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R2017-0110/1

May 1, 2017

Closing Date: Friday, May 26, 2017 at 6:00 p.m.

FROM: Vice President and Corporate Secretary

India - Andhra Pradesh 24X7 Power for All Project

Project Appraisal Document

Attached is the Project Appraisal Document regarding a proposed loan to India for an Andhra Pradesh 24X7 Power for All Project (R2017-0110), which is being processed on an absence-of-objection basis.

Distribution:
Executive Directors and Alternates
President
Bank Group Senior Management
Vice Presidents, Bank, IFC and MIGA
Directors and Department Heads, Bank, IFC and MIGA

Document of

The World Bank

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Report No: PAD1877

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED LOAN

IN THE AMOUNT OF US$240 MILLION

TO THE

REPUBLIC OF INDIA

FOR THE

ANDHRA PRADESH 24X7 POWER FOR ALL PROJECT

May 1, 2017

Energy and Extractives Global Practice
India Country Management Unit
South Asia Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective {1st March 2017})

Currency Unit	=	US$
US$1	=	INR 66.8

FISCAL YEAR

April 1 – March 31

ABBREVIATIONS AND ACRONYMS

ABC	Aerial Bundled Cable
ACB	Audit Committee of the Board
ACS	Average Cost of Supply
AP	Andhra Pradesh
APCPDCL	Andhra Pradesh Central Power Distribution Company Limited
APDISCOMS	Andhra Pradesh Power Distribution Companies
APEPDCL	AP Eastern Power Distribution Company
APERC	Andhra Pradesh Electricity Regulatory Commission
APGENCO	Andhra Pradesh Power Generation Company
APL	Adaptable Program of Lending
APNPDCL	Andhra Pradesh Northern Power Distribution Company Limited
APSEB	Andhra Pradesh State Electricity Board
APSPDCL	Andhra Pradesh Southern Power Distribution Company
APTRANSCO	Andhra Pradesh Power Transmission Company
ARR	Accounting Rate of Return
AT&C	Aggregate Technical and Commercial Losses
BEE	Bureau of Energy Efficiency
C&AG	Comptroller and Auditor General of India
CAAA	Controller of Aid and Audit Accounts
CAGR	Compounded Annual Growth Rate
CAT	Consumer Analysis Tool
CGFA	Corporate Governance and Financial Accountability Action Plan
CGS	Central Generation Station
CIDA	Canadian International Development Agency
CPTD	Compensatory Plan for Temporary Disturbance
CQS	Consultant’s Qualifications Based Selection
DC	Direct Contracting
DDUGJY	Deen Dayal Upadhaya Grameen Jyoti Yojna
DFID	Department for International Development
DGS&D	Directorate General of Supplies and Disposals
DISCOM	Distribution Companies
DPR	Detailed Project Reports

DTR	Distribution Transformer
EESL	Energy Efficiency Services Limited
EIA	Environmental Impact Assessment
EMP	Environment Management Plan
ERP	Enterprise Resource Planning
ESMF	Environment and Social Management Framework
ESMP	Environment and Social Management Plans
FRP	Financial Restructuring Plan
FSA	Fuel Surcharge Adjustment
GAP	Gender Action Plan
GIS	Gas Insulated Substations
GoAP	Government of Andhra Pradesh
GoI	Government of India
GRS	Grievance Redress Service
HVDS	High Voltage Distribution System
IA	Implementing Agencies
IBRD	International Bank for Reconstruction and Development
ICB	International Competitive Bidding
ICT	Information and Communications Technology
IDA	International Development Association
IUFR	Interim Unaudited Financial Reports
IMR	Infant Mortality Rate
IPDS	Integrated Power Development Scheme
IT	Information Technology
KPI	Key Performance Indicators
LARR 2013	Land Acquisition Resettlement and Rehabilitation Act 2013
M&E	Monitoring and Evaluation
MATS	Monitoring and Tracking System
MIS	Management Information Systems
MMR	Maternal Mortality Rate
MoU	Memorandum of Understanding
MTOA	Medium Term Open Access
NCB	National Competitive Bidding
NIC	National Information Center
NSDP	National State Domestic Product
OFR	Operational Funding Requirements
OM	Operations Manual
OMS	Outage Management System
PAP	Project Affected Persons
PAT	Profit After Tax
PERT	Program Evaluation and Review Technique
PFA	Power for All
PFC	Power Finance Corporation
PFS	Project Financial Statements
PIU	Project Implementing Unit
PLF	Plant Load Factor
PMRS	Performance Monitoring and Reporting System

P-RAMS	Procurement Risk Assessment Management System
RAP	Resettlement Action Plan
R-APDRP	Restructured Accelerated Power Development and Reforms Program
RE	Renewable Energy
REC	Rural Electrification Corporation of India
RPF	Resettlement Policy Framework
RMR	Remote Meter Reading
RMU	Ring Main Unit
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SC	Scheduled Caste
SCADA	Supervisory Control And Data Acquisition
SIMP	Social Impact Management Plan
SIP	Scheme Implementation Plans
SSS	Single Source Selection
ST	Scheduled Tribe
T&D	Transmission and Distribution
TIMS	Transformer Information Management System
TOR	Terms of Reference
TPDP	Tribal People Development Plan
TPPF	Tribal People Development Planning Framework
UDAY	Ujjwal DISCOM Assurance Yojna
UNDB	United Nations Development Business

Regional Vice President:	Annette Dixon
Country Director:	Junaid Kamal Ahmad
Senior Global Practice Director:	Riccardo Puliti
Practice Manager:	Demetrios Papathanasiou
Task Team Leaders:	Mani Khurana, Amol Gupta, Simon Stolp

India: Andhra Pradesh 24x7 Power for All Project

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PAD DATA SHEET

India

Andhra Pradesh 24x7 Power for All Project (P155038)

PROJECT APPRAISAL DOCUMENT

SOUTH ASIA

0000009260

Report No.: PAD1877

Basic Information		
Project ID P155038	EA Category B - Partial Assessment	Team Leader(s) Mani Khurana, Amol Gupta, Simon J. Stolp
Lending Instrument Investment Project Financing	Fragile and/or Capacity Constraints [ ] Financial Intermediaries [ ] Series of Projects [ ]	
Project Implementation Start Date 18-Aug-2017	Project Implementation End Date 17-Jun-2022	
Expected Effectiveness Date 31-Jul-2017	Expected Closing Date 17-Jun-2022	
Joint IFC No		

Practice Manager/Manager	Senior Global Practice Director	Country Director	Regional Vice President
Demetrios Papathanasiou	Riccardo Puliti	Junaid Kamal Ahmad	Annette Dixon

Borrower: Republic of India

Responsible Agency: Government of Andhra Pradesh

Contact:	Ajay Jain	Title:	Secretary (Energy)
Telephone No.:	9848882211	Email:	ajayjainias@gmail.com

Project Financing Data(in USD Million)					
[X]	Loan	[ ]	IDA Grant	[ ]	Guarantee
[ ]	Credit	[ ]	Grant	[ ]	Other

Total Project Cost:	570.00	Total Bank Financing:	240.00
Financing Gap:	0.00		

Financing Source	**Amount**
Borrower	170.00
International Bank for Reconstruction and Development	240.00
Asian Infrastructure Investment Bank	160.00
Total	570.00

Expected Disbursements (in USD Million)

Fiscal Year	2017	2018	2019	2020	2021	2022	0000	0000	0000	0000
Annual	0.60	7.20	35.90	64.60	71.80	59.90	0.00	0.00	0.00	0.00
Cumulative	0.60	7.80	43.70	108.30	180.10	240.00	0.00	0.00	0.00	0.00

Institutional Data

Practice Area (Lead)

Energy & Extractives

Contributing Practice Areas

Proposed Development Objective(s)

The development objective of the project is to increase the delivery of electricity to customers and to improve the operational efficiency and system reliability in distribution of electricity in selected areas in Andhra Pradesh.

Components

Component Name	**Cost (USD Millions)**
Component 1: Power Transmission System Strengthening	42.00
Component 2: Smart Grid Development in Urban Areas	88.20
Component 3: Distribution System Strengthening – Rural	105.00
Component 4: Technical Assistance for Institutional Development and Capacity Building	4.20
Front end fees	0.60

Systematic Operations Risk- Rating Tool (SORT)

Risk Category	**Rating**
1. Political and Governance	Substantial
2. Macroeconomic	Moderate
3. Sector Strategies and Policies	Substantial

4. Technical Design of Project or Program	Moderate
5. Institutional Capacity for Implementation and Sustainability	Moderate
6. Fiduciary	Substantial
7. Environment and Social	Moderate
8. Stakeholders	Substantial
9. Other	
OVERALL	Substantial

Compliance

Policy

Does the project depart from the CAS in content or in other significant respects?	Yes [ ]	No [X]
Does the project require any waivers of Bank policies?	Yes [ ]	No [X]
Have these been approved by Bank management?	Yes [ ]	No [X]
Is approval for any policy waiver sought from the Board?	Yes [ ]	No [X]
Does the project meet the Regional criteria for readiness for implementation?	Yes [X]	No [ ]

Safeguard Policies Triggered by the Project	**Yes**	**No**
Environmental Assessment OP/BP 4.01	**X**	
Natural Habitats OP/BP 4.04	**X**	
Forests OP/BP 4.36	**X**	
Pest Management OP 4.09		**X**
Physical Cultural Resources OP/BP 4.11	**X**	
Indigenous Peoples OP/BP 4.10	**X**	
Involuntary Resettlement OP/BP 4.12	**X**	
Safety of Dams OP/BP 4.37		**X**
Projects on International Waterways OP/BP 7.50		**X**
Projects in Disputed Areas OP/BP 7.60		**X**

Legal Covenants

Name	**Recurrent**	**Due Date**	**Frequency**
Subsidiary Agreement	**X**		CONTINUOUS

Description of Covenant

GoAP to make the proceeds of the Loan available to APEPDCL, APSPDCL and APTRANSCO (collectively the "Implementing Agencies") pursuant to individual subsidiary agreements to be entered under terms and conditions acceptable to the Bank.

Name	**Recurrent**	**Due Date**	**Frequency**

Project Implementation Units	**X**		CONTINUOUS
Description of Covenant			
GoAP to ensure that the Implementing Agencies maintain their respective project implementation unit for carrying the day-to-day implementation of the activities under their respective parts of the Project (including compliance with the safeguard documents)			
Name	**Recurrent**	**Due Date**	**Frequency**
Internal Audits	**X**		CONTINUOUS
Description of Covenant			
GoAP to cause the Implementing Agencies to select and engage, and thereafter maintain the services of one or more consulting firm(s) under the terms agreed with the Bank, in order to carry out the Implementing Agencies' internal audits on financial management performance, procurement process and decisions and contract administration.			
Name	**Recurrent**	**Due Date**	**Frequency**
Project Management Consultant	**X**		CONTINUOUS
Description of Covenant			
GoAP to ensure that, if and when required by the Bank, APEPDCL and APSPDCL hire a project management consulting firm with qualifications and under terms of reference agreed with the Bank, to assist their respective PIUs with the planning, implementation and execution of activities under their respective parts of the Project.			
Name	**Recurrent**	**Due Date**	**Frequency**
Operations Manuals	**X**		CONTINUOUS
Description of Covenant			
GoAP to ensure that the Implementing Agencies carry out their respective parts of the Project in accordance with their respective operations manuals.			
Name	**Recurrent**	**Due Date**	**Frequency**
Safeguard Documents	**X**		CONTINUOUS
Description of Covenant			
GoAP to cause the Implementing Entities to carry out their respective parts of the Project pursuant to, and in compliance with, the ESMF (including the CPTD) as well as the respective EMP(s), RAP(s) and TPDP(s) prepared or to be prepared pursuant to the ESMF (the ESMF, ESMP(s), RAP(s) and TPDP(s) collectively referred to as the (Safeguard Documents")			
Name	**Recurrent**	**Due Date**	**Frequency**
Screening of Project Activities	**X**		CONTINUOUS
Description of Covenant			
The Implementing Agencies to refrain from commencing any civil works for each transmission line, substation or distribution network to be erected/built or augmented under Components 1, 2 and 3 of the Project, or undertaking any activities ancillary thereto, until and unless: (i) the proposed activities/civil works have been screened in accordance with the ESMF; (ii) the respective EMPs, RAPs and/or TPDP(s), as required by the ESMF, have been prepared and submitted to the Bank for review and no-objection; and (iii) these safeguard documents have been disclosed by concerned Implementing Agency			

in local language(s) at the relevant Project's sites at least thirty (30) days prior to the award of the contract for such activities/civil works.

Name	Recurrent	Due Date	Frequency
Permits and Clearances	X		CONTINUOUS

Description of Covenant

GoAP and the Implementing Agencies to ensure, prior to commencing any civil works for each transmission line, substation or distribution network to be erected/built or augmented under Components 1, 2 and 3 of the Project, that: (i) all necessary permits and clearances have been obtained; (ii) all pre-conditions imposed in those permits/clearances shall have been complied with; and (iii) all resettlement measures set forth in the applicable RAPs shall have been executed (including full payment of compensation prior to displacement or the provision of relocation assistance to affected persons).

Name	Recurrent	Due Date	Frequency
Civil Works Contracts	X		CONTINUOUS

Description of Covenant

GoAP to ensure and cause the Implementing Agencies to ensure that each contract for civil works includes the obligation of the relevant contractor to comply with the Safeguard Documents

Name	Recurrent	Due Date	Frequency
M&E Safeguard Protocols	X		CONTINUOUS

Description of Covenant

GoAP to cause the Implementing Agencies to maintain monitoring and evaluation protocols and record keeping procedures adequate to GoI, GoAP and the Bank to supervise and assess the implementation of/compliance with the Safeguard Documents.

Name	Recurrent	Due Date	Frequency
Grievance Redress Mechanism	X		CONTINUOUS

Description of Covenant

GoAP and the Implementing Agencies to maintain and operate a multi-layered grievance redress mechanism acceptable to the Bank for the handling of any stakeholder complaints arising out of the implementation of their respective activities under the Project.

Name	Recurrent	Due Date	Frequency
Ineligible Expenditures	X		CONTINUOUS

Description of Covenant

GoAP and the Implementing Agencies to ensure that: (i) all land acquisition required for the Project, (ii) any compensation, resettlement, and rehabilitation payment to Affected Persons as per the RAPs and/or CPTD; (iii) any compensatory afforestation payments (including as required by the ESMF); (iv) any interest during construction; (v) any retention money deducted from contract payments and not released by the Closing Date; and (vi) any expenditures objected or considered ineligible by the independent auditors in the Financial Statements, are financed exclusively out of GoAP and/or the Implementing Agencies' own resources.

Conditions

Source Of Fund	Name	Type

IBRD	Ancillary Legal Documents	Effectiveness

Description of Condition

(a) The Subsidiary Agreements between the GoAP and the Implementing Agencies have been executed and all conditions precedents for their effectiveness have been met; and (b) the Co-financing Agreement between GoI and the AIIB has been executed and delivered and all conditions precedent to its effectiveness, or to the right of the GoI to make withdrawals under it, have been fulfilled.

Team Composition

Bank Staff

Name	Role	Title	Specialization	Unit
Mani Khurana	Team Leader (ADM Responsible)	Senior Energy Specialist	Energy	GEE06
Amol Gupta	Team Leader	Energy Specialist	Energy	GEE06
Simon J. Stolp	Team Leader	Lead Energy Specialist	Energy	GEE06
Swayamsiddha Mohanty	Procurement Specialist (ADM Responsible)	Senior Procurement Specialist	Procurement	GGO06
Puneet Kapoor	Financial Management Specialist	Sr Financial Management Specialist	Financial Management	GGO24
Bipulendu Narayan Singh	Team Member	Energy Economist	Energy	GEE06
Boonsri Prasertwaree Kim	Team Member	Program Assistant	ACS	GEE06
Gaurav D. Joshi	Safeguards Specialist	Senior Environmental Specialist	Environment	GEN06
Kavita Saraswat	Team Member	Sr Power Engineer	Technical	GEE06
Martin M. Serrano	Counsel	Senior Counsel	Legal	LEGES
Obaidullah Hidayat	Safeguards Specialist	Environmental Specialist	Environment	GEN06
Radha Narayan	Team Member	Procurement Assistant	Procurement	GGO06
Ritika Rodrigues	Team Member	Program Assistant	ACS	SACIN
Sona Thakur	Team Member	Senior Communications Officer	Communications	SAREC
Suryanarayana Satish	Safeguards Specialist	Senior Social Development Specialist	Social	GSU06

Extended Team

Name	Title	Office Phone	Location
Debabrata Chakraborti	Procurement Consultant	9811755494	New Delhi
Dinkar Sohony	Consultant		Hyderabad
Kuldip Kaul	Technical Consultant	9810602466	New Delhi
Ramola Bhuyan	Consultant-Financial Management	8420155702	Kolkata

Locations

Country	First Administrative Division	Location	Planned	Actual	Comments
India	Andhra Pradesh	State of Andhra Pradesh		**X**	

Consultants (Will be disclosed in the Monthly Operational Summary)

Consultants Required? Yes

I. STRATEGIC CONTEXT

A. Country Context

1. **India is the world's 3rd largest economy accounting for around 17 percent of the world's population.** India is also currently the world's third largest consumer of electricity, however average per capita consumption of electricity is only one third of the global average – slightly lower than the average for the African continent[1]. India has the largest energy access deficit of any single country.

2. **Lifted by lower oil prices and prospects for implementation of critical structural reforms, India has become the world's fastest growing large economy.** Growth in real Gross Domestic Product (GDP) (market prices) increased from 5.1 percent in FY 2013 to 7.3 percent in FY 2015 before moderating slightly to 7.2 percent in the first half of FY16.[2] While the momentum was initially supported by private consumption (average growth of 6 percent during FY 2013-FY 2015), it has more recently benefited from increase in investments (4.6 percent in FY 2015 and 5.8 percent in H1[3] FY 2016 versus an average of 1.3 percent in the preceding two years). Non-farm activities continue to be the major drivers of growth. While trade and transport services still make the largest contribution to growth, manufacturing, construction and real-estate services have gained prominence and their combined contribution to growth increased to nearly 55 percent in FY 2015 from 45 percent in the previous two years.

3. **Growth is expected to accelerate further, albeit modestly, driven by increase in investments.** In the near-term, India is relatively well-positioned to weather the recent global volatility. India has low trade exposure to China, while Indian financial markets (local bond markets in particular) are fairly closed. India's considerable foreign exchange reserves (9 months of retained imports) provide additional buffer. In the medium-term, however, the Indian economy is not immune to a slowdown in global demand and heightened volatility. India requires some measure of foreign capital inflows to finance both fiscal and current account deficits and ultimately the investments needed to spur growth. China's slowdown and its reverberation in the global economy has led to further deterioration of the already weak export outlook. Although India may be able to achieve fast GDP growth without export growth for a short period (as suggested by the low year-to-year correlation between exports and GDP growth), sustaining high rates of GDP growth over a longer period will require a recovery of export growth.

4. **Andhra Pradesh with a population 49 million, is a middle income state (National State Domestic Product (NSDP) INR 107, 532[4] per capita in FY 2016) and is growing at a growth rate of 10.5 percent which is higher than the country average.** Services sector[5] registered a

[1] India per capita consumption in 2013 was 765 kilo-Watt-hour (kWh) while the world average is 3104 kWh per capita. (Source : International Energy Agency, India Energy Outlook 2015)

[2] FY 2015 refers to the fiscal year ending March 31, 2015, and so on.

[3] H1 refers to first half of FY i.e. the period from April to September.

[4] Advanced estimates in Socio Economic Survey Andhra Pradesh 2015-16

[5] Trade, Hotels, Communications, Banking and Insurance

growth rate of 11.39 percent in FY 2016 and is the engine for pushing the overall growth. It is situated on the southeastern coast of the country with the second longest coastline.

B. Sectoral and Institutional Context

5. **Efficient, reliable and affordable electricity supply is critical to India's ongoing economic growth and demographic transformation.** India's GDP growth was accompanied by a reduction in the poverty ratio from 37.2 percent in FY 2005 to 21.9 percent in FY 2012. Today, two thirds of India's population is above the poverty line. India is also becoming increasingly urban with urbanization rate of 31.2 percent, compared to only 28.6 percent in 2001. The urbanization rate is expected to exceed 40 percent by 2030. Demand for power is expected to grow significantly, to meet current suppressed demand (evidenced by load shedding and unreliable supply), to support economic diversification, the growing manufacturing sector, and to meet the rising economic aspirations of India's people.

6. **Of the around 244 million people who are without access to electricity in India, more than half could legally connect to the electricity grid, but choose not to, because electricity supply is so unreliable**. Rural consumers and the urban poor constitute the bulk of the almost 244 million people without electricity. Even those who do have a connection to the electricity grid face intermittent power supply, particularly in rural areas. Industry and commercial enterprises also suffer due to unreliable supply, and are forced to invest in expensive diesel-fueled back-up generation. This lack of reliability is not an issue of availability of power generation – India currently has surplus generation capacity. Against an estimated peak demand of 165 GW in FY 2017, the total generation capacity in India had already reached 303 GW in June 2016 and India is expected to be energy surplus by 1.1 percent in FY17[6]. The reason for this lack of reliability is the poor performance of India's heavily indebted Distribution Companies (DISCOMs), which are for the most part publicly owned, and whose limited resources leave them incapable of providing reliable electricity supply. Total accrued losses by distribution companies currently stand at around US$66 billion (INR4422 billion), as a result of weak governance, low regulatory support (often resulting in below-cost-recovery tariffs), high aggregate technical and commercial (AT&C) losses, and poor commercial performance.

7. **Enacting improvements in the provision of electricity services is particularly challenging since electricity is a "concurrent" subject under the Indian Constitution**. The central government establishes the national legal framework and sets policies that provide overall guidance to the sector, but may not necessarily be binding on states in areas within the latter's jurisdiction. Central government-owned corporations play an important role in power generation and transmission, for the purposes of inter-state supply. State governments are responsible for electricity transmission and distribution within their territories. They may also engage in power generation, primarily to meet the state's individual energy requirements, though many energy-rich states have their companies export surplus power.

8. **In 2014, Government of India (GoI) announced an ambitious 24 x 7 Power for All (PFA) program involving a partnership approach with States to ensure reliable electricity supply within the next five years.** This initiative aims at ensuring uninterrupted supply of quality

[6] Load Growth Balance report of 2016-17 by Central Electricity Authority of India

power to existing consumers[7] by the end of 12th Five Year Plan i.e. 2017, and providing access to electricity to all unconnected consumers in the next five years, i.e. by 2019. Each state has prepared a detailed roadmap of the steps to be taken to address the issues of the power sector. The PFA plan is a common integrated planning framework across the power sector value chain to augment the power capacity of the state commensurate with the increase in demand. The PFA plan is signed jointly by the GoI and state government to indicate that GoI will complement the efforts of the state government in bringing uninterrupted quality power to all households, industries, commercial businesses, public needs and any other electricity consuming entities as per the state policy. To support the financial sustainability of the electricity sector, and provide distribution companies with the financial capacity to meet the Government's 24x7 Power for All plans, the GoI also announced a parallel program - Ujjwal DISCOM Assurance Yojna (UDAY) in 2015. The UDAY program seeks to restructure distribution companies' debt, requiring State governments to take responsibility for part of this debt, in return for improvements in service delivery and commercial performance by the distribution companies.

9. **Andhra Pradesh was among the first Indian states to initiate legal, structural, regulatory and institutional reforms in the power sector in the late 1990s.** Vertically integrated Andhra Pradesh State Electricity Board (APSEB) was unbundled into six independent companies, namely, Andhra Pradesh Power Generation Company (APGENCO), to undertake generation of electricity, Andhra Pradesh Power Transmission Company (APTRANSCO) to undertake transmission, and four Andhra Pradesh Power Distribution companies (APDISCOMS). The Andhra Pradesh Electricity Regulatory Commission (APERC) was set up in 1999. In 2014, The Andhra Pradesh Reorganization Act bifurcated the state of Andhra Pradesh into Telangana and the residuary Andhra Pradesh state. Following the state bifurcation, the Andhra Power sector operations now rest with four entities: (i) APGENCO and (ii) APTRANSCO with a state wide mandate; (iii) Southern Power Distribution Company of Andhra Pradesh Ltd. (APSPDCL), covering eight districts; and (iv) Eastern Power Distribution Company of Andhra Pradesh Ltd. (APEPDCL) for five districts in the remaining part of the state.

10. **The power sector reforms undertaken by Government of Andhra Pradesh from 1997-2004 were successful but were not sustained**. The reforms resulted in the state's energy deficit being reduced to 1.5 percent during FY 2004, while the country-wide average was 7.1 percent. In 2003, the credit rating agency, CRISIL, ranked Andhra Pradesh as the best state among all Indian states, based on the performance parameters for the power sector. However, after 2004 the reform was not maintained and the sector started facing considerable challenges.

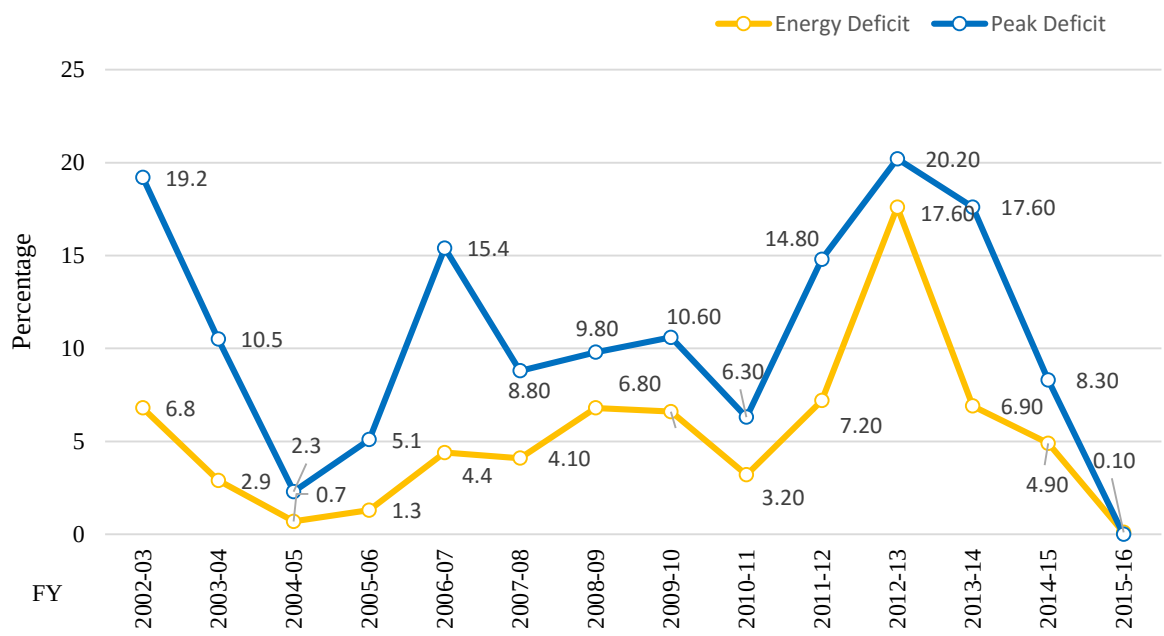
i. *High energy and peak power deficit led to significant cost being incurred on power purchase:* Inadequate capacity addition, idle capacity due to unavailability of gas, and low utilization of existing thermal power generation stations due to inadequate supply of fuel, prevented in-state generation from servicing the growing demand for power in the state. The energy and peak power deficit in the state increased to 17.6 percent and 20.2 percent respectively during FY 2013 as against the all India average of 8.7 percent and 4.5 percent respectively. Further, delay in connectivity of Southern Grid to the national grid[8], restricted the state's option of buying cheaper power from power surplus states in other parts of India.

[7] Except agricultural consumers who are supplied power for 7 hours as decided by the state

[8] Southern Grid was connected to the national grid in January 2014.

Despite the integration of the Southern Grid with the rest of India in 2014, the state has not benefited significantly through reduced power purchase cost, as it has been allocated inter-regional Medium Term Open Access (MTOA) power of only about ~170 MW, owing to constraints in the transmission corridor. The state, being unable to secure dependable power imports at reasonable prices, has resorted to procuring power at higher cost from short term sources (short term Power Purchase Agreements (PPAs) or purchases from the exchange). The share of short term power purchases in total power procurement reached 23 percent in FY 2015 against only 4 percent in FY 2010. The average cost of short term power in FY 2015 was US$0.085 (INR5.7)/kWh (~62 percent higher than per unit costs of long term PPAs).

Figure 1: Power Deficit 2002-2015



Source: Compilation from Annual Reports of APDISCOMS & Monthly Reports of Central Electricity Authority (CEA)

ii. *State faced the challenge of managing scarce power supply between agriculture, small domestic and industrial consumers*: To reduce the financial burden on small and marginal farmers, the state of Andhra Pradesh has a stated policy of supplying free or significantly subsidized power to agriculture consumers. Thus the state also faces an additional challenge of balancing the socio-political imperatives of supplying the large agriculture-based demand (~25% of total consumption in FY 2015), while also meeting the growing needs of cross-subsidizing consumer categories like industry. In FY 2013, due to an electricity shortfall, industrial consumers were forced to cut their consumption by 40 percent, and were charged substantial fines if they chose to do otherwise, and distribution companies were not allowed to release new or additional industrial load. This adversely impacted the financial position of the distribution companies and industry, and reduced economic growth of the state. Further, Andhra Pradesh also has tariffs that are much lower than the cost of supply for small domestic consumers, with up to 200 units of monthly consumption (as per the FY

2016 tariff structure). Small domestic (<200 units of monthly consumption) and agriculture consumers constitute more than 40 percent of the sales by volume in the state.

iii. *Distribution utilities faced financial stress due to non-recovery of cost of supply:* The distribution companies were not compensated for the high power purchase cost. In FY 2013, distribution companies indicated Government receivables towards additional power subsidy amounting to US$1274.6 million (INR8539 crores) as doubtful and also wrote off unapproved or pending-in-court Fuel Surcharge Adjustment (FSA) to the tune of US$553 million (INR3705 crores)[9]. The gap between the revenue generated from supply of power and the utility's cost of supply has been rising. This gap can be bridged either through subsidy from the state government or tariff increase, but both subsidy support and tariff hikes have been insufficient and have resulted in financial losses for the two utilities. The distribution sector reported a cumulative loss of around US$1,500 million (INR10050 crores) across the three years, FY 2013-2015. Further, the state has had to resort to short term loans to pay for power purchases, leading to short term borrowings of ~US$1,060 million (~INR 7102 crores) in FY 2013, before the kick-in of the GoI's Financial Restructuring Plan (FRP), details of which are discussed in the subsequent section. Please refer to Annex 2 for more details.

iv. *The financial stress led to inadequate investment in transmission and distribution infrastructure:* Due to the poor financial performance of the utilities, there has been an under investment in the transmission and distribution infrastructure of the state. While the state has entered into significant long term PPAs in power generation, the growing power demand has already exposed bottlenecks in the transmission and distribution network in the state, which are only going to increase as more power flows through the network. Based on data shared by the distribution utilities, in some districts with high industrial loads, the distribution network has already reached its peak capacity (high transformer loading at 33kV substations), high distribution transformer failure rate (~5 percent annually), and many network components have already reached their rated economic life (thus further increasing the chance of failures).

11. **Since 2014, the Government of Andhra Pradesh has taken significant steps to improve the power sector in the state.** The political leadership has accorded a high priority to improving the availability and quality of power supply for the state's economic development. Andhra Pradesh was one of the first states to sign the 24x7 Power for All plan and the specific indicators of state commitment include:

i. *Implementation of a generation expansion strategy and simultaneously improving the generation mix through renewable energy*: The state plans to more than double the installed capacity of the state from 8,300 MW in FY 2015 to ~16,000 MW (from non-RE sources alone) by 2019, through a mix of private sector and public sector investments. By March 2016, around 4000 MW capacity addition had been achieved. Further, a five year renewable energy plan has been prepared to ensure that renewable energy installed capacity is also increased significantly (~7000MW from grid connected solar and wind combined). Through implementation of the generation plan outlined above, the state distribution companies have

[9] Incurred on account of additional expensive power purchase made by the distribution companies to meet deficit

been able to reach a NIL energy and peak deficit. This has lowered their dependence on short term purchases and hence, reduced average power purchase costs.

ii. *Virtual feeder segregation to regulate agriculture supply and dedicated feeders for rural industries and commercial establishments*: Andhra Pradesh has completed the virtual segregation (single phase supply for rural households and three phase supply for agricultural loads) of all its rural feeders, which has enabled the distribution companies to provide 24 hour supply to all rural domestic consumers while restricting the supply to about 7 hours for agriculture consumers. Further, to ensure reliable and continuous supply to the industries and commercial establishments in rural areas, the distribution companies are supplying power to these establishments through dedicated feeders in the majority of their supply area, and plan to construct new dedicated feeders in the remaining areas.

iii. *Reduction in aggregate technical and commercial (AT&C) losses*: The AT&C losses in the state decreased from 23 percent in FY 2004 to around 11 percent in FY 2015, through better metering, regular energy audits, and successful promotion of demand-side measures. However, there is still room for improvement to further reduce these losses.

iv. *Signing up for UDAY (Ujjwal DISCOM Assurance Yojana) Scheme and FRP, 2012:* GoAP signed an MoU with Ministry of Power in June, 2016 under the UDAY scheme in order to ensure the turnaround and long term financial viability of the state distribution companies. Under this scheme GoAP will take over 75 percent of the working capital term loans (WCTL) outstanding as on September 30, 2015. In addition, the state government had earlier also taken over certain portions of the debt of the distribution companies under the GoI's FRP of 2012. Thus, under the two schemes together, the state government is expected to take over US$1.3 billion (INR87.1 billion) of distribution companies' debt by the end of the current financial year, FY 2017. In addition, under UDAY, the state government has also agreed to finance the future losses of the distribution companies in a graded manner over the next five years. It shall also provide operational funding requirements (OFR) support to the distribution companies, until they achieve turnaround. On their part, the distribution companies are expected to undertake specified measures for loss reduction, demand side management, quarterly tariff revisions to offset fuel price increase, increase employee engagement, develop a customer service strategy, and procure power through a transparent process of competitive bidding. The outcome of operational improvements will be measured through indicators such as reduction in AT&C losses and reduction in gap between average cost of supply and average revenue realization.

