ADB

Evaluation Study

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Project Numbers: 29473
Loans 1868/1869
Program Performance Evaluation Report
February 2011

India: Madhya Pradesh Power Sector Development Program

Independent Evaluation Department

Asian Development Bank

CURRENCY EQUIVALENTS

(as of February 2011)

Currency Unit	–	rupee/s (Re/Rs)
Re1	=	$0.0220
$1.00	=	Rs45.335

ABBREVIATIONS

ABA	–	aerial bundled conductors
APDRP	–	Accelerated Power Development and Reform Program
ATC	–	aggregate technical and commercial
CERC	–	Central Electricity Regulatory Commission
CSEB	–	Chhattisgarh State Electricity Board
CSU	–	central sector utilities
DISCOM	–	distribution companies
DMC	–	developing member countries
EIRR	–	economic internal rate of return
EISP	–	Energy Infrastructure Services Project
FIRR	–	financial internal rate of return
FRP	–	financial restructuring plan
HVDS	–	high-voltage distribution system
IAS	–	Indian Administration Service
IPP	–	independent power producers
MFF	–	multitranche financing facility
MOU	–	memorandum of understanding
MPEB	–	Madhya Pradesh Electricity Board
MPG	–	Madhya Pradesh Government
MPGenco	–	Madhya Pradesh Power Generation Company
MPSEB	–	Madhya Pradesh State Electricity Board
MPSERC	–	Madhya Pradesh State Electricity Regulatory Commission
MPTransco	–	Madhya Pradesh Power Transmission Company
NTPC	–	National Thermal Power Corporation
O&M	–	operation and maintenance
PCR	–	project completion report
PFC	–	Power Finance Corporation
PMU	–	project management unit
PPER	–	project performance evaluation report
RAPDRP	–	Revised Accelerated Power Distribution Rehabilitation Project
REC	–	Rural Electrification Corporation
RGVY	–	Rajeev Gandhi Vidutkarana Yojana
Tradeco	–	trading company
SDP	–	sector development program
SERC	–	State Electricity Regulatory Commission
T&D	–	transmission and distribution

NOTES

(i) The fiscal year (FY) of the Government ends on 30 June. FY before a calendar year denotes the year in which the fiscal year ends, e.g., FY2000 ends on 30 June 2000.

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

Key Words

asian development bank, energy, india, madhya pradesh, power sector development, project, project performance evaluation, program loan, sector development program.

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The guidelines formally adopted by the Independent Evaluation Department (IED) on avoiding conflict of interest in its independent evaluations were observed in preparing this report. Mr. Rahul Raizada a national consultant assisted in preparation of the report . V. B. Tuladishar, Advisor, and Kapil Thukral, Senior Evaluation Specialist, IED, acted as peer reviewesr. To the knowledge of the management of IED, the persons preparing, reviewing, or approving this report had no conflict of interest.

APPENDIXES

BASIC DATA
Madhya Pradesh Sector Development Program
(Loan 1868-IND (Program) and Loan 1869-IND (Project))

Project Preparatory/Institution Building

TA No.	Technical Assistance Name	Type	Person-Months	Amount $	Approval Date
2980	Madhya Pradesh Power Sector Development	ADTA	13	1,000,000	7 Jan 1998

Key Project Data ($ million)

	Loan 1868		Loan 1869	
	Per ADB Loan Documents	Actual	Per ADB Loan Documents	Actual
Total program or project cost	150.0	150.0	318.9	260.0
Foreign exchange cost	150.0	150.0	200.0	179.0
ADB loan amount/utilization	150.0	150.0	200.0	179.0
ADB loan amount/cancellation				21.0

Key Dates	**Expected**	**Actual**
Fact-finding mission		19 Mar−9 Apr 2001
Appraisal mission	27 Aug−14 Sep 2001	27 Aug−18 Sep 2001
Loan negotiations	5−7 Nov 2001	7−9 Nov 2001
Board approval	7 Dec 2001	6 Dec 2001
Loan agreement		21 Mar 2002
Loan effectivity	22 Mar 2002	22 Mar 2002
First disbursement		
Program		25 Mar 2002
Project		31 Oct 2002
Project completion		
Program	30 Dec 2003	28 Nov 2003
Project	30 Jun 2006	3 Apr 2007
Months (effectivity to completion)		
Program		21.3
Project		61.8

	Appraisal	**PCR**	**PPER**
Economic Internal Rates of Return (%)			
Component A	17.1	23.6	46.6
Component B	16.8	15.1	8.5
Component C	16.4	24.0	48.0
Financial Internal Rates of Return (%)			
Component A	9.8	14.5	32.8
Component B	10.0	10.0	20.3
Component C	16.3	11.1	36.6

	Loan 1868 (Program)	Loan 1869 (Project)
Borrower	India	India
Executing Agency	Energy Department and Finance Department of the Government of Madhya Pradesh	Madhya Pradesh State Electricity Board

Mission Data

Type of Mission	**No. of Missions**	**No. of Person-Days**
Contact	3	24
Fact-finding	1	110
Appraisal	1	195

Type of Mission	No. of Missions	No. of Person-Days
Inception	1	110
Review	12	91
Loan disbursement	4	23
Project completion review mission	1	16
Independent evaluation mission	1	26

ADB = Asian Development Bank, ADTA = advisory technical assistance.

EXECUTIVE SUMMARY

The sector development program (SDP) was designed to support the government of Madhya Pradesh (MPG) in ensuring that the power sector was efficient, financially sustainable, competitive, and capable of providing the required quantity and quality of power for the state's economic and social development. Specifically, the SDP was to assist MPG in (i) improving the policy environment and governance of the sector; (ii) initiating the establishment of a commercial and competitive business environment to promote efficiency gains and loss reduction; (iii) improving the financial position of the Madhya Pradesh State Electricity Board (MPSEB) through financial restructuring; (iv) improving the quality and quantity of power supply by reinforcing, modernizing, and rehabilitating the transmission and distribution systems to promote economic growth; (v) setting up a computerized information and revenue management system; and (vi) installing three-phase meters for large consumers.

The SDP, which consisted of a policy-based program loan of $150 million and an investment-based project loan of $200 million for a total of $350 million from ordinary capital resources of the Asian Development Bank (ADB), was approved in November 2001. The program loan was disbursed in three tranches between March 2002 and November 2003 and the counterpart funds it generated were transferred to MPG by the Government of India to support the financial restructuring of MPSEB and finance part of the adjustment cost associated with the SDP. The investments to be financed by the project loan had six components with a totaling $318.9 million: $200 million loan in foreign currency to be financed by the ADB loan and $118.9 million in local currency to be financed by MPSEB and MPG. The actual project cost at completion in 2007 including additional works approved in 2004 was $260 million, of which $179 million was financed by ADB.

Assessment of Performance

Relevance. The SDP was prepared after a comprehensive assessment of key constraints and barriers to improved performance of the Madhya Pradesh power sector. The SDP was fully consistent with ADB's country assistance strategy for India, which focused on state-level reforms to improve public resource management for better service delivery and economic growth. The SDP took into account the overall strategy of the central government as well as MPG for fixing the structural problems of the power sector and built on the reform road map already formulated by MPG. It also leveraged the capacity building and technical assistance provided by other bilateral aid agencies. Hence, the SDP is rated *highly relevant*.

Effectiveness. The regulatory and legal reforms have been effective in establishing a transparent regulatory environment for the power sector. However, the institutional reforms have not been effective in establishing accountability of the management of the utilities; therefore, the regulatory interventions have not resulted in the expected performance improvements. The institutional and regulatory reforms have not also been effective in restoring the financial viability of the sector. The investments financed by the project have been effective in improving the performance of the transmission network, but the improvements in distribution are lower than expected. Hence, the SDP is rated *less effective* in achieving its intended objectives. However, the State Government has initiated several projects after the completion of SDP to improve the performance of distribution network such as the deployment of HVDS (High Voltage Distribution Systems) in urban areas and segregating agricultural and residential feeders in rural areas. It is expected that there would be a considerable improvement in the performance of the distribution network in next 3 years.

Efficiency. Given the relatively high economic benefits (compared with the economic cost of investment of the three investment components) from reduced technical losses, the investment loan (covering only components A, B, and C) is rated *efficient*. Although there are marginal improvements in the overall efficiency of the power sector, these efficiency gains are less than those required to make the power sector in Madhya Pradesh self-sustaining. The program loan is rated *less efficient.* Given the importance given to sector reforms in the SDP is rated *less efficient*. However, there is a strong possibility of efficiency gains in the distribution systems with the completion of on-going initiatives.

Sustainability. The legal reforms, regulatory regime, and the institutional reforms are likely to be sustainable as the reforms enjoy broad support from stakeholders, and MPG and the central government have the political will to address the structural problems of the power sector. However, the sector has not yet reached financial sustainability and continues to depend on extensive fiscal subsidies. The physical sustainability of the project-financed investments critically depends on the availability of financial resources for operation and maintenance and reinforcement. Physical sustainability cannot be guaranteed as the power sector is not yet in a position to recover the full cost of supply. Hence, the SDP is *less likely to be sustainable*. However, if the structural problems affecting the financial sustainability of the sector could be addressed in next couple of years, the sustainability rating would be improved.

Overall Assessment:

Although the investment component of the SDP had been efficient and effective, the policy-based program loan has been less than effective in achieving the intended development outcomes at the time of PPER mission. This result has impacted on the overall financial sustainability of the sector and on the operational sustainability of the project-financed assets. The overall performance of the SPD is rated *partly successful* on the basis of the ratings—*highly relevant*, *less effective*, *less efficient*, and *less likely* sustainable. However, there is a strong possibility of considerable improvement to the performance of power distribution sector by 2013–2014, as a result of on-going initiatives to deploy HVDS and feeder segregation through out the State. If these improvements materialized as expected, the overall rating of SDP could be improved as SDP set the preconditions for subsequent developments of the sector. However, it is premature to take into account the expected improvements to the performance of the sector in rating the SDP.

Other Assessments

Impacts. The broader impacts in terms of improvement in the investment climate for private sector participation in the power sector, promoting overall economic growth, and the socio-economic impacts of power sector reforms are addressed here. Most of the recent initiatives to attract private sector investments in the power sector in Madhya Pradesh can be attributed to the provisions of the Government of India's Electricity Act of 2003. These included soliciting private sector investments for power generation with over 60% of generation capacity to be sold competitively in the power market, franchising power distribution, and promoting private sector investments in transmission. The initial reforms undertaken under the SDP enabled Madhya Pradesh power sector agencies to exploit the new provisions of the Electricity Act of 2003.

Madhya Pradesh continues to lag behind the rest of India in economic growth and industrial investment, partly because of inadequate physical infrastructure including power. The SDP has not fully achieved its objective of improving the investment climate and economic

growth prospects of Madhya Pradesh. The socioeconomic impacts of the SDP are mixed. While there has been a marginal improvement in the quality of supply, load shedding in excess of over 10 hours continues in rural areas. The tariff levied on residential and agricultural consumers was gradually increased, with targeted subsidies for people below the poverty line. This is likely to have adverse impacts on consumer welfare as the tariffs were increased with only a marginal improvement in the quality of the supply. The impacts of the SDP have been rated *moderate*.

ADB performance. The overall design of the reform program was based on sound economic and sector work, as the report and recommendation of the President (RRP) contained a thorough analysis of key problems and challenges to the power sector. The SDP was closely aligned with ADB's program loan to India for public resource management in Madhya Pradesh and ADB's overall country and state-level assistance strategy. The socioeconomic impacts of likely tariff reforms were analyzed and protective measures were included to mitigate the adverse impacts of tariff reforms on the poor. However, the project design did not include a detailed monitoring and evaluation program to assess the socioeconomic impacts of the institutional and tariff reforms.

ADB had engaged MPG in policy dialogue with respect to the financial restructuring plan and employee transfer to the successor companies of MPSEB during the implementation of the SDP. Although MPG has not yet formally accepted the financial restructuring plan, it took over most of the critical financial issues facing the sector such as outstanding liabilities to central sector power utilities and domestic financial institutes and these liabilities have been converted to MPG equity in MPSEB. ADB had played a key role in coordinating capacity development and capacity building for implementing reforms provided by bilateral aid agencies (Canadian International Development Agency [CIDA] and the United Kingdom's Department for International Development [DFID]). In recognition of MPSEB's capacity for project management, ADB agreed to do away with the project implementation consultants. ADB had anticipated the cost savings due to the lower bid prices and cancellation of several components of the loan such as project implementation consultants and revenue management systems. The savings were reallocated to expansion of the scope of the transmission and distribution networks. The performance of ADB is rated *satisfactory*.

Borrower's performance. MPG had taken full ownership of the reform program, as it realized the precarious situation of Madhya Pradesh's power sector and its adverse impact on the fiscal situation and overall economic growth of the state. MPG had the political will to go ahead with potentially unpopular measures such as tariff reforms, curtailment of free electricity supply, and increasing metering of end users. MPG and MPSEB had put in place adequate institutional arrangements for implementing the SDP. MPG had implemented most policy reforms included in the policy matrix, but had been reluctant to approve a comprehensive debt restructuring plan. MPG allowed MPSERC (MP State Electricity Regulation Commission) to act as an independent economic regulator and did not interfere with tariff setting based on full cost recovery. Through fiscal allocations, MPG has promptly paid the tariff subsidies that it provided to residential consumers below the poverty line and for agricultural consumers. MPSEB performed well in implementing the investment component of the project. The work for the original scope of the project was implemented ahead of schedule with significant cost savings. The borrower's performance is rated *satisfactory*.

Outstanding Issues

Generation capacity shortages. The demand for electricity in the state has been rising over the years and the average demand during the peak season was around 7,000 megawatts

(MW) in fiscal year (FY) 2010. The total average available capacity for the state, including central sector allocation to Madhya Pradesh, is around 5,600–6,000 megawatts (MW), resulting in generation capacity shortage of around 1,000–1,400 MW. State authorities are compelled to limit the power supply to rural areas to around 12 hours while providing over 22 hours of electricity supply to urban areas. There are several projects having capacity allocations of over 5,000 MW to MP under construction and with the commissioning of these projects, the generation capacity shortages are expected to be eliminated.

Persistent distribution losses. The most critical issue facing the power sector in Madhya Pradesh is the high distribution losses coupled with low collection efficiency. The current aggregate technical and commercial (ATC) losses is of the order of 34%, with only West Distribution Company (DISCOM) having ATC losses below 30% (29.3%), while East and Central DISCOM have ATC losses of 36.8% and 34.2%, respectively. Although the transmission and distribution losses have been reduced significantly from around 50% in 2002, the current levels are still very high. Additional efforts are required to keep the loss levels within reasonable limits. The on-going distribution improvement projects are expected to result in a considerable reduction in the ATC losses.

Financial deficit. The state power sector utilities have been running in deficit for over 20 years. The sector wide accumulated financial losses were Rs65.8 billion for the period FY2006–2009, with Rs26.6 billion in FY2009 alone. Although MPG has financed the cash deficit and investment needs in the past, the performance of the sector has to be significantly improved to achieve financial sustainability. Given the already high tariffs in the state, there is little scope for further increase in tariffs. Hence, it is imperative that the proposed measures for reducing technical and commercial losses are carried out as planned, subject to technical and financial viability. Until the sector achieves financial breakeven, fiscal subsidies will be necessary.

Performance improvement of MPSEB successor entities. Another unfinished item in the reform process is autonomy for financial and human resource management of the successor companies of MPSEB as those functions are still retained by the residual MPSEB. The tariff regime is designed in a manner that results in financial gains to regulated companies if they manage to exceed the performance standards used in tariff setting. However, MPSEB consolidates these financial gains at the sector level and better performing companies do not gain any financial benefits. The State Government has recently taken action to transfer the employees and cash management to successor companies and it is expected that these actions would result in improved accountability for performance improvements.

Lessons Learned

Regulatory and institutional reforms are important, but they will not result in improved performance in the absence of accountability and incentives. The SDP was based on the premise that regulatory and institutional reforms would result in improved performance by the sector entities. Although the regulatory and institutional reforms were implemented as intended, there was no significant improvement in the performance of the sector entities with the possible exception of Madhya Pradesh Transmission Company. The regulatory interventions were limited to annual tariff settings based on progressively improving performance norms. Hence, the reform program should have gone beyond institutional and regulatory reforms and encouraged MPG and the regulator to set performance targets and ensure compliance with these targets through an incentive and/or penalty mechanism. It is encouraging to note that the MP State Government and MPSERC have set targets for loss reduction, revenue realization etc in last 3- 4 years with periodic monitoring of compliance with the targets.

Restoring the financial viability of the power sector in the prevailing context of Madhya Pradesh requires a holistic approach encompassing technical, institutional, and governance measures. The improved operational efficiency of utilities and tariff adjustments aimed at reducing the cross-subsidies to residential and agricultural consumers can address part of the problem; however, the underlying issue in the power sector remains the high ATC losses. Reducing ATC losses requires technical measures (reducing the overloading of distribution feeders and having high-voltage distribution system [HVDS] and bundled conductors to prevent electricity pilferage), institutional measures (improved metering, billing and bill collection) as well as governance-related action (discouraging electricity theft by taking legal action against pilferers). Underlying political economy issues such as affordability to Madhya Pradesh agriculture sector in the event of full cost recovery for the supply of electricity to that sector also needs to be taken into account. As some of these issues are beyond the mandate of power sector entities, they have to be tackled as part of a broader fiscal reform initiative, given the high fiscal burden resulting from the power sector cash deficit.

Over reliance on the private sector for power generation investments when there are structural issues in the distribution sector may not result in desired outcomes. Before the setting up of a competitive Indian power market and open access to transmission systems, it was difficult to attract private sector investments to power generation in Madhya Pradesh as investors were concerned about MPSEB's ability to set aside adequate cash flows to meet power purchase obligations (escrow cover). After the new provisions of India's Electricity Act of 2003 related to the setting up of a competitive power market and open access to transmission networks were implemented, private investors have shown increased willingness to invest in power generation in Madhya Pradesh as demonstrated by on-going private sector projects with capacity allocations of more than 1,500 MW for the state.

Follow-Up Actions

Although the original SDP was completed in 2004, ADB continues to be engaged in the Madhya Pradesh power sector through the ongoing multitranche financing facility (MFF) facility (Madhya Pradesh Power Sector Investment Program) approved in 2007. There is scope for ADB to engage MPG in policy dialogue to address some of the remaining structural issues in the sector.

(i) **Restoring the financial viability of the power sector**. It would be useful to prepare a time-bound road map for restoring the financial viability of the sector, taking into account the structural issues facing the sector and the projected efficiency gains of proposed investments. The multiyear tariff-setting framework could be coordinated with the financial restructuring road map to ensure that some efficiency gains were retained within the sector to improve its profitability. This would be a departure from the current practice where efficiency gains, if any, are passed on to the consumers through progressively stringent performance norms used in tariff setting. It is noted that the State Government is in the process of preparing a Financial Restructuring Plan which includes a road map for restoring the financial viability of the sector.

(ii) **Accountability for improved operational performance.** The management of the sector entities created after the unbundling of MPSEB is not held responsible for the operational and financial performance of the entities mainly because it lacks financial autonomy and the respective board of directors and regulators

have not set a performance target. As MPG covers the cash deficit of the sector and in the absence of performance targets set by either the regulator (the performance norms are used only for the purpose of tariff setting) or MPG as shareholder, the utility management does not have adequate incentives to strive for improved performance. ADB could engage MPG and MPSERC in establishing a framework for improving operational performance and a corresponding incentive scheme.

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I. INTRODUCTION

A. Project Description and Expected Outcomes

1. The sector development program (SDP) was to support the government of Madhya Pradesh (MPG) in ensuring that the power sector was efficient, financially sustainable, competitive, and capable of providing the required quantity and quality of power for the state's economic and social development. Specifically, the SDP was to assist the state government in (i) improving the policy environment and governance of the sector; (ii) initiating the establishment of a commercial and competitive business environment to promote efficiency gains and loss reduction; (iii) improving the financial position of the Madhya Pradesh State Electricity Board (MPSEB) through financial restructuring; (iv) improving the quality and quantity of power supply by reinforcing, modernizing, and rehabilitating the transmission and distribution systems; (v) setting up a computerized information and revenue management system; and (vi) installing three-phase meters for large consumers.

2. The SDP consisted of program and project components: a program loan of $150 million from the ordinary capital resources of the Asian Development Bank (ADB) and a project (investment loan) loan of $200 million. The program loan consisted of three tranches to be disbursed on achievement of key policy and institutional reforms such as (i) establishing a regulatory regime, (ii) functional unbundling of MPSEB, and (iii) initiating financial restructuring of MPSEB. The project loan was to improve the quality and quantity of the power supply by reinforcing, modernizing, and rehabilitating the transmission and distribution systems to promote economic growth.

B. Evaluation Purpose and Process

3. ADB's lending operations to the energy sector during 1998–2005, especially in the South Asian region, had focused on legal, regulatory, and institutional reforms; financial restructuring; and financing critical investments in network infrastructure. It was also expected that legal and regulatory reforms combined with improved network infrastructure would attract private sector investments to bridge the prevailing shortages in generation capacity. The SDP modality for power sector reforms in Madhya Pradesh, India, was considered as an appropriate and representative case study for assessing the impacts and outcomes achieved in energy sector reform programs supported by ADB in several South Asian countries.

4. Although ADB's recent energy sector operations tend to focus on promoting clean energy investments and creating an enabling environment for clean energy investments, some of the underlying policy and institutional barriers and financial challenges still remain in the power sectors of a number of developing member countries (DMCs). Hence, this project performance evaluation report (PPER) is expected to provide useful insights into the impacts and outcomes attributable to the ADB-supported SDP in one of the larger states in India and useful lessons for designing similar programs in the future.

C. Key Findings of the Project Completion Report

5. The project completion report (PCR) rated the SDP efficacious (effective) because the immediate objectives of the reform program and investment project had been achieved and the expected outcomes were being realized. The PCR reported that MPSEB was unbundled into a generation company, a transmission company, three distribution companies, and a power trading company; and the power sector became more focused with better supervision through

decentralized decision making, improved accountability, and improved operational effectiveness and efficiency. The PCR reported that the investment project had not only achieved the physical scope of work established at appraisal but also increased the scope by utilizing loan savings for additional works under the project. The PCR rated the SDP *efficacious*, but did not explain why a higher rating was not given.

6. The PCR noted that the reform program was efficiently managed and the investment project was, on average, about 8 months late for all components. The financial internal rate of return (FIRR) and the economic internal rate of return (EIRR) for all components were lower at completion than at appraisal, but all the FIRRs were still above the weighted average cost of capital and all the EIRRs were all above the 12% threshold. The PCR rated both the reform program and the investment project *efficient*.

