Completion Report

Project Number: 32298-033
Loan Number: 2324
May 2016

India: Madhya Pradesh Power Sector Investment Program (Tranche 2)

Asian Development Bank

CURRENCY EQUIVALENTS

Currency Unit – Indian rupee/s (Re/Rs)

		At Appraisal (12 December 2006)	At Project Completion (31 December 2012)
Re 1.00	=	$0.0223	$0.0178
$1.00	=	Rs 44.83	Rs 56.05

ABBREVIATIONS

ADB	-	Asian Development Bank
DISCOM-East	-	Madhya Pradesh Poorv Kshetra Vidyut Vitaran Company Limited
DTR	-	Distribution transformer
EMP	-	Environmental management plan
EIRR	-	Economic internal rate of return
FIRR	-	Financial internal rate of return
FY	-	Fiscal Year
GOMP	-	Government of Madhya Pradesh
GSDP	-	Gross state domestic product
HVDS	-	High voltage distribution system
IDC	-	Interest during construction
LIBOR	-	London interbank offered rate
PFC	-	Power Finance Corporation
REC	-	Rural Electrification Corporation

WEIGHTS AND MEASURES

GWh	–	gigawatt-hour
hp	–	horse power
km	–	kilometer
kV	–	kilovolt
kVA	–	kilovolt-ampere
kW	–	kilowatt
kWh	–	kilowatt-hour

NOTES

(i) The fiscal year (FY) of the Government of India ends on 31 March. FY before a calendar year denotes the year in which the fiscal year ends, e.g., FY2013 ends on 31 March 2013.

(ii) In this report, "$" refers to US dollars.

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CONTENTS

BASIC DATA

A. Loan Identification

1.	Country	India
2.	Loan Number	2324
3.	Project Title	Madhya Pradesh Power Sector Investment Program (Tranche 2)
4.	Borrower	Government of India
5.	Executing Agency	Madhya Pradesh Poorv Kshetra Vidyut Vitaran Company Limited (DISCOM-East)
6.	Amount of Loan	$45 Million
7.	Project Completion Report Number	PCR: IND 1558

B. Loan Data

1.	Appraisal	
	- Date Started	12 December 2006
	- Date Completed	14 December 2006
2.	Loan Negotiations	
	- Date Started	19 February 2007
	- Date Completed	20 February 2007
3.	Date of Board Approval	4 April 2007
4.	Date of Loan Agreement	12 April 2007
5.	Date of Loan Effectiveness	
	- In Loan Agreement	14 May 2007
	- Actual	11 July 2007
6.	Closing Date	
	- In Loan Agreement	30 September 2011
	- Actual	15 July 2013
	- Number of Extensions	1
7.	Terms of Loan	London interbank offered rate-based
	- Interest Rate	Sum of LIBOR and 0.6%
	- Maturity (number of years)	20 years
	- Grace Period (number of years)	5 years
8.	Terms of Relending (if any)	
	- Interest Rate	Relending between the Government of India and GOMP is on the same terms and conditions as those applicable to the Government of India.
	- Second-Step Borrower	GOMP on-lending to DISCOM-East, with a one percentage point spread.
	- Maturity (number of years)	20 years
	- Grace Period (number of years)	5 years

9. Disbursement
   a. Dates

Initial Disbursement	Final Disbursement	Time Interval
15 July 2007	28 March 2013	72.42 months
Effective Date	**Original Closing Date**	**Time Interval**
14 May 2007	30 September 2011	52.62 months

DISCOM-East = east zone distribution company, GOMP = government of Madhya Pradesh, LIBOR = London interbank offered rate

b. Amount ($ million)

Category No.	Category or Subloan	Original Allocation	Last Revised Allocation[a]	Amount Disbursed	Undisbursed Balance
1.	Works	2.00	0.00	0.00	0.00
2.	Equipment	33.50	39.95	39.95	4.25
3.	Interest & Commitment charges	0.80	0.80	0.80	0.00
4.	Unallocated	8.70	0.00	0.00	0.00
	Total	**45.00**	**40.75**	**40.75**	**0.00**

[a] Reallocation among various categories was undertaken on 12 October 2010.

10. Local Costs (Financed)
    - Amount ($) 0
    - Percent of Local Cost 0
    - Percent of Total Cost 0

C. Project Data

1. Project Cost ($ million)

Cost	Appraisal Estimate	Actual
Foreign Currency Cost	45.0	40.75
Local Currency Cost	20.7	23.55
Total	**65.7**	**64.30**

2. Financing Plan ($ million)

Cost	Appraisal Estimate	Actual
ADB Financed	45.00	40.75
PFC	10.00	7.60
REC Loan	00.00	5.32
DISCOM-East	10.70	10.63
Total	**65.70**	**64.30**

ADB = Asian Development Bank, DISCOM-East = distribution company, REC = Rural Electrification Corporation, PFC = Power Finance Corporation

3. Cost Breakdown by Project Item ($ million)

Item	Appraisal Estimate			Actual		
	Foreign	Local	Total	Foreign	Local	Total
Total Base line Costs	33.50	20.20	53.70	39.95	17.99	57.94
Contingency						
Physical	1.70	1.00	2.70	0.00	0.00	0.00
Price	3.30	2.00	5.30	0.00	0.00	0.00
IDC and Commitment charges	3.90	0.00	3.90	0.80	5.56	6.36
Total	**42.40**	**23.30**	**65.70**	**40.75**	**23.55**	**64.30**

IDC = interest during construction

4. Project Schedule

Item	Appraisal Estimate		Actual	
	Start	End	Start	End
High-Voltage Distribution System	Mar 2008	Jun 2012	Mar 2008	Dec 2012
Remote Metering	Mar 2009	Oct 2010	Mar 2009	Jun 2011
Supply of 33 kV and 11 kV VCB	July 2008	Apr 2010	Jul 2007	Apr 2010
Supply of AAA Raccoon conductor	Mar 2012	Dec 2012	Mar 2012	Dec 2012
Supply of PVC Cable and AB cable	Feb 2012	Dec 2012	Feb 2012	Dec 2012
Supply of fabricated material and H-beam	Mar 2012	Nov 2012	Mar 2012	Dec 2012

AAA = all aluminum alloy, AB = aerial bundled, H = hot-rolled steel, kV = kilo volt, PVC = polyvinyl chloride, VCB = vacuum circuit breaker

5. Project Performance Report Ratings

	Ratings	
Implementation Period	**Outcome**	**Implementation Progress**
From 15 March 2008 to 31 December 2008	Satisfactory	Satisfactory
From 1 January 2009 to 31 December 2009	Satisfactory	Satisfactory
From 1 January 2010 to 31 December 2010	Satisfactory	Satisfactory
From 1 January 2011 to 31 December 2011		On Track
From 1 January 2012 to 31 December 2012		On Track
From 1 January 2013 to 30 June 2013		On Track

D. Data on Asian Development Bank Missions

Name of Mission	Date	No. of Persons	No. of Person-Days	Specialization of Members
Fact-finding Mission	16–24 Oct 2006	5	45	a,c,k,d
Appraisal Mission	12–14 Dec 2006	5	29	a,b,c,d
Inception Mission	20–25 May 2007	5	30	a,b,c,d,e
Loan Review Mission	07–17 Jan 2008	3	33	c,f,d
Loan Review Mission	01–03 Sep 2008	3	9	c,f,d
Loan Review Mission	15–17 Apr 2009	1	3	i
Loan Review Mission	15–20 Jun 2009	2	12	b,e
Special Loan Administration	24–27 Nov 2009	2	8	b,e
Special Loan Administration	6–16 Apr 2010	2	22	g,h
Loan Review Mission	27–30 Oct 2010	2	8	g,h
Loan Review Mission	29 Nov–01 Dec 2010	2	6	b,e
Loan Review Mission	11–14 Oct 2011	2	8	f,j
Loan Review Mission	14–16 Feb 2012	2	6	f,j
Loan Review Mission	10–14 Dec 2012	1	5	f
PCR Missions	31 Mar–03 Apr 2015 and 7-19 March 2016	1	13	f

a = senior finance specialist (energy), b = senior project implementation specialist, c = energy specialist, d = project implementation specialist, e = assistant project analyst, f = project officer (energy), g=resettlement and social development officer, h=environment officer, i=team leader (energy), j= senior project assistant, k=social development specialist, i=senior control officer (now senior financial control officer)

I. PROJECT DESCRIPTION

1. India faces formidable challenges in achieving balanced infrastructure development, in which the provision of adequate energy plays an essential role in reducing poverty through sustainable economic growth.[1] The Government of India developed Integrated Energy Policy[2] in 2006 to address energy security throughout the country. The policy's vision is to meet energy demand reliably with safe, clean, and convenient energy ("power for all") in a technically efficient, economically viable, and environmentally sustainable manner. The policy provides for specific rectification measures, including (i) optimizing the power supply mix through greater use of indigenous hydropower resources and renewable energy; (ii) pursuing technologies that maximize energy efficiency, demand-side management, reduced greenhouse gas emissions and conservation; and (iii) continuing related power sector reforms to control technical and commercial losses from state transmission and distribution utilities, with restructuring supported by the Accelerated Power Development and Reform Program.

2. To facilitate economic growth in the state of Madhya Pradesh, a diagnostic assessment, which resulted in development of a power sector road map, conducted by the Government of Madhya Pradesh (GOMP), revealed that significant investments were needed to enhance evacuation capacity of the distribution system, which would also facilitate evacuation of power from upcoming central and state sector generation projects. The aim of the Madhya Pradesh Power Sector Investment Program was to support the GOMP's sector road map through improvement in the overall efficiency of the distribution system and reduction of system losses.

3. In order to address the high losses, exceeding 35% and to improve reliability (energy security), the distribution network needed significant investment. The high technical losses and poor electrical power quality, common to each of the three state level distribution companies, was due to undersized conductors, long low voltage circuits and overloading of distribution transformers. Furthermore, the long low voltage power lines caused high losses and enabled theft through easy access to the lines, particularly in urban areas. Non-technical losses were high due to outdated meters, non-metered and illegal connections, and weak billing and collection. At the request of the government, ADB prepared a road map and a multi-tranche loan to address these deficiencies, the first such intervention in the Indian power sector. The multi-tranche financing facility (MFF) modality was deemed to be particularly well suited for the investment program because it offered the flexibility needed to support investments in the three distribution companies, which had different needs and various levels of project readiness.

