

PROJECT DOCUMENT

OF

THE ASIAN INFRASTRUCTURE INVESTMENT BANK

Republic of India

Andhra Pradesh 24x7 – Power for All Project

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Andhra Pradesh 24x7 – Power for All

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CURRENCY EQUIVALENTS

Exchange Rate Effective March 01 2017

US \$1 = Rs 67

FISCAL YEAR

January 01 – December 31

ABBREVIATIONS AND ACRONYMS

ACB	Audit Committee of the Board
ACS	Average Cost of Supply
AIIB	Asian Infrastructure Investment Bank
APEPDCL	Eastern Power Distribution Company of Andhra Pradesh Ltd.
APERC	Andhra Pradesh Electricity Regulatory Commission
APGENCO	Andhra Pradesh Power Generation Corporation Ltd.
APSEB	Andhra Pradesh State Electricity Board
APSPDCL	Southern Power Distribution Company of Andhra Pradesh Ltd.
APTRANSCO	Transmission Corporation of Andhra Pradesh Ltd.
ARR	Accounting Rate of Return
AT&C	Aggregate Technical and Commercial Losses
CAAA	Controller of Aid and Audit Accounts
CAGR	Compounded Annual Growth Rate
CAT	Consumer Tool Analysis
CPTD	Compensatory Plan for Temporary Disturbance
DDUGJY	Deen Dayal Upadhaya Grameen Jyoti Yojna
DISCOMS	Power distribution companies
DPR	Detailed Project Reports
DTR	Distribution Transformer
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
GAP	Gender Action Plan
GDP	Gross Domestic Product
GHG	Greenhouse gas
GIS	Gas Insulated Substations
GoAP	Government of Andhra Pradesh
GoI	Government of India
GRS	Grievance Redress Service
HVDS	High Voltage Distribution System
IA	Implementation Agency

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
M&E	Monitoring and Evaluation
MATS	Monitoring and Tracking Tool
MIS	Management Information Systems
MMR	Maternal Mortality Rate
MOU	Memorandum of Understanding
NCB	National Competitive Bidding
NIC	National Information Center
OFR	Operational Funding Requirements
OMS	Outage Management System
PAP	Project Affected Persons
PAT	Profit After Tax
PFA	Power for All
PFS	Project annual financial statements
PIU	Project Implementing Unit
PLF	Plant Load Factor
PMRS	Performance Monitoring and Reporting System
PPP	Public Private Partnership
RAP	Resettlement Action Plan
R-APDRP	Restructured Accelerated Power Development and Reforms Program
RE	Renewable Energy
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
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
WB	The World Bank
WTP	Willingness to pay

1. Project Summary Sheet

Republic of India Andhra Pradesh 24x7 – Power for All Project

Project No.	000009
Borrower(s)	Republic of India
Implementation Agency	Andhra Pradesh Transmission and Distribution companies (APTRANSCO, APEPDCL and APSPDCL)
Sector(s) Subsector(s)	Energy Power Transmission and Distribution
Project Objectives/Brief Project Description	<p>To increase the system capacity to deliver electricity to customers, and to improve the operational efficiency and system reliability in distribution of electricity in selected areas in the State of Andhra Pradesh.</p> <p>The Project aims to support the implementation of the 24x7 Power for All plan in State of Andhra Pradesh, by:</p> <ul style="list-style-type: none"> 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 distribution companies
Project Implementation Period	Start Date: August 18, 2017 End Date: June 17, 2022
Expected Loan Closing Date	June 30, 2022
Project cost and Financing Plan	<p>Total Project Cost: US\$ 571 million</p> <p><u>Financing plan:</u> Govt. of Andhra Pradesh: US\$ 171 million World Bank (IBRD): US\$ 240 million AIIB: US\$ 160 million</p>
AIIB Loan (Size and Terms)	US\$ 160 million; 19-year tenor including a 5-year grace period

Co-financing (if any) (Co-financier(s), Size and Terms)	World Bank (IBRD): US\$ 240 million; 19-year tenor including a 5-year grace period
Environmental and Social Category	B
Project Risk (Low/Medium/High)	Medium
Conditions for Effectiveness and Disbursement (if any)	Conditions for Effectiveness include: (i) execution and effectiveness of Subsidiary Agreements between GoAP and the Implementing Agencies; and (ii) cross-effectiveness with the IBRD loan agreement.
Key Covenants	(i) Maintenance by each Implementing Agency of a project implementation unit (PIU) and hiring and maintenance by each Implementing Agency of consulting firm(s) for the carrying out of external audits throughout the implementation period; (ii) implementation of the Project in accordance with the agreed operations manuals; (iii) compliance with the safeguard documents (ESMF (including the CPTD), ESMP(s), RAP(s), and TPDP(s)); (iv) preparation and submission of quarterly interim unaudited financial reports and annual audited financial statements; and (v) provision of counterpart funding by GoAP and the Implementing Agencies for ineligible expenditures, such as land acquisition costs and compensation, resettlement and rehabilitation payments.
Policy Assurance	The Vice President, Policy and Strategy confirms an overall assurance that the Bank is in compliance with the policies applicable to the Project.

President	Liqun Jin
Vice President	D.J. Pandian
Director General, Operations	Supee Teravaninthorn
Manager, Operations	Ke Fang
Project Team Leader	Hari Bhaskar, Senior Investment Operations Specialist
Project Team Members	Amiko Sudo, Office of the General Counsel Ian Nightingale, Procurement Advisor Somnath Basu, Senior Social Development Specialist Yan Li, Economic and Financial Analyst (consultant) Yige Zhang, Project Assistant

2. STRATEGIC CONTEXT

A. Country Context

1. India is a lower-middle-income country, with a population of 1.3 billion accounting for 17% of the world's population. India is also the world's 3rd-largest economy based on PPP GDP. Indian real GDP expanded at an average annual rate of 7.3 percent between FY2003 and FY2012. While the real GDP slowed to 5.1 percent in FY2012/13, it increased from 5.1 percent in FY 2012/13 to 7.3 percent in FY 2014/15 before moderating slightly to 7.2 percent in the first half of FY2015/16. While the momentum was initially supported by private consumption (average growth of 6 percent during FY 2012/13-FY 2014/15), it has more recently benefited from a pick-up in investments (4.6 percent in FY 2014/15 and 5.8 percent in first half of FY 2015/16 vs. an average of 1.3 percent in the preceding two years).

2. However, since late 2014, a collapse of global oil prices has boosted economic activity in India and underpinned a further improvement in the current account and fiscal positions. It has also brought about a sharp decline in inflation. Growth reached 7.3 percent in FY2014/15 on the back of an improvement in sentiments. A range of supply-side measures (including release of surplus grain buffer stocks) and an appropriate monetary stance have also contributed to the decline in inflation, from an average of about 9.5 percent during 2011–13 to 5.9 percent in FY2014/15. The economy's strength lies in a limited dependence on exports, high saving rates, favorable demographics, and a rising middle class. India is world's fastest growing large economy.

3. Andhra Pradesh with a population 49 million, is a middle income state and is growing at a growth rate of 10.5% which is higher than the country average. Service sectors registered a growth rate of 11.39 % in FY 2016 and they are the engine for pushing the overall growth. Andhra Pradesh is situated on the south-eastern coast of the country.

B. Sectoral and Institutional Context

4. Efficient, reliable and affordable electricity supply is critical to India's ongoing economic growth and socioeconomic transformation. As India's economy continues growing, demand for power is expected to grow significantly, to meet current suppressed demand (evidenced by load shedding and unreliable supply), to support economic diversification and the growing manufacturing sector, and to meet the rising economic aspirations of India's people.

5. India's average per capita consumption of electricity is only one third of the global average even though India is the world's third largest consumer of electricity. The rural and the poorest consumers constitute the bulk of India's 300 million people without access to electricity. Even those who do have access to electricity, particularly in rural areas, face intermittent power supply. The industries and commercial enterprises suffer due to unreliable supply and invest in expensive back-up generation. Further the per capita consumption of electricity in India in 2012-13 was 917 units, which is around 20% of that in China or 5% of the level in the USA.

6. This lack of reliability is not an issue of availability of power generation; it is rather due to the commercial performance of India's heavily indebted distribution companies, which are for the most part publicly owned, and whose limited resources make it difficult for them to provide reliable electricity supply. The distribution companies suffer from low regulatory support (often resulting in below-cost-recovery tariffs), high aggregate technical and commercial (AT&C) losses and, as a consequence, poor commercial performance.

7. Recognizing that efficient supply of reliable electricity to all of its citizens is essential for the sustained growth of the Indian economy, in 2014, the Government of India (GoI) launched the Power for All (PFA) program, involving a partnership approach with the states, that aims to ensure 24x7 electricity supply to all consumer categories across the selected states within 5 years of the start of implementation. Andhra Pradesh is one of the three states (along with Rajasthan and Delhi) selected by the GoI to roll out the PFA program. The PFA plan is signed jointly by the GoI and State government to indicate that the 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.

8. To support the financial sustainability of the electricity sector, and provide distribution companies with the financial capacity to meet the GoI's 24x7 PFA 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. The reforms resulted in the State's energy deficit being reduced to 1.5% during FY 2004, while the country-wide average was 7.1%. 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 including:

- i. **High peak deficit and energy deficit** that led to significant additional cost spent on procuring power from short term sources at higher cost.
- ii. **Managing scarce power supply** among agricultural, small domestic and industrial consumers; free or heavily subsidized power to agricultural consumers (~ 25% of total consumption) and heavily subsidized power to small domestic consumers (~ 20% of total consumption) combined with forced consumption cut by industrial consumers further deteriorated the financials of the distribution companies.
- iii. **Under investment in transmission and distribution infrastructure** due to poor financial performance of the utilities (which was caused mainly by i and ii above).

10. Since 2014, the GoAP 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. The specific measures include the following:

- i. **Expand generation capacity** from 8,300 MW in FY 2015 to approximately 16,000 MW by FY 2019 (including significant capacity additions of around 7,000 MW from renewable sources in the five-year plan). With this increase in generation, the energy and peak deficit are expected to be brought down significantly thereby reducing the need to procure power from short term sources at a higher cost. Consequently, this will reduce average power purchase cost and improve utilities' financials.
- ii. **Virtual feeder segregation** to regulate agriculture supply and dedicated feeders for rural industries and commercial establishments. Such segregation will ensure that a) the rural domestic consumers are provided with single phase power supply 24x7, b) agricultural consumers are provided with three phase power supply for 7 hours a day, and c) dedicated feeders are provided (where available – if not available, new feeders to be constructed) to the industries and commercial establishments in the rural areas to ensure reliable and continuous power supply.
- iii. **Reduction in aggregate technical and commercial (AT&C) losses:** The AT&C losses in the State decreased from 23% in FY 2004 to around 11% 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 Financial Restructuring Plan (FRP) of 2012:** 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. GoAP signed a Memorandum of Understanding 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% of the working capital term loans outstanding as of September 30, 2015. In addition, the State government had earlier had 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 (INR 88.9 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 future losses of the distribution companies in a graded manner over the next five years. GoAP will 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.

11. With the measures described in the previous paragraph, the distribution companies are expected to achieve a financial turnaround by FY 2020.
12. Andhra Pradesh's power sector currently rests with four entities: (i) APGENCO, responsible for power generation; (ii) APTRANSCO, responsible for power transmission; (iii) APSPDCL, covering power distribution in eight districts; and (iv) APEPDCL, covering power distribution in five districts in the remaining part of the State.

3. THE PROJECT

A. Rationale

13. The Project, through its focus on improving operational efficiency in transmission and distribution system, will provide increased supply of affordable, reliable electricity to households, industries, businesses, and various other productive sectors in State of Andhra Pradesh, and thus will contribute significantly to economic development of the State. Successful implementation of the ambitious PFA program in one of the progressive States in India will also create significant demonstration and transformation impacts across the country and the South Asia region. The Project is well aligned with the Bank's primary mandate; i.e., to promote social and economic development in Asia through investment in infrastructure.