7. The PCR was of the opinion that the reliability of the program components will play a major role in the long-term sustainability of the power sector in the state. The PCR rated the SDP *sustainable* in both the short and long term. The new companies derived from unbundling MPSEB were reported to have in-house capacity to operate and maintain the equipment and systems effectively and efficiently. Hence, all components of the investment project are expected to provide excellent service throughout their expected life.

D. Key Evaluation Issues

8. **Relevance of ADB-supported reform program to the prevailing political economy.** Complex political economy issues underlay the structural weaknesses affecting the power sector. Strong political will to confront vested interests at both central and state levels was essential to successfully implement power sector reforms. ADB supported the power sector reform program in Madhya Pradesh, which was conceived and implemented in support of a Government of India-driven reform agenda to address the political and economic issues associated with the power sector. The Government had entered into memoranda of understanding (MOUs) with the states with regard to the reform measures that each state would undertake. The measures included establishing regulatory commissions, feeder metering, timely payment of subsidies and tariff adjustments. This incentive-driven system—which incorporates concessionary financing for new investments, and penalties such as suspension of concessionary funding from the central government for power sector investments if the reform measures included in the MOU were not implemented—had transformed the political economy for power sector reforms.

9. **Impact of tariff adjustments on the rural poor and agricultural consumers.** The tariff policy prevailing at the time of loan appraisal was meant to provide subsidies to agricultural and domestic users of electricity as a means to help the poor. However, several structural weaknesses with the prevailing tariff regime reduced the benefits of subsidies to the poor. They included the high connection cost, a flat rate that favored the better-off farmers having bigger pumps, and poor quality of electricity resulting in burnout of small pumps used by poorer farmers. Several measures were included in the reform program to better target the subsidies to the poor while increasing cost recovery in the agricultural and residential sectors.

10. **Effectiveness and impact of reforms on operational and managerial efficiency of the power sector.** The SDP has resulted in the functional unbundling of the power sector and increased the accountability and transparency of the performance of the successor companies of MPSEB. The reform program also supported the improvement of managerial efficiency in the distribution sector through feeder metering, consumer metering, and increased focus on

reducing technical and nontechnical losses. These efforts continued with special focus on scaling up a high-voltage distribution system (HVDS) under the subsequent multitranche financing facility (MFF)[1] approved in 2007. The ability of the transmission system to meet the increased power demand will also be assessed with special focus on the impact of the reforms in attracting new investments and improving the performance of the power transmission and generation subsectors.

11. **Effectiveness of the reform program in establishing the financial sustainability of the sector and reducing the fiscal burden.** The weak financial position caused by inadequate cost recovery from agricultural and residential consumers, accompanied by a high level of aggregate technical and commercial losses (ACT) (in excess of 45%), contributed to insufficient investments in power generation capacity and network infrastructure. The results were persistent power shortages and poor quality of power supply causing industrial consumers to increasingly resort to captive power generation. This further affected the financial viability of MPSEB as the industrial tariff structure was set at a level above the cost of supply to cross-subsidize agricultural and residential consumption. The inadequate cost recovery forced MPSEB to default on payments to fuel suppliers and central power generation utilities such as the National Thermal Power Corporation (NTPC) and loan repayments, and to increasingly depend on fiscal subsidies from state governments. MPSEB also suffered from high levels of account receivables, especially from public sector consumers. As the tariffs were set below cost recovery levels, MPG was expected to provide tariff subsidies to ensure 3% return on assets (ROA). However, the state government did not have fiscal space to provide these subsidies on time and by the year 2000 the financial position of MPSEB had become unsustainable. The SDP was expected to improve cost recovery and financial sustainability in the power sector in Madhya Pradesh.

II. DESIGN AND IMPLEMENTATION

A. Rationale

1. National Context

12. After growing strongly during 1991–1996, due to the liberalization of the external trade and delicensing of the domestic sector, the Indian economy experienced a slowdown during 1997–1999. One contributory factor for the slowdown was the persistent and structural deficits at the state level. The weak fiscal situation of Indian states also adversely affected the vital infrastructure and social service delivery for which states were responsible under India's federal constitution. In recognition of the vital role played by Indian states in service delivery to the poor and the precarious fiscal situation of most Indian states, ADB's country strategy of 1996[2] advocated a shift toward more interventions at the state level to support efforts to improve public resource management and to create an enabling environment for enhanced efficiency of public sector enterprises.

13. The initial policy response from the central government to the persistent capacity shortages in the power sector in the early 1990s was to encourage private investments in the generation sector from foreign investors by providing special incentives such as guaranteed return on equity. However, the underlying problems in the power distribution sector had not

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

[2] ADB. 1996. *Country Operational Strategy: India.* Manila.

been addressed and the weak capacity of state electricity boards to absorb power generated by the proposed independent power producers (IPPs) made it difficult to attract sufficient investments from the private sector to meet the generation shortfall.

14. Several attempts to reform the power sector in several states during the period 1995–2000 had varying degrees of success. The reform process that included the privatization of distribution and generation in the state of Orissa supported by the World Bank was unsuccessful because baseline data on transmission and distribution (T&D) losses was inaccurate. Thus the business plans of the privatized distribution companies (DISCOMs) became nonviable with inadequate tariff increases and nonpayment of subsidies by the state government to cover the unexpectedly high T&D losses. In Andhra Pradesh, the reform program was more successful; it did not attempt to privatize, but it improved the efficiency of DISCOMs through regulatory oversight and incentives in the form of tariff adjustments and timely payment of subsidies against improved performance indicators.

15. The Government of India initiated the Electricity Regulatory Commission Act of 1998, which provided a consistent legal basis for state electricity regulatory commissions (SERCs) and for the Central Electricity Regulatory Commission (CERC) to be established to regulate state and central electricity utilities, respectively. In 2000, the central government initiated the Accelerated Power Development and Reform Program (APDRP) to reward the state that performed best in implementing reforms and improving efficiencies, with low-interest investment loans and matching grants for loss reduction.

2. State-Level Context

16. Madhya Pradesh was the largest state in India and fourth in population until it was divided into two states, Madhya Pradesh and Chhattisgarh, on 1 November 2000, on the basis of the Madhya Pradesh Reorganization Act of 2000. The power demand of undivided Madhya Pradesh at an annual rate of 7.3% reached 6,600 megawatts (MW) in 2000 from 4,300 MW in 1993. However, the available generation capacity increased from 3,500 MW in 1993 to 5,500 MW in 2000, resulting in an average load shedding of about 1,100 MW. The quality of the supply also suffered as a result of overloaded transmission and distribution facilities. The system had been operating at lower than normal frequency and voltage about 55% of the time. Transmission, distribution, and generation limitations were thus preventing the system from meeting demand. In direct response to the deficient quantity and quality of power supply and the high tariffs, major industrial consumers set up their own captive power generation plants. From FY1996 to FY2000, captive generation grew at an average 8.7% a year, and amounted to over 1,400 MW.

17. With the division of Madhya Pradesh in November 2000, the erstwhile Madhya Pradesh Electricity Board (MPEB) was divided into MPSEB and Chhatisgarh State Electricity Board (CSEB). The division resulted in inequitable division of generation capacity and demand as well as assets and liabilities between MPSEB and CSEB. While MPSEB had most of the electricity sales (78%), its revenue base amounted to only 64% of the erstwhile MPEB as it inherited more than 90% of heavily subsidized agricultural consumers. MPSEB also obtained only 68% of the generation assets of MPEB. MPEB's annual loss of about Rs11 billion and power shortage of 1,070 MW were divided, resulting in MPSEB's power deficit and annual loss increasing to about 1,700 MW and over Rs21 billion, respectively, while CSEB had surplus generation capacity of 750 MW and a profit of Rs9.5 billion. MPSEB experienced severe financial difficulties for it was also required to assume 78% of MPEB's liabilities. At the time the SDP was approved, there

remained unresolved issues and litigation regarding the distribution of liabilities between MPSEB and CSEB.

18. Major parts of the transmission systems were overloaded, causing suboptimal operation of the network coupled with poor voltage profile in numerous pockets and weak power delivery system. MPSEB suffered from severe handicaps in preventive maintenance because critical testing and maintenance equipment and needed spare parts were not available. Total losses were estimated at 47%–22% technical and 25% commercial. Technical losses of 22% are very high and reducing them generally requires significant investment. Because of the financial constraint of MPSEB, technical losses were not reduced. Estimating the precise loss was hampered because currently only about 38% of energy input into the distribution system is measured due to the policy of free supply for designated agricultural and unmetered domestic consumers, at a flat rate. In addition, a significant number of meters were defective and consumption by the involved customers also needed to be estimated. A detailed analysis of the performance of the power sector in Madhya Pradesh during 2000–2009 is in Appendix 1.

19. In response to the National Development Council's recommendation for restoring the financial sustainability of the power sector at the state level, MPG appointed a high-level committee in 1996, the Tata Rao Committee, to review the existing power sector situation and to suggest measures for its restructuring in the context of economic liberalization and introduction of private capital into the sector. The major recommendations of the report were to (i) divide MPEB along functional lines, (ii) maintain MPEB as a holding company, (iii) establish a regulatory authority, (iv) allow private sector investment in all functional areas, and (v) improve the financial and operational efficiency of the distribution segment before inviting private sector investment. The report recommended fundamental changes in the free supply of power to certain consumer segments, and that any subsidy must be transparent and reimbursed to the utility on time. The recommendations formed the basis of the power sector reforms implemented in Madhya Pradesh since 1998.

20. The central and state governments had recognized the urgent need for undertaking sector reforms to address the structural problems facing the power sector in Madhya Pradesh. However, there was a need for external support in formulating a reform road map taking into account the specific circumstances of the state, achieving a consensus among the key stakeholders on such a reform road map, and support for implementing the reform road map, taking into account the complex political economy issues. Due to the weak fiscal position of Madhya Pradesh, the adjustment cost of financially restructuring the sector had to be financed from external sources, which could also provide an added incentive for policymakers to implement the reforms. The power transmission and distribution networks had not been adequately expanded to meet the increasing power consumption despite shortages in generation capacity and severe network constraints. ADB's engagement through the SDP and the technical assistance (TA) provided by ADB and other bilateral aid agencies (Canadian International Development Agency [CIDA] and the UK Department for International Development [DFID]) were conceived to address some of those needs.

3. Project Formulation

21. MPG adopted the recommendations of the Tata Rao reports as the road map for sector reforms, namely, (i) functional unbundling of MPSEB, (ii) retaining MPSEB as a holding company, (iii) establishing a regulatory authority, and (iv) improving operational and financial efficiency of the distribution utility before inviting private sector participation in power distribution. In May 2000, the central government and MPG signed a memorandum of agreement (MOU),

affirming the commitment of both parties to reform the power sector and set out time-bound reform measures to be implemented by MPG. The reforms would be implemented in two phases. A detailed plan for reforms in phase 1 was formulated, with inputs from ADB and CIDA. The phase I reforms were to

(i) establish an independent sector Regulator,
(ii) establish new sector companies and gradually make them operational,
(iii) decide the configuration and geographical demarcation of the distribution sector,
(iv) improve managerial and operational efficiencies of the sector, and
(v) improve the financial viability of and cost recovery in the sector.

22. The SDP supported by ADB and CIDA and, subsequently, by DFID consisted of the noted policy interventions, and physical investments to reduce technical losses and network constraints and increase the delivery capacity of the network so that the stakeholders can reap the benefits offered by sector restructuring. The SDP was also intended to progressively restore the financial performance of the sector through efficiency improvements, reduction in both technical and commercial losses, and tariff adjustments to reduce fiscal transfers to the sector. ADB adopted the mixed-modality approach consisting of a program loan to support the policy reforms and the adjustment cost of implementing the reforms, complemented by a project loan to support the urgent physical investments. CIDA and, subsequently, DFID financed the technical assistance required for implementing the reform road map and building the capacity of newly formed power sector entities.

23. The immediate objectives of the SDP were to (i) improve the policy environment and the governance of the sector with the establishment of an independent regulatory body, (ii) initiate the establishment of a commercial and competitive environment for the successor companies of MPSEB, (iii) improve the financial viability of the sector, (iv) improve the quality and quantity of power supply by rehabilitating the T&D systems, and (v) introduce a computerized revenue management system and promote 100% consumer metering. Appendix 2 gives the updated design and monitoring framework.

B. Cost, Financing, and Executing/Implementing Arrangements

24. The SDP approved in November 2001 consisted of a policy-based program loan of $150 million to be disbursed in three tranches and an investment-based project loan of $200 million for a total of $350 million from the ordinary capital resources of ADB to support the restructuring of the Madhya Pradesh power sector.

1. Program Loan

25. The Madhya Pradesh Department of Finance was the executing agency for the program loan. The state government set up an institutional framework for managing the power sector reforms process under a steering committee chaired by the chief secretary of MPG. The members of the committee were the MPG principal secretaries for power, finance, law, and planning, and the chairman of MPSEB. To ensure better coordination between state and central government departments, the joint secretary of sector reform of the central Ministry of Power, and the director of the Department of Economic Affairs were included as members. The establishment of the steering committee and regular monitoring of the implementation of reforms at the highest level by the chief secretary helped the state government to meet the tranche conditions very close to the envisaged dates and facilitated the timely approval of tranche releases. This institutional arrangement for overseeing the sector reforms progress was

supported by consultants financed by CIDA and DFID and helped MPG in taking timely actions and meeting the tranche release conditions.

26. The central government transferred to MPG the counterpart funds generated by the program loan to support the financial restructuring of MPSEB and finance part of the adjustment cost associated with the SDP. The adjustment costs were expected to include (i) payment of outstanding dues of municipalities and other local and state bodies owed to MPSEB (Rs7.423 billion); (ii) rationalization of the electricity tax (Rs350 million); (iii) setoff of dues of MGP and MPSEB (Rs620 million); and (v) reduction of debt obligations of MPSEB (i.e., unspecified). The estimated cost at appraisal and actual cost incurred by MPG for these adjustments during 2002–2006 are compared in Table 1.

Table 1: Comparison Appraisal Estimates and Actual Adjustment Costs Incurred

Item	Appraisal Estimate (Rs billion)	Actual Cost incurred (Rs billion)
Setoff of municipality electricity dues	7.42	7.40
Rationalization of electricity tax	0.35	
Setoff of overdue interest on market borrowings of MPSEB	6.75	7.50
Setoff of cross-liabilities between MPG and MPSEB	0.62	0.62
Tariff subsidies (2002–2006)		32.30
Reduction of debt obligations of MPSEB		
- Issuance of tax-free bonds to CSU		27.50
- Issuance of bonds for settling REC debts	17.50	14.15
- Conversion of MGP loans to MPSEB to equity		32.90
Total adjustment cost (2002–2006)	**32.64**	**122.37**
CAPEX support	41.00	
- CAPEX grants		1.55
- Equity injections for CAPEX		8.90
- MPG Loans for CAPEX		42.80
Total fiscal support to power sector (2002– 006)	**73.64**	**175.6**

CAPEX = capital expenditure, CSU = central sector undertaking, MPG = government of Madhya Pradesh, MPSEB = Madhya Pradesh State Electricity Board, REC = Rural Electrification Corporation.
Source: Independent Evaluation Mission.

27. At appraisal the adjustment cost related to debt restructuring and tariff subsidies were not estimated as there were uncertainties regarding the actual level of debt overhang of MPSEB due to unresolved debt allocation between MPSEB and CSEB after the bifurcation of MPEB in 2001. The required level of tariff subsidies was also not known at the time of appraisal as there was uncertainty regarding the tariff levels to be stipulated by MPSERC and the actual tariff regime to be notified by MPG. The original intention at the time of appraisal was to increase the tariff to achieve 75% recovery of the cost of supply by 2002.

28. During the implementation of the program loan, a draft financial restructuring plan was prepare. It was also expected that due to tariff increases and improved billing and collection efficiency, MPSEB would recover (i) all expenses excluding depreciation and debt service by

2004, (ii) all expenses excluding debt service but including depreciation by 2006, and (iii) all expenses by 2010. The total cash deficit including the cash requirement for 2002–2005 capital expenses (part of which was to be financed through debt financing) was estimated to be Rs73.8 billion.

29. However, the financial assistance MPG provided to the power sector during 2002–2005 when the institutional restructuring and unbundling of MPSEB were completed amounted to Rs175.6 billion because the expected efficiency gains and tariff adjustments had not been realized. A major share of the adjustment cost (Rs74.6 billion) was related to the debt restructuring undertaken before the unbundling of MPSEB, when MPG absorbed outstanding debts of MPSEB to domestic financial institutions and central sector power utilities and issued MPG bonds to those entities in lieu of the debts to MPSEB. In addition to the debt adjustment, MPG also provided tariff subsidies of Rs32.3 billion to MPSEB for providing electricity at subsidized rates below the regulated tariff for low-income agricultural and residential consumers. Furthermore, Rs53.3 billion was provided as MPG loans, equity, and grants for capital investment projects including power generation plants. However, the Madhya Pradesh power sector has not yet reached financial sustainability and required further Rs111.4 billion during 2007–2009, and the annual cash deficit and accounting loss exceeded Rs34 billion and Rs28 billion (excluding the tariff subsidies of Rs9.4 billion), respectively, in 2009.

2. Project Loan

30. MPSEB was the executing agency for the project loan. The implementation arrangements were the same as envisaged at appraisal. Overall responsibility for project implementation was with the chairman of MPSEB, who was assisted by the project management unit (PMU). The PMU, which was established in May 2001, was headed by the superintending engineer, who was assisted by a team of professionals consisting of five executive engineers and associated support staff. Consulting services were envisaged to support the PMU in project implementation, but they were not utilized. A thorough review of the PMU staff qualifications and expertise showed no need for external consulting services and that MPSEB staff were capable of implementing the project. A member (transmission) was in charge of overall coordination with ADB. The chief engineer in each zone or circle was in charge of civil works and erection and commissioning of distribution works in the respective zones. MPSEB's board regularly reviewed implementation progress. Forest clearances and land acquisition for substations were planned and executed well in advance to avoid delays.

31. The project loan had six components estimated to cost $318.9 million, comprising $200 million in foreign currency and $118.9 million in local currency. The ADB loan of $200 million was expected to cover the foreign currency expenses. During project implementation in 2004, it was realized that there was going to be significant savings of $136.2 million, comprising $78.8 million in foreign currency savings (ADB loan savings) and $57.4 million equivalent in local currency financing. The loan savings were mainly due to lower than expected contract prices and cancellation of components D and F from ADB financing. MPSEB proposed to ADB to add additional works to the original scope of the project amounting to $103.4 million, and requested ADB to finance the foreign currency expenses of the additional works. The revised estimated project cost including the additional works amounted to $338.8 million. However, the project cost at project completion including additional works amounted to $260 million. ADB financed $179 million of the project cost and $21 million of the ADB loan was cancelled. Cost savings of $78.8 million consisted of $21 million in foreign currency and $57.8 million in local currency. The actual project costs vis-à-vis the estimated project cost for the six components of the project loan are described in Appendix 3 and summarized in Table 2.

Table 2: Actual and Estimated Costs ($ million), by Component

	Project Components	Estimates		Actual
		Appraisal	Revised	Costs
A.	33 kV and 11 kV systems improvement	82.9	81.0	67.5
B.	Conversion of LT lines to 11 kV	7.1	5.7	5.1
C.	Transmission system reinforcement	118.7	153.5	133.1
D.	Computerized information and revenue management system	9.8	9.8	0.0
E.	Metering	1.1	0.7	0.6
F	Consulting services	1.8	0.0	0.0
G.	**Subtotal (A−F)**	**221.4**	**250.7**	**206.3**
H	Contingencies			
	Physical	21.9	16.6	0.0
	Price	13.7	19.2	0.0
I.	Front-end fee	2.0	2.0	2.0
J.	Taxes and duties	30.5	13.0	16.0
K.	Interest and commitment charges during	29.4	37.3	35.7
	Grand Total	**318.9**	**338.8**	**260.0**

kV = kilovolt, LT = low tension.
Sources: Independent Evaluation Mission, project completion report and recommendation of the President.

C. Application of Counterpart Funds

32. Although the program loan was expected to finance part of the adjustment cost, the disbursement of the loan was related to specific policy actions, which included the settlement of municipal dues in installments. The setoff of cross liabilities and overdue interest on market borrowings, rationalization of electricity tax, and reduction of debt obligations were not included as conditions for disbursement of the program loan. The fiscal cost of complying with the tranche release conditions pertained only to the settlement of overdue municipal electricity dues amounting to over Rs7,423 million ($164 million) as the debt restructuring of MPSEB was carried out after the completion of the program loan. Hence, it can be deduced that the counterpart funds generated by the program loans were utilized primarily to finance the payment of overdue municipality and other state government electricity dues.

D. Consultants

33. The power sector reform program in Madhya Pradesh required substantial technical assistance resources during the preparatory as well as the implementation phase. After MPG accepted the recommendations of the Tata Rao Committee in 1997, ADB, the Government of India, and MPG identified the following set of studies as prerequisites for implementing the reform program:

(i) preparing the power sector master plan,
(ii) preparing a framework for rationalizing tariffs,
(iii) reviewing electricity legislation and regulations,
(iv) soliciting private sector investments for power generation,
(v) building technical and managerial capacity for the distribution sector, and
(vi) managing demand

34. CIDA had collaborated with ADB in providing the technical assistance (TA) for implementing the reform program. It was agreed that ADB would provide TA for items (iii) and (iv), and CIDA would finance the consultants for items (i), (ii), (v), and (vi). In 1998 ADB approved TA for Madhya Pradesh Power Sector Development[3] consisting of two separate components for items (iii), and (iv). The TA consultants had important contributions in drafting and finalizing the Madhya Pradesh Electricity Reform Act, which was enacted in 2001 as a precondition for the SDP. However, the second component of the TA was not implemented because of the difficulties encountered in finalizing private sector power generation projects initiated by several Indian states including Madhya Pradesh due to the poor financial status of the power sector. The TA savings due to the cancellation of the second component were utilized for exploring the possibility of franchising the Gwalior distribution circle to NTPC (National Thermal Power Corporation). However, this was not successful because of significant subsidies required by NTPC from MPG for rehabilitating and operating the power distribution system in Gwalior.

34. The consultants that CIDA financed under the Energy Infrastructure Services Project (EISP) in 2000 provided useful inputs during the preparation and early implementation of the reform program in the following areas:

(i) coordinating the reform process,
(ii) planning system expansion and investment,
(iii) financial and tariff analyses,
(iv) building the capacity for demand side management,
(v) preparing a financial restructuring plan for the Madhya Pradesh power sector to address issues arising from the bifurcation of MPEB into MPSEB and CSEB, and
(vi) advising on how to configure the distribution sector after unbundling.