4. In order to address the inefficiencies in power distribution, the Madhya Pradesh Power Sector Investment Program (Tranche 2), (the project), implemented by the Madhya Pradesh Poorv Kshetra Vidyut Vitaran Company Limited (DISCOM-East), supported construction of a high-voltage distribution system (HVDS), installation of remote metering, renovation of the electrical protection system through installation of 11 kilovolt (kV) and 33 kV vacuum circuit breakers and through a metering component. The project helped to improve the voltage profile, reduce transmission and distribution losses, reduce distribution transformer failures, reduce non-technical losses and improve tariff collection and revenues.

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[1] ADB. 2007. *Report and Recommendation of the President to the Board of Directors: Proposed Multitranche Financing Facility (India: Madhya Pradesh Power Sector Investment Program). Manila.*

[2] Planning Commission, Government of India. 2006. *Integrated Energy Policy: Report of the Expert Committee.* New Delhi.

II. EVALUATION OF DESIGN AND IMPLEMENTATION

A. Relevance of Design and Formulation

5. At appraisal (March 2007) the installed generation capacity of the state of Madhya Pradesh, including the central sector and joint venture power stations was 6,822 megawatts (MW). This enabled a restricted state level peak demand of 6,109 MW to be met during 2006–2007, compared with an unrestricted demand of 7,114 MW, resulting in a shortage of 1,005 MW and related "brown outs" and reduced voltage levels. The project was relevant and consistent with the government's overall development objectives and the Asian Development Bank's (ADB) strategy for India in supporting infrastructure-led poverty reduction. [3]

6. The project addressed distribution capacity constraints with the added benefit of significantly reducing losses; losses declined from 37.72% in FY2008 to 23.68% in FY2014, and further to 21.69% FY2015, the reduction in losses was equivalent to 764 gigawatt hours/year,[4] while bill collection improved from 92.52% in FY2008, to 103.52% in FY2014 and 105.53% in FY2015, which included collection of a number of accounts in arrears.[5] The project's outputs were implemented as proposed at appraisal and the resulting improvements in efficiency, reduced losses, bill collection and increased revenue of DISCOM-East, confirmed the relevance of the project design and formulation.

7. The specific outcomes, outputs and project milestones were achieved as detailed in the Design and Monitoring Framework in Appendix 1.

B. Project Outputs

8. The project was designed to reduce distribution transformer failures, improve the voltage profile and reduce distribution losses. At appraisal, the project proposed: (i) construction of high voltage distribution systems (HVDS) in six distribution circuits with 9,800 25-kilovolt ampere (kVA), 12,400 16-kVA transformers[6] and conversion of about 7,400 kilometers (km) of low-voltage lines to high-voltage lines (440 volt to 11kV); (ii) remote metering of about 2,000 larger consumption agricultural and industrial consumers; (iii) metering of about 200,000 single phase residential, rural and commercial consumers; (iv) about 50,000 three phase consumers, and (v) renovation of the protection systems at about 100 substations. The HVDS covered predominantly agriculture areas in six divisions (Gadarwara, Patan, Damoh South, Prithvipur, Satna and Rewa divisions).

9. Actual HVDS outputs included installation of 10,248 25-kVA and 5,327 16-kVA 3-phase distribution transformers, lower than estimated. Similarly, 4,028 km of low tension line required conversion by 11 kV line, also lower than estimated. Appraisal estimates were based on preliminary data and on the basis of prototype engineering designs. Completed works were based on detailed global positioning surveys (GPS) and technical optimization, as required in the turn key contracts issued by the DISCOM.[7] Similarly, 1,084 km of

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[3] ADB. 2004. *Country Strategy and Program Update (2004–2006): India*. Manila, and ADB. 2005. *Country Strategy and Program Update (2005–2007): India*. Manila

[4] From DISCOM-East.

[5] From DISCOM-East.

[6] Estimated new and replacement transformers.

[7] This was the DISCOM's first interaction with an ADB loan project and the implementation followed their normal procedures.

Raccoon conductor line[8], 957 km of polyvinyl chloride coated cable and new reinforced concrete power poles (1,500 metric tons), that had not been included at appraisal, were added to the project. The area covered by the project at completion was unchanged from the six divisions intended at appraisal, equipment specifications were also unchanged and the project cost was lower than estimated.

10. Remote metering was completed for 10,598 existing consumers with greater than 10 hp load (9,798 between 10 to 25 hp, and 800 above 25 hp), a substantial increase from the 2,000 estimated at appraisal. The remote metering facilitated monitoring of real time consumption of high value consumers, leading to lower non-technical losses and establishment cost. There were 53,000 three phase meters installed, slightly higher than the 50,000 estimated at appraisal.The 200,000 single phase consumer meters estimated at appraisal were installed, through a separate DISCOM-East program. Since DISCOM-East already had a similar program underway, there were technical and economic benefits to this minor change in scope.

11. The substation protection system for the 100 33/11 kV substations was completed with installation of 960 11 kV and 320 33-kV vacuum circuit breakers, as estimated at appraisal. Overall, the changes made as a result of detailed surveys and engineering design based on actual on-the-ground conditions optimized the design and operation of the new project facilities and strengthened its relevance.

C. Project Costs

12. At appraisal, the total cost of the project was $65.7 million, comprising $45 million in foreign currency and $20.7 million in local currency. At completion the project cost totaled $64.30 million, comprising $40.75 million in foreign currency and $23.55 million in local currency costs. Savings of $4.25 million for equipment are primarily attributed to (i) a lower-than-estimated equipment cost due to competitive bidding; (ii) reduction in the length of 11 kV distribution lines due technical optimization; and (iii) shifting of the 200,000 meters from the ADB loan. The cost breakdown by project category is in Appendix 2. The contract summary is in Appendix 3 and the project financing plan is summarized in Appendix 4.

D. Disbursements

13. ADB disbursements totaled $40.75 million (90.53%) from ordinary capital resources out of the original loan amount of $45 million; $4.25 million (9.47%) was cancelled as a result of cost savings. The projected and actual disbursement of loan proceeds, are in Appendix 5.

E. Project Schedule

14. At appraisal, all physical subprojects were scheduled to be completed by end 2011. The major part of the project was completed by December 2012. The loan closing date was extended, at the request of the executing agency (DISCOM-East), from September 2011 to December 2012, to facilitate project completion. However, the Gadarwara portion of the project was not completed until October 2013 in order to avoid disruption of agricultural activity. A chronological listing of the main project events is in Appendix 6.

[8] Racoon conductor is the trade name off commonly used high voltage (33 kV) line.

F. Implementation Arrangements

15. The implementation arrangements were as envisaged at appraisal. The executing agency under the direction of the Managing Director, DISCOM-East had overall responsibility for project implementation. A dedicated project management unit (PMU), led by a senior chief engineer and staffed by experienced technical, project construction management and administrative staff, provided overall day to day project co-ordination. To ensure ADB procurement guidelines were consistently and efficiently complied with, design and procurement of all packages was guided and facilitated from the DISCOM-East headquarters at Jabalpur, India. Chief engineers for each distribution district were placed in charge of civil works (installation of mechanical and electrical equipment, power pole erection and commissioning of distribution works). Due diligence with respect to financial matters were overseen by the chief financial officer of DISCOM-East. Project progress was documented through quarterly progress reports. The organizational chart for the project is in Appendix 7.

G. Conditions and Covenants

16. Loan covenants were generally met as required and no covenants were modified, suspended or waived during implementation. However, the loan covenants for compliance on cash management responsibility, debt service coverage ratio, self-financing ratio and pension funds could not be fully met within the project time frame. The covenants on cash management responsibility, debt service coverage ratio and pension funds while not achievable by loan closing are expected to be complied with by end 2018, coinciding with completion of ongoing projects. The delay in meeting these covenants did not impact project execution nor ongoing operation of project supplied facilities. The status of compliance with loan covenants is in Appendix 8.

H. Consultant Recruitment and Procurement

1. Consultants

17. At appraisal, it was assessed that the executing agency had the required technical design, procurement, construction management, financial and administrative institutional capacity to implement the project, and that a project implementation consultant was not required. The executing agency did recruit independent safeguard consultants; Xavier Institute of Development Action and Studies (Jabalpur, India) was recruited for preparation of social, environmental management and related monitoring and reporting. However, their contract ended in December 2010.[9] Subsequently, the Water and Power Consultancy Services (Gurgaon, India) were recruited to complete environmental management and project completion reports. Quarterly/annual reports on the implementation of environmental management and monitoring plans were submitted to ADB beginning in 2010. The executing agency also recruited the services of the Electrical Research and Development Association (Vadodara, India) as the third party inspector to conduct technical monitoring and testing of project equipment and materials.

[9] DISCOM-East contracts with consultants do not allow for extensions.

2. Procurement

18. The executing agency took early action to prepare bids, and major contracts were awarded in December 2007, ahead of the schedule projected at appraisal. ADB assisted in enabling timely project implementation through expeditious procurement approvals. Procurement of the 13 equipment and installation contracts was through international competitive bidding in accordance with ADB's *Procurement Guidelines* (2006 as amended from time to time).

I. Performance of Consultants, Contractors, and Suppliers

19. The contractors and suppliers performed their assigned tasks in accordance with their contracts, and the performance of all contractors and independent safeguard consultants was generally found to be *satisfactory*. However, the implementation of environmental safeguards by the executing agency and contractors in the initial years of implementation was found to be weak due to lack of qualified and experienced personnel, combined with limited supervision, monitoring and reporting. However, once the weak performance was confirmed by ADB review missions, ADB strengthened the performance through specific safeguard review missions and follow-up meetings with the environmental and social management unit staff of DISCOM-East and the consultants. ADB also conducted focused capacity-building programs. Subsequent implementation was improved and was reasonably adequate and effective in the later years of the project. All goods and services procured for the project complied with the specifications and other operational performance standards.

J. Performance of the Borrower and the Executing Agency

20. The overall performance of the borrower and the executing agency was *satisfactory*. The borrower was the Government of India and the executing agency was DISCOM-East. This was ADB's first power distribution loan in Madhya Pradesh. However, all project outputs were procured, constructed and commissioned successfully, within the extended loan completion date, and within budget. The contract for the Gadawara district was allowed a further extension to avoid damage to crops due to contractor's activities. Only one contract was terminated, due to poor performance by the contractor (the related works were completed by DISCOM's own forces), and the related lessons were successfully applied to strengthening the technical and financial evaluation criteria for future bid evaluation.