15. Under the GoI'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 consumers by 2019. Of the total investment required for meeting *Power for All* commitments in the State, a quarter of the investments is required in the generation segment and the remaining three fourths in the transmission and distribution segments. The GoAP expects to draw significant private investment in generation through independent power producers to double the installed generation capacity in the State from 8,300 MW in 2015 to 16,000 MW in 2019¹. However, private investment is not expected to be available in the transmission and distribution segments since the assets are owned by the public sector utilities. Therefore, public investment (with financial support from international financial

¹ "Power for All", Government of Andhra Pradesh, 2015
http://powermin.nic.in/sites/default/files/uploads/joint_initiative_of_govt_of_india_and_andhrapradesh_0.pdf

institutions, such as the Bank and WB) is required to increase the transmission and distribution capacity and ensure that the additional generation can be evacuated efficiently by the state owned utilities. This is the rationale for supporting the Project with public sector financing.

B. Objective

16. The **Project's development objectives** are 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.

17. 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. Around half of the proposed investments are targeted towards improving power supply to rural areas, therefore providing opportunities to increase the household income and thus standards of living in some of the poorer communities in India.

18. The results indicators for the Project are

- i. increase in electricity supply (MWh);
- ii. reduction in AT&C losses in selected districts (%); and
- iii. reduction in distribution transformer failure rate in select project areas.

19. A series of intermediate outcome indicators are designed and their progress will be measured periodically to ensure that the Project is progressing in the right track to achieve the results indicators listed in the previous paragraph. The intermediate outcome indicators are:

- i. Transmission lines constructed (in circuit kilometers);
- ii. Distribution lines constructed (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. Reduction in SAIDI/SAIFI in select urban areas;
- vi. Percentage of females among the number of persons participating in the safeguard consultation meetings (percentage);
- vii. Person-days of utility staff participating in trainings; and
- viii. Grievances received that are addressed within two months of receipt (percentage).

C. Project Description and Components

20. The Project aims to support the implementation of the 24x7 PFA plan in 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 distribution companies

21. To provide uninterrupted power supply to its citizens, GoAP launched the PFA scheme in October 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 coal, 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 (INR 543 billion) has been planned over a period of five years in the State of Andhra Pradesh which includes central financial assistance component in the range of US\$ 2.3 billion (INR 154 billion) over five years.

22. While the generation requirements have been planned (through the PPP route with the involvement of private sector), the capital investment envisaged under the two current schemes (i.e., DDUGJY² and IPDS³ for transmission and distribution) are insufficient to meet the projected requirement of funds. Therefore, the Bank along with the WB is supporting the GoAP in the implementation of the aforementioned PFA plan. The Bank's 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 leading to increased ability to service to meet growing demand, reduction in AT&C losses, and improvement in system reliability. This engagement allows the Bank to support GoI's PFA initiative and facilitate the State government in achieving 24x7 reliable, quality and affordable power to the citizens of Andhra Pradesh.

23. The project components are as follows:

Component 1: Power Transmission System Strengthening

² DDUGJY – Deen Dayal Upadhyaya Grameen Jyoti Yojana is a Government of India scheme to fund strengthening of sub-transmission and distribution networks in rural areas.

³ IPDS – Integrated Power Development Scheme is a Government of India scheme to fund strengthening of sub-transmission and distribution networks in urban areas.

24. This component includes priority investments in 220 kV, 132 kV, 66 kV, and 33 kV power transmission and sub-transmission 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's transmission network.

25. Twelve substations and the associated lines will be funded under the Project. These packages will be implemented through integrated turnkey supply and installation contracts.

Component 2: Smart Grid Development in Urban Areas

26. GoI 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. The IAs are in the process of finalizing the list of cities in Andhra Pradesh to be covered under this initiative.

27. This component would support investments in smart grids and underground cables in the selected cities. These investments would include smart meters on selected consumers, distribution SCADA, automated sub-stations, and ring main units. It also includes investments on distribution network strengthening and augmentation (33kV and 11kV) in urban areas to meet the growing power demand, reduce technical & commercial losses, improve operational efficiency and increase the system reliability especially in coastal towns prone to natural calamities.

28. The investments under this component include:

- i. **Smart Meters:** Smart consumer meters, with two-way communication and backend ICT 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 access to better data and hence, encouraging them to reduce their electricity consumption.
- ii. **Underground Cables:** System reliability is a major concern, especially in coastal towns. 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 to restore power 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 selected smart cities.

- iii. Supervisory Control and Data Acquisition (SCADA): Under RAPDRP⁴, the distribution companies are in the process of setting up SCADA centers in three towns – Vishakhapatnam, Vijayawada and Guntur. This would facilitate centralized monitoring of the distribution network and enable improvement in system reliability. Integration of SCADA with smart meters and 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 to the distribution substations in selected cities and towns, which are not covered under R-APDRP.
- iv. Distribution Network Strengthening & Augmentation: This includes investments in 33kV and 11kV distribution lines and associated 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 – Rural

29. This component would support strengthening and augmentation of low voltage distribution network (33kV and below) and construction of high voltage distribution system (HVDS) in rural areas, particularly in the districts of Anantapur, Kurnool, East Godavari and West Godavari. A majority of the investments is located in Anantapur and Kurnool - the two new districts that have been transferred to APSPDCL after the restructuring of the State. The state of infrastructure in these districts is poor and the majority of power transformers, distribution transformers and feeding 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 18.31% and 10.78%, respectively.

30. 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 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. An independent study⁵ shows that, over time, the DTR failure rate has reduced drastically and the quality of supply has improved. Under the Project, Andhra Pradesh plans to cover the agriculture consumers that are still not converted to rural HVDS, particularly in the Districts of

⁴ R-APDRP is a centrally funded program that primarily aims at reducing Aggregate Technical and Commercial (AT&C) losses in select urban areas through ICT initiatives.

⁵ Impact evaluation study on benefits of HVDS was carried out by Mitcon, India.

Anantapur, Kurnool, East Godavari, and West Godavari in Andhra Pradesh; i.e., around 300,000 agriculture consumers in APEPDCL, and convert all agriculture 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 Andhra Pradesh.

Component 4: Technical Assistance for Institutional Development and Capacity Building

31. This component would (a) improve the project management capabilities and commercial performance of the Andhra Pradesh distribution utilities by (i) developing, upgrading and integrating APEPDCL's and APSPDCL's ICT infrastructure, (ii) if and when required by the Bank, support supervision of contracts by hiring project management consultants, and (iii) strengthening APEPDCL's and APSPDCL's institutional capacity and human resources' skills in the core areas of utility management and operation; and (b) enhance the engineering capabilities of the Andhra Pradesh transmission company by (i) investing in software and testing instruments, and (ii) supporting capacity building activities for APTRANSCO's officials.

32. APEPDCL and APSPDCL: Given the existence of several legacy systems in the distribution companies of Andhra Pradesh, the WB funded a study during project preparation to carry out an assessment of the existing ICT infrastructure and business processes, identify gaps and prepare a detailed road map for ICT implementation. This study is being carried out by independent consultants for both utilities. Based on the output of the study, investments in ICT enabled systems and training programs will be made. If and when required by the Bank, a project management consultant will be hired to assist both distribution companies to supervise and manage contracts funded under the Project. This component will also fund activities undertaken for capacity building and institutional strengthening of the distribution utilities, which will strengthen the core skills of the utilities in the key areas of utility operations and management, to help the utilities achieve efficiency in operations and improvement in service delivery to consumers and ensure the sustainability of assets created under the Project.

33. APTRANSCO: APTRANSCO proposes to enhance its engineering capabilities by investing in software (tower spotting, design of line/sub-station), and testing instruments. The components will also support trainings for APTRANSCO officials.

D. Cost and Financing

34. The total project cost is estimated to be US\$ 571 million, of which US\$ 160 million will be financed by the Bank. The table below indicates the project cost and financing plan by component.

Table 1: Cost and Financing (US\$ million)

Item	Cost	Financing					
		AIB		IBRD		Counterpart	
		Amount	Share	Amount	Share	Amount	Share
A. Base Cost							
Power Transmission System Strengthening	100	28	28%	42	42%	30	30%
Smart Grids interventions in Urban areas	210	58.8	28%	88.2	42%	63	30%
Distribution investments - Rural	250	70	28%	105	42%	75	30%
Technical Assistance	10	2.8	28%	4.2	42%	3	30%
Total Base Cost	570	159.6	28%	239.4	42%	171	30%
B. Front-End Fees	1	0.4	40%	0.6	60%	0	0%
Total	571	160	28%	240	42%	171	30%

35. Co-financing arrangements: The Bank and the WB are requested by GoI to jointly co-finance the Project on a 40:60 basis for each component of the Project, with the WB taking the lead. The WB is planning to provide sovereign backed IBRD loans to the borrower. The co-financing arrangements for the Project between the WB and the Bank will follow the co-financing framework agreement signed by the respective Presidents of the two institutions in April 2016. As permitted by the Bank's policies, the WB's policies and procedures on safeguards, procurement, financial management, project monitoring, and reporting will be used for the Project (including activities to be financed by the Bank), which are materially consistent with the Bank's corresponding policies.

E. Implementation Arrangement

36. The transmission and distribution companies in Andhra Pradesh, namely APTRANSCO (transmission company), APEPDCL and APSPDCL (distribution companies) will be the Implementation Agencies (IA) of the Project. All three entities are state owned but legally independent entities. The proceeds of the loans from the Bank and the WB to GoI will be passed on to GoAP under a back to back arrangement between GoI and GoAP in accordance with GoI's standard arrangements for development assistance to the States of India. The loan proceeds will then be on-lent from GoAP to the IAs; the IAs will be required to repay the loan to the GoAP.

37. All three IAs have established dedicated project implementation units (PIUs) to implement the project. 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 loans by the Bank and the WB.

38. **Implementation Supervision.** The WB will be the lead co-financier and will supervise the Project, in accordance with the WB's applicable policies and procedures, and a Project Co-Lenders' Agreement to be signed between the Bank and the WB. The WB plans to visit the project sites two to three times per year to monitor progress. The Bank will send its team to join the WB team in the project supervision missions. Proper resources will be made available to match the frequency of the WB supervisions.

39. Consulting firms will be hired by each of the IAs to assist the IAs in their internal audits on, inter alia, financial management performance, procurement process and decisions and contract administration. Additionally, if and when the Bank determines necessary, project management consultants could be appointed to supervise and manage contracts funded under the Project. If such project management consultants are hired to ease the pressure on the utility manpower and ensure regular monitoring of the packages under the Project, such consultants will report to the utility on the daily progress and highlight the key issues on site. The consultants will also act as a focal point of contact for the Bank and the WB and will provide independent reports, as required, to the Bank and WB. This will ensure that the Project's progress, current status at any point of time and issues, if any, are brought to the attention of the Bank and the WB without any delays.

40. **Results Monitoring and Evaluation:** 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:

- i. APTRANSCO PIU: This PIU is responsible for implementing the transmission system components funded under the Project. The PIU is already functioning and is responsible for developing a detailed operational manual, which will cover the implementation of all major transmission investments. The operations manual will include 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 charts will be used to monitor project implementation.
- ii. APEPDCL and 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. If project management consultants are appointed, the PIUs will be supported in contract management by such project management consultants with a focus on delivery of quality assets, and adherence to the implementation schedule.

41. The PIUs will provide the Bank and the WB with quarterly physical progress reports and interim unaudited financial 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 and installation, M&E is linked to project targets upon completion of milestones like delivery of material, erection and commissioning.