35. The CIDA-financed consultants provided valuable input for the policy dialogue conducted by ADB during the preparatory phase of the SDP, especially with regard to tariff reforms, financial restructuring, and reconfiguration of distribution. In 2002, DFID took over from CIDA as the main TA provider for the power sector reform program in Madhya Pradesh. DFID engaged in extensive discussions with ADB and MGP and they reached agreement on the scope of the TA to be provided by DFID. This included the following;

(i) supporting the strategic policy unit of MGP responsible for overall implementation of reform and providing high-level policy advice for discussions with the government of India and ADB;
(ii) advising MPG and MPSEB on human resource needs of the restructured power sector and preparing strategies for meeting the human resource needs;
(iii) identifying measures for addressing the critical financial problems of the sector and making recommendations for the financial restructuring necessary to start the new sector entities as financially viable entities;
(iv) advising on management information systems, accounting systems, financial controls and revenue management systems for each successor company;
(v) developing grid, metering and distribution codes, security and safety regulations, power procurement guidelines, and building MPSERC capacity for economic regulation and tariff setting; and
(vi) developing the capacity of MPSEB and its successor entities for making tariff filings with the regulator and compliance with other regulatory requirements.

[3] ADB. 1998. *Technical Assistance to Madhya Pradesh for t*he *Madhya Pradesh Power Sector Development*. Manila. (TA 2980-IND).

36. During appraisal of the SDP, it was recognized that additional TA to complement the TAs from CIDA and DFID was required to (i) recommend personnel transfer to successor entities, taking into account the human resource needs of the successor companies through a consultative process with the relevant labor unions; and (ii) develop a communication strategy with key stakeholders and consumer groups for the reform process. In November 2002, ADB approved two TAs: legal support for the sector reform[4] and consumer and stakeholder communication on sector reform.[5] However, there was much overlap between the two TAs and the assistance provided by DFID. ADB could have waited until DFID had finalized the scope of its TA before approving the two TAs.

E. Outputs

1. Program Loan

37. The program loan was designed to support MPG to (i) implement key policy reforms and establish a policy framework, including a fully operational independent state regulatory commission; (ii) unbundle MPSEB into companies; (iii) improve sector governance through more functional independence of the companies; and (iv) meet part of the adjustment cost of financial restructuring of the power sector, which was to be financed by MPG during the reform period. MPG had adopted several policy measures in 2001, which were considered prior actions for the approval of the program loan. They included

(i) enacting and notification of the Madhya Pradesh Electricity Reform Act,
(ii) establishing the Madhya Pradesh State Electricity Regulatory Commission (MPSERC),
(iii) authorizing MPSEB to disconnect municipalities with electricity dues of more than 1 year, and
(iv) restricting free electricity supply only to (i) scheduled castes/scheduled tribes and (ii) consumers below the poverty line consuming less than 25 kilowatt-hours (kWh) in the case of residential consumers and 5 horsepower (hp) for agricultural consumers.

38. The specific policy measures that MPG fulfilled before the first tranche of the program loan was disbursed in March 2002 included

(i) payment of Rs3 billion to MPSEB as settlement of the outstanding electricity receivables from municipalities and other local bodies,
(ii) first tariff award by MPSERC to ensure 75% cost recovery, and
(iii) incorporation and registration of Madhya Pradesh Power Generation Company (MPGenco), Madhya Pradesh Power Transmission Company (MPTransco), and Madhya Pradesh Power Distribution Company.

39. The reform momentum was maintained after the disbursement of the first tranche, and further progress was made to comply with conditions for disbursement of the second tranche in October 2002. The reform measures achieved were the following;

(i) finalized the configuration of the distribution sector by establishing three distribution companies to take over the distribution function of MPSEB;

[4] ADB. 2002. *Technical Assistance to Madhya Pradesh for the Legal Support for Madhya Pradesh Power Sector Reform*. Manila. (TA 3883-IND).
[5] ADB. 2002. *Technical Assistance to Madhya Pradesh for the Strengthening Consumer and Stakeholder Communication for Madhya Pradesh Power Sector Reform*. Manila. (TA 3972-IND).

(ii) appointed directors for MPGenco and MPTransco in an open and transparent manner, ensuring adequate representation of non-government directors and appropriate skills mix;
(iii) finalized an operation and management agreement between MPSEB and five successor companies to enable the successor companies to exercise a substantial level of autonomy pending the final of transfer of assets, liabilities, and personnel;
(iv) MPG payment of Rs2 billion to MPSEB in settlement of the outstanding electricity receivables from municipalities and other local bodies;
(v) MPSEB preparation of a debt restructuring plan;
(vi) built on the first tariff award, which raised cost recovery to 76%; filed second tariff revision with MPSEB for an average tariff increase of 24%; and
(vii) installed over 7,500 energy meters in 33 kilovolt (kV) and 11 kV feeders to enable energy audit at feeder level and undertook targeted loss reduction measures in feeders with high losses.

40. As a result of the efficiency improvement measures and tariff adjustments carried out in 2002, the monthly cash collection of MPSEB reached Rs3.614 billion in 2003 from Rs2.778 billion in 2002, and the cash deficit was reduced from Rs18.4 billion in 2002 to Rs11.6 billion in 2003. More reforms were undertaken in July 2003 to further improve the performance of Madhya Pradesh power sector and to meet the disbursement conditions of the third tranche. The reforms included the following:

(i) registered the three distribution companies formed to take over the distribution function of MPSEB;
(ii) finalized scheme to transfer assets and allocate liabilities and personnel to five successor companies in a fair and equitable manner;
(iii) paid Rs2.423 billion to completely settle the outstanding electricity dues of municipalities as of 31 March 2001;
(iv) increased the average tariff by 15% with the second tariff award of MPSEB in November 2002. The third tariff petition was filed in July 2003.
(v) finalization by MPSEB board of the financial restructuring plan (FRP), which was expected to achieve cash breakeven by 2006 and profitability by 2010. The full fiscal cost of implementing the FRP during 2004–2010 was estimated to be Rs23.9 billion, excluding the unfunded pension liability of Rs18.5 billion. However, when the third tranche was released, only the draft FRP was available. The draft was extensively discussed with MPG, MPSEB, and ADB and only certain parts of the FRP had been implemented by the time MPSEB was unbundled. A comprehensive FRP is yet to be approved by MPG.

2. Project Loan

41. **Component A.** This component was for improvement of the 33 kV and 11 kV systems in Bhopal, Gwalior, Indore, Jabalpur, Khargone, Mandau, and Ujjian areas. At appraisal, component A comprised construction of (i) 170 33/11 kV substations and 7,600 11/0.4 kV substations; and (ii) 1,800 kilometers (km) of 33 kV lines and 2,095 km of 11 kV lines in Bhopal, Gwalior, Indore, Jabalpur, Khargone, Mandsaur, and Ujjain areas. Subsequently, to utilize loan savings, additional works consisting of (i) 112 33/11 kV substations and 1,050 11/0.4 kV substations, and (ii) 1,071 km of 33 kV lines and 858 km of 11 kV lines, were included in October 2004. Component A (including additional works) was completed in March 2007 and operations since then have been satisfactory.

42. **Component B.** This component provided for the conversion to HVDS of selected low-voltage (LV) feeders supplying agricultural pumps in selected divisions in Mandsaur and Ujjian districts. Component B comprised (i) conversion of 927 km of LV lines to 11 kV lines; (ii) construction of 58 km of new 11 kV lines; and (iii) installation of 5,842 transformers of 10 kilovolt-ampere (kVA) and 5 kVA capacity in Mandsaur and Ujjain districts. Component B was completed in May 2006 as envisaged, without any deviations. MPSEB carried out component B on a pilot basis to reduce the commercial losses in Mandsaur and Ujjain, where the number of connected agricultural pumps was highest, and, as MPSEB reported, the incidence of theft due to illegal tapping of power at 0.4 kV had been high.

43. Since the completion of component B, the illegal tapping of power has been practically eliminated. MPSEB estimates that commercial losses have been reduced from 25% to 8%, and actual losses recorded in the feeders have gone down from 40–45% to 12–18%. Given the benefits accrued under this pilot scheme, MPSEB is now implementing a similar system across the state, part of which is being financed under the ongoing MFF ADB loan facility.

44. **Component C.** This component covered the reinforcement and augmentation of the transmission system in selected priority areas. At appraisal, component C comprised (i) installation of three 315 megavolt-ampere (MVA) 400/220 kV transformers and five 160 MVA 220/132 kV additional transformers; (ii) establishment of 222 km of 220 kV lines and 634 km of 132 kV lines; (iii) construction of five new 220 kV substations and 25 132 kV substations; (iv) construction of four 220 kV feeder bays; and (v) augmentation of 71 132/33 kV substations. To utilize the loan savings, additional works consisting of (i) construction of four 220/132 kV substations and 13 132/33 kV substations, (ii) augmentation of 132/33 kV substations, and (iii) establishment of 647 km of 220 kV lines and 446 km of 132 kV lines were included. Component C (including additional works) was completed in April 2007 as envisaged and without any deviations.

45. Component C helped (i) enhance transformation capacity in the state from (a) 2,940 MVA in 2002 to 3,885 MVA in 2007 at 400 kV level, (b) 6,770 MVA in 2002 to 9,650 MVA in 2007 at 220 kV level, and (c) 6,950 MVA in 2002 to 11,299.5 MVA in 2007 at 132 kV level; (ii) meet peak demand of 6,107 MW in 2007 without any grid disturbances in the system and maintaining the grid frequency within the 49.0–50.5 hertz (Hz) range for 89.83% of the time in FY2007; and (iii) increase the availability of the transmission system from below 90% in 2002 to 98.96% in 2007. In addition, component C also contributed to reducing transmission system losses (technical) from 7.93% in FY2003 to 5% in FY2007.

46. With the completion of components A, B and C, the state was able to (i) meet 6,107 MW of peak demand during FY2007; (ii) transmit and distribute 32,600 million kWh of energy during FY2007; (iii) enhance the stability and reliability of the distribution system; (iv) reduce the rate of distribution transformers failure from about 22% to 13% in the west and eastern zones, and from about 25% to 17% in the central zone; (v) achieve substantial improvement in the voltage profile of the distribution system (voltage profiles at low-tension level are maintained within a +/-6% range); and (vi) reduce scheduled and unscheduled power cuts.

47. **Component D.** This component was to set up a computerized information and revenue management system. In October 2005 MPSEB requested and ADB approved to delete this component from ADB financing as MPSEB intended to finance it from its own resources. ADB deleted component D from ADB financing and reallocated the funds allocated to component D to components A and C. MPSEB has since implemented a decentralized revenue management

system in 66 of 136 divisions. In the remaining 70 divisions, MPSEB is now implementing a revenue management system including other features such as payroll, materials management, financial accounting, project management, and human resources. This component is being implemented with MPSEB's own resources and technical assistance from DFID.

48. **Component E.** This component was to provide three-phase meters. MPSEB procured 35,273 three-phase meters which were installed by November 2003.

49. **Component F.** This component to provide consulting services for project implementation was later deleted as MPSEB had adequate capacity and experienced staff to implement the project. The amount earmarked for consulting services was reallocated to components A and C when additional works under the project were approved.

F. Design Changes

1. Program Loan

50. The main objectives of the program loan were for MPG to (i) improve the regulatory and policy framework of and governance in the sector;, (ii) initiate corporate restructuring to enhance the sector's commercial orientation and accountability; (iii) improve its financial viability through efficiency improvement, tariff adjustment and debt restructuring; and (iv) introduce a computerized information and revenue management system. The program loan was disbursed after compliance with specific actions (described in para. 56) that were required to achieve the policy objectives. The policy reform program was implemented as intended, except for the full implementation of the financial restructuring of the sector and the employee transfer to successor companies during 2002–2003.

2. Project Loan

51. The investment project originally had six components with a total investment cost of $318.9 million. The ADB loan of $200.0 million was to finance the foreign currency cost that included $160.9 million for base cost, $20.9 million for contingencies $2.0 million for front-end fee, and $16.2 million for interest and commitment charges during construction. During the initial phase of implementation, it was decided to drop component E (consulting services) as MPSEB had the requisite expertise to implement the project.

52. As of 30 June 2004, MPSEB had awarded contracts amounting to $104.6 million and with $13.4 million to be awarded to complete the original scope of work in components A, B, and C. The remaining $54 million of loan proceed was unutilized: (i) $41.5 million due to lower than expected contract prices, (ii) $1.8 million savings when component F was cancelled, and (iii) estimated savings in price and physical contingencies of $10.7 million. In July 2004, ADB agreed with MPSEB and the Government of India to utilize the uncommitted amount to expand the scope of component A (increase medium-voltage lines and 33/11 KV substations) and of component C (add 220 kV and 132 kV lines and 220/132 kV and 132/33/11 kV substations). The cost of the additional works amounted to $103.4 million ($54 million foreign currency cost and $49.4 million of local currency cost), and the total project cost increased to $338 million compared with the original estimate of $318 million. ADB funded the foreign currency cost of additional works and MPSEB financed the local currency cost.

53. In October 2005, ADB removed component D from ADB financing as MPSEB intended to finance the component from internal sources, with technical assistance from DFID consultants. The Government of India had also decided to make cash payments for interest

during construction (IDC) instead of capitalizing the IDC. As a result, the total disbursements for the project loan amounted to $179 million and $21 million was cancelled in two stages ($13.6 million in April 2005 and $7.4 million in April 2007 at loan closing).

G. Procurement and Scheduling

54. Because of the initial delay in finalizing the bid documents for components A and B, the award of the first contract in March 2003 was late against the scheduled award date of June 2002. The contract award in component A took 24 months as against the originally scheduled period of 12 months. As a result, component A was completed in May 2006 as against the scheduled completion date of May 2005. For component C, however, the first contract award was in October 2002, 6 months ahead of the original schedule. Component C was completed 6 months ahead of schedule in February 2005. The original work under the project was completed in May 2006 before the original closing date of June 2006. The additional work approved in July 2004 was expected to be completed before the original closing date of June 2006 but was completed in April 2007. As a result, the loan closing date had to be extended by 6 months to December 2006.

H. Loan Covenants

55. The 6 specific prior actions and 14 tranche release conditions in the program loan are listed in Appendix 4. Most of the tranche release conditions were fulfilled before the release of the tranches except for following conditions.

(i) The program loan tranche release conditions required MPG to settle in three installments the outstanding dues as of March 2001 of municipalities and other local bodies and maintain the account receivables from municipalities and other local bodies to less than 1 month equivalent of sales. When that fails, MPSEB is allowed to disconnect the defaulting municipalities. Although the outstanding dues were settled as required before each tranche was released, the account receivables were allowed to exceed the 1 month sales and the defaulting municipalities were not disconnected.

(ii) Another condition for the release of the second tranche was to have a financial restructuring plan agreed upon by MPG, MPSEB, and ADB. However, at the time the second tranche was to be disbursed only a draft financial restructuring plan prepared by CIDA consultants was available. MPG did not fully accept or implement the financial restructuring plan, and only certain aspects such as the partial restructuring of outstanding payments to central sector power utilities and domestic financial institutions were carried out during 2002–2006. The recurrent cash deficit in the sector is financed through working capital loans and grants extended by MPG.

(iii) The release of the third tranche also required the finalization of assets, liabilities, and human resources among MPSEB's successor companies. Although the assets were allocated to successor companies, the liabilities were not and are still held and serviced by MPSEB as MPSEB is responsible for cash management on behalf of the successor companies. Although the human resources are allocated to successor companies for functional activities, they are still considered as staff of MPSEB from the point of view of human resource management.

56. Compliance with loan covenants for the project and program loans is described in Appendix 5. Several loan covenants that were not fully complied with are listed below.

(i) The program loan covenants required MPG to maintain the prior actions taken before loan approval as stated in the Policy Letter and Policy Matrix submitted to ADB in November 2001. The government has maintained the prior actions except the restriction of free power supply only to residential and agricultural consumers belonging scheduled castes and/or tribes (SC/ST) whose consumption was below 25 kWh and 5 hp pumping capacity, respectively. Many poor agricultural consumers not belonging to SC/ST were disconnected as a result of this action in 2002. In 2003 MPG decided to reconnect them and provide electricity to those below the poverty line and those whose monthly consumption was less than 25 kWh or pumping capacity was below 5 hp. The outstanding dues were waived on condition that the consumers agree to a metered connection. MPG absorbed MPSEB's overdue liabilities to REC (Rural Electrification Corporation) amounting to Rs6.75 billion as compensation for write off of overdue payments from those consumers who had been reconnected at the request of MPG.

(ii) There was a loan covenant to ensure metering of all end users within 4 years of loan approval. Although the number of consumers with electricity meters increased, the great majority of agricultural consumers are still not metered.

(iii) MPSEB was also required to submit the audited financial statements for project accounts within 9 months of the end of the financial year. Due to the disputes regarding the allocation of assets and liabilities between MPSEB and CSEB after the bifurcation, the audited financial statements (AFS) for MPSEB and audited project accounts (APA) for FY2002 and FY2003 were delayed and not completed until December 2004. Therefore, ADB suspended the replenishment of imprest accounts while continuing with the approval of contract awards. By March 2005, AFS for FY2002 and APA for FY2003 were submitted but AFS for FY2003 and FY2004 and APA for FY2004 had not been submitted. At this point, ADB notified the central government that no further contract awards and disbursements would be approved. ADB resumed disbursements upon receipt of AFS for FY2003 and APA for FY2004 in May 2005,. The AFS for FY2004 and APA for FY2005 were submitted in May 2006 and September 2006, respectively.

(iv) As noted in para. 56, the loan covenants related to employee transfer to successor companies and maintaining account receivables from municipalities and other local government bodies at less than 1 month equivalent of electricity sales have not been fully complied with.

I. Power Sector Policy Framework

57. The SDP focused on introducing policy changes in the power sector to improve its overall performance. The policy interventions that were undertaken in implementing the SDP (2001–2005) are integral to the SDP. It is appropriate to describe and assess these policy interventions with respect to the expected outcomes of the SDP. These are explained in relation to assessing the efficacy of SDP in paras. 75–85. This section focuses on the policy interventions that were introduced after the completion of the SDP (2006–2009) to enable provisions of India's Electricity Act of 2003 to take effect in Madhya Pradesh.

58. **Open access.** Open access to the transmission system is allowed in Madhya Pradesh for consumers who have contracted demand of more than 1 MW from Oct 2007, which is much earlier than the January 2009 target envisaged in the National Tariff Policy. This allows the larger consumers connected to medium-voltage or HV network to enter into commercial contracts with generators and power suppliers other than the regional DISCOM. It also enables

the embedded generators in the Madhya Pradesh power system to sell their output to a buyer other than the regional DISCOM. MPSERC has already notified wheeling charges for transmission and distribution of power as well as a cross-subsidy surcharge for open access. The cross-subsidy surcharge is meant to compensate the relevant DISCOM for losing an industrial consumer (with above average tariff) due to open access. Presently, Special Economic Zone (SEZ) Indore and 28 non conventional generators and captive customers are availing themselves of long-term open access facility.

59. **Public-private partnership in distribution.** MPG has taken several initiatives to promote public-private partnership (PPP) in power distribution. The initial efforts involved limited engagement of the private sector through outsourcing and/or management contracts for meter reading and bill collection. Recently the government decided to initiate PPP by granting concessions to the private sector to manage a fairly large area (distribution circle) with at least 500,000 consumers. The concessionaire will be responsible for capital investments and operation and maintenance (O&M) and will be required to levy the regulated tariffs. The concessionaire will be selected using a competitive process based on the price at which the electricity is sold by DISCOM to the concessionaire. Recently, MPG approved the overall policy on franchising of distribution and concessionaires are currently being selected.

60. **Attracting private sector investments to power generation.** To address the persistent generation capacity shortage of around 1,500 MW (about 20% of the peak demand) and Madhya Pradesh's relative lack of success in attracting private sector investments to power generation, MPG recently launched a policy on IPPs consisting of both the negotiated MOU and competitive routes. In the MOU route, proposals are requested from credible and financially strong private sector parties to invest in power plants, with the condition that that the selected private developers would have to supply 10% of power output to state at variable cost of generation and 30% of the plant output at a price stipulated by MPSERC.. In addition to the MOU route, MPG also followed the competitive bidding guidelines of the Ministry of Power (case 1 and case 2). Under case 1 bidding guidelines, MPG floated tenders inviting bids for a certain capacity at a particular injection point irrespective of the location and technology of the plant. Under case 2, MPG developed the site for erection of a power plant and provided all the clearances for, e.g., land acquisition, water linkage, fuel linkage, environment clearance.

(i) MPG entered into MOUs with private investors to develop 43 power projects, 7 of which amount to 12,400 MW with capacity allocation of 4,450 MW for Madhya Pradesh. The projects are in advanced stages of implementation.
(ii) MPG has invited competitive bids for new generation capacity for 2,000 MW following case I bidding guidelines.
(iii) MPG is also facilitating a 4,000 MW power plant under the Government of India's Ultra Mega Power Program (UMPP) in Madhya Pradesh with capacity allocation of 1,485 MW for Madhya Pradesh, following case 2 bidding guidelines.

III. PERFORMANCE ASSESSMENT

A. Overall Assessment

61. The overall performance of the SDP (Table 3) is rated *partly successful* on the basis of the PPER guidelines'[6] four-category evaluation criteria of relevance, effectiveness, efficiency, and sustainability. The SDP is *highly relevant* as it was designed to address the key development challenges through legal and institutional reforms and by financing the urgent investment needs. However, it is *less effective* as it failed to achieve significant improvement in

[6] ADB. 2006. *Guidelines for Preparing Performance Evaluation Reports for Public Sector Operations*. Manila.

the overall performance of the sector although the investment component of the SDP is *efficient*. Although the economic benefits exceed the economic costs, there are structural inefficiencies in the sector such as a high degree of ACT losses and prevalence of tariff subsidies that lead to inefficient use of electricity. Inasmuch as these inefficiencies have not been satisfactorily addressed, the SDP is rated *less efficient*. Even if the institutional and regulatory reforms are likely to be sustainable, the overall sustainability of the SDP is rated *less likely* due to a significant financial gap and the continued dependence on fiscal transfers.

Table 3: Overall Performance Assessment

Item	Weight (%)	Rating	Score
Relevance	20	Highly relevant	3
Effectiveness	30	Less effective	1
Efficiency	30	Less efficient	1
Sustainability	20	Less likely	1
Overall Rating[a]		**Partly successful**	**1.4**

[a] Highly successful $\geq$ 2.7, Successful 2.7 > S $\geq$ 1.6, Partly successful 1.6 > PS $\geq$ 0.8, Unsuccessful < 0.8.
Source: Independent Evaluation Mission.

B. Relevance

1. Consistency and Adequacy of Program Coverage to Address Key Constraints and Challenges

62. ADB decided in 1996 to address the public finance management reforms at state level as states are responsible for delivering most of the public services in India. ADB also recognized that state governments do not have the capacity and financial resources to adequately address the challenges they face. In 1997, Madhya Pradesh was selected as one of the states to be supported in undertaking far-reaching public finance reforms. The criteria for selection, which were specified in the 1996 Country Operational Strategy,[7] included the willingness and commitment of MPG to undertake structural reforms, its sizable need for infrastructure, and its social needs. The main constraints to improved macroeconomic performance of Madhya Pradesh were identified as ((i) inefficiency of public sector undertakings (PSUs), (ii) structural weaknesses in public finance due to budget support for loss-incurring PSUs including MPEB, and (iii) inadequate development of physical infrastructure due to under-investments brought about by poor financial performance and fiscal constraints. ADB assisted MPG in addressing these macro level issues through the Madhya Pradesh Public Resource Management Program,[8] approved in 1999.