21. Overall, the executing agency demonstrated the ability to formulate, appraise, and arrange its own counterpart financing and carry out engineering, procurement and construction of a variety of technically complex electrical distribution projects that conformed to approved specifications and standards in a timely manner and within budget.

K. Performance of the Asian Development Bank

22. ADB closely monitored project progress through periodic review missions, assessment of quarterly progress reports, and provided useful and proactive advice in several areas including procurement, project management and capacity building of environmental monitoring procedures. ADB accorded timely approvals that enabled project milestones to be achieved that contributed to smooth project execution. Furthermore, ADB, the executing agency and government officials (from the Ministry of Power and Department of Economic Affairs) conducted regular/annual tripartite meetings, which assisted project execution through corrective actions. ADB's overall performance was *satisfactory.*

III. EVALUATION OF PERFORMANCE

A. Relevance

23. The project was *relevant* and consistent with both India's development priorities and ADB's country and sector strategies (footnotes 2 and 3). ADB's country strategy was to finance infrastructure projects in key sectors contributing to economic growth. Its power sector strategy focused on (i) reinforcing and expanding existing transmission and distribution systems relating to existing and new generation; (ii) reforming state power sectors with particular emphasis on State Electricity Board restructuring and commercialization; (iii) rationalizing power tariffs, at bulk and retail levels; (iv) reforming the regulatory framework; and (v) improving energy efficiency. At project completion, ADB's strategy for the power sector in India is in synergy with the Eleventh Five Year Plan (2007-2012) objectives of the government to develop infrastructure for economic growth and poverty reduction. The multi-tranche financing facility modality was appropriate, given that several implementing agencies with different scope, objectives and states of readiness were involved.

24. Reform of the Madhya Pradesh power sector was continued under the project in line with India's policy and legislative framework. GOMP has made progress in improving the efficiency, consumer service levels and financial performance of its power sector DISCOMs through implementation of the ADB financed multi-tranche financing facility. The design of the project was in line with the government's and state's objectives and resulted in increased hours of service to both urban and rural areas (10 and 24 hours/day, respectively), improved power security and voltage levels, reduced distribution system losses and helped reduce commercial losses by eliminating illegal connections through the metering program in the project areas. Due diligence for the project was carried out by the Madhya Pradesh Electricity Regulatory Commission and relevant government units that monitored project performance. The project incorporated technical optimization to improve the design based on actual ground conditions and was ultimately implemented within the revised project time period and budget. The resultant improved electricity service contributed to growth of economic activity in the project areas. The project was therefore relevant and will continue to improve distribution system planning, operation and maintenance of physical facilities and financial procedures of DISCOM-East.

25. The inclusion of detailed surveys and designs in turn-key contracts, as followed by DISCOM-East, is a common approach followed to adjust the schedules of quantity and related costs, as required by field conditions. While this led to some changes in as-built quantities/output, the end result is better technical optimization and use of loan funds, with better outcome and relevance of the project.

B. Effectiveness in Achieving Outcome

26. The project is rated *effective* in achieving its outcomes. Distribution losses were reduced significantly (para. 6); power distribution now meets local demand requirements, and resultant excess power is transmitted to other deficit areas. Furthermore, customer complaints have been reduced by half.[10] The project has increased voltage levels and reduced power outages to consumers, improved power distribution and guaranteed a

[10] Based on Quarterly Progress Report of EA for India: Madhya Pradesh Power Sector Investment Program (Tranche 4).

reliable supply of electricity in the intended areas. The resulting multiplier effect of multiple power sector improvement projects has helped increased state per capita income to Rs37,744, from Rs12,303[11] in the period 2006-2014. The enhanced distribution capacity and reliability caused many temporary connections to become permanent, increasing the revenues from energy charges, and lowered demand and maintenance cost of electric appliances, irrigation pumps and equipment thereby improving the economic opportunities of farmers, industrial and commercial consumers. The improved electricity supply contributes to increased agricultural production with some farmers increasing annual crop rotations. Implementation of the project provided opportunities for job creation, income growth, and upgrading of local infrastructure, and thus contributed to poverty reduction and sustainable development in urban areas of the project. The project achieved all physical targets established at appraisal. All project outputs are operating as designed and the new infrastructure is being maintained. The project is rated *effective,* as the project outcome has been fully achieved.

C. Efficiency in Achieving Outcome and Outputs

27. The project is rated *efficient* in achieving outcome and outputs. The project was implemented within budget and within a reasonable time frame. The economic internal rate of return (EIRR) for all the outputs is calculated at 18.50%, which is higher than the appraisal estimate of 14.7%. A 10% increase in operation and maintenance costs or a 10% reduction of either the value of losses or the value of incremental benefits would cause the project EIRR to remain above the assumed hurdle rate of 12%. The switching analysis indicates that incremental benefits could decrease by 60% and non-incremental benefits by 17%, and the project would still remain viable. The detailed EIRR is in Appendix 9.

D. Preliminary Assessment of Sustainability

28. The project is considered *likely sustainable*. The financial internal rate of return (FIRR) is calculated to be 14.82%, substantially higher than the 10.6% estimated at appraisal and also substantially higher than the project's estimated weighted average current cost of capital of 1.05%. Details of the FIRR calculations are in Appendix 10. Technically, the design of all the subprojects and the technology adopted are robust and appropriate, given the technical complexities of the Indian power sector. Sensitivity analysis (para 8 of Appendix 10) indicates that the project FIRR is robust and would remain unchanged for wide variations of operational costs and revenues earned. The project has been implemented efficiently and all outputs have operated continuously in accordance with design since commissioning. The revenues of DISCOM-East have increased from Rs25 billion in FY 2006/07 (the year of project appraisal) to Rs72 billion in FY2014/15.[12]

29. The project helped reduce distribution losses and transformer failures, and improve voltage regulation and consumer satisfaction. The equipment procured and commissioned under the project were in accordance with approved specifications and met or exceeded relevant design standards. The executing agency has the in-house capacity to operate and maintain the project facilities effectively and efficiently and suitable annual budget has been put in place for maintenance and replacement as required. All commissioned components are expected to be operated in an optimal manner and in accordance with design loadings

[11] Government of Madhya Pradesh, India. *Budget 28 February 2012.*
[12] As reported by DISCOM-East.

throughout their lifespan, supporting the project's technical and financial sustainability. Hence the project is *likely* to be sustainable.

E. Impacts

1. Socioeconomic Impacts

30. The overall socio-economic impact of the project is *significant*. At completion, the project supported sustained economic growth and social development in Madhya Pradesh. The improved power distribution capacity was able to meet peak demand of 2,854 MW in the project area and enabled trading of surplus power to deficit areas. The upgraded distribution system helped encourage economic growth of irrigation farmers through increased numbers of crops and higher crop yields as well as lowering operating costs for commercial and industrial consumers. The improved electricity services, achieved through the project, likely contributed to an increase in the state per capita income to Rs37,744 in FY2012 from Rs12,303 in FY2003.

2. Environmental Impacts

31. The project was classified as environment category B in accordance with ADB's *Environment Policy (2002)*. The scale of construction works was minor in nature and was carried out along existing power lines, roads and rights-of-way. An initial environmental examination report, including an environmental management and monitoring plan (EMP), was prepared. The various contract included line items for environmentally related mitigation in the bills of quantity to control temporary construction related impacts. The executing agency confirmed that no complaints were received from the public regarding the environmental aspects of any project activities.

3. Social Impact

32. All works were completed within existing rights-of-way on land owned or controlled by the executing agency. There was no land acquisition, resettlement nor indigenous peoples' impacts and preparation of a resettlement plan was not required. At appraisal the project was classified as category C for involuntary resettlement and category C for indigenous people's impacts in accordance with ADB's *Involuntary Resettlement Policy* (1995) and *Policy on Indigenous Peoples* (1998). There were no grievances received.

IV. OVERALL ASSESSMENT AND RECOMMENDATIONS

A. Overall Assessment

33. Overall, the project is rated *successful*. It was relevant, effective, and efficient, and its benefits are *likely* sustainable. The project resulted in the outcome envisaged at appraisal and was fully in line with the Government's development strategy and ADB's sector policy. It was effective in achieving the project's purpose and objectives, and efficiently implemented being completed within a reasonable timeframe and under budget. The project design was adjusted as required during implementation, based on actual findings on the ground, and several innovative initiatives resulted in reduction of works while maintaining the original scope, output and outcome.

34. Through the joint efforts of the project stakeholders, including contractors, executing agency and ADB, the project, excluding Gadarwara portion, was completed within the revised

loan completion schedule. The 15-month extension required to protect agricultural activity in the Gadarwara area did not cause any undue impact on the completed portions of the project nor on the overall operation of DISCOM-East. Project implementation was in line with the country's rules and regulations as well as ADB's safeguard requirements and loan covenants. The cost savings related to tapping at the nearest connection point, which reduced the length of low voltage distribution lines by 60% and related reduced distribution line losses, is a successful example of technical optimization in rural electrification, as summarized in Appendix 11.

35. The actual electricity output from the new infrastructure created under the project has exceeded the design capacity due to reduced losses. Power distribution capacity in urban areas has increased and a stable supply of electricity, especially to the rural areas, is now provided. The local industrial, commercial and agricultural electrical equipment are operating more efficiently due to proper voltage resulting in savings in power cost and equipment maintenance. The improved power supply has contributed to increased economic activity. Project implementation has strengthened the institutional capacity of DISCOM-East and the managerial and operational competence of its managers and staff. The financial and economic viability of the project has been confirmed with better than projected EIRR and FIRRs. The projected direct benefits have been fully realized and these will be maintained in the longer term life of project facilities.

B. Lessons

36. DISCOM-East was proactive in solving problems in the development of design documents, procurement, the timely delivery of equipment and in resolving the numerous issues and problems normal to project implementation. Lessons for future ADB projects include the need for capable and committed implementing agencies. DISCOM-East demonstrated that; (i) open communication and willingness to deal with stakeholders—and particularly contractors—are helpful in resolving complex technological and economic issues leading to better resolution in a timely and cost efficient manner, (ii) a properly administered procurement process will lead to improved bids with lower prices and better quality of equipment and workmanship of contractors; (iii) ability to adjust project scope due to actual field conditions and to apply technical optimization will improve project implementation and outcome; and (iv) assignment of experienced and sufficiently ranked technical managers with autonomy to plan, design and implement the project, will lead to better project implementation.