42. The Bank has reviewed the applicable World Bank Operational Policies (OP) and Business Procedures (BP), the WB's Procurement and Consultant Guidelines, and the WB's sanctions policies and procedures, including the WB's Anti-Corruption Guidelines. The Bank has found them all satisfactory for application to the Project, in accordance with the requirements, respectively of the: (a) Bank's Environmental and Social Policy (ESP) and Environmental and Social Standards (ESSs) (ESS1 – Environmental and Social Assessment and Management, and ESS2 – Involuntary Resettlement Assessment; (b) the requirements of the Bank's Procurement Policy; and (c) the Bank's Policy on Prohibited Practices. The Bank will rely on the WB's determination of compliance with the above World Bank policies and procedures applicable to the Project. Project monitoring and reporting, as well as financial management, will also be carried out in accordance with the WB's requirements. This approach ensures that one set of policies will apply to the entire Project. It will also provide a single point of contact for Borrower and the IAs, and therefore facilitate a more efficient and seamless approach to project implementation.

43. 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 procurement under WB-funded projects. This is likely to increase efficiency and transparency of procurement.

44. **Funds Flow and Disbursements:** Project funds flow arrangement will be as follows:

- i. **From GoI to GoAP:** Based on the project expenditure report, the office of the CAAA (Controller of Aid, Accounts and Audit) will submit withdrawal applications to the Bank (through the WB) for disbursement. Bank funds will be disbursed to GoI, who will pass on these funds to GoAP in accordance with its standard arrangements for development assistance to the State. The funds will be provided in the Consolidated Fund of the State.
- ii. **From GoAP to the IAs:** Project funds on a needs basis will be drawn from the State's Consolidated Fund in accordance with existing treasury systems and provided in a project designated bank account of each of the IAs. Designated project bank accounts will be 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.

45. The disbursement of funds will be using reimbursement method, based on expenditure reported in the quarterly (or more frequent) Interim Unaudited Financial Reports (IUFs) to be submitted by the PIUs. Supporting documents required for Bank disbursement using these various methods will be as per the World Bank's

Disbursement Handbook and documented in the disbursement instructions to the Borrower.

46. Retroactive financing: All eligible Project expenditure meeting the Bank's procurement guidelines and in respect of which payment is made on or after January 1, 2017 can be claimed from the Bank up to 20% of the loan amount (US\$ 32 million). A stand-alone IUFR detailing the expenditure incurred during the retroactive financing will be submitted for these claims and such financial reports are subject to audit during the annual audit by the Project's external auditors.

4. PROJECT ASSESSMENT

A. Technical

47. The Project involves conventional T&D system wherein the technology is quite standard. The IAs are responsible for the overall implementation and management of the Project to ensure that the Project is realized as per the requirements of time, budget and safety.

48. Projects of similar nature have been successfully implemented by many Indian state owned T&D companies in the past. The IAs 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 PIUs have demonstrated capabilities in T&D system planning and development. Regarding the smart grid related investments, given the IA's ability to absorb new ICT technologies, the Project does not pose any particular technical risks. Especially, the PIUs involved have shown in the past World Bank programs have demonstrated that they are capable of implementing such conventional T&D programs, including digital technologies. The Project is well within the implementation capabilities of the PIUs. No significant technical issues have been identified.

49. Given the scale of the Project and considering that the Project will be implemented across the State through different utilities (IAs), a key risk that would require close monitoring is potential delays in implementation (supply, installation, testing and commissioning) of various packages. Continuous monitoring of project implementation by the IAs is vital to ensure that the delays, if any, are detected in advance and timely mitigation actions are implemented. Both the Bank and the WB will receive regular project progress reports. The Banks, based on the status updates received through such progress reports and during the supervision missions, will decide the need for the IAs to hire a project management consultant for monitoring and controlling project implementation to reduce implementation delays.

B. Economic and Financial

50. **Economic Analysis. Cost benefit analysis and key assumptions.** A cost-benefit analysis is carried out to assess the economic viability of the Project on a *with-* and *without-project* basis, using a social discount rate of 10%. All costs and benefits are estimated in constant 2016 prices with an average exchange rate of INR 67.0/US\$.

51. **Project cost.** Economic prices of capital works and annual operation and maintenance are derived from the financial cost estimates with adjustments to allow for transfer payments and corrections for any market distortions. A standard correction factor (SCF) of 0.96 is applied to the domestic portion of the investments to correct for exchange rate distortions. The economic costs of the Project comprise (i) capital costs of an estimated US\$439 million (INR 29,413 million); (ii) operating and maintenance (O&M) costs assumed at 2% and 5% of the capital costs, for the T&D investments, respectively; (iii) costs of incremental generation; and (iv) negative global externalities.

52. **Project benefits.** The primary economic benefits of the Project include (i) incremental power supply of 1,152 GWh per annum from 2019 onward; (ii) technical loss reduction from 13.1% to 12.0%; and (iii) avoided local externalities from avoided emissions of SO₂, NO_x, and PM₁₀. The willingness to pay (WTP) for the additional power supply is valued at 15.7 US cent per kWh.

53. **Outcome of the economic analysis.** In the base case scenario with a discount rate of 10%, the Project investment yield an economic net present value (ENPV) of US\$508 million, and an economic internal rate of return (EIRR) of 19.9%, well exceeding the hurdle rate of 10%. The investment is thus economically justified. The additional energy supplied as a result of the T&D lines accounts for 95% of the benefits while the reduction in technical losses accounts for the remaining. The local environmental benefits roughly offset the global environmental costs. At 10% discount rate, the Project has a payback period of 5 years, inclusive of the 4-year construction period.

Table 2. Outcomes of the Economic Analysis – Base-case Scenario

	EIRR (%) Base Case	ENPV at 10% (US\$ million)
Excluding environmental benefits & costs	19.9%	508
Including environmental benefits & costs	20.0%	542

54. **Sensitivity analysis** suggest that the economic viability of the Project investment is highly robust to withstand large variations in key market and project-specific parameters, including (i) construction cost overruns; (ii) commercial operation date (COD) delays; (iii) short falls in electricity supply; and (iv) average WTP.

55. **Risk assessment using Monte Carlo simulation** with 5,000 randomly drawn from the assigned probability distributions the risk variables reveals that that (i) the probability of an EIRR below the hurdle rate of 10% is only 20%; (ii) the mean of the EIRR probability functions stands as high as 25.9%.

56. **Financial Analysis.** The financial analysis of the Project was carried out from the perspective of the two Andhra Pradesh distribution companies. Project costs include both investment costs and additional costs of power purchase. Project benefit is measured in terms of additional revenue receipts from power sales resulted from the Project intervention. The weighted average tariff starts from INR 6.19 per kWh in 2016, and is assumed to increase 5% per annum going forward.

57. **Project financing and the weighted average cost of capital (WACC).** The Project investment will be financed, in part, by US dollar denominated loans from the Bank (28%) and IBRD (42%), both with a 19-year tenor including a 5-year grace period. The remaining 30% is financed by counterpart equity at a 12.5 percent per annum per State Tariff Order.

58. **Outcome of the analysis.** Based on the above assumptions, the Project investment will yield a financial internal rate of return (FIRR) of 8.3%. Given power sales being the sole benefit stream from the investment, the tariff growth trajectory will thus have crucial impact on the FIRR.

59. **Distributional analysis.** A distributional analysis of the Project shows broad based gains to different groups from the Project with the end-users in Andhra Pradesh as 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 (due to the fact that the diesel generators currently operated are done so in populated areas and with low stacks, without any filters to reduce emissions of particulate matters), while there is net increase in greenhouse gas (GHG) emissions and, consequently, global damage costs.

60. The assumption in this analysis is that 50% of the additional electricity evacuated will go towards replacing diesel self-generation while the remaining 50% 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 net increase in GHG emissions as a result of the Project.

61. **Financial assessment of the implementing entities.** While the tariff had been well below cost recovery, GoAP had a subsidy scheme that promises cost-plus a 12.5% return on equity. The subsidy scheme had resulted in relatively healthy financial status with positive operating margins for both distribution companies until 2013, when their financial situation took a dive and sank into heavy losses. Several reasons had contributed to this situation: (i) costly short-term power purchase; (ii) government arrears and immaterialized subsidies; (iii) rising costs and debt service burden.

62. Recognizing the system constraints and the premium of short-term power purchases, the distribution companies have been actively pursuing long-term PPAs with new generations companies in the pipeline. Some of these companies had started operation in 2016, while others are expected to come online over the next two to three years. As a

result, average power purchase cost is expected to plateau with an estimated average annual growth of 0.8% over the period of 2015-2020.

63. **Debt restructuring program - UDAY:** To reduce the distribution companies' debt service burden, the GoAP has signed a UDAY MOU, which promises a debt-equity swap of 75% of the distribution companies' existing debt. The reduced debt burden will take effect on the companies' financing statements in 2018. Moreover, the GoAP has also agreed on providing OFR support to the distribution companies until their financial situation is turned around.

64. The financials had assumed relatively modest tariff growth trajectory, no OFR support, but strictly followed tariff subsidy scheme along with a sales mix shift toward more commercial/industrial consumption and less agriculture consumption. With these assumptions, the projections suggest that the financial turnaround is expected in FY 2019 for APEPDCL and in FY 2020 for APSPDCL.

C. Fiduciary and Governance

65. **Corporate Governance:** The governance of the three IAs are under their respective Board of Directors headed by a Chairman and Managing Director, who along with a combination of functional and nominee directors are appointed by the GoAP. Each IA has constituted an Audit Committee of the Board (ACB) comprising 3 directors each with a nominee director as the Chair of the Committee. Board/ACB meetings are held regularly. The IAs 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 any of the IAs, 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. The IAs have committed to working with the Bank and the WB to address these issues.

66. **Financial Management:** As indicated in the 'Implementation Arrangements' section in the earlier paragraphs, project monitoring and reporting, as well as financial management, will also be carried out in accordance with the World Bank's requirements as per the Project Co-lenders' Agreement to be entered into between the Bank and the WB. The following paragraphs summarize the WB's due diligence.

67. 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 WB's reporting and auditing arrangements.

68. 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 in line with the Companies Act of 2013. The IAs have experience in implementing World Bank/other multi-lateral supported projects and hence are familiar with their requirements. Project Financial Management arrangements have been documented in the respective operations manuals. GoAP will create 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 up to 2015-16 prior to receiving Project funds. []

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

- i. **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 World Bank within 60 days from the close of the quarter.
- ii. **Project Annual Financial Statements:** Each PIU will prepare annual Project financial statements (PFS) for their part of the Project activities. One of the IAs 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.

70. **Procurement** for the Project will be carried out in accordance with the WB's "Guidelines: Procurement of Goods, Works and Non-consulting Services under IBRD Loans and IDA Credits and 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 and Grants by World Bank Borrowers" dated January 2011 as updated in July 2014 ("Consultant Guidelines") and the additional provisions mentioned in the legal agreements. The following paragraphs summarize the World Bank's due diligence on procurement aspects.

71. The Project will be implemented by the three IAs, namely, APSPDCL, APEPDCL and APTRANSCO. The IAs have been staffed through a multi-disciplinary team comprising officials mapped to technical, procurement, and financial management functions. The IAs have prepared 18 months' procurement plan and these procurement plans have been approved by the World Bank through their STEP system (see next paragraph for details about STEP system).

72. **Systematic Tracking of Exchanges in Procurement (STEP):** The Project will use STEP, a planning and tracking system that would provide data on procurement activities and 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.

73. **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 WB-funded Projects. This is likely to increase efficiency and transparency of procurement.