12. **The Financial health of the distribution companies is projected to improve in the future.** A detailed financial analysis has been undertaken to understand the business environment that is expected to exist in the future. Based on the pipeline of generation projects already implemented and planned in the future, the average costs of power purchase are expected to plateau. From improvement in operational efficiency and support from GoAP through UDAY, the distribution companies are expected to achieve a financial turnaround by FY 2020.

C. Higher Level Objectives to which the Project Contributes

13. The overarching objective of the World Bank Group's Country Partnership Strategy (FY 2013-2017) is to support poverty reduction and shared prosperity in India. Continued rapid economic growth is a precondition for poverty reduction and shared prosperity, and to achieve economic growth it is imperative that India is able to provide all of its citizens with affordable, reliable electricity supply, in line with growing demand. The proposed Project supports the first pillar of the ongoing India Country Partnership Strategy (2013-2017) – 'integration'. This Project, through its focus on improving operational efficiency in transmission and distribution sector will provide increased supply of affordable, reliable electricity to the citizens in the state of Andhra Pradesh.

II. PROJECT DEVELOPMENT OBJECTIVES

A. PDO

14. The development objective of the Project is to increase the delivery of electricity to customers and to improve the operational efficiency and system reliability in distribution of electricity in selected areas in Andhra Pradesh.

B. Project Beneficiaries

15. The direct beneficiaries of the Project are the (existing and new) customers of the power distribution companies in the state of Andhra Pradesh, who will benefit from an increase in the supply of grid-based electricity, resulting from the augmentation and strengthening of the intrastate transmission and distribution (T&D) network.

16. By increasing the supply of reliable electricity to households, industries, businesses, and various other productive sectors, the Project will also contribute to economic development, poverty alleviation, and inclusive growth in Andhra Pradesh. Around half of the proposed investments are targeted towards improving power supply to rural areas thus providing opportunities to increase the household income and standards of living in some of the poorer communities in India. Most of the investment in the rural areas is in Anantapur and Kurnool districts. These districts are part of the Rayalaseema [10] region which is less developed than the rest of the state.

C. PDO Level Results Indicators

17. PDO level results indicators for the Project are (a) Increase in delivery of electricity in the state (Gigawatt-hour (GWh)) (b) Reduction in AT&C losses in select districts (percentage); (c) Reduction in distribution transformer failure rate in select project areas (percentage)[11].

[10] Rayalaseema (Rāyalasīma) is a geographic region in the Indian state of Andhra Pradesh. It includes the four southern districts of Anantapur, Chittoor, Kadapa and Kurnool. The region borders the state of Tamil Nadu to the south, Karnataka to the west and Telangana to the north.

[11] SAIDI and SAIFI were considered for measurement of achievement of the third PDO, however utilities in Andhra Pradesh are not capable of measuring these indicators at this point in time. The Project will therefore establish a baseline for SAIDI and SAIFI early in the Project's implementation, institute measurement of these indicators, and show a reduction in SAIFI and SAIDI over the remainder of the Project.

18. The intermediate outcome indicators will be:

i. Transmission Lines constructed under the Project(in circuit kilometers);
ii. Distribution lines constructed under the Project (in circuit kilometers);
iii. Number of transmission substations constructed (Numbers of 220/132kV, 220/33kV and 132/33kV substations);
iv. Number of distribution substations constructed or upgraded (Number of 33/11 kV substations);
v. Establishment and reduction of SAIDI in select urban areas;
vi. Establishment and reduction of SAIFI in select urban areas;
vii. Percentage of females among the number of persons participating in the safeguard consultation meetings (percentage);
viii. Person-days of utility staff participating in trainings;
ix. Grievances received that are addressed within two months of receipt (percentage).

III. PROJECT DESCRIPTION

19. This proposed Project aims to support the implementation of the 24x7 Power For All (PFA) plan in the state of Andhra Pradesh, by:

i. augmenting and strengthening the transmission and distribution network;
ii. increasing network capacity and thereby increasing the distribution companies' ability to reliably service growing demand;
iii. reducing AT&C losses;
iv. improving system reliability; and
v. supporting operational reforms to improve the commercial performance of the state's two distribution companies.

20. The state of Andhra Pradesh is one of the first states to prepare a 24x7 Power for All plan, and sign a Memorandum of Understanding (MoU) with GoI to launch the Andhra Pradesh 'Power for All' scheme on October 2, 2014. The focal areas identified by Andhra Pradesh under its PFA plan include:

i. Additional energy requirement to provide 24x7 power supply to all households in the state through adequacy of generation (including renewable energy plan and energy efficiency plan of the state).
ii. Adequacy of power transmission and distribution systems in the state, especially to meet the additional demand.
iii. Interventions to improve operational efficiency and customer satisfaction through AT&C loss reduction, introduction of modern technologies to provide reliable supply such as substation automation, adequate communication infrastructure to support smart grid implementation, centralized network analysis and planning tools, enhanced Enterprise Resource Planning (ERP) systems, etc.

21. The energy demand met in the state of Andhra Pradesh was 45,600 GWh in FY 2015. According to Andhra Pradesh's PFA plan it is expected to grow to 78,900 GWh by FY 2019 (~83,900 GWh in case the agricultural supply is increased to 9 hours per day from current levels of 7 hours per day) implying an annual growth rate of more than 8.5 percent. This compares well with the historical numbers of 8 percent growth in energy requirement across the last five years. Substantial investments would be needed to meet this rise in demand. A more detailed description of the interventions planned under the state's PFA and funding sources is as follows:

i. *Power generation capacity addition and power purchase agreements* {Investments by the state, private sector and central sector enterprises}: According to the PFA plan, the state must meet a peak demand of ~13,400 MW in FY 2019 whereas its capacity in FY 2014 was only 8,300 MW. To meet the gap of 5,100 MW, the state plans to tap both its own as well as private and central sector resources. The state generator (APGENCO) plans to add ~3,800MW and the erstwhile united Andhra Pradesh's expected share from some key upcoming central sector generating stations and Independent Power Producers (IPPs) is expected to add ~4,600MW. However, the actual share that Andhra Pradesh will now get from central sector plants shall be lower after factoring in the bi-furcation of the state. Similarly, some of APGENCO's generation capacity addition would also be subject to availability of fuel linkages. To meet such exigencies, Andhra Pradesh plans to further tap-into private sector investments and has also recently invited two bids to procure 1000 MW and 2400 MW from the Independent Power Producers. Finally, the state of Andhra Pradesh is also planning to add significant renewable energy to its grid from grid-connected solar (~3000MW) and wind (~4000MW).

ii. *Inter-state transmission system augmentation* {Primary investment by central sector enterprise}: As stated earlier, despite the southern grid being connected to the national grid in 2014, transmission corridor capacity constraints has restricted the state of Andhra Pradesh to enter into long term PPAs with generators outside the southern region. POWERGRID, the central transmission utility, has already identified and started the construction of projects to relieve the grid of this congestion. Based on the estimates provided by the state, the inter-regional transmission connectivity constraints are expected to be resolved by 2018.

iii. *Intra-state transmission & distribution network augmentation and distribution efficiency improvements* {Investment by the state, central government, domestic financial institutions, and World Bank – under this proposed Project}:

- *Network augmentation and strengthening:* A significant expansion and strengthening of the intra-state transmission and distribution network is required to disperse power to the load centers in the state. The investment requirement identified by the state in the transmission sector is ~US$1.1 billion (INR73.7 billion) over the next five years (excluding the requirement for Renewable Energy (RE) evacuation). These investment needs are expected to be met through various resources - internal accruals, state government funding, domestic financial institutions (FI) and bi-lateral and multilateral institutions. Similarly, the state has identified an investment requirement of ~US$1.17 billion (INR78.39 billion) over the next five years to strengthen/augment the distribution network. A significant part

of this investment is expected to be funded under the proposed Project, while some investments would also be funded from two central government schemes of Deen Dayal Upadhaya Grameen Jyoti Yojna (DDUGJY) for rural areas and Integrated Power Development Scheme (IPDS) for urban areas.

- *AT&C loss reduction and improved reliability:* Overall AT&C loss levels in Andhra Pradesh are low in comparison to many states. However, losses in rural areas are high in a few rural districts. Hence the state has also identified interventions to lower the AT&C losses. These include setting up a High Voltage Distribution System (HVDS)[12] in selected rural areas, replacement/augmentation of Distribution Transformers (DTR), consumer metering, low voltage Aerial Bunched Cable (ABC) in high density urban areas etc. Further, the state of Andhra Pradesh has a long coastline in an area that is at a risk of cyclones and other natural events such as storm surges and floods. Thus, the distribution utilities plan to deploy technologies such as underground cabling, Gas Insulated (GIS)/Underground substations etc., in these areas, to make the network more robust, improve reliability and increase the state's capacity to adapt to climate change. These investments would be funded under IPDS. The proposed Project will also support the state in implementing some of these interventions.

- *Smart Grids:* The distribution companies in the state of Andhra Pradesh are ahead of many of their peers in deployment of ICT based technologies in distribution. They now plan to move to the next level by developing a power distribution grid with greater monitoring and control capacity, and thus further improving operational efficiency and system reliability.

22. The proposed Project will support a rapidly-growing state which has experienced the benefits of a Bank engagement in the past. This engagement also provides an opportunity to work with a well performing yet delicately balanced system. Strengthening of the power system in Andhra Pradesh under the proposed Project will facilitate the state in achieving the objectives of providing 24x7 reliable, quality and affordable power to the citizens. The Project will also support operational reforms, and the improved commercial performance of the Andhra Pradesh distribution companies, particularly through improved management information systems, and smart technology. Lastly, the Project will develop stronger relationships with the Andhra Pradesh power sector, and the building blocks for longer term policy dialogue, and potential longer term policy reform.

23. Since Andhra Pradesh is one of the first World Bank engagement under GoI's 24x7 PFA agenda, the lessons learnt from this Project can be used to inform and design subsequent projects under the same program.

24. The key components under the proposed Project are as follows:

[12] Distribution is done through 11kV feeders with low capacity transformers placed close to a small group of consumers.

A. Project Components

Component 1: Power Transmission System Strengthening (US$100million, of which IBRD is US$42 million)

25. This component will make priority investments in 220 kV, 132 kV, 66 kV, and 33 kV transmission and sub-transmission lines and associated substations, to strengthen and augment the power system. The specific investments proposed by the state have been verified based on a load flow study. These investments will reduce overall transmission system losses and increase the capacity of the state transmission network to enable it to meet demand growth.

26. A long list of twelve substations and the associated lines will be funded under this component. These packages will be implemented through integrated turnkey supply and installation (S&I) contracts.

Component 2: Smart Grid Development in Urban Areas (US$210 million, of which IBRD is US$88.2 million)

27. The Government of India has launched a 'Smart Cities Mission', which aims to identify and develop a number of selected cities across India as 'smart cities'. It is expected that the development of these cities will develop a 'smart city' model which can then be replicated throughout the country. In Andhra Pradesh, Kakinada, Vishakhapatnam and Tirupati have been selected for development as smart cities in the Smart Cities Challenge[13] conducted by GoI.

28. This component would support investments in smart grids and underground cables in the above mentioned three cities and in other major cities. These investments would include smart meters for selected consumers, distribution SCADA[14], automated substations, and ring main units. It also includes investments in distribution network strengthening and augmentation (33kV and below) in urban areas to meet growing power demand, reduce technical and commercial losses, improve operational efficiency and increase the system reliability, especially in coastal towns prone to natural calamities.

29. The investments that will be made under this component include:

i. Smart Meters: Smart consumer meters, with two way communication and backend IT infrastructure, would be deployed in select urban towns. These meters will not only reduce technical and commercial losses, but also improve peak load management. It is expected the meters will support demand side management by providing consumers with access to better data and hence, encouraging them to reduce their electricity consumption.

[13] GoI through Ministry of Urban Development conducted a Smart Cities Challenge in which the smart city proposals of various cities were evaluated by a panel of experts which included World Bank, Asian Development Bank, London School of Economics, etc.

[14] Supervisory Control and Data Acquisition System

ii. Underground Cables: System reliability is a major concern. As witnessed in 2014, natural calamities, such as cyclones, cause major disruption to the power system. In the event of a cyclone, it takes on average about a week, and extensive effort and resources to restore power infrastructure. Investment in underground cables to replace the overhead network will minimize the breakdown of power infrastructure and improve restoration time in the event of calamity, and will therefore be implemented in the three smart cities.

iii. Supervisory Control and Data Acquisition (SCADA): Under Restructured Accelerated Power Development and Reforms Program (R-APDRP)[15], the distribution companies are in the process of setting up SCADA centers in four towns – Vishakhapatnam, Vijayawada, Nellore and Guntur. This would facilitate centralized monitoring of the distribution network and enable improvement in system reliability. Integration of SCADA with smart meters and Ring Main Units (RMUs), will enable implementation of system management solutions including an Outage Management System (OMS). This component will cover the investments that are required to introduce SCADA in the distribution substations, which are not covered under R-APDRP.

iv. Distribution Network Strengthening and Augmentation: This includes investments in 33 and 11 kV lines and substations to augment and strengthen the distribution infrastructure in urban areas in Andhra Pradesh. These investments will reduce losses, and improve the quality of supply to consumers.

Component 3: Distribution System Strengthening in Rural Areas (US$250 million, of which IBRD is US$105 million)

30. This component would support strengthening and augmentation of the distribution network (33kV and below) and construction of the High Voltage Distribution System (HVDS) in rural areas. The majority of the investments under this component are located in Anantapur and Kurnool - the two new districts that have been transferred to APSPDCL post the restructuring of the State. East Godavari and West Godavari districts will also benefit from financing under this component. The power infrastructure in these districts is poor and the majority of power transformers, distribution transformers and feeder lines are overloaded, leading to frequent outages and high technical losses. As advised by the state, the AT&C losses in Anantapur and Kurnool districts are 18.3 percent and 10.8 percent respectively.

31. The objective of this component is to reduce distribution system losses, increase the capacity of the distribution network to meet growing load demand, improve system reliability, and improve the quality of supply to end consumers. The specific investment components are briefly described below:

i. Rural HVDS: System losses will be reduced by replacement of the low voltage network with a HVDS, and installation of a smaller capacity Distribution Transformers (DTR) to enable supply to two to three agriculture consumers per transformer. Andhra Pradesh has already implemented rural HVDS for a majority of its agricultural consumers with

[15] R-APDRP is a centrally funded program started during the 11th Five year Plan. It primarily aims at reducing AT&C losses in select urban areas through ICT initiatives.

loss reductions and positive consumer feedback. An independent study[16] shows that, over time, the distribution transformer failure rate has been reduced significantly, and the quality of supply has improved. Under this project, Andhra Pradesh plans to cover the agriculture consumers which are still not supplied by rural HVDS (i.e. around 30,000 agriculture consumers in APEPDCL), and convert all agricultural consumers in Anantapur and Kurnool to rural HVDS.

ii. Distribution Network Strengthening and Augmentation: This includes the investments required to augment and strengthen the distribution infrastructure in rural areas of the state. These investments are expected to improve the quality of supply in the intervention areas.

Component 4: Technical Assistance for Institutional Development and Capacity Building (US$10 million, of which is IBRD US$4.2 million)

32. This component would improve the project management capabilities and commercial performance of the Andhra Pradesh distribution utilities by: (i) improving ICT systems; (ii) improving the business processes; (iii) supporting supervision of contracts through Project Management Consultants; and (iv) building staff capacity through training, workshops, and study tours.

i. APEPDCL & APSPDCL:

a) Andhra Pradesh distribution companies over a period of several years have implemented number of IT systems often to address specific issues. As a result, the distribution companies currently have multiple legacy IT systems which are not integrated. Further, a number of processes in the utility, particularly around planning, and management reporting on key commercial parameters are not automated. Lastly, the ICT systems have to be upgraded to accommodate the deployment of smart grid technologies such as OMS, DMS, and SCADA etc. The Bank funded a study during project preparation to carry out an assessment of the existing ICT infrastructure and business processes, identify gaps and assist the distribution companies in preparing a detailed Roadmap for ICT implementation. This study is being carried out by independent consultants in both the utilities and is almost complete. Based on the output of the study, investments in ICT enabled systems will be funded under the project.

b) Project Management Consultant will be hired, if and when required by the Bank, to assist both distribution companies to supervise and manage contracts funded under this Project.

c) This component will also fund activities undertaken for capacity building and institutional strengthening of the distribution utilities. The Project will strengthen the human resources' skills of the utilities in the core areas of utility operations and management.

[16] Impact evaluation study on benefits of HVDS by Mitcon Pune

ii. APTRANSCO: APTRANSCO proposes to enhance its engineering capabilities by investing in software (tower spotting, design of line/substation), and testing instruments. This component will also support trainings for APTRANSCO officials.

B. Project Financing

33. The Project will be financed by Government of Andhra Pradesh and debt from the World Bank and Asian Infrastructure Investment Bank. World Bank and Asian Infrastructure Investment Bank will provide loans in 60:40 ratio in every component of the Project. World Bank will finance through the Investment Project Financing instrument, and will cover investments required for strengthening and modernizing the intrastate power transmission & distribution systems in Andhra Pradesh. Loan agreement will be signed with Government of India, and Bank loan will be passed on to GoAP on similar terms and on-lent to the project implementing agencies. Further, there will be project agreement among Government of Andhra Pradesh and the project implementing agencies and the Bank. Lastly, a subsidiary agreement would be signed between GoAP and the three project implementing entities.

Project Cost and Financing

Table 1: Component wise Financing

Project Components	Project cost	IBRD Financing	AIIB Financing	Counterpart Financing	IBRD Financing (%)
1. Power Transmission System Strengthening	100	42	28	30	42%
2. Smart Grid Development in Urban Areas	210	88.2	58.8	63	42%
3. Distribution System Strengthening in Rural Areas	250	105	70	75	42%
4. Technical assistance for Institutional Development and Capacity Building	10	4.2	2.8	3	42%
Total Costs					
Total Project Costs	570	239.4	159.6	171	42%
Front-End Fees	1.0	0.6	0.4	0	60%

Total Financing Required	571	240	160	171	42%

C. Lessons Learned and Reflected in the Project Design

34. The Bank's previous support to Andhra Pradesh power sector (1999-2003), through an Adaptable Program Loan 1 (APL) was completed with a "satisfactory" rating. The APL1 project was instrumental in establishing legal, institutional and regulatory reforms and the removal of critical bottlenecks in the transmission and distribution system. Wider consensus around the more complex reforms proposed (around tariff and subsidy reform, private sector involvement etc.) could not be achieved, and these were ultimately not implemented.

35. The proposed Project will incorporate the lessons learnt from the previous Andhra Pradesh project and from Bank's experiences in Haryana, West Bengal, and Maharashtra and GoI's R-APDRP program. In particular, the following lessons proved relevant to the proposed Bank engagement in the Andhra Pradesh power sector:

a. The political economy of reform is always complex and the Bank needs to be mindful of local context and constraints that influence policy-making. Often, the most constructive role the Bank can play is to make available advice on policy benchmarks and best practices, so that policy-makers can take decisions most appropriate to their context regarding the timing, depth and extent of the reform process.

b. Upfront and visible improvements in the quality of supply and customer service are important for building stakeholder consensus for reforms. It is important that consumers, the ultimate beneficiary of the potential reforms, experience tangible improvements in service quality before being expected to support deeper reforms such as tariff rationalization.

c. Policy decisions on subsidies are driven by socio-economic and political concerns that are often difficult for policy-makers to ignore. The most important role the Bank can play in advising these policy decisions is to ensure that, to the extent possible, subsidies are well-targeted, transparent and measurable. In the particular case of Andhra Pradesh, it is important that electricity subsidies not impact the overall financial health of distribution companies, and therefore the sector – since this will ultimately affect service to consumers.

d. In many instances technology can provide solutions where policy and regulatory measures are constrained: Since the agriculture consumers in Andhra Pradesh are not metered, the calculation of subsidy towards agriculture supply is based on a methodology agreed with the state regulator. A more accurate calculation of this subsidy would enable the Distribution Company's management to focus on key areas of loss within their paying consumer base.

36. Given these lessons, the Project will focus on operational reforms, and improving the financial performance of the distribution companies through immediate technology improvements. The Project will also serve to develop stronger relationships across the Andhra Pradesh power sector, and allow for an ongoing policy dialogue.

37. The Bank's experience in the Haryana Power System Improvement Project has highlighted the importance of including a Project Management Consultant (PMC) under the TA component of the project. Monitoring the progress of contracts, identifying and resolving the key issues that might delay implementation is critical during the implementation phase. The proposed Project includes a large number of contract packages (around 30 in APSPDCL) and the investments are spread across the state covering a large geographical area. Further the utilities are carrying out parallel investments to meet the 24x7 Power for All agenda. To ease the pressure on the utility manpower and ensure regular monitoring of the packages under the Project, PMCs will be appointed, as and when required by the Bank, who will report to the utility on the daily progress and highlight the key issues on site.

38. The implementation of R-APDRP[17] in different stages in the various states but one common learning is that even though investments have been made in the ICT systems, these technologies are not being fully utilized by the utilities. Further the utilities are dependent on a third party for updating the software and feeding and updating system data. It is important to focus on the softer aspects of running successful ICT systems like training of key personnel, building the capacity of the IT cadre and putting in place operations integrated with IT applications.

39. Given the above learning, the Project will initially focus on operational reforms: - creating operationally and commercially efficient utilities, capable of providing reliable supply of electricity to their customers. This is in accordance with the state government's strategy of balancing the twin objectives of providing adequate, reliable, and affordable 24x7 power to its citizens, and facilitating sustainable operations of its transmission and distribution utilities. The Project will also develop the building blocks for ongoing policy dialogue, and potential longer term policy reforms.

IV. IMPLEMENTATION

A. Institutional and Implementation Arrangements

40. The Project will be implemented in the state of Andhra Pradesh, by three state-owned but legally separate entities/companies — APTRANSCO, APEPDCL and APSPDCL, referred to as the Implementation Agencies (IAs). The Bank loan will be passed on to GoAP under a back-to-back agreement between GoI and GoAP, and then on-lent from GoAP to the IAs; the IAs will be required to repay the loan to the GoAP.

41. The three IAs have set up dedicated Project Implementation Units (PIUs) to implement the project. This does not imply that the Project would be ring-fenced from the IAs broader organization. Within the existing departmental structure (procurement, finance, etc.), the IAs will

[17] R-APDRP was a centrally funded program started during the 11th Five year Plan. It primarily aims at reducing Aggregate Technical and Commercial (AT&C) losses in select urban areas through ICT initiatives.

have designated individuals with clear responsibility for dealing with all issues related to the proposed World Bank loan.

B. Results Monitoring and Evaluation

42. Monitoring and evaluation (M&E) mechanisms have been established at the Project, entity and sector levels. At the Project level, the M&E framework includes the following:

- APTRANSCO PIU: This PIU is responsible for implementing the transmission system components funded under this Project. The PIU is already functioning and is responsible for developing a detailed Operations Manual (OM) which will cover the implementation of all major transmission investments under the Project. The Operations Manual includes a clearly defined rationale for each investment, implementation milestones, and a detailed description of how project monitoring tools such as Program Evaluation and Review Technique (PERT) charts will be used to monitor Project implementation.

- APEPDCL & APSPDCL PIUs: The two distribution company PIUs are responsible for preparing detailed project reports (DPR), with baseline data, for distribution investments in each town/district, detailing the technical and financial justification and the layout of existing and proposed distribution infrastructure, with clearly defined implementation milestones. The PIUs will implement the distribution components funded under the Project. The PIUs will be supported in contract management by PMCs with a focus on delivery of quality assets, and adherence to the implementation schedule.

43. The PIUs will provide the Bank with quarterly physical progress reports, audited financial statements (within nine months of the end of each financial year), and other such information as the Bank may reasonably require. Since the nature of the contracts awarded under the Project will be turnkey Supply & Installation, M&E is linked to project targets upon completion of milestones like delivery of material, erection and commissioning.

44. A robust group of monitoring indicators has been put in place to track the progress of the Project – (i) information on results indicators (ii) information on monitoring indicators - additional data on Project progress across various functional areas such as environment, social, technical as well as financial indicators that will be collected and tracked on a periodic basis (elaborated in Operations Manuals). SAIDI and SAIFI were considered for measurement of achievement of quality and reliability of supply, however these are not able to be measured by the AP utilities at this point in time. The Project will therefore establish a baseline for SAIDI and SAIFI early in the Project's implementation, institute measurement of these indicators, and show a reduction in SAIFI and SAIDI over the remainder of the Project

C. Sustainability

45. There is strong ownership of the Project at the level of the state government and the project implementing agencies, as the Project supports investments identified under the PFA plan of the state. The subprojects identified are economically and financially viable, and analysis has been

undertaken in the scheme specific DPRs. Environmental and social sustainability is facilitated through the adoption of an environmental and social management framework (ESMF) by the Project implementing agencies. The utilities are experienced in the operations of the assets, and the O&M practices would be further strengthened through the technical assistance component under the Project.

46. While working on improving the technical performance of the distribution utilities through direct investments, the Project would also indirectly assist the distribution companies in financial recovery and long-term sustainability, by assisting them in improving their commercial and procurement processes, and IT systems for better management reporting on key commercial and operational parameters.

V. KEY RISKS

A. Overall Risk Rating and Explanation of Key Risks

47. The 'Political & Governance risk' and 'Sector Strategies and Policies' is rated as Substantial, as financial viability of the sector is associated with a complex issues of political economy and governance. As mentioned earlier the Andhra Pradesh distribution companies suffered financial losses for the first time in FY 2013. This was due to the high quantum of short power purchases to meet the growing energy deficit of the state. The gap between the ARR and ACS was increasing and was not met by support from the government or tariff adjustments. This led to the distribution companies taking on short term debts to meet the gap and making high levels of interest payments which further put pressures on the distribution company's finances. Therefore adequate power supply, management of power purchase costs, reduction in AT&C losses and tariffs adjustments, are essential for financial turnaround of the distribution sector. The GoI and the GoAP are fully aware of the situation and are committed to working on these issues in a practical manner through the Ujjwal Discom Assurance Yojana (UDAY)[18]. However, since the proposed engagement will primarily target investments in transmission and distribution to improve the quality of supply and operational efficiency, these risks are expected to have only a limited impact on the Project. Andhra Pradesh has prepared a business plan to fully understand the key business drivers, the impact of the proposed investments on the key business drivers and the key steps that need to be taken to improve financial performance of the state.

48. The stakeholder risk of the Project is rated as Substantial as the full success of the Project lies in the effective collaboration between all the stakeholders including GoAP, state regulator and the implementing agencies. The Project proposes to address this risk by the establishment of a steering committee. The risk associated with technical design of the Project or Program is 'Moderate'. The Andhra Pradesh utilities are well versed in the planning, design, development and operation of a robust T&D system. They also have a strong track record of introducing advanced

[18] UDAY is the financial turnaround and revival package for electricity distribution companies of India (DISCOMs) initiated by the Government of India with the intent to find a permanent solution to improve the financial status of power distribution sector. The scheme comprises four initiatives - improving operational efficiencies of distribution companies, reduction of cost of power, reduction in interest cost of distribution companies and enforcing financial discipline on distribution companies through alignment with state finances. It allows state governments to take over 75 percent of their DISCOM's debt as of September 30, 2015. Distribution companies are expected to issue bonds for the remaining 25 percent of their debt and also meet specified operational targets.

technology to their power system. The risks associated with deployment of relatively new smart grid technologies is also 'Moderate'. To mitigate this risk, the Bank team will draw upon its global expertise and make international best practices in this area available to the utilities. The present Project design incorporates a technical assistance component which will develop the institutional capacity of the utilities and increase awareness of the utility staff through practical training, workshops, technical visits and study trips.

49. The Fiduciary risk for this Project has been rated as "Substantial". Financial Management risk is rated "substantial" as auditors of the Discoms have reported internal control weaknesses. During Project implementation, the Bank team will work with the IAs to strengthen corporate governance and financial management. Procurement Risk is rated 'substantial' as the distribution companies till now have procured using partial turnkey contracts versus the large turnkey supply and installation (S&I) contracts to be procured under the Project.

50. Environment and Social risks are rated as moderate because the impacts from the Project assessed till date can be adequately managed through the mitigation measures that have been put in place.

51. Even though the interventions proposed under the Project are not reform-intensive, the historically complex political economy of power sector reforms in Andhra Pradesh and elsewhere suggest that the Overall risk of the Project be rated Substantial.

VI. APPRAISAL SUMMARY

A. Economic and Financial Analysis

Rationale for public sector financing:

52. The GoAP expects to attract significant private investment in generation through Independent Power Producers to substantially increase the generation capacity in the state. However, private investment is not expected to be available in the transmission and distribution sectors, which remain publicly owned and operated. Therefore, public investment is required to ensure that additional generation can be evacuated and distributed efficiently by the state owned utilities.

Value added of the Bank's support:

53. The key value additions that the Bank's support is expected to bring are focused on support for operational reform and performance improvement, and include:

- Support in identifying priority investments for loss reduction, and transmission system strengthening, through the introduction of integrated multi-voltage level load flow analysis. The state currently undertakes a more localized planning approach particularly at lower transmission levels of 132kV;

- Introduction of integrated distribution system planning across various, on-going or planned, state-funded and GoI-funded schemes, leading to efficient resource utilization while meeting the requirements of the 24X7 Power for All Program;

- Support for the state in deploying newer ICT based technologies for improved system reliability and commercial performance of distribution companies;

- Provision of international best-practice in smart grid development, and smart technologies;

- Provision of international best-practice in distribution utility management, and management information systems.

Development Impact

54. Economic rate of return: The proposed Project is economically viable. As part of the state's Power for All Program, Project investments will bring substantial economic benefits to Andhra Pradesh's power sector by helping displace expensive diesel based self-generation, meet growing demand, and improve the efficiency of the power system. The baseline economic rate of return (ERR) of the "with project" scenario is 20.0 percent (NPV US$508 million) (INR3403 crores), using conservative estimates of average 'Willingness to Pay' for electricity in Andhra Pradesh. The additional energy supplied as a result of the Project's transmission and distributions investments accounts for 93 percent of the benefits and the reduction in technical losses accounts for the remaining benefits (See Table 2). See Annex 5 for more information on the methodology, assumptions and the results.

55. Andhra Pradesh faces huge economic costs from not having a universal, cost effective and reliable supply of electricity. While more than 90 percent of the state has electricity connections, the state faced significant power shortages which are resolved through load shedding. The peak load deficit was 8.3 percent in FY 2014-15. Industries have suffered load shedding up to 40 percent of their demand in recent years. Similarly load relief has been imposed up to 4 hours in Municipal Corporations, 6 hours in Municipalities, and 12 hours in villages. Consumers have to rely on expensive diesel generators for back up supply. Average annual per capita electricity consumption of Andhra Pradesh (1040 kWh) [19] is a third of the global average consumption (3,298 kWh)[20]. With improved electricity supply, Andhra Pradesh can be expected to launch itself into higher growth trajectory that is needed to reduce poverty to 3 percent by 2030.

56. Green House Gas (GHG) Accounting: GHG accounting[21] of the project indicates that the Project leads to reduction in emissions of 0.9 million tons of CO2e over the life of the Project. The reduction in GHG emissions is on account of replacement diesel self-generation and reduction in technical losses from the implementation of the Project.