63. The Madhya Pradesh power sector suffered from (i) inadequate generation capacity resulting in load shedding, (ii) poor quality of electricity supply due to overloading of transmission and distribution infrastructure, (iii) ATC losses in excess of 45%, (iv) low staff morale and poor performance incentives, and (v) inadequate electricity tariffs and poorly targeted subsidies to agricultural consumers. The weak operational performance and excessive tariff subsidies resulted in inadequate cost recovery, financial losses, and buildup of liabilities to MPG, fuel suppliers, financial institutions, and central government power utilities.

[7] ADB. 1996. *Country Operational Strategy Study*. Manila.
[8] ADB. 1999. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to India for the Madhya Pradesh Public Resource Management.* Manila. (Loan 1717-IND).

64. Although MPG was expected to bear the cost of tariff subsidies to agricultural consumers, the subsidies were not paid in cash on time because of fiscal constraints MPG faced. As a result MPG resorted to periodic debt write-offs, debt equity conversions, and payment of outstanding subsidies in an ad hoc manner. The financial crisis in the sector resulted in inadequate generation capacity and overloading of the transmission and distribution network due to decades of underinvestment and continued reluctance of private investors to invest in new generation capacity. The division of Madhya Pradesh in 2001 adversely affected the already deteriorating status of the power sector as most of the generation assets and lucrative industrial consumers were allocated to the newly created state of Chattisgarh. Madhya Pradesh, on the other hand, was saddled with highly subsidized agricultural consumers and most of the liabilities.

65. The SDP was designed to address several aspects of the structural challenges faced by the power sector. The prevailing governance and the legal and regulatory framework were considered inappropriate for establishing a commercially viable power sector. Hence, the SDP supported the enactment of Madhya Pradesh Electricity Act of 2001, which clearly delineated the responsibilities for overall sector formulation, economic regulation, and utility function among MPG, MPSERC, and MPSEB and its successor entities, respectively. It was pointed out that the prevailing institutional mechanism for tariff setting was highly politicized and, because of political considerations, the tariff was set significantly below cost recovery. It was recognized that the cross-subsidies from industrial consumers to agricultural and residential consumers were no longer sustainable as industrial consumers were increasingly resorting to captive power generation. Therefore, the program loan had specific conditions to institute a transparent tariff-setting mechanism through the newly established MPSERC, with specific targets to increase the level of cost recovery. The vertically integrated utility structure lacked accountability and did not provide performance incentives to utility managers to improve operational performance. Thus, the program loan encouraged institutional reforms and unbundling of MPSEB along functional lines and optimal geographical reconfiguration of distribution operations.

66. Although the financial restructuring of MPSEB was identified as the critical issue to be addressed during implementation of the SDP, a comprehensive financial restructuring plan was not prepared at the time the SDP was approved. This was partly due to the uncertainty over the unresolved issues pertaining to the allocation of liabilities of the former MPEB between MPSEB and CSEB. However, some limited measures such as settlement of outstanding electricity dues from municipalities and local bodies, and settlement of cross-liabilities between MPG and MPSEB were included in the program loan and MPG gave the assurance that the liabilities would not be allowed to build up again. It was expected that a comprehensive debt restructuring plan acceptable to ADB, MPG, and the central government would be prepared during the implementation of SDP.

67. The inadequate generation and network infrastructure was one of the main constraints to industrial growth in the state. An improved institutional framework and improved financial performance of the sector were expected to encourage private sector investments in power generation. The investment loan supported by the project focused on addressing the constraints and the overloading of the distribution and transmission network. In retrospect, mobilizing private sector investments in power generation was delayed as the investors were concerned about the ability of MPSEB to honor the payments for power purchase and the fact that there had not been any significant additions to generation capacity in Madhya Pradesh through private investments. Weak revenue management, lack of energy auditing at feeder level, and lack of metering of agricultural consumers were also identified as contributory factors to the ATC

losses in the power sector. Specific components of the project loan were included to address these weaknesses through targeted investments and capacity building.

2. Consideration of Political Economy Issues, Government Support, and Stakeholder Support at Project Approval

68. At the time of project approval, there was increasing recognition at the central and state government levels of the need for major structural reforms in the power sector. The National Development Council (NDC) on the power sector recommended (i) organizational reforms including vertical and horizontal unbundling, (ii) private sector participation in generation and distribution, (iii) depoliticizing electricity tariff setting by establishing regulatory bodies, and (iv) progressive phasing out of agricultural subsidies. In response to the NDC recommendations, MPG appointed a high-level committee, which recommended (i) functional unbundling of MPSEB, (ii) establishing a regulatory body, (iii) improving the operational and financial efficiency of the distribution subsector, (iv) curtailing the free supply of power to certain consumer groups, and (v) payment by MPG of tariff subsidies to utilities in a transparent and timely manner. MPG also implemented several policy actions prior to the approval of the project, such as (i) establishing MPSERC in 1998, (ii) enacting Madhya Pradesh Electricity Act in 2001, and (iii) restricting free electricity supply only to scheduled caste and/or scheduled tribe consumers below the poverty line. Thus, the SDP program is fully consistent with the government strategy and policy for the power sector in Madhya Pradesh at the time of project approval.

69. Consumer groups and employees generally accepted that the prevailing institutional structure and regulatory regime were not sustainable and a fundamental restructuring of the sector was needed. The stakeholders recognized that the quality of power supply and staff morale had been low due to decades of poor performance. Stopping the free electricity supply resulted in the large-scale disconnection of agricultural consumers, prompting the government to write off past dues and restore the supply to disconnected consumers with subsidized tariffs. Nevertheless, there have not been major policy reversals or opposition from affected parties.

3. Choice of Modality and Instrument

70. The power sector in Madhya Pradesh suffered from structural issues pertaining to (i) an institutional and regulatory framework; (ii) inadequate tariff, high degree of electricity theft, and poorly targeted subsidies; (iii) poor financial performance of the sector; and (iv) generation capacity and network constraints. It was necessary to address those issues in a holistic manner to achieve the expected sector outcomes and impacts. It was recognized that project investments in the absence of regulatory and institutional reforms would not be sufficient as such investments would not be sustainable if the underlying problems were not addressed. Similarly policy interventions alone in the absence of urgent investments in generation capacity and network infrastructure would not provide immediate benefits to the stakeholders. In such a scenario, the political will to continue with the reforms may be affected. The immediate benefits to the stakeholders due to the project-financed investments in network infrastructure were limited due to inadequate investments in generation capacity. The choice of modality and instrument with a combined program and project loan was appropriate in the context of circumstances that prevailed in Madhya Pradesh at the time of loan approval.

4. Aid Agency Coordination

71. During the lead-up to the approval of the SDP in 2001, ADB closely coordinated with CIDA in providing technical assistance and capacity building for implementing the power sector reform program. The SDP was originally designed as a joint effort of ADB and CIDA. ADB was to provide financial resources to cover the adjustment cost of policy reforms and investments in network infrastructure. CIDA was to provide technical assistance in implementing the reform and strategic advice to the government on key policy issues such as tariff setting, financial restructuring, and institutional structure for the reformed sector entities. ADB provided TA for drafting the electricity law and mobilizing investments in power generation from the private sector. This was an appropriate and effective division of responsibilities between ADB and CIDA, as it had taken into account the institutional strengths and strategies of two development partners.

72. During the implementation of the SDP, the governments of India and Canada agreed to phase out CIDA assistance to India. Subsequently, ADB, together with MPG, engaged DFID to take over CIDA's role as the key development partner for financing the technical assistance requirements for implementing the reform and building capacity. ADB was instrumental in ensuring the smooth transfer of these roles from CIDA to DFID, taking into account the institutional preferences and strengths of DFID while meeting the overall requirements for reform implementation. ADB also provided additional TA grants (footnotes 4 and 5) in 2002 for employee transfer and stakeholder consideration due to the uncertainty over the availability of TA resources from DFID at the time. Overall, ADB performed well as the lead development partner in coordinating assistance from bilateral development partners in close collaboration with MPG.

5. Relevance Rating of the SDP

73. The SDP was based on a comprehensive assessment of key constraints and barriers to improved performance of the power sector. It is consistent with the ADB strategy for India, which focused on state-level reforms to improve public resource management for better service delivery and economic growth. The SDP took into account the overall strategy of the central government and MPG for fixing the structural problems of the power sector and built on the reform road map formulated by MPG. It also leveraged the capacity building and technical assistance provided by other bilateral aid agencies. The SDP is rated *highly relevant*.

C. Effectiveness

74. The expected outcomes of the SDP are (i) improved policy environment and governance of the sector, (ii) establishment of a commercial and competitive business environment to promote efficiency gains, (iii) improved financial viability of the power sector in Madhya Pradesh through financial restructuring, (iv) enhanced capacity in the transmission and distribution network to meet the growth in demand, and (v) introduction of modern utility management systems to reduce ATC losses. The effectiveness of the SDP is assessed in terms of the achievement or nonachievement of the above development outcomes.

1. Improved Legal Framework, Policy Environment, and Governance of the Sector

75. The state government formed the MPERC, a statutory independent regulatory authority for the electricity sector in Madhya Pradesh in 1998 under the Electricity Regulatory

Commission Act of 1998. In 2001, the state government enacted the Madhya Pradesh Vidyut Sudhar Adhiniyam (Madhya Pradesh Electricity Act of 2001). The state act provides for (i) establishing an independent regulatory body with wide-ranging powers to regulate the power sector, (ii) unbundling of MPSEB, and (iii) development of a competitive business environment. However, the legal framework established by the state act was superseded by India's Electricity Act of 2003, which provided for open access to transmission and distribution networks, power trading and power exchanges, and franchising of distribution.

76. As the sole shareholder of MPSEB and its successor companies, MPG is responsible for corporate governance of the sector as well as the formulation of sector policy. MPSEB was satisfactorily restructured and reorganized. Initially, it was unbundled into five successor companies, namely, MPGenco, MPTransco, Madhya Pradesh East DISCOM, Madhya Pradesh West DISCOM, and Madhya Pradesh Central DISCOM. Even after the unbundling, MPSEB continues to exist, with responsibility for (i) cash management in the power sector including servicing of liabilities and payments, and (ii) human resource management. In 2006, a power trading company was also established. The distribution system was reconfigured into three distribution companies on a geographical basis with consultancy support from CIDA. The transfer of assets was completed and provisional balance sheets for the three distribution companies were ready by 2005 with notional transfer of liabilities. All the successor entities are functioning independently subject to limitations due to incomplete delegation of cash management and human resource management. The majority of the directors of the successor entities are serving public servants with nominal representation of independent directors..

77. MPSERC has been constituted as an independent regulatory agency for the sector. Its three commissioners are retired public servants. MPSERC has instituted a transparent tariff-setting mechanism where the tariffs are set on the basis of the tariff applications submitted by each regulated entity and taking into account the reasonable cost of supply and future investment requirement. Tariffs have been gradually increased to achieve 100% cost of the supply. In 2007, MPSERC instituted a multiyear tariff-setting framework with the aim of gradually phasing out the cross-subsidies in the sector. MPSERC has also assumed progressively stringent performance norms for tariff setting to encourage operational efficiency improvements in the sector. MPSERC has recently revised the loss reduction norms set for distribution companies taking into account the constraints faced by the distribution companies. MPSERC also set technical performance standards and service quality standards and encouraged the distribution companies to increase consumer metering, especially for agricultural consumers.

2. Establishing a Commercial and Competitive Business Environment for the Power Sector

78. The successor companies of MPSEB were established in 2005, with the management of each company accountable for its operational performance. The companies are subject to regulatory oversight through the licenses and tariff setting. However, they are not fully autonomous, especially with regard to financial management and human resource management. These functions are still retained by the residual MPSEB, which allocates the power sector revenues as payment for fuel and power, and for debt service. Each company is allocated an operational and maintenance allowance to cover its administrative and maintenance expenses. MPSEB also manages the human resources, taking into account the overall seniority of the staff concerned. However, the company management has the flexibility to assign functional responsibilities without taking into account the overall seniority of the person.

79. MPERC has consistently focused on tariff rationalization, which includes aligning the tariffs with cost of supply, reducing cross-subsidies, and improving coverage of cost. The commission has finalized a cross-subsidy reduction plan, which was notified by the state government in October 2007. The commission has assumed increasingly stringent targets for loss reduction and collection efficiency in formulating the multiyear tariff rulings. That gave the utilities incentives to improve their performance. Since its inception, MPERC has issued four tariff orders for the composite MPSEB (up to 2006) and two each for MPGenco, MPTransco, and the distribution companies. A multiyear tariff framework for a 3-year control period is also in place and is the basis for the tariff orders issued for MPGenco and MPTransco for 2007. The adoption of a multiyear tariff framework provides better regulatory certainty and an improved investment environment to the utilities.

80. Since 2006, MPSERC have stipulated the tariffs based on normative performance standards and 100% cost recovery. The performance standards relate to ACT losses, collection efficiency, and consumer metering. This policy has given incentives to utilities to achieve normative performance standards if they are to achieve full cost recovery. The normative performance standards have been gradually tightened to provide incentives for further improvements. The difference between the tariffs stipulated by the regulator and the tariffs notified by MPG is directly paid by the MPG to utilities through fiscal allocation. The other regulatory interventions include the tariff incentives for metering previously unmetered consumers, seasonal tariffs, determination of open access charges to transmission and/or distribution system, telescopic tariffs to smoothen the transition from one tariff block to another, incentives for improvements in the power factor and load factor to industrial consumers. There are special tariffs for residential consumers below the poverty line and consuming less than 30 kWh, and agricultural consumers with a capacity of 5 hp.

81. The adoption of a multiyear tariff framework provides better regulatory certainty and an improved investment environment to the utilities. Based on the tariff regulations stipulated by MPSERC, the average domestic tariff increased from Rs2.36/kWh in 2003 to Rs3.50/kWh in 2010 and the agricultural tariff increased from Rs0.90/kWh in 2003 to Rs2.62/kWh in 2010. Cost recovery as a percent of the average cost of supply improved from 27% in 2004 to 69% in 2010 for agricultural consumers. The cross-subsidy from HV consumers (mainly industrial) to LV consumers (mainly residential and agricultural) has been significantly reduced from Rs1.73/kWh in 2004 to Rs0.7/kWh in 2010. However, the tariffs are still below the cost recovery levels.

82. The institutional reforms had limited impact in attracting private investments to power generation. This was partly due to the inability to set aside an adequate share of power sector revenues (escrow cover) for power purchase obligations from IPPs. Due to the difficulties encountered in mobilizing private sector investments, MPG supported MPGenco in adding new generation capacity (700 MW of thermal capacity and 130 MW of hydropower capacity) during 2002–2009. MPG also invested in several large multipurpose hydropower projects with a combined capacity of over 2,400 MW during this period. The allocation for Madhya Pradesh from central power generation utilities also increased by over 1,000 MW during 2002–2009. As a result of these investments, the installed and allocated generation capacity for Madhya Pradesh increased from 4,130 MW in 2002 to over 8,350 MW in 2009. As of 2010, Madhya Pradesh depends mostly on self-generation and power purchase from central public sector generators (NTPC) and to a limited extent on power purchase from neighboring states. However, this situation is likely to change by 2013, when privately financed power plants with over 4,000 MW and with capacity allocations for Madhya Pradesh are commissioned.

83. There has been no significant improvement in the technical performance of MPGenco as a result of the institutional reforms. MPGenco generating plants have not achieved the benchmark norms of operating efficiency and plant factors. Its efficiency indicators, plant utilization, station heat rate, specific fuel consumption, and auxiliary consumption of the thermal plants are much below the desired level. Some of MPGenco's plants need renovation and modernization, not only to extend their life, but also to improve the performance parameters. Availability of funds is, however, the main constraint as MPGenco does not have financial autonomy and depends on the cash allocations from residual MPSEB, which is responsible for cash management in the sector. In spite of the financial constraints faced by MPGenco, the rehabilitation and maintenance (R&M) of 120 MW Amarkantak thermal power station (TPS) was recently completed and the R&M of second unit is in under progress. MPGenco has also secured Rs. 4,500 million from Power Finance Corporation for R&M of two units amounting to 410 MW of Satpura TPS.

84. Due to the low plant factor of MPGenco thermal plants and the seasonal nature of hydropower, the available generation capacity is in the range of 5,600 MW–6,000 MW and Madhya Pradesh continues to suffer from peak generation capacity of around 1,000–1,500 MW and energy shortage in excess of 10% of annual unconstrained energy demand. Recently, MPG was able to enter into agreements with several private sector investors to add new generation capacity of over 12,000 MW with over 4,500 MW capacity allocations for Madhya Pradesh. The new provisions of the central government's Electricity Act of 2003 have encouraged investment in power generation as the act provides flexibility to sell power outside the state if MPSEB's cash flow constraints prevent it from honoring its commitments to purchase power. The generation capacity shortage is expected to be eliminated by 2013.

3. Improved Financial Viability of the Power Sector in Madhya Pradesh through Financial Restructuring

85. MPG adopted several measures to restructure the debt overhang of MPSEB before establishing successor companies with separate balance sheets in 2005. The measures included (i) the settlement of outstanding dues of municipalities and other local bodies to the power sector as of March 2001, (ii) set-off of cross-liabilities between MGP and MPSEB, (iii) issuance of MPG bonds to central sector power utilities to settle outstanding debts of MPSEB, and (iv) absorbing MPSEB's debts to REC as compensation for writing off outstanding dues from unmetered agricultural consumers and single-point residential consumers who were reconnected at the request of MPG.

86. At the time of the notification of the opening balance sheets of MPSEB's successor entities in 2005, MPG had (i) converted Rs32.3 billion of MPG loans to MPSEB to equity in the newly created entities; (ii) taken over Rs27.5 billion worth of outstanding liabilities of MPSEB to central sector power entities and the corresponding amount was treated as MPG equity injection in MPSEB (MPG bonds were issued to the central sector utilities for this amount); (iii) taken over Rs14.1 billion worth of outstanding dues of MPSEB to REC, in lieu of writing off unpaid electricity bills of agricultural consumers (MPG bonds were issued to REC for this amount); (iv) settled overdue interests of MPSEB's market borrowings amounting to Rs7.5 billion; and (v) paid the unpaid electricity bills of municipalities amounting to Rs7.4 billion. In addition, MPG provided annual fiscal support comprising (i) Rs28.8 billion of tariff subsidies, and (ii) Rs8.9 billion of equity injections, Rs1.5 billion of capital grants, and loans of Rs28.9 billion to finance capital investments during 2002–2005. The total fiscal support for the power sector during 2002–2005 amounted to Rs175.5 billion or 4.57% of Madhya Pradesh's gross domestic product (GDP) during that period.

87. Since the institutional reforms undertaken in 2005, MPG has continued to support the power sector as the sector has not yet reached financial sustainability. The support comprised (i) taking over the commercial liabilities of the sector, amounting to Rs13.7 billion and converting the corresponding amount to MPG equity; (ii) converting to equity Rs14.8 billion of penal interest on liabilities to government dues and loans; (iii) injecting working capital loans amounting to Rs25 billion; and (iv) tariff subsidies of Rs22.8 billion. In addition, MPG has provided additional equity investments of Rs41.6 billion and loans of Rs41.2 billion to finance new capital investment in the sector. The total fiscal assistance that MPG provided during 2006–2009 amounted to Rs145.4 billion or 2.5% of the state GDP during this period. Although the overall fiscal burden remains roughly the same as before the reforms, as a percentage of the state GDP it has decreased after the reforms. It is also noted that, before the reforms, only 22.5% of fiscal transfers was spent on capital expenditure; this has increased to over 57% after the reforms.

88. MPSEB and its successor companies continue to suffer from cash flow shortfalls as a result of the high ATC losses, which remained above the norms stipulated by MPSERC for the purpose of tariff setting. The cash deficit of the power sector in 2009 exceeded Rs25 billion excluding the tariff subsidies. Although MPG has financed the cash deficit and investment needs in the past, the performance of the sector has to be significantly improved to achieve financial sustainability. It can be concluded that the SDP has not fully achieved the expected outcome of financial sustainability of the sector.

4. Enhanced Capacity in the Transmission and Distribution Network

89. The investments undertaken have significantly improved the technical performance of the transmission system. The voltage profile of the network significantly improved, with all 400 kV and 220 kV substations maintaining a voltage deviation of not more than 7.5% and the voltage deviations exceeding the stipulated 10% at 132 kV substations was limited to less than couple of substations. Transmission system availability has been above the target set by the regulator and has exceeded 98% since 2005–2006. This indicates that Madhya Pradesh Transco has been maintaining its lines and substations properly and managing outages promptly. The availability of the five major critical lines in Madhya Pradesh has been over 99%. Loss reduction is an important technical consideration for a transmission company. Transmission losses have come down significantly since the inception of the company. The transmission loss of 7.93% in July 2002 came down to 4.09% in FY2009 as against the regulatory target of 4.9%. Due to the higher level of energy transmitted by the company in FY2009 than in FY2002, the transmission losses would have exceeded 11% in the absence of transmission investments and capacity augmentation.

90. The number of consumers and electricity consumption by the residential, agricultural, and other commercial consumers connected to the LV network of three distribution companies significantly increased during 2002–2009. The number of residential consumers rose from 4.48 million in 2002 to 5.77 million in 2009, and the number of agricultural consumers rose from 1.15 million in 2002 to 1.21 million in 2009. Electricity sales to residential and agricultural consumers increased by 85% and 117%, respectively, from 2002 to 2009.

91. New 33/11 kV substations and high-tension lines have been constructed to reduce technical loss and improve the quality of supply, including voltage levels. To reduce commercial losses, an energy audit has started to identify the areas with high levels of ATC losses. This has enabled the DISCOMs to prioritize loss reduction efforts in theft-prone areas. Feeder metering

has been provided in most of the 11 kV feeders and regular energy audits have begun. To improve metering at consumer ends, more than 3,400,000 electronic meters were installed. Metering of LV consumers has significantly increased, and in 2009, 92% of residential and 22% of agricultural consumers had been provided with meters compared with 87% and 11%, respectively, in 2002.