74. **Procurement Review:** The WB and the Bank will prior review the following contracts:

- i. Works including turnkey Supply & Installation of Plant and Equipment: All contracts more than US\$10 million equivalent
- ii. Goods, Information Technology and Non-consulting Services: All contracts more than US\$2 million equivalent
- iii. Consultancy Services for selection of firms: All contracts more than US\$1 million equivalent
- iv. Consultancy services for selection of individuals: All contracts above US\$0.3 million

75. First contract issued by the IAs will be subject to prior review irrespective of their value. In addition, the justifications for all contracts to be issued on the basis of Limited International Bidding, single-source or direct contracting will be subject to prior review. The above thresholds are for the initial 18 months' implementation period; based on the procurement performance of the Project these thresholds may be subsequently modified. Even for Post Review cases, inputs of the WB and the Bank on Technical Specifications / TORs will be sought by the 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 WB and the 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 WB and the Bank may conduct at any time Independent Procurement Reviews (IPRs) of all the contracts financed under the loan.

D. Environmental and Social

76. **Environmental and Social Policies:** The Bank has decided to use the WB's environmental and social safeguard policies (ESSP) since (i) they are consistent with the Bank's Articles of Agreement and materially consistent with the provisions of the Bank's Environmental and Social Policy and relevant Environmental and Social Standards; and (ii) the monitoring procedures that the WB has in place to ascertain compliance with its safeguard policies are appropriate for the Project. Most of the potential environmental and social risks and impacts are anticipated to be short-term, modest, site-specific and reversible in nature wherein mitigation measures can be adopted to reduce the negative impacts of the interventions. Thus, the Project is classified as Category B, according to both the World Bank's ESSP and the Bank's

Environmental and Social Policy. The environmental and social documentation for the project has been posted by the WB at their website in the following link:

<http://documents.worldbank.org/curated/en/435591472024110073/Environment-and-social-management-framework>

77. **Key Environmental and Social Issues:** The safeguard policies triggered by the Project by WB are (i) OP/BP 4.01 Environment Assessment, (ii) OP/BP 4.11 Physical Cultural Resources, (iii) OP/BP 4.10 Indigenous Peoples, and (iv) OP/BP 4.12 Involuntary Resettlement. To ensure compliance with the policies concerning safeguards management, the Project has adopted a framework approach since all investment packages have not yet been identified. Subsequently, 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. The ESMF incorporates the essence of “The Right to Fair Compensation in Land Acquisition, Resettlement and Rehabilitation Act 2013” and Indian Constitution’s Fifth Schedule provision related to protecting the interest of the tribal people. The ESMF also addresses the environmental and biodiversity concerns including potential infringement with local drainage systems apart from construction related safety and O&M related disposal of wastes. The ESMF has included indicative costs for social and environmental management, which will need to be firmed up as sub-projects are finalized. It also includes cost of training both at the corporate and field level and development of training modules.

78. **Social Safeguards:** Andhra Pradesh has a population of 49.5 million (12.72 million households) which is highly diverse in terms of its social, cultural and economic profile. The has about 17% SC (Scheduled Caste) and 5.5 % ST (Scheduled Tribe) population. Geographically the State is also heterogeneous having a coastal belt, uplands, forest lands and significant flood plains. The State has about 30 % urban population with majority of its people living in rural areas.

79. Notably, 50% of the total STs (34 major tribal groups and 6 primitive tribes) in Andhra Pradesh are concentrated in four districts Vishakhapatnam (23%), East Godavari (11%), Nellore (10%) and Vizianagaram (9%). This provisions of the Fifth Schedule of the Indian Constitution is applicable to the districts of Vishakhapatnam, West Godavari and East Godavari. These districts are also prone to militant insurgencies. However, the tribal people of Andhra Pradesh are better off in terms of their socio-economic profile compared to the tribes of other regions. Yet, remoteness and undulating hilly terrain could render them rather excluded at times. Given the inherent attachment of the tribal population to the natural forests and associated environment, in certain pockets, safeguards have been built to ensure risks against land alienation and related socio-economic impact.

80. 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 and sanitation, skill development and employment, and ensuring specific focus on disadvantaged sections of the society such as SC, ST, minorities, backward classes and other poor. The State is also disaster prone being affected by regular cyclones that impacts its 1,000 km long coast line and the

communities inhabited in those areas. Thus, the State's Social Empowerment Mission has been rendered high priority.

81. **Land Acquisition:** Major social safeguards aspects relate to land, its tribal population and other vulnerable and excluded groups to ensure their participation, inclusiveness and empowerment which will be achieved through targeted information dissemination and capacity building. 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 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 World Bank's OP 4.12 - Involuntary Resettlement and OP 4.10 - Indigenous People.

82. The ESMF's social safeguard component includes 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). For land acquisition in tribal areas or for presence of tribal groups in the subproject areas, the framework provides guidance for Social Assessment (SA) and subsequently preparation of RAP and/or TPDP, whichever is applicable. Use of land will have to be secured through either voluntary donations or outright purchase based on negotiations with the land owners. Measures have been described in the ESMF to ensure that such transactions are voluntary and not subject to any external pressures.

83. **Gender Aspects:** In line with the WB's mandate to address gender issues, a Gender Action Plan has been prepared. The 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. The Gender Action Plan is envisaged at two levels. Firstly, 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, ensuring participation and that the views of the womenfolk are effectively addressed while implementing the Project. The M&E arrangement for the Project has indicators to monitor the implementation of the GAP.

84. **Public Consultations and Citizen Engagement:** The Project has adopted citizen engagement plan that includes (i) SA-centered consultations with all the relevant stakeholders; (ii) moving beyond consultations into consent in the tribal areas; (iii) external bodies overseeing the conducting of SAs and Social Impact Management Plan (SIMPs); (iv) sharing of all the plans and engaging in extensive discussions and deliberations with all the stakeholders, especially project-affected persons (PAPs); (v) multilayers of grievance redressal arrangements; and (vi) full adoption of India's Right to Information Act. The M&E arrangement provides for indicators reflecting on citizen engagement.

85. **Environmental Aspects:** The Project components mainly include strengthening and augmentation of the existing power supply system including replacement of overhead wires with underground cables, power transmission and distribution equipment, by the IAs. The key environmental concerns are related to clearance/felling of trees within the right of way (RoW) for transmission lines and substation sites, incidental impacts on local fauna, infringement of localized fluvial systems - where substation construction may impede drainage, safety of workers and communities living in the vicinity of project site. The operational phase impacts could arise from indiscriminate use and disposal of batteries, transformer oil, e-waste and in case of circuit breaker – Sulphur Hexa Fluoride (SF6) gas handling.

86. The ESMF provides guidance for the preparation of the specific environmental impact assessment (EIA) for transmission sub-projects and a Generic EMP for the HVDS distribution schemes. Currently, EIA preparation is underway for the three schemes/sub-projects. EIA for cluster of distribution substations will also be undertaken as locations are 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.

87. The ESMF/ESMP will be implemented through integration of the environmental management requirements within contract documents, and monthly monitoring of works on-site during implementation.

88. **Grievance Redress:** Communities and individuals who believe that they are adversely affected may submit complaints to existing project-level grievance redress mechanisms. The Project has established grievance redress mechanisms (Grievance Redress Cell) for all three IAs namely, APSPDCL, APEPDCL and APTRANSCO. The IAs along with the World Bank Staff have conducted consultation workshops at the community level and disseminated the functions of the Grievance Redress Cell. The Cell is designed to review and redress the issues and concerns of communities pertaining to project implementation.

E. Risks and Mitigation Measures

89. **Overall Risks Rating:** Considering the GoAP's strong commitment to implementing the PFA agenda and the implementing capacity of the IAs, the conventional technology, as well as the limited social and environmental impacts, the overall risk of the Project is rated Medium. The description of the foreseen risks and the corresponding risk management plan are tabulated in the table below:

Table 3. Risk Management Plan

Risk Description	Risk Rating / Risk Management Plan
<p>Technology – Since some of the components of the project involve digital technology (smart meters), there could be impediments in design and implementation due to IAs’ level of experience.</p>	<p>The IAs implementing the Project (APTRANSCO, APEPDCL and APSPDCL) have implemented projects involving digital technology earlier and are very conversant with the technology. Moreover, the institutional capacity (technical) of the IAs is planned to be developed through trainings, workshops, technical visits and study trips using the Technical Assistance component of the Project. So, the chances of this risk materializing are <i>low</i>.</p>
<p>IAs’ institutional capacity to implement the Project.</p>	<p>The IAs have implemented several projects (including projects financed by the WB) of this nature successfully. Moreover, the GoAP is strongly committed to implementing the PFA agenda successfully.</p> <p>Continuous monitoring of project implementation by the IAs will aid in detecting delays, if any, at an early stage and to implement mitigation action. Based on the regular progress reports received from the IAs and on the observations during the supervision missions, the Banks will assess the need for appointing a project management consultant to assist the IAs with project monitoring and controlling which will help reducing the delays.</p> <p>This risk is considered a <i>Medium</i> risk.</p>
<p>Procurement capacity of the IAs</p>	<p>The IAs are using NIC’s e-procurement system which has been assessed and accepted by the Bank and the WB. The IAs have also been trained by the WB in using WB’s STEP system, which is a procurement tracking and management system.</p> <p>However, the procurement related risks are categorized as <i>Medium</i> since the IAs have so far only procured ‘partially turnkey’ contracts and not the large turnkey supply and installation contracts as envisaged in the Project. Even though the Bank is confident that the IAs can successfully procure the contracts under the Project, due to their lack of experience in procuring the specific type of contracts (supply and installation contracts), the risk rating is retained as <i>Medium</i>.</p>

Risk Description	Risk Rating / Risk Management Plan
Environmental and Social impact of the Project	<p>The Environmental and Social risks are Low to Medium as the impacts assessed from the Project so far can be adequately managed. To be conservative and in order not to lose sight of the need to manage the environmental and social aspects diligently and continuously, the risk rating assigned is <i>Medium</i>.</p>
Political Economy	<p>The WB has rated this risk as ‘Substantial’ (Substantial being in between Moderate and High risk categories) citing “though the interventions proposed in the Project are not reform-intensive, the historically complex political economy of power sector reforms in AP and elsewhere” as the reason for doing so.</p> <p>The Project is not reform-intensive and will target investments in transmission and distribution sector to improve the quality of power supply and operational efficiency, which are expected to have a positive impact, if any, on political economy. Accordingly, the Bank assigns a <i>Medium</i> rating.</p>

90. The WB has analyzed the project risks utilizing its Systematic Operations Risk-Rating Tool (SORT) and had proposed an overall risk rating of the Project as Moderate at the concept stage. Subsequently, it was revised to Substantial due to the possible impacts of the Project on the political economy. The Bank’s stand on this particular risk on political economy is discussed in the above table and accordingly, the Bank retains the overall risk rating of the Project as *Medium*.

Annex 1: Results Framework and Monitoring

Country: Republic of India

Project Name: Andhra Pradesh 24x7 - Power for All

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

Project 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
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, 220/33kV and 132/33kV substations) (Number)	0.00	0.00	1	15	11	12	12
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 in							

SAIFI is 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 in SAIDI for 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 consultation meetings (Percentage)	0.00	5	10	15	20	25	25.00
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 Kurnool. Reporting methodology same as above	Annual	Progress Report	Implementing Agency
Anantapur	This indicator measures the reduction in annual aggregate technical and commercial losses in district Anantapur. Reporting methodology same as above	Annual	Progress Report	Implementing Agency
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 Kurnool.	Annual	Progress Report	Implementing Agency
Anantapur	This indicator measures the reduction in distribution transformer failure rate in district 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 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 of the transmission lines constructed under the project.	No description provided.	No description provided.	No description provided.
Distribution lines constructed or rehabilitated under the project	This indicator measures the length 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 of the distribution lines constructed under the project. The baseline value for this indicator is expected to be zero.	No description provided.	No description provided.	No description provided.
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	Annual	Progress Report	Implementing Agency

	<p>would calculated using the following formula: $\{\text{sum of } (ixNi)/Nt\}$ 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.</p> <p>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”.</p>			
Establishment and Reduction of SAIDI for select urban area	<p>This indicator measures the reduction in System Average Interruptions Duration Index (SAIDI) for a selected area. SAIDI would be calculated using the following formula: $\{\text{sum of } (d*Nd)/Nt\}$ where d is the duration of each interruption in a year in control area and Nd is the number of consumers that are affected by that interruption; Nt is the total number of consumers in the project area.</p> <p>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”.</p>	Annual	Progress Report	Implementing Agency
Percentage of females among the number of persons participating in the safeguard consultation meetings	<p>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.</p>	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

B Andhra Pradesh Power Sector

1. **Introduction:** Situated on the southeastern coast of the country with the geographical area of 162,760 sq. km, Andhra Pradesh is 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 4.1% of the total population. 70.4% 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%.

