-16	6		
5	220 kV D/C (Twin MOOSE) Transmission Line from Sunda to Hatkoti	9.330	55.98	Shyama Power	0	Apr-17	56		443
6	132/220 kV, 2x100 MVA Pooling Station at Sunda	18.000	108.00		0	Jun-17		200	289
7	132 kV D/C LILO line from looping point of 132 KV Dehra Kangra line to 132/33 KV Pooling Substation at Chambi (Shahpur	4.650	27.90		0	Nov-16	24		44
8	220 kV D/C line (Twin MOOSE) from Charor to 400/220 kV Banala sub station of PGCIL	9.400	56.40	RS infra	2.85	Aug-16	30		290
9	132/220 KV Sub-station at Charor	11.830	70.98		0	Apr-17		100	190

ADB Tranche III

Sl.	NAME OF WORK	Tentative Project Cost Million USD	Tentative Project Cost INR Crores	Awarded Company	COD	Ckt Kms	MVA	Power evacuation (MW)
1	400 kV D/C line (Twin MOOSE) from 400/220 kV, 2x315 MVA Lahal GISS to 400/220 kV Chamera Pooling station of PGCIL	27.33	164.00		Mar-18	70		793
2	132/220 kV, 2x80/100 MVA GISS Mazra	19.33	116.00		Oct-17		200	400
3	220 kV D/C Line from 132/220 kV GISS Mazra , Chamba to 33/220 kV Karian GISS	10.17	61.00		Mar-17	36		
4	66/22 kV, 2x10 MVA GISS at Nirmand (Bagipul)I	6.33	38.00		Jun-17		20	54
5	66 kV D/C Line from 66/22 kV GISS Nirmand to 66/220 kV Kotla sub station	6.33	38.00		Jun-17	42		
6	220 kV D/C line (Twin MOOSE) from Bajoli Holi HEP to 400/220 kV Lahal GISS	9.00	54.00		Jun-18	28		400
7	220 kV Switching Station at Hatkoti	10.67	64.00		Apr-17			554

Sl.	NAME OF WORK	Tentative Project Cost		Awarded Company	COD	Ckt Kms	MVA	Power evacuation (MW)
		Million USD	INR Crores					
8	33/132 kV Sub Station at Barsaini	8.67	52.00		Apr-17		63	58
9	132 KV D/C line from Barsaini to 132/220 KV Sub-Station at Charor	10.83	65.00		Apr-17	68		

REC Funded

Sl.	NAME OF WORK	Cost INR Crores	Awarded Company	COD	Ckt Kms	MVA	Power evacuation (MW)
1	i) 33/220 kV 31.5 MVA sub station in the yard of Allain Dhuangan HEP	2.68	M/S Kapil Mohan & Associates,	Jun-16		31.5	30
	ii) 33/220 kV, 31.5 MVA transformer	2.22	M/S Vijay Electrical				
2	33 kV D/C line between Palchan and 33/220 kV sub station in the yard of Allain Dhuangan HEP	3.41	M/S Kapil Mohan	Aug-16	20		
3	i) 33/220 kV, 100 MVA GIS sub station at Phojal	39.2	M/S L & T , Chennai	Completed		100	80
	ii) 33/220 kV, 100 MVA transformer	12.56	M/S Transformers & Electricals Kerala				
4	220 kV D/C line from LILO point to Phojal	6.84	M/S Hythro Power Corporation Ltd,	Dec-15	20		
5	33/220 kV, 50/63 MVA GIS sub station at Karian	29.3	M/S Siemens Ltd, Gurgaon	completed		63	60
6	220 kV S/C line on D/C towers between Karian and 22/400 kV Chamera pooling station of PGCIL	5.55	M/S Case Cold Roll Forming, Gurgaon	Dec-15	6		
7	220 kV D/C Kashang- Bhaba line	87.79	M/S Jyoti Structures	Dec-15	76		295