92. The HVDS pilot-tested by the project is being widely deployed under the ongoing ADB MFF project in theft-prone urban areas, With these efforts and special drives to regularize the unauthorized connections, ATC loss levels of 43.6% when power sector reforms began in 2002 went down to 34% by 2009. DISCOM Central and DISCOM West have managed to reduce ATC losses—from 52.9% to 37.1% for DISCOM Central, and from 41.2% to 29.3% for DISCOM West. However, ATC losses in DISCOM East have not been reduced; they remained at 37% mainly because the rural agricultural consumers in DISCOM East's franchise area are widely dispersed and, to a certain degree, DISCOM East's management lack focus (the position of CMD (Chief Managing Director) of DISCOM East was vacant for more than 2 years before it was filled recently). There has been an improvement in the loss reduction efforts in recent times and ATC losses of 3.72% had been reduced in FY 2009 – 10.

93. It was also noted that SDP had allocated relatively small amount to the distribution sector and most of the improvements to distribution sector were implemented after the completion of SDP program. These included $ 360 million for distribution sector from ADB through the Multitranche Financing Facility (MFF) that followed the SPD. Under the MFF program, low voltage lines (LT) in theft prone areas were converted high voltage (HT) or aerial bundled conductors to reduce the technical and commercial losses. Apart from this all the cities /towns with a population exceeding 30,000 are covered under GOI supported R APDRP program which has the objective bringing down ATC (Aggregate Technical and Commercial) losses to 15%. The state government has also launched an ambitious program of feeder segregation under which 11 kV feeders for rural households and agriculture pumps would be separated with the objective of providing 24 hours of power supply to rural households and 8 hours of power supply to agriculture pumps. This program is under implementation in two phases with the phase I supported by Rural Electrification Company (REC) with a loan of Rs. 18.3 billion and the state government has applied a loan from ADB for the second phase.

94. The State Assembly has adopted a resolution to achieve an ATC loss reduction of 3% per year and Rs. 100 billion of investments in distribution sector has been lined up. The state government is also in the process of selecting distribution franchisees on long term basis for distribution circles having high levels of ATC losses. It is expected that with these efforts, the ATC losses in distribution sector would be significantly reduced by 2013 – 14.

5. Effectiveness Rating of the SDP

95. The regulatory and legal reforms have been effective in establishing a transparent regulatory environment for the power sector. However, the institutional reforms have not been effective in establishing accountability of the utility management. As a result, the regulatory interventions have not produced the expected performance improvements. The institutional and regulatory reforms have also not been effective in restoring the financial viability of the sector. The investments financed by the project have been effective in improving the performance of the transmission network, but the improvements in distribution are less than expected. Although the performance of distribution sector is expected to be improved as a result of on going efforts

by around 2013–2014, these improvements have not yet materialized. Hence, the SDP is rated *less effective* (Table 4).

Table 4: Effectiveness Rating of the SDP

Item	Rating
Improved legal framework, policy environment, and governance of the sector	Effective
Establishment of a commercial and competitive business environment for the sector	Less effective
Improved financial viability of power sector in Madhya Pradesh through financial restructuring	Ineffective
Enhanced capacity in the transmission and distribution network	Effective
Madhya Pradesh Power Sector Development Program	**Less effective**

Source: Independent Evaluation Mission.

D. Efficiency

1. Efficiency of Investments Financed by the Project Loan

96. The economic efficiency of the investments in network infrastructure financed by the project loan (components A, B, and C) is assessed using the economic internal rate of return (EIRR) of the investment components. Although there are economic benefits arising from the improved quality of supply and increased electricity sales attributable to improved network capacity, only the economic benefits attributable to reduction in technical losses are considered for ex post economic analysis as a conservative way of estimating the economic benefits. The increased network capacity will not result in economic benefits in the absence of a corresponding increase in generation capacity (the project did not finance any addition to the generation capacity), and economic benefits associated with improved quality of supply are difficult to quantify.

97. As Madhya Pradesh had been suffering from electricity shortages, any electricity saved due to reduction in technical losses will result in reduction in unserved electricity. It is likely that part of the reduction in unserved energy would have resulted in non-incremental energy consumption to replace captive power generation by industries and use of diesel generators by commercial consumers. The remainder would be incremental energy consumption by industrial and commercial consumers as well as by residential consumers due to increased availability of electricity and increased household connections due to the expanded distribution network.

98. ADB's guidelines for economic analysis suggest that incremental benefits be valued at the consumer's willingness to pay and the non-incremental benefits by the replacement cost. The consumer's willingness to pay is likely to be much higher than the prevailing tariff as proven by several studies undertaken in India and elsewhere. The cost of generating electricity using captive power plants and small diesel generators is also in the range of Rs10–12 per kWh and higher than the prevailing electricity tariffs. As a conservative measure, the economic benefits due to reduced transmission and distribution losses are valued at the average electricity tariff of 2007. As a further conservative measure, it is assumed that there will be no increase in electricity tariff in real terms after 2007 and the tariff will remain constant in real terms.

99. Appendix 6 shows the ex post economic analysis of components A, B, and C of the project loan. The results of the economic analysis are summarized in Table 5
.

Table 5: Recalculated Economic Internal Rates of Return

	EIRR (%)
Component A : 33 kV and 11 kV network rehabilitation	46.6
Component B : Conversion of selected LV feeders to 11 kV	8.5
Component C: Reinforcing and augmenting 220 kV and 132 kV transmission system	48.0

EIRR = economic internal rate of return, kV = kilovolt, LV = low voltage.
Source: Independent Evaluation Mission.

100. The recalculated EIRR implies a high degree of economic efficiency in the project investments, especially in components A and C due to the high ATC losses (in excess of 40%) before the project and further increase in technical losses in the absence of network investment. The EIRR also implies that a relatively modest investment can significantly reduce energy losses. However, the economic analysis does not take into account the structural inefficiencies in the sector, including the persistent levels of high ATC losses (around 34%) although lower than that at the initial condition. The persistent financial deficit in the sector may also cause underinvestment and poor maintenance in the future and may affect future economic benefits and the EIRR. On the basis of the foregoing, the investment component of the SDP is rated *efficient*.

2. Efficiency of the Policy-Based Program Loan

101. The program loan component of the SDP was expected to improve the overall efficiency of the Madhya Pradesh power sector and its overall public resource management by (i) reducing the fiscal burden of the power sector on the state budget, (ii) improving cost recovery in the sector, (iii) gaining efficiency through improvement of the technical performance of the power sector entities, and (iv) encouraging more efficient use of electricity by end users because of the application of cost-reflective tariffs and reduction in cross-subsidies as well as other measures such as curtailment of free electricity and metering of consumer connections.

102. Although cross-subsidies from HV consumers to LV consumers have been reduced, the tariff regime is still significantly distorted due to subsidies to agricultural consumers for whom metering increased from only 11% in 2002 to only 22% by 2009. Lack of improvement in the operational efficiencies of the power sector entities is due to the persistently high level of ATC losses in the distribution sector as well as the low plant factors and thermal efficiencies of MPGenco thermal power plants, which lack investment to rehabilitate older power plants. The continued shortages in generation capacity and the resultant load shedding have contributed to the use of relatively inefficient captive power generation by industrial consumers.

103. MPG efficiently managed and implemented the reform program, with technical assistance and capacity building provided by CIDA, DFID, and ADB through policy dialogue and targeted TA. The tranche release conditions had been largely met within the envisaged time frame. The counterpart funds generated by the program loan were used to settle outstanding liabilities of municipalities to the power sector.

104. Since the completion of the SDP, the State Government has taken several measures to improve the efficiency of power distribution system as outlined in para. 94–95 consisting of rolling out of HVDS systems and feeder segregation and introduction of Enterprise Resource Planning (ERP) at utility level with the support of ongoing ADB MFF Tranche VI. Hence it is likely that the efficiency of the distribution network would improve once the expected outcomes of on-going initiatives are realized. However, as these efficiency gains have not yet been achieved, the efficiency of the policy reform component of SDP has been rated as *less efficient*.

3. Efficiency Rating of the SDP

105. Given the relatively high economic benefits (compared with the economic cost of investment and technical losses realized), the project loan is rated *efficient*. Although there are marginal improvements to the overall efficiency of the power sector, the efficiency gains are less than those needed to make the power sector in Madhya Pradesh self-sustainable. The policy-based program loan is rated *less efficient*. Given the importance of overall improvement in sector efficiency to the success of the SDP, the overall efficiency of the SDP is rated *less efficient*.

E. Sustainability

106. The outcomes achieved were assessed with respect to the presence or absence of contributory factors for ensuring sustainability of each outcome.

1. Sustainability of Improvement in the Legal and Policy Environment and Sector Governance

107. **Legal framework.** The program loan supported the enactment of the Electricity Reform Act of 2001. India's Electricity Act of 2003 superseded the provisions of Madhya Pradesh Electricity Reform Act. The Electricity Act of 2003 further strengthened the regulatory and legal framework and opened up possibilities for further deregulation of the power sector. There were provisions for open access to transmission and distribution networks in a nondiscriminatory manner, private sector participation in power distribution through franchising, and establishment of a power market in India, which, in turn, provided for merchant power plants and opportunities for diversifying the sources of generation capacity for capacity-constrained states such as Madhya Pradesh. The conclusion is that subsequent actions by the central government further advanced the legal and regulatory framework established in the program loan.

108. **Regulatory regime.** MPSERC continues to discharge its responsibility as the economic regulator for the electricity sector in Madhya Pradesh. Its role in incentive-based tariff setting with the objective of improving technical performance such as voltage and frequency stability and commercial efficiency of electricity distribution including the reduction of ATC losses has increased with the introduction of multiyear tariff setting in 2007. The technical assistance provided by DFID has enhanced the institutional and human resource capacity of MPSERC and the capacity of regulated entities to comply with the regulatory requirements including the periodic tariff fillings. The regulatory regime in Madhya Pradesh is *likely* to be sustainable.

109. **Political will and stakeholder support**. The major stakeholders including consumer groups, trade unions, and politicians have generally accepted the merit of institutional and tariff reforms. At the time of the reforms, the consensus was that the Madhya Pradesh power sector was in serious difficulty, the quality of supply was poor with persistent load shedding, the sector was a major drain on the state budget, and ATC losses were excessive. MPG had disconnected

unmetered agriculture consumers with overdue electricity bills in 2002–2003. But on the eve of state elections, it reversed the action by providing electricity to agriculture at a subsidized rate. The other reform measures continued or were further strengthened since the completion of the SDP. MPG continues to honor its commitment to provide upfront subsidies to compensate power utilities for the lower electricity tariffs levied to residential consumers below the poverty line and agricultural consumers. MPG intends to launch the next round of reforms to attract private sector participation in managing the distribution networks in selected areas through franchising arrangements. The SDP's outcomes are *likely* to be sustainable in view of stakeholder acceptance and political will on the part of the government.

2. Sustainability of Institutional Reforms for Enhanced Commercial Performance

110. **Institutional reforms.** Although the unbundling process has not advanced beyond the initial establishment of successor companies with limited autonomy, there have not been any major policy reversals to the institutional reforms undertaken in 2005. However, the rest of the institutional reforms brought about in 2005 with the support of the program loan remain an unfinished agenda. The human resource management function and financial management are still controlled by residual MPSEB; to a certain extent this has constrained the managerial flexibility of MPSEB's successor companies. Although limited by lack of financial autonomy and autonomy over senior management appointments, the successor entities enjoy an adequate degree of managerial autonomy with regard to operational aspects and such autonomy has gradually increased.

111. **Human resources.** There has been no major change in the skills mix available in the power sector at the senior level since the reforms were implemented in 2005. This is a concern for these reasons: (i) there was no recruitment in the sector during 1990–2005, (ii) most of the senior management staff are expected to retire in the next 5 years, and (iii) the recent recruits are too inexpereienced to assume management responsibilities. Another issue is lack of financial and business management expertise within the power sector as it continues to be dominated by engineering professionals, except for the managing directors of DISCOMs who are seconded from Indian Administration Service (IAS) for a fixed term. The conclusion is that the sustainability of institutional reforms is *less likely* without significant changes to the human resource practices and delegation of human resource management to successor companies.

3. Financial Sustainability

112. The Madhya Pradesh power sector has depended heavily on fiscal support as it is yet to achieve financial sustainability. Although the revenues had increased from Rs33.4 billion in 2002 to Rs68.1 billion in 2009, they did not keep pace with the increase in power purchase and fuel costs. As a result, accounting loss rose from Rs9.6 billion in 2002 to Rs26.6 billion in 2009, and the cash flow deficit from Rs7.9 billion in 2002 to Rs20.7 billion in 2009.

Table 6: Consolidated Financial Performance of Madhya Pradesh Power Sector
(Rs billion)

Item	2002	2003	2004	2005	2006	2007	2008	2009
Revenues billed	37.07	42.00	46.92	50.32	58.90	62.57	65.91	69.41
Revenues collected	33.36	38.09	39.09	45.77	57.12	60.39	63.62	68.12
Government tariff subsidies	5.43	6.68	8.90	7.78	3.52	4.19	5.69	9.44
Cost of power purchase	25.58	25.18	27.21	30.13	30.02	32.49	43.42	49.27
Fuel cost	11.08	12.40	12.51	14.43	14.74	16.45	16.30	20.35
Depreciation	5.34	4.85	4.76	5.33	5.99	7.22	6.55	7.23
O & M expenses	10.52	10.04	12.15	14.12	16.00	17.30	20.91	23.93
Interest cost	11.32	4.88	6.61	4.73	6.10	4.84	5.65	5.56
Write-offs/prior period Expenses and taxes	-2.90	0.98	-1.50	0.24	0.24	2.98	4.42	3.99
Profit/ Loss	**-9.56**	**-7.40**	**-1.76**	**-7.51**	**-8.04**	**-10.13**	**-20.96**	**-26.63**
Cash flows from operations excluding government subsidies	**-7.93**	**-6.46**	**-4.83**	**-6.73**	**-3.83**	**-5.09**	**-16.70**	**-20.69**

O&M = operation and maintenance.
Source: Independent Evaluation Mission.

113. The main reason for the increase in the cost of supply was the cost of power from central agencies and other utilities. While the fuel cost for self-generation of MPGenco increased from Rs0.79/kWh in 2002 to Rs1.14/kWh in 2009, the cost of power purchased from third parties including MPG's joint-venture hydro plants increased from Rs1.87/kWh in 2002 to Rs2.79/kWh in 2009. In addition to the high purchase cost of power, expenses for operation and maintenance also increased from Rs0.76/kWh in 2002 to Rs1.16/kWh in 2009.

Table 7: Cost Recovery in the Madhya Pradesh Power Sector

Item	2002	2003	2004	2005	2006	2007	2008	2009
Cost of supply (Rs/kWh)	3.38	3.26	3.24	3.41	3.90	4.11	4.39	4.98
Avg. tariff award (Rs/kWh)	2.90	3.12	3.74	3.39	3.61	3.62	3.73	3.80
Avg. subsidy (Rs/kWh)	0.39	0.44	0.56	0.45	0.20	0.22	0.28	0.46
Avg. revenue billed (Rs/kWh)	2.67	2.77	2.93	2.94	3.27	3.24	3.21	3.37
Avg. revenue collected (Rs/kWh)	2.41	2.52	2.44	2.68	3.17	3.13	3.10	3.31
Avg. tariff as % of cost of supply	85.7	95.6	115.3	99.4	92.6	88.1	85.0	76.3
Avg. tariff billed + subsidy (as % of tariff award)	105.7	103.2	93.4	100.2	95.9	95.5	93.6	100.8
Revenue collected (as % of revenue billed)	90.0	90.7	83.3	91.0	97.0	96.5	96.5	98.1
Avg. revenue collected (as % of cost of supply)	71.2	77.2	75.4	78.5	81.3	76.1	70.6	66.4
Avg. revenue + subsidy(as % of cost of supply)	82.8	90.8	92.6	91.8	86.4	81.5	77.0	75.7

avg. = average, kWh = kilowatt-hour, Rs = Indian rupees.
Source: ADB staff estimates

114. The revenue realized has not increased at the same rate despite the increase in average tariff from Rs2.90/kWh in 2002 to Rs3.80/kWh in 2009 stipulated by MPSERC (Table 7).

(i) Although the average tariff awarded by MPSERC is expected to ensure 100% cost recovery, the actual tariff award is less than the cost of supply. In setting tariff, MPSERC has assumed progressively stringent performance standards with respect to operational efficiency (ATC losses, plant factor, and heat rates) as the means of providing performance incentives to power sector entities. However, the actual performance efficiency of the power sector has fallen short of the

standards assumed by MPSERC. Thus, the tariff levels awarded by MPSERC are less than the actual cost of supply. The gap between the cost of supply and average tariff awarded by MPSERC has been widening since 2006.

(ii) MPG has notified tariffs for certain categories of consumers such as single-point residential consumers below the poverty line (subsidized), those belonging to scheduled castes and/or scheduled tribes (free), and agricultural consumers (subsidized). MPG usually pays the difference between the regulated tariff and the notified tariff as an up-front tariff subsidy through the annual budget allocation.

(iii) The revenue that the power sector collects has been less than the revenue billed. However, collection efficiency improved from 90% in 2002 to over 98% in 2009.

115. MPG pays to the power sector as a direct subsidy the difference between regulated tariff and notified tariff, but this is not a major cause for concern. The Madhya Pradesh DISCOMs improved their collection efficiency to collect over 98% of billed revenue in 2009. It is clear that the main reason for the power sector's inability to achieve 100% cost recovery is its failure to abide by the performance norms assumed by MPSERC in tariff setting. The difference between regulated tariff and cost of supply after taking into account the subsidy had continuously increased and reached over 24% in 2009. Table 8 shows the targets set by the regulator for distribution loss reduction and the actual achievement.

Table 8: Achievement (%) of Targets to Reduce Distribution Loss

Distribution	2006		2007		2008		2009	
Company	Target	Achieved	Target	Achieved	Target	Achieved	Target	Achieved
West		31.91	30.00	30.73	28.50	33.99	27.00	33.76
Central		43.39	43.00	42.67	40.00	41.43	37.00	38.93
East		36.30	34.50	35.39	32.50	37.72	29.50	37.23

Source: Independent Evaluation Mission.

116. MPSERC had been setting increasingly stringent targets for reducing distribution losses in tariff setting. But DISCOM West and DISCOM East showed increasing levels of distribution losses from 2007 to 2009. As a result, the cost of supply increased (as distribution losses are included in the cost base) and the revenue deficit for the sector widened. Neither MPSERC nor MPG had taken the DISCOMs to task for noncompliance with regulatory norms used in tariff setting. MPG continued to provide working capital loans to bridge the resulting cash gap; however, the power sector has not repaid the loans.

117. The MP state government expects that the power sector financial viability would improve considerably in the coming years as a result of improvements to distribution network and management practices outlined in para 94, 95 and 105. It was noted that during FY 2010 / 11, the total revenue realization up to Nov. 2010 has increased by 25% to Rs. 60.4 billion from Rs. 48.5 billion in the previous year for the corresponding period. It is also expected that the generation capacity deficit would also be eliminated by 2013–2014 when the generation projects under development are commissioned.

118. The general consensus among the policymakers is that distribution losses (electricity theft and pilferage) which is mainly a governance and management problem,, should be addressed through a technical solution (conversion of LV feeders to 11 kV, feeder segregation, increasing the metered connections). MPG is in the process of preparing a large investment program in the power distribution sector, which is leveraging India's Revised Accelerated Power Distribution Rehabilitation Project (RAPDRP) to bring down distribution losses to below 20% by

2014. The financial sustainability of Madhya Pradesh's power sector critically depends on the success of this initiative, but it is too early to make a definitive assessment of its likely success. On the basis of current performance, the financial sustainability of the power sector and the reform program supported by the SDP is rated *less likely*.

4. Physical Sustainability of Project-Financed Assets

119. The investment project that ADB financed as part of the SDP was to support the urgent needs of the transmission and distribution network of Madhya Pradesh. The network had become heavily overloaded and dilapidated by 2000 due to underinvestment in the preceding decade caused by the financial crisis in the power sector. Although the operation and maintenance of project-financed assets do not require significant financial resources (assumed to be about 1% per annum of capital cost), in the absence of continued investments to expand network capacity, the project-financed assets could become overloaded and their useful lifetime shortened.

120. The financial internal rate of return (FIRR) is compared with the weighted average cost of capital (WACC) to ascertain the financial viability of the project. The project was financed by an ADB loan and domestic debt. The ADB loan to MPSEB was in the form of a local currency loan to the Government of India at an interest rate of 10.6%, and the domestic debt was raised at an interest rate of 11%.

Table 9: Financial Internal Rate of Return (%)

Item	Appraisal	PCR	PPER
Component A: 33 kV and 11 kV network rehabilitation	15.5	14.5	32.8
Component B: Conversion of selected LV feeders to 11 kV	10.3	10.0	20.3
Component C: Reinforcing and augmenting 220 kV and 132 kV transmission system	23.8	11.1	36.6

kV = kilovolt, PCR = project completion report, PPER = project performance evaluation report.
Sources: Independent Evaluation Mission, project completion report, report and recommendation of the President.

121. The MFF facility that ADB provided in 2007 (footnote 1) further financed the augmentation of the transmission and distribution network's capacity to cater to the rising demand for electricity in Madhya Pradesh. The MFF facility also had several components to scale up the HVDS technology, which was pilot-tested in the SDP. To upgrade the distribution network in urban areas, the Government of India also launched the RAPDRP, which now covers over 80 urban centers in Madhya Pradesh. As a result of these investments, the loading of the network was maintained within the prescribed limits and the overall sustainability of the network assets was ensured. The challenge is to maintain regular investments in network capacity as the electricity demand in Madhya Pradesh grows in the context of severe financial shortfall in the power sector.

5. Sustainability Rating of the SDP

122. The legal reforms, regulatory regime, and institutional reforms are likely to be sustainable as they enjoy broad support from the stakeholders, and MPG and the central government have the political will to address the structural problems of the power sector.

Although the state government expects the financial viability to considerably improve in next 3-4 years, the sector, however, has not yet reached financial sustainability and continues to depend on extensive fiscal subsidies. The physical sustainability of the project-financed investments critically depends on the availability of financial resources for operation and maintenance and reinforcement. The resources cannot be guaranteed as the power sector is not yet in a position to recover the full cost of supply. Hence, the SDP is *less likely* to be sustainable based on the prevailing financial situation of power sector in the State. However, if the financial performance is to improve, then the sustainability rating could be improved.

IV. OTHER ASSESSMENTS

A. Impacts

123. The development outcomes included improved institutional structure and regulatory regime for the power sector as the SDP had specific components that targeted those outcomes. They are considered outcomes rather than impacts and are discussed under the effectiveness of the SDP. The broader impacts such as improved investment climate for private sector investment in the power sector, promoting overall economic growth, and the socioeconomic impacts of power sector reforms are addressed here. The impacts of the SDP were rated *moderate,* and the reasons are discussed in the following paragraphs.