[19] "Rajya Sabha - Starred Question No. 897" (PDF). Ministry of Power, Govt. of India.
[20] World Development Indicators 2016
[21] GHG accounting of the Project follows the approach laid out in World Bank's 2015 Guidance Manual on Greenhouse Gas Accounting for Energy Investment Operations

Table 2: Summary of Economic Analysis						
				Base Case		Sensitivity
[1]	Discount rate			10.0%		6.0%
[2]	**Economic rate of return**					
[3]	ERR		[ ]	19.9%		19.9%
[4]	ERR+local externalities		[ ]	22.2%		22.2%
[5]	ERR+local+GHG@BankGuidanceValues		[ ]	20.0%		20.0%
[6]	Levelized cost of elec. through grid		US$/kWh	0.11		0.09
[7]	Levelized cost of diesel self generation		US$/kWh	0.23		0.23
[8]	**Composition of NPV**					
[9]	*Costs*					
[10]	Generation Costs		[$USm]	613		796
[11]	Trasmission Costs		[$USm]	62		68
[12]	Distribution Costs		[$USm]	286		315
[13]	Transmission O&M		[$USm]	54		88
[14]	Distribution O&M		[$USm]	30		48
[15]	**total costs**		**[$USm]**	**1045**		**1316**
[16]	*Benefits [additional supply of electricity]*					
[17]	Additional electricity supplied		[$USm]	1553		2403
[18]	of which Technical loss reduced		[$USm]	102		163
[20]	**total benefits**		**[$USm]**	**1553**		**2403**
[21]	**NPV (before environmental benefits)**		**[$USm]**	**508**		**1087**
[22]	local env. benefits: avoided grid gen.		[$USm]	164.4		314.3
[23]	NPV (incl. local environmental benefits)		[$USm]	**672**		**1401**
[24]	value of avoided GHG emissions		[$USm]	-130		-217
[25]	**NPV (including environment)**		**[$USm]**	**542**		**1185**

57. Sensitivity analysis and risk assessment: Sensitivity analysis shows that the Project ERR is robust to unfavorable outcomes of some variables such as Commercial Operation Date (COD) delay, additional electricity supply, and Average Willingness to Pay. The Project cost would have to be two times higher, COD date three years later, Average Willingness to Pay and energy wheeled a third lower than the base value, for the ERR to fall below the hurdle rate. Monte Carlo analysis, which assesses the impact of more than one input variable combining unfavorably, confirms these findings.

Table3: Switching Values			
Input	**Unit**	**Baseline Value**	**Switching Value**
Cost Overrun	US$ Million	448	1138
Construction delay	Years	0	3
Additional energy wheeled	GWh	1,152	772
Willingness to Pay	US$ cents	15.7	10.5

58. Actions during implementation: To enable the economic analysis to be revisited at mid-term and during the Implementation Completion Review, more information on the costs and benefits of the project will be collected during project implementation. These include (i) data on additional electricity delivered through Bank investments; (ii) data on loss reduction achieved through project investments, including breakdown of commercial and technical loss reduction.

59. Financial analysis: A detailed entity level financial analysis has been undertaken for the two distribution companies in Andhra Pradesh (APSPDCL and APEPDCL). The companies are already expected to report improved financial performance in FY17 (financial year ending 31st March, 2017). Based on assumptions of improvement in operational efficiencies, loan re-structuring under UDAY, and continued tariff adjustments to account for inflationary increase in costs, APEPDCL is expected to turnaround in FY18, while APSPDCL is expected to turnaround in FY20 (delayed due to difference in consumer mix). APTRANSCO will receive a return on capital employed of 12.5 percent, as per current Andhra Pradesh Electricity Regulatory Commission tariff order. The details are presented in Annexes 5 and 6.

B. Technical

60. The implementing utilities have designed the Project's investment components based on comprehensive planning and an appropriate level of system studies. The Project design follows well-proven designs and technologies and replicates established and efficient practices as far as conventional T&D investments are concerned. Also, the implementing utilities have demonstrated capabilities in transmission and distribution system planning and development. Regarding the smart grid related investments, Andhra Pradesh is one of the most advanced states in R-APDRP implementation and given its ability to absorb new ICT technologies, the Project does not pose any particular technical risks.

C. Financial Management

61. Assessment of the IAs indicates that the IAs have established Financial Management systems, and that these can meet essential fiduciary requirements. The guiding principle is that project Financial Management arrangements would be predicated on existing systems followed by these entities, supplemented by the Bank's reporting and auditing arrangements. Project Financial Management arrangements are being documented in Operations Manuals and will be finalized at negotiations.

62. The IAs are governed by the Electricity Act, 2003 and the Indian Companies Act, 2013 and subordinate rules, and regulated by the APERC which largely determine their Financial

Management framework. Project funds will be provided through the Consolidated Fund of the state and will be subject to budget and expenditure controls of the state government. Being companies, the IAs are board-managed entities appointed by the state government. These companies have adopted good corporate governance practices such as convening annual general meetings, setting up audit committees, holding regular meetings of Board/audit committee, issuing detailed annual reports on their working, appointing full-time Company Secretary, and obtaining independent secretarial audit report.

63. The IAs will individually provide assurance over the use of Project funds that they will receive. Project Financial Management (FM) responsibilities will be borne by a PIU set up in each of the IAs. Project transactions will be centralized in the PIUs. Project funds will be provided in the state budget and released to the IAs in dedicated Project bank accounts. Accounting and internal controls will follow extant systems in the IAs, including the use of ERP.. Project financial reporting through quarterly interim unaudited financial reports (IUFR) will be the basis for reimbursement. Project transactions will be subject to periodic internal audit and annual external audit carried out on terms of reference agreed with the Bank. Details are provided in Annex 3.

64. Financial Management manuals of the entities are dated and need to be developed in line with current practices; and internal controls in areas such as fixed assets and inventory and financial reporting need strengthening. Audited financial statements of APTRANSCO for 2015/16 is in backlog and need to be finalized at the earliest. The IAs are proposing to upgrade their IT systems (ERP) that will be supported under the Project. Corporate governance in the IAs can be enhanced through induction of independent directors and instituting a risk management framework and also aligning their articles of association in line with the Companies Act of 2013. These risks can be mitigated by covering the backlog of audit of APTRANSCO’s financial statements and satisfactory implementation of the agreed Project Financial Management arrangements The Bank team will work with the IAs to strengthen their corporate governance and Financial Management systems during Project implementation.

65. The IAs have experience in implementing Bank/other multi-lateral Projects and hence are familiar with their requirements. Intensive support, including field visits and desk review, in the initial years by Bank staff is envisaged to ensure implementation of agreed Financial Management arrangements. Audit reports and interim financial reports will be reviewed and mitigation measures agreed with the IAs for any issues identified.

D. Procurement

66. Procurement for the Project will be carried out in accordance with the World Bank's "Guidelines: Procurement of goods, works and non-consulting services under IBRD loans and IDA credits & grants by World Bank borrowers" dated January 2011 as updated in July 2014 ("Procurement Guidelines") and "Guidelines: Selection and employment of consultants under IBRD loans and IDA credits & grants by World Bank borrowers" dated January 2011 as updated in July 2014 "(Consultant Guidelines)" and the additional provisions mentioned in legal agreement.

67. The proposed Project will be implemented by three implementing agencies, viz. APSPDCL, APEPDCL and APTRANSCO. There will be procurement of Goods, Works, Non-

consulting Services and Consultancy Services. Procurement under these components is already in progress.

68. Procurement capacity: The procurement systems, covering procurement process, documentation, internal controls, planning, staffing, complaint redressal, contract management, audits and procurement oversight of the implementing agencies, have been assessed for adequacy for the purposes of ensuring economy, efficiency, transparency and fairness in procurement process for Bank funded procurements and providing fiduciary assurance to the Bank. The implementing agencies have adequate procurement staff who are responsible for procurements under the Project, however, they are not fully conversant with Bank's procurement procedures. Procurement of several packages are in process. There is also limited experience in procurement of plant, supply and installation on turnkey basis. Apart from delays in procurement process, contract management delays and non-compliance with agreed procurement arrangements are potential problem areas. Detailed Procurement Capacity Assessment is available in P-RAMS (Procurement Risk Assessment Management System).

69. E-procurement System: The implementing agencies will be using the NIC e-procurement system for all procurements. This is likely to increase efficiency and transparency of procurement. More details are provided in Annex 3.

E. Social (including Safeguards)

70. Andhra Pradesh is a highly diverse state in terms of social, economic, cultural and geographic characteristics. Its population of 49.5 million accounting for 4.10 percent of the country's population makes it the tenth most populous state in the country. The bulk of the population, 71 percent, lives in rural areas and the remaining 29 percent live in urban areas. There are 12.72 million households in the State and the average size of the household is four. Inter and intra district demographic variations are quite substantial, given that the state has huge tracts of upland, forests and coastal areas. Social diversity is reflected in sizeable populations of Scheduled Caste (SC), 17 percent, and Scheduled Tribe (ST), 5.5 percent. Out of the total scheduled tribes in Andhra Pradesh, approximately 50 percent reside in four districts Vishakhapatnam (23 percent), East Godavari (11 percent), Nellore (10 percent) and Vizianagaram (9 percent). There are 34 major tribal groups and six primitive tribal groups inhabiting the state. Given the preponderance of tribal communities and compactness as well as collective attachment to the natural forest based environ, in certain pockets, safeguards have been built to ensure risks against land alienation and other socio-economic exploitations, are mitigated. This provision, enshrined under the Fifth Schedule of the Indian Constitution, recognizes Vishakhapatnam, West Godavari and East Godavari districts. These districts are also prone to insurgency and conflict. Tribal People of Andhra Pradesh are economically and technologically better equipped than the tribes of other regions. Yet, remoteness and undulating hilly terrain could render them rather excluded at times.

71. Andhra Pradesh has nearly 1000 km of coastal line bordering nine districts and harbors a large number of fisheries, ports, wildlife sanctuaries and estuaries. These areas are often subject to cyclones resulting in huge social and economic losses. The state has made a decent economic progress in recent times, yet, lags behind other states in India in respect of the following social aspects – Infant Mortality rate (IMR), Maternal Mortality rate (MMR), poverty, drinking water & sanitation, skill development & employment and ensuring specific focus on disadvantaged sections

of the society such as SC, ST, minorities, backward classes and other poor. All these have figured high on the agenda of the state's Social Empowerment Mission.

72. Given the 'diversity' and natural hazards, two major issues assuming significance in the context of the current Project are (a) exclusion and (b) vulnerability, which have implications on ensuring 'participation'. These issues are further defined and addressed by the following activities and factors: capacity building; information, education, and communication; consultations and negotiations; and transparency and accountability. These aspects are built into the Project design as a part of safeguards management, which is central to the Project.

73. Major social safeguards aspects relate to land and tribal people. The Project will require lands for the (a) erection of towers to draw transmission lines and (b) construction of T&D substations. The former does not entail permanent acquisition of lands, but creates some temporary disturbances, thereby demanding a Compensatory Plan for Temporary Disturbance (CPTD). The latter, however, does require land on a permanent basis. The state has reported that there may be no need to acquire lands involuntarily as the government lands are available in most cases. A few may be purchased in a willing buyer-willing seller basis at a negotiated rate. For CPTD, the state intends to make use of the existing legislation – Electricity Act of 2003 and Indian Telegraph Act of 1885. Further, some of the facilities may be taken up in scheduled/ tribal areas. In view of this situation, the project triggers OP 4.12 – Involuntary Resettlement and OP 4.10 – Indigenous Peoples.

74. To ensure compliance with the policies concerning safeguards management, the Project has adopted a framework approach as all the investments have not yet been identified. Therefore, the state has prepared an Environment and Social Management Framework (ESMF) which is a generic document that serves as a framework and can be adopted for all T&D projects of the state. Essentially, the framework is prepared based on the recently approved World Bank assisted North East Power Systems Improvement Project and incorporates due requirements of India's new 'The Right to Fair Compensation in Land Acquisition, Resettlement and Rehabilitation Act, 2013' (LARR 2013) as well as Indian Constitution's Fifth Schedule provision related to protecting the interest of the tribal people.

75. The ESMF's social content embodies a synthesis of the Resettlement Policy Framework (RPF) (according to OP 4.12) and a Tribal People Development Planning Framework (TPPF) (according to OP 4.10). In cases where land is to be acquired and/or there are tribal peoples in the subproject area, the framework will be adopted and a Social Assessment (SA) will be carried out to enable preparation of a Resettlement Action Plan (RAP) and/or Tribal People Development Plan (TPDP), where applicable. The Framework lays down the modalities for undertaking the SA as well as the preparation and implementation of the RAP and TPDPs. Use of land will have to be secured through either voluntary donations or outright purchases based on negotiations with the land owners. Measures have been described in the Framework to ensure that such transactions are voluntary and not subject to any external pressures.

76. Gender: The Project recognizes that providing electricity to communities and providing power for tasks considered women's work can promote gender equality, women's empowerment, and women's and girls' access to education, health care, and employment. Most gender benefits of providing electricity and motive power occur because women tend to spend more time at home,

are responsible for household chores that can be carried out more productively with electricity, and because certain tasks that are culturally defined as women's work can benefit from motive power. In general, lighting and TV are the most common first uses of electricity, accounting for at least 80percent of rural electricity consumption. The first and strongest impacts of electricity therefore also occur via lighting and TV. Electricity displaces more expensive candles and kerosene lamps, thereby reducing indoor air pollution and fire and burn risk, and providing higher quality light. Lighting and television help improve access to information, the ability to study, and extend the effective working day. Lighting also improves the productivity of many household activities, and has potential benefits for public safety and expanded income-generating opportunities. The health benefits of electricity stem from cleaner air, reduced risk of burns, fires, and accidents, better nutrition and food safety from refrigeration, and improved health knowledge from access to mass media. Potential negative impacts of the Project include: Security concerns for the women during construction due to blockage of access roads; Impact due to securing land for Project activities - loss of livelihood, decrease in sale value of land, decrease in agricultural output of land and damage to crops and trees; Construction activities leading to restricted access; and threat of electric shock from distribution wires in residential areas.

77. Under the Project, gender actions are envisaged at two levels. First, at the Project level, through capacity building to ensure that the staff have the necessary capacity to identify and integrate gender issues in the subproject cycle. Second, at the community level, by encouraging participation and designating interventions as appropriate. The former relates to (a) capacity building of the staff so as to be effective in reaching out to the communities, in general, and women, in particular, and be engaged in consultations and contribute toward undertaking the SA and (b) facilitating the implementation as well as monitoring the plans. At the community level, efforts will be made by the Project to provide a conducive environment for all women, particularly female-headed households, to participate in consultations and express their requirements. All field-level plans shall necessarily have an exclusive section on 'gender', detailing actions for addressing such requirements. The M&E arrangement provides for indicator reflecting on gender. Gender Action Plan (GAP) has been prepared with the following objectives: (i) promote women's participation; (ii) maximize Project's benefits to women; (iii) minimize vulnerability due to loss of land/ livelihoods / accesses; and (iv) security hazards.

78. Citizen engagement: The state is committed to ensure engagement of citizens in the management of the Project as it paves the way for (a) legitimacy in decision making; (b) designing the appropriate interventions; (c) effective institutional and implementation arrangements; (d) enhancing inclusion, reducing conflicts, and establishing common platforms for sharing of knowledge and concerns as well as justice, liberty, and dignity; (e) local-level capacity building leading to responsible and responsive citizenry; (f) better-quality outcomes; and (g) downward accountability. In effect, the Project is expected to contribute to better service delivery and sustainable impacts as a result of the engagement. Keeping these purposes in mind, the Project has inbuilt mechanisms for ensuring citizen engagement. The key citizen engagement elements enshrined in the Project design are (a) consultations hosted annually with relevant stakeholders and a summary of the discussions/ follow-up actions publicly disclosed ; (b) moving beyond consultations into consent in the tribal areas; (c) external bodies overseeing the conducting of Social Assessments and Social Impact Management Plan (SIMPs); (d) sharing of all the plans and engaging in extensive discussions and deliberations with all the stakeholders, especially Project-affected persons (PAPs); (e) multilayers of grievance redressal arrangements; and (e) full adoption

of the country's Right to Information Act. The M&E arrangement provides for indicators reflecting on citizen engagement.

F. Environment (including Safeguards)

79. The Project components mainly include strengthening and augmentation of the existing power supply system including financing new transmission and distribution lines, replacement of overhead wires with underground cables, by the Project implementing agencies. Potential impacts identified during the implementation phase include clearance/felling of trees within the right of way (RoW) for transmission lines and substation sites, any incidental impacts on local fauna, localized drainage issues where substation construction may impede drainage, safety of workers and near-by residents. The operational phase impacts could arise from indiscriminate use and disposal of batteries, transformer oil, e-waste and in case of circuit breaker – Sulphur Hexafluoride handling. Most of these environmental impacts are likely to be short-term, modest, site-specific and reversible in nature where, mitigation measures can be managed to reduce the negative impacts of the interventions. In view of this, in accordance with the scope of the project, World Bank safeguard policy OP 4.01 is triggered while the project is classified as Category B.

80. As the scope of subprojects interventions is diverse and will be implemented across Andhra Pradesh and some locations and alignments are yet to be finalized, an Environmental and Social Management Framework (ESMF) has been prepared. This ESMF will guide the preparation of the specific EIA for transmission sub-projects and a Generic EMP for the HVDS distribution schemes. Currently ESIAs for Package-2 and Substations scheme have been prepared. EIA for cluster of distribution substations will also be undertaken as locations get identified and finalized. The ESMF has adequate guidelines to prepare required tools and environmental safeguards instruments policies where applicable. A generic ESMP has also been prepared on Project level as part of the ESMF, while site specific ESMPs would also be prepared during Project implementation stage.

81. The environmental and social member of the PIUs at the transmission company and both distribution companies will be responsible for the implementation of ESMF/ESMP provisions in their respective subprojects. This will be undertaken through integration of the environmental management requirements within contract documents, and monthly monitoring of works on-site during implementation.

82. The ESMF has included indicative costs for environmental management which will need to be firmed up as sub-projects are finalized. It also has developed training modules based on an assessment of training needs and capacity building at the corporate level as well as in the field.

83. Consultations have been held with a range of stakeholders by each utility –APEPDCL on August 19, 2016 and for APTRANSCO and APSPDCL in the end of August. The ESMF and the generic ESMP has been disclosed locally on August 5, 2016 and externally through Info Shop on August 23, 2016.

G. Other Safeguard Policies

84. No other safeguard policies are triggered for the Project.

H. World Bank Grievance Redress

85. Communities and individuals who believe that they are adversely affected by a World Bank (WB) supported project may submit complaints to existing project-level grievance redress mechanisms or the WB's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed in order to address project-related concerns. Project affected communities and individuals may submit their complaint to the WB's independent Inspection Panel which determines whether harm occurred, or could occur, as a result of WB non-compliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the World Bank's attention, and Bank Management has been given an opportunity to respond. For information on how to submit complaints to the World Bank's corporate Grievance Redress Service (GRS), please visit http://www.worldbank.org/GRS. For information on how to submit complaints to the World Bank Inspection Panel, please visit www.inspectionpanel.org.

Annex 1: Results Framework and Monitoring

Country: India

Project Name: 24x7 - Power for all in Andhra Pradesh (P155038)

Results Framework

Project Development Objectives

PDO Statement

The development objective of the Project is to increase the delivery of electricity to customers and to improve the operational efficiency and system reliability in distribution of electricity in selected areas in Andhra Pradesh.

These results are at | PDO Level

Indicator Name	Baseline	YR1	YR2	YR3	YR4	YR5	End Target
Increase in electricity supply (Gigawatt-hour (GWh))	50,366	54,395	58,747	63,447	68,522	74,000	74,000
Reduction in AT&C Losses in select districts (Percentage)							
Kurnool (Percentage - Sub-Type: Breakdown)	10.82	10.5	10.25	10	9.5	9.25	9.25
Anantapur (Percentage - Sub-Type: Breakdown)	18.30	18.0	17.5	17.0	16.5	15.5	15.5

Reduction in distribution transformer failure rate in select project areas (Percentage)							
Kurnool (Percentage - Sub-Type: Breakdown)	11.4	10.5	9.2	8.5	7.5	6.5	6.5
Anantapur (Percentage - Sub-Type: Breakdown)	13.0	12.0	11.0	10.0	9.0	8.0	8.0
These results are at	Intermediate Level						
Indicator Name	Baseline	YR1	YR2	YR3	YR4	YR5	End Target
Transmission lines constructed or rehabilitated under the project (Kilometers) - (Core)							
Transmission lines constructed under the project (Kilometers - Sub-Type: Breakdown) - (Core)	0.00	40	130	220	310	357	357
Distribution lines constructed or rehabilitated under the project (Kilometers) - (Core)							
Distribution lines constructed under the project (Kilometers - Sub-Type: Breakdown) - (Core)	0.00	0.00	119.75	323.25	371	474	474
Number of transmission substations constructed (Numbers of 220/132kV,	0.00	0.00	1	5	11	12	12

220/33kV and 132/33kV substations) (Number)							
Number of distribution substations constructed or upgraded (Number of 33/11 kV substations) (Number)	0.00	29	57	65	85	116	116
Establishment and reduction of SAIFI in select urban areas (Number)							
Vishakapatnam	NA	NA	NA	X	0.9X	0.8X	0.8X
Vijaywada	NA	NA	NA	X	0.9X	0.8X	0.8X
Establishment and Reduction of SAIDI in select urban area (Hours)							
Vishakapatnam	NA	NA	NA	X	0.9X	0.8X	0.8X
Vijaywada	NA	NA	NA	X	0.9X	0.8X	0.8X
Percentage of females among the number of persons participating in the safeguard consultation meetings (Percentage)	0.00	5	10	15	20	25	25
Person-days of utility staff participating in trainings (Number)	0.00	75	150	225	300	375	450
Grievances received that are addressed within two months of receipt (Percentage)	0.00	20	30	50	70	90	90

Project Development Objective Indicators				
Indicator Name	Description (indicator definition etc.)	Frequency	Data Source / Methodology	Responsibility for Data Collection
Increase in electricity supply	This indicator measures the increase in electricity supply within the state. The numbers presented are the total power supplied within the state on an annual basis. Baseline data is for FY 2016 (Financial year ending March 2016).	Annual	Progress Report	Implementing Agency
Reduction in AT&C Losses in select districts	This indicator measures the reduction in annual aggregate technical and commercial losses in select districts of Anantapur and Kurnool. The numbers presented are the AT&C losses in each of the financial years. The base figure would be calculated for FY16	Annual	Progress Report	Implementing Agency
Kurnool	This indicator measures the reduction in annual aggregate technical and commercial losses for district of Kurnool. Reporting methodology same as above	Annual	Progress Report	Implementing Agency
Anantapur	This indicator measures the reduction in annual	Annual	Progress Report	Implementing Agency

	aggregate technical and commercial losses in district of Anantapur. Reporting methodology same as above			
Reduction in distribution transformer failure rate in select project areas	This indicator measures the reduction in failure rate of distribution transformers in select project areas.	Annual	Progress Report	Implementing Agency
Kurnool	This indicator measures the reduction in distribution failure rate in district of Kurnool.	Annual	Progress Report	Implementing Agency
Anantapur	This indicator measures the reduction in distribution transformer failure rate in district of Anantapur	Annual	Progress Report	Implementing Agency
Intermediate Results Indicators				
Indicator Name	Description (indicator definition etc.)	Frequency	Data Source / Methodology	Responsibility for Data Collection
Transmission lines constructed or rehabilitated under the project	This indicator measures the length (in circuit kilometers) of the transmission lines constructed or rehabilitated/upgraded under the project.	Annual	Progress Report	Implementing Agency
Transmission lines constructed under the project	This indicator measures the length (in circuit kilometers) of the	Annual	Progress Report	Implementing Agency

	transmission lines constructed under the project.			
Distribution lines constructed or rehabilitated under the project	This indicator measures the length (in circuit kilometers) of the distribution lines constructed or rehabilitated/upgraded under the project. The baseline value for this indicator is expected to be zero.	Annual	Progress Report	Implementing Agency
Distribution lines constructed under the project	This indicator measures the length (in circuit kilometers) of the distribution lines constructed under the project. The baseline value for this indicator is expected to be zero.	Annual	Progress Report	Implementing Agency
Number of transmission substations constructed (Numbers of 220/132kV, 220/33kV and 132/33kV substations)	This indicator measures the number of transmission substations (Numbers of 220/132kV, 220/33kV and 132/33kV substations) constructed or rehabilitated.	Annual	Progress Report	Implementing Agency
Number of distribution substations constructed or upgraded (Number of 33/11 kV substations)	This indicator measures the number of distribution substations constructed or upgraded (Number of 33/11 kV substations)	Annual	Progress Report	Implementing Agency

Establishment and Reduction of SAIFI in select urban areas	This indicator measures the System Average Interruptions Frequency Index (SAIFI) for select urban towns. SAIFI would calculated using the following formula: {sum of (ixNi)/Nt} where i is the number of interruptions that occur in a particular year in the control area and Ni is the number of consumers that are impacted by the interruption. Nt is the total number of consumers in the control area. As it is not possible to estimate a value now, the value has been indicated as an unknown value “x” in FY19 and subsequent reduction in values denoted in comparison to value “x”.	Annual	Progress Report	Implementing Agency
Establishment and Reduction of SAIDI in select urban area	This indicator measures the reduction in System Average Interruptions Duration Index (SAIDI) for a selected area. SAIDI would be calculated using the following formula: {sum of (d*Nd)/Nt} where d is the duration of each interruption in a year in control area and Nd is	Annual	Progress Report	Implementing Agency

	the number of consumers that are affected by that interruption; Nt is the total number of consumers in the project area. As it is not possible to estimate a value now, the value has been indicated as an unknown value “x” in FY19 and subsequent reduction in values denoted in comparison to value “x”.			
Percentage of females among the number of persons participating in the safeguard consultation meetings	This indicator measures the percentage of females among the number of persons participating during the consultations for preparation/implementation of safeguard plans like SIMP and or CPTD.	Annual	Progress Report	Implementing Agency
Person-days of utility staff participating in trainings	This indicator measures the person-days of utility staff participating in trainings including local and foreign study tours.	Annual	Progress Report	Implementing Agency
Grievances received that are addressed within two months of receipt	This indicator measures the percentage of grievances received that are addressed within two months of receipt with respect to the total number of grievances.	Annual	Progress Report	Implementing Agency

Annex 2: Detailed Project Description

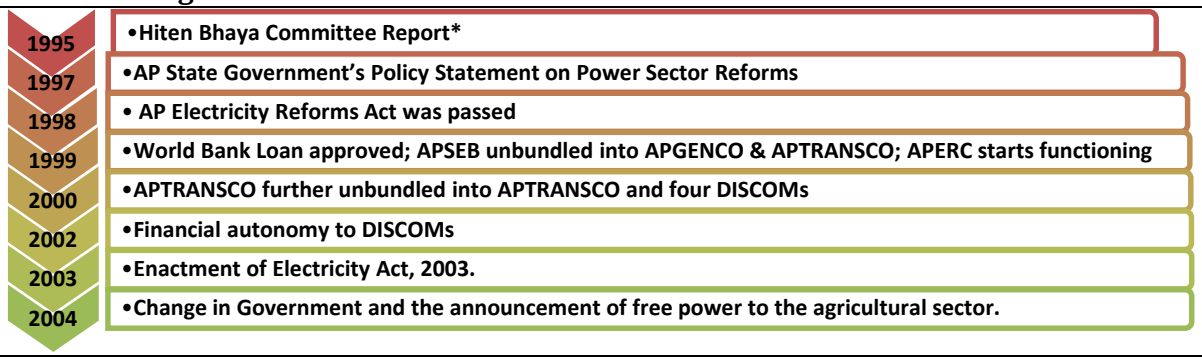
INDIA: ANDHRA PRADESH 24X7 POWER FOR ALL PROJECT (P155038)

1. ***Introduction:*** Situated on the southeastern coast of the country with the geographical area of 1, 62,760 sq. km, Andhra Pradesh ranks as the 8th largest State in the country. The state has the 2nd longest coastline in the country with a length of 974 km, after Gujarat. In terms of population, it is the tenth largest state in the country with 49 million inhabitants accounting for 4.10 percent of the total population. 70.4 percent of the population lives in rural areas. The density of population for Andhra Pradesh is 304 persons per square kilometer, as against 368 persons per square kilometer at all India level in 2011. The literacy rate of the State is 67.35 which is lower than the all India literacy rate of 72.98 percent.

2. ***Institutional Structure*:** Andhra Pradesh was the third state in the country to enact the state Power Sector Reform Legislation (February 1999) to initiate legal foundation for reforms, regulation, industry and market structure. The vertically integrated Andhra Pradesh State Electricity Board (APSEB) was restructured into six corporatized entities – a power generation company (APGENCO), a transmission and bulk supply company (APTRANSCO) and four distribution companies for retail power supply for each region – north, south, east and central. Andhra Pradesh Electricity Regulatory Commission (APERC) was established in April 1999, as an independent and autonomous body to regulate the business of electricity including tariff fixation and create an environment for dynamic and equitable growth of the electricity sector in the State. The APERC has set a good track record of operating through transparent regulatory processes, with the involvement of stakeholders and public, and has demonstrated its ability to take independent decisions. It has issued important regulatory orders (including licenses, tariffs, consumer performance standards, technical codes, guidelines for planning etc.) and has set precedent in defining several regulatory approaches in the country. The utilities have also implemented measures to control electricity theft and improve operational efficiency. Andhra Pradesh was the first state to enact anti-theft legislation in July, 2000.

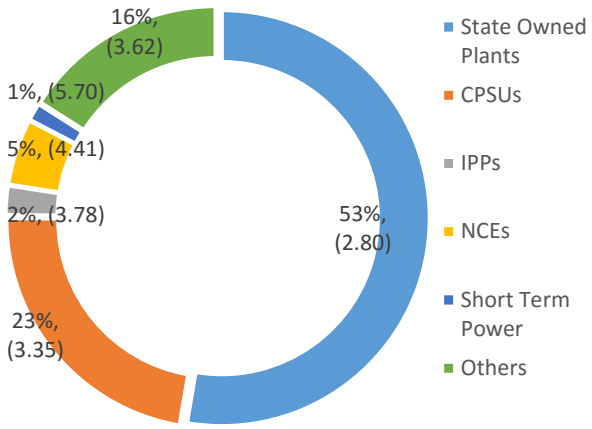
3. In 2014, the combined state of Andhra Pradesh was bifurcated and a new state of Telangana was formed. After bifurcation, the Andhra Pradesh Power sector rests with four entities: (i) APGENCO (ii) APTRANSCO with a state wide mandate; (ii) Andhra Pradesh Southern Power Distribution Company (APSPDCL), covering eight districts; and (iii) Andhra Pradesh Eastern Power Distribution Company (APEPDCL) for five districts in the remaining part of the state.

Figure 2: Timeline of Reforms in Andhra Pradesh Power Sector[22]



4. ***Power Generation and Availability***: After the implementation of the reforms there has been improvement in capacity addition to meet the consistently growing demand of Andhra Pradesh. The total installed capacity of APGENCO stood at 8924.86 MW till bifurcation of the state in FY 2012. After bifurcation, 46 percent of the total capacity of APGENCO stations (existing and under construction) was allocated to Andhra Pradesh. The present installed capacity of APGENCO is 4559.6 MW comprising Thermal: 2810 MW, Hydro: 1747.6 MW and Wind: 2 MW. There have been substantial efforts to improve the operating efficiency of generating stations through renovation and modernization (R&M) of old generating stations. In all of the past 10-yrs, APGENCO's PLF has remained higher than the average national PLF.

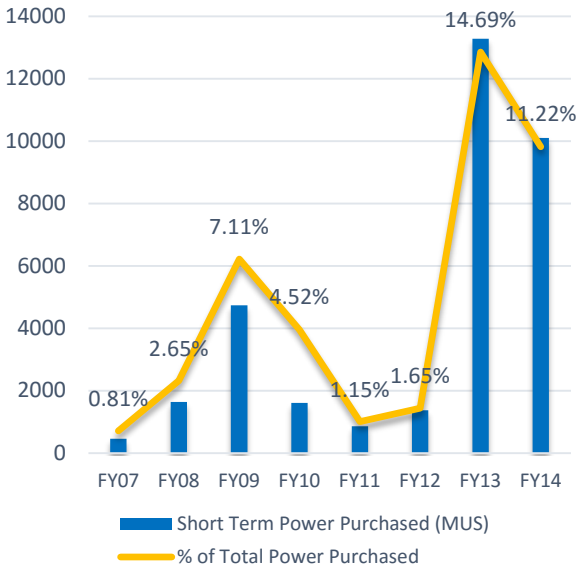
Figure 3: Generation Profile of AP 2015



*Figures in bracket show average purchase price

Source: Tariff Order for Retail Supply of Electricity 2015-16

Figure 4: Short Term Power Purchase



Source: Compilation from Tariff Orders

[22] A High Level Committee set up by the GoAP under the chairmanship of Mr. Hiten Bhaya submitted its report on the medium term reform program in April 1995 which recommended reforms including unbundling of vertically integrated APSEB & establishment of APERCs

5. In terms of power availability, the state owned plants contributed 53 percent of the power, while another 23 percent is tied up with central generating stations, 16 percent with other public and private generating stations and 5 percent is contributed by non-conventional energy sources. Over the past few years the growth in installed capacity has not kept pace with the increasing demand. There was limited capacity addition from FY 2005 – FY 2014. Though, the energy deficit in Andhra Pradesh has substantially decreased during the reform period due to improved planning and increased capacity addition; it had picked up substantially since FY 2012. The energy deficit in the state decreased to 2.9 percent in 2003-04 as against the all India average of 7.1 percent while it has increased to 17.6 percent during FY 2013 as against the all India average of 8.7 percent. Similarly, the peak deficit has also increased to 20 percent in 2012-13 as against all India peak demand deficit of 4.5 percent. To meet the energy deficit, Andhra Pradesh Power sector has been purchasing significant amount of short term power at high prices. The share of power purchase from short term sources increased from 0.8 percent in FY 2007 to 15 percent in FY 2013. The average purchase price was US$0.08 (INR5.36) per unit in FY 2013 against US$0.04 (INR2.68) in FY 2010.

6. However, since 2014, due to various initiatives taken by the state governments to improve capacity addition and transmission planning, the energy as well as peak deficit has reduced drastically and Andhra Pradesh has achieved self-sufficiency in meeting energy demand. The energy deficit is reduced from 7.0 percent in FY 2014 to almost NIL at present.