KfW Funded

Sl.	Name of Project	Cost		Ckt Kms	MVA	Power evacuation (MW)
		Rs(Crores)	Euro(Million)			
1	Construction of 22/132 kV substation in the yard of Tangnu Romai HEP	50.00	7.14		63	52
2	Construction of 132 kV D/C line from 22/132 kV substation at Tangnu Romai HEP to 132/220 kV substation at Sunda (>12 km)	26.00	3.71	36		96
3	Construction of 132/220 kV, 2x100 MVA GIS substation at Dehan in Distt. Kangra along with 220 kV D/C Transmission Line (55 Kms) from Dehan substation to 400/220 kV substation f PGCIL at Hamirpur	227.00	32.43	110	200	440
4	Construction of 33/132 kV, 31.5 MVA substation in the yard of Rupin HEP:	28.50	4.07		31.5	55
5	Construction of 132 kV D/C line between 33/132 kV substation at Rupin HEP and 132/220 kV substation at Sunda	38.00	5.43	44		100
6	Construction of 33/220 kV, 50/63 MVA substation at Village Heling in Distt, Chamba by LILO of 220 kV D/C (Twin MOOSE) line between Bajoli Holi HEP and 400/220 kV	60.00	8.57	2	63	45

Sl.	Name of Project	Cost		Ckt Kms	MVA	Power evacuation (MW)
		Rs(Crores)	Euro(Million)			
	substation of HPPTCL planned at Lahal					
7	Construction of 33 kV GIS switching Station at Palchan in District Kullu	8.40	1.20	-	-	57
8	66/220 kV, 80/100 MVA substation in the yard of 132/220 kV Sunda substation along with 66 kV D/C line from Sunda to Andhra	77.00	11.00	10	100	64
9	Construction of 33/132 kV, 2x31.5 MVA GIS substation Sarsadi by LILO of one circuit of 132 kV Barsaini-Charor D/C line in Distt. Kullu	50.00	7.14	-	63	61
10	Construction of 33/132 kV, 2x31.5 MVA GIS sub station near Malana-II (100 MW) power house in Distt. Kullu.	48.00	6.86	-	63	45
11	Providing additional 132/220 kV, 100 MVA Transformer at 132/220 kV, 100 MVA GIS substation at Charor	39.00	5.57	-	100	190
12	Providing additional 33/132 kV, 31.5 MVA Transformer at 33/132 kV, 31.5 MVA GIS substation at Pandoh in Distt. Mandi	24.00	3.43	-	31.5	54
13	Providing additional 400/220 kV, 1x315 MVA transformer in the 400/220 kV substation at Gumma [Pragatinagar] –base substation is funded by ADB- in Distt. Shimla.	70.00	10.00	-	315	170
	Total	**745.90**	**106.56**	**202**	**1,030**	**-**

Annexure 2 : Planned Transmission System alongwith phased development for upper part of Satluj Basin, Chandrabhaga Basin

The details of planned inter-state transmission system for development is provided below:

Satluj Basin

SHPs:

- Establishment of 66/220/400 kV GIS Pooling Station at Wangtoo by Mid 2014 to match commissioning of SHPs in Bhaba Khad (57 MW) and Sangla Valley (40 MW) + LILO of 220 kV Kashang- Bhaba D/c Line and LILO of both circuits of 400 kV Karcham Wangtoo-Abdullapur D/c line at Wangtoo.

Shongtong Karcham :

- Shongtong Karcham – Wangtoo 400 kV D/c Line (Quad HTLS Conductor – Equivalent to about 3000MW) – 18 km
- Switchyard Capacity etc. must be able to handle about 2800-3000MW power planned in the upstream of the generation project. It is proposed that the GIS switchyard may be designed with 4000 Amps switchgear. However, the cable capacity from Pot head yard to GIS switchyard may be augmented with generation addition in the upstream projects.