1. Investment Climate for Private Sector Investments in the Power Sector

124. The institutional and regulatory reforms undertaken in the SDP were limited and aimed at addressing the immediate concerns of Madhya Pradesh's power such as introducing transparent regulation of the power sector and creating managerial accountability by functional unbundling of the sector. The legal and regulatory framework in the power sector of India underwent a major change in 2003 with the enactment of India's Electricity Act of 2003. The new provisions of the Electricity Act superseded the limited objectives of the SDP. The primary objective of the Electricity Act was to open up the power sector to private sector investments and establish competitive electricity markets.

125. Most of the recent initiatives to attract private sector investments to Madhya Pradesh's power sector can be attributed to the provisions of the Electricity Act. They included soliciting private sector investments for power generation with over 60% of generation capacity to be sold competitively in the Indian power market outside Madhya Pradesh, franchising distribution, and private sector investments in transmission. The initial reforms undertaken in the SDP enabled Madhya Pradesh power sector agencies to exploit the new provisions of the Electricity Act. The conclusion is that the SDP contributed to a certain extent to the subsequent improvements in the climate for private sector investments in the power sector.

2. Overall Economic Growth

126. The per capita income of Madhya Pradesh remains below the Indian national average. The state's average economic growth has not matched the high economic growth achieved by India as a whole. Lack of industrialization and poor infrastructure including power are some of the key reasons for the relative underperformance of Madhya Pradesh. Although, the installed generation capacity allocated to Madhya Pradesh had been increased from 4,100 MW in 2002 to over 8,000 MW in 2009, the available generation capacity had been in the range of 5,600–6,000 MW and Madhya Pradesh continues to suffer from load shedding. The increased transmission capacity and improved distribution network achieved in the SDP could not be

effectively utilized to provide electricity to industrial consumers. The agricultural consumers who use electricity for water pumping also suffer from curtailed electricity supply during the cropping season, which affects the farm outputs.

127. MPG has managed to secure new investments for power generation from the private sector as well as from central sector utilities. The investments are expected to eliminate the generation capacity shortages by 2014 and could result in increased industrial investment in Madhya Pradesh. MPG is also investing in segregating the agricultural feeders to ensure adequate electricity supply to agricultural consumers during the cropping season.

3. Socioeconomic Impacts

128. The primary aim of the SDP was to improve the institutional arrangements and commercial performance of power sector entities. Two of the main reasons for the poor performance of the power sector were the high level of commercial losses in power distribution and poorly targeted tariff subsidies. Improving the quality of the power supply was expected to benefit the poorer farmers who tend to use smaller water pumps (below 5 hp), which were more likely to be damaged by electricity of poor quality

129. The SDP had also required the restriction of free electricity supply only to scheduled cast / schedule tribe consumers below poverty line and having a demand below 25 kWh in the case of residential consumers and below 5 hp for agricultural consumers). Thus, large numbers of poor farmers were disconnected during the drought of 2002 (para. 57(i)), but MPG had to restore electricity supply to those consumers in 2003 before the state elections. Since then, the non SC/ST residential consumers below poverty line with single-point connections and agricultural consumers using pumps with less than 10 hp receive a tariff subsidy, while the SC/ST consumers with single-point connections continue to get free electricity. Despite load shedding (more than 12–14 hours in rural areas per day), the quality of the supply (voltage and frequency stability) has significantly improved since 2002, resulting in less damage to water pumps used by farmers.

130. The number of residential consumers slightly increased (4.5 million in 2002 to 5.8 million in 2009), and the overall electrification rate of Madhya Pradesh remains below 50%. This is expected to be addressed through the Rajeev Gandhi Grameen Vidutkarana Yojana (RGGVY) scheme financed by the central government. The reduction in cross-subsidy from industrial consumers to residential and agricultural consumers would have an adverse impact on the welfare of the latter categories. As a result of the improvement to transmission and distribution network undertaken since 2002, there has been a significant improvement in quality of supply to rural areas. Hence the welfare adverse impacts due to increased tariffs would have been mitigated to a certain extent due to welfare gains attributable to improved quality of supply.

B. Performance of the Asian Development Bank

1. Quality of Program Design at Entry

131. During program design, ADB engaged MPG in policy dialogue, especially with respect to the provisions of the Electricity Reform Act of 2001, functional unbundling of MPSEB, and tariff reforms to ensure improved cost recovery in the sector. The policy measures included in the reform matrix and the actions MPG took before loan approval were the essential steps to initiate the reform program. The policy conditions were set, taking into account MPG's capacity to implement the reform and the time frame for implementing the program loan. The overall design

of the reform program was based on sound economic and sector work. The report and recommendation of the President (RRP) gives a thorough analysis of key problems and challenges of the power sector. The SDP is closely aligned with ADB's Madhya Pradesh Public Resource Management Program (footnote 8) and ADB's overall country and state-level assistance strategy to Madhya Pradesh.

132. The weak financial status of the power sector and the inadequate cost recovery due to poorly designed tariff structure and high degree of commercial losses from unmetered end user connections were identified as major issues in the sector. Although the SDP envisaged an increase in cost recovery to 75% of the cost of supply to all consumer categories and 100% metering of end users, there were no specific loan covenants to achieve those targets. ADB was not in a position to engage MPG on restructuring MPSEB's balance sheet during program approval because there were unresolved issues with respect to the allocation of liabilities after the bifurcation of MPSEB (para. 17).

133. The socioeconomic impacts of tariff reforms were analyzed and safety nets were designed to mitigate the adverse impacts on the poor. However, the project design did not have a detailed monitoring and evaluation program to assess the socioeconomic impacts of the institutional and tariff reforms. The mixed modality of program loan for policy reforms combined with a project loan was appropriate at the time of entry as the power sector was suffering from decades of underinvestment, and gave early benefits in terms of increased network capacity.

2. Quality of ADB Supervision

134. ADB effectively engaged MPG in policy dialogue during program implementation to ensure that intended reforms are implemented. ADB prepared detailed tranche release reports clearly describing the progress achieved and the policy actions to be taken to comply with the tranche release conditions. ADB had engaged MPG in policy dialogue with respect to the financial restructuring plan and employee transfer to the successor companies of MPSEB. Although MPG has not yet formally accepted the financial restructuring plan, it has taken over most of the critical financial liabilities the sector such as issuing MPG bonds to outstanding liabilities to central sector power utilities and domestic financial institutions. The corresponding liabilities were converted MPG equity in MPSEB.

135. ADB played a key role in coordinating the TA for capacity building and reform implementation financed by CIDA and DFID (para. 22). During the preparation of the SDP, it was envisaged that CIDA would provide the TA required for reform implementation while ADB would provide the financial resources to cover the adjustment cost and investment cost. When CIDA had to withdraw from the sector as per the agreement between the governments of India and Canada, ADB played a proactive role in smoothly transferring the TA financing from CIDA to DFID (para. 73). ADB also provided additional TA to bridge any gaps in the TA resources provided by CIDA and DFID. ADB encouraged MPG to explore the possibility of franchising part of the distribution network (Gwalior City circle) to central sector power utility (National Thermal Power Corporation). However, that did not materialize because MPG was not able to provide a guarantee on capital and working capital subsidies. ADB realized the importance of stakeholder consultation during project implementation and provided a TA for the purpose.

136. MPSEB and its successor agencies implemented the investment component of the project smoothly. Recognizing MPSEB's capacity for project management, ADB agreed to do away with the project implementation consultants (paras. 50 and 53). ADB had anticipated the cost savings due to the lower bid prices and cancellation of several components of the loan

such as project implementation consultants and revenue management systems. The savings were reallocated to widening the expansion of the transmission and distribution network. ADB's performance is rated *satisfactory*.

C. Performance of the Borrower

1. Quality of Project Preparation

137. MPG took full ownership of the reform program because it realized the precarious situation of the power sector and its adverse impact on the fiscal situation and overall economic growth of the state. MPG appointed the Tata Rao Committee (para. 19) to recommend sector reforms and initiate several actions such as establishing MPSERC through India's 1998 Electricity Regulatory Commission Act. MPG had the political will to go ahead with potentially unpopular measures such as tariff reforms, curtailment of free electricity supply, and intensifying the metering of end users connections. MPG and MPSEB put in place adequate institutional arrangements for implementing the SDP. A high-level committee headed by the chief secretary of MPG coordinated the policy reforms. MPSEB established a project management unit at its corporate office to coordinate and manage the procurement of goods and works.

2. Quality of Reform Implementation

138. MPG implemented most of the policy reforms in the policy matrix; however, it was reluctant to approve a comprehensive debt restructuring plan. Instead, it resorted to periodic debt write-offs, equity injections, and working capital loans. MPG's actions are creating a degree of uncertainty about overall fiscal management as well as financial management of the power sector. MPG has maintained the reform momentum by adopting several provisions of the Electricity Act of 2003 such as initiating franchising of distribution. However, the institutional reforms of the power sector including the full delegation of financial and human resource management are yet to be achieved.

139. MPG has allocated significant amounts of resources to invest in power generation, especially in public sector hydropower projects. As these investments were inadequate to meet the deficit in generation capacity, MPG recently took several steps to attract private investments to power generation. It allowed MPSERC to act as an independent economic regulator and did not interfere with tariff setting. It promptly paid through fiscal allocation the tariff subsidies that it provided to residential consumers below the poverty line and for agricultural consumers. However, it could not yet come up with an effective strategy to address the substantial commercial losses in power distribution (electricity theft), which is at the root of the financial deficit of the sector.

140. MPSEB has performed well in implementing the investment component of the project. The original work for the project was implemented ahead of schedule with significant cost savings. The services of project implementation consultants were not required as MPSEB had adequate capacity for project management. MPSEB and its successor entities initiated an energy audit program at feeder level to identify theft-prone areas. This initiative has enabled the selective application of HVDS and aerial bundled conductors to minimize losses. MPSEB also maintained the support of stakeholders—employees and consumers—to the reform program. The performance of the borrower is rated *satisfactory*.

V. ISSUES, LESSONS, AND FOLLOW-UP ACTIONS

A. Outstanding Issues and Recent Initiatives

141. **Shortages in generation capacity.** The demand for electricity in Madhya Pradesh has been rising over the years**.** The average demand during the peak season was around 7,000 MW in FY2010. The total average available capacity for the state including central sector allocation to Madhya Pradesh is around 5,600–6,000 MW. The state authorities were compelled to supply power to rural areas for around 12 hours while supplying urban areas for over 22 hours. Given the persistent deficit scenario, MPG adopted several measures to attract investment to power generation (para. 61). This has resulted in doubling the generation capacity during last six years and the state plans to increase the generation capacity by 5,000 MW during next three years including capacity additions of 1,500 MW by MPGenco. It is critical that projects are implemented as scheduled to alleviate the power shortages by 2014.

142. **Persistent distribution losses.** The most critical issue facing the power sector in Madhya Pradesh is the high distribution losses coupled with low collection efficiency. The current ATC losses are about 34%, with only DISCOM West having ATC losses below 30%., ATC losses are 37% for DISCOM East and 34.2% for DISCOM Central. Although the T&D losses have significantly gone down from around 50% in 2002, the current levels are still very high and additional efforts are required to keep the levels within reasonable limits. In consultation with MPG, the distribution companies have set loss reduction targets for the next 3 years, and have scaled up their efforts to achieve those targets.

143. One of the major initiatives undertaken by the Madhya Pradesh DISCOMs is the RAPDRP scheme (paras. 115, 118). The scheme financed by the central government as a loan to state power utilities is implemented in two phases. The first phase aims to measure and record all baseline data in selected town areas, and the second is focused on implementing efforts to strengthen systems including aerial bundled conductors (ABC) and HVDS and effective consumer metering to bring the losses down to 20%. The RAPDRP scheme provides for converting part of the loan to grant if the companies are able to bring down the losses and maintain the losses at 15% for another 3 years.

144. Another major initiative that MPG is promoting is the feeder segregation scheme in rural areas. The scheme aims to segregate the domestic and the agricultural feeders to enable the DISCOMs to control the power supply to agricultural and residential consumers by making power available to agricultural consumers for 8–10 hours while ensuring 24-hour supply to rural residential consumers. It is also envisaged that HVDS will be deployed for agricultural feeders due to higher power demand and to reduce the thermal losses as well potential for electricity theft from agricultural feeders as well as to increase the metering of agricultural consumers. This step is expected to significantly reduce both technical and commercial losses in agricultural feeders while encouraging more efficient use of electricity for water pumping. The first phase of the scheme is to be financed by REC. For the second phase, MPG expects financing from external sources.

145. The feeder segregation program would amount to redesigning the entire rural distribution network of Madhya Pradesh. The present level of human resources available in the sector may not be adequate for implementing this ambitious plan. Therefore, it will be necessary to obtain the services of consultants to design and supervise as well as monitor the results of this program. It may be useful to obtain inputs from a panel of agronomists to achieve the optimum design for agricultural feeders, for the water requirements of different crops are not the same.

The investments required for RAPDRP and the feeder segregation program are in the range of Rs22 billion and Rs50 billion, respectively. It is critical that these investments give adequate financial returns for them to have a positive impact on the financial performance of the sector.

146. **Financial deficit.** The state power sector utilities have been running in deficit in the last several years. Currently, the sectorwide accumulated financial losses are Rs65.8 billion for the period FY2006–2009, with Rs26.6 billion in FY2009 alone. The major portion of the financial losses is borne by the distribution companies (close to 87% of the total losses). Madhya Pradesh Genco has accumulated financial losses of over Rs8.3 billion. Madhya Pradesh Transco has close to Rs0.14 billion of losses, while the three distribution companies have accumulated losses of Rs57.8 billion for 2006–2009. The huge losses could be attributed to the inability of Madhya Pradesh DISCOMs and Madhya Pradesh Genco to meet the performance standards stipulated by MPERC for ATC losses and plant load factor/heat rates, respectively. When the low collection ratios (96%) are considered, the cash deficits in the distribution subsector are even higher than the accounting losses.

147. Although MPG has financed the cash deficit and investment needs in the past, the performance of the sector has to be significantly improved to achieve financial sustainability. Given the already high tariffs in the state, there is little scope for a further increase in tariffs. It is imperative that the proposed measures for reducing technical and commercial losses are carried out as planned, subject to technical and financial viability. Until the sector achieves financial breakeven, it will require fiscal subsidies. MPG can better target these subsidies by making them conditional upon progressive improved performance in reducing distribution loss, and other performance indicators.

148. **Institutional incentives**. Another unfinished item in the reform process is the lack of autonomy in financial and human resource management in MPSEB's successor companies as MPSEB still retains those functions. The tariff regime is designed in a manner that results in financial gains to regulated companies if they manage to exceed the performance standards used in tariff setting. However, MPSEB consolidates the financial gains at the sector level and better performing companies do not gain any financial benefits as a result of improved performance. The financial management of the sector needs to be revised to give the management of utilities better targeted incentives to improve performance. In this regard, the State Government has recently transferred the employees from MPSEB to the successor companies vide notification dated 30th November 2010, The State Government has also initiated the termination of centralized cash management system and it is expected to be implemented by April 2011.

B. Lessons Learned

149. **Regulatory and institutional reforms alone are important, but they will not result in improved performance in the absence of accountability and incentives.** The SDP was based on the premise that regulatory and institutional reforms will improve the performance of sector entities. Although the regulatory and institutional reforms were implemented as intended, the sector entities except for MPTransco showed no significant improvement in performance. Although there are several reasons for this such as the underlying political economy issues constraining the measures that can be taken to reduce the ATC losses, the lack of financial autonomy, financial incentives, and managerial accountability could have contributed to under-achievement of this important development outcome. The management of a utility is not responsible for financial performance and MPG has regularly stepped in to finance the cash deficit. The regulatory interventions were limited to annual tariff settings based on progressively

improving performance norms. The reform program should have gone beyond the institutional reforms and encouraged MPG and the regulator to set performance targets and ensure compliance with those targets through an incentive and/or penalty mechanism. It is encouraging to note that the MP State Government and MPSERC have set targets for loss reduction , revenue realization etc in last 3–4 years and the reporting requirements to periodically monitor the performance of DISCOMs with respect to these targets have been initiated.

150. **Restoring financial viability of the power sector in Madhya Pradesh requires a holistic approach encompassing technical, institutional, and governance measures.** The Madhya Pradesh power sector has been suffering from structural problems such as persistently high level of ATC losses, increasing cost of generation and power purchase, and limited scope of tariff increase as industrial tariffs have already reached the cost of captive power generation. Improving the operational efficiency of utilities and tariff adjustments aimed at reducing the cross-subsidies to residential and agricultural consumers can help, but the underlying problem in the power sector remains the high ATC losses. The reduction of ATC losses requires technical measures (reducing the overloading of distribution feeders and measures such as HVDS and bundled conductors to prevent electricity pilferage), institutional measures (improved metering, billing and bill collection) as well as governance-related actions (discouraging electricity theft by taking legal action against the pilferers). However, the underlying political economy such as affordability and competitiveness of Madhya Pradesh's agriculture sector in the event of full cost recovery of supply of electricity to agriculture needs to be addressed.

151. **Overreliance on the private sector for power generation investments when there are structural issues in the distribution sector that may not result in desired outcomes.** Financial viability and cost recovery in the sector are important considerations for private sector investments in power generation in the absence of opportunities to sell electricity outside the state. Before India's Electricity Act of 2003 was enacted, it was difficult to attract private sector investments to power generation in Madhya Pradesh, for investors were concerned about MPSEB's ability to set aside adequate cash flows to meet power purchase obligations (escrow cover). After the provisions of the Electricity Act related to the setting up of a competitive power market and open access to a transmission network were implemented, private investors have shown increased willingness to invest in power generation in Madhya Pradesh as demonstrated by the recent success in initiating several private sector investments with likely capacity additions of more than 1,500 MW from private sector projects in next 2–3 years.

C. Follow-Up Actions

152. Although the original SDP had been completed in 2004, ADB continues to be engaged in the Madhya Pradesh power sector through the ongoing Madhya Pradesh Power Sector Investment Program (footnote 1) approved in 2007. ADB therefore has the opportunity to engage the government in policy dialogue with respect to the following points.

(i) **Restoring the financial viability of the power sector**. It would be desirable to have a time-bound road map for restoring the financial viability of the sector, taking into account the structural issues facing the sector and the projected efficiency gains of proposed investments. It is noted that DIFID consultants are assisting the State Government in preparation of Financial Restructuring Plan which includes a road map for restoring the financial viability of the sector. The multiyear tariff-setting framework can be coordinated with the financial restructuring road map to ensure that some efficiency gains are retained in the sector to improve its profitability. This will be a departure from the current

practice where efficiency gains, if any, are passed on to the consumers through progressively stringent performance norms used in tariff setting.

(ii) **Accountability for improved operational performance.** The management of the sector entities created after the unbundling of MPSEB is not held responsible for the operational and financial performance of the sector entities. This is mainly due to lack of financial autonomy and lack of performance target set by the respective boards of directors and regulator to comply with. As MPG covers the cash deficit of the sector and in the absence of performance targets set by either the regulator (the performance norms are used only for the purpose of tariff setting) or MPG as the shareholder, the utility management lacks incentives to strive for improved performance. ADB could engage MPG and MPSERC in establishing a framework for improving operational performance and a corresponding incentive scheme.

MADHYRA PRADESH POWER SECTOR PERFORMANCE ASSESSMENT (2000–2009)

A. Sector Overview

1. The Madhya Pradesh Electricity Board (MPEB) was constituted in 1952 under the Electricity (Supply) Act of 1948. MPEB was a vertically integrated utility responsible for power generation, transmission, and distribution in the state of Madhya Pradesh. As of 2000, MPEB was suffering financially due to high transmission and distribution (T&D) losses (49%), high level of agricultural consumption (41% of total consumption), and low level of tariffs for agricultural and domestic consumers. Although MPEB was entitled for revenue subsidies from the government of Madhya Pradesh (MPG) for setting the tariffs for agricultural and residential consumers below cost recovery levels, these subsidies were not being paid in a timely manner. MPEB also had high levels of receivables from municipalities and other state-owned agencies. As a result MPEB had defaulted on its loan and tax payments to MPG. MPEB was also defaulting its payment obligations to the National Thermal Power Corporation (NTPC) for power purchase and to Coal India for coal purchase.

2. After the division of the state of Madhya Pradesh in 2001, the Madhya Pradesh State Electricity Board (MPSEB), the successor entity to MPEB, inherited most of the agricultural consumers but lost most of the industrial consumers and power generation capacity to the newly created state of Chhattisgarh. The reconstituted state of Madhya Pradesh had 73% of the population and 78% of energy consumed in the undivided Madhya Pradesh. Being responsible for power supply in the reconstituted Madhya Pradesh, MPSEB was allocated only 68% of the installed generation capacity and 64% of the revenues of the former MPEB. As a result, MPSEB suffered from generation capacity deficit (1,700 megawatts [MW]), higher cost of supply, and higher financial deficit, whereas the newly created Chhattisgarh State Electricity Board (CSEB) had surplus generation capacity (750 MW) and lower cost of supply. MPSEB was also allocated 78% of the outstanding liabilities and 78% of the staff of MPEB.

3. The reforms initiated in the state of Madhya Pradesh since 2002 aimed to develop a financially and economically sustainable power sector that does not rely on subsidy or support from MPG and operates autonomously. Since 2002, the generation, transmission, and distribution companies have been operating independently under an operation and maintenance (O&M) agreement with MPSEB. The companies were granted partial functional and financial autonomy, but MPSEB retained financial management and human resource management for the entire power sector. In the initial phase of unbundling, five companies were formed: one generation company (Madhya Pradesh Power Generation Company [MPGenco]), one transmission company (Madhya Pradesh Power Transmission Company Limited [MPTransco]), and three distribution companies (DISCOMs). In 2006 Madhya Pradesh Trading Company Limited (Tradeco) was formed with responsibility for the bulk purchase and supply of electricity.

B. Power Generation

4. The installed power generation capacity of the reconstituted MPSEB reached 2,900 MW (2,150 MW of thermal generation capacity and 750 MW of hydro capacity) as of 2001. In addition to its -own generation capacity, MPSEB also had an allocation of 1,120 MW from the central sector. The total available generation capacity was about 4,000 MW in 2001; however, the unconstrained peak demand was in the range of 5,700 MW during the farming season, resulting in extensive load shedding. The average age of 60% of the thermal plants in the state was 25 years and only 867 MW of capacity was added during 1993–2001. As a result, the plant load factor (a measure of availability of generation stations) was around 65%.

5. Given the national policy of encouraging private sector investments for power generation, MPG signed 22 memoranda of understanding (MOU) with independent power producers (IPPs) for an additional 8,230 MW. However, only 13 projects with a total generation capacity of 5,340 MW received techno-economic clearance from the Central Electricity Authority. Since MPEB had limited financial capacity to provide escrow cover (earmarking revenues of MPSEB for meeting the power purchase payments to IPPs), it was decided by MPG to allocate escrow cover on a competitive basis to IPPs. This process got embroiled in protracted litigation. Finally, the Supreme Court directed MPG to allocate escrow cover to four projects (400 MW Maheswar hydropower project, 1,070 MW Korba coal power project, 580 MW Bina coal power project, and 330 MW gas power project). The Korba coal power project is now with Chhattisgarh after the division of the state. Most of the work on Maheswar hydropower is complete and commissioning is expected in December 2010. The Bina power project has been restructured and is now under construction as an IPP with a capacity of 1,280 MW.