7. ***Transmission System***: APTRANSCO has a vast transmission network with a total network length (consisting of 4410 kms of 400 KV, 17684 kms of 220 KV, 10764 kms 132 KV) of 32858 Circuit kms. It also owns and operates a total of 258 substations comprising of 6 nos 440kV, 75 nos. 220 kV and 177 nos. 132kV substations. The transmission losses were among the lowest in the country at 3.59 percent in FY 2014 as against 7.90 percent during unbundling. APTRANSCO has maintained high line availability in excess of 99 percent for all the years under consideration. This is at par with the best in the industry in India.

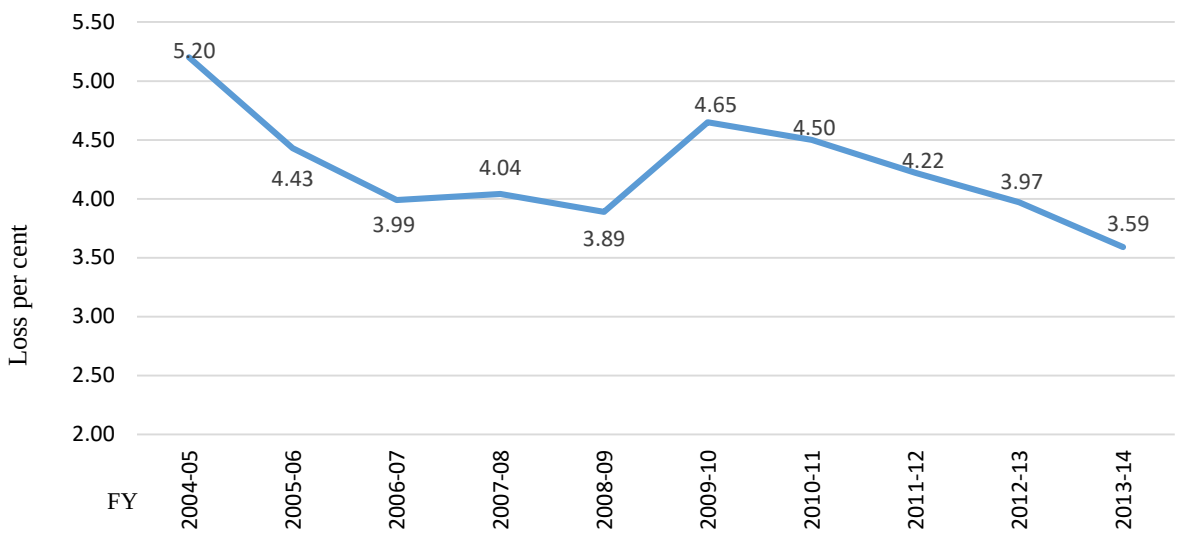
Table 2.1: APTRANSCO Capacity Addition

Years		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Transmission Network Length (ckt kms.)	440kV	732	0	0	653	130	171	21	164	136	140	804	145
	220kV	599	187	335	108	214	452	266	191	185	745	296	471
	132kV	379	237	320	544	419	392	233	165	480	328	345	382
No. Of Substations	440kV	0	0	0	4	0	1	1	0	1	1	1	1
	220kV	4	3	2	1	3	8	3	3	4	10	8	3
	132kV	5	19	19	15	13	8	5	8	19	14	3	17

Source: Compilation from Annual Reports of APTRANSCO

8. APTRANSCO has shown consistent financial performance on the back of sound investment program, high line availability and low level of transmission losses. The transmission business is regulated as cost plus pricing regulation through which the utility has been allowed to earn a return on equity of 14 percent. The utility has high reliance on information technology such as ERP and SCADA. APTRANSCO has also won the India Power Award 2012 for overall utility performance.

Figure 5: Transmission Losses



Source: Annual Reports - APTRANSCO

9. ***Distribution System***: After the bifurcation of Andhra Pradesh into two new states i.e. Andhra Pradesh and Telengana in 2012, the jurisdiction of state distribution companies have been altered. Currently, the two distribution companies i.e. Andhra Pradesh Eastern Power Distribution Company and Andhra Pradesh Southern Power Distribution Company together serve about 15 million consumers in the state. The residential consumers constitute around 80 percent of the overall consumers. Category-wise sales and revenue earned is shown in the following figures:

Figure 6 – License Areas of Andhra Pradesh DISCOMS

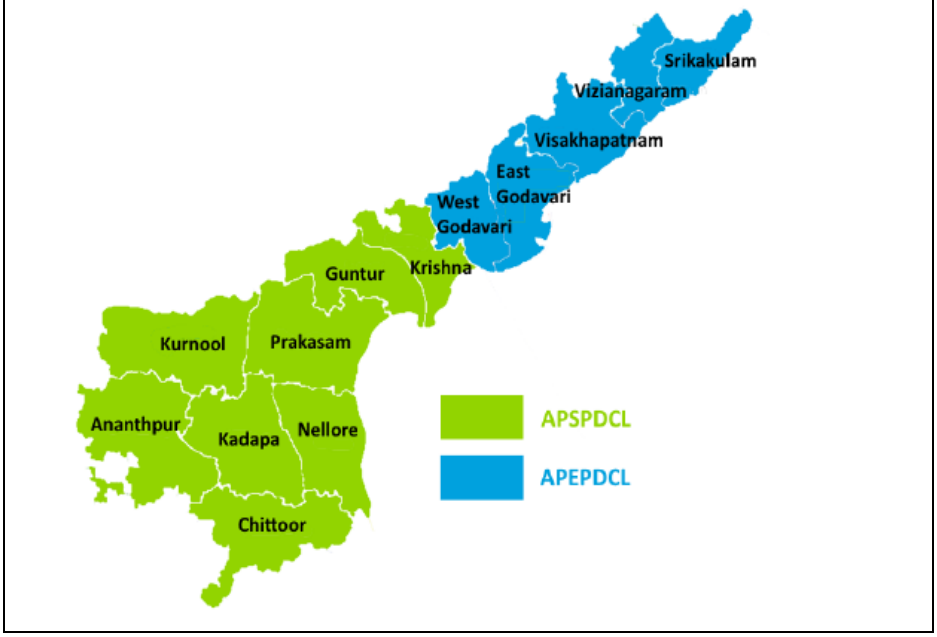
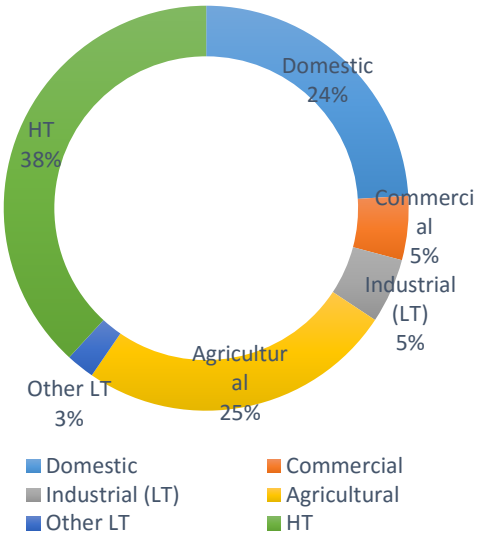
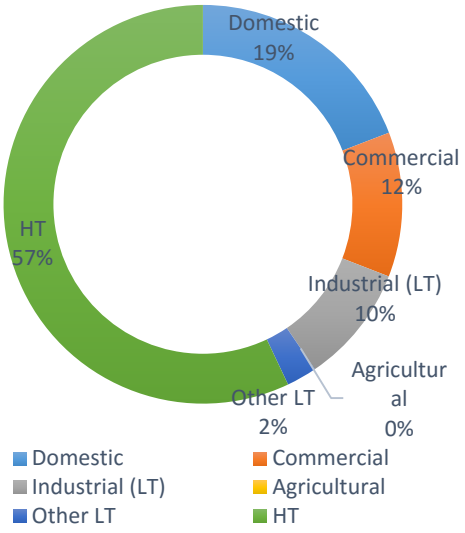


Figure 7: Category Wise Sales (%) (FY15)



Source: Annual Reports FY 2015, APEPDCL & APSPDCL

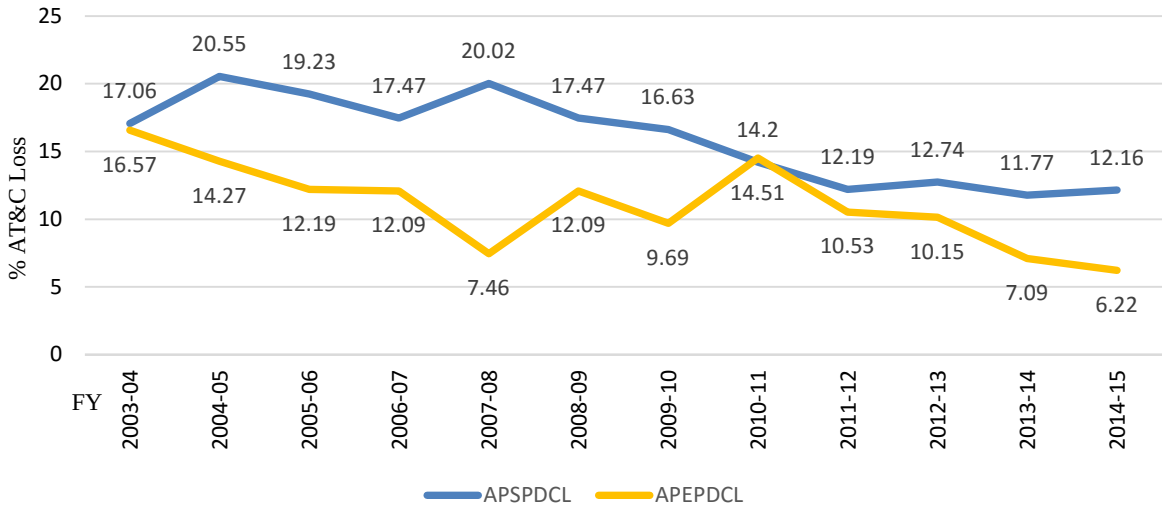
Figure 8: Category Wise Revenue (%) (FY15)



Source: Annual Reports FY 2015, APEPDCL & APSPDCL

10. The operating efficiency of the distribution system have shown some improvements over the years due to enhanced metering, regular energy audits, separation of all industrial feeders (> 11 kV voltage level) into either dedicated or express feeders; feeder wise monitoring- 100 percent metering at interface points. Both the distribution companies have shown impressive performance in terms of reduction of AT&C. APEPDCL had the lowest level of distribution losses at the time of its inception FY2001, which has drastically reduced to a record level of 6.22 percent in FY 2015 which is among the lowest in the country.

Figure 9: AT&C Losses of Andhra Pradesh DISCOMS



Source: Annual Reports FY 2014 – 15 of APEPDCL & APSPDCL

11. Several Information Technology (IT) initiatives such as CAT (Consumer Analysis Tool), MATS (Monitoring and Tracking System), TIMS (Transformer Information Management System), PMRS (Performance Monitoring and Reporting System), Book Consolidation Module and Remote Meter Reading (RMR) have been taken up in (distribution companies) to improve performance and bring in transparency & accountability. Enterprise Resource Planning (ERP) tool has been implemented in APDISCOMs. e- Vaaradhi, an electronic method of reaching electricity consumers was introduced in APEPDCL for passing messages relating to billing information, power shut down information etc., through SMS.

12. APERC has issued Multi-year Tariff in the state for generation, transmission and distribution business in year 2005 with control period of three years. APERC has also revised and notified the Multi-year Tariff regulation on generation tariff in year 2009 with control period of 5 years. Since 2004, APERC has been revising the tariff annually; this can be seen in the following table which indicates the evolution of average realization of each distribution company from consumers in last six years.

Table 2.2: Average Realization (INR/kWh) of DISCOMS

Discoms	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
APEPDCL	2.43	2.78	2.77	2.98	2.88	2.63	3.01	3.06	4.46	4.34
APSPDCL	2.23	2.47	2.09	2.29	2.27	2.32	2.32	2.64	3.20	3.59

Source: Annual reports of APEPDCL & APSPDCL

13. APERC has been calculating the full cost recovery tariff since FY 2011, however, to reduce the impact on consumers, reference or indicative tariff schedule have been drawn up by APERC allowing nominal tariff revisions in various consumer categories leaving the gap to be covered by Government subsidy. However, subsidy do not fully cover the revenue requirement for e.g. in FY 2013 government subsidy only covered 16 percent of the ARR. For instance, APERC only approved revenue of US$4.3billion (INR288.1 billion) against a revenue requirement of US$5.1 billion (INR341.7 billion) after approving the tariff increase pertaining to extent of energy sales volumes leaving the rest to be met by subsidies from the government.

Operational & Financial Performance of the Distribution Companies:

14. Prior to FY 2013, distribution companies were making profits with subsidy, however, in FY 2013 DISCOMs made huge losses even with subsidy. In FY 2013, distribution companies made provision made for Govt. receivables towards addition power subsidy to the tune of US$1274.6 million (INR8539 crores) as doubtful and wrote off unapproved FSA or pending FSA in courts to the tune of US$553.2 million (INR3706 crores) towards additional expensive power purchase made by the distribution companies to meet deficit. The employee costs have also increased substantially-from 5.96 percent to 11.38 percent since FY 2012.

Figure 10: PAT- APSPDCL

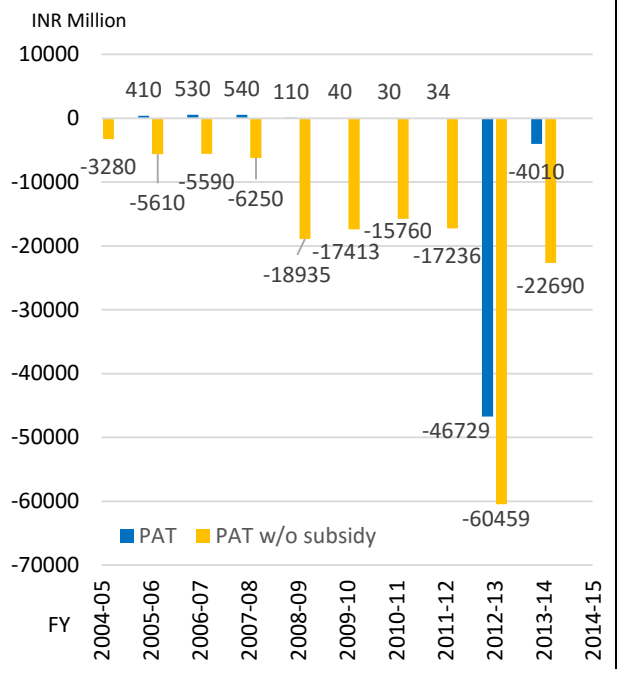
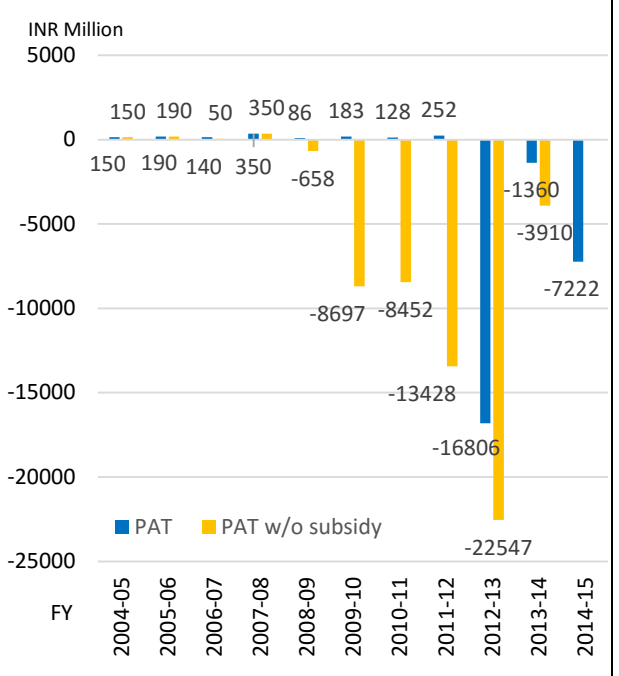


Figure 11: PAT-APEPDCL



Source: Report on the Performance of the State Power Utilities, Power Finance Corporation (PFC)

15. Distribution companies' reliance on short term loans from banks increased to cover operational expenses. During the last decade, the loans increased by five times (Figure 12) and the corresponding interest payment have jumped exponentially and have tripled in last three years (Figure 13).

Figure 12: DISCOM Debt Profile

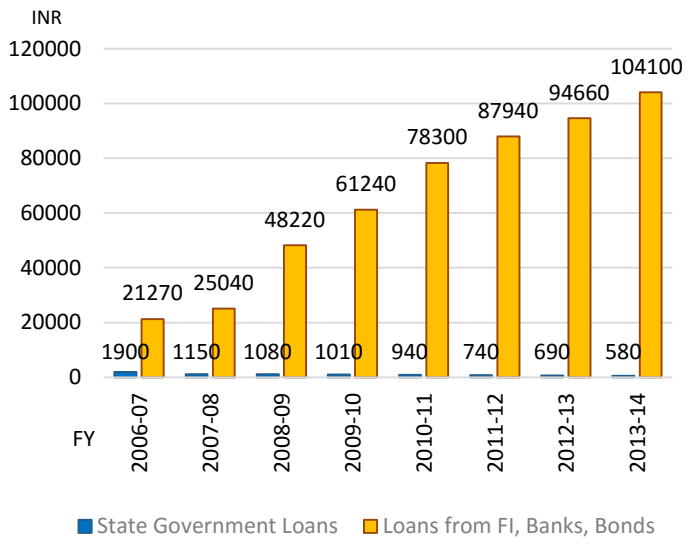
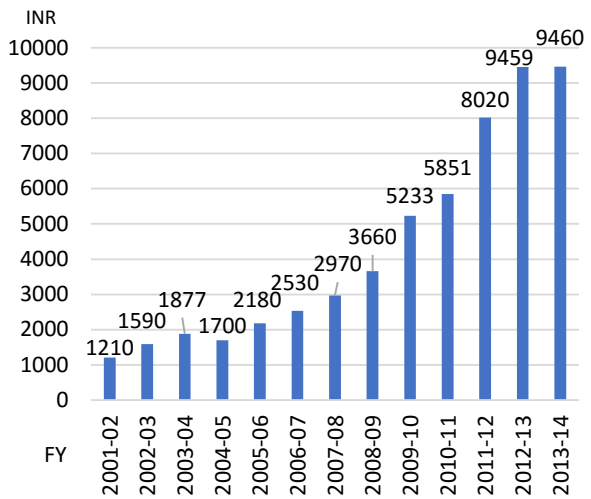


Figure 13: Interest Cost

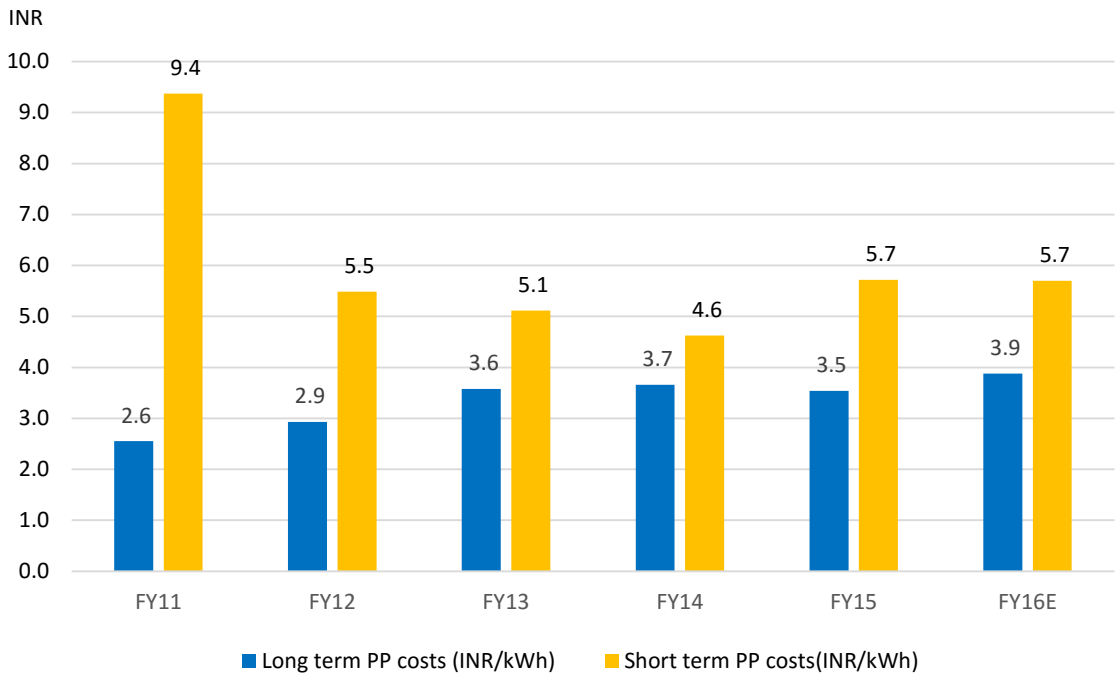


Source: Report on the Performance of the State Power Utilities, Power Finance Corporation (PFC)

16. The key reason for this trend was the reliance on costly short term power purchases to meet the rising demand, which was not reflected at its true costs in the regulatory tariff orders. This issue is dealt with in more detail in the following paragraphs.

a) ***High cost short term power purchases***: A quick analysis of the costs of power purchase, highlights the large difference in the per-unit cost of short term power and long term power. This difference was due to the fact that till January 2014, the southern grid was not synchronized with the national grid, thus forcing the Andhra Pradesh power utilities to buy power only from the region and not take the benefit of cheaper power available from the power exchanges and in other regions of the country. Even after grid integration, transmission corridor constraints continued and Andhra Pradesh distribution companies were given an inter-regional Medium Term Open Access (MTOA) of only 170 MW in FY 2015 and 400 MW in FY 2016. During the decade from 1999 to 2004, only 12 percent of power was procured from private sources (other than APGENCO and Central Generation Station (CGS) projects). However, it increased to 21 percent during 2004-2014. The overall power purchase cost has increased significantly in last decade. In recent years, it has increased from US$0.04 (INR2.68) per unit in 2009-2010 to US$0.05 (INR3.35)/ unit in FY 2012 and to US$0.06 (INR4.02)/ unit in FY 2013.

Figure 14: Average cost of short term power on a per unit basis is significantly higher than the cost of long term power

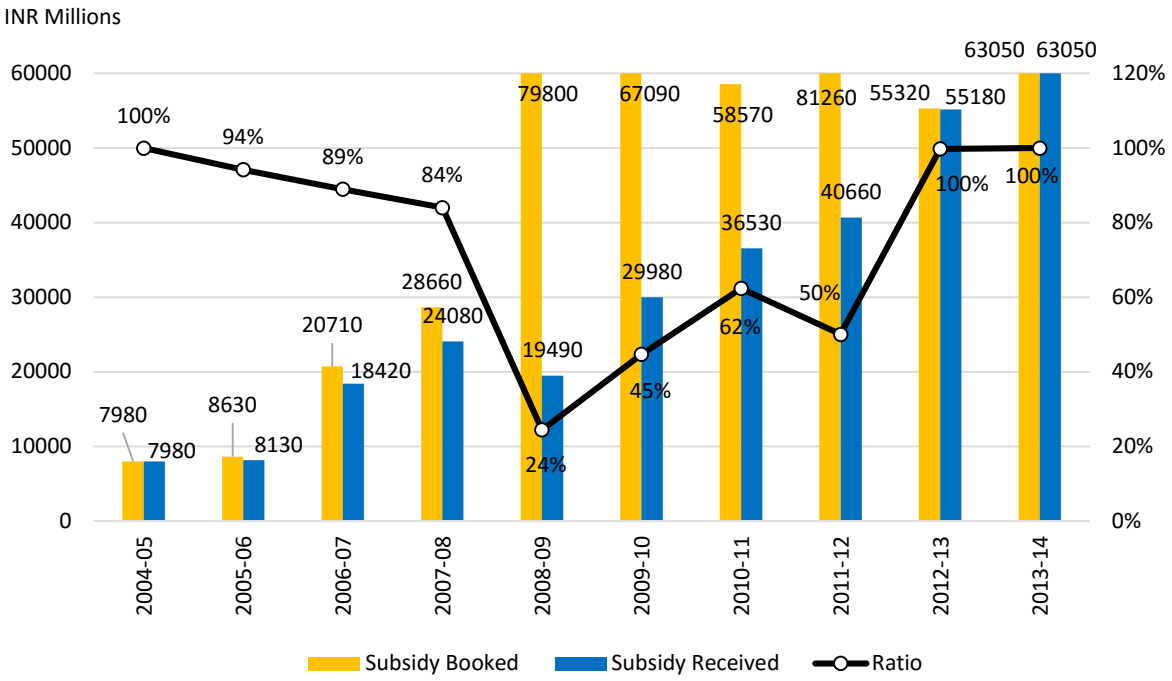


b) ***Non receipt of subsidies for expensive power:*** In addition, subsidies received by the distribution companies from the GoAP has reduced as share of subsidy booked between FY 2007 to FY 2012. While the agriculture subsidy was paid fully, the discrepancy in subsidy booked /subsidy received was due to the power purchase component beyond the APERC approved volumes in the tariff order. GoAP has not subsidized in total FSA and the interest paid on Short Term Loan drawn for purchase of expensive power from the banks making the financial position of the APDISCOMS precarious. The Ministry of Power report on State Distribution Utilities First Annual Integrated Rating published in March 2013 had noted several concerns regarding APDISCOMS such as:

- Non receipt of subsidy for expensive power from government leading to high receivables and receivable days
- Weak coverage of costs through revenue
- Weakening of capital structure over the last three years with increasing reliance on short term debt (constituting 88 percent of debt profile as on March 31, 2012)

Though the situation has improved in last two years and the subsidies are being paid fully by the state government, the accumulated losses have reached to the level of US$153.8 million (INR1030crore).

Figure 15: Subsidy Booked/ Received Ratio



c) ***Low tariffs:*** Andhra Pradesh has zero to negligible tariffs for agricultural consumers and low domestic tariffs. To reduce the financial burden on the small and marginal farmers, the state of Andhra Pradesh has a stated policy of free to significantly subsidized power supply for agriculture consumers. Thus the state faces the challenge of balancing the socio-political imperatives of supplying free power to agriculture (which constitutes ~25 percent of the total sales by volume) and recovering the costs through cross subsiding other consumer categories such as industries and higher domestic loads. However, as this cross-subsidizing had limits, the regulatory orders did not fully compensate the distribution utilities for the costs and only allowed the distribution companies a much lower power purchase costs (which is the largest share of the total costs) than what the distribution companies were actually incurring.

Further, the tariff for domestic consumers up to 200 units of monthly consumption were also very low compared to the cost of supply (Figure 16). Furthermore, these consumers constitute about 20 percent of the total sales by volume and more than 80 percent in numbers.

Figure 16: High Agriculture and Domestic (Lower Category) Account for more than 40 percent of the Sales by Volume in the State

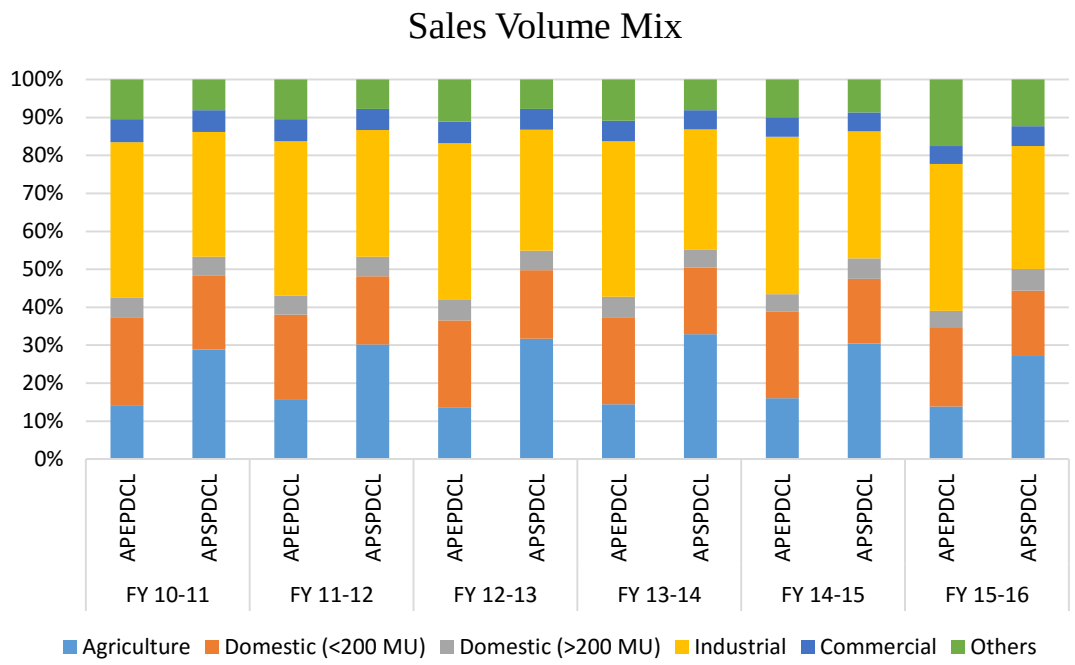


Figure 17: Consumer Mix in Andhra Pradesh is heavily tilted towards lower category domestic consumers

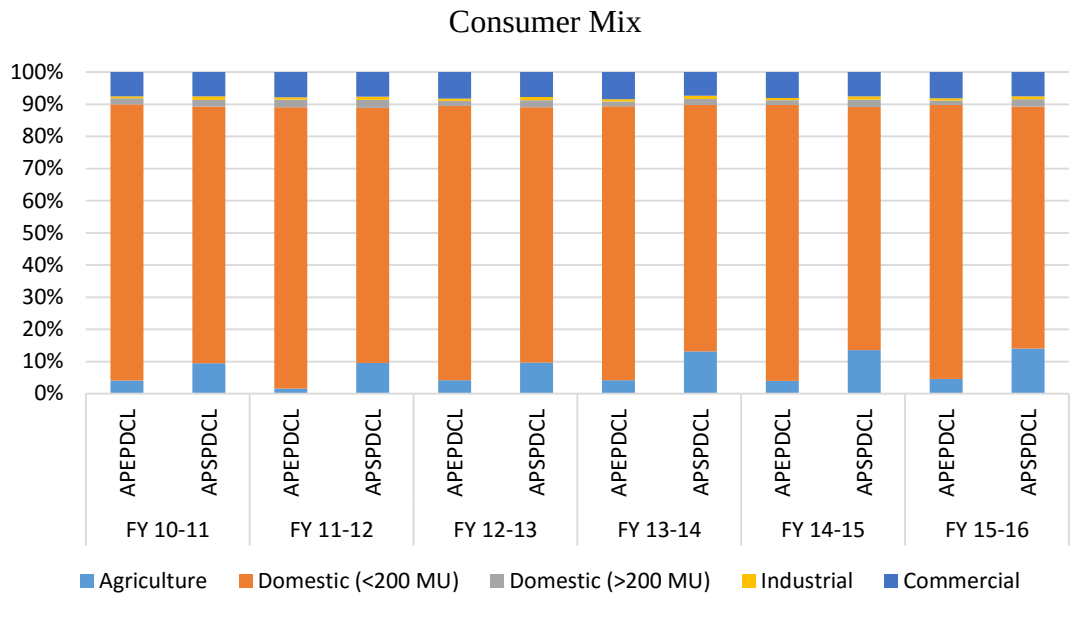
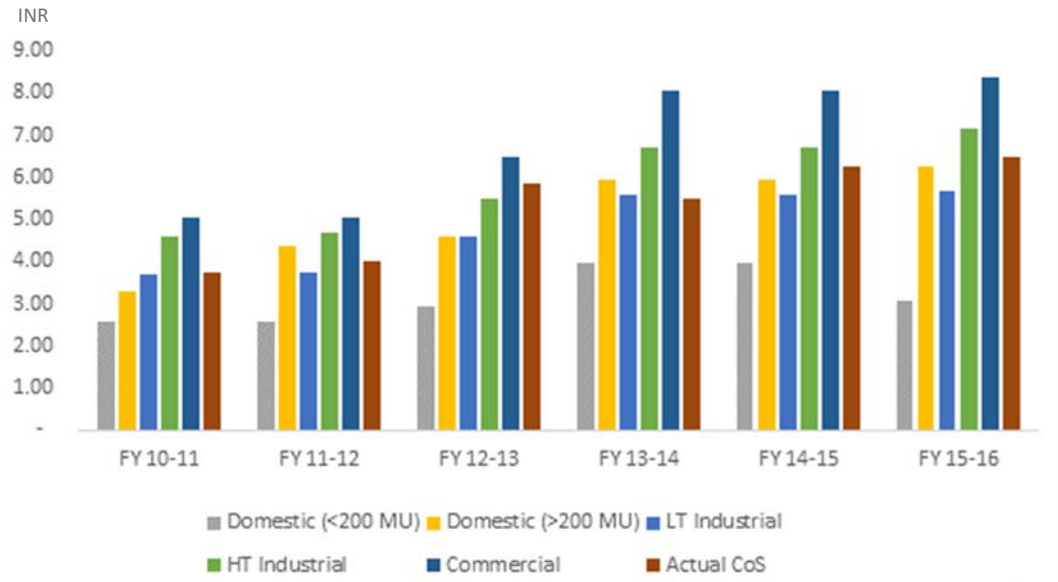


Figure 18: The Tariff Structure Leads to High Cross Subsidy for Industrial and Commercial Consumers



d) ***Gap between ARR & COS:*** The state government provides to each of the distribution company a tariff subsidy to compensate the utilities for the lower tariff compared to the average revenue requirement (as approved by the APERC). This subsidy burden is different in case of the two distribution companies as shown in the figures 19 & 20. However, the subsidy provided has been insufficient to bridge the gap between Average Revenue Realized (ARR) and Average Cost of Supply (CoS) which stood at~US$0.007 (INR0.469)/kWh for FY 2015.