Tidong-I (100 MW) & Tidong-II (90 MW) HEP :

- 2x315 MVA (7x105 MVA units) 220/400 kV GIS Pooling Station at Jangi (with 4000 Amps. switchgear) (with space provision for 3rd ICT)
- LILO of one ckt. of Shongtong –Wangtoo 400 kV Line at Jangi
- Tidong – Jangi Pooling Station 220 kV D/c line

Kashang-I (65 MW), Kashang-II (65 MW), Kashang-III (65 MW) & Kashang-IV (48 MW) HEP:

Kashang –I (65 MW) HEP is under construction and is likely to be commissioned during 2013. For evacuation of power from Kashang-I, HP is constructing a 220 kV D/c line from Bogtu to Kashang. Accordingly, power can be evacuated through Bogtu-Wangtoo-Bhabha 220 kV D/c line. With the commissioning of other stages of Kashang, the power shall be injected at Jangi pooling station. The Transmission scheme for Kashang shall be as given as below:

- Kashang-Jangi Pooling Station 220 kV D/c line

Chango Yangthang (140 MW):

- Chango Yangthang – Proposed site of Ka Dogri Pooling Station 220 kV D/c line – 18 km
- Proposed Site of Ka Dogri – Jangi Pooling Station 400 kV D/c line (Twin Moose) to be initially charged at 220 kV – 50 km
- Provision of 3rd 400/220 kV ICT (3 nos. of 105 MVA Single Phase units) at Jangi Pooling Station

Yangthang Khab (261 MW):

- 220 kV Yangthang Khab- Ka Dogri D/c Line with HTLS conductor – adequate for 300 MW capacity – 4 km
- 2x315 MVA (7x105 MVA units) 220/400 kV GIS Pooling Station at Ka Dogri
- Charging of Ka Dogri – Jangi line at 400 kV level
- Direct termination of Chango Yangthang at Ka Dogri Pooling Station

Khab (636 MW):

- Khab – Jangi Pooling Station 400 kV D/c line – 20 km

Jangi Thopan (480 MW) & Thopan Powari (480 MW) :

- LILO of one circuit of Jangi Pooling Station – Wangtoo 400 kV D/c (Quad HTLS) line at generation project
- Switchgear Capacity at Generation switchyard must be equivalent to 4000 Amps.

Ropa (60 MW)

- Direct injection to Jangi Pooling station by a 220 kV D/c line
- The generation of SHPs in the area may be injected at Ropa Generation Switchyard

Other Projects of Spiti Valley (Satluj Basin)

- The generation of these projects can be injected at Ka Dogri Pooling Station.
- From Killing Lara (40 MW), Lara (60 MW) & Mane Nadang (70 MW), a combined 220 kV D/c line can be constructed upto Lara Sumte HEP. From Lara Sumte HEP(104MW), a high capacity 220 kV line (with twin Moose conductor) can be constructed upto Ka Dogri Pooling Station.
- Augmentation of transformation capacity would be required at Ka Dogri.

  Space for 2 additional ICTs of 315 MVA (105 MVA single phase units) would be required. These transformers can be provided progressively matching with the generation addition.

CHANDRABHAGA CORRIDOR-I

Seli HEP (400 MW):

- 400 kV D/c Line (Twin HTLS-Adequate for about 2000 MW) from Seli to the site of 400 kV Pooling Station near Sissu /Gramphu (Pooling Station shall not be constructed during this time frame)
- From site proposed near Sissu/Gramphu Pooling Station – Hamirpur 400 kV D/c (Triple HTLS – adequate for 2500 MW cap

Miyar HEP(120 MW) :

- Step up of Miyar generation at 400 kV level
- LILO of one circuit of Seli – Hamirpur (via Rohtang) 400 kV D/c line (Twin HTLS) at Miyar

Chhatru HEP (120 MW):

- Establishment of 2x315 MVA (7x105 Single Phase units) 400/220 kV GIS Pooling station near Sissu / Gramphu
- Chhatru – Sissu / Gramphu GIS Pooling Station 220 kV D/c line (HTLS adequate for 300 MW per circuit)
- LILO of both circuits of Seli - Hamirpur line at Sissu/ Gramphu GIS Pooling Station.