6. Due to difficulties in attracting private sector investments to power generation, MPG instructed MPSEB to initiate several power generation projects including 500 MW Brisinghpur coal power plant, 210 MW Amarkantak coal power plant. 1,000 MW Indira Sagar Hydropower Project (HPP), 520 MW Omkareshwar HPP, and 825 MW Sardar Sarovar hydropower projects were commissioned by the state government as joint ventures with National Hydropower Corporation.(NHPC). All these projects were successfully commissioned. The Indira Sagar project and Sardar Sarovar were commissioned in 2006, and Omkareshwar was commissioned in August 2007. The Brisinghpur plant was commissioned in September 2008 and Amarkantak in October 2009. In addition, NTPC initiated several projects with capacity allocations for Madhya Pradesh (Table A1.1).

Table A1.1: Installed Generation Capacity (MW) in Madhya Pradesh, 2002–2009

Item	2002	2003	2004	2005	2006	2007	2008	2009
State Sector								
- Thermal	2,147	2,147	2,147	2,147	2,147	2,147	2,647	2,857
- Hydro	793	843	843	843	843	903	923	923
MPG joint ventures								
- Hydro	0.00	0.00	500	1,256	1,598	1,836	2,411	2,411
Central Sector								
- Thermal	1,193	1,250	1,697	1,770	1,716	1,941	2,035	2,160
Total	**4,133**	**4,240**	**5,188**	**6,017**	**6,304**	**6,827**	**8,016**	**8,351**

MPG = government of Madhya Pradesh, MW = megawatt.
Source: Independent Evaluation Mission.

7. As a company registered under the Companies' Act, MPGenco began independent operations on 1 June 2005. The company has been operating since 2002 under an O&M agreement with the former MPSEB. However, the cash flows are still being managed by residual MPSEB, MPGenco faces the challenge to gear up to meet market competition through efficiency improvement programs. The generating plants have not achieved the benchmark norms of operating efficiency. The efficiency indicators, plant utilization, station heat rate, specific fuel consumption, and auxiliary consumption of the thermal plants are much below the desired level. Some plants of MPGenco need renovation and modernization, not only to extend

their life, but also to improve the performance parameters. Availability of funds is, however, the main constraint in this regard.

8. One of the most prominent reasons for the low plant factor of MPGenco plants is the age of the plants. Of the 16 thermal generating units that MPGenco operates, 10 units constituting about 43% of the thermal generating capacity have already completed the economic life of 25 years. The average age of all the five units in Indira Gandhi Sagar Hydro Generating Station is above 46 years. These five units together constitute 12.57% of the total hydro generating capacity of MPGenco. Several thermal power plants such as Satpura and Amarkantak TPS urgently need rehabilitation requiring an investment of over $150 million. During the period 2008–2009, coal supply to the power stations of MPGenco was inadequate, thereby affecting power generation. Due to the acute shortage of coal, MPGenco's units were forced to run on partial load. For this reason, MPGenco's plant load factor (PLF)[1] was lower by about 7.5% for the period 2008–2009 and the resultant decrease in electricity generation amounted to over 1,600 gigawatt-hours (GWh).

9. The generation loss due to the coal shortfall in 2009–2010 was estimated at 497.82 GWh. The coal supplies were delayed because of the persistent delay in paying for the supply. This has also led to poor quality of coal being supplied to MPGenco. The coal linkage for fiscal year (FY) 2009–2010 was further reduced to 15 million tons.

Table A1.2: Energy Balance in Madhya Pradesh 2002–2009

(GWh)

	FY2001–FY2002	**FY2002–FY2003**	**FY2003–FY2004**	**FY2004–FY2005**	**FY2005–FY2006**	**FY2006–FY2007**	**FY2007–FY2008**	**FY2008–FY2009**
MPSEB Thermal availability (GWh)	10,575	12,366	11,865	12,225	9456	12,096	11,780	12,034
MPSEB Hydro availability	2,277	1,764	2,658	2,139	2,394	2,968	2,831	2,344
Central sector allocations to MP	10,873	9,177	8,866	9,552	11,347	12,072	13,668	12,708
JV Hydro			193	1,393	3,648	4,609	5,885	3,561
Additional power purchases	2,207	2,798	4,160	3,213	0.00	0.00	0.00	1,335
Energy trading	603	1,027	816	1,529	344	413	487	45
Total MPSEB supply	**26,535**	**27,132**	**28,558**	**30,051**	**27,188**	**32,157**	**34,654**	**32,027**
Peak deficit MW					954	1,005	631	1195
(%)		24.5	17.0	14.0	(14.2)	(14.1)	(8.8)	(14.7)
Energy deficit					4,846	5,269	5,533	4199
GWh (%)		14.0	13.0	12.5	(13.1)	(13.6)	(13.3)	(9.3)

FY = fiscal year, GWh = gigawatt hour, JV = joint venture, MPSEB = Madhya Pradesh State Electricity Board, MW = megawatt.
Source: Independent Evaluation Mission.

10. MPGenco is currently constructing two large thermal power plants (1,200 MW Shri Singhaji TPS. 500 MW Satpura TPS Extension); they are expected to be commissioned before 2013. MPG provided the equity capital for these projects and debt financing was sourced against MPG guarantees. In addition to these plants, several other power plants promoted by

[1] PLF is a measure of the utilization of generation capacity; 100% PLF implies the installed capacity has been utilized to the maximum extent.

central agencies have allocated over 2,700 MW to Madhya Pradesh. For example, 4,000 MW Sasan Ultra Mega private sector power plant allocated 1,500 MW to Madhya Pradesh.

11. MPG had notified a policy inviting private sector participation in the power sector through the memorandum of agreement (MOU) route. Under the policy, MPG assists the private developers in land acquisition, fuel and water linkages, aside from other administrative facilitation. The policy has 35 active MOUs; 7 projects are at advanced stage of construction and have a combined allocation of 440 MW for Madhya Pradesh (Table A1.3).

Table A1.3: Added Private Sector Generation Capacity Expected in Madhya Pradesh before 2013

Plant	Status	Aggregate Capacity (MW)	Capacity Allocated to Madhya Pradesh (MW)
Bina Power Supply Company	Construction started	1,250	525
Essar Power	Construction started	2,000	750
Jaiprakash Ventures	Construction started	1,320	462
BLA Power	Construction started	626	219
Jhabua Power	Obtained all clearances	1,200	420
M.B. Power	Obtained all clearances	2,000	700
Reliance Power	Obtained all clearances	4,000	1,400
Total		**12,396**	**4,476**

Source: Independent Evaluation Mission.
MW = megawatt.

12. In addition to the foregoing IPP projects promoted under the MOU arrangement, MPG also followed the competitive bidding guidelines of the Ministry of Power (case 1 and case 2). In case 1 bidding guidelines, MPG needs to float a tender inviting bids for a certain capacity at a particular injection point, irrespective of the location and technology of the plant. In case 2, MPG needs to develop a site for erection of a power plant and provide all the clearances for land acquisition, water linkage, fuel linkage, environment, etc. Bids are than invited from interested parties for developing the project. MPG conducted bidding for the procurement of 2,000 MW of power under case 1. The bids were received on 27th November 2007. However, the transaction has not been completed to date because of several regulatory bottlenecks. For power procurement under case 2, MPG provided all the support for developing the 4,000 MW Sasan ultra Mega Power Plant initiated by the central government.

13. The demand during the peak season is currently close to 7,000 MW and the average peak is about 6,500 MW. The available generation capacity is around 5,600–6,000 MW. The average deficit is around 500–1,000 MW which increases to 1,300–1,500 MW during peak season. The peak demand is expected to increase by over 50% to 10,500 MW by 2013. The installed generation capacity in Madhya Pradesh including allocations from the central sector is expected to increase by 5,150 MW to reach 14,000 MW, and the available generation capacity at 70% plant factor would be in the region of 10,000 MW. Hence, the tight capacity demand-supply balance is likely to continue in the medium term, and it is important to increase the availability of thermal plants by reducing the maintenance outages and increasing the coal allocations.

C. Power Transmission System

14. At the time of unbundling and the establishment of MPTransco, the transmission system in Madhya Pradesh was suffering from severe overloading, poor voltage regulation, instability and frequent network tripping as a result of underinvestment in the preceding decade. The extensive investments that MPTransco made during 2002–2008 enabled the company to increase its transmission capacity from 3,890 MW in 2002 to 7,620 MW in 2009. The total transformation capacity of MPTransco as of May 2010 was 32,474 megavolt-ampere (MVA), with 141 substations. Further additions to the transmission network are being installed under the ongoing Madhya Pradesh Power Sector Investment Program approved in April 2007 for $106 million[2] and $144 million approved in August 2007[3] under a multitranche financing facility (MFF) for Madhya Pradesh Power Sector Investment Program. The first loan was to finance the expansion of 400 kilovolt (kV) and 220 kV network and substations (315 MVA of 400/220 kV substations and 3,120 MVA of transformation capacity at 220 kV level and 1,435 kilometers (km) of 220 kV lines. The second loan was to finance the expansion of 132 kV network with 1,020 MVA of transformation capacity and 1,450 km of 132 kV lines. Table A1.4 is a snapshot of transmission capacity additions from June 2002 to May 2010.

Table A1.4: Transmission Capacity in Madhya Pradesh 2002 and 2010

Particulars		Status as of June 2002	Status as of May 2010	Addition from June 2002 to May 2010
400 kV substations	Units	4	5	1
	MVA	2,940	4,200	1,260
220 kV substations	Units	26	49	23
	MVA	6,770	13,610	6,840
132 kV substations	Units	110	175	65
	MVA	6,950	14,644	7,694
Total substations	Units	141	230	89
	MVA	16,680	32,474	15,794
400 kV lines	c-km	1,706	2,343	637
220 kV lines	c-km	6,496	9,860	3,364
132 kV lines	c-km	9,230	12,432	3,202
Total lines	c-km	17,493	24,696	7,203

c-km = circuit kilometers, kV = kilovolt, MVA = megavolt-ampere.
Source: Independent Evaluation Mission.

15. The technical performance of the transmission system significantly improved as a result of the investments undertaken (about Rs20 billion). The voltage profile of the network significantly improved with all 400 kV and 220 kV substations maintaining a voltage deviation of not more than 7.5%. Voltage deviations exceeding the stipulated 10% at 132 kV substations were limited to less than two substations. Transmission system availability has been above the target set by the regulator and has been exceeding 98% since 2005–2006. This indicates that MPTransco has been maintaining its lines and substations properly and managing outages promptly. The higher availability has entitled the company to incentive as per the regulations. The availability of the five major critical lines in Madhya Pradesh has been over 99%.

[2] ADB. 2007. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to Madhya Pradesh for the Madhya Pradesh Power Sector Investment Program – Tranche 1*. Manila. (Loan 2323-IND).

[3] ADB. 2007. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to Madhya Pradesh for the Madhya Pradesh Power Sector Investment Program – Tranche 1*. Manila. (Loan 2346-IND).

16. A portion of the electrical energy transmitted through a transmission system is lost on account of the resistance of the conductor and losses in transformers and other equipment. Loss reduction is an important technical consideration of a transmission company. Transmission losses have come down significantly since the inception of the company. The transmission loss of 7.93% in July 2002 dropped to 4.09% in FY2009 as against the regulatory target of 4.90%. Without transmission investments and capacity augmentation, transmission losses would have exceeded 11% in FY2009.

D. Power Distribution

17. There was a significant increase in the number of consumers and electricity consumption by residential, agricultural, and other commercial consumers connected to the low-voltage network of the three distribution companies during 2002–2009. Residential consumers increased from 4.48 million in 2002 to 5.77 million in 2009, and agricultural consumers from 1.15 million in 2002 to 1.21 million in 2009. Electricity sales to residential and agricultural users increased by 85% and 117%, respectively, from 2002 to 2009. Metering of low-voltage consumers significantly increased. In 2009, 92% of residential and 22% of agricultural consumers were metered compared with 87% residential and 11% agricultural consumers in 2002.

18. New 33/11 kV substations and high-tension lines were constructed to reduce technical losses and to improve the quality of the supply in low-voltage pockets. To reduce commercial losses, energy audit started in the state to identify areas incurring high losses. Metering was 100% up to the 11 kV feeders and regular energy audits were started. To improve metering at consumer ends, more than 3,400,000 electronic meters were installed. Through these efforts and special drives to regularize unauthorized connections, aggregate technical and commercial (ATC) loss levels of 43.6% at the time power sector reforms began in 2002 went down to 34% in 2010. Distribution company (DISCOM) Central managed to reduce ATC losses from 52.9% in 2002 to 37.1% in 2009, and DISCOM West from 41.2% in 2002 to 29.3% in 2009. ATC losses in DISCOM East remained unchanged at around 37% (Table A1.5).

Table A1.5: Distribution Losses and Collection Efficiency
(%)

Fiscal Year	Distribution Losses				Collection Efficiency			
	East	West	Central	State	East	West	Central	State
2003	33.77	36.79	45.09	38.61	90.94	89.23	85.23	88.64
2004	37.27	34.77	44.88	38.83	83.92	83.25	79.86	82.48
2005	37.08	34.24	43.03	37.91	87.18	89.34	83.10	86.71
2006	36.46	31.91	43.39	36.96	90.05	92.67	91.72	91.50
2007	35.81	30.73	42.64	36.13	91.19	91.69	89.27	90.79
2008	37.72	33.99	41.44	37.53	92.01	92.30	89.97	91.49
2009	37.23	33.76	38.93	36.47	92.03	97.61	95.66	95.20
2010	33.45	28.62	35.15	32.13	90.84	97.65	94.87	94.60

Source: Independent Evaluation Mission.

19. The Madhya Pradesh distribution subsector has undertaken massive capacity augmentation in the last 5 years. A detailed physical network addition is shown in Table A1.6.

Table A1.6: Capacity Additions in the Distribution Network 2003–2009

Item	Unit	Fiscal Year 2003/04	Addition during 5 years	2009	Increase (%)
33 kV line	km	29,990	5,936	35,926	20
11 kV line	km	163,186	14,351	177,537	9
LT line	km	325,832	4,672	330,504	1
33/11 kV S/S	no.	1,731	739	2,470	43
33/LT and 11/LT S/S	no.	181,322	33,016	214,338	18
HT/LT line ratio		0.59		0.64	9

Source: Independent Evaluation Mission.
H/T = high tension, Km = kilometers, kV = kilovolt, L/T = low tension, no. = number, S/S = Substations.

20. The Rajeev Gandhi Grameen Vidutkarana Yojana (RGGVY) scheme aimed to electrify all villages. It would give all households access to electricity by extending the rural electricity distribution backbone with at least one distribution transformer in each village, with an associated last mile low-tension (LT) connectivity. The RGVY scheme was to accelerate rural development, generate employment and eliminate poverty through irrigation, small-scale industries and providing improved access to health care, education, and information technology. Available RGGVY data as of 23 April 2010 indicate that the total project cost approved for Madhya Pradesh was Rs17.53 billion, of which Rs9.08 billion had been released. A total of 806 villages without electricity or underserved were identified, and 89 (11%) have been electrified. Furthermore, 34,094 electrified villages 5,445 villages were covered for intensive electrification. . In these 34,094 villages, 2.65 million rural households (8.1%) have been electrified.

21. The Accelerated Power Development Program (APDP) was undertaken in 2000–2001 to restore the commercial viability of the distribution subsector in the urban areas. The original APDP was renamed Accelerated Power Development and Reform Program (APDRP) during FY2003 for the 10th Five-Year Plan with increased focus on supporting the sector reforms and reduction of distribution loss. The objectives of APDRP were to

(i) improve the financial viability of state power utilities,
(ii) reduce aggregate technical and commercial (ATC) losses,
(iii) improve customer satisfaction, and
(iv) increase the reliability and quality of the power supply.

22. The APDRP scheme had two components. As part of the investment component the Government of India was to provide additional assistance to strengthen and upgrade the sub-transmission and distribution networks. Of the project cost, 25% was to be provided as additional central plan assistance in the form of a grant to the state utilities. The central government was to finance 25% of the project cost in the form of a loan. However, in accordance with the recommendation of the 12th finance commission, the loan component was discontinued starting in FY2006. Utilities now have to make other arrangements for the remaining 75% of the project cost from domestic financing institutions like Power Finance Corporation (PFC) and/or Rural Electricity Corporation (REC). The approved total cost of the project was Rs68.7 billion, of which the APDRP component was Rs34.4 billion, and the approved counterpart funding was Rs33.9 billion. However, only Rs13 billion was released, and the total funds utilized including the counterpart funding amounted to Rs13.1 billion.

23. The ongoing Madhya Pradesh Power Sector Investment Program approved in April 2007 for $45 million,[4] and the component in August 2007 (footnote 2) and tranche 5 of the same program[5] approved in May 2009 for $166 million are financing further improvements to the distribution network. The works under the program include

(i) conversion of about 7,400 km of LV lines to high-voltage distribution systems (HVDS), remote metering of 2,000 industrial consumers, and metering of 250,000 residential consumers;

(ii) for DISCOM East, feeder segregation as a pilot project by installing 751 km of 11 kV lines and 70,000 single-phase meters and 12,500 three-phase meters; for DISCOM Center, installation of 11 KV 1200 KVR capacitor bank, construction of High Voltage Distribution System in theft prone areas of Bhopal, Gwailor and Morena with conversion of LV line to 11 KV Line 125 km and installation of remote meters at 8394 in industrial and commercial consumers; and for DISCOM West, HVDS systems by converting 870 km LV lines to 11 kV, feeder segregation by constructing 1,100 km of new 11 kV lines and renovating the existing 33/11 kV substations.

(iii) for DISCOM Central, "Construction of HVDS in 2 circles, including conversions of 3198 km of LT lines to HT and construction of 1555 km of new 11 KV lines and renovation of 33/11 KV 443 substations; for DISCOM East, 7,580 km of HVDS lines and 1,250 km of 11 kV lines for feeder segregation; and for DISCOM West, installation of 2,100 km of 11 kV lines and renovation and construction of 65 33/11 kV substations.

24. Taking into account the lessons learned in implementing the APDRP, the Ministry of Power of the central government launched the Revised APDRP in 2007. The Revised Accelerated Power Distribution Rehabilitation Project (RAPDRP) is part of the sustained efforts of the central government to make the power sector more financially viable and to improve the quality of the power supply in urban areas. The RAPDRP is a scheme that the central government launched for towns with a population of more than 30,000.
The entire RAPDRP scheme has two parts.

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(i) Part A has projects for establishing baseline data and applying information technology (IT) for energy accounting and consumer services.

(ii) Part B is to improve, strengthen, and augment systems.

All three DISCOMs in Madhya Pradesh have submitted proposals for 82 towns to the PFC for upgrading the distribution network under RAPDRP. PFC approved a loan of Rs2.28 billion for part A and Rs19.66 billion for part B.

[4] ADB. 2007. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to Madhya Pradesh for the Madhya Pradesh Power Sector Investment Program – Tranche 1*. Manila. (Loan 2324-IND).

[5] ADB. 2009. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to Madhya Pradesh for the Madhya Pradesh Power Sector Investment Program – Tranche 5*. Manila. (Loan 2520-IND).

25. The DISCOMs are focusing on implementing HVDS so as to reduce technical and commercial losses. Companies have also planned to separate agriculture and domestic categories of connections in rural areas by feeder separation with HVDS system. During 2008–2009, MPG had provided the DISCOMs with Rs1.0 billion for feeder segregation. DISCOMs have already covered about 471 feeders with this funding. The feeder segregation program will help improve supply hours and quality of supply in rural areas while reducing losses. However, it requires investment of about Rs5.0 billion over the next 2–3 years, and support from debt financing institutions like PFC and REC has been sought. Financial support from the central government/external financing in the form of a soft loan/grant would also be needed to roll out the feeder segregation program to cover the entire state.

E. Renewable Energy

26. Madhya Pradesh is endowed with good renewable energy potential and the same can be harnessed not only to meet the domestic demand but also to contribute to the sustainable development of the energy sector in the state. The state has technical potential of around 1,200 MW for wind-based power generation. The installed capacity of wind projects in Madhya Pradesh is around 212 MW and around 800 MW of capacity is being considered for development.

27. In India, hydropower projects with capacity of up to 25 MW are classified as renewable energy. Madhya Pradesh has an estimated potential of 410 MW for small hydro-based generation. The installed capacity of a small hydropower plant is 71 MW and around 20 MW is under construction. One small hydropower project of 2.20 MW had been set up by the private sector in Madhya Pradesh as of 31 March 2009.

28. Biomass resources can also be used to generate electricity for a supply to the grid. The gross potential for biomass-based power in Madhya Pradesh is around 1,040 MW. However, the installed capacity of biomass-based power projects is only 1 MW. Biomass-based projects with capacity of around 401 MW are going through the approval process and around 99.5 MW of capacity has been approved for different biomass project developers. Around 10 villages have been electrified under the Village Energy Security Program and work is in progress in 27 villages. The state of Madhya Pradesh is endowed with good solar intensity. Certain regions have potential of more than 5.5 kWh per square meter and thus offer good sites for solar-based power projects.