Figure 19: APEPDCL's ARR vs ACS (INR/kWh)

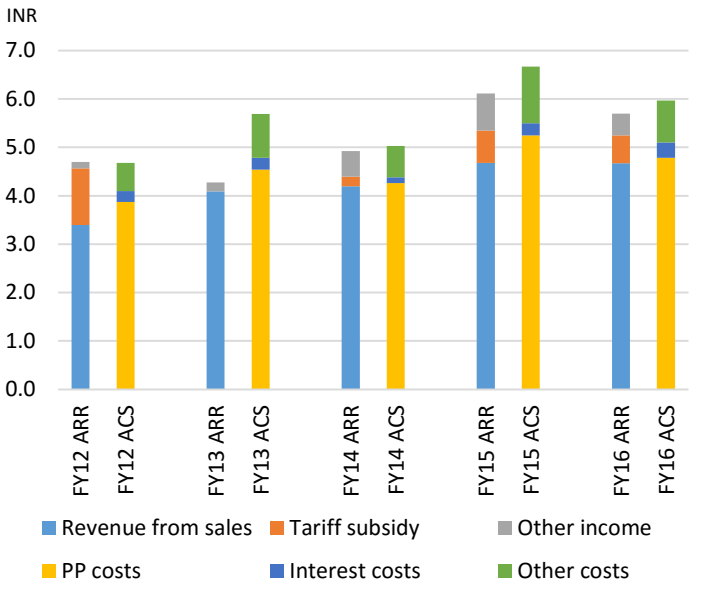
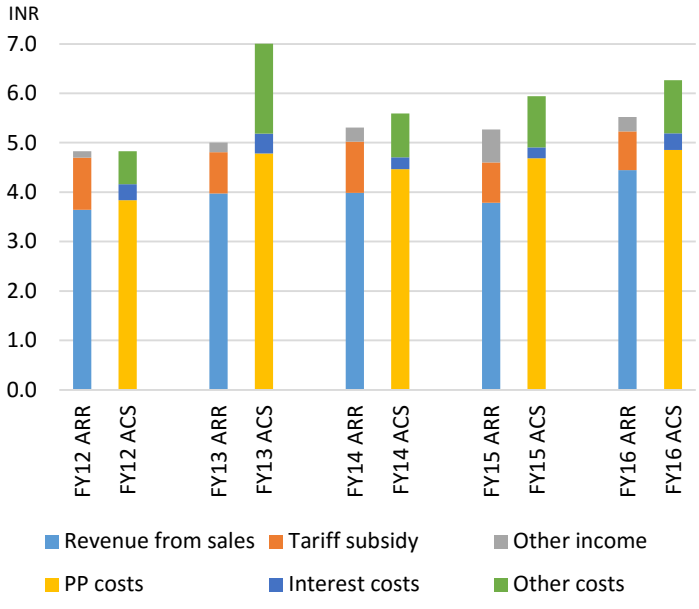


Figure 20: APSPDCL's ARR vs ACS (INR/kWh)



17. ***Steps by GoAP to Improve the Performance of the Power Sector*****:** Since 2014 the state continued its reform efforts at a steady pace, albeit in a challenging socio-political environment. The political leadership has accorded a high priority to improving the availability and quality of power supply for the state's economic development. Some of the initiatives taken by the state government include:

- ***Generation expansion strategy*****:** The state government has planned implementation of a generation expansion strategy and simultaneously improving generation mix through renewable energy. The state plans to more than double the installed capacity of the state from 8,300 MW to -16,000 MW (from non-RE sources) by 2019 through a mix of private sector and public sector investments. Further, a renewable energy five-year plan has been prepared to ensure that installed capacity in the state from renewable energy sources is also increased significantly (7000MW from grid connected solar and wind combined. The state had, over the last few years, resorted to significant short term power purchases, which on one hand reduced the peak load deficit from 17.6 percent in FY 2013 to 5 percent in FY 2015, but on the other hand resulted in huge financial losses for the utility. However, with the implementation of the generation plan outlined above, the state distribution companies would be able to lower their dependence on short term purchases and hence, reduce average power purchase costs.

- ***AT&C Losses***: The AT&C losses in the state have decreased from 23 percent in FY 2004 to around 11 percent in FY 2015 through better metering, regular energy audits, and successful promotion of demand-side measures. However, there is still room for improvement in reducing these losses.

- ***Feeder Segregation***: In addition, virtual feeder segregation to regulate agriculture supply and dedicated feeders for rural industries and commercial establishments were deployed. Andhra Pradesh has completed the virtual segregation (single phase supply for rural households and three phase supply for agricultural loads) of all its rural feeders, which has enabled the distribution companies to provide 24-hour supply to all rural domestic consumers while restricting the supply to about 7 hours for agriculture consumers. Further, to ensure reliable and continuous supply to the industries and commercial establishments in rural areas, the distribution companies are supplying power to most of the areas through dedicated feeders and plan to further construct new dedicated feeders in the remaining areas.

- ***Old Financial restructuring scheme:*** To ensure financial viability of the distribution companies, GoAP participated in the GoI's Financial Restructuring Plan (FRP) of 2012, wherein long term bonds backed by state government were issued by the distribution companies in 2013, against the short term liabilities of US$60.3 million (INR404 crores). As per the provisions of the scheme, a minimum of 50 percent of these bonds were to be taken over by the state. The state government in March, 2015 had already taken over bonds worth US$22 million (INR147 crores). The remaining would be taken over progressively in the current financial year.

- ***UDAY (Ujwal DISCOM Assurance Yojana) Scheme***: GoAP has signed an MoU with Ministry of Power on 24 June, 2016 under the UDAY scheme in order to improve the operational and financial efficiency of the Andhra Pradesh distribution companies to enable their financial turnaround of the distribution companies. GoAP will take over 50 percent of the outstanding debt of the distribution companies to the tune of US$219.7 million (INR1472 crore) over the next two years and 75 percent of the working capital loan of US$126.2 million (INR845 crore) by issuing bonds. In addition, the future losses of the distribution companies will be funded by the state government in a graded manner over the next five years. It shall provide operational funding requirements (OFR) support to the distribution companies till the distribution companies achieves turnaround which shall also include the outstanding power purchase liabilities of the distribution companies as on March 31, 2015. The distribution companies shall undertake specified measures for loss reduction, demand side management, quarterly tariff revisions to offset fuel price increase, increase employee engagement, customer service strategy and shall procure power through transparent process of competitive bidding. The outcome of operational improvements will be measured through indicators such as reduction in AT&C losses and reduction in gap between average cost of supply and average revenue realization, where the target is to reach zero by 2018-19.

18. ***Project Description:*** To provide uninterrupted power supply to its citizens, GoAP signed Memorandum of Understanding (MoU) with Government of India (GoI) to launch the 'Power for All' (PFA) scheme from October 2, 2014 in the state to ensure 24x7 power to all existing consumers including agriculture farm holdings by FY 2017 and access to electricity to all unconnected consumers in the next five years by FY 2019. Through this PFA program, the state government has planned a holistic approach for addressing concerns across the entire value chain in the power sector. The State Government has planned to undertake all the necessary steps for capacity addition, import of fuel, power procurement, strengthening the required transmission and distribution network, encouraging renewables, energy efficiency measures, undertaking customer centric initiatives, reduction of AT&C losses, bridging the gap between ACS & ARR, providing the required subsidy for free power supply to agriculture and following good governance practices in implementation of all central and state government schemes. A total investment of US$8.1 billion (INR542.7 billion) has been planned over a period of next five years till 2018-19 in the state of Andhra Pradesh which includes Central Financial Assistance component to the tune of US$2.3 billion (INR154.1 billion).

19. While the generation requirements have been planned, the capital investment envisaged under the two schemes i.e. DDUGJY and IPDS for transmission and distribution are insufficient to meet the projected requirement of funds. Therefore, the World Bank is supporting the GoAP in the implementation of the aforementioned PFA plan. The Bank support would be provided towards areas already identified in the PFA Plan of Andhra Pradesh and would be limited to areas of transmission and distribution network augmentation and strengthening. The proposed Project will lead to increased ability to meet growing demand, reduction in AT&C losses, and improvement in system reliability. This engagement allows the Bank to support GoI power for all initiative and facilitate the state government in achieving 24X7 reliable, quality and affordable power to the citizens of Andhra Pradesh.

20. The Project components are:

Component 1: **Power Transmission System Strengthening (US$100million, of which IBRD is US$42 million)**

21. This component includes priority investments in 220 kV, 132 kV, 66 kV, and 33 kV lines and associated substations for system augmentation. The specific investments proposed by the state have been verified based on a load flow study. These investments will reduce overall transmission system losses and increase the transfer capability of the state transmission network.

22. A long list of twelve substations and the associated lines will be funded under this component. These packages will be implemented through integrated turnkey supply and installation (S & I) contracts.

Component 2: **Smart Grid Development in Urban Areas (US$210 million, of which IBRD is US$88.2 million)**

23. Government of India has launched the Smart Cities Mission which aims to identify and develop a few selected cities across India as "smart cities." It is expected that these cities would set examples in the country that can be replicated and thus catalyze creation of similar smart cities in various parts of the country. In Andhra Pradesh, Kakinada, Vishakhapatnam and Tirupati have been selected as smart cities in the Smart Cities Challenge conducted by GoI.

24. This component would support investments in smart grids and underground cables in the above mentioned three cities and other major cities. These investments would include smart meters for selected consumers, distribution SCADA, automated substations, and ring main units. It also includes investments on distribution network strengthening and augmentation (33kV and below) in urban areas to meet the growing power demand, reduce technical and commercial losses, improve operational efficiency and increase the system reliability, especially in coastal towns prone to natural calamities.

The investments include:

i. Smart Meters: Smart consumer meters, with two way communication and backend IT infrastructure, would be deployed in select urban towns. These meters will not only reduce technical and commercial losses, but also improve peak load management. It is expected the meters will support demand side management by providing consumers with access to better data and hence, encouraging them to reduce their electricity consumption.

ii. Underground Cables: System reliability is a major concern. As witnessed in 2014, natural calamities like cyclone cause major disruption to the power system; and on an average, it takes about a week to restore power and extensive effort and time is spent in restoration of the power infrastructure. To minimize destruction of power infrastructure and improve restoration time in the event of calamity, investment in

underground cables to replace the overhead network has been included in the three smart cities.

iii. Supervisory Control and Data Acquisition (SCADA): Under R-APDRP, the distribution companies are in the process of setting up SCADA centers in four towns – Vishakhapatnam, Vijaywada, Nellore and Guntur. This would facilitate centralized monitoring of distribution network and enable improvement in system availability. Integration of SCADA with smart meters and RMUs, will enable implementation of applications like Outage Management System (OMS). This component will cover the investments that are required to make the distribution substations in these towns SCADA enabled.

iv. Distribution Network Strengthening & Augmentation: This includes investments in 33 and 11 kV lines and substations to augment and strengthen the distribution infrastructure in urban areas in Andhra Pradesh. These investments are likely to improve the quality of supply and customer satisfaction.

Component 3: Distribution System Strengthening in Rural Areas (US$250 million, of which IBRD is US$105 million)

25. This component would support strengthening and augmentation of distribution network (33kV and below) and construction of High Voltage Distribution System (HVDS) in rural areas. Majority of the investments are located in Anantpur and Kurnool - the two new districts that have been transferred to APSPDCL post the restructuring of the State. East Godavari and West Godavari districts will also benefit from financing under this component. The state of infrastructure in these districts is poor and the majority of power transformers, distribution transformers and feeder lines are overloaded leading to frequent outages and high technical losses. As advised by the state, the AT&C losses in Anantpur and Kurnool districts are 18.31 percent and 10.78 percent respectively.

26. The objective of this component is loss reduction, catering to the increasing load demand, enhancement of system reliability, increased quality of supply to the end consumers, and improved customer satisfaction. The specific investment components are briefly described below:

i. Rural HVDS: The High Voltage Distribution System (HVDS) aims at reduction of losses through replacement of the low voltage network with high voltage network and installation of a smaller capacity Distribution Transformer (DTR) to supply two to three agriculture consumers. Andhra Pradesh has already implemented rural HVDS for almost all its agriculture consumers with positive results and consumer feedback. Independent study shows that over time the distribution transformer failure rate has reduced drastically and the quality of supply has improved. Under this component Andhra Pradesh plans to cover the agriculture consumers which are still not converted to rural HVDS i.e. around 30,000 agriculture consumers in APEPDCL and convert all agriculture consumers in Anantpur and Kurnool to rural HVDS.

ii. Distribution Network Strengthening and Augmentation: This includes the investments required to augment and strengthen the distribution infrastructure in rural areas of

Andhra Pradesh. These investments are expected to improve the quality of supply and customer satisfaction.

Component 4: Technical Assistance for Institutional Development and Capacity Building (IBRD US$10 million, of which IBRD is US$4.2 million)

27. This component would improve the project management capabilities and commercial performance of the Andhra Pradesh distribution utilities by: (i) improving ICT systems; (ii) improving the business processes; (iii) supporting supervision of contracts through Project Management Consultants; and (iv) building staff capacity through training, workshops, and study tours.

i. APEPDCL & APSPDCL:

a) Andhra Pradesh distribution companies over a period of several years have implemented number of IT systems often to address specific issues. As a result, the distribution companies currently have multiple legacy IT systems which are not integrated. Further, a number of processes in the utility, particularly around planning, and management reporting on key commercial parameters are not automated. Lastly, the ICT systems have to be upgraded to accommodate the deployment of smart grid technologies such as OMS, DMS, and SCADA etc. The Bank funded a study during project preparation to carry out an assessment of the existing ICT infrastructure and business processes, identify gaps and assist the distribution companies in preparing a detailed Roadmap for ICT implementation. This study is being carried out by independent consultants in both the utilities and is almost complete. Based on the output of the study, investments in ICT enabled systems will be funded under the project.

b) Project Management Consultant will be hired, if and when required by the Bank, to assist both distribution companies to supervise and manage contracts funded under this Project.

c) This component will also fund activities undertaken for capacity building and institutional strengthening of the distribution utilities. The Project will strengthen the human resources' skills of the utilities in the core areas of utility operations and management.

ii. APTRANSCO:

APTRANSCO proposes to enhance its engineering capabilities by investing in software (tower spotting, design of line/substation), and testing instruments. This component will also support trainings for APTRANSCO officials.

World Bank Experience in Andhra Pradesh Power Sector

28. *Pre-reform Period (Before 1997)*: Andhra Pradesh State Electricity Board (APSEB) was formed in the year 1959 and was responsible for all the three functions of the power sector, namely, generation, transmission and distribution of power. It was one of the largest and efficiently run power utilities in the country. The State witnessed phenomenal growth in the power sector after the formation of the APSEB in 1959. The financial strain started from 1989-90 and the situation

continued to worsen over the years. Though there was a significant growth of the power system in Andhra Pradesh, it became extremely difficult for APSEB to meet the substantial gap between demand and supply due to ever increasing demand in agriculture and domestic consumption. There was deterioration in the financials of the sector primarily due to the adverse change in hydro-thermal mix, steep increase in cost of power, shift in customer mix towards subsidized categories, increase in supply to industrial users from captive units and third party and increase in transmission and distribution losses. Though the revenue of the APSEB was increasing, the financial loss incurred by APSEB was perilous and by the end of the year 1997-98, the outstanding dues of APSEB were of the order of US$38.8 million (INR 260 crore). Consequently, based on recommendations of the High Level Committee and World Bank, the reform initiatives were started by the Government in April 1997 with the issue of a policy statement clearly stating the objectives of the reforms and the strategy to be followed to achieve the same.

29. *Reform Period (1998 to 2004)*: The Government of Andhra Pradesh (GoAP) was one of the pioneer states in the country to initiate the power sector reforms as early as 1998. With the objectives to improve the financial viability of the state's power sector and to cater to the growing needs and demands of the consumers efficiently, the state government enacted Andhra Pradesh Electricity Act in 1999. The GoAP approached the World Bank for a multi-phased adaptable program lending with an indicative financing of US$1 billion (INR67 billion) over a period of eight to ten years to support the implementation of reforms. The Bank support design was consistent with the GoAP's plan for reforms laid out in its detailed "Power Sector Policy Statement" (October 1998). The Bank provided both financial and technical assistance through Adaptable Program of Lending ('APL') and the project was implemented in four phases. Along with the Bank, other bilateral agencies like Department for International Development ('DFID') and Canadian International Development Agency ('CIDA') played a crucial role in facilitating reform program implementation and provision of grant finance. The reform initiatives during 1998-99 to 2003-04 covered various facets across the entire value chain of the power sector and can be broadly categorized into:

(a) *Structural* – erstwhile Andhra Pradesh State Electricity Board (APSEB) was unbundled into six entities to focus on the core operation of Power Generation (APGENCO), Power Transmission (APTRANSCO) during March, 1999 and Distribution (APDISCOMS) – four distribution companies in four regions of Andhra Pradesh were formed in the year 2000 –

- Central Zone (APCPDCL)-To cater to the districts of Anantapur, Kurnool, Mahaboobnagar, Nalgonda, Medak and Rangareddy.
- Eastern Zone (APEPDCL)-To cater to the operation circles of Srikakulam, Visakhapatnam, Vizianagaram, East and West Godavari districts and 17 Divisions of coastal Andhra Pradesh.
- Northern Zone (APNPDCL)-To cater to the districts of Warangal, Karminar, Khammam, Nizamabad and Adilabad.
- Southern Zone (APSPDCL)-To cater to the districts of Krishna, Guntur, Pakasam, Nellore, Chittoor and Kapada.

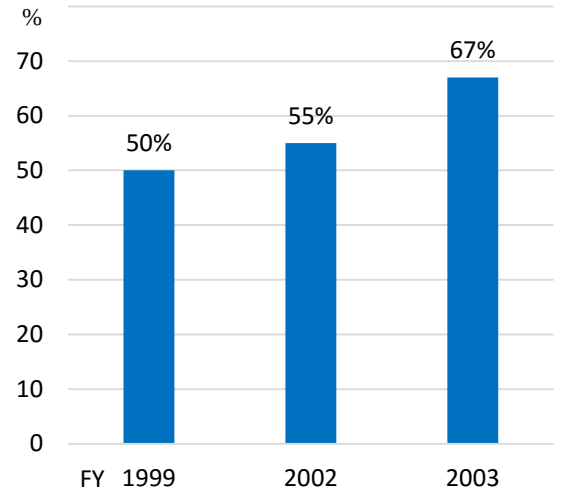
(b) *Regulatory* – establishment of Andhra Pradesh Electricity Regulatory Commission ('APERC') in April 1999, an independent and autonomous body to regulate the business of electricity including tariff fixation and create an environment for dynamic and equitable growth of the electricity sector in the State. The APERC has set a good track record of operating through transparent regulatory processes, with the involvement of stakeholders and public, and has demonstrated its ability to take independent decisions. It has issued important regulatory orders (including licenses, tariffs, consumer performance standards, technical codes, guidelines for planning etc.) and has set precedent in defining several regulatory approaches in the country.

(c) *Efficiency improvement* – comprising both commercial and technical aspects across metering, billing and collection were realized through enactment of anti-power theft legislation (first state to enact such legislation in 2000), regularization of unauthorized connections, spot billing, establishment of customer cells, improvement in the availability and flow of timely management information, human resource development, customer service and communication initiatives. Significant amount of investments were made for building up generation capacity, strengthening transmission and distribution network, industrial feeder segregation, loss reduction and improving quality of power supply.

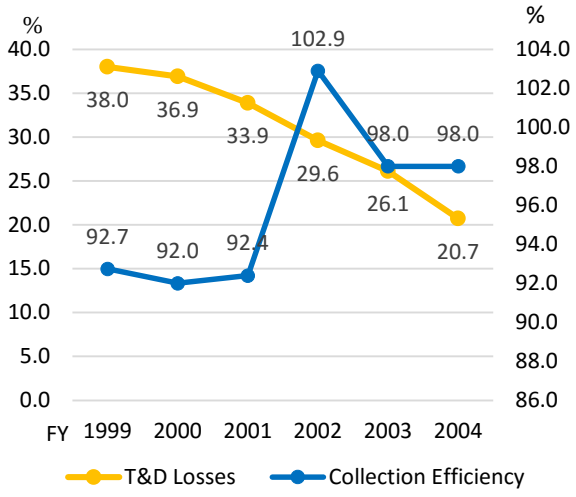
30. As a result of the reform program and various initiatives undertaken with the World Bank support in reform implementation in the power sector, the credit worthiness of the power sector utilities in the state of Andhra Pradesh improved. The utilities saw real gains in terms of improved collections, reduction in commercial losses provision of better customer service and improved organizational skills. GoAP reform initiatives and the Bank's support also catalyzed the state to attract investment and technical assistance support from several financial institutions, bilateral donors and private investors. During FY 2000-03 about US$0.9 billion (INR60.3 billion) has been invested in Andhra Pradesh's power sector (public companies) of which two-third has been in the transmission and distribution (T&D) system. The key achievements of Andhra Pradesh in context of power sector after the reforms are shown in the following figure:

Figure 21: Key Achievements of Andhra Pradesh Power Sector Reforms (1999-2004)

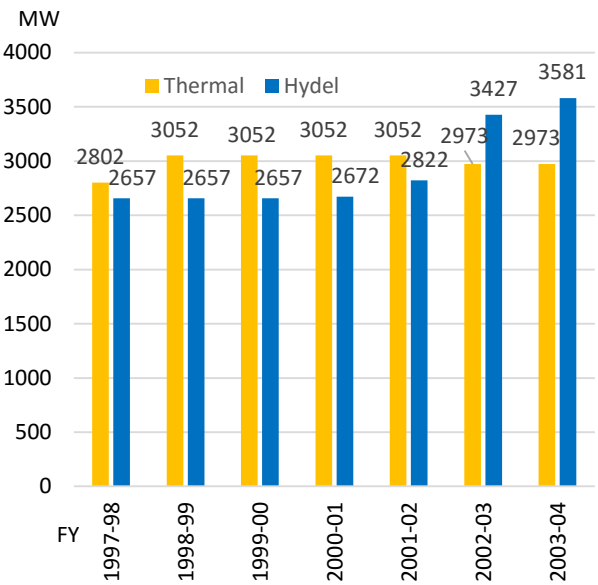
Energy Access Rate (%)



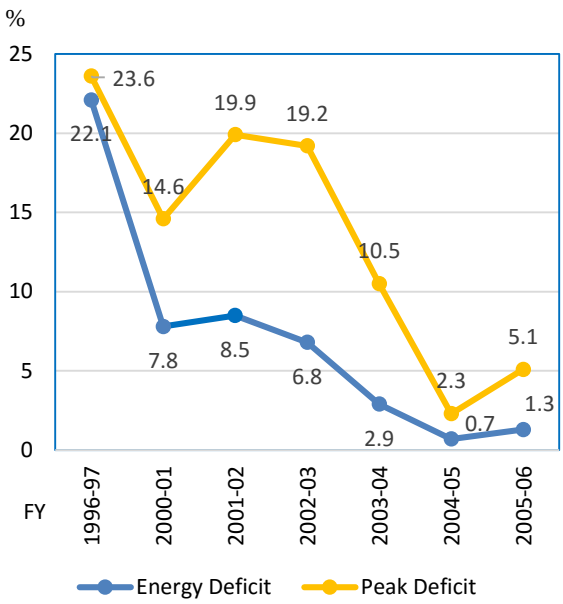
Losses & Efficiency (%)



Installed Capacity of APGENCO



Energy & Peak Deficit



Source: CEA, Report on State Power Utilities, Planning Commission and PFC

31. CRISIL had ranked Andhra Pradesh state as No.1 in 2003 among all the states based on the performance parameters for the power sector, specifically Andhra Pradesh scored highest on regulatory reforms. The state government recognized that the role of the World Bank and co-financers towards advisory services, guidance, project monitoring and supervision in the implementation and in objectively reviewing bottlenecks was critical.

32. This first phase APL support to Andhra Pradesh power sector was rated “satisfactory” by the IEG(Independent Evaluation Group). While the APL1 & APL2 project was instrumental in facilitating legal, structural and regulatory reforms, other planned reforms did not materialize. Uncertainty and volatility in the political environment weakened the political appetite to undertake complex reforms, specifically tariff revisions and privatization of distribution entities which were specified as triggers to move forward with APL3 & APL4.

33. The experience from the Bank’s past engagement in Andhra Pradesh as well as in other state reform projects in India provides vital lessons for reform-oriented projects in general as well as the proposed project. Some of the key lessons are (i) ownership and commitment of the governments are critical for successful implementation of the reforms. External agencies like the Bank can only facilitate the process by providing technical and financial assistance; (ii) an understanding of the political economy needs to inform the implementation strategy, recognizing that implementation (especially of reforms) is a long and gradual process and flexibility is required to respond to the changes in political economy as they dynamically evolve; (iii) expectation of the pace at which reforms can be implemented and outcomes realized should be realistic; particularly the expectations of sector financial turnaround and the phasing out of subsidies need to be moderated; (iv) upfront visible improvements in the quality of power supply and customer service are important for fostering pro-reform constituency and build stakeholder consensus for reforms; (v) improvements in corporate governance and institutional strengthening enhance credibility of sector reforms and their sustainability; and (vi) incentives to strengthen financial management and performance accountability frameworks are essential.

Annex 3: Implementation Arrangements

INDIA: ANDHRA PRADESH 24X7 POWER FOR ALL PROJECT (P155038)

Project Institutional and Implementation Arrangements

1. The Project will be implemented in the state of Andhra Pradesh, by three state-owned but legally separate entities/companies — APTRANSCO, APEPDCL and APSPDCL, referred to as the Implementing agencies (IAs). The Bank loan will be passed on to GoAP under a back-to-back agreement between GoI and GoAP, and then on-lent from GoAP to the IAs; the IAs will be required to repay the loan to the GoAP.

2. The three IAs have set up dedicated Project Implementation Units (PIUs) to implement the project. This does not imply that the Project would be ring-fenced from the IAs broader organization. Within the existing departmental structure (procurement, finance, etc.), the IAs will have designated individuals with clear responsibility for dealing with all issues related to the proposed World Bank loan.

Financial Management, Disbursements and Procurement

Financial Management

3. Financial management assessment of the IAs indicates that their Financial Management arrangements are considered satisfactory for meeting essential fiduciary requirements. Therefore, the guiding principle is that the project Financial Management arrangements would be predicated on the existing systems followed by these entities supplemented by the Bank's reporting and auditing arrangements.

4. Financial Management manuals in the IAs are dated and need to be developed in line with current practices; and internal controls in areas such as fixed assets and inventory and financial reporting need strengthening. The IAs are proposing to upgrade their IT systems (ERP) that will be supported under the Project. Corporate governance in the IAs can be enhanced through induction of independent directors and instituting a risk management framework and also aligning their articles of association with the Companies Act of 2013. The IAs have experience in implementing Bank/other multi-lateral supported projects and hence are familiar with their requirements[23]. The overall Financial Management risk rating is assessed as Substantial. Project Financial Management arrangements have been documented in Operations Manuals. GoAP will use a separate budget head for provision of Project funds. During implementation, IAs will ensure appointment of internal and external auditors and adequate Financial Management staffing in PIUs and GoAP will ensure timely release of project funds. APTRANSCO will make available its audited financial statements for FY 2015-16 at the earliest. An action plan to strengthen corporate

[23] APEPDCL is currently an implementing agency in the Bank supported AP Disaster Recovery Project (P154847) effective Aug 28, 2015) and the component that it is implementing accounts for 32% of project cost.

governance and Financial Management in these entities is proposed to be discussed and agreed during Project implementation.

5. ***Corporate Governance*****:** The governance of the three companies are under their respective Board of Directors headed by a Chairman cum Managing Director who along with a combination of functional and nominee directors are appointed by the GoAP. Each company has constituted an Audit Committee of the Board (ACB) comprising three directors each with a nominee director as the Chair of the Committee[24]. Board/ACB meetings are held regularly. The companies have a full-time Company Secretary and an independent Secretarial Audit is conducted annually. Annual Reports contain discussion on the results and reasonable amount of financial and non-financial information. There are, however, no independent directors on the Board though the Companies Act stipulate a minimum of two. A formal Risk Management Framework is not visible in either of the companies and there is also no discussion on risks/risk mitigation in the annual report. These are statutory requirements under the Companies Act, 2013 and areas requiring strengthening.

6. ***Financial Management Staffing*****:** Each of the IAs will individually be responsible for providing fiduciary assurance on the Project funds that they will handle. The IAs have set up dedicated cells (PIUs) to implement the Project, manned with dedicated staff for various functions, including a Finance Manager, supported by other staff and external consultants, as needed and the IAs will ensure adequate staffing in the PIUs. All Project related activities will be centralized at the respective PIU.

7. ***Budgeting*****:** GoAP will act as a pass through for Bank funds to the IAs. A distinct budget line with separate classification for each component will be used by GoAP in the demand for grants of Energy Department (demand no. XXXV) and provision will be made under this head in accordance with the State's extant budgeting system based on plans approved by the Board of each of the IA per their individual procedures.

8. ***Planning*****:** The IAs statutorily file Annual Revenue Requirements or Tariff Petitions to the APERC which contains multi-year projections and function as budgets and plans. Additionally, the IAs prepare annual scheme-wise allocations for operations and project divisions. For the interventions proposed under the Project, the IAs will prepare detailed Project reports/ implementation plans for each transmission scheme/distribution investments in each town detailing the technical and financial details with clearly defined milestones. Actual performance will be monitored through periodical reports drawn on agreed formats and contents.

9. ***Funds Flow*****:** Project funds flow arrangements will be as follows.

- **From GoI to GoAP**: Based on Project expenditure reported, the office of the Controller of Aid and Audit Accounts (CAAA) will submit withdrawal applications to the Bank and disbursement will be made to GoI who will pass on these funds to the Consolidated Fund of GoAP in accordance with its standard arrangements.

[24] The statutory requirement is to have at least three directors on the ACB and the majority being independent directors. Hence, the current constitution of the ACB is not in line with statutory requirements.

- **From GoAP to the IAs:** Project funds will be drawn from the state's Consolidated Fund in accordance with existing treasury systems and provided in a Project dedicated bank account of each of the IAs opened at the level of the PIU, operated through joint signatories, and payments can be made from these bank accounts in accordance with each IA's own systems. GoAP will ensure that the Project funds are released to the IAs in a timely manner.

10. ***Accounting*****:** The IAs follows double entry system of accounting on accrual basis following the accounting standards generally accepted in India as mandated under the Companies Act, 2013. These provisions require companies to prepare books of account which give a true and fair view of its state of affairs. The IAs follow these principles though there are some deviations in terms of non-compliance with accounting standards and pending adjustments of some legacy balances. Each of the company has a standard chart of accounts and accounting is carried out in electronic form on ERP applications. The system allows identifying transactions for each project or scheme. There are accounting manuals, but these are dated having been prepared prior to unbundling and based on departmental mode of functioning following the state treasury systems. Under corporate functioning, these manuals will not suffice and hence there is an opportunity to modernize the manuals. This is also essential as the IAs propose to upgrade their ERP systems to SAP platform (this activity is proposed to be supported under the Project).

11. IAs will use the extant accounting systems to account for Project transactions. Accounting will be centralized and records kept at the PIU which will facilitate financial reporting and auditing. The PIU or the Project will be configured in ERP so that Project transactions are easily identified.

12. ***Financial Reporting*****:** The reporting arrangements for the Project are proposed as follows:

a) *Interim Unaudited Financial Reports (IUFR):* Each PIU will prepare IUFRs for their part of Project expenditure, based on their books of account, at least on a quarterly/ basis, and submit to the Bank within 60 days from the close of the quarter. The format of the IUFR has been included in the POM.

b) *Project annual financial statements:* Each PIU will prepare annual Project financial statements (PFS) for their part of the Project activities. One of the IAs, APTRANSCO, will be designated to consolidate the individual PFSs and prepare the PFS for the Project as a whole which will be subject to audit. The PFS will separately identify each component under the Project and the funding sources for each of the components.

13. ***Internal Controls including Internal Audit*****:** The IAs have in place formal delegation of technical, administrative and financial powers updated periodically. Functional responsibilities are performed according to the ERP workflow and authorization. Reconciliation of bank accounts is done periodically, but all accounts are reconciled at the year end. Auditors have reported weaknesses in internal controls including internal financial controls over financial reporting.

14. *Internal Audit:* All the IAs have instituted internal audit arrangements through multiple private audit firms. Internal Audit is under the Director (Finance) and day to day coordination is done by General Manager (Internal Audit)/Financial Advisor. Reports are produced monthly/quarterly and are considered by the Audit Committee. For the Project, one firm will be

appointed to conduct internal audit of the Project transactions and provide a consolidated report which will be coordinated by one of the IAs.