2. **Institutional Structure:** Andhra Pradesh was the third state in the country to enact the state power sector reform legislation (the Andhra Pradesh Electricity Reform Act, 1998 came into force in 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 (APEREC) was established in 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 APEREC 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, which stipulates penalties that includes mandatory imprisonment for electricity theft.

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 statewide mandate; (iii) APSPDCL, covering eight districts; and (iv) APEPDCL, for five districts in the remaining part of the state.

Figure 1: Timeline of Reforms in AP Power Sector⁶

1995	•Hiten Bhaya Committee Report*
1997	•AP State Government's Policy Statement on Power Sector Reforms
1998	• AP Electricity Reforms Act was passed
1999	•World Bank Loan approved; APSEB unbundled into APGENCO & APTRANSCO; APERC starts functioning
2000	•APTRANSCO further unbundled into APTRANSCO and four DISCOMs
2002	•Financial autonomy to DISCOMs
2003	•Enactment of Electricity Act, 2003.
2004	•Change in Government and the announcement of free power to the agricultural sector.

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 8,924.86 MW till bifurcation of the state in FY 2012. After bifurcation, 46% of the total capacity of APGENCO stations (existing and under construction) was allocated to Andhra Pradesh. The present installed capacity of APGENCO is 4,559.6 MW comprising Thermal: 2810 MW, Hydro: 1,747.6 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 All India average PLF.

5. In terms of power availability, the state owned plants contributed 53% of the power, while another 23% is tied up with central generating stations, 16% with other public and private generating stations and 5 % 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; however, it has again picked up substantially since FY 2012. The energy deficit in the state decreased to 2.9% in 2003-04 as against the all India average of 7.1% while it has increased to 17.6% during FY 2013 as against the all India average of 8.7%. Similarly, the peak deficit has also increased to double digits in 2012-13 as against all India peak demand deficit of 4.5%. 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% in FY 2007 to 15% in FY 2013. The average purchase price of US\$0.08 (INR 6.00) per unit in FY 2013 against US\$ 0.04 (INR 3.30) in FY 2010.

6. However, since 2014, due to various initiatives taken by the state governments to improve capacity addition and better transmission planning, the energy as well as peak deficit has reduced drastically and Andhra Pradesh has achieved self-sufficiency in meeting

⁶ 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 SEB & establishment of APERCs

energy demand. The energy deficit is reduced from 7.0% in FY 2014 to almost NIL at present.

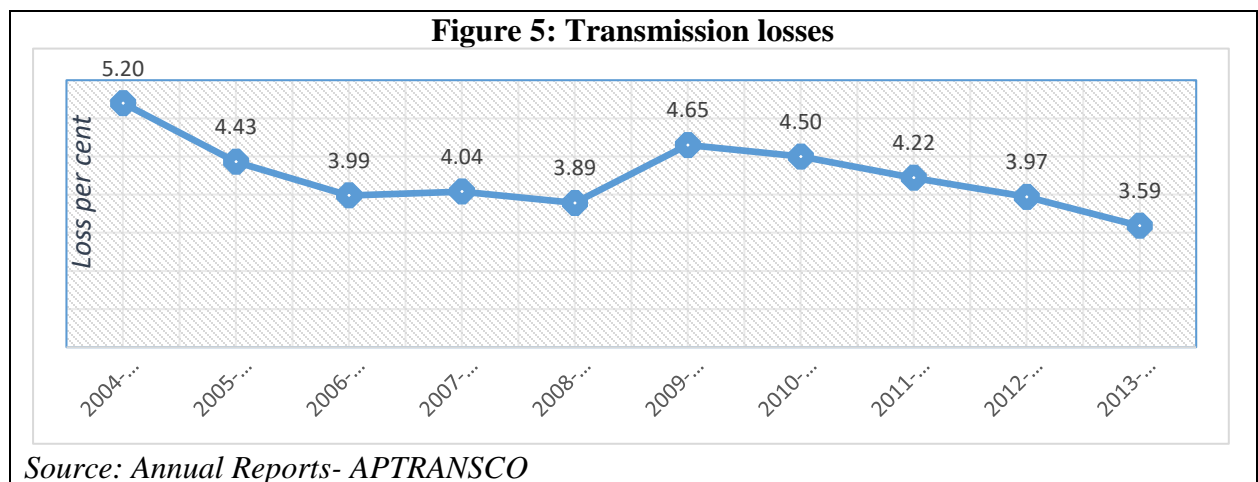
7. **Transmission System:** APTRANSCO has a vast transmission network with a total network length (consisting of 4,410 kms of 400 kV, 17,684 kms of 220 kV, 10,764 kms 132 kV) of 32858 Ckt. Kms. It also owns and operates a total of 258 substations comprising of 6 nos 440kV, 75 nos. 220 kV and 177 nos. 132kV substations. The transmission losses are among the lowest in the country at 3.59% in FY 2014 as against 7.90% during unbundling. APTRANSCO has maintained high line availability in excess of 99% for all the years under consideration. This is at par with the best in the industry in India.

Table 2.1: APTRANSCO Capacity Addition

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%. 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.



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

Figure 6 –License Areas of AP DISCOMS

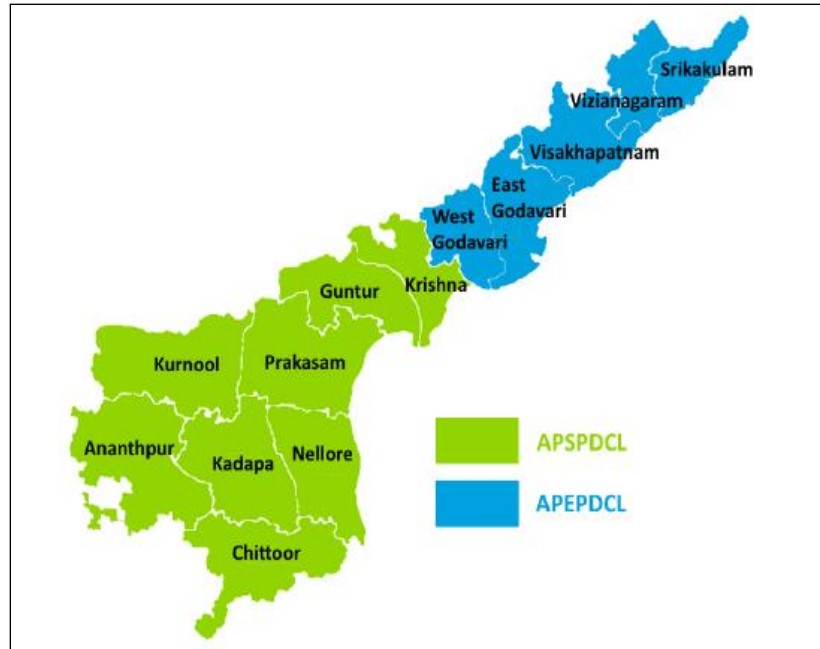


Figure 7: Category Wise Sales (%) (FY15)

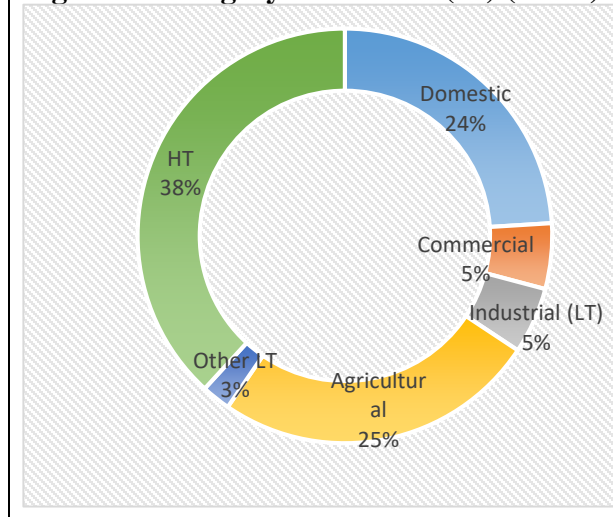
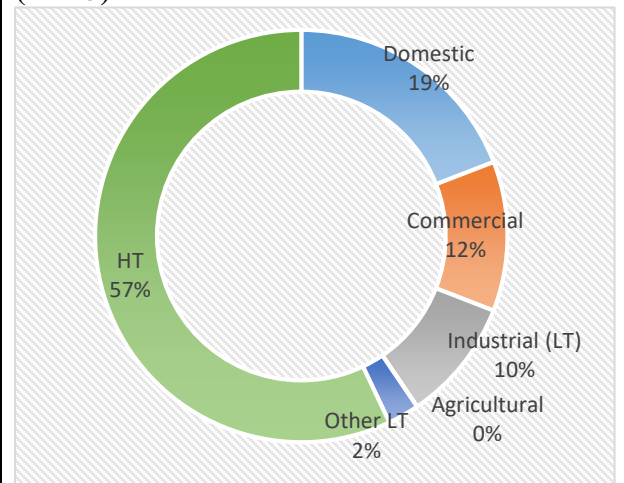


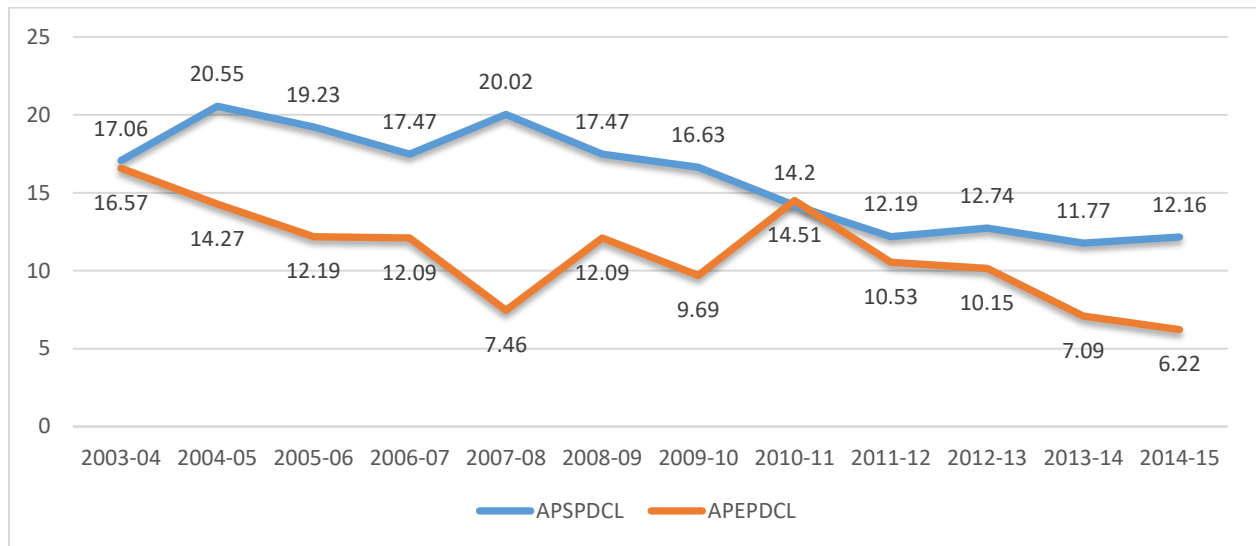
Figure 8: Category Wise Revenue (%) (FY15)



Source: Annual Reports FY 2015, APEPDCL & APSPDCL and World Bank PAD

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% metering at interface points. Both the distribution companies have shown impressive performance in terms of reduction of aggregate technical and commercial losses (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% in FY 2015 which is among the lowest in the country.