Teling & Shangling HEP (94 & 44 MW)

- LILO of one circuit of Chhatru – Sissu / Gramphu Pooling Station 220 kV D/c (HTLS) at Teling
- LILO of one circuit of Chhatru – Sissu / Gramphu Pooling Station 220 kV D/c (HTLS) at Shangling

Jispa (300 MW):

- Jispa – Sissu / Gramphu Pooling Station 400 kV D/c line

Bardang HEP (126 MW):

- Step up at 400 kV
- LILO of one circuit of Seli – Sissu / Gramphu Pooling Station 400 kV D/c (Twin HTLS)

Rasil HEP (130 MW)

- Step up at 400 kV
- LILO of one circuit of Seli – Sissu / Gramphu Pooling Station 400 kV D/c (Twin HTLS)

Tandi HEP (104 MW)

- Step up at 400 kV
- LILO of one circuit of Seli – Sissu / Gramphu Pooling Station 400 kV D/c (Twin HTLS)

Pattam HEP (60 MW) :

- Step up at 220 kV
- Pattam – Miyar 220 kV D/c

- Provision of 1x250 MVA(4 nos. of 83.3MVA Single Phase units), 220/400 kV GIS Pooling Station at Miyar. In case of space constraints at Miyar switchyard, a separate pooling station would be required.

Tignet HEP (81 MW)

- Step up at 220 kV
- LILO of one circuit of Pattam – Miyar 220 kV D/c

CHANDRABHAGA CORRIDOR-II

Reoli Dugli HEP (420 MW) & Sach Khas (149 MW):

- Generation step up at 400 kV level (for both projects)
- Reoli Dugli– Kishtwar 400 kV D/c (Twin HTLS-Adequate for 1500 MW)
- Establishment of 400 kV switching station at Kishtwar
- LILO of Dulhasti / Ratle – Kishenpur 400 D/c (Quad) line at Kishtwar
- LILO of one circuit of Reoli – Kishtwar at Sach Khas
- Generating Switchyard capacity to be kept for 1500 MW at each Power House.

Purthi HEP (300 MW):

- Generation step up at 400 kV level
- LILO of one circuit of Reoli – Kishtwar 400 kV D/c at Generating station
- Generating Switchyard capacity to be kept for 1500 MW at Power House.

Duggar HEP (236 MW):

- Generation step up at 400 kV level
- LILO of one circuit of Reoli – Kishtwar 400 kV D/c at Generating station
- Generating Switchyard capacity to be kept for 1500 MW at Power House.

Annexure 3: Balance Sheet and Cash Flow Statement of Base Case and Scenarios

Base case scenario

Balance Sheet	FY 16	FY 17	FY 18	FY 19
Current Assets				
Cash @ Bank	339	231	-	-
Stocks - Stores	69	81	97	106
Receivables	826	962	1,081	1,180
Total	**1,712**	**1,752**	**1,655**	**1,764**
Non-current Assets				
Gross Fixed Assets	8,127	9,714	10,637	11,305
Less: Accumulated Depreciation	(2,129)	(2,512)	(2,948)	(3,422)
Intangible Assets	16	16	16	16
Non Current Investments	431	431	431	431
Other current assets	1,127	1,127	1,127	1,127
Loans and Advances	190	190	190	190
Other Non-current assets	146	146	146	146
Capital Works in Progress	793	149	(20)	(113)
Net Fixed Assets	**8,700**	**9,260**	**9,579**	**9,680**
Total Assets	**10,411**	**11,011**	**11,234**	**11,444**
Liabilities				
Long Term Debt	1,642	2,149	2,454	2,550
Other Long-Term Debt	1,621	1,621	1,621	1,621
Working Capital Loan/ Short term borrowings	2,073	2,129	2,167	2,195
Cash deficit loan	-	-	382	1,380
Trade payables	2,050	2,065	2,087	2,116
Short term provisions	171	171	171	171
Current Liabilities	2,104	2,104	2,104	2,104
Total	**9,661**	**10,240**	**10,988**	**12,137**
Equity				
Share Capital	736	912	1,040	1,152
Grants	39	285	311	327
Capital Liabilities	-	-	-	-
Retained Earnings	(24)	(425)	(1,105)	(2,172)
Total	**751**	**772**	**246**	**(693)**
Total Liabilities	**10,411**	**11,011**	**11,234**	**11,444**