C. Recommendations

1. Project-Related

37. **Future Monitoring.** The project has been implemented and is operating as planned. But DISCOM-East will continue to monitor and evaluate the project impact, and report its findings to ADB, through the established project performance management system to ensure that the project facilities are managed effectively and that the benefits are maximized. Routine maintenance and equipment repairs/replacement should be carried out expeditiously. DISCOM-East distribution centers should continue to conduct due diligence/monitoring of the flat rate consumers and continue their program to install three phase meters for all irrigation pumps and other electrical equipment greater than 10 hp. The ongoing metering programs should be expanded to reduce the number of flat rate consumers over time.

38. **Further Action or Follow-Up.** The project requires no specific future action from ADB, as most performance targets have been met. However, DISCOM-East will continue to report annually on the progress of meeting its financial and debt service ratio as required in the loan covenants through 2018, when these are expected to have been achieved.

39. **Timing of the Project Performance Evaluation Report.** All the facilities under the project are operating normally. ADB could undertake a project performance evaluation review in 2016.

2. General

40. The favorable experience with the project demonstrates that power distribution projects do contribute to sustainable development, economic growth of consumers/beneficiaries and related poverty alleviation. ADB may consider supporting more distribution projects that are designed to maximize efficiency by reducing distribution system technical losses and metering programs to reduce non-technical losses.

DESIGN AND MONITORING FRAMEWORK

Design Summary	Performance Indicators/Targets	Results
Impact Contributed to sustaining economic growth and social development in Madhya Pradesh. Contributed to meeting the energy demand growth in Madhya Pradesh.	GSDP grows by at least 6% annually in 2007–2012. Energy deficit is reduced from 13% in 2007 to 0% in 2012.	GSDP at constant prices was 9.07% for the 11th Five Year Plan 2007–2012; state per capita income increased to Rs37,744 in FY2012 from Rs12,303 in FY2003.[13] Distribution system capacity increased to 3,168 MW, with peak demand of 2,854 MW met successfully. The enhanced distribution system capacity facilitates trading of surplus power to deficit areas.
Outcome Reduction in system losses and improved supply quality and reliability.	Improvement in system reliability, substantial reduction in fault restoration time. Reduced customer complaints about quality of electricity supply.	Distribution losses reduced significantly: from 37.72% in FY2008 to 23.68% in FY2014 and 21.69% in FY2015. The reduction of losses attributed to the project is 764 GWh/year, as of 2014. Power system reliability improved; 10 hours of supply for rural areas, 24 hour supply for urban areas, fewer interruptions, improved voltage and fewer power surges. Customer complaints reduced by half.
Outputs Installation of, high voltage distribution systems, remote metering consumer metering and renovation of substation protection system.	By 2011: <u>High Voltage Distribution Systems</u>: Conversion of 7,400 km of low-tension lines to high-voltage lines. 9,800 25 kVA transformers 12,400 16 kVA transformers <u>Remote Metering</u>: 2,000 industrial consumers <u>Consumer Metering</u>: 50,000 three phase 200,000 single phase <u>Substation Protection System</u>: 100 33/11 kV substations.	As a result of technical optimization and detailed surveys using GPS 4,028 km of low-tension lines were converted to high-voltage lines, including installation of 10,248, 25 kVA, and 5,327, 16 kVA, transformers. Additionally, 1,084 km of 33 kV and 957 km of polyvinyl encased lines were constructed. The intended project coverage wwas fully met. Technical optimisation (by tapping from nearest feasible point) resulted in reduced line length. Remote metering for 10,598 consumers. 53,000 three phase consumers connected. 200,000 consumer meters were installed under other ongoing programs by DISCOM-East. Substation Protection System for 100 33/11 kV substations was achieved.

[13] Government of Madhya Pradesh, India. *Budget 28 February 2012.*

Activities with Milestones (i) Procurement of major equipment: issuance of bidding documents in March 2007 and contract awards by September 2007 (ii) Construction started by December 2007 (iii) Commissioning by 2011	All the major activities were completed within the revised loan closing date except the Gadarwara portion of the project, which was completed by October 2013, to allow for essential agricultural activity to be completed
Inputs ADB: $45.0 million PFC: $10.0 million DISCOM-East: $10.7 million	Actual disbursement from ADB loan was $40.75 million. Disbursements from PFC were reduced to $7.6 million and a loan of $5.32 million was obtained from REC. The project target was fully achieved, and additional 33 kV lines and polyvinyl encased lines were added within the budget due to lower equipment prices than estimated at appraisal.

ADB = Asian Development Bank, DISCOM-East = east zone distribution company (Madhya Pradesh Poorv Kshetra Vidyut Vitaran Company), FY = financial year, GWh = gigawatt hours, GSDP = gross state domestic product, km = kilometer, kV = kilovolt, kVA = kilovolt ampere, PFC = Power Finance Company, REC=Rural Electrification Corporation.

Source: ADB. 2007. *Report and Recommendation of the President to the Board of Directors: Proposed Multitranche Financing Facility (India: Madhya Pradesh Power Sector Investment Program).*

COST BREAKDOWN BY PROJECT CATEGORY
($ million)

		Appraisal Estimate			Actual		
		Foreign	**Local**	**Total**	**Foreign**	**Local**	**Total**
I.	**Project Category**						
	Total Baseline Cost	33.50	20.20	53.70	39.95	17.99	57.94
II.	**Contingencies**						
	Physical	1.70	1.00	2.70	0.00	0.00	0.00
	Price	3.30	2.00	5.30	0.00	0.00	0.00
	Interest and/or commitment charges during construction	3.90	0.00	3.90	0.80	5.56	6.36
	TOTAL	**42.40**	**23.30**	**65.70**	**40.75**	**23.55**	**64.30**

Sources: Revised estimates and actual figures: Madhya Pradesh Poorv Kshetra Vidyut Vitaran Company Appraisal estimate: ADB. 2007. *Report and Recommendation of the President to the Board of Directors: Proposed Multi-tranche Financing Facility. (India: Madhya Pradesh Power Sector Investment Program)*

SUMMARY OF CONTRACTS

PCSS No.	Category No.	Item Description	Contract Amount (ADB Financing) ($)	Actual Disbursed ($)
0001	02	HVDS works at Patan O&M Dn. Distt Jabalpur	6,885,386.15	6,831,890.62
0002	02	HVDS works at Satna O&M Dn. Distt Satna	6,931,238.50	6,678,811.58
0003	02	HVDS works at Prithvipur O&M Dn. Distt Tikamgarh	5,521,044.15	5,519,589.51
0004	02	HVDS works at Damoh (N) Dn. Distt Damoh	4,322,951.17	4,087,044.85
0005	02	HVDS works at Rewa O&M Dn. Distt Rewa	3,784,563.56	3,745,778.83
0006	02	HVDS works at Gadarwara O&M Dn. Distt Narsinghpur	1,045,001.90	1,045,001.88
0007	02	Supply of 11 kV VCB.	1,791,688.35	1,718,794.17
0008	02	Supply of 33 kV VCB	1,320,385.73	1,183,126.82
0009	02	Remote Metering & Energy Audit	2,995,080.11	2,964,661.66
0010	02	HVDS Works in Gadarwara Dn. Distt Narsinghpur	6,117,825.62	3,342,391.29
0011	02	Supply of PVC & AB XLPE Cable	1,031,331.35	1,030,872.17
0012	02	Supply of Racoon Conductor	619,122.86	609,436.39
0013	02	Supply of H.Beam, RS Joist & GS Materials.	1,265,007.89	1,188,295.87

AB = aerially bunched, ADB = Asian Development Bank, Disst = district, GS = galvanized steel, HVDS = high voltage distribution system, Dn. = division, kV = kilo volt, O&M = operation and maintenance, PCSS = procurement contract summary sheet, RS = reinforce steel, PVC = polyvinyl chloride, VCB = vacuum circuit breaker, XLPE = cross linked polyethylene

Source: Asian Development Bank

PROJECT FINANCING PLAN
($ million)

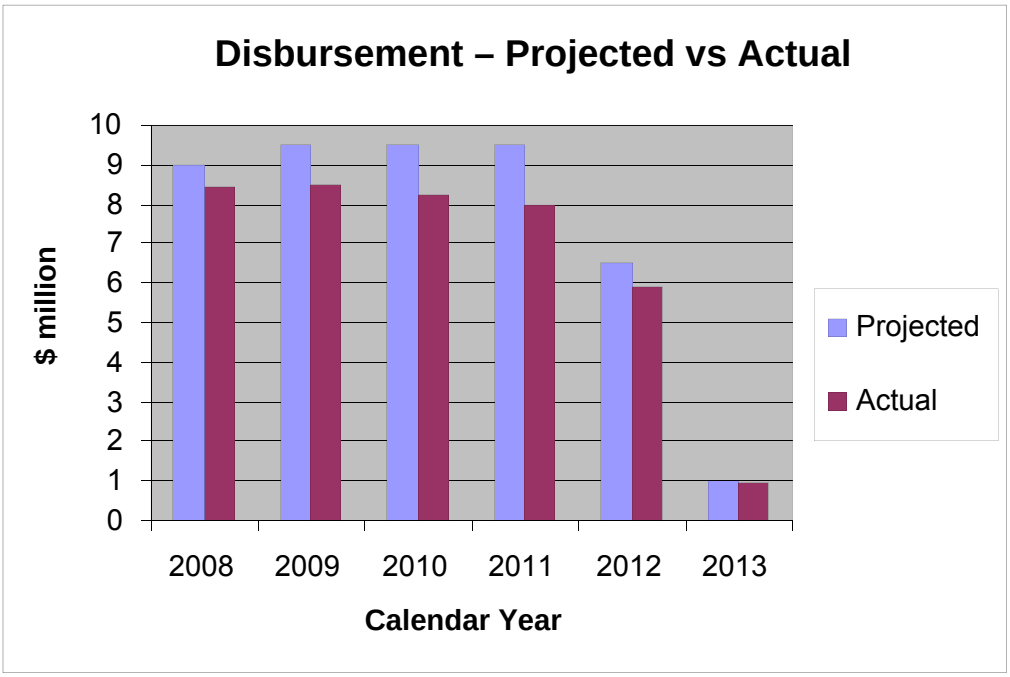
Source	Appraisal Estimate			Actual		
	Foreign	**Local**	**Total**	**Foreign**	**Local**	**Total**
ADB	45.0		45.0	40.75		40.75
PFC		10.0	10.0		7.60	7.60
REC					5.32	5.32
DISCOM-East		10.7	10.7		10.63	10.63
Total	**45.0**	**20.7**	**65.7**	**40.75**	**23.55**	**64.30**