Figure 9: AT&C Losses of AP DISCOMS



Source: Annual Reports FY 2014-2015 of APEPDCL & APSPDCL and World Bank PAD

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 the distribution companies to improve performance and bring in transparency and accountability. Enterprise Resource Planning (ERP) tool has been implemented in Andhra Pradesh’s power distribution companies. 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 text messaging service.

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 MYT 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 and 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% of the ARR. For instance, APERC only approved revenue of US\$ 4.3 billion (INR 289 billion) against a revenue requirement of US\$ 5.1 billion (INR 343 billion) after approving the tariff increase pertaining to extent of energy sales volumes leaving the rest to be met by subsidies from the government.

14. **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 (7,000 MW 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% in FY 2013 to 5% 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% in FY 2004 to around 11% 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. 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.
- **Financial restructuring scheme:** To ensure financial viability of the distribution companies, Govt. of Andhra Pradesh participated in the Govt. of India's 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 (INR 4,046 crores). As per the provisions of the scheme, a minimum of 50% 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 (INR 1,500 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 June 24, 2016 under the UDAY scheme in order to improve the operational and financial efficiency of the Andhra Pradesh distribution companies to enable financial turnaround of the distribution companies. GoAP will take over 50% of the outstanding debt of the distribution companies in the range of US\$ 219.7 million (INR 14,720 crore) over the next two years and 75% of the working capital loan of US\$ 126.2 million (INR 8,462 crore) by issuing bonds. In addition, future losses of the distribution companies will be funded by the state government in a graded manner over the next five years. GoAP will provide operational funding requirements (OFR) support to the distribution companies until the distribution companies achieve turnaround, which shall also include the outstanding power purchase liabilities of the distribution companies as of 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 to zero by 2018-19.

B Project Description and Project Components

15. **Project Description:** To provide uninterrupted power supply to its citizens, GoAP launched the PFA scheme in October 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 coal, 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 (INR 543 billion) has been planned over a period of five years in the State of Andhra Pradesh which includes central financial assistance component in the range of US\$ 2.3 billion (INR 154 billion) over five years.

16. 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 leading to increased ability to service 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.

17. The project components are:

Component 1: Power Transmission system strengthening

18. This component includes priority investments in 220 kV, 132 kV, 66 kV, and 33 kV power transmission and sub-transmission 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's transmission network.

19. Twelve substations and the associated lines will be funded under the Project. These packages will be implemented through integrated turnkey supply and installation contracts.

Component 2: Smart Grid interventions in Urban areas

20. GoI 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.

21. This component would support investments in smart grids and underground cables in the above mentioned three cities. These investments would include smart meters on selected consumers, distribution SCADA, automated sub-stations, and ring main units. It also includes investments on distribution network strengthening & augmentation (33kV and 11kV) in urban areas to meet the growing power demand, reduce technical & 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 ICT 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 access to better data and hence, encouraging them to reduce their electricity consumption.
- ii. Underground Cables: System reliability is a major concern, especially in coastal towns. As witnessed in 2014, natural calamities like cyclone cause major disruption to the power system and on 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 selected 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 three towns – Vishakhapatnam, Vijaywada 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 selected cities and towns, which are not covered under R-APDRP, SCADA enabled.
- iv. Distribution Network Strengthening & Augmentation: This includes investments in 33kV and 11 kV lines and substations to augment and strengthen the distribution infrastructure in urban areas in AP. These investments are likely to improve the quality of supply and customer satisfaction.

Component 3: Distribution Investments – Rural

22. This component would support strengthening and augmentation of low voltage distribution network (33kV and below) and construction of high voltage distribution system (HVDS) in rural areas, particularly in the districts of Anantapur, Kurnool, East Godavari and West Godavari. Majority of the investments are located in Anantapur and Kurnool - the two new districts that have been transferred to APSPDCL post the restructuring of the State. The state of infrastructure in these districts is poor and the majority of power transformers, distribution transformers and feeding 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 18.31% and 10.78% respectively.

23. 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 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 overtime the DTR failure rate has reduced drastically and the quality of supply has improved. Under the Project, Andhra Pradesh plans to cover the agriculture consumers that are still not converted to rural HVDS i.e. around 300,000 agriculture consumers in APEPDCL and convert all agriculture 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 Andhra Pradesh.

Component 4: Technical assistance for capacity building

24. This component would (a) improve the project management capabilities and commercial performance of the Andhra Pradesh distribution utilities by (i) developing, upgrading and integrating APEPDCL's and APSPDCL's ICT infrastructure, (ii) if and when required by the Bank, support supervision of contracts by hiring project management consultants, and (iii) strengthening APEPDCL's and APSPDCL's institutional capacity and human resources' skills in the core areas of utility management and operation; and (b) enhance the engineering capabilities of the Andhra Pradesh transmission company by (i) investing in software and testing instruments, and (ii) supporting capacity building activities for APTRANSCO's officials.

25. APEPDCL and APSPDCL: Given the existence of several legacy systems in the distribution companies of Andhra Pradesh, the WB funded a study during project preparation to carry out an assessment of the existing ICT infrastructure and business processes, identify gaps and prepare a detailed road map for ICT implementation. This study is being carried out by independent consultants for both utilities. Based on the output of the study, investments in ICT enabled systems and training programs will be made. If and when required by the Bank, a project management consultant will be hired to assist both distribution companies to supervise and manage contracts funded under the Project.

This component will also fund activities undertaken for capacity building and institutional strengthening of the distribution utilities, which will strengthen the core skills of the utilities in the key areas of utility operations and management, to help the utilities achieve efficiency in operations and improvement in service delivery to consumers and ensure the sustainability of assets created under the project.

26. APTRANSCO: APTRANSCO proposes to enhance its engineering capabilities by investing in software (tower spotting, design of line/sub-station), and testing instruments. The components will also support trainings for APTRANSCO officials.

Annex 3: Economic and Financial Analysis

1. This annex comprises three parts: (i) the economic analysis of the project investments; (ii) the financial analysis of the project investments; (iii) the financial assessment of the implementing utilities.

A. Economic analysis

Program overview

2. Andhra Pradesh experiences high economic costs from insufficient and unreliable power supply. Although more than 90 percent of the state has access to electricity, consumption is severely curbed by capacity constraints and heavy load shedding. The average annual per capita electricity consumption in Andhra Pradesh around 1040 kWh⁷ is only a third of the global average⁸. In recent years, up to 40 percent of the demand from industries cannot be met due to load shedding. Similarly, varied degree of load relief has been imposed on different customer segments, with up to 12 hours in rural areas, 6 hours in urban areas, and 4 hours among urban corporations. In FY 2015-16, the peak load supply was 12.1 percent below demand, with the deficit bridged by costly standby diesel generation.

3. Through investments in power system-wide capacity expansion and upgrades, the *Power for All Program* aims to increase power supply of reliable electricity to households, industries, businesses, and other productive sectors in Andhra Pradesh. The project will contribute to the economic development, poverty reduction, and inclusive growth in Andhra Pradesh. Empirical studies suggest that a 1 percent increase in electricity consumption is associated with a 0.8 percent increase in economic growth. The project investment will help shift the state into a higher growth trajectory.

4. To meet 24x7 power service in Andhra Pradesh by 2018, the energy requirement and peak demand will need to increase by 45.7% from their 2015 levels. (see table below) Robust & reliable transmission and distribution network is needed to support this magnitude of demand growth.

Table 1: Andhra Pradesh 24x7 Electricity Demand Projection

	FY14-15	FY15-16	FY16-17	FY17-18	FY18-19
Gross energy requirement	54,864	59,253	65,178	71,696	78,866
Energy requirement for 2 hour of agriculture	1,740	3,759	4,136	4,549	5,004
Total energy requirement	56,604	63,012	69,314	76,245	83,870
Energy savings	69	399	751	1044	1478
Net energy requirement	56,535	62,613	68,563	75,201	82,392
Peak demand @ 70% of system load factor	9,220	10,211	11,181	12,264	13,436

Source: AP Power for All Program 2015

^{7/} "Rajya Sabha - Starred Question No. 897" (PDF). Ministry of Power, Govt. of India

^{8/} 3,298 kWh a year according to the World Development Indicators 2016

5. In its entirety, the Andhra Pradesh *Power for All Program* has an estimated total investment requirement of over US\$8.5 billion (INR569.5 billion), of which US\$560 million (INR 37.52 billion) or about 6.5% will be covered under the scope of the proposed project with the following three components:

- **Component 1: Power Transmission system strengthening** includes priority investments in 220 kV, 132 kV, 66 kV, and 33 kV lines and associated substations for system augmentation;
- **Component 2: Smart Grid interventions in Urban areas** include smart meters on selected consumers, distribution SCADA, automated sub-stations, ring main units as well as distribution network strengthening & augmentation in Kakinada, Vishakhapatnam and Tirupati;
- **Component 3: Distribution Investments – Rural** include The High Voltage Distribution System (HVDS) and distribution network strengthening and augmentation primarily in two districts (Anantapur and Kurnool) under APSPDCL.

6. At the time of this assessment, the investment details had not been confirmed, thus the project benefits were estimated as a portion (6.5%) of the *Power for All Program* benefits attributable to the project investments.

Methodologies and key assumptions

7. **Cost-benefit analysis and key assumptions.** A cost-benefit analysis is carried out to assess the economic viability of the Project on a *with-* and *without-project* basis, using a social discount rate of 10%. All costs and benefits are estimated in constant 2016 prices with an average exchange rate of INR 67.0/US\$.

8. **Project cost.** Economic prices of capital works and annual operation and maintenance are derived from the financial cost estimates with adjustments to allow for transfer payments and corrections for any market distortions. A standard correction factor (SCF) of 0.96 is applied to the domestic portion of the investments to correct for exchange rate distortions. The economic costs of the project comprise the following components:

- *Capital costs.* After subtracting taxes and duties and incorporating SCF, the economic cost of the Project investment comes up to US\$439 million (INR2,941 million).

Table 2. Project cost

	Financial Cost (US\$ million)	Taxes and Duties (US\$ million)	Economic Cost w/ SCF (US\$ million)
Transmission system strengthening	100	20	78
Distribution Investments – Rural	250	50	196
Smart Grid interventions in Urban areas	210	42	165
Total	560	112	439

- *Operation and maintenance (O&M) costs.* The annual O&M costs are assumed at 2 percent and 5 percent of the capital costs, for the transmission and distribution investments, respectively;
- *Costs of incremental generation.* Under the with-project scenario, the additional power supply will enter the Andhra Pradesh grid at the weighted average cost estimated using benchmark costs (i) for coal and solar plants provided by Central Electricity Regulatory Commission; (ii) for gas plants provided by ESMAP's META; and (iii) fuel price based on the World Bank commodity price forecasts. The table below provides a summary of the incremental generation cost breakdown:

Table 3– Breakdown of incremental generation and capital costs

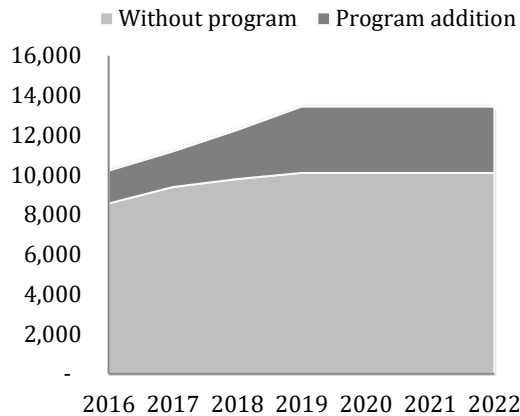
Technology	Share (%)	Capital Cost (US\$/MW)
Coal (Supercritical)	60%	0.96
Gas (CCGT)	30%	0.78
Solar (Utility Scale)	10%	0.83

- *Negative global externalities.* The Power for All program will lead to net increase in fossil fuel generation. The analysis assumes that half of the additional power generation will replace diesel-based self-generation while the other half will be incremental to the rising demand. The GHG emission factors are estimated as (i) 0.8272 kg/kWh for coal-based generation; (ii) 0.3830 kg/kWh for CCGT; and (iii) 0.60 kg/kWh for diesel. In the base case, the social cost of carbon is assumed at US\$30 (INR2,010) in 2015, increasing to US\$80 (INR5,360) by 2050.