Cash Flow Statement	FY 16	FY 17	FY 18	FY 19
Cash from Operations				
Revenue	4,677	5,009	5,349	5,690
Operating Costs	(3,900)	(4,455)	(4,923)	(5,471)
Increase in Short term capital requirements	261	(25)	(21)	(10)

Cash Flow Statement	FY 16	FY 17	FY 18	FY 19
Tax	-	-	-	-
Net Cash from Operations	**1,038**	**529**	**405**	**208**
Cash from Investment Activities				
Capex	(879)	(943)	(755)	(575)
Net Cash from Investment Activities	**(879)**	**(943)**	**(755)**	**(575)**
Cash from Financing Activities				
Equity Investments	155	176	128	112
Debt Drawn	724	767	627	463
Loan Repayment	(182)	(259)	(322)	(368)
Increase in working capital loan	(38)	56	38	28
Payment of past current liabilities	-	-	-	-
Grants	39	246	27	15
Interest on cash deficit loan	-	-	(26)	(119)
Interest on Loans	(515)	(578)	(626)	(650)
Interest on Working Capital Loan	(95)	(103)	(108)	(112)
Net Cash from Financing Activities	**62**	**305**	**(263)**	**(631)**
Net Cash Balances				
Cash BF	118	339	231	(382)
Cash Flow during the year	221	(108)	(613)	(998)
Cash	**339**	**231**	**(382)**	**(1,380)**
Cash CF to balance sheet - post deficit loan	**339**	**231**	**-**	**-**

Scenario 1: Tariff Hike

Balance Sheet	FY 16	FY 17	FY 18	FY 19
Current Assets				
Cash @ Bank	339	501	497	558
Stocks - Stores	69	81	97	106
Receivables	826	1,017	1,201	1,377
Total	**1,712**	**2,077**	**2,273**	**2,520**
Non-current Assets				
Gross Fixed Assets	8,127	9,714	10,637	11,305
Less: Accumulated Depreciation	(2,129)	(2,512)	(2,948)	(3,422)
Intangible Assets	16	16	16	16
Non Current Investments	431	431	431	431
Other current assets	1,127	1,127	1,127	1,127
Loans and Advances	190	190	190	190
Other Non-current assets	146	146	146	146
Capital Works in Progress	793	149	(20)	(113)
Net Fixed Assets	**8,700**	**9,260**	**9,579**	**9,680**
Total Assets	**10,411**	**11,336**	**11,852**	**12,199**
Liabilities				
Long Term Debt	1,642	2,149	2,454	2,550

Balance Sheet	FY 16	FY 17	FY 18	FY 19
Other Long-Term Debt	1,621	1,621	1,621	1,621
Working Capital Loan/ Short term borrowings	2,073	2,176	2,268	2,358
Cash deficit loan	-	-	-	-
Trade payables	2,050	2,065	2,087	2,116
Short term provisions	171	171	171	171
Current Liabilities	2,104	2,104	2,104	2,104
Total	**9,661**	**10,287**	**10,707**	**10,920**
Equity				
Share Capital	736	912	1,040	1,152
Grants	39	285	311	327
Capital Liabilities	-	-	-	-
Retained Earnings	(24)	(148)	(207)	(199)
Total	**751**	**1,049**	**1,145**	**1,279**
Total Liabilities	**10,411**	**11,336**	**11,852**	**12,199**