ADB = Asian Development Bank, PFC = Power Finance Corporation Limited, REC = Rural Electrification Corporation Limited, DISCOM-East = Electricity Distribution Company-East (Madhya Pradesh Poorv Kshetra Vidyut Vitaran Company Limited).
Source: Asian Development Bank

PROJECTED AND ACTUAL DISBURSEMENT OF LOAN PROCEEDS
($ million)

Calendar Year	Projected		Actual[a]	
	For the year	Cumulative	For the year	Cumulative
2008	9.0	9.0	8.411	8.411
2009	9.5	18.5	8.504	16.915
2010	9.5	28.0	8.219	25.134
2011	9.5	37.5	7.987	33.122
2012	6.5	44.0	5.888	39.010
2013	1.0	45.0	0.936	39.946

[a] Excludes interest during construction of $0.8 million



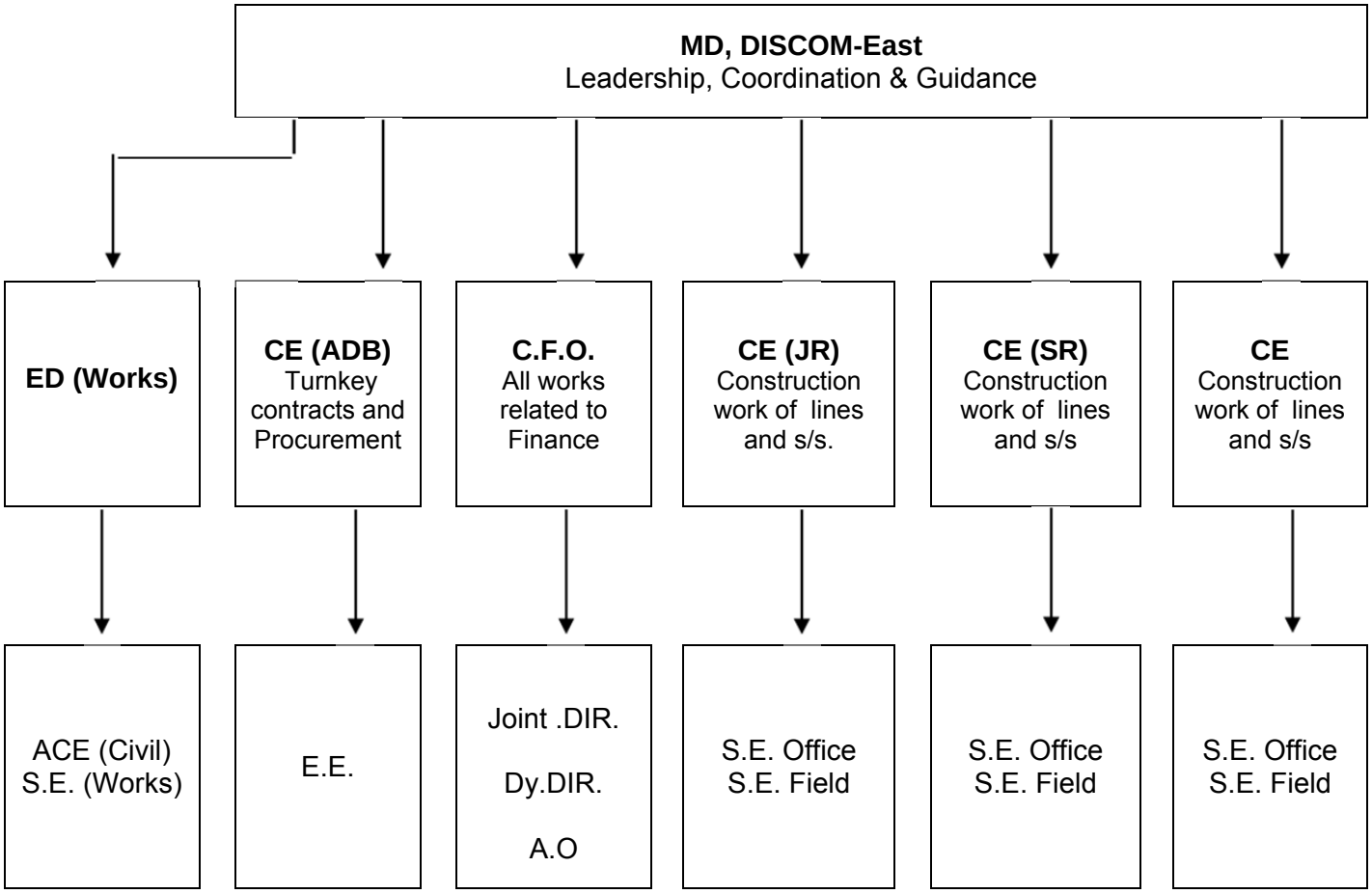
Source: Asian Development Bank

CHRONOLOGY OF MAIN PROJECT EVENTS

Date	Event
2006	
16–24 Oct	Fact-Finding
11 Dec	Management Review Meeting
12–14 Dec	Appraisal Mission
2007	
19 Jan	Staff Review Committee
19–20 Feb	Loan Negotiations
04 Apr	President's Consideration and Approval
12 Apr	Loan Agreement Signing
14 May	Loan Effectiveness, including Conditions
20–25 May	Inception Mission
2008	
07–17 Jan	Review Mission
01–03 Sept	Review Mission
2009	
15–17 April	Review Mission
15–20 Jun	Review Mission
24–27 Nov	Special Loan Administration Mission
2010	
6–16 Apr	Special Loan Administration Mission
27–30 Oct	Loan Review Mission
29 Nov–1 Dec	Review Mission
2011	
11–14 Oct	Review Mission
2012	
14–16 Feb	Review Mission
10–14 Dec	Review Mission
2015	
31 Mar–3 Apr	PCR Mission
2016	PCR Mission
7-19 Mar	

Source: Asian Development Bank

ORGANIZATIONAL CHART OF DISCOM-East



ACE = additional chief engineer, ADB = Asian Development Bank, AO = accounts officer, CE = chief engineer, CFO = chief financial officer, DIR = director, DISCOM = distribution company, Dy. = deputy, ED = executive director, JR = junior, MD = managing director, MP = Madhya Pradesh, S.E. = superintendent engineer, SR = senior, s/s = sub-station

Source: DISCOM-East

STATUS OF COMPLIANCE WITH LOAN COVENANTS

Covenant	Reference in Loan Agreement	Responsible Agencies	Status of Compliance
Project Implementation			
The State, acting through DISCOM-East, shall be the EA for the Project and shall be responsible for the execution of the Project.	LA, Schedule 5, para 2	Government/ GOMP/ DISCOM-East	Complied.
The project management unit (PMU), established within DISCOM-East, shall be headed by a PMU Manager. The PMU Manager shall report all Project related matters to the Chairman and the Managing Director of DISCOM-East. The PMU shall comprise technical, financial, procurement and safeguard sections.	LA, Schedule 5, para 3	DISCOM-East	Complied.
An investment program Coordinating Committee, chaired by the Chairman and the Managing Director of DISCOM-East, shall be established to coordinate and monitor the overall implementation of the investment program. The Coordinating Committee shall report to the ED through a Program Implementation Unit (PIU) to be established within the ED and to MPERC.	LA, Schedule 5, para 4	DISCOM-East	Complied.
The Borrower and the EA shall ensure that all subprojects are selected and approved in accordance with the criteria and approval process stipulated in Schedule 4 to the FFA	LA, Schedule 5, para 5	Government/ GOMP/ DISCOM-East	Complied.
Financial and Sector Reforms			
Counterpart Funding. The Government and GOMP will ensure and cause the availability and timely release of counterpart funding for the timely implementation of each subproject.	LA, Schedule 5, para 6	Government/ GOMP	Complied.
Cash Management Responsibilities. GOMP will ensure that the cash management responsibilities are transferred to DISCOM-East from 1 April 2009 and DISCOMs from 1 April 2009, so that the EAs can commence commercially independent operations, with any deficits met by commercial borrowings or other satisfactory means.	LA, Schedule 5, para 7	GOMP/ DISCOM-East	Not complied by loan closing. (para 16)
Audits. The EA will engage independent private audit firms, whose qualifications, experience and terms to conduct annual financial and procurement audits. In addition the EAs will ensure that independent auditors whose qualifications, experience, and terms of reference are acceptable to ADB and GOMP conduct (i) energy audit for distribution	LA, Schedule 5, paras 8-9	DISCOM-East/ ADB/GOMP	Complied.

Covenant	Reference in Loan Agreement	Responsible Agencies	Status of Compliance
reconfiguration and corporatization and divestment, and (ii) business process and performance audits in all operational areas.			
Corporate Governance. The GOMP will ensure the accountability and transparency of EAs is maintained through the stakeholders meeting and publication of its agendas, actions through the duration of the investment program. The EAs will ensure that the following measures to strengthen corporate governance will have been completed by 31 December 2007: (i) independent directors at the board level are recruited; (ii) board-level committees, including audit and risk management committees, are formed; (iii) internal audit functions strengthened and internal audit guidelines in line with best practices are developed (internal audit scope to cover revenue audit and internal audit reports to the audit committee of the board); (iv) internal controllers reporting to the chairmen and managing directors of the respective EAs on a regular basis are appointed.	LA, Schedule 5, paras 10-11	GOMP/ DISCOM-East	Complied.
The EA shall ensure that the current capacity development program that covers financial management and human resources development is implemented on a timely basis till 2010.	LA, Schedule 5, para 12	DISCOM-East	Complied.
Turnkey Contracts. The EAs will (i) ensure utilization of turnkey contracts, where appropriate; (ii) negotiate longer terms of guarantees on equipment; and (iii) include long-term maintenance provisions in the turnkey contracts.	LA, Schedule 5, para 13	DISCOM-East	Complied.
Recruitment. By not later than31 December 2008, the EAs will have appointed managers for operations, information technology, commercial functions, and finance; and will have recruited (i) chartered accountants, (ii) information technology specialists, and (iii) specialists in commercial areas. The EAs will have established management training programs in finance, operations, and commercial functions.	LA, Schedule 5, para 14	DISCOM-East	Complied.
Debt Service Coverage Ratio. The EAs will maintain a debt service coverage ratio of 1.2 from 2007 and onwards.	LA, Schedule 5, para 15	DISCOM-East	Not complied by loan closing (para 16).
Self-Financing Ratio. The EAs will maintain historic self-financing ratio of 20% from 2010 onwards (3 years moving average capital expenditure).	LA, Schedule 5, para 16	DISCOM-East	Not complied by loan closing. (para16)