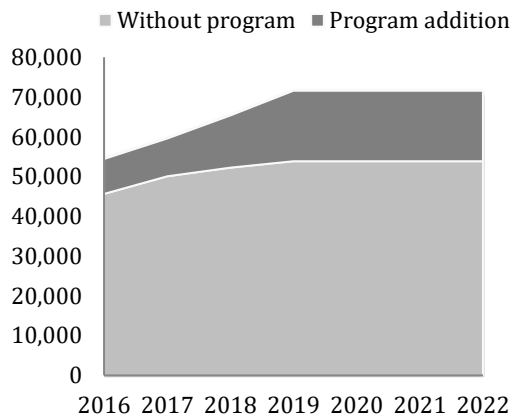
9. **Project benefits.** The project investment is expected to bring the following economic benefits:

- *Power supply.* The investments proposed under the *Power for All* program are expected to increase the system capacity of the Andhra Pradesh's grid from 8.6 GW to 10.2 GW in 2016, and from 10.2 GW to 13.4 GW from 2019 onward, translating to an additional annual power supply of 17,722 GWh by 2019 assuming a load factor of 0.7 and a technical loss of 13.1%. Thus, the additional electricity supply attributable to the Project investments (6.5% of the total Program investment) will be around an annual supply of 1,152 GWh from 2019 onward.

Capacity (MW)



Energy Supply (GWh)



- Technical losses reduction.** Over the course of 4 years, the Program is expected to reduce the technical losses in Andhra Pradesh from 13.1% to 12.0% and maintain at that level beyond 2019.

Table 4. Technical loss with and without the Project

	2016	2017	2018	2019	2020	2021	2022
Without program	13.1%	13.1%	13.1%	13.1%	13.1%	13.1%	13.1%
With Program	12.9%	12.6%	12.3%	12.0%	12.0%	12.0%	12.0%
Tech loss reduction GWh	1.4	3.4	7.2	13.0	13.0	13.0	13.0

- Avoided local externalities.** Diesel-based self-generation emits more damaging local pollutants, such as SO₂, NO_x, and PM₁₀, in populous urban demand centers than utility-scale power generation in remote rural areas. Damage cost estimates are based on a 6-city study carried out by the World Bank in India.

Table 5. Local pollutant emissions from power generation

	Units	NOx	PM10	SO2
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

10. **Willingness to pay (WTP).** The additional power supply made available by the additional transmission capacity and technical loss reduction is valued at 15.7 US cent per kWh, the weighted average WTP for the following consumption groups in Andhra Pradesh:

- *Industry and commercial*, constituting a half of the total consumption, has an estimated WTP of INR 14.10 per kWh, based on the cost of supply from small-scale diesel gensets with 30% utilization factor, a capital cost of US\$383 per kW and a diesel price based on the 2016 Commodity Price forecast by the World Bank;
- *Agriculture*, constituting 27% of the total consumption, has an estimated WTP around INR 3.37 per kWh, assumed at a half the tariff for the highest consumption tier in APERC's 2016 Tariff Order;
- *Households*, constituting 24% of the total consumption, has an estimated WTP around INR 7.75 per kWh, assumed at the tariff for the highest consumption tier in APERC's 2016 Tariff Order

11. **Outcome of the economic analysis.** In the base case scenario with a discount rate of 10 percent, the Project investment yield an economic net present value (ENPV) of US\$508 million, and an economic internal rate of return (EIRR) of 19.9 percent, well exceeding the hurdle rate of 10 percent. The investment is thus economically justified. The additional energy supplied as a result of the transmission and distributions lines accounts for 95 percent of the benefits while the reduction in technical losses accounts for the remaining. The local environmental benefits roughly offset the global environmental costs. At 10 percent discount rate, the project has a payback period of 5 years, inclusive of the 4-year construction period.

Table 6. Outcomes of the Economic Analysis – Base-case Scenario

	EIRR (%) Base Case	ENPV at 10% (US\$ million)
Excluding environmental benefits & costs	19.9%	508
Including environmental benefits & costs	20.0%	542

12. **Sensitivity analysis.** Given the uncertainties associated with various market and project-specific parameters, sensitivity study is carried out to assess the robustness of the economic viability of the Project investment, and to estimate the investment breakeven point, i.e., the switching value, for each parameter. The analysis the economic viability of

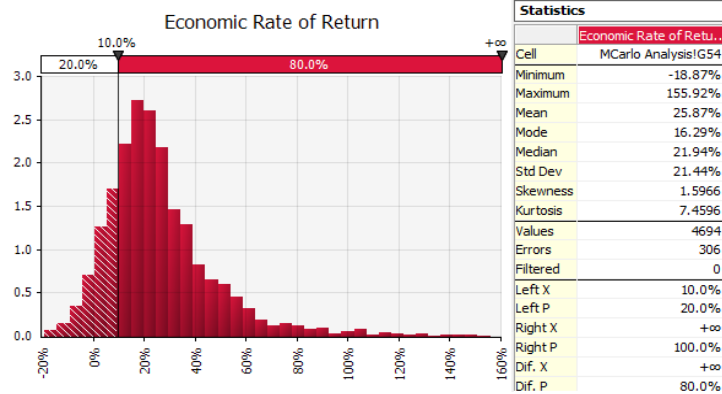
the project investment is highly robust to withstand large variations in key market and project-specific parameters, including (i) construction cost overruns; (ii) commercial operation date (COD) delays; (iii) short falls in electricity supply (due to delay in commissioning of generation plants and/or drop in demand); and (iv) average WTP. The outcomes of the analysis are summarized below.

Table 7. Sensitivity analysis

Parameter	Parameter impact on EIRR	Baseline Value	Switching Value
<i>Construction cost overruns</i>		\$448 million	\$1,138 million
<i>Commercial Operation Date (COD) delays</i>		0 year	3 years
<i>Shortfall in electricity supply</i>		1,152 GWh	772 GWh
<i>Average Willingness to Pay</i>		15.7 US cent/ kWh	10.5 US cent/ kWh

13. Risk assessment using Monte Carlo simulation. Using Monte Carlo simulations, the analysis estimates the distribution of the EIRR using the assigned probability distributions of the above mentioned risk parameters along with some variations in carbon value, each repeatedly and randomly drawn from their assigned probability distributions for 5,000 times. The results of the Monte Carlo simulation suggest that (i) the probability of an EIRR below 10 percent, the hurdle rate, is only 20 percent; and (ii) the mean of the EIRR probability functions stands at 25.9%.

Figure 1. Monte Carlo simulation EIRR distribution



B. Financial analysis

Methodology and key assumptions

14. The financial analysis of the project was carried out from the perspective of the two Andhra Pradesh distribution companies. Project costs include investment costs, additional costs of power purchase and operational costs. Project benefit is measured in terms of additional revenue receipts from power sales resulted from the Project intervention. The weighted average tariff starts from INR 6.19 per kWh in 2016, and is assumed to increase 5% per annum going forward.

15. **Project financing and the weighted average cost of capital (WACC).** The project investment will be financed, in part, by US dollar denominated loans from AIIB (28%) and IBRD (42%), to be repaid in 25 years, including a 5-year grace period, with rate linked to the London interbank offered rate (LIBOR). The remaining 30% is financed by counterpart equity at a 12.5 percent per annum per State Tariff Order.

16. **Outcome of the analysis.** Based on the above assumptions, the Project investment will yield a financial internal rate of return (FIRR) of 8.3%. Given power sales being the sole benefit stream from the investment, the tariff growth trajectory will thus have crucial impact on the FIRR.

Table 8: Financial Internal Rate of Return

		NPV	2016	2017	2018	2019	2020	2021	
	Discoms								
	<i>benefits</i>								
[1]	Projected Average Tariff	INR/KwH	104.5	6.19	6.5	6.9	7.3	7.6	8.1
[2]	Additional electricity wheeled	[GWh]	9914.9	570	618	853	1152	1152	1152
[3]	Additional Electricity Revenue	INRmillion	112638.8	3532	4035	5869	8355	8806	9282
[4]		\$USm	1298.3	55.2	61.5	87.3	121.4	124.9	128.5
[5]	of which VAT	\$USm	129.8	5.5	6.2	8.7	12.1	12.5	12.9
[6]	total benefits		1298.3	55.2	61.5	87.3	121.4	124.9	128.5
[7]		\$USm							
[8]	<i>costs</i>								
[9]	Power Purchase Cost	\$USm	773.6	55.2	58.4	78.7	103.8	101.3	98.9
[10]	of which VAT	\$USm	77.4	5.5	5.8	7.9	10.4	10.1	9.9
[11]	Distribution Costs	\$USm	374.8	81.0	82.6	124.7	127.1	8.1	8.1
[12]	of which Taxes	\$USm	37.5	8.1	8.3	12.5	12.7	0.8	0.8
[13]	Payments to APTRANSCO		110.1	11.9	11.9	11.9	11.9	11.9	11.9
[14]	net cash flows	\$USm		-98.4	-97.6	-136.7	-133.5	-8.9	-3.2
[15]	aggregate FIRR	[]		8.3%					

17. **Distributional analysis.** A distributional analysis of the Project shows broad based gains to different groups from the project with the end-users in Andhra Pradesh as 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.

C. Financial assessment of the implementing agencies

18. Financial assessments are carried out followed by financial projections for the two distribution utilities, namely APEPDCL and APSPDCL.

19. While the tariff had been well below cost recovery, Andhra Pradesh state government had a subsidy scheme that promises cost-plus a 12.5 percent return on equity. The subsidy scheme had resulted in relatively healthy financial status with positive operating margins for both distribution companies until 2013 when their financial situation took a dive and sank into heavy losses. Several reasons had contributed to this situation:

- *Costly short-term power purchase.* With fast growing demand, system-wide capacity constraint and power shortages, both companies become increasing reliant on costly short-term power purchases to make up for the supply deficits. As a result, in the period of 2011-15, the average power purchase costs for both companies had been growing at an average annual rate of 9.6 percent. In 2016, short-term power purchase tariff averaged around 8.5 US cent or INR 5.7 per kWh while the cost premium is not compensated under the regulated tariff and subsidy regimes;
- *Government arrears and immaterialized subsidies.* In spite of the cost-plus-based tariff and subsidy schemes, government subsidies had not been fully materialized except for in agriculture where subsidies had been paid in full. As a result, while the distribution companies' income statements had been showing positive operating margins (prior to 2013), most of the promised subsidies had only been registered as receivables from the government on their balance sheets. For years, while

government arrears kept on mounting, the receivables had not been materialized. In 2013, both distribution companies took a one-time write-off of a combined amount of US\$1,274.6 million (INR85,399 million) in government receivables, and registered that as a loss on their income statements.

- *Rising costs and debt service burden.* Besides the rising costs from increase short-term power purchase, employee costs have also increased substantially from under 6 percent of revenue to 11.4 percent since FY 2012. Moreover, both companies have become increasingly reliant on short-term loans to make up for the cash deficits from operations. As it stands, short-term debts currently account for 88 percent of the companies' debt portfolio; interest payment had tripled over the last years.