Cash Flow Statement	FY 16	FY 17	FY 18	FY 19
Cash from Operations				
Revenue	4,677	5,286	5,946	6,655
Operating Costs	(3,900)	(4,455)	(4,923)	(5,471)
Increase in Short term capital requirements	261	(72)	(76)	(72)
Tax	-	-	-	(4)
Net Cash from Operations	**1,038**	**759**	**947**	**1,108**
Cash from Investment Activities				
Capex	(879)	(943)	(755)	(575)
Net Cash from Investment Activities	**(879)**	**(943)**	**(755)**	**(575)**
Cash from Financing Activities				
Equity Investments	155	176	128	112
Debt Drawn	724	767	627	463
Loan Repayment	(182)	(259)	(322)	(368)
Increase in working capital loan	(38)	104	92	90
Payment of past current liabilities	-	-	-	-
Grants	39	246	27	15
Interest on cash deficit loan	-	-	-	-
Interest on Loans	(515)	(578)	(626)	(650)
Interest on Working Capital Loan	(95)	(109)	(122)	(134)
Net Cash from Financing Activities	**62**	**346**	**(197)**	**(472)**
Net Cash Balances				
Cash BF	118	339	501	497
Cash Flow during the year	221	162	(4)	61
Cash	**339**	**501**	**497**	**558**
Cash CF to balance sheet - post deficit loan	**339**	**501**	**497**	**558**

Scenario 2: Grants not available

Balance Sheet	FY 16	FY 17	FY 18	FY 19
Current Assets				
Cash @ Bank	325	-	-	(0)
Stocks - Stores	69	81	97	106
Receivables	826	962	1,081	1,180
Total	**1,698**	**1,521**	**1,655**	**1,764**
Non-current Assets				
Gross Fixed Assets	8,127	9,714	10,637	11,305
Less: Accumulated Depreciation	(2,130)	(2,517)	(2,965)	(3,454)
Intangible Assets	16	16	16	16
Non Current Investments	431	431	431	431
Other current assets	1,127	1,127	1,127	1,127
Loans and Advances	190	190	190	190
Other Non-current assets	146	146	146	146
Capital Works in Progress	817	412	265	184
Net Fixed Assets	**8,724**	**9,518**	**9,847**	**9,944**
Total Assets	**10,408**	**11,039**	**11,502**	**11,708**
Liabilities				
Long Term Debt	1,657	2,315	2,615	2,701
Other Long-Term Debt	1,621	1,621	1,621	1,621
Working Capital Loan/ Short term borrowings	2,073	2,129	2,167	2,195
Cash deficit loan	-	70	776	1,887
Trade payables	2,050	2,065	2,087	2,116
Short term provisions	171	171	171	171
Current Liabilities	2,104	2,104	2,104	2,104
Total	**9,677**	**10,475**	**11,542**	**12,795**
Equity				
Share Capital	744	990	1,124	1,236
Grants	14	22	27	30
Capital Liabilities	-	-	-	-
Retained Earnings	(26)	(448)	(1,191)	(2,353)
Total	**732**	**564**	**(40)**	**(1,086)**
Total Liabilities	**10,408**	**11,039**	**11,502**	**11,708**

Cash Flow Statement	FY 16	FY 17	FY 18	FY 19
Cash from Operations				
Revenue	4,677	5,009	5,349	5,690
Operating Costs	(3,900)	(4,455)	(4,923)	(5,471)
Increase in Short term capital requirements	261	(25)	(21)	(10)
Tax	-	-	-	-
Net Cash from Operations	**1,038**	**529**	**405**	**208**
Cash from Investment Activities				