Covenant	Reference in Loan Agreement	Responsible Agencies	Status of Compliance
Commercial			
Corporate Social Responsibility. DISCOMs will conduct extensive public awareness campaigns through installing appropriate signs, issuing flyers to the public and placing newspaper and television ads in local language to ensure that people are aware that HVDS networks may result in serious injury or death in case of attempts to illegally connect to overhead circuits.	LA, Schedule 5, para 17	DISCOM-East	Complied.
Tariff. DISCOMs' Multi-Year Tariff will be effective as of 1 April 2007.	LA, Schedule 5, para 18	DISCOM-East	Complied.
Billing and Collection Efficiency. DISCOM-E will ensure improved collection efficiency from 92% in 2006 to 96% by not later than 31 December 2010.	LA, Schedule 5, para 19	DISCOM-East	Complied
Loss Reduction. The State shall ensure that agreed DISCOM-E's loss reduction targets are met as follows: (i) by 31 December 2007 to 32.5%; (ii) by 31 December 2008 to 29.5%; and (iii) by 31 December 2009 to 26.5%.	LA, Schedule 5, para 20	DISCOM-East	Complied.
Customer Service Centers. The State shall ensure that by not later than 31 January 2009, DISCOM-East shall have established, made operational and fully staffed with specialists with appropriate skills, a number of customer service centers in large cities.	LA, Schedule 5, para 21	DISCOM-East	Complied.
Human Resources			
Pension Funds. The EAs will have legally established trust funds to cover pension arrears by 31 December 2008.	LA, Schedule 5, para 22	DISCOM-East	Not complied by loan closing (para 16).
Safeguards			
Land Availability, Resettlement and Indigenous Peoples. Without limiting the generality of Schedule 5 to the FFA, including its Annexes, the EA shall, subject to compliance with the relevant provisions of the RF/RPs and EARF/EMP and in accordance with all applicable laws and regulations of the Borrower, acquire or make available the land and rights to land free from any encumbrances, and cleared the utilities, trees and any other obstruction from such land, required for commencement of construction activities in accordance with the schedule agreed under the related civil works contract.	LA, Schedule 5, para 23	Government/ GOMP/ DISCOM-East/ADB	Complied.
The EA shall ensure that all land and rights-of way required by the subprojects are made available in a timely manner and that the provisions of the RPs, including compensation and entitlements for affected households and persons, are implemented	LA, Schedule 5, para 24	Government/ GOMP/ DISCOM-East/ADB	Complied.

Covenant	Reference in Loan Agreement	Responsible Agencies	Status of Compliance
in conformity with all applicable laws and regulations of the Borrower, including as amended from time to time, and the entitlement benefits as listed in the Borrower's applicable laws, ADB's *Policy on Involuntary Resettlement* (1995), and the RF.			
The EA shall ensure that people affected by each subproject are fairly compensated in a timely manner based on replacement values in accordance with the related RPs and RF, such that their living standards are not adversely affected. The EA shall submit progress and completion reports on land acquisition and resettlement under the quarterly progress reports for each subproject. In addition, the external monitoring report shall be submitted to ADB on a semi-annual basis for review.	LA, Schedule 5, para 25	Government/ GOMP/ DISCOM-East/ADB	Complied.
The EA shall ensure that prior to land acquisition and any resettlement under each subproject, the related RP, including its update based on consensus of the affected peoples (APs) concerned, is disclosed with all necessary information made available to persons affected by the subproject and confirm that it be uploaded onto ADB website. The EA shall ensure that essential public infrastructure that may be affected under land acquisition and resettlement is replaced as appropriate in an expeditious manner in accordance with the RPs.	LA, Schedule 5, para 26	Government/ GOMP/ DISCOM-East/ADB	Complied.
The EA shall ensure that construction contracts contain binding requirements for construction contractors to fully reinstate pathways, other local infrastructures, and agricultural land to at least their pre-project condition upon construction completion. Provision shall be made for adequate recording of the condition of roads, agricultural land and other infrastructure prior to transport of material and construction commencement.	LA, Schedule 5, para 27	Government/ GOMP/ DISCOM-East/ADB	Complied.
For each subproject, the EA shall ensure timely provision of budget for land acquisition, resettlement and other activities outlined in the related RP and shall meet any unforeseen obligations in excess of the RP budget estimate in order to satisfy the RP requirements.	LA, Schedule 5, para 28	Government/ GOMP/ DISCOM-East/ADB	Complied.
Within 3 months of the Effective Date, the EA shall engage an independent external expert/agency, acceptable to ADB, for monitoring and verification of the RP implementation under each subproject that will be responsible for providing ADB through the PMU quarterly monitoring and evaluation reports on resettlement implementation in accordance with the RPs.	LA, Schedule 5, para 29	Government/ GOMP/ DISCOM-East/ADB	Complied.

Covenant	Reference in Loan Agreement	Responsible Agencies	Status of Compliance
Within 3 months of the Effective Date, the EA shall establish a grievance redress committee with representation from all stakeholders for the Project to address any grievances from APs concerning resettlement, environment and other social issues in a timely manner.	LA, Schedule 5, para 30	Government/ GOMP/ DISCOM-East/ADB	Complied.
Indigenous Peoples The EA shall prepare and implement the IPDPs or appropriate indigenous peoples actions for all subprojects with indigenous peoples issues in accordance with the requirements set out in (i) ADB's *Policy on Indigenous Peoples* (1998), the IPDF, and (ii) the Borrower's and the State's applicable laws	LA, Schedule 5, para 31	Government/ GOMP/ DISCOM-East/ADB	Complied.
Environmental. GOMP through the EAs will ensure that proposed investments under the MFF are undertaken and that all subproject facilities are operated and maintained in accordance with all applicable laws, rules, and regulations of the Government and ADB's *Environment Policy* (2002). For each subproject, EAs will prepare and implement the necessary IEE, environmental impact assessment, and EMP (with budget) in accordance with the EARF. For subprojects not defined prior to approval of the MFF, the environmental categorization and assessment procedures defined in the EARF will be followed as part of subproject appraisal. For any category A or B sensitive subprojects, a Summary Environmental Impact Assessment (SEIA) or IEE for subsequent tranches will be prepared and made available to the general public 120 days before a PFR is submitted to ADB. EAs will monitor, audit, and report to ADB twice a year on the implementation of the EMPs for each subproject. The EA shall ensure that (i) the subprojects are not located within national parks and wildlife sanctuaries, unless prior environmental clearance is obtained from relevant government agencies; (ii) monuments of cultural or historical importance are avoided; and (iii) EMP with adequate budget is developed and implemented for each subproject.	LA, Schedule 5, paras 32-35	Government/ GOMP/ DISCOM-East/ADB	Complied.
The EA shall ensure that, subsequent to award of civil works contract under any subproject, no section or part thereof under the civil works contract shall be handed over to the contractor unless the applicable provisions of the RF/RP and the EARF/EMP have been complied with.	LA, Schedule 5, paras 36-37	DISCOM-East	Complied.

Covenant	Reference in Loan Agreement	Responsible Agencies	Status of Compliance
Any changes to the location, land alignment, or environmental impacts on account of detailed designs of related subproject shall be subject to prior approval by ADB and/or the EA, as the case may be, in accordance with the selection criteria and process stipulated in Schedule 4 to the FFA			
Performance Monitoring and Reporting			
The Borrower shall ensure that within 3 months of the Effective Date, a Project Performance Monitoring System (PPMS) shall have been established by the EA in a form and with a composition acceptable to ADB in accordance with the investment program and project performance indicators. The EA shall undertake periodic project performance review, and also the investment program in accordance with the PPMS to evaluate the scope, implementation arrangements, progress and achievements of outcome of the related subproject and overall investment program. The EA shall prepare quarterly progress reports and shall submit these to ADB within 30 days of the end of each quarter. These reports shall provide (i) a narrative description of progress made during the period (progress on compliance with environment and social requirements including EMP and RF shall also be included), (ii) changes in the implementation schedule, (iii) problems or difficulties encountered, and (iv) work to be carried out in the next period. The progress reports shall also include a summary financial account for the outputs, including subprojects, consisting of expenditures during the period, total expenditure to date, and reports on environmental, resettlement and benefit monitoring. The Borrower shall ensure the submission to ADB of a Project Completion Report within 3 months of physical completion of the Project by the EA, and the Facility Completion Report within 3 months of physical completion of the investment program. These reports shall cover a detailed evaluation of the Project and the Facility respectively, covering the design, costs, contractors' and consultants' performance, social, environmental and economic impact, economic and financial rates of return, and other details of the Project and the Facility, as may be requested by ADB.	LA, Schedule 5, paras 38-40	Government/ GOMP/ DISCOM-East/ADB	Complied.

Covenant	Reference in Loan Agreement	Responsible Agencies	Status of Compliance
ADB, the Borrower and the EA shall meet regularly as required to discuss the progress of the Project and any changes to implementation arrangements or remedial measures required to be undertaken towards achieving the outcome of the Project and the investment program. A mid-term review of the Project shall be undertaken by ADB and the EA. The mid-term review shall include a review of issues and any problems or weaknesses in implementation arrangements, and agree on any changes needed to achieve the outcome of the Project and the investment program	LA, Schedule 5, paras 41-42	Government/ GOMP/ DISCOM-East/ADB	Complied.

LA = loan agreement, GOMP = government of Madhya Pradesh, MD = managing director, ADB = Asian Development Bank, APA = audited project account, AFS = audited financial statement, MPERC = Madhya Pradesh Electricity Regulatory Commission, EARF = environmental assessment and review framework, IEE = initial environmental examination.

ECONOMIC REEVALUATION

A. General

1. A domestic price level numeraire was used throughout the analysis. The unit of account selected was Indian rupees (Rs). The project boundary was defined to be the distribution network of DISCOM-East, and the existing customers and prospective customers in Madhya Pradesh served through the distribution network.