UPDATED DESIGN AND MONITORING FRAMEWORK

Design Summary	Performance Targets Achieved	Validity of Assumptions and Risk Assumption at Appraisal
Desired Impacts: Program Loan		
Financially sustainable power sector to promote economic growth of the state	• The GDP of Madhya Pradesh has grown at an average of 4.89% per annum since 2005 compared with the national average of 8.49% during the same period. • Industrial consumption has grown close to 4.3% in 7 years compared with the 5.8% overall increase in electricity consumption. • Power sector loss in a year increased from Rs9.5 billion in FY2002 to Rs25.9 billion in FY2009. • Fiscal subsidies to the sector increased to Rs280 billion over 2002–2009, and the trend in the amount of subsidies required is not declining. • The average generation capacity shortage remains at around 1,000 MW and 4,000 GWh. However, as a share of unconstrained demand, it has dropped from around 25% to about 10%.	The regulatory improvement and improved institutional accountability as well as enhanced network capacity did not result in elimination of fiscal subsidies to the sector. The commercial performance of the sector especially in reducing distribution loss was less than expected. Hence, the reforms supported by the program loan did not eliminate the fiscal burden. The overall performance of the power sector in terms of adequate and reliable power supply was not achieved because generation capacity was inadequate. The poor financial status of the sector may have contributed to the relatively lower level of private investments in power generation. Although the industrial consumers were provided with 24 hours of power supply since 2004, the high industrial tariffs may have contributed to the relatively lower growth rate in electricity consumption in the industry sector and the relatively lower economic growth of Madhya Pradesh compared with the rest of India.
Desired Impacts: Project Loan		
Improved performance of power transmission	• Transmission capacity increased from 16,480 MVA in 2002 to	The outcomes achieved (increased transmission

and distribution systems to provide reliable power supply to promote economic growth	32,475 MVA in 2010, at a CAGR of over 10% per annum. • Met 7,786 MW of peak demand during FY2010; • Transmitted and distributed 32,600 GWh of energy during FY2007; • Achieved substantial improvement in the voltage profile of the distribution system (the voltage profiles at low-tension level are maintained within a +/- 6% range); and • Reduced scheduled and unscheduled power cuts. • The number of residential consumers increased from 4.48 million in 2002 to 5.77 million in 2009, and the number of agricultural consumers increased from 1.15 million in 2002 to 1.21 million in 2009 • The metering of low-voltage consumers significantly increased. In 2009, 92% of residential and 22% of agricultural consumers were metered compared with 87% of residential and 11% of agricultural consumers in 2002. • Based on the benefits accrued in pilot HVDS schemes, MPSEB is now implementing a similar system across the state, part of which is being financed under the ongoing MFF ADB loan facility.	capacity and transmission network performance) have enabled the transmission network to support the growth of demand by more than 35% during 2002 to 2009 and enabled the evacuation of power from newly commissioned generating plants. The over 1.25 million new residential consumers increased the rate of rural electrification. But because of the increased demand, the state continued to suffer from persistent power shortages despite the increase in installed generation capacity to over 8,000 MW by 2009 compared with about 4,000 MW in 2002. Hence, the improvement in the transmission network and removal of overloading of the distribution network did not translate into improved power supply to the end consumers. While the urban areas had electricity on average about 22 -23 hours per day, the supply to rural areas is currently limited to around 10–12 hours per day.
Desired Outcomes: Program Loan		
Improved regulatory oversight, financial performance, and accountability of the sector through institutional and legal reforms	• Madhya Pradesh signed 35 MOUs with private generating companies, and 7 projects with a combined capacity of over 12,000 MW and 4,500 MW capacity allocations for Madhya Pradesh are under construction. • Six companies were formed from the former MPSEB (1 generation, 1 transmission, 3 generation and 1 trading company). • Since its inception, MPERC has	The institutional reforms supported by the program loan were backed up by consulting services funded by CIDA and DFID and strong political support from MPG. This has enabled MPSERC to effectively discharge its responsibilities as the economic regulator of the sector and institute a multiyear tariff framework.

	so far issued four tariff orders for the composite MPSEB (up to 2006) and two each for MPGenco, MPTransco, and the distribution companies. • A multiyear tariff framework for a 3-year control period is also in place and the tariff orders issued for MPGenco and MPTransco for 2007 are based on that. • The tariff regulations stipulated by MPSERC raised the average domestic tariff from Rs2.36 /kWh in 2003 to Rs3.50/kWh in 2010, and the agricultural tariff from Rs0.90/kWh in 2003 to Rs2.62/kWh in 2010. • Cost recovery as a percentage of average cost of supply improved from 27% in 2004 to 69% in 2010 for agricultural consumers. The cross-subsidy from high-voltage consumers (mainly industrial) to low-voltage consumers (mainly residential and agricultural) was significantly reduced from Rs1.73/kWh in 2004 to Rs0.7 /kWh in 2010. • Aggregate technical and commercial losses had marginal improvement, from over 50% in 2002 to around 38% in 2009. Collection efficiency rose from 95% in 2003 to 99% in 2009.	MPG has honored its commitment to provide up-front subsidies to bridge any gap between the notified tariff and the tariff stipulated by the Madhya Pradesh State Electricity Regulatory Commission (MPSERC). However, the regular tariff adjustments awarded by MPSERC and the timely payment of tariff subsidies by MPG have not resulted in cash breakeven in the power sector. This was due to the inability of distribution companies to maintain the ATC losses at the norms used for the purpose of tariff setting. The improving cost recovery of the power sector has not increased installed generation capacity with private investment. However, several large privately financed thermal power plants are under construction and MPG is aggressively pursuing private investments for power generation and distribution franchising.
Desired Outcomes: Project Loan		
Enhanced capacity for power transmission and improved quality of power supply through improvement to the distribution network	• Transmission losses dropped from 7.9% in 2002 to 4.1% in 2009. • The voltage profile of the network significantly improved with all 400 kV and 220 kV substations maintaining a voltage deviation of not more than 7.5%, and the voltage deviations exceeding the stipulated 10% at 132 kV substations limited to less than two substations. • Enhanced the transformation capacity in the state from (i) 2,940	The investments made in the transmission network during 2002–2006 contributed significantly to the improved performance of the transmission system in terms of transmission loss reduction, overall network capacity, and voltage and frequency stability. The new corporate structure for Madhya Pradesh Transco provided

	MVA in 2002 to 3,885 MVA in 2007 at 400 kV level, (ii) 6,770 MVA in 2002 to 9,650 MVA in 2007 at 220 kV level, and (iii) 6,950 MVA in 2002 to 11,299.5 MVA in 2007 at 132 kV level. • Met peak demand of 6,107 MW in 2007 without any grid disturbances in the system and maintaining the grid frequency within the 49.0–50.5 hertz (Hz) range for 89.83% of FY2007. • Increased transmission system availability from below 90% in 2002 to 98.96% in 2007. • Aggregate technical and commercial (ATC) loss levels of 43.6% at the start of power sector reforms in 2002 dropped to 34% in 2010. • DISCOM Central and DISCOM West have managed to reduce ATC losses from 52.9% to 37.1%, and from 41.2% to 29.3%. ATC losses in DISCOM East have remained at around 37%. • The failure rate of distribution transformers dropped from about 22% to 13% in the west and eastern zones, and from about 25% to 17% in the central zone. • The illegal tapping of power has been practically eliminated in the distribution zones where HVDS systems were deployed. • As per MPSEB estimates, commercial losses have been reduced from 25% to 8%, and actual losses recorded in the feeders have dropped from about 40–45% to 12–18% in the distribution feeders where HVDS was deployed.	managerial flexibility and accountability to enable the company to effectively implement the project and achieve significant improvement in the performance of the transmission system. However, improvement in the distribution subsector was not as significant as that in power transmission. Although the investments funded by ADB helped the DISCOMs remove the bottlenecks and constraints in the distribution network caused by under investments in the preceding decade (1990–2000), the investments did not translate into improved commercial performance in terms of significant reduction in ATC losses. However, commercial losses in the pilot areas where the HVDS systems were installed were virtually eliminated.
Desired Outputs: Program Loan		
• Establishment of regulatory agency and institution of regulatory	• Establishment of MPSERC • Annual tariff awards by MPSERC using transparent mechanism • Restructuring and reorganization of MPSEB were satisfactorily	The financial support provided by the ADB program in terms of budget support provided additional incentives to MPG to

oversight over tariff setting • Unbundling of power sector in Madhya Pradesh	completed. Initially MPSEB was unbundled into five successor companies consisting of a generation company, a transmission company, and three distribution companies. • Payment of Rs7.423 billion in lieu of settlement of outstanding dues from municipalities to MPSEB.	implement the key reform measures within the agreed-upon time frame. The additional fiscal space provided by the disbursement of program loan also helped MPG meet part of the adjustment cost including the settlement of electricity dues of municipalities and other local bodies. There was no strong opposition from stakeholders such as trade unions, and MPG had the political will to undertake the sector reforms to meet the conditions of the program loan.
Desired Outputs: Project Loan		
• Increased transmission capacity • Pilot-testing the HVDS (high-voltage distribution systems) • Rehabilitation and expansion of distribution network	• (i) Installation of three 315 megavolt-ampere (MVA) 400/220 kV and five 160 MVA 220/132 kV additional transformers, (ii) construction of 222 kilometers (km) of 220 kV lines and 634 km of 132 kV lines, (iii) construction of five new 220 kV substations and 25 132 kV substations, (iv) construction of four 220 kV feeder bays, and (v) augmentation of 71 132/33 kV substations. • To utilize the loan savings, additional works were undertaken: (i) construction of four 220/132 kV substations and 13 132/33 kV substations, (ii) augmentation of 132/33 kV substations, and (iii) establishment of 647 km of 220 kV lines and 446 km of 132 kV lines. • Conversion of 927 km of low-voltage lines to 11 kV lines. • Construction of 58 km of new 11 kV lines. • Installation of 5,842 transformers of 10 kilovolt-ampere (KVA) and 5 KVA capacity in Mandsaur and	Financial resources provided by ADB were more than adequate to implement the original scope of the project. The resultant loan savings were utilized to expand the scope of project investments in augmenting the transmission and distribution networks. The project implementation capacities of implementing agencies were good and they did not require consultancy support to implement the project. The unbundling of distribution operations of MPSEB into three companies did not affect project implementation as MPSEB continued to handle the procurement of material and recruitment of contractors. Only the supervision of contractors was delegated to the successor entities. The pilot-testing of HVDS undertaken by the project

• Installation of consumer meters • Institution of a revenue management system	Ujjain districts of Madhya Pradesh. • Construction of (i) 170 33/11 kV substations and 7,600 11/0.4 kV substations, and (ii) 1,800 km of 33 kV lines and 2,095 km of 11 kV lines in Bhopal, Gwalior, Indore, Jabalpur, Khargone, Mandsaur, and Ujjain areas. • Subsequently, to utilize loan savings, additional works were included in October 2004: (i) 112 33/11 kV substations and 1,050 11/0.4 kV substations, and (ii) 1,071 km of 33 kV lines and 858 km of 11 kV lines,. • MPSEB procured 35,273 three-phase meters, which had been installed by November 2003 • MPSEB requested ADB to delete this component from ADB financing as MPSEB intended to finance it from its own resources.	was successful. The revenue management system that was to be funded by the project was financed using domestic resources and inputs from the DFID finance consultants.

ADB = Asian Development Bank, ATC = aggregate technical and commercial, CIDA = Canadian International Development agency, DFID = UK Department for International Development, DISCOM = distribution company, HVDS = high voltage distribution system, kV = kilovolt, KWh = kilowatt hour, MFF = multitranche financing facility, MoU = memorandum of understanding, MPG = MPGenco = MPSEB = Madhya Pradesh State Electricity Board, MPSERC = Madhya Pradesh State Electricity Regulatory Board Commission, MPTranscom = Madhya Pradesh Power Transmission Company, MW = MVA.

Sources: Independent Evaluation Mission; ADB. 2001. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to India for the Madhya Pradesh Power Sector Development Program*. Manila.

COMPARISON OF APPRAISAL AND ACTUAL COST ESTIMATES

	Appraisal Estimate			Revised Estimate			Actual		
A. Project Components	**Foreign**	**Local**	**Total**	**Foreign**	**Local**	**Total**	**Foreign**	**Local**	**Total**
33 kV and 11 kV Systems Improvement	55.80	27.10	82.90	52.50	28.50	81.00	55.20	12.30	67.50
Conversion of LT lines to 11 kV	5.30	1.80	7.10	3.90	1.80	5.70	4.10	1.00	5.10
Transmission System Reinforcement	89.10	29.60	118.70	99.50	54.00	153.50	114.45	18.66	133.11
Computerized Information and Revenue Management System	7.80	2.00	9.80	7.80	2.00	9.80	0.00	0.00	0.00
Metering	1.10	0.00	1.10	0.70	0.00	0.70	0.61	0.00	0.61
Consulting Services	1.80	0.00	1.80	0.00	0.00	0.00	0.00	0.00	0.00
Subtotal (A)	**160.90**	**60.50**	**221.40**	**164.40**	**86.30**	**250.70**	**174.36**	**31.96**	**206.32**
B. Contingencies									
Physical	15.90	6.00	21.90	7.50	9.10	16.60	0.00	0.00	0.00
Price	5.00	8.70	13.70	9.90	9.30	19.20	0.00	0.00	0.00
Subtotal (B)	**20.90**	**14.70**	**35.60**	**17.40**	**18.40**	**35.80**	**0.00**	**0.00**	**0.00**
Front-End Fee	2.00	0.00	2.00	2.00	0.00	2.00	2.00	0.00	2.00
Taxes and Duties	0.00	30.50	30.50	0.00	13.00	13.00	0.00	16.00	16.00
Interest/Commitment Charges during Construction	16.20	13.20	29.40	16.20	21.10	37.30	2.63	33.10	35.73
Grand Total	**200.00**	**118.90**	**318.90**	**200.00**	**138.80**	**338.80**	**178.99**	**81.06**	**260.05**

kV = kilovolt, LT = low tension.

Sources: Independent Evaluation Mission; ADB. 2001. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to India for the Madhya Pradesh Power Sector Development Program*. Manila.

COMPLIANCE WITH PROGRAM LOAN TRANCHE RELEASE CONDITIONS

Condition	Compliance at the Time of Approval of Tranche Release
Prior Actions before Loan Approval	
• Establishment of Madhya Pradesh State Electricity Regulatory Commission (MPSERC) in 1998	• Established in June 1999 under the Electricity Regulatory Commission (ERC) Act of the Government of India
• Order issued by the government of Madhya Pradesh (MPG) to exempt the Madhya Pradesh State Electricity Board (MPSEB) from paying electricity duty on its own auxiliary consumption	• Order issued in October 2001
• Notification of the effective date of the Madhya Pradesh Reform Act	• Notified in July 2001
• Restriction of free power supply to residential and agricultural consumers below poverty line only to those belonging to scheduled caste/scheduled tribe (SC/ST) categories and having consumption below 25 kWh and 5 hp, respectively	• Restriction of free electricity supply became effective in January 2001 and large number of residential and agricultural consumers below poverty line and receiving free electricity up to then but did not belong to SC/ST categories were disconnected in 2002. In 2003, the government decided to provide subsidized electricity to non SC/ST consumers below the poverty line (BLP) and reconnect them with the outstanding dues waived on the condition that they agree to have a metered connection.
• Submission of comprehensive and implementable loss reduction plan by November 2001	• The plan was submitted in November 2001. It included undertaking energy auditing at feeder level by installing feeder meters.
• MPSEB to allow consumers to pay the connection charge in 12 monthly installments	• Although this was expected before the loan approval, the order was issued in May 2002.
1st Tranche Release and Loan Effectiveness Conditionalities	
• Payment by MPG of R s3.0 billion to MPSEB as partial settlement of outstanding account receivables as of March 2001 and payment of total electricity dues between April 2001 and August 2001	• The payment of Rs. 3.0 billion was made in March 2002 and was considered sufficient for declaring the loan effective and to release the first tranche.
• The Madhya Pradesh Electricity Reform Act becomes effective	• The Madhya Pradesh Electricity Reform Act became effective in July 2001. • The first tariff award made in October

• First tariff award by MPSERC	2001 increased average HT tariff by 12.3% and average LT tariff by 18.7%, resulting in an overall tariff increase of 14.7%
• Incorporation and registration of Madhya Pradesh Power Generation Company Limited (MPGenco), Madhya Pradesh Power Transmission Company Limited (MPTransco), and Madhya Pradesh Power Distribution Company Limited (MP Discom) under Indian Companies Act, 1956. • MPG and MPSEB agree on all outstanding dues and cross liabilities.	• MPGenco MPTransco, and MPDiscom incorporated and registered in November 2001.However, the final decision regarding the configuration of distribution companies was not made at this time. • MPG made the payment of Rs620 million for settling of over due payments to MPSEB in accordance with the MOU between MPSEB and MPG in November 2001.
• Orders issued by MPG allowing MPSEB to disconnect all defaulting municipalities and other MPG bodies exceeding payables for more than the immediately preceding 1 month equivalent of sales. This order was reinforced by MPSERC in its first tariff award	• Order issued in June 2001. However, it was not implemented as intended and the receivables from municipalities increased after the settlement of dues as of March 2001 using the program loan proceeds. As of May 2002, the receivables had already increased to 2.1 times monthly sales.
2nd Tranche Release Conditionalities	• Energy audit meters numbering 7,795 had been installed and put into operation by July 2002. They represent over 85% of medium-voltage feeders.
• Installation of 7,500 33 kV and 11 kV feeders by MPSEB for undertaking energy audit at feeder level. • Establishment of board of directors of MPGenco and MPTransco including majority of experts recruited through open and transparent selection from outside government services, and representing the disciplines of finance, commerce, human resource, corporate planning, and information technology • Decision by MPG on reconfiguration of distribution based on, inter alia, the findings of the Energy Infrastructure Services Project (EISP) study, as mutually agreed upon by the Asian Development Bank (ADB) and MPG.	• Boards of directors established on 12 September 2002 with 8 directors for MPGenco and 6 directors for MPTCL. The directors were appointed in accordance with the recommendations of a selection committee, including 6 directors from outside the government service for MPGenco and 4 directors for MPTransco. • Decision made in accordance with the condition in June 2002 to split MPSEB's distribution unit into three franchises.
• MPG paid in cash Rs2.0 billion as partial	• This payment had been made by July 2002.

settlement of outstanding dues of municipalities and other local bodies due as of March 2001. • MPG submitted to the central government an approved debt restructuring plan that MPG and ADB agreed on.	• A debt restructuring plan was prepared by Canadian International Development Agency (CIDA) consultants. It required substantial fiscal transfer of around Rs10 billion per year during 2003–2005 before MPSEB could reach cash breakeven by 2006. The plan included restructuring of existing debts and transfer of outstanding liabilities to central utilities to MPG. However, MPG had not accepted that at the time of release of the second tranche.
• MPSEB submitted a second tariff application to MPSERC.	• MPSEB filed the second tariff in May 2002, a 48% increase for LT consumers and 4% increase for HT consumers, resulting in an overall increase of 24%.
3rd Tranche Release Conditions	• Three distribution companies were incorporated and registered on 16 July 2002.
• Incorporation and registration of new distribution companies under Indian Companies Act, 1956 • Finalization of transfer scheme	• An asset and liability transfer scheme was prepared with assistance from CIDA and DFID. An ADB technical assistance for developing a personnel transfer scheme was approved in October 2002. However, implementation of the transfer scheme of liabilities and staff took more than 3 years after the release of the third tranche.
• Transfer of MPSEB assets to MPGenco, MPTransco, and at least one of the newly incorporated distribution companies, in accordance with the transfer scheme(s)	• The transfer of assets to 5 successor companies was completed in July 2003.
• Filing of Third Tariff Application before MPSERC	• The third tariff application was submitted in July 2003.
• Payment of Rs2.423 billion by MGP for full settlement of outstanding electricity dues of municipalities and other local bodies as of March 2001	• This payment was made in July 2003.

Sources: Independent Evaluation Mission; ADB. 2001. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to India for the Madhya Pradesh Power Sector Development Program*. Manila; ADB. 2008. Completion Report.

COMPLIANCE WITH LOAN COVENANTS

	Covenant	Reference in Loan Documents	Status of Compliance
	Program Loan <u>Implementation Arrangements and Executing Agency</u>		
1.	(a) The State shall be responsible for the coordination and execution of the Program with the various concerned ministries and agencies of the State. (b) Without limiting the generality of the foregoing clause, the Energy Department and Finance Department of the State shall be the Program Executing Agencies and shall be responsible for implementation and monitoring of the Program.	Program Loan LA Schedule 5, clause 1 (a) Program Loan LA Schedule 5, clause 1 (b)	Complied with and the state had set up a steering committee chaired by the chief secretary of the state with principal secretaries for finance, power, law and planning as members to oversee the implementation of the reform program.
	<u>Loan Proceeds and Counterpart Funds</u>		
2.	The Borrower shall transfer the Counterpart Funds generated under the Loan, under the normal arrangements for transfer of external assistance to the State and shall treat such Counterpart Funds as additional to its transfers allocated annually to the State.	Program Loan LA Schedule 5, clause 2	Additional allocations had been made to Madhya Pradesh in fiscal years 2001/02, 2002/03, and 2003/04, respectively by the central government to cover the adjustment cost of reforms including the payment of outstanding electricity dues of municipalities.
3.	The Borrower shall ensure that the Counterpart Funds are used by the State to finance the adjustment costs associated with the Program, satisfactory to ADB for this purpose and shall, in particular, provide necessary budget appropriations in support of the financial	Program Loan LA Schedule 5, clause 3	During 2001–2003 the government of Madhya Pradesh (MPG) incurred (i) Rs7.42 billion for municipal dues, (ii) Rs350 million for rationalization of electricity dues, (iii) Rs620 million for set-off of cross-liabilities between Madhya Pradesh State Electricity Board

	Covenant	Reference in Loan Documents	Status of Compliance
	restructuring of MPSEB including (i) payment of outstanding municipality and other local and State Bodies' due owed to MPSEB; (ii) rationalization of electricity duty; (iii) set-offs on dues of market borrowing of MPSEB to the State; (iv) set-off cross liabilities between the State and MPSEB; and (v) reduction of debt obligation of MPSEB.		(MPSEB) and MPG, (iv) Rs6.75 billion for set-off on dues on market borrowings, and (v) Rs17.5 billion for reduction of debt obligations of MPSEB.
4.	Budgetary Allocations The Borrower shall cause the State to ensure that sufficient budgetary allocations are made in a timely manner for the efficient and timely implementation of the Program.	Program Loan LA Schedule 5 clause 4,	MPG had made budgetary allocations of Rs1.8 billion, Rs1.06 billion, and Rs1.25 billion in fiscal years 2001/02, 2002/03, and 2003/04, respectively, to the power sector. The debt restructuring of power sector liabilities implemented in 2005 was carried out through issuance of government bonds to the creditors to MPSEB in settlement of MPSEB liabilities. The servicing cost of these bonds is charged to the annual budget.
5.	Policy Actions The Borrower and the State shall ensure that all policies adopted and actions taken prior to the date of this Loan Agreement, as described in the Policy Letter and Policy Matrix, shall continue to be in effect for at least the duration of the Program.	Program Loan LA Schedule 5, clause 5	The supply of free electricity to single-point connection (below 25 kWh) residential consumers and agricultural consumers with less than 5 hp pumps was restricted to consumers belonging to scheduled caste (SC)/ scheduled tribes (ST) in 2001 as a prior action. As a result, large numbers of agricultural and residential consumers were disconnected in 2002. However, this was changed in 2003 when the government decided to reconnect the disconnected consumers and waive off the past areas, on the condition that they agree to have metered

	Covenant	Reference in Loan Documents	Status of Compliance
			connections. It was also decided to provide electricity to non SC/ST consumers below the poverty line at a discounted price and for MPG to bear the cost of subsidy. Set-off of arrears against free supply to agricultural consumers (during Jan 01 to Dec 03) was Rs5 billion in 2004-05 and Rs12.8 billion in 2005-06 (total-Rs17.8 billion).
6.	<u>Sector Reforms</u> The Borrower shall take timely steps in the resolution of issues relating to (i) the final allocation of assets and liabilities of MPSEB and the CSEB; (ii) the revenue collected by the CSEB for the period 1 December 2000 to 15 April 2001l and (iii) allocation of surplus power from