Cash Flow Statement	FY 16	FY 17	FY 18	FY 19
Capex	(903)	(1,181)	(776)	(587)
Net Cash from Investment Activities	**(903)**	**(1,181)**	**(776)**	**(587)**
Cash from Financing Activities				
Equity Investments	163	246	134	112
Debt Drawn	741	935	642	475
Loan Repayment	(184)	(278)	(342)	(389)
Increase in working capital loan	(38)	56	38	28
Payment of past current liabilities	-	-	-	-
Grants	14	8	5	4
Interest on cash deficit loan	-	(5)	(57)	(180)
Interest on Loans	(516)	(589)	(647)	(670)
Interest on Working Capital Loan	(95)	(103)	(108)	(112)
Net Cash from Financing Activities	**59**	**271**	**(335)**	**(732)**
Net Cash Balances				
Cash BF	118	311	(70)	(776)
Cash Flow during the year	193	(381)	(707)	(1,111)
Cash	**311**	**(70)**	**(776)**	**(1,887)**
Cash CF to balance sheet - post deficit loan	**311**	**-**	**-**	**-**

Scenario 3: Under-achievement of T&D loss target

Balance Sheet	FY 16	FY 17	FY 18	FY 19
Current Assets				
Cash @ Bank	304	172	-	(0)
Stocks - Stores	69	81	97	106
Receivables	826	962	1,081	1,180
Total	**1,677**	**1,693**	**1,655**	**1,764**
Non-current Assets				
Gross Fixed Assets	8,127	9,714	10,637	11,305
Less: Accumulated Depreciation	(2,129)	(2,512)	(2,948)	(3,422)
Intangible Assets	16	16	16	16
Non Current Investments	431	431	431	431
Other current assets	1,127	1,127	1,127	1,127
Loans and Advances	190	190	190	190
Other Non-current assets	146	146	146	146
Capital Works in Progress	793	149	(19)	(101)
Net Fixed Assets	**8,700**	**9,260**	**9,579**	**9,692**
Total Assets	**10,377**	**10,953**	**11,235**	**11,456**
Liabilities				
Long Term Debt	1,642	2,149	2,455	2,561
Other Long-Term Debt	1,621	1,621	1,621	1,621
Working Capital Loan/ Short term borrowings	2,070	2,129	2,167	2,195
Cash deficit loan	-	-	472	1,526

Balance Sheet	FY 16	FY 17	FY 18	FY 19
Trade payables	2,052	2,065	2,087	2,116
Short term provisions	171	171	171	171
Current Liabilities	2,104	2,104	2,104	2,104
Total	**9,661**	**10,240**	**11,078**	**12,294**
Equity				
Share Capital	736	912	1,040	1,152
Grants	39	285	311	314
Capital Liabilities	-	-	-	-
Retained Earnings	(59)	(484)	(1,194)	(2,304)
Total	**716**	**714**	**157**	**(838)**
Total Liabilities	**10,377**	**10,953**	**11,235**	**11,456**

Cash Flow Statement	FY 16	FY 17	FY 18	FY 19
Cash from Operations				
Revenue	4,669	4,985	5,324	5,663
Operating Costs	(3,927)	(4,455)	(4,923)	(5,471)
Increase in Short term capital requirements	263	(27)	(21)	(10)
Tax	-	-	-	-
Net Cash from Operations	**1,005**	**503**	**380**	**182**
Cash from Investment Activities				
Capex	(879)	(943)	(755)	(587)
Net Cash from Investment Activities	**(879)**	**(943)**	**(755)**	**(587)**
Cash from Financing Activities				
Equity Investments	155	176	128	112
Debt Drawn	724	767	628	475
Loan Repayment	(182)	(259)	(322)	(369)
Increase in working capital loan	(40)	59	38	28
Payment of past current liabilities	-	-	-	-
Grants	39	246	26	4
Interest on cash deficit loan	-	-	(32)	(135)
Interest on Loans	(515)	(578)	(626)	(651)
Interest on Working Capital Loan	(95)	(103)	(108)	(112)
Net Cash from Financing Activities	**60**	**308**	**(269)**	**(649)**
Net Cash Balances				
Cash BF	118	304	172	(472)
Cash Flow during the year	186	(132)	(645)	(1,054)
Cash	**304**	**172**	**(472)**	**(1,526)**
Cash CF to balance sheet - post deficit loan	**304**	**172**	**-**	**-**