B. Economic Costs

2. **Project investments.** The economic costs of the project were calculated using the reported annual financial costs, but (i) excluding taxes and duty; (ii) excluding costs of financing such as commitment fees and interest during construction; and (iii) by multiplying the cost of tradable inputs and an assumed shadow exchange rate factor (SERF) of 1.2. Accordingly, the annual project costs used in the economic re-evaluation are summarized in Table A9.1.

Table A9.1: Financial and Economic Costs of the Project

2014 Rs million

Financial Year[a]	Project Financial Costs	Project Economic Costs
2008	627.49	529.90
2009	663.43	562.51
2010	643.70	545.32
2011	630.08	534.53
2012	477.49	406.69
2013	76.65	65.49
2014	318.70	318.70
Total	3,437.55	2,963.14

[a] The financial year is from 1 April to 31 March.

Source: Asian Development Bank estimates, based on annual financial disbursements

3. **Operation and maintenance costs.** Operation and maintenance (O&M) costs, as described in the computation of financial costs were estimated to be equal to 22.0% of the gross fixed assets of DISCOM-East, on the basis of the O&M allowed by Madhya Pradesh Electricity Regulatory Commission in fiscal year 2014. No adjustment was made when converting these O&M costs to border prices. In keeping with the assumptions made during appraisal, O&M costs were assumed to apply to the completed portion of the project, from the second year after the first disbursement.

C. Economic Benefits

4. Project benefits comprise incremental and non-incremental income to Madhya Pradesh. These benefits were evaluated as described below. The non-incremental benefit was computed based on the evaluated reduction in technical losses in the distribution system, expressed in terms of energy saved. The reduction of technical losses in the distribution network may cause benefits in two ways: (i) in an energy deficit power system, saved energy causes the energy deficit to be lower than otherwise, and the value of energy saved would be the economic value of income from energy sold, or the economic cost of unserved energy; and (ii) in an energy surplus system, energy saved in reduced distribution losses would reduce the operation of the marginal generator, which is likely to be more expensive to operate than base load generators. The Madhya Pradesh system was running an energy deficit until about 2015; load shedding has now been almost completely eliminated. Madhya Pradesh has been assumed to have an

energy surplus over the period of project operations. Therefore, over the economic life of the project, saved energy losses would reduce the operation of marginal generators, and save the corresponding fuel costs.

5. The reduction in energy losses in DISCOM-East owing to the project was assessed as follows. DISCOM-East sold 2,141 gigawatt-hours (GWh) per year in the project areas (six circles covered by the project) prior to the project (in FY2008), which increased to 4,182 GWh/year by the end of the project (FY2014). The reduction of losses attributed to the project is 764 GWh/year as of 2014, as considered in the financial re-evaluation (Appendix 10). However, this reduction in losses includes both technical and commercial losses. The economic benefits of the losses reduced by the project relate only to the technical losses. To assess the reduced technical losses, a study conducted under a multi-tranche financing facility was used.[1] The study indicated that by using high voltage distribution systems, a technical loss reduction from 24.8% to 18.8% of input at the 11 kilovolt (kV) level (i.e., a reduction of 6%) would be typical. Accordingly, the technical losses reduced owing to the project were estimated to be 436 GWh/year as of 2014. In estimating this saving in technical losses, the present sales in the project area, the 6% saving in losses, and the corresponding saving in losses upstream of the 11 kV network (33 kV and the transmission network) were included. The loss reduction attributed to the project may increase after FY2014 when increasing customer demand results in delivery of more power through the DISCOM-East network. However, in the economic evaluation, the achieved loss level of 436 GWh in FY2014 attributed to the project was conservatively assumed to remain constant throughout the evaluation period.

6. The economic value of the reduction of such losses was estimated on the basis of the economic cost of generation. In FY2014, DISCOM-East purchased 18,114 GWh at a cost of Rs50,366 million, indicating a financial price of Rs2.78 per kWh. This results in a financial saving of Rs1,211 million in 2014 owing to reduced losses in project areas, and correspondingly reduced losses in upstream 33 kV and transmission networks. This financial avoided cost of generation was converted to an equal economic values of Rs1,009 million per year, from FY2014 onwards. During the project implementation period, because project components were gradually commissioned, thereby accruing the benefits of reduced losses, a benefit proportional to the value of assets commissioned in each year was assigned from 2008 onwards. From 2014 onwards, the full benefits of reduced losses were assigned to each year of the evaluation.

7. Incremental benefits occur owing to incremental demand served by the distribution system, which in turn is sold to customers. The total benefits can be divided into (i) project revenue, and (ii) consumer surplus. Consumer surplus was estimated using the following equation: consumer surplus = $0.5(P1[\Delta Q]^2)/(ed\ Q1)$, where ΔQ is the additional consumption and ed is the absolute value of the price elasticity of demand. P1 (price prior to the project), Q1 (consumption before the project), and Q2 (consumption after the project) are available, while ed was assumed to be 0.4, from published literature. Note that this method provides a theoretically correct estimate of benefits of additional power consumed. However, the estimates are conservative because the demand curves shift upward due to increasing incomes and that effect is not accounted for in the analysis. The additional consumption requires electricity to be generated, transmitted, and distributed to the customers. The cost of this additional consumption was valued at the total average cost of purchase of generation. The selling price of the additional consumption was fixed at the 2008 average price level of Rs3.67 per kilowatt-

[1] ADB. 2011. *Report and Recommendation of the President to the Board of Directors: Proposed Multitranche Financing Facility and Technical Assistance Grant to India for the Madhya Pradesh Energy Efficiency Improvement Investment Program.*

hour. These generation costs and selling prices were held constant throughout the project evaluation period of 20 years.

8. The calculated incremental benefit was Rs8,895 million per year, and the cost of production to serve this incremental benefit was estimated to be Rs8,625 million per year. Accordingly, the net benefit owing to incremental consumption was assessed to be Rs270 million per year.

D. Economic Re-evaluation

9. Based on the estimates of economic costs and benefits as described above, the economic internal rate of return (EIRR) was recalculated to be 18.50%. This value is higher than the appraisal evaluation of 14.7%, and higher than the benchmark EIRR of 12%. The detailed calculations for the project are in Table A9.2.

Table A9.2: Re-evaluated Economic Costs and Benefits of the Project

(Rs. million of 2014) (Rs. million of 2014)

Fiscal Year	Capital Cost	Operation and Maintenance Cost	Total Cost	Benefits		Total Benefits	Net Benefit
				Incremental	Non-incremental		
2008	529.90		529.90				(529.90)
2009	562.51	133.60	696.12	54.05	180.41	234.46	(461.65)
2010	545.32	275.43	820.75	111.43	371.92	483.35	(337.40)
2011	534.53	412.92	947.45	167.05	557.59	724.64	(222.81)
2012	406.69	547.69	954.39	221.58	739.57	961.15	6.76
2013	65.49	650.23	715.72	263.06	878.04	1,141.10	425.38
2014	318.70	666.74	985.44	269.74	1,008.84	1,278.58	293.14
2015	0.00	747.10	747.10	269.74	1,008.84	1,278.58	531.48
2016	0.00	747.10	747.10	269.74	1,008.84	1,278.58	531.48
2017	0.00	747.10	747.10	269.74	1,008.84	1,278.58	531.48
2018	0.00	747.10	747.10	269.74	1,008.84	1,278.58	531.48
2019	0.00	747.10	747.10	269.74	1,008.84	1,278.58	531.48
2020	0.00	747.10	747.10	269.74	1,008.84	1,278.58	531.48
2021	0.00	747.10	747.10	269.74	1,008.84	1,278.58	531.48
2022	0.00	747.10	747.10	269.74	1,008.84	1,278.58	531.48
2023	0.00	747.10	747.10	269.74	1,008.84	1,278.58	531.48
2024	0.00	747.10	747.10	269.74	1,008.84	1,278.58	531.48
2025	0.00	747.10	747.10	269.74	1,008.84	1,278.58	531.48
2026	0.00	747.10	747.10	269.74	1,008.84	1,278.58	531.48
2027	0.00	747.10	747.10	269.74	1,008.84	1,278.58	531.48
2028	0.00	747.10	747.10	269.74	1,008.84	1,278.58	531.48
2029	0.00	747.10	747.10	269.74	1,008.84	1,278.58	531.48
2030	0.00	747.10	747.10	269.74	1,008.84	1,278.58	531.48
2031	0.00	747.10	747.10	269.74	1,008.84	1,278.58	531.48
2032	0.00	747.10	747.10	269.74	1,008.84	1,278.58	531.48
2033	0.00	747.10	747.10	269.74	1,008.84	1,278.58	531.48
Remaining	value						528.89
				EIRR			18.50%

( ) = negative, EIRR = economic internal rate of return

10. **Sensitivity analysis.** In this re-evaluation, there are three parameters that may adversely affect the economic viability of the project. Any increase in the O&M costs, or reductions in the value of saved energy losses or incremental consumption, may reduce the economic viability of the project. Results of the sensitivity analysis are summarized in Table A9.3.

Table A9.3: Results of Sensitivity Analysis

Sensitive parameter			Calculated	Switching r values[a]		
O&M Cost	Non-incremental benefit	Incremental benefit	EIRR	O&M	Non-incremental benefit	Incremental benefit
Base value	Base value	Base value	18.50%			
10%	Base value	Base value	15.76%	23%		
Base value	-10%	Base value	17.46%		–60%	
Base value	Base value	–10%	14.74%			–17%
All the above			10.74%			

EIRR = economic internal rate of return, O&M = operation and maintenance
[a] Value at which the calculated EIRR equals the benchmark EIRR.

11. A 10% increase in O&M costs or a 10% reduction of either the value of losses or the value of incremental benefits would cause the project EIRR to be within the benchmark of 12%. The switching analysis indicates that the incremental benefits or non-incremental benefits may decrease by 60% and 17%, respectively, and the project would remain economically viable with an EIRR in excess of 12%. The combined impacts of adverse changes in all four parameters would cause the EIRR to be below the benchmark.

FINANCIAL REEVALUATION

A. Background

1. The unit of account selected was Indian rupees (Rs). The project boundary was defined to be the distribution network of DISCOM-East, and the existing customers and prospective customers in Madhya Pradesh served by DISCOM-East.