15. *Contract Management:* All major contracts are handled centrally in the IAs and payments also made at the corporate office generally through electronic mode based on Letter of Authority issued by field offices. Accounting and reporting of contracts is managed through ERP. Measurement Books are recorded by the concerned Assistant Engineer and check measurement done by Divisional Engineer. Contract variations are approved by the Board/competent authority. These will be applied to the Project.

16. *Asset Management*: The distribution companies need to strengthen their controls over fixed assets with reference to updating fixed assets register and physical verification. IA's own inventory management systems and procedures will be used for the Project. The inventory procured/assets constructed by IA's under the Project shall be clearly marked and recorded such that they are not intermingled with the IA's own inventory at any point in time. In addition, IA's will have the primary responsibility for physical verification of inventory and assets under construction. Project auditors will review the adequacy of these procedures and conduct physical verification of Project assets on a sample basis.

17. ***Auditing*****:** The statutory auditors of the IA's are private audit firms appointed by the Comptroller & Auditor General of India (C&AG) based on a panel of auditors maintained by the C&AG. The scope of audit and powers and responsibilities are detailed in the Companies Act, 2013 and the auditors have to follow the Standards of Auditing and other guidelines issued by the Institute of Chartered Accountants of India and directives of the C&AG. The statutory auditor issues an audit report including a primary opinion on whether the entity financial statements show a true and fair view.

18. External audit of the annual PFS will be conducted by a firm of Chartered Accountants, acceptable to the Bank, selected and appointed by one of the IAs (APTRANSCO) on behalf of all the IAs. The ToR for external audit has been included in the Operations Manuals. The audit firm will be given access to books of account and other documents pertaining to the Project transactions by each of the IA. The annual audit report will be accompanied by audited project financial statements, and a management letter highlighting significant issues to be reported to management. The audit report will be submitted to the Bank within nine months from close of the financial year. The Bank will also review the entity audit report and audited annual financial statements.

19. If a designated account advance is used under the Project, an audit report for the designated account held with the office of the CAAA will also be submitted by the GoI within nine months of the close of the financial year. The following audit reports will be monitored through the Bank's systems.

Table 3.1: Audit Reports Monitoring

Audit Report	Audited by	Due Date
Annual Project Financial Statements (consolidated)	Private Audit Firm acceptable to the Bank	December 31
Designated Account	Comptroller & Auditor General of India	December 31

*Disclosure***:** Under the Access to Information Policy of the Bank, the annual Project audit report and the audited Project financial statements will be disclosed on the website of the Bank/IAs.

Disbursements

20. IBRD funds will be disbursed using reimbursement as the primary method, based on expenditure reported in the quarterly (or more frequent) IUFRs. The other method of disbursement that can be considered based on Project needs is fixed advance payment in a designated account. Supporting documents required for Bank disbursement using these various methods will be per the Bank's Disbursement Handbook and documented in the Disbursement Letter. The project is jointly co-financed by the Asian Infrastructure Investment Bank (AIIB) in the ratio of 60:40 between the Bank and AIIB. The Bank will provide financial management and disbursement services, in accordance with the Framework Agreement and Co-Lenders Agreement between the two institutions.

Table 3.2: Disbursement Table

Category	**Amount of Loan Allocated (US$ mn)**	**Percentage of eligible Expenditures to Be Financed (Inclusive of Taxes)**
1. Goods, works, non-consulting services, consultants' services, and Training	239.4	42%
2. Front End Fee	0.6	Amount payable in accordance with the legal agreement

21. **Retroactive financing:** All eligible Project expenditure meeting the Bank's procurement guidelines and in respect of which payment is made on or after the date mentioned in the legal agreements can be claimed from the Bank up to US$48 million (INR321 crores). The Project will submit a stand-alone Interim Unaudited Financial Report detailing the expenditure incurred during the retroactive financing, which will be subject to audit by the Project's external auditors.

Procurement

22. Procurement for the Project will be carried out in accordance with the World Bank's "Guidelines: Procurement of goods, works and non-consulting services under IBRD loans and IDA credits & grants by World Bank borrowers" dated January 2011 as updated in July 2014 ("Procurement Guidelines") and "Guidelines: Selection and employment of consultants under IBRD loans and IDA credits & grants by World Bank borrowers" dated January 2011 as updated in July 2014 "(Consultant Guidelines)" and the additional provisions mentioned in legal agreement.

23. ***Procurement capacity:*** The Project will be implemented by the three implementing agencies, viz. APSPDCL, APEPDCL and APTRANSCO. The Implementing Agencies have been staffed through a multi-disciplinary team comprising officials mapped to technical, procurement,

and financial management functions. The implementing agencies are not fully conversant with Bank's procurement procedures, although they have been doing procurements under their own guidelines. The IAs have been doing their own procurements, through partial turnkey basis, for which they have tested the market capacity. Under this project, the IAs would be procuring mainly through turnkey basis, for which the market capacity is not known. Therefore, the IAs jointly with the Bank have conducted a contractors' workshop to assess the market capacity and to inform the prospective bidders about the requirements under the Project. This market uncertainty coupled with the Implementing Agencies inexperience in Bank's procurement procedures, and procurements on turnkey basis, may result in delays in procurement process, contract management delays and Non-compliance with agreed procurement arrangements. Detailed Procurement Capacity Assessment is available in P-RAMS**.**

24. ***Procurement Planning***: For each contract to be financed by the Loan, the different procurement methods or consultant selection methods, the need for pre-qualification, estimated costs, prior review requirements, and time frame will be reflected in the Procurement Plan. The capacity building plan will also be reflected in the procurement plan. The Implementing Agencies have prepared 18 months procurement plan and have submitted the same through Bank's STEP system. Bank has reviewed and approved the 18 months' procurement plans for all three implementing agencies in STEP. The procurement plan is provided in Table No. 3.3-3.6.

Table 3.3: Procurement Plan

PROCUREMENT PLAN for APSPDCL

Sl No	Package No.	Description of Works/Goods	Estimated Cost USD	Review Type	Method of procurement ICB/NCB	Preparation of Bid Document (Date)	Bank's No Objection to Bidding Documents (Date)	Bids			Bank's No Objection to Contract Award (Date)	Contract Signed (Date/Value/ Currency)	Contract No.	Value of awarded contract in Equivalent INR Million	Value of awarded Contract in Equivalent US$ Million at ER: US$1 = INR 60	Name of Contractor/ Nationality & ZIP Code	World Bank Reference NO.	Date of Completion of Contract	Remarks
								Invitation (Date)	Opened on (Date)-1st Envelope	Opened on (Date)-2nd Envelope									
1	*2*	*3*	*4*		*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*
	IN-SPDCL-AP-2407-CW-RFB	SYSTEM IMPROVEMENT PROJECT FOR CONVERSION OF EXISTING LT NETWORK INTO HIGHVOLTAGE DISTRIBUTION SYSTEM IN Adoni DIVISION OF KURNOOL DISTRICT	24,038,462	Prior	NCB	2016/10/07	2016/10/26	2016/10/20			2017/02/16	2017/03/29						2019/03/29	
	IN-SPDCL-AP-2421-CW-RFB	SYSTEM IMPROVEMENT PROJECT FOR CONVERSION OF EXISTING LT NETWORK INTO HIGH VOLTAGE DISTRIBUTION SYSTEM IN Nandyla DIVISION OF KURNOOL DISTRICT	17,587,139	Prior	NCB	2016/10/25	2016/11/04	2016/11/03			2017/02/16	2017/03/29						2019/03/29	

	IN-SPDCL-AP-2424-CW-RFB	SYSTEM IMPROVEMENT PROJECT FOR CONVERSION OF EXISTING LT NETWORK INTO HIGH VOLTAGE DISTRIBUTION SYSTEM IN Kurnool & Dhone DIVISIONS OF KURNOOL DISTRICT	18,858,173	Prior	NCB	2016/10/25	2016/11/04	2016/11/03			2017/02/16	2017/03/29						2019/03/29	
	IN-SPDCL-AP-2443-CW-RFB	SYSTEM IMPROVEMENT PROJECT FOR CONVERSION OF EXISTING LT NETWORK INTO HIGHVOLTAGE DISTRIBUTION SYSTEM IN Anantapur DIVISION OF Anantapur DISTRICT	33,202,674	Prior	NCB	2016/10/25		2016/11/03			2017/02/16	2017/03/29						2019/03/29	
	IN-SPDCL-AP-2444-CW-RFB	SYSTEM IMPROVEMENT PROJECT FOR CONVERSION OF EXISTING LT NETWORK INTO HIGHVOLTAGE DISTRIBUTION SYSTEM IN GOOTY DIVISION OF Anantapur DISTRICT	22,885,216	Prior	NCB	2016/10/25	2016/11/04	2016/11/03			2017/02/16	2017/03/29						2019/03/29	
	IN-SPDCL-AP-2445-CW-RFB	SIP FOR CONVERSION OF EXISTING LT NETWORK INTO HIGH VOLTAGE DISTRIBUTION SYSTEM IN Hindupur & Kadiri DIVISION OF Anantapur District under world bank funding	31,301,532	Prior	NCB	2016/10/25	2016/11/04	2016/11/03			2017/02/16	2017/03/29						2019/03/29	

	IN-SPDCL-AP-2446-CW-RFB	SYSTEM IMPROVEMENT PROJECT FOR CONVERSION OF EXISTING LT NETWORK INTO HIGHVOLTAGE DISTRIBUTION SYSTEM IN Kalyandurg DIVISION OF Anantapur DISTRICT under world bank funding	18,456,130	Prior	NCB	2016/10/25	2016/11/04	2016/11/03			2017/02/16	2017/03/29						2019/03/29	
	IN-SPDCL-AP-2447-CW-RFB	Supply, Erection and commissioning of 14Nosnew 33/11KV Substations along with 33KV & 11KV connected lines in Rural area of Krishna District of APSPDCL	4,844,050	Post	NCB	2016/12/15		2017/01/10			2017/04/24	2017/06/05						2018/06/05	
	IN-SPDCL-AP-2451-CW-RFB	Supply, Erection and commissioning of 17Nos new 33/11KV Substations along with 33KV & 11KV connected lines in Rural area of Guntur District of APSPDCL	5,882,061	Post	NCB	2016/12/15		2017/01/10			2017/04/24	2017/06/05						2018/06/05	
	IN-SPDCL-AP-2453-CW-RFB	Supply, Erection and commissioning of 14Nos new 33/11KV Substations along with 33KV & 11KV connected lines in Rural area of Chittoor District of APSPDCL	4,844,050	Post	NCB	2016/12/15		2017/01/10			2017/04/24	2017/06/05						2018/06/05	
		Supply, Erection and commissioning of 11Nos new 33/11KV Substations along with 33KV & 11KV connected lines in Rural area of Kadapa District of APSPDCL	3,806,040	Post	NCB	2016/12/15		2017/01/10			2017/04/24	2017/06/05						2018/06/05	

	IN-SPDCL-AP-2455-CW-RFB	Supply, Erection and commissioning of 16Nos new 33/11KV Substations along with 33KV & 11KV connected lines in Rural area of Anantapur District of APSPDCL	13,874,399	Prior	NCB	2016/12/15		2017/01/10			2017/04/24	2017/06/05						2018/06/05	
	IN-SPDCL-AP-2456-CW-RFB	Supply, Erection and commissioning of 12Nos new 33/11KV Substations along with 33KV & 11KV connected lines in Rural area of Kurnool District of APSPDCL	7,307,091	Post	NCB	2016/12/15		2017/01/10			2017/04/24	2017/06/05						2018/06/05	
	IN-SPDCL-AP-2470-CW-RFB	Implementation of SCADA for balance 33/11KV Substations in Guntur city of APSPDCL	6,009,615	Post	NCB	2017/05/10		2017/06/10			2017/09/14	2017/11/04						2018/11/04	
	IN-SPDCL-AP-2471-CW-RFB	Supply & Installation of 1,32,000 Nos Smart Meters for urban consumers with energy consumption above 500units per month in Vijayawada, Guntur & Tirupati towns of APSPDCL	29,747,596	Prior	NCB	2017/06/12		2017/07/11			2017/10/14	2017/12/06						2018/12/06	
	IN-SPDCL-AP-2458-CW-RFB	Supply, Erection and commissioning of UG cable in high populated and tourist area in Tirupati city of APSPDCL	54,086,538	Prior	ICB	2017/01/02		2017/02/01			2017/05/15	2017/07/01						2018/07/01	
	IN-SPDCL-AP-2465-CW-RFB	Supply, Erection and commissioning of Covered conductor in Vijayawada city of Krishna District	6,009,615	Post	NCB	2017/01/02	2016/12/22	2017/02/01			2017/05/15	2017/07/01						2018/07/01	
	IN-SPDCL-AP-2468-CW-RFB	Supply, Erection and commissioning of Covered conductor in Guntur city of Guntur District	6,009,615	Post	NCB	2017/01/02	2016/12/22	2017/02/01			2017/05/15	2017/07/01						2018/07/01	

	IN-SPDCL-AP-2469-CW-RFB	Supply & Implementation of SCADA for balance 33/11KV Substations in Vijayawada city of APSPDCL	12,019,231	Prior	NCB	2017/05/10		2017/06/10			2017/09/14	2017/11/04						2018/11/04	

Table 3.3 (contd)

PROCUREMENT PLAN FOR CONSULTANCY SERVICES for APSPDCL

Sl. No	Package No.	Description of Services	Estimated Cost USD	Review Type	Method of procurement	Preparation of TOR (Date)	Invitation of Expression of Interest (Date)	Short List and Draft Request for Proposals (Date)	Bank's No Objection to Evaluation of Technical Proposals (Date)	Bank's No Objection to Draft Negotiated Contract	Contract Signed (Date/Value/ Currency	Contract No.	Value of awarded contract in Equivalent INR Million	Value of awarded Contract in Equivalent US$ Million at ER: US$1 = INR 60	Name of Contractor/ Nationality & ZIP Code	World Bank Reference NO.	Date of Completion of Contract	Remarks
1	IN-SPDCL-AP-4920-CS-QCBS	Consulting Services to appoint a Third Party Evaluation Agency to determine the appropriate software for Consumer Care and Billing system in APSPDCL	142,860	Post	QCBS	2016/12/26	2017/01/16	2017/03/01	2017/04/28	2017/06/02	2017/07/07						2018/07/07	

Table 3.4

PROCUREMENT PLAN FOR APTRANSCO

Sl No	Package No.	Description of Works/Goods	Estimated Cost USD	Review Type	Method of procurement ICB/NCB	Preparation of Bid Document (Date)	Bank's No Objection to Bidding Documents (Date)	Bids			Bank's No Objection to Contract Award (Date)	Contract Signed (Date/Value/ Currency)	Contract No.	Value of awarded contract in Equivalent INR Million	Value of awarded Contract in Equivalent US$ Million at ER: US$1 = INR 69	Name of Contractor/ Nationality & ZIP Code	World Bank Reference NO.	Date of Completion of Contract	Remarks
								Invitation (Date)	Opened on (Date)-1st Envelope	Opened on (Date)-2nd Envelope									
1	*2*	*3*	*4*		*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*
1	IN-APTRANSCO-3145-CW-RFB / Package 1	Supply, erection & commissioning of I) 132/33kV SS Mummidivaram connected lines ii) 132/33kV SS Gollapalem & connected bays & lines III) 132/33kV SS at Jaggampet &connected bays & lines, IV)132/33kV SS Kothapalli (Gudipala) connected lines.	16,150,000	Prior	NCB	2016/11/08	2016/11/29	2016/11/10			2017/03/09							2017/04/18	

Table 3.5

PROCUREMENT PLAN FOR APEPDCL

Sl No	Package No.	Description of Works/Goods	Estimated Cost USD	Review Type	Method of procurement ICB/NCB	Preparation of Bid Document (Date)	Bank's No Objection to Bidding Documents (Date)	Bids			Bank's No Objection to Contract Award (Date)	Contract Signed (Date/Value/ Currency)	Contract No.	Value of awarded contract in Equivalent INR Million	Value of awarded Contract in Equivalent US$ Million at ER: US$1	Name of Contractor/ Nationality & ZIP Code	World Bank Reference NO.	Date of Completion of Contract	Remarks
								Invitation (Date)	Opened on (Date)-Ist Envelope	Opened on (Date)-2nd Envelope									
1	*2*	*3*	*4*		*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*
1	IN-EPDCL-2750-CW-RFB	Design, Supply and Erection of 3Nos. 33/11KV Indoor Substations in Vizianagaram Town, 3 Nos in Srikakulam town, 5 Nos in East Godavari District, 4 Nos in West Godavari District & 3 Nos GIS substations in Visakhapatnam City with connected 33KV & 11KV line	9,500,000	Post	NCB	2016/11/21		2016/11/26			2017/03/24	2017/04/28						2018/10/20	

Table 3.5

PROCUREMENT PLAN FOR APEPDCL

Sl No	Package No.	Description of Works/Goods	Estimated Cost USD	Review Type	Method of procurement ICB/NCB	Preparation of Bid Document (Date)	Bank's No Objection to Bidding Documents (Date)	Bids			Bank's No Objection to Contract Award (Date)	Contract Signed (Date/Value/ Currency)	Contract No.	Value of awarded contract in Equivalent INR Million	Value of awarded Contract in Equivalent US$ Million at ER: US$1	Name of Contractor/ Nationality & ZIP Code	World Bank Reference NO.	Date of Completion of Contract	Remarks
								Invitation (Date)	Opened on (Date)-1st Envelope	Opened on (Date)-2nd Envelope									
1	*2*	*3*	*4*		*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*
2	IN-EPDCL-2566-CW-RFB	Design, Supply & Conversion of existing LT network into High Voltage Distribution System in West Godavari Districts, of Andhra Pradesh on Turnkey Basis.	21,830,000	Prior	NCB	2016/10/25		2016/10/30			2017/02/23	2017/03/30						2019/03/29	
3	IN-EPDCL-2572-CW-RFB	Design, Supply & Conversion of existing LT network into High Voltage Distribution System in East Godavari District, of Andhra Pradesh on Turnkey Basis.	8,000,000	Post	NCB	2016/11/10	2016/11/04	2016/11/15			2017/03/11	2017/04/15						2019/04/14	

Table 3.5

PROCUREMENT PLAN FOR APEPDCL

Sl No	Package No.	Description of Works/Goods	Estimated Cost USD	Review Type	Method of procurement ICB/NCB	Preparation of Bid Document (Date)	Bank's No Objection to Bidding Documents (Date)	Bids			Bank's No Objection to Contract Award (Date)	Contract Signed (Date/Value/ Currency)	Contract No.	Value of awarded contract in Equivalent INR Million	Value of awarded Contract in Equivalent US$ Million at ER: US$1	Name of Contractor/ Nationality & ZIP Code	World Bank Reference NO.	Date of Completion of Contract	Remarks
								Invitation (Date)	Opened on (Date)-1st Envelope	Opened on (Date)-2nd Envelope									
1	*2*	*3*	*4*		*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*
4	IN-EPDCL-2577-CW-RFB	Design, Supply and Erection of 33/ 11KV Indoor Substations in Visakhapatnam District with connected 33KV and 11KV lines and control Rooms on Turnkey Basis.	21,670,000	Prior	NCB	2016/10/25	2017/01/11	2016/10/30			2017/02/23	2017/03/30						2018/09/29	
5	IN-EPDCL-2752-CW-RFB	Design, supply and erection of 33 and 11KV Interlinking lines in Sirkakulam, Vizianagaram, Visakhapatnam, East & West Godavari Districts on Turnkey.	8,840,000	Post	NCB	2016/12/30		2017/01/04			2017/04/30	2017/06/04						2018/11/26	

Table 3.5

PROCUREMENT PLAN FOR APEPDCL

Sl No	Package No.	Description of Works/Goods	Estimated Cost USD	Review Type	Method of procurement ICB/NCB	Preparation of Bid Document (Date)	Bank's No Objection to Bidding Documents (Date)	Bids			Bank's No Objection to Contract Award (Date)	Contract Signed (Date/Value/ Currency)	Contract No.	Value of awarded contract in Equivalent INR Million	Value of awarded Contract in Equivalent US$ Million at ER: US$1	Name of Contractor/ Nationality & ZIP Code	World Bank Reference NO.	Date of Completion of Contract	Remarks
								Invitation (Date)	Opened on (Date)-1st Envelope	Opened on (Date)-2nd Envelope									
1	*2*	*3*	*4*		*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*
6	IN-EPDCL-2755-CW-RFB	Design, supply and installation of Smart meters including installation of DCUs & Control Centre equipment with communication in Visakhapatnam City	24,167,000	Prior	NCB	2017/03/30		2017/04/04			2017/07/29	2017/09/02						2019/02/25	
7	IN-EPDCL-2756-CW-RFB	Design, supply and installation of Smart meters in Kakinada Town including installation of DCUs & integration with proposed Control Centre in Visakhpatnam	9,167,000	Post	NCB	2017/04/10		2017/04/15			2017/08/13	2017/09/17						2019/03/13	

Table 3.5

PROCUREMENT PLAN FOR APEPDCL

Sl No	Package No.	Description of Works/Goods	Estimated Cost USD	Review Type	Method of procurement ICB/NCB	Preparation of Bid Document (Date)	Bank's No Objection to Bidding Documents (Date)	Bids			Bank's No Objection to Contract Award (Date)	Contract Signed (Date/Value/ Currency)	Contract No.	Value of awarded contract in Equivalent INR Million	Value of awarded Contract in Equivalent US$ Million at ER: US$1	Name of Contractor/ Nationality & ZIP Code	World Bank Reference NO.	Date of Completion of Contract	Remarks
								Invitation (Date)	Opened on (Date)-1st Envelope	Opened on (Date)-2nd Envelope									
1	*2*	*3*	*4*		*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*
8	IN-EPDCL-2759-CW-RFB	TA and Capacity Building	5,000,000	Post	NCB	2017/06/15		2017/06/20			2017/10/14	2017/11/18						2019/05/15	
9	IN-EPDCL-2574-GO-RFB	Design & Supply of LT static CT operated Trivector meters with pilfer proof boxes	1,000,000	Prior	NCB	2016/11/09		2016/11/14			2017/03/10	2017/04/14						2018/10/11	

Table 3.5

PROCUREMENT PLAN FOR APEPDCL

Sl No	Package No.	Description of Works/Goods	Estimated Cost USD	Review Type	Method of procurement ICB/NCB	Preparation of Bid Document (Date)	Bank's No Objection to Bidding Documents (Date)	Bids			Bank's No Objection to Contract Award (Date)	Contract Signed (Date/Value/ Currency)	Contract No.	Value of awarded contract in Equivalent INR Million	Value of awarded Contract in Equivalent US$ Million at ER: US$1	Name of Contractor/ Nationality & ZIP Code	World Bank Reference NO.	Date of Completion of Contract	Remarks
								Invitation (Date)	Opened on (Date)-1st Envelope	Opened on (Date)-2nd Envelope									
1	*2*	*3*	*4*		*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*
10	IN-EPDCL-2751-CW-RFB	Supply and replacement of existing bare AAA conductor with Covered Conductor on 33KV/11KV lines in Visakhapatnam District	12,834,000	Prior	NCB	2016/11/29		2016/12/04			2017/03/30	2017/05/04						2018/10/26	

Table 3.5

PROCUREMENT PLAN FOR APEPDCL

Sl No	Package No.	Description of Works/Goods	Estimated Cost USD	Review Type	Method of procurement ICB/NCB	Preparation of Bid Document (Date)	Bank's No Objection to Bidding Documents (Date)	Bids			Bank's No Objection to Contract Award (Date)	Contract Signed (Date/Value/ Currency)	Contract No.	Value of awarded contract in Equivalent INR Million	Value of awarded Contract in Equivalent US$ Million at ER: US$1	Name of Contractor/ Nationality & ZIP Code	World Bank Reference NO.	Date of Completion of Contract	Remarks
								Invitation (Date)	Opened on (Date)-1st Envelope	Opened on (Date)-2nd Envelope									
1	*2*	*3*	*4*		*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*
11	IN-EPDCL-2754-CW-RFB	Design, Supply and implementation of SCADA DMS in 52, 33-11KV Subsations in Visakhapatnam City includes installation of RTUs, FRTUs, IEDs, RMUs, selection of Network Service Provider and integration with existing SCADA Control centre	13,340,000	Prior	NCB	2016/12/29		2017/01/03			2017/04/29	2017/06/03						2018/11/25	

Table 3.5

PROCUREMENT PLAN FOR APEPDCL

Sl No	Package No.	Description of Works/Goods	Estimated Cost USD	Review Type	Method of procurement ICB/NCB	Preparation of Bid Document (Date)	Bank's No Objection to Bidding Documents (Date)	Bids			Bank's No Objection to Contract Award (Date)	Contract Signed (Date/Value/ Currency)	Contract No.	Value of awarded contract in Equivalent INR Million	Value of awarded Contract in Equivalent US$ Million at ER: US$1	Name of Contractor/ Nationality & ZIP Code	World Bank Reference NO.	Date of Completion of Contract	Remarks
								Invitation (Date)	Opened on (Date)-1st Envelope	Opened on (Date)-2nd Envelope									
1	*2*	*3*	*4*		*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*
12	IN-EPDCL-2757-CW-RFB	Design, Supply and Conversion of existing LT network into High Voltage Distribution System in Srikakulam & Visakhapatnam Districts on Turnkey Basis (except supply of LTTVR meters)	19,167,000	Prior	NCB	2017/04/27		2017/05/02			2017/08/26	2017/09/30						2019/09/29	
13	IN-EPDCL-2758-CW-RFB	Design, Supply & Conversion of existing LT network into High Voltage Distribution System in Vizianagaram District on Turnkey Basis (except supply of LTTVR meters)	17,500,000	Prior	NCB	2017/05/09		2017/05/14			2017/09/07	2017/10/12						2019/10/13	

25. ***E-procurement System****:* The IAs will be using the NIC e-procurement system for all procurements. The NIC e-procurement system assessment was carried out against the multilateral development banks' requirements and has been accepted for use for procurements under Bank-funded Projects. This is likely to increase efficiency and transparency of procurement.

26. ***Systematic Tracking of Exchanges in Procurement (STEP*)**: The Project will use STEP a planning and tracking system which would provide data on procurement activities, establish benchmarks. The details of the procurement activities, presently prepared in the procurement plan have been transferred in the STEP system. Initial training on the operation of the STEP system has been provided to the procurement staff of the IAs.

27. ***Procurement Training****:* Key staff may be sent for trainings at ASCI (Administrative Staff College of India), Hyderabad / NIFM (National Institute of Financial Management), Faridabad. The Project could also avail of the free Massive Open Online Course on public procurement (www.procurementlearning.org) offered by the Bank as well as the paid Professional Diploma in Public Procurement course delivered through the Charter of Public Procurement Studies.

28. ***Procurement risk assessment****:* The IAs have been carrying out their own procurements on partial turnkey basis. However, they do not have the experience of procurement of plant, supply & installation on turnkey basis. The table below describes major procurement-related risks and the mitigation plan. The risk ratings have been decided based on both the probability of occurrence of various events as well as their likely impact. Based on the risk factors and mitigation measures, the overall procurement risk at this stage is "Substantial". The risk rating of procurement will be reviewed and updated periodically by the World Bank.

Table 3.6 : Assessed Procurement Risks and Mitigation Measures **(to be updated after PRAMS is completed)**				
Risk Factor	**Initial Risk**	**Mitigation Measure**	**Completion Date**	**Residual Risk**
Limited capacity in use of Bank's procurement procedures/guidelines resulting in delays in procurement and contract management processes	Substantial	- Use of skilled procurement staffs for handling procurement activities - Monitoring through procurement plan and quarterly reports - Use of e-Procurement and contract management tools - Attending training/workshops etc.	Continuous from year 1	Moderate
Non-compliance with agreed procurement arrangements	Substantial	- Training and hand-holding provided by the Bank - Prior and post reviews by the World Bank - Internal and external audits	Continuous from year 1	Substantial
External interference in the procurement process	Substantial	- Disclosure of procurement-related information - Appropriate handling of complaints	Continuous from year 1	Moderate
Overall Risk	**Substantial**			**Moderate**

29. Procurement methods: The table below describes the various procurement methods to be used for activities financed by the proposed loan. These along with agreed thresholds will be reproduced in the procurement plan. The thresholds indicated in the following table apply to the initial 18 month implementation period and are based on the procurement performance of the project; these thresholds will be modified as required. Domestic preference will (or will not) be applicable for International Competitive Bidding (ICB) procurement of goods as per Appendix 2 of the Procurement Guidelines.

Table 3.7 : Procurement Methods		
Category	**Method of Procurement**	**Threshold (US$ Equivalent)**
Works	International Competitive Bidding (ICB)	> 40,000,000
	National Competitive Bidding (NCB)	Up to 40,000,000 (with NCB conditions)
	Shopping	Up to 100,000
	Direct Contracting (DC)	As per paragraph 3.7 of Guidelines
	Public-Private Partnership (PPP) for Works	As per paragraph 3.14 of Guidelines
	Force Account	As per paragraph 3.9 of Guidelines
	Framework Agreement (FA)	As per paragraph 3.6 of Guidelines
Goods and non-consultant services (NCS)	International Competitive Bidding (ICB)	> 3,000,000
	Limited International Bidding (LIB)	wherever agreed by Bank
	National Competitive Bidding (NCB)	Up to 3,000,000 (with NCB conditions)
	Shopping	Up to 100,000
	Direct Contracting (DC)	As per paragraph 3.7 of Guidelines
	Public-Private Partnership (PPP) Services	As per paragraph 3.14 of Guidelines
	Force Account (only for NCS)	As per paragraph 3.9 of Guidelines
	Framework Agreement (FA)[25]	As per paragraph 3.6 of Guidelines
	Procurement from United Nations (UN) Agencies	As per paragraph 3.10 of Guidelines
Consultants' Services	Selection Based on Consultants' Qualifications (CQS)/Least-Cost Selection (LCS)	Up to 300,000
	Single-Source Selection (SSS)	As per paragraphs 3.9-3.11 of Guidelines
	Individuals	As per Section V of Guidelines
	Particular Types of Consultants	As per paragraphs 3.15-3.21 of Guidelines
	Quality- and Cost-Based Selection (QCBS)/ Quality-Based Selection (QBS)/ Selection under a Fixed Budget (FBS)	for all other cases
	(i) International shortlist (ii) Shortlist may comprise national consultants only	> 800,000 Up to 800,000

30. World Bank review of procurement: The World Bank will prior review (thresholds are based on "**Substantial**" rating, will be modified if risk rating is changed after assessment by Bank during the Project implementation) the following contracts:

a) Works including turnkey Supply & Installation of Plant and Equipment and PPP: All contracts more than US$10 million equivalent

b) Goods, Information Technology and Non-consulting Services: All contracts more than US$2 million equivalent

[25] DGS&D rate contracts may be used as framework agreement (FA) provided

Source : IEA India Energy Outlook 2015

c) Consultancy Services for selection of firms : All contracts more than US$1 million (INR 67 crores) equivalent;

d) Consultancy services for selection of individuals: All contracts above US$0.3 million (INR2 crores)

31. First contract issued by implementing agency [IA] will be subject to prior review irrespective of their value. In addition, the justifications for all contracts to be issued on the basis of LIB, single-source or direct contracting will be subject to prior review. The above thresholds are for the initial 18 month implementation period; based on the procurement performance of the project these thresholds may be subsequently modified. **Even for Post Review cases, the inputs of Bank on Technical Specifications / TORs will be obtained by Project.** The prior review thresholds will also be indicated in the procurement plan. The procurement plan will be subsequently updated annually (or at any other time if required) and will reflect any change in prior review thresholds. The World Bank will carry out an annual ex-post procurement review of the procurement falling below the prior review thresholds provided above. To avoid any doubts, the Bank may conduct at any time Independent Procurement Reviews (IPRs) of all the contracts financed under the Project.

32. **NCB Condition:** National competition for the procurement of goods and works according to the established thresholds will be conducted in accordance with paragraphs 3.3 & 3.4 of Section III of the Guidelines and the following provisions:

a) Only the model bidding documents for NCB agreed with the GoI Task Force (and as amended for time to time), shall be used for bidding;

b) Invitations to bid shall be advertised in at least one widely circulated national daily newspaper (or on a widely used website or electronic portal with free national and international access along with an abridged version of the said advertisement published in a widely circulated national daily inter-alia giving the website/electronic portal details from which the details of the invitation to bid can be downloaded), at least 30 days prior to the deadline for the submission of bids;

c) No special preference will be accorded to any bidder either for price or for other terms and conditions when competing with foreign bidders, state-owned enterprises, small-scale enterprises or enterprises from any given State;

d) Except with the prior concurrence of the Bank, there shall be no negotiation of price with the bidders, even with the lowest evaluated bidder;

e) Extension of bid validity shall not be allowed with reference to Contracts subject to Bank prior review without the prior concurrence of the Bank (i) for the first request for extension if it is longer than four weeks; and (ii) for all subsequent requests for extension irrespective of the period (such concurrence will be considered by Bank only in cases of Force Majeure and circumstances beyond the control of the Purchaser/Employer);

f) Re-bidding shall not be carried out with reference to contracts subject to Bank prior review without the prior concurrence of the Bank. The system of rejecting bids outside a pre-determined margin or "bracket" of prices shall not be used in the Project;

g) Rate contracts entered into by Directorate General of Supplies and Disposals (DGS&D) will not be acceptable as a substitute for NCB procedures unless agreed with the Bank on case to case basis. Such contracts will be acceptable however for any procurement under the Shopping procedures;

h) Two or three envelope system will not be used (except when using e-procurement system assessed and agreed by the Bank).