Financial Projections

20. Recognizing the system constraints and the premium of short-term power purchases, the distribution companies have been actively pursuing long-term PPAs with new generations companies in the pipeline. Some of these companies had started operation in 2016 while others are expected to come online over the next two to three years. As a result, average power purchase cost is expected to plateau with an estimated average annual growth of 0.8 percent over the period of 2015-2020.

Table 8 . New generation plants with long-term PPAs

Sr. No.	Name of the Plant	Capacity (MW)	Costs* (INR/kWh)	Estimated Generation (MUs)			
				FY16	FY17	FY18	FY19
1	Krishnapatnam	1,600	4.5	-	10,450	10,450	10,450
2	Tuticorin	118	3.9	960	960	960	960
3	Hinduja	1,040	4.2	450	6,470	6,470	6,470
4	Thermal Power Tech	230	3.5	1,710	1,720	1,720	1,720
5	RTPP Stage IV	600	4.0	-	-	4,000	4,000
6	Kudigi	200	4.6	-	170	300	300
Sub-total				3,120	19,770	23,900	23,900
7	Solar	NA	5.0	450	3,700	5,600	7,500

21. **Debt restructuring program - UDAY:** To reduce the distribution companies' debt service burden, the state of Andhra Pradesh has signed a UDAY MoU, which promises a debt-equity swap of 75 percent of the distribution companies' existing debt. The reduced debt burden will take effect on the companies' financing statements in 2018. Moreover, the state government has also agreed on providing Operational Funding Requirement (OFR) support to the distribution companies till their financial situation is turned around.

Table 9: Schedule for Debt takeover by the state government

Timelines	Debt takeover under UDAY	Debt takeover of FRP, 2012
30 th Sep, 2016	INR 42.3 bn	INR 15 bn
31 st Mar, 2017	INR 21.2 bn	INR 10.5 bn

22. **On the tariff front**, Andhra Pradesh Electricity Regulatory Commission made some revisions to the tariff structure in its 2017 tariff order. Moreover, in its tariff projection, UDAY had built in a 5 percent annual growth in average tariff starting from 2018. To be conservative, this analysis assumes a more modest annual growth rate of 2 percent to be in line with historical situation.

23. **Other key assumptions for the financial projections** include:

- **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.
- **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 percent in costs and also includes a pay revision of 15 percent in FY 2019.
- **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 10: Other key assumptions for the financial projections

	FY15	FY16	FY17	FY18	FY19	FY20	FY21
Average Tariff hike (%)	Base year	5.0%	0.8%	2.8%	0.5%	1.8%	3.8%
Subsidy (INR million)							
• 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%*	-6.8%	4.5%	7.4%	15.7%	7.2%	7.2%
• APSPDCL	95.5%*	0.9%	8.3%	9.0%	19.9%	7.6%	8.4%
ATC losses (%)							
• APEPDCL	6.2%	8.0%	7.5%	7.0%	6.6%	6.2%	5.8%
• APSPDCL	12.2%	9.3%	8.4%	8.1%	7.9%	7.6%	7.3%

24. Based on the above assumption, the financial projects for both distribution companies are summarized in the tables below:

Table 11: APEPDCL financial projections (INR million)

	FY15	FY16	FY17	FY18	FY19	FY20	FY21
Revenue from power sales	6,091	7,102	8,730	9,914	11,119	12,602	14,461
Tariff subsidy	875	868	136	136	136	136	136
Sub-Total	7,965	8,656	9,811	11,090	12,923	14,732	16,684
Costs							
<i>PP</i>	6,835	7,272	8,252	9,325	10,489	11,585	13,346
<i>Employee</i>	1,003	874	914	980	1,149	1,230	1,317
<i>Other</i>	143	194	203	220	239	259	279
Sub-total	7,981	8,340	9,369	10,525	11,877	13,074	14,942
EBITDA	(16)	315	442	565	1,046	1,658	1,742
Dep	252	290	371	422	476	533	593
Interest	326	484	541	548	433	389	447
PAT	(718)	(408)	(428)	(358)	125	520	501
ARR (INR/kWh)	6.1	5.7	5.9	6.0	6.3	6.5	6.7
ACS (INR/kWh)	6.6	6.0	6.1	6.2	6.3	6.2	6.4

Table 12: APSPDCL financial projections (INR million)

	FY15	FY16	FY17	FY18	FY19	FY20	FY21
Revenue from power sales	10,498	12,626	14,773	16,930	20,298	23,496	26,848
Tariff subsidy	2,250	2,318	3,153	3,153	3,153	3,153	3,153
Sub-Total	14,611	15,804	18,892	21,236	24,783	28,175	31,750
Costs							
<i>PP</i>	12,995	14,652	15,497	17,570	19,546	21,394	24,474
<i>Employee</i>	1,813	1,945	2,093	2,255	2,735	2,920	3,153
<i>Other</i>	468	357	399	460	521	582	644
Sub-total	15,276	16,954	17,988	20,285	22,801	24,895	28,271
EBITDA	(665)	(1,150)	904	950	1,982	3,280	3,480
Dep	586	839	1,002	1,184	1,404	1,624	1,842
Interest	602	993	912	901	954	991	1,089
PAT	(1,856)	(2,995)	(1,023)	(1,148)	(389)	391	321
ARR (INR/kWh)	5.3	5.4	5.9	6.0	6.4	6.6	6.8
ACS (INR/kWh)	5.9	6.4	6.2	6.3	6.5	6.5	6.7

25. **Conclusions of the Financial Analysis** are summarized as:

- a. With reduction in growth of power purchase costs expected in the future, and corresponding levels of subsidy, the financial situations are expected to turn around in FY 2019 for APEPDCL and in FY 2020 for APSPDCL. The early turnaround for APEPDCL is due to the company's favorable consumer mix with lower percentage of agriculture sales.
- b. While the project assumed relatively modest tariff hikes and no OFR support from the state, it has indeed assumed the tariff subsidy scheme to be strictly followed in practice, and further enforced through state regulation in both 2017 and 2021.

The reliability of the projection's outcome is also contingent upon the sales mix shifting towards more commercial/industrial consumption and less agriculture consumption.

Annex 4: Sovereign Credit Fact Sheet

A. Recent Economic Development

India is a lower-middle-income country, with a population of 1.3 billion. India is also the world's 3rd-largest economy based on PPP GDP. Indian real GDP expanded at an average annual rate of 7.3 percent between FY2003 and FY2012. In FY2012/13 and FY2013/14, real GDP growth had slowed to 5.1 percent and 6.9 percent, as a result of growing imbalances, binding supply constraints, and subdued sentiment.

However, since late 2014, a collapse of global oil prices has boosted economic activity in India and underpinned a further improvement in the current account and fiscal positions. It has also brought about a sharp decline in inflation. Growth reached 7.3 percent in FY2014/15 on the back of an improvement in sentiments. A range of supply-side measures (including release of surplus grain buffer stocks) and an appropriate monetary stance have also contributed to the decline in inflation, from an average of about 9.5 percent during 2011–13 to 5.9 percent in FY2014/15.

Due to its further-reduced vulnerabilities and improved growth prospects, India has experienced large foreign direct investment inflows in 2015. As a result, and in conjunction with the continued much-smaller current account deficit (largely due to continued low global commodity prices), international reserves have increased.

B. Economic Indicators

Selected Macroeconomic Economic indicators (2012/13-2016/17)

Economic Indicators	2012/13	2013/14	2014/15	2015/16*	2016/17*
National income and prices (change %)					
Real GDP	5.1	6.9	7.3	7.3	7.5
Industrial production	1.1	-0.1	2.8		
Consumer price (change %, average)	9.9	9.4	5.9	5.0	5.3
Central government operations (% of GDP)					
General government deficit	-7.4	-7.6	-7.0	-7.0	-7.0
External debt (% of GDP, EOP)	22.3	23.8	23.2	24.0	23.6
Gross external financing requirement (%GDP)		11.7	10.5	10.1	10.6
Nominal gross public debt (% of GDP)		65.8	66.3	65.7	64.8
Public gross financing needs (% of GDP)		12.2	12.1	12.1	11.9
Money and credit					
Broad money (% annual change, EOP)	13.6	13.4	10.8	11.1	13.6

Direct investment in India (% of GDP)	1.5	1.6	1.7	2.3	2.4
Gross reserves (months imports)	6.4	6.7	7.9	8.0	7.9
Current account balance (% of GDP)	-4.7	-1.7	-1.3	-1.3	-1.5
Exchange rate (Rupee/\$, end period)	54.4	61.0	62.6	66.8	

Note: * denotes projected figures. Source: IMF Country Report No. 16/75, March 2016.

C. Economic Outlook and Risks

Looking ahead, Indian growth is projected at 7.3 percent for fiscal year FY2015, picking up to 7.5 percent in FY2016, supported by stronger domestic demand. However, economic risks remain tilted to the downside.

Despite the improvement in terms of trade due the decline in oil prices, the current account remains in deficit. Government deficits remain high, at around 7% of GDP. These imply a continuing reliance on external funding. The exchange rate has also weakened from 1 USD to 50 Rupees in 2011, to 67 Rupees in 2015.

At more than 60 per cent to GDP, India's public debt level is relatively high compared to developing economies. Nevertheless, India's public debt remains sustainable so long as the economy continues to grow strongly and interest cost remains manageable. Under the baseline scenario, assuming gradual fiscal consolidation, the public debt-to-GDP ratio is forecast to decline gradually to around 61.6 percent of GDP in FY2020 from the current level of about 66 percent, with gross financing needs also declining slightly to about 10.7 percent of GDP in FY2020.

Externally, there could be disruptive impact arising from global financial market volatility stemming from unexpected developments in the course of U.S. monetary policy or China's growth slowdown. Domestic risks include continued weaknesses in corporate financial positions and public bank asset quality, in particular the banks that have lent heavily to infrastructure projects. There could also be setbacks in the reform process, which could weigh on growth. Realization of contingent liabilities coming from future bank recapitalization as well as the liabilities of the electricity distribution companies may also push the public debt trajectory up above the 70 percent benchmark, before the debt-to-GDP ratio declines gradually in the medium term.

Nevertheless, India's external debt stays currently at 24 percent of GDP, remains sustainable.⁹ India's reserves are also assessed to be adequate.

⁹ International Monetary Fund (IMF), 2016. Country Report No. 16/75– 2016 Article IV Consultation— Press Release; Staff Report; and Statement by the Executive Director for India, March, 2016.

Annex 5: Coordination with other Financiers and Private Sector

1. The Project is financed partly with the Borrower's own sources and partly with loans from multilateral development banks (the Bank and the WB). Private sector participation is not expected in the Project which is basically a T&D project that is owned and operated by the public sector. Private sector's active participation will be in the power generation projects via the Public Private Partnership (PPP) route.
2. The WB will be the lead co-financier and will supervise the Project and administer the AIIB loan on behalf of the Bank, in accordance with the WB's applicable policies and procedures, and a Project Co-Lenders' Agreement, to be signed between the Bank and the WB. The WB plans to visit the project sites three times per year to monitor progress. The Bank will join these supervision missions.
3. The Bank has reviewed the applicable World Bank's Operational Policies (OP) and Business Procedures (BP), the WB's Procurement and Consultant Guidelines, and the WB's sanctions policies and procedures, including the World Bank's Anti-Corruption Guidelines. The Bank has found them all satisfactory for application to the Project. The Bank will rely on the WB's determination of compliance with the above World Bank policies and procedures applicable to the project. Project monitoring and reporting, as well as financial management, will also be carried out in accordance with the WB's requirements. This approach ensures that one set of policies will apply to the entire Project. It will also provide a single point of contact for Borrower and the IAs, and therefore facilitate a more efficient and seamless approach to Project implementation.