B. Evaluation of Project Costs

2. **Project costs.** The base cost of the project comprises capital investments (equipment, and civil engineering costs including erection), project management costs, expenses on safeguards, purchase of land, and taxes and duty. The annual disbursements reported in dollars were used in the project to pay for all contracts, which consisted of a mix of equipment and works (civil works and erection). These expenses were divided among equipment (denominated in dollars) and works (denominated in Indian rupees), and disbursements in each year during the project period were assigned as stated by the project management unit (PMU). The project was completed in 2014. Thereafter, Asian Development Bank methodology was used to convert the dollar-denominated equipment costs and Indian rupee-denominated local costs from current prices in respective years to 2014 levels.[1] The calculation is summarized in Table A10.1.

Table A10.1: Conversion of Project Costs to 2014 Price Levels

	Foreign costs	Local costs				Adjustment of costs to a constant 2014 basis				
Year	Equip-ment ($million)	Equip-ment (Rs million)	Civil works, erection (Rs million)	Project management, safeguards, resettlement, land (Rs million)	Taxes and duty (Rs million)	Foreign price index	Foreign Cost (in 2014 Rs million)	Local price Index	Local Cost (in 2014 Rs million)	Total cost (in 2014 Rs million)
2008	8.33	362.3	84.7	32.7	9.9	92.6	548.7	161.6	302.9	851.6
2009	9.60	464.8	108.7	41.9	12.7	105.6	554.7	150.2	418.3	972.9
2010	8.71	398.2	93.1	35.9	10.9	97.8	543.4	139.5	385.8	929.2
2011	8.20	382.9	89.5	34.5	10.5	95.7	523.4	126.1	410.3	933.7
2012	6.05	323.4	75.6	29.2	8.8	97.6	378.6	114.9	380.4	759.0
2013	0.94	54.8	12.8	4.9	1.5	97.5	58.6	106.4	69.6	128.2
2014				318.7		100.0		100.0	318.7	318.7
Total	**41.83**	**1,986.32**	**464.5**	**497.9**	**54.3**		**2,607.4**		**2,285.9**	**4,893.3**

Note: Foreign price index is based on dollars compared with a basket of currencies (http://www.fxstreet.com/rates-charts/usdollar-index/). The local price index is based on the consumer price index published by the Reserve Bank of India. In 2014 DISCOM-East allocated the proceeds from a loan from Rural Electrification Corporation to project expenses.

3. **Operation and maintenance costs.** The operation and maintenance (O&M) costs were calculated on the basis of the Madhya Pradesh Electricity Regulatory Commission (MPERC) revenue determination for DISCOM-East. MPERC approved an O&M cost of Rs10,918 million for an evaluated gross fixed asset of Rs48,653 million, or 22.3% of the asset value. Accordingly, an estimated O&M cost of 22.3% of the cumulative capital costs starting from the year after the first capital investment was included as a project cost. Once the project is commissioned, the value of the gross fixed asset added by the project (which excludes taxes and financing charges) would be Rs3398 million; the O&M cost is Rs747.1 million in 2014 currency.

[1] Asian Development Bank, Independent Evaluation Department. 2013. *ADB Guidelines for Preparing Performance Evaluation Reports for Public Sector Operations.* Manila.

C. Evaluation of Project Benefits

4. **Revenue from distribution business.** DISCOM-East is allowed to charge for its electrical distribution services, enabling a pre-tax return on equity of 16%, and full recovery of O&M costs, interest expenses, depreciation and other recurrent expenses. Therefore, the financial benefit to DISCOM-East from the project is the increased revenue earned from its distribution and retail businesses. In the fiscal year 2015 tariff petition to MPERC, DISCOM-East filed audited accounts that stated their actual O&M costs; on that basis, MPERC approved Rs13,450 million as allowed revenue for distribution and retail businesses. DISCOM-East provided their distribution and retail service using a gross fixed asset of Rs49,654 million as of 2014. Therefore, the income attributed to the assets added by the project, when calculated in proportion to the assets added by the project, would equal Rs920.4 million per year in 2014 currency; this value was used as the financial benefit of the project to DISCOM-East.

5. **Benefit of reduced distribution losses.** DISCOM-East is required to perform within the allowed level of losses established by MPERC. At the company level, DISCOM-East has been unable to meet the loss targets established by MPERC, at both project commencement and completion, and was operating at a loss from a financial point of view. The reduced distribution losses as a consequence of the project would result in financial savings to DISCOM-East by way of reduced financial losses. DISCOM-East sold 2,141 gigawatt-hours (GWh) per year in the project areas (six circles covered by the project) prior to the project (FY2008), which increased to 4,182 GWh/year by the end of the project (FY2014). The reduction of loss attributed to the project is 764 GWh/year as of 2014. This reduced loss was assumed to be sustained throughout the project evaluation period (20 years). In FY2015, the approved power purchase cost of DISCOM-East was Rs1.33 per kilowatt-hour, considering long-term contracts with generators. Reduced losses would first reduce more expensive short-term purchases, and then reduce purchases from longer-term contracts. In this analysis, it was conservatively assumed that in the longer term, reduced energy losses in the distribution network would save the energy value of purchases under long-term contracts with generators. Accordingly, the reduced energy losses attributed to the project were estimated to be Rs1,018 million per year as of 2014, and assumed to remain constant throughout the evaluation period.

D. Evaluation Basis, Period and Remaining Value

6. The assumed hurdle rate for this re-evaluation is the project's real pre-tax weighted average cost of capital. To provide a consistent analytical basis the project costs, O&M costs and revenue earned were expressed in pre-tax terms. The evaluation period was 20 years from the first year of operation of the completed project (2014). The project was assumed to have a useful life of 30 years from the commissioning date. The project asset was depreciated using the straight line depreciation method to assign a remaining value at the end of the 20-year evaluation period. The results of the financial evaluation are in Table A10.2.

Table A10.2: Financial Re-evaluation of the Project
(Rs.million at 2014 price levels)

Fiscal Year	Total Capital Cost	Cumulative Capital Cost	Operation and Maintenance Cost	Total Cost	Revenue Earned	Net Cash Flow
2008	627.49	627.49		627.49		(627.49)
2009	663.43	1,290.93	136.63	800.06		(800.06)
2010	643.70	1,934.63	280.64	924.35		(924.35)
2011	630.08	2,564.71	420.46	1,050.54		(1,050.54)
2012	477.49	3,042.20	557.18	1,034.67		(1,034.67)
2013	76.65	3,118.85	660.48	737.13		(737.13)
2014	318.70	3,437.55	677.02	995.72	1,938.26	942.53
2015			747.10	747.10	1,938.26	1,191.16
2016			747.10	747.10	1,938.26	1,191.16
2017			747.10	747.10	1,938.26	1,191.16
2018			747.10	747.10	1,938.26	1,191.16
2019			747.10	747.10	1,938.26	1,191.16
2020			747.10	747.10	1,938.26	1,191.16
2021			747.10	747.10	1,938.26	1,191.16
2022			747.10	747.10	1,938.26	1,191.16
2023			747.10	747.10	1,938.26	1,191.16
2024			747.10	747.10	1,938.26	1,191.16
2025			747.10	747.10	1,938.26	1,191.16
2026			747.10	747.10	1,938.26	1,191.16
2027			747.10	747.10	1,938.26	1,191.16
2028			747.10	747.10	1,938.26	1,191.16
2029			747.10	747.10	1,938.26	1,191.16
2030			747.10	747.10	1,938.26	1,191.16
2031			747.10	747.10	1,938.26	1,191.16
2032			747.10	747.10	1,938.26	1,191.16
2033			747.10	747.10	1,938.26	1,191.16
Residual value	(679.56)	(679.56)		(679.56)		679.56
					FIRR	14.82%

( ) = negative, FIRR = financial internal rate of return

7. **Benchmark financial internal rate of return.** During appraisal, the benchmark financial internal rate of return (FIRR) was defined to be the project pre-tax weighted average cost of capital, excluding inflation. In this re-evaluation, the costs and benefits considered were in constant 2014 currency, but included taxes. Therefore, weighted average cost of capital was re-evaluated to be 1.05% on pre-tax terms as follows. The re-calculated FIRR of 14.82% exceeds the re-assessed financial viability benchmark of 0.59%.

Table A10.3: Re-estimation of the Weighted Average Cost of Capital

Source	Financed by	Amount (2014 Rs million)	Interest rate or ROE (pre-tax)	Domestic inflation	Real cost of capital	Weight
Loan	ADB Loan	1,887.0	1.61%	6.00%	–4.39%	–2.54%
	SBI Loan	441.7	14.75%	6.00%	8.75%	1.18%
	REC Loan	395.1	12.25%	6.00%	6.25%	0.76%
Equity	DISCOM-East	539.5	16.0%	6.00%	10.00%	1.65%
					WACC	**1.05%**

ADB = Asian Development Bank, DISCOM-East = distribution company-east, REC = Rural Electrification Corporation, SBI = State Bank of India, WACC = weighted average cost of capital

8. **Sensitivity analysis.** In this re-evaluation, there are two parameters that may adversely affect the results of the financial viability of the project. Results of the sensitivity analysis are summarized in Table A10.4. Results indicate that the project FIRR assessed is robust and would remain unchanged for wide variations of the O&M costs and revenue earned. Therefore, the project financial viability is confirmed by this re-evaluation.

Table A10.4: Results of Sensitivity Analysis

Sensitive parameter		**Calculated**	**Switching values**[a]	
O&M Cost	Revenue earned	FIRR	O&M	Revenue earned
Base value	Base value	14.82%		
10%	Base value	13.62%	105%	
Base value	–10%	12.66%		–47%
10%	**–10%**	11.39%		

FIRR = financial internal rate of return, O&M = operation and maintenance
[a] Value at which the calculated FIRR equals the benchmark FIRR

CONTRIBUTION TO ADB RESULTS FRAMEWORK

Level 2 Results Framework Indicator	Original Target	Revised Target	Aggregate Output	Methods/Comments
Distribution lines installed or upgraded (kilometers)	7,400		4,028	As a result of technical optimization, 4,028 km of low-tension lines were converted to high-voltage lines, including installation of 10,248 25 kVA, 11/0.4 kV DTRs and 5,327 16 kVA, 11/0.4 kV DTRs. However, the intended project coverage and consumers were fully met. Technical optimization (by tapping from nearest feasible point resulted in reduced line length.

ADB = Asian Development Bank, DTR = distribution transformer, km = kilometer, kVA = kilovolt ampere, kV = kilovolt