33. Record keeping. All records pertaining to award of tenders, including bid notification, register pertaining to sale and receipt of bids, bid opening minutes, bid evaluation reports and all correspondence pertaining to bid evaluation, communication sent to/with the Bank in the process, bid securities, and approval of invitation/evaluation of bids by the IAs would be retained by respective IAs.

34. Disclosure of Procurement Information*:* The following documents shall be disclosed on the Project website: (i) procurement plan and updates, (ii) invitation for bids for goods and works for all ICB, NCB and shopping contracts, (iii) request for expression of interest for selection/hiring of consulting services, (iv) contract awards of goods and works procured following ICB/NCB procedures, (v) list of contracts/purchase orders placed following shopping procedure on quarterly basis, (vi) short list of consultants, (vii) contract award of all consultancy services, (viii) list of contracts following DC or CQS or SSS on a quarterly basis, (xi) monthly financial and physical progress report of all contracts and (xii) action taken report on the complaints received on a quarterly basis.

35. The following details shall be sent to the Bank for publishing in the UNDB and World Bank external website: (a) invitation for bids for procurement of goods and works using ICB procedures, (b) request for expression of interest for consulting services with estimated cost more than US$300,000 (INR20,100,000), (c) contract award details of all procurement of goods and works using ICB procedure, (d) contract award details of all consultancy services with estimated cost more than US$300,000 (INR20,100,000) , and (e) list of contracts/purchase orders placed following SSS or CQS or DC procedures on a quarterly basis.

36. Further, the IAs will create a separate web-page for Bank funded Project and a separate procurement field in the Project web-page and will publish on their websites any information required under the provisions of ‘suo moto’ disclosure as specified by the Right to Information Act.

37. Implementation support: The World Bank will normally carry out implementation support missions, including review and support on procurement, on a semi-annual basis. Mission frequency may be increased or decreased based on the procurement performance of the Project.

38. Use of government institutions and enterprises: Government-owned enterprises or institutions in India may be hired for activities of a unique and exceptional nature if their participation is considered critical to achievement of Project objectives. In such cases the conditions provided in clause 1.13 of the Consultant Guidelines will be satisfied and each case will be subject to prior review by the World Bank.

Annex 4: Implementation Support Plan

INDIA: ANDHRA PRADESH 24X7 POWER FOR ALL PROJECT (P155038)

Strategy and Approach for Implementation Support

1. The strategy for implementation support has been developed based on the nature of activities involved in the project and their commensurate risk profile in accordance with the Systematic Operations Risk Rating Tool. The implementation Support Plan, as described below, will be a live document and will be reviewed regularly and revised, as and when required during project implementation.

2. **Technical.** The Bank will provide required support through sector specialists and institutional specialists to the utilities on technical aspects. The implementation support will be provided through at least two implementation support missions in a year and through continuous exchange of correspondence and regular communication. Frequent use of telecommunication will be resorted to maintain a close coordination among the Bank team and the project staff.

3. **Procurement.** Implementation support will include (a) reviewing procurement documents and providing timely no objection; (b) providing detailed guidance on the Bank's Procurement Regulations to the project staff; (c) monitoring procurement progress against the detailed Procurement Plan; (d) review of contract management activities; and (e) identifying the capacity-building/training need for project staff and officials of the utilities on procurement processing and providing training, if required. The support will be provided through regular interactions, half-yearly implementation support missions, and thematic implementation support missions, if required.

4. **Financial Management:** In the initial years, intensive implementation support is envisaged to ensure implementation of agreed financial management arrangements, which will be done through field visits (including half-yearly missions) and desk reviews. Financial Management support will cover, in addition to the operational status and capability of Financial Management systems, timeliness of release of funds to the Project, quality of financial reports, reconciliation of financial data, capacity building of Financial Management staff, review of IUFR/audit reports and follow up for mitigation of issues and implementation of recommendations, and ensuring that the agreed auditing, reporting, and disbursement arrangements are adhered to.

5. **Environmental and social safeguards.** The Bank safeguards specialists in the team will supervise various activities to ensure full compliance with the Bank's operational policies/procedures and the agreed readiness criteria for subprojects related to environment and social safeguards aspects. Gender issues will be covered, as required, by a social development/gender specialist. The implementation support will be provided through regular interactions, half-yearly implementation support missions, and thematic review missions, if required.

Implementation Support Plan

6. Most of the Bank team members will be based in the India country office, including the task team leader, technical, procurement, FM, and safeguards specialists, who would facilitate timely, efficient, and effective implementation support to the client.

7. Project implementation and supervision will be conducted through the following activities:

- Project launch, to be conducted soon after the project approval, to bring all project functionaries/ officials together and ensure a clear understanding of the project scope, design, process, and responsibilities
- At least two regular supervision missions in a year during the project duration
- Intermediate technical missions by specialists, as needed
- Quarterly implementation progress reports (physical and financial progress) prepared by the project PIUs
- A midterm review once the project is around halfway in project implementation/loan tenure to review the progress and assess the need for any mid-course correction
- An Implementation Completion and Results Report at the end of the project to assess achievement toward the PDO and lessons learned

8. The main focus of implementation support is summarized in Table 4.1 and skill mix required in Table 4.2.

Table 4.1. Key Focus of Implementation Support

Time	Focus	Skills Needed	Resource Estimate (staff weeks)	Partner Role
First twelve months	• Four Components Ensuring Preparation of the rest of the bidding documents. Implementation of Contracts according to schedule Fiduciary and Safeguards arrangements in place	Technical specialist	10	NA
		Procurement specialist	8	
		Environment specialist	5	
		Social development specialist	5	
		Financial management specialist	5	
		Institutional development specialist	10	
		Task team leader	10	
12–84 months	• Four Components	Technical specialist	8	NA
		Procurement specialist	6	

Table 4.1. Key Focus of Implementation Support				
Time	**Focus**	**Skills Needed**	**Resource Estimate (staff weeks)**	**Partner Role**
		Environment specialist	5	
		Social development specialist	5	
		Financial management specialist	4	
		Social development/gender specialist	2	
		Institutional development specialist	10	
		Task team leader	10	

Table 4.2. Skill Mix Required			
Skills Needed	**Number of Staff Weeks**	**Number of Trips (Annually)**	**Comments**
Technical specialist	10 for the first year and then 8 annually	3	–
Institutional development specialist	10 every year	3	–
Procurement specialist	8 for the first year and then 6 annually	2	Country based
Financial management specialist	5 for the first year and then 4 annually	2	Country based
Environment specialist	5 every year	3	Country based
Social specialist	5 every year	3	Country based
Social (Gender) specialist	2 every year	1	Country based
Communications specialist	2 every year	1	Country based
Task team leader	10 every year	3	–

Annex 5: Economic and Financial Analysis

INDIA: ANDHRA PRADESH 24X7 POWER FOR ALL PROJECT (P155038)

1. This annex presents the rationale for public financing of the Project, the valued added of the Bank support and presents the analysis of the Project's development impact in terms of expected benefits and costs[26]. The analysis finds that the Project investments will bring substantial economic benefits to Andhra Pradesh's economy by helping displace expensive diesel based self-generation, meet growing demand, and improve the efficiency of the power system. The baseline economic rate of return (ERR) of the "with project" scenario is 20.0 percent (NPV US$508 million) (INR3403 crores).

A. Rationale for public sector provision/financing

2. Under Government of India's *Power for All* program, the state of Andhra Pradesh is scaling up investments in the power sector to supply 24x7 electricity to residential, commercial and industrial consumer by 2019. The investment requirement for meeting *Power for All* commitments in the state is estimated at US$11.2 billion (INR750.4 billion), a quarter of which is required in the generation segment and the remaining three fourths in the transmission and distribution segments. The Government of Andhra Pradesh expects to draw significant private investment in generation through Independent Power Producers to double the installed generation capacity in the state of 8.3GW in 2015 to 16GW in 2019[27]. However, private investment is not expected to be available in the transmission and distribution segments and public investment is required to ensure that the additional generation can be evacuated efficiently by the state owned utilities.

B. Value added of the Bank's support

3. The key value additions that the Bank's support is expected to facilitate are:

- Support in identifying priority investments for loss reduction, and transmission system strengthening, through the introduction of integrated multi-voltage level load flow analysis. The state currently undertakes a more localized planning approach particularly at lower transmission levels of 132kV;

- Introduction of integrated distribution system planning across various, on-going or planned, state-funded and GoI-funded schemes, leading to efficient resource utilization while meeting the requirements of the 24X7 Power for All program;

- Support for the state in deploying newer ICT based technologies for improved system reliability and commercial performance of distribution companies;

[26] This analysis is consistent with the following World Bank guidelines: i) Operational Policy and Bank Procedure 10.00, Investment Project Financing, ii) Power Sector Policy and Investment Projects: Guidelines for Economic Analysis, iii) Social Value of Carbon in Project Appraisal 2014 and (iv) Discounting Costs and Benefits in Economic Analysis of World Bank Projects 2016.

[27] "Power for All", Government of Andhra Pradesh, 2015 retrieved at http://powermin.nic.in/sites/default/files/uploads/joint_initiative_of_govt_of_india_and_andhrapradesh_0.pdf

- Provision of international best-practice in smart grid development, and smart technologies;

- Provision of international best-practice in distribution utility management, and management information systems.

C. Development Impact

Project's Economic Rationale

4. Andhra Pradesh faces huge economic costs from not having a universal, cost effective and reliable supply of electricity. While more than 90 percent of the state has electricity connections, the state faces significant power shortages which are resolved through load shedding. The peak load deficit was 8.3 percent in FY 2014-15. Industries have suffered load shedding up to 40 percent of their demand in recent years. Similarly load relief has been imposed up to 4 hours in Municipal Corporations, 6 hours in Municipalities, and 12 hours in villages[28]. Consumers have to rely on expensive diesel generators for back up supply. Average annual per capita electricity consumption of Andhra Pradesh (1040 kWh)[29] is a third of the global average consumption (3,298 kWh)[30].

5. There is hence likely to be huge economic payoffs from the successful implementation *Power for All* program in Andhra Pradesh, which envisions a coordinated increase in investment across the entire power supply chain to increase the supply of electricity. Empirical studies on the relationship between electricity consumption and economic growth have found that a 1 percent increase in electricity consumption is associated with a 0.8 percent increase in economic growth. With improved electricity supply, Andhra Pradesh can be expected to launch itself into higher growth trajectory that is needed to reduce poverty to 3 percent by 2030. The proposed transmission and distributions investments are key part of *Power for All* program and as such critical for realizing the large economic gains associated with these reforms.

Investment requirements for 24X7 power in Andhra Pradesh

6. The investment requirements of the *Power for All* program in Andhra Pradesh were estimated by state electricity agencies with inputs from central transmission utility, Power Grid Corporation India Limited and the central planning agency, Central Electricity Authority. Andhra Pradesh will need to meet an energy requirement and peak demand of 82,392 GWh (or million units (MU) of electric energy) and 13,436 MW respectively by FY 2019 (Table 1) compared with 43,684 MU & 6,158 MW in 2015. To meet this growing demand, robust & reliable transmission and distribution network will be required. Investment requirement for transmission and distribution through to FY 2019 are estimated at US$5.6 billion (INR375.2 billion) and US$2.8 billion (INR187.6 billion), respectively[31].

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[28] Ibid

[29] "Rajya Sabha - Starred Question No. 897" (PDF). Ministry of Power, Govt. of India

[30] World Development Indicators 2016

[31] Government of Andhra Pradesh 2015

Table 5.1: Andhra Pradesh Electricity Demand Projection

Particulars	Unit	FY 14-15	FY 15-16	FY 16-17	FY 17-18	FY 18-19
Gross Energy Requirement (A)	MU	54,864	59,253	65,178	71,696	78,866
Energy Requirement - 2 hours Agri. Supply (B)	MU	1,740	3,759	4,136	4,549	5,004
Total Energy Requirement (C= A+ B)	MU	56,604	63,012	69,314	76,245	83,870
Energy Savings - Efficiency & Conservation (D)	MU	69	399	751	1,044	1,478
Net Energy Requirement (E=C–D)	MU	56,535	62,613	68,563	75,201	82,392
Peak Demand @ 70% System Load Factor (F)	MW	9,220	10,211	11,181	12,264	13,436

Source: AP Power for All Program 2015

Cost Benefit Analysis of Andhra Pradesh 24x7 Power for All Project

7. The economic viability of the Project was assessed through a cost-benefit analysis. Net benefits of the Project was calculated by comparing the "*with project*" and "*without project*" scenarios. In its entirety, the Andhra Pradesh *Power for All* program consists of transmission and distribution investment of more than US$8.5 billion (INR569.5 billion) to increase the evacuation capacity power system from 7.2GW in 2015 to 13.4GW in 2019[32]. Of this, US$560 million (INR3752 crores), excluding TA component, or 6.5 percent of the investments will be financed by the proposed Project. Since the entire Bank financing has not been allocated to specific schemes as yet, the project benefits have been calculated by proportionately allocating the overall benefits of the program to Bank investments.

8. A range of scenarios and sensitivities that reflect the uncertainties (and correlations) of key input variables are evaluated. The analysis includes a consideration of the relevant environmental and social externalities, both positive and negative. Monte Carlo simulation, which assumes input assumptions are defined as probability distributions rather than as single "best estimates", is used to analyze the possibility of more than one input assumption combines unfavorably.

Project costs

Capital costs

9. The total Project (financial) cost excluding price contingencies and interest during construction is US$560 million (INR3752 crores)(Table 5.2). This includes US$100 million (INR670 crores) of transmission investment, US$250 million (INR1675 crores) of rural distribution investments and US$210 million (INR1407 crores) of smart grid investments in urban areas. Subtracting price taxes and duties from the base cost, one obtains an economic cost of US$448 million (INR3001 crores).

[32] Government of Andhra Pradesh 2015, p 7

Table 5.2: Total Project Cost			
	Base Cost (US$ Million)	**Taxes and Duties (US$ Million)**	**Economic Cost (US$ Million)**
Transmission system strengthening	100	20	80
Distribution Investments – Rural	250	50	200
Smart Grid interventions in Urban areas	210	42	168
Total	560	112	448

10. The domestic content of the investment cost is estimated at 50 percent, which amount is subject to the standard correction factor (SCF) which corrects for distortions in the exchange rate. The SCF calculates to 0.96. The SCF adjusted economic cost calculates to US$439 million (INR2,941 crores).

Operating and maintenance costs

11. The operation and maintenance (O&M) costs of transmission and distribution investments are estimated as 2 percent and 5 percent of the capital costs, respectively which when adjusted for SCF, computes to US$11.4 million (INR76 crores) per year.

Cost of incremental generation

12. Costs of incremental generation constitute another economic cost for the Project. These costs, have been estimated using benchmarks provided by Central Electricity Regulatory Commission of India and ESMAP META tool. These range between US$0.83 million/MW to US$0.96 million/MW.

Negative global externalities

13. Negative global externalities constitute another economic cost of the proposed Project, given that the *Power for All* program will lead to increase in generation to meet additional demand. However, this impact will be muted as 50 percent of the additional electricity will go towards replacing diesel self-generation while the remaining 50 percent will help meet the growing electricity demand in the state. GHG emissions of the mix of electricity supplied through the grid are roughly equivalent to GHG emission from diesel self-generation. However, since the program would lead to an increase grid generation beyond the displacement of self-generation, there is an initial increase in GHG emissions. However, this increase would be balanced by the reduction in technical losses (which has been presented below). The GHG emission factors for different sources of generation is given in Table 5.3.

Table 5.3: GHG emission factors of generation

			coal	gas	Diesel
			super critical	CCGT	Self-gen
[1]	IPCC default	Kg/GJ	94.6	56.1	74.1
[2]	converted to mmBTU	Kg/mmBTU	89.7	53.2	70.26
[3]	efficiency	[ ]	0.37	0.5	0.4
[4]	heat rate	BTU/kWh	9222	7200	8530
[5]	emissions	kg/kWh	0.827200271	0.3830	0.60

14. Consistent with Bank guidance on the social value of carbon, carbon emission reductions are valued in the base case at US$30 (INR2010) in 2015 and increasing to US$80 (INR5360) in real terms by 2050. The low US$15 (INR1005) in 2015 increasing to US$50 (INR3350) in 2050) and the high paths (US$50 (INR3350) in 2015 increasing to US$150 (INR 10050) in 2050) for the social value of carbon suggested in the Bank guidance have are added to reflect a range of uncertainties and can be used for sensitivity analysis.

Project benefits

Energy generation

15. The investments proposed under the *Power for All* program are expected to increase the transmission capacity of Andhra Pradesh from 8.6 GW in 2016 to 13.4 GW in 2019. Without the program investments, the capacity would only increase to 10.1 GW by 2019. At a load factor of 0.70, this translates into additional annual energy transmitted through the system of 20,401GWh. After taking into account of technical losses of 13.1 percent, the additional electricity made available to consumers annually upon program completion is 17,722GWh. Of this, the additional electricity supply attributable to Project investments annually is 1,152GWh. Table 5.4 presents the detailed energy balance of the Project.

Table 5.4: Energy Balance of the Andhra Pradesh 24x7 Power for All Project

		2016	2017	2018	2019	2020	2021	2022
Energy supply without program	[GwH]	45619	50051	52209	53849	53849	53849	53849
Energy supply with program	[GwH]	54393	59560	65329	71572	71572	71572	71572
Additional supply with program	[GwH]	8773	9508	13120	17722	17722	17722	17722
Additional supply attributable to Bank Inv.	[GwH]	570	618	853	1152	1152	1152	1152
Technical loss without program	%	13.1%	13.1%	13.1%	13.1%	13.1%	13.1%	13.1%
Technical loss with program	%	12.9%	12.6%	12.3%	12.0%	12.0%	12.0%	12.0%
Technical loss reduced due to Program	[GWh]	1.4	3.4	7.2	13.0	13.0	13.0	13.0
Total addn. supply attributable to Bank project	[GWh]	570	618	853	1152	1152	1152	1152

Technical losses

16. Andhra Pradesh is projected to have technical losses of 13.1 percent in 2016. The investment proposed under this Project are forecast to reduce losses to 12 percent by 2019. This level of transmission losses is expected to be maintained at this level beyond 2019.

Incremental benefits

17. The additional electricity made available by the increase in transmission capacity can be valued at the consumers' *Willingness to Pay (WTP)* for electricity supply. The *Willingness to Pay* analysis is typically based on computing the area under a derived demand curve during each year of the project's life. The key parameters needed to determine the area under the curve include total demand in each year of the project, the price elasticity of demand, and the marginal tariff.

18. However, given the difficulties in reliably establishing these parameters for Andhra Pradesh, this economic analysis uses estimates of average *Willingness to Pay* based on diesel self-generation costs for the industry and commerce sector and the prevailing electricity tariff for the domestic and agriculture sectors. Table 5.5 presents the estimates of *Willingness to Pay* for different sector for FY 2016. These diesel self-generation costs have been projected through to 2043 based on diesel price forecast in World Bank's April 2016 Commodity Price Forecasts.

19. The *Willingness to Pay* estimate of domestic and agriculture sectors is conservative because household and farmers that use diesel generators to cope with power shortages, will have higher *Willingness to Pay* than the prevailing electricity tariff. This method of estimating the *Willingness to Pay* also does not include consumer surplus from electricity consumption. Given this uncertain estimate of *Willingness to Pay*, sensitivity analysis has been carried out around this value, with cost of diesel self-generation as the upper limit. Switching values have also been calculated.

Table 5.5: Estimate of average WTP (based on avoided cost and tariff)

Sector	Share	WTP (INR/KWh)	Assumptions
Industry	33%	14.10	30% Utilization Factor of diesel gensets; capital costs of US$383/kw
Commercial and others	17%	14.10	30% Utilization Factor of diesel gensets; capital costs of US$383/kw
Agriculture	27%	3.37	Half of tariff for highest consumption slab
Domestic	24%	7.75	Tariff for highest consumption slab in APERC 2016 Tariff order
Total	100%		
	Weighted average (USc/KWh)	15.7	

Source: ESMAP META, APERC Tariff Order 2016-1027

Avoided local externalities

20. Local damage costs resulting from sulphur dioxide (SO_2), nitrogen oxides (NO_x), and particulate matter (PM_{10}) emissions of self-generation (in densely populated urban areas with no pollution controls and emissions near ground level) are an order of magnitude greater than grid

based supply in more remote rural areas[33]. As a result, local damage costs are lower under the "*with project*" scenario than under the "*without project*" scenario[34]. This is in contrast to GHG emissions which are higher under the "*with project*" scenario than under the "*without project*" scenario.

The emission factors for SO_2, NO_x, and PM_{10} for coal generation plants in India from Cropper et al.(2012). Damage costs are from the latest version of the World Bank's Guidelines for Economic Analysis of Power projects (which are based on the 2015 Update of the Six Cities Study) (Table 5.6). The local environmental damage costs of coal are based on modern coal units with state-of-the art pollution control (and tall stacks).

Table 5.6: Local Environmental and Health Damage Costs

	Units	**No_x**	**PM_{10}**	**SO_2**
Emission Factor, coal	g/kwh	2.09	0.227	1.44
Emission Factor, gas	g/kwh	1.79	0	0
Emission factor, self-generation	g/kwh	18.8	1.34	0
Damage costs, coal	US$/ton	16	66	21
Damage costs, gas	US$/ton	16	66	21
Damage costs, self-generation	US$/ton	575	2,396	767

Economic Analysis:

Assumptions

21. In addition to the costs and benefits noted in the previous section, the economic analysis rests on the following additional assumptions:

- Discount rate: The Bank's guideline on discount rate, issued in May 2016, recommends the use of discount rate twice the expected long term per capita growth rate[35]. Since India has grown at an average rate of 5 percent over the last 20 years and can be expected to maintain this rate going forward, a 10 percent discount rate is

[33] Diesel self-generation mostly occur in densely populated areas with low stacks, and are rarely fitted with pollution controls. Moreover, particulate emissions, largely absent from gas are particularly damaging to human health.

[34] This is despite the fact that only 50 percent of the additional electricity will go towards replacing diesel self-generation while the remaining 50 percent will help meet the growing electricity demand in the state.

[35] The guidance on appropriate social discount rates is anchored in welfare economics. Standard welfare analysis tells us that the net benefits of a project at different points in time should be valued according to their marginal impact on welfare at the time they occur. Higher (lower) growth prospects would normally imply a higher (lower) discount rate for a particular country. Given reasonable parameters for the other variables in the standard Ramsey formula linking discount rates to growth rates, a 3 percent per capita growth rate translates into a 6 percent discount rate, and per capita growth rates of 1 percent-5 percent yield discount rates of 2 percent-10 percent.

used in this analysis in the base case together. NPV values for 6 percent discount rate is presented as a sensitivity analysis.

- Construction cost phasing: as follows:

2016	2017	2018	2019
20%	20%	30%	30%

Results

22. The baseline Economic Rate of Return (ERR) of the "*with project*" scenario is 19.9 percent (NPV US$508 million/INR3403 crores) (Table 5.7). The additional energy supplied as a result of the transmission and distributions lines accounts for 95 percent of the benefits and reduction in technical losses accounting for the remaining benefits. The avoided local environment damage cost from the Project (+2.7 percent) helps cancel out the global environmental damage cost from the Project (-3.1 percent) – so that the Project ERR without environmental benefits (19.9 percent) is about the same as the Project ERR with environmental benefits (20.0 percent)[36].

23. Sensitivity analysis on the value of carbon using the low case (increasing from US$15 (INR1005) per ton in 2015 to US$50 (INR3350) in 2050) and high case (increasing from US$50 (INR3350) per ton in 2015 to US$150 (INR10050) in 2050) is presented in Table 5.9. There is a 3 percentage point difference in the ERR between the low case and high case social value of carbon.

Table 5.7: Summary of Economic Analysis

		NPV	2016	2017	2018	2019	2020	2021	2022
Generation Costs	[$USm]	*613.1*	350.1	23.0	31.3	35.2	35.1	35.2	35.1
Transmission Costs	[$USm]	*62.2*	16.0	16.0	24.0	24.0			
Distribution Costs	[$USm]	*286.1*	73.6	73.6	110.4	110.4			
Distribution O&M Costs	[$USm]	*29.5*	0.0	0.8	1.6	2.8	4.0	4.0	4.0
Transmission O&M Costs	[$USm]	*54.3*	0.0	1.5	2.9	5.2	7.4	7.4	7.4
total costs	**[$USm]**	**1045.3**	**439.7**	**114.9**	**170.2**	**177.5**	**46.4**	**46.6**	**46.4**
Benefits									
Additional electricity supplied	[$USm]	*1553.0*	89.7	97.2	134.1	181.2	181.2	181.2	181.2
of which technical loss reduced	[$USm]	*102.3*	1.4	3.4	7.2	13.0	13.0	13.0	13.0
Collection loss reduced	[$USm]	*1.0*	0.0	0.0	0.0	0.0	0.0	0.0	0.0
total benefits	**[$USm]**	*1553.0*	**89.7**	**97.2**	**134.1**	**181.2**	**181.2**	**181.2**	**181.2**
total economic flows	**[$USm]**	507.8	**-350.0**	**-17.7**	**-36.1**	**3.7**	**134.7**	**134.6**	**134.7**
ERR	[ ]	**19.9%**						*-8.8%*	*0.2%*
local environmental impacts		164.4	4.1	4.7	7.0	10.1	10.9	11.7	12.5
economic flows including local env.	[$USm]	672.1	-346.0	-13.0	-29.1	13.8	145.6	146.3	147.3
ERR including local env.	[ ]	**22.2%**							
avoided GHG emissions	[$USm]	*-130.5*	-5.7	-6.3	-9.0	-12.5	-12.5	-13.3	-13.6
econmic flows incl. global GHG benefits	**[$USm]**	**541.7**	**-351.6**	**-19.3**	**-38.1**	**1.2**	**133.1**	**133.1**	**133.7**
ERR including global GHG	[ ]	**20.0%**							

[36] Although only 50 percent of the additional electricity supply resulting from the project goes towards displacing diesel self-generation, this is sufficient to lower the local environmental damage costs because damage costs associated with diesel self-generation are many times those from grid base supply. This does not, however, apply to GHG emissions. Grid and diesel self-generation have similar GHG emission factors and since the project results in an increase in electricity supply, there is a net increase in GHG emissions from the Project.

24. Table 5.8 shows the summary of the calculations of the economic returns, for both 10 percent and 6 percent discount rates.

Table 5.8: Economic Analysis Results

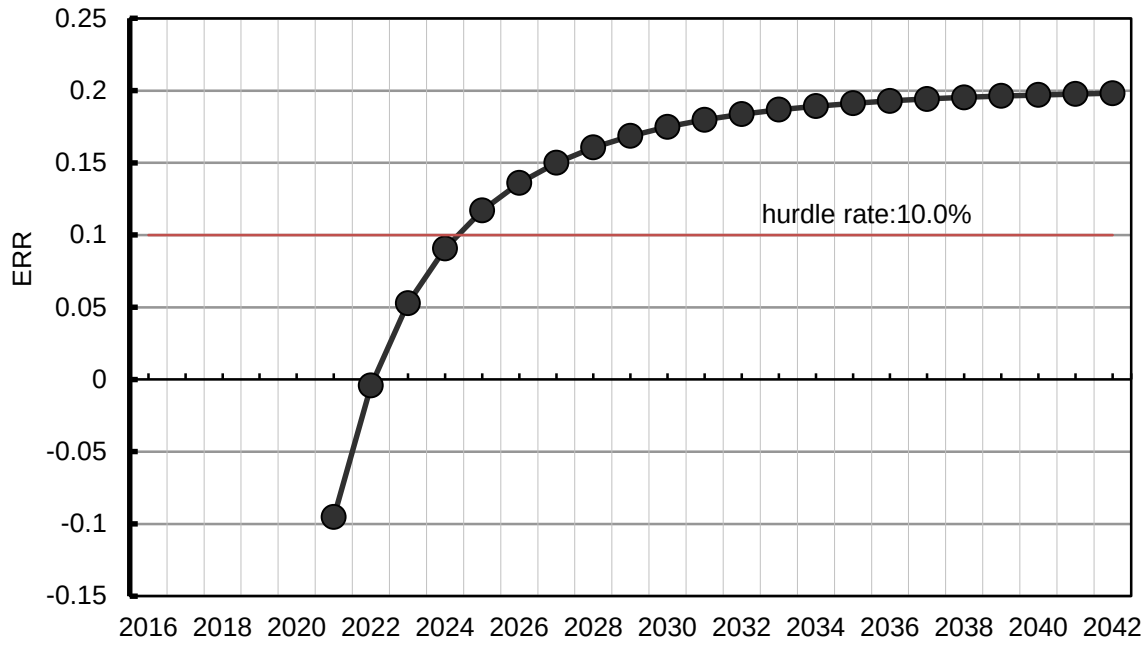
			Base Case		Sensitivity
[1]	Discount rate		10.0%		6.0%
[2]	**Economic rate of return**				
[3]	ERR	[ ]	19.9%		19.9%
[4]	ERR+local externalities	[ ]	22.2%		22.2%
[5]	ERR+local+GHG@BankGuidanceValues	[ ]	20.0%		20.0%
[6]	Levelized cost of elec. through grid	US$/kWh	0.11		0.09
[7]	Levelized cost of diesel self generation	US$/kWh	0.23		0.23
[8]	**Composition of NPV**				
[9]	*Costs*				
[10]	Generation Costs	[$USm]	613		796
[11]	Trasmission Costs	[$USm]	62		68
[12]	Distribution Costs	[$USm]	286		315
[13]	Transmission O&M	[$USm]	54		88
[14]	Distribution O&M	[$USm]	30		48
[15]	**total costs**	**[$USm]**	**1045**		**1316**
[16]	*Benefits [additional supply of electricity]*				
[17]	Additional electricity supplied	[$USm]	1553		2403
[18]	of which Technical loss reduced	[$USm]	102		163
[20]	**total benefits**	**[$USm]**	**1553**		**2403**
[21]	**NPV (before environmental benefits)**	**[$USm]**	**508**		**1087**
[22]	local env. benefits: avoided grid gen.	[$USm]	164.4		314.3
[23]	NPV (incl. local environmental benefits)	[$USm]	**672**		**1401**
[24]	value of avoided GHG emissions	[$USm]	-130		-217
[25]	**NPV (including environment)**	**[$USm]**	**542**		**1185**

Table 5.9: Sensitivity on Social Value of Carbon

Social Value of Carbon	**EIRR**
Low Case	21.1
Base Case	20.0
High Case	18.5

25. The payback period of the investment is very short – the hurdle rate of 10 percent is already reached in the fifth year of project completion (Figure 22).

Figure 22: ERR Vs Time



26. The Project achieves robust rates of economic return despite the conservative estimates for *Willingness to Pay* used in the analysis[37]. As demonstrated in the sensitivity analysis in the next section, higher estimates of average *Willingness to Pay* would lead to significant increase in the economic returns of the Project. The results of the cost benefit analysis indicate the incremental transmission and distribution investments financed by the Project will bring substantial economic benefits to Andhra Pradesh's power sector.

Project Risks

Construction cost overruns

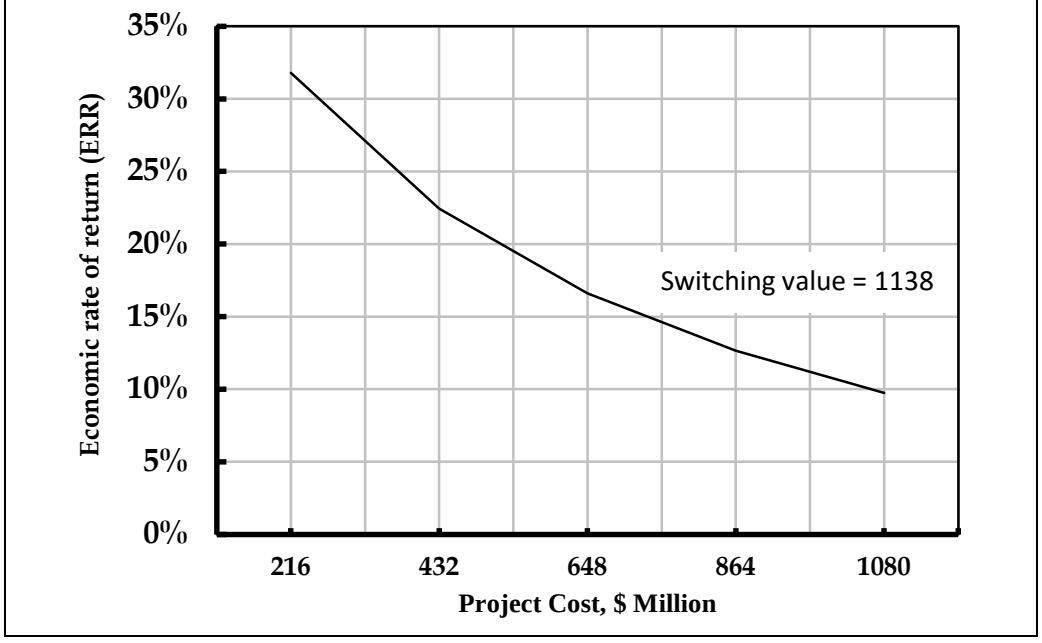
27. Past experience with Bank financed power sector projects indicate that there is an optimism bias with regards to project costs and construction schedules. A review of 135 power projects carried out by the Bank in 1996 found that the actual project cost (in current prices and excluding interest during construction) exceeded the estimated project costs on average by 21 percent of the estimated project cost, and the actual project implementation periods exceeded the estimated

[37] The use of prevailing tariff to estimate average tariff rates for agricultural and domestic consumers is an extremely conservative estimate of the average WTP for these consumers.

periods on average by 36 percent of the estimated periods. These estimates are consistent with the Bank's experience in India. The Fifth Power System Development Project that is under implementation is now expected to close two year behind of schedule in May 2017 instead of the original closing date June 2015. While construction cost overruns have not been an issue recent in transmission projects, this continues to be a potential risk factor for this Project if equipment prices increase unexpectedly.