Scenario 4: UDAY Scheme

Balance Sheet	FY 16	FY 17	FY 18	FY 19
Current Assets				

Balance Sheet	FY 16	FY 17	FY 18	FY 19
Cash @ Bank	156	477	325	(0)
Stocks - Stores	69	81	97	106
Receivables	826	962	1,081	1,180
Total	**1,529**	**1,998**	**1,980**	**1,764**
Non-current Assets				
Gross Fixed Assets	8,127	9,714	10,637	11,305
Less: Accumulated Depreciation	(2,129)	(2,512)	(2,948)	(3,422)
Intangible Assets	16	16	16	16
Non Current Investments	431	431	431	431
Other current assets	1,127	1,127	1,127	1,127
Loans and Advances	190	190	190	190
Other Non-current assets	146	146	146	146
Capital Works in Progress	793	149	(20)	(113)
Net Fixed Assets	**8,700**	**9,260**	**9,579**	**9,680**
Total Assets	**10,229**	**11,258**	**11,559**	**11,444**
Liabilities				
Long Term Debt	1,174	1,489	1,877	2,054
Other Long-Term Debt	784	575	575	575
Working Capital Loan/ Short term borrowings	1,017	546	584	612
Cash deficit loan	-	-	-	137
Trade payables	2,050	2,065	2,087	2,116
Short term provisions	171	171	171	171
Current Liabilities	2,104	2,104	2,104	2,104
Total	**7,301**	**6,950**	**7,398**	**7,770**
Equity				
Share Capital	736	912	1,040	1,152
Grants	2,063	3,321	3,348	3,363
Capital Liabilities	-	-	-	-
Retained Earnings	129	74	(227)	(840)
Total	**2,928**	**4,307**	**4,161**	**3,674**
Total Liabilities	**10,229**	**11,258**	**11,559**	**11,444**

Cash Flow Statement	FY 16	FY 17	FY 18	FY 19
Cash from Operations				
Revenue	4,677	5,009	5,349	5,690
Operating Costs	(3,900)	(4,455)	(4,923)	(5,471)
Increase in Short term capital requirements	261	(25)	(21)	(10)
Tax	(60)	-	-	-
Net Cash from Operations	**978**	**529**	**405**	**208**
Cash from Investment Activities				
Capex	(879)	(943)	(755)	(575)
Net Cash from Investment Activities	**(879)**	**(943)**	**(755)**	**(575)**

Cash Flow Statement	FY 16	FY 17	FY 18	FY 19
Cash from Financing Activities				
Equity Investments	155	176	128	112
Debt Drawn	724	767	627	463
Loan Repayment	(650)	(452)	(239)	(286)
Increase in working capital loan	(38)	56	38	28
Payment of past current liabilities	-	-	-	-
Grants	2,063	1,258	27	15
Interest on cash deficit loan	-	-	-	(9)
Interest on Loans	(302)	(232)	(273)	(307)
Interest on Working Capital Loan	(95)	(103)	(108)	(112)
Net Cash from Financing Activities	**(61)**	**734**	**199**	**(95)**
Net Cash Balances				
Cash BF	118	156	477	325
Cash Flow during the year	38	321	(151)	(463)
Cash	**156**	**477**	**325**	**(137)**
Cash CF to balance sheet - post deficit loan	**156**	**477**	**325**	**-**