28. Figure 23 shows the sensitivity of ERR to construction cost overruns. The switching value (i.e. the value at which the ERR to the hurdle rate of 10 percent) is US$963 million (INR6,452 crores), or 122 percent higher than the baseline value of US$4448 million (INR29,801 crores). Given that costs of transmission investments are well established, cost overruns of this magnitude must be considered extremely unlikely.

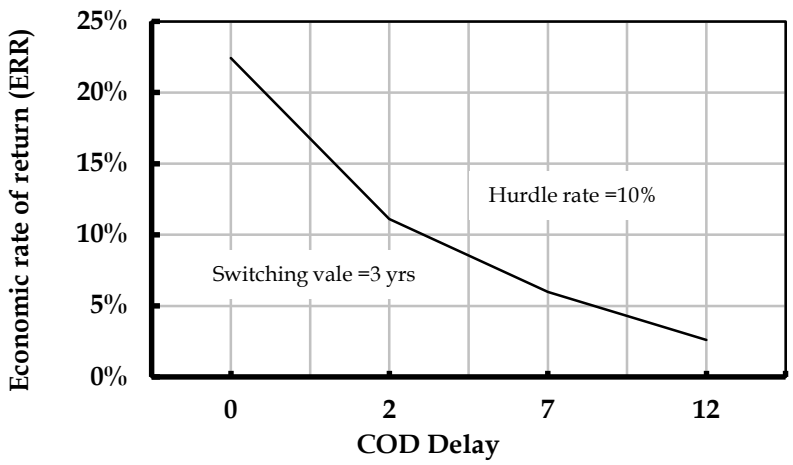
Figure 23: ERR Vs Project Cost Overruns



Commercial Operation Date (COD) delays

29. Given the scale of the investments proposed under Andhra Pradesh *Power for All* program as well as the necessity of coordinating these investments with generation investments, there is risk that the proposed investments may be delayed.

Figure 24: ERR Vs COD delay



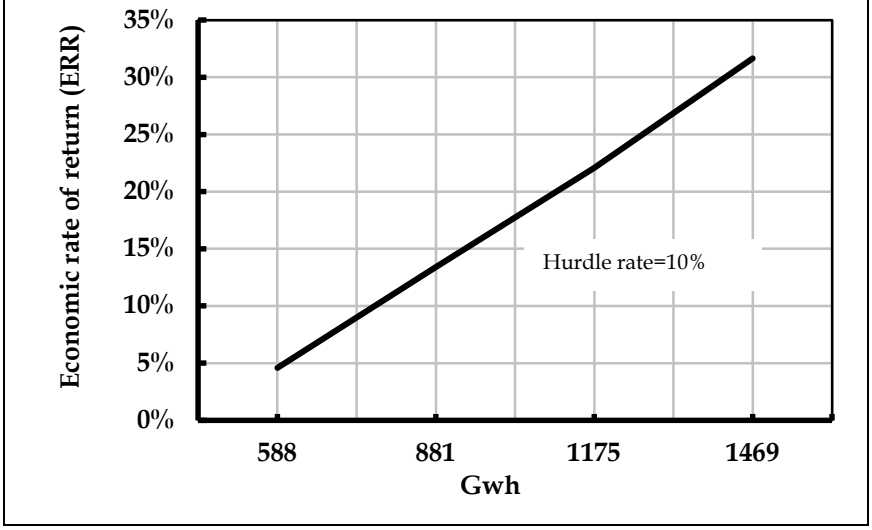
30. Figure 24 shows the sensitivity of ERR to COD delays under a worst case scenario in which the delay occurs after the bulk of the investment outlays have been made – with a switching value of 3 years: in other words, even if the Project investment were complete, and for some reason there is a delay of 3 years before the start of operation, the Project still meets the hurdle rate. The Project would hence have to be delayed significantly beyond the initial construction period of 4 years for the returns on the project to fall below the hurdle rate.

Shortfall in electricity supply

31. The economic returns of the Project depend entirely on the amount of additional electricity generation that will be delivered to consumers using transmission and distribution infrastructure. If the projected amount of additional electricity is not delivered for any reason[38], the economic returns of the Project will be lower. Figure 25 shows the sensitivity of ERR to additional electricity wheeled annually with a switching value of 764GwH. This indicates that the Project would meet the hurdle rate as long as the additional electricity evacuated using the transmission lines is at least two thirds of the planned 1152GwH. While such a scenario cannot be completely ruled out, it is highly unlikely.

[38] This could be because of supply side (i.e. delays in the construction of new generation plants) or demand side (i.e. shortfalls in projected demand) reasons.

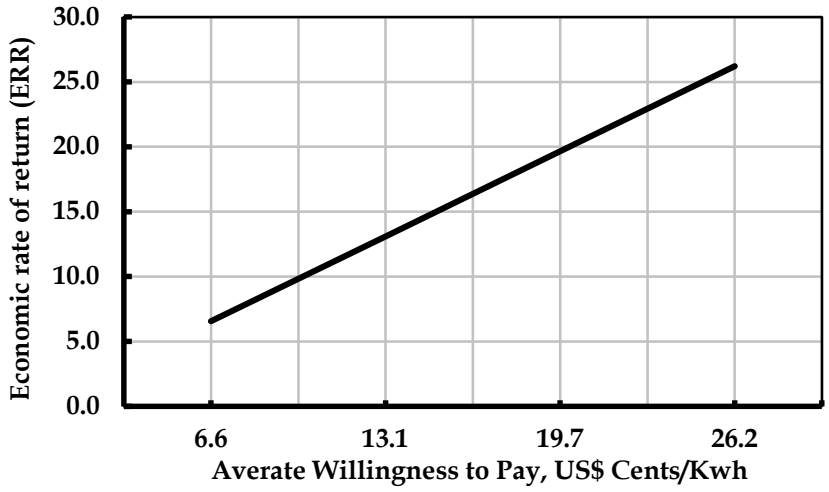
Figure 25: ERR Vs Shortfalls in Electricity Supply



Average Willingness to Pay

32. As mentioned above, the additional electricity evacuated by the Project is valued base on avoided costs of self-generation for industrial and commercial customers and the prevailing tariff for domestic and agriculture customers. This is a conservative estimate of average *Willingness to Pay* because there are likely to be some domestic and agricultural customer who make use diesel generator sets and have higher average *Willingness to Pay* than the prevailing tariff. In addition, this method of estimating the *Willingness to Pay* also does not include consumer surplus from electricity consumption. The values used in this economic analysis are, hence, subject to high uncertainty. However, as shown in Figure 26, the switching value is just 10.5 US cents (INR703.5)/kWh, a third less than the baseline estimate.

Figure 26: ERR Vs Average Willingness to Pay



Switching Values

33. The switching values analysis is summarized in Table 5.10. The analysis indicates that the Project is robust to the major risk factors, and to the main input assumptions. In particular, it is seen that the Project is robust to significant delays in the implementation schedule as well shortfalls in electricity supply.

Table 5.10: Switching Values

Input	Unit	Baseline Value	Switching Value
Cost Overrun	US$ Million	448	1138
Construction delay	Years	0	3
Additional energy wheeled	GwH	1,152	772
Willingness to Pay	US$ cents	15.7	10.5

Risk assessment using Monte Carlo simulations

34. The objective of risk assessment is to derive a probability distribution of economic returns. This is achieved by using Monte Carlo simulation, in which the input variables to the calculation of returns are specified as probability distributions rather than as single "best estimates". The ERR then is calculated for each random drawing from these probability distributions (typically repeated 5,000-10,000 times), from which the probability distribution for economic returns follows. The following is the assumed probability distributions for the uncertainty in input assumptions as well as the rationale for the hypothesized distributions (Table 5.11):

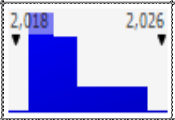
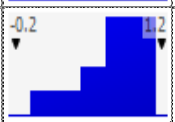
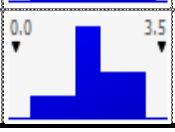
- Capital Cost: skewed to the right, given the experience that capital cost estimates tend to be higher than assumed, rather than lower than assumed

- Willingness to Pay: skewed to the right, reflecting that the average WTP estimates used in the analysis are conservative estimates

- Additional Energy Evacuated; skewed to the left to account of risks that can disrupt electricity supply in Andhra Pradesh

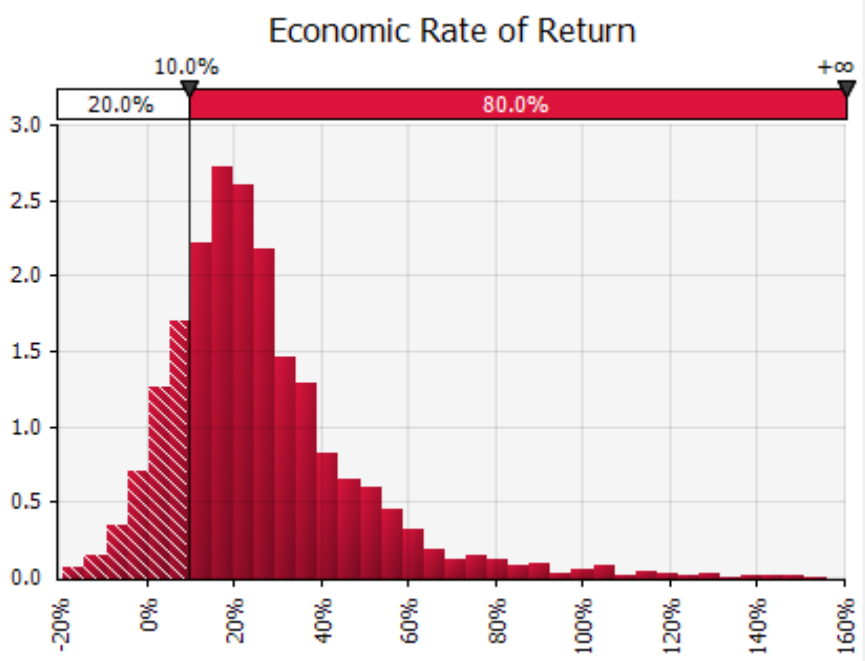
- COD Delay; skewed to the right based on past experience with similar projects.

Table 5.11: Assumed probability distributions of input variables

Name	Cell	Graph	Function	Min	Mean	Max
Capital cost	D13		RiskHistogrm(0.75,1.5,{0,0.1,0.4,0.2,0.1},RiskStatic(1))	0.9	1.18125	1.5
Project completion	D14		RiskHistogrm(2019,2025,{0.4,0.3,0.1,0.1,0.1},RiskStatic(2019))	2019	2021.04	2025
Additional Electricity	D15		RiskHistogrm(0,1.1,{0.1,0.1,0.2,0.4,0.4},RiskStatic(1))	0	0.715	1.1
Average WTP	D16		RiskHistogrm(0.5,3,{0.1,0.1,0.4,0.2,0.2},RiskStatic(1))	0.5	1.9	3

35. Figure 27 shows the results of the Monte Carlo simulation, shown as the probability distribution of economic returns. The probability that returns fall below the hurdle rate is 20 percent (i.e. the area under the curve to the left of 10 percent). The mean of the ERR probability functions (25.9 percent) is higher than the ERR based on “most likely” values (20.0 percent).

Figure 27: Probability distribution of ERR



Statistics	
	Economic Rate of Retu..
Cell	MCarlo Analysis!G54
Minimum	-18.87%
Maximum	155.92%
Mean	25.87%
Mode	16.29%
Median	21.94%
Std Dev	21.44%
Skewness	1.5966
Kurtosis	7.4596
Values	4694
Errors	306
Filtered	0
Left X	10.0%
Left P	20.0%
Right X	+∞
Right P	100.0%
Dif. X	+∞
Dif. P	80.0%

Financial analysis

36. The financial analysis of the Project was carried out by valuing the additional electricity delivered as a result of the project in financial terms (i.e. the average electricity tariff), adding taxes and duties to the Project costs used in the economic analysis and excluding global and environmental benefits from the Program benefit. The analysis shows that Financial Internal Rate of Return (FIRR) of the Project will depend on the electricity tariff trajectory approved by the state electricity regulatory commission. As shown in Table 5.12, an annual increase in average electricity tariff of 5 percent yields a Financial Internal Rate of Return (FIRR) of 8.3 percent for the two Andhra Pradesh distribution companies. The Andhra Pradesh will receive a return on capital employed of 12.5 percent, as per current APERC tariff order.

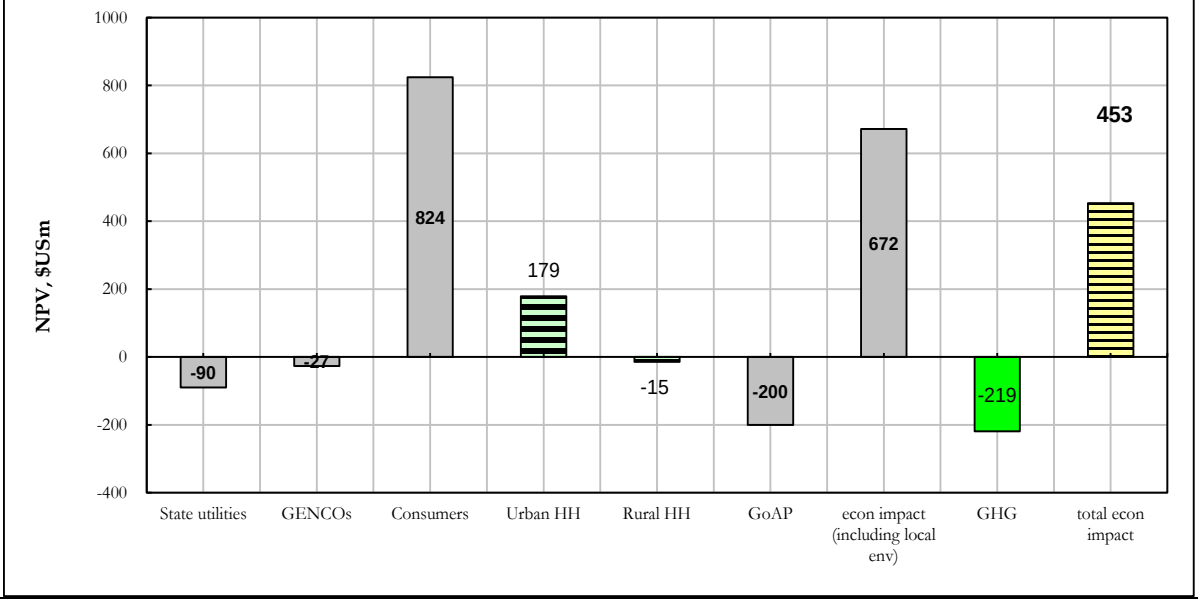
Table 5.12: Financial Internal Rate of Return								
			NPV	2016	2017	2018	2019	20
	Discoms							
	benefits							
[1]	Projected Average Tariff	INR/KwH	*104.5*	6.19	6.5	6.9	7.3	
[2]	Additional electricity wheeled	[GWh]	*9914.9*	570	618	853	1152	11
[3]	Additional Electricity Revenue	INRmillion	*112638.8*	3532	4035	5869	8355	88
[4]		$USm	*1298.3*	55.2	61.5	87.3	121.4	124
[5]	of which VAT	$USm	*129.8*	5.5	6.2	8.7	12.1	12
[6]	total benefits		*1298.3*	55.2	61.5	87.3	121.4	124
[7]		$USm						
[8]	***costs***							
[9]	Power Purchase Cost	$USm	*773.6*	55.2	58.4	78.7	103.8	101
[10]	of which VAT	$USm	*77.4*	5.5	5.8	7.9	10.4	10
[11]	Distribution Costs	$USm	*374.8*	81.0	82.6	124.7	127.1	8
[12]	of which Taxes	$USm	*37.5*	8.1	8.3	12.5	12.7	0
[13]	Payments to APTRANSCO		*110.1*	11.9	11.9	11.9	11.9	11
[14]	net cash flows	$USm		-98.4	-97.6	-136.7	-133.5	-8
[15]	**aggregate FIRR**	**[ ]**		**8.3%**				

Distributional analysis

37. A distributional analysis of the Program shows broad based gains to different groups from the Project (Table 5.13 & Figure 28). Electricity consumers in Andhra Pradesh are the biggest gainers while Government of Andhra Pradesh sees some reduction in tax revenue. There are local benefits in the form of avoided damage costs of local pollutants while there is net increase in GHG emissions and global damage costs.

Table 5.13: Distributional Analysis										
		State utilities	GENCOs	Consumers	Urban HH	Rural HH	GoAP	econ impact (including local env)	GHG	total econ impact
		[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
[1]	**Utilities**									
[2]	electricity purchases from gencos	-773.6	696.3				77	0.0		0.0
[3]	transmission investments	-110.1					18	-91.7		-91.7
[4]	distribution investments	-374.8					34.3	-340.4		-340.4
[5]	subsidy payments	181.2					-181.2			0.0
[6]										
[7]	**Consumers**									
[8]	electricity payments	987.3		-1117.1			129.8	0.0		0.0
[9]	avoided coping costs			1941			-388.3	1553.0		1553.0
[10]										
[11]	**Generators**									
[12]	capital costs		-377.0				75	-302		-302
[13]	fuel costs		-346.1				35	-311.5		-311.5
[14]										
[15]	**Environmental benefits**							0.0		0.0
[16]	avoided GHG emissions							0.0	-219.1	-219.1
[17]	avoided local health damage costs				179.0	-14.6		164.4		164.4
[18]										
[19]	Net impact (NPV)	-90	-26.8	824.2	179.0	-14.6	-199.9	672	-219	453
	Discount rate:=	10.0%					ERRs>	22.2%		18.5%

Figure 28: Distributional Analysis of Costs and Benefits



Annex 6: Financial Projections of Andhra Pradesh Distribution Companies

INDIA: ANDHRA PRADESH 24X7 POWER FOR ALL PROJECT (P155038)

1. Andhra Pradesh Distribution utilities started incurring losses from FY 2013 onwards despite breaking even in the immediate preceding years. The key reason for this trend was the reliance on costly short term power purchases to meet the rising demand, which was not reflected at its true costs in the regulatory tariff orders. For more details please refer to Annex 2.

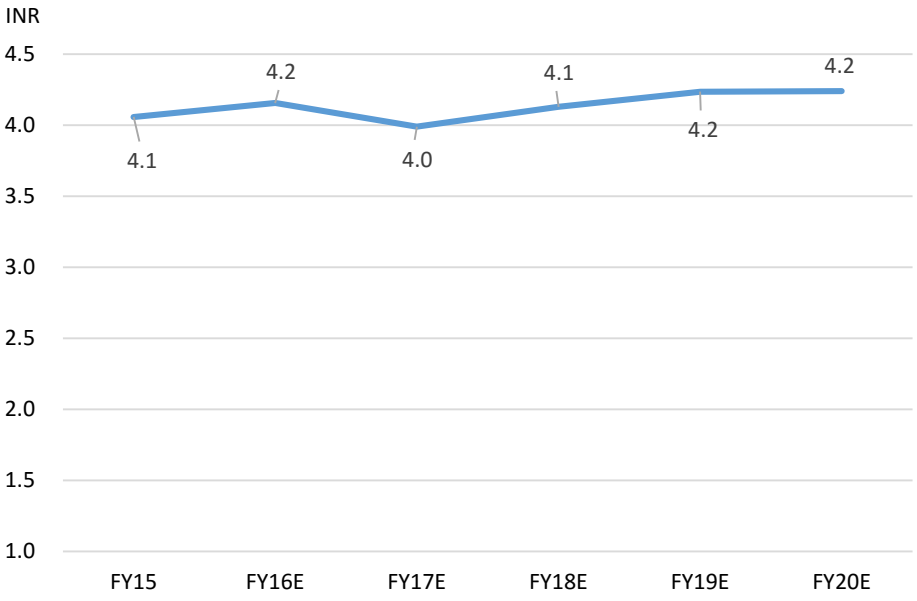
Financial Projections:

2. A detailed financial analysis has been undertaken to understand the business environment that is expected to exist in the future. Some of the assumptions are explained in the following paragraphs.

3. ***Generation planning is expected to improve the financial performance***: Realizing the constraints and costs of power purchases, Andhra Pradesh distribution companies have signed long term PPAs with a number of generation plants, some of which have started generating towards the end of FY 2016 and others are expected to start generating progressively over the next two to three years. These total to upwards of 3500MW of power and the average costs of power purchased from these plants is significantly less compared to the cost of short term power purchases {The weighted average cost of power purchase from these plants is estimated at US$0.063/kWh (INR4.3/kWh) vs US$0.085/kWh (INR5.7/kWh) for short term power in FY 2016}.

4. Thus, the power purchase cost in the state is expected to plateau over FY 2017-FY 2020. While power purchase costs grew at a CAGR of 9.6 percent over FY 2011-15, they are expected to grow at a CAGR of 0.8 percent over FY 2015-FY 2020.

Figure 29: Average Costs of Power Purchase are Expected to Plateau after Significant Rise till FY15 (INR/kWh)

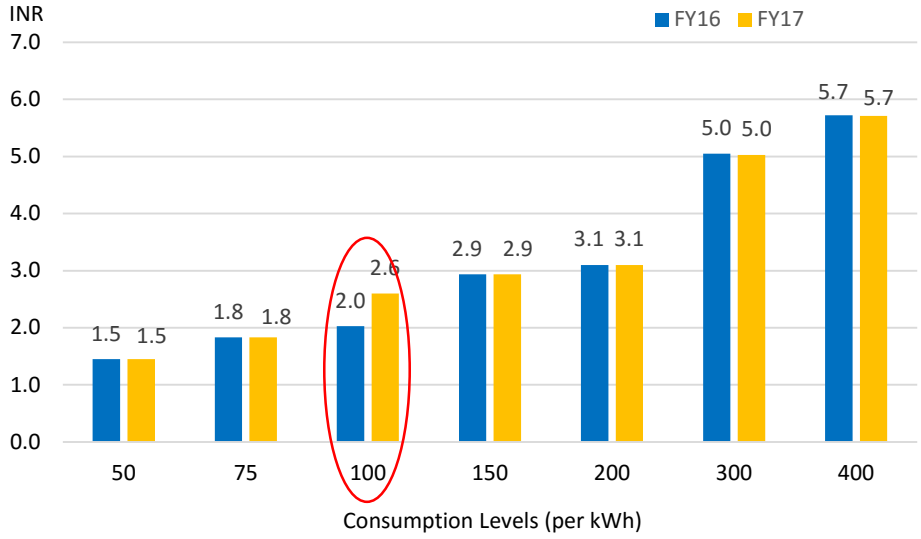


5. **Debt restructuring program - UDAY**: The state of Andhra Pradesh has also signed UDAY MoU, under which it shall take over 75 percent of the debt of distribution companies (by transferring the benefit to the distribution companies in the form of grants), thus reducing the interest and debt servicing burden from the distribution companies. Further, it has also agreed to provide Operational Funding Requirement (OFR) support to the distribution companies till the distribution companies achieve the financial turnaround. The reduced debt burden on the distribution companies is expected to lead to reduced interest outgo, full impact of which would be seen in FY 2018. As a conservative estimate, the model does not assume any OFR support from the state government going ahead.

Table 6.1: Schedule for Debt takeover by the state government		
Timelines	**Debt takeover under UDAY**	**Debt takeover of FRP, 2012**
30th Sep, 2016	INR 42.3 bn	INR 15 bn
31st Mar, 2017	INR 21.2 bn	INR 10.5 bn

6. **Tariff:** Andhra Pradesh Electricity Regulatory Commission in its FY 2017 tariff order has made a major change to the tariff structure for the domestic category consumers. The old tariff structure had four slabs in the domestic consumer category based upon the monthly consumption viz. 0-50 kWh, 50-100 kWh, 100-200 kWh and >200 kWh. The new tariff order has grouped the consumers in the following categories based on **annual consumption** (vs monthly consumption): 0-900 kWh, 900-2700 kWh and >2700 kWh. A quick comparison across the various consumption levels reveals that while there is no difference in the effective tariff the consumer would pay (except for a marginal difference in a small section of consumers with consumption in the range of 75-100 kWh).

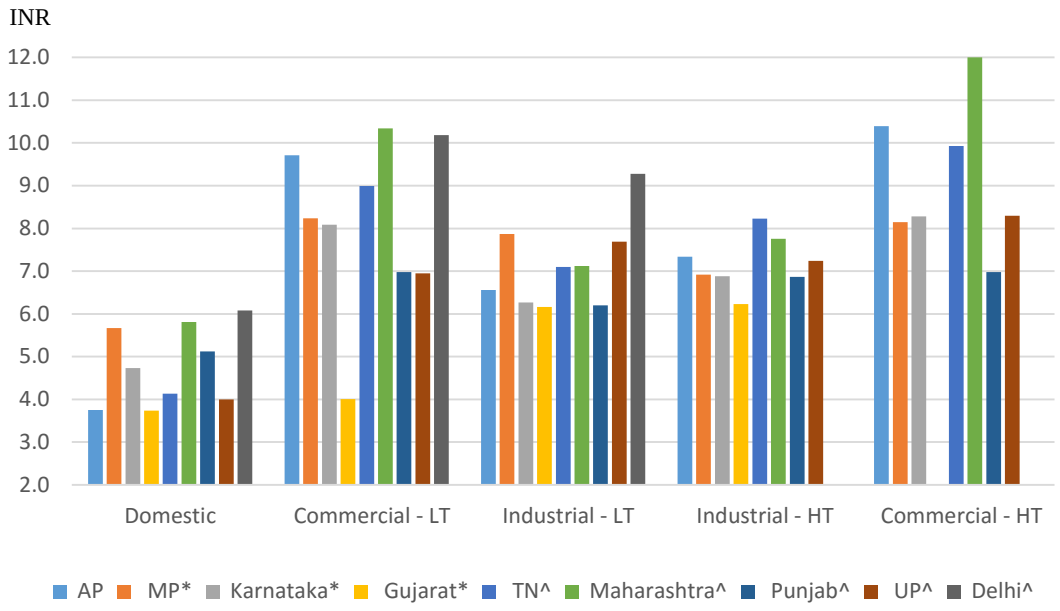
Figure 30: Average tariff for domestic consumers in FY17 at various monthly consumption levels remains similar to FY16 (INR/kWh)*



*= for simplicity no monthly seasonality has been assumed

7. For the building future projections, a comparison has been made with historical and with UDAY projections (which indicate a 5 percent average tariff hike from FY 2018 onwards). However, the analysis assumes a lower tariff hikes (as shown in table 31) in line with the recent trend. This assumption is also supported by the fact that tariffs in Andhra Pradesh for industrial and commercial consumers are already at a higher end when compared to some of its peers.

Figure 31: Tariff comparisons across states with Andhra Pradesh FY 2017 tariff (INR/kWh)



*=denotes FY 2017 tariff proposed by the distribution companies; ^=denotes FY 2016 numbers

8. **Other key assumptions**: Other key assumptions used in the model are as below:

   a. ***Subsidy***: For simplification of analysis, the model assumes the same state government subsidy levels over FY 2018 - FY 2021 as has been agreed be paid in FY 2017.

   b. ***O***&M costs: O&M costs have been modelled separately for each of the sub-components. The state government had allowed for a major hike in the employee benefits (salary, retirement and other employee benefits) in FY 2015 leading to a hike in O&M costs. The model assumes an inflationary annual increase of 5-7 percent in costs and also includes a pay revision of about 15 percent in FY 2019.

   c. ATC ***losses***: Both the utilities have achieved high level of operational efficiency and have very low AT&C losses. A marginal improvement has been considered in the numbers going forward.

Table 6.2: Other key assumptions for the financial projections

	FY15 (base year)	**FY16**	**FY17**	**FY18**	**FY19**	**FY20**	**FY21**
Average Tariff hike (%)	nill	5%	0.8%	5.1%	1.1%	2.3%	1.3%
Subsidy from GoAP (INR mn)							
APEPDCL	8,755	8,675	1,359	1,359	1,359	1,359	1,359
APSPDCL	22,497	23,185	31,535	31,535	31,535	31,535	31,535

O&M Costs increase (%)							
APEPDCL	78.7%*	-14.9%	30.3%	7.4%	15.9%	7.2%	7.2%
APSPDCL	95.5%*	-9.9%	9.7%	10.0%	19.0%	8.9%	9.3%
ATC losses (%)							
APEPDCL		7.9%	7.5%	7.0%	6.6%	6.2%	5.8%
APSPDCL		9.3%	8.4%	8.1%	7.9%	7.6%	7.3%

*= due to revision in salaries and other employee benefits

9. **Results of the Financial Analysis**: The model outputs are shown in table 6.3 and table 6.4. The key results can be summarized as:

a. With reduction in growth of power purchase costs expected in the future, and with the similar levels of tariff subsidy, the distribution companies are expected to return back to profits in FY 2018 (in case of APEPDCL) and FY 2020 (in case of APSPDCL). Turnaround for APEPDCL is expected earlier due to favorable consumer mix (lower percentage of agriculture sales).

b. The turnaround is expected despite the analysis assuming minimal tariff hikes (except in FY18) and no OFR support from the state. However, a similar tariff subsidy as approved in FY 2017 is assumed till FY 2021 as well.

c. However, changing sales mix towards more commercial/industrial consumption and lesser agriculture, is the essential pre-requisite for this trend.

Table 6.3: APEPDCL financial projections (INR Million)							
	FY15	**FY16**	**FY17**	**FY18**	**FY19**	**FY20**	**FY21**
Revenue from sales (excluding subsidy)	60,914	69,645	90,291	105,564	119,426	137,934	158,022
Other income	9,983	9,643	11,063	11,797	12,900	14,128	14,832
Tariff subsidy	8,755	8,676	1,359	1,359	1,359	1,359	1,359
Sub-Total	**79,652**	**87,964**	**102,713**	**118,720**	**133,685**	**153,422**	**174,213**
Costs							
PP	68,352	75,483	81,828	94,661	106,246	118,477	135,617
Employee	10,032	7,901	10,687	11,450	13,430	14,378	15,388
Other	1,430	1,854	2,026	2,203	2,394	2,590	2,796
Sub-total	**79,814**	**85,237**	**94,540**	**108,314**	**122,070**	**135,445**	**153,801**
EBITDA	**(162)**	**2,727**	**8,172**	**10,406**	**11,615**	**17,977**	**20,412**
Dep	2,524	2,731	3,598	4,108	4,650	5,222	5,815
Interest	3,264	4,530	5,561	4,685	3,482	4,047	4,647
PAT	**(7,177)**	**(4,718)**	**(591)**	**1,345**	**2,625**	**6,075**	**6,920**
ARR (INR/kWh)	5.4	5.3	5.9	6.2	6.3	6.6	6.8
Subsidy (INR/kWh)	0.7	0.6	0.1	0.1	0.1	0.1	0.1
ACS (INR/kWh)	6.6	6.2	6.0	6.2	6.2	6.3	6.4

Table 6.4: APSPDCL financial projections (INR Million)							
	FY15	**FY16**	**FY17**	**FY18**	**FY19**	**FY20**	**FY21**
Revenue from sales (excluding subsidy)	104,984	117,395	151,264	177,163	200,922	232,939	267,857
Other Income	18,633	8,707	11,996	14,271	17,023	20,278	22,518
Tariff subsidy	22,497	23,185	31,535	31,535	31,535	31,535	31,535
Sub-Total	**146,114**	**149,287**	**194,795**	**222,969**	**249,479**	**284,753**	**321,910**
Costs							
PP	129,951	149,205	161,161	180,895	200,104	220,033	249,259
Employee	5,864	7,162	10,192	12,494	14,694	16,895	19,101
Other	15,158	11,784	10,599	10,378	12,528	12,753	13,297
Sub-total	**150,973**	**168,151**	**181,952**	**203,767**	**227,326**	**249,680**	**281,657**
EBITDA	**(4,859)**	**(18,864)**	**12,843**	**19,202**	**22,153**	**35,073**	**40,253**
Dep	5,864	7,162	10,192	12,494	14,694	16,895	19,101
Interest	6,024	8,247	9,151	9,596	10,596	12,043	13,097
PAT	**(16,747)**	**(34,273)**	**(6,634)**	**(3,023)**	**(3,273)**	**3,998**	**5,277**
ARR (INR/kWh)	4.5	4.3	4.8	5.2	5.4	5.7	6.0
Subsidy (INR/kWh)	0.8	0.8	0.9	0.9	0.8	0.7	0.7
ACS (INR/kWh)	5.9	6.2	6.0	6.1	6.3	6.3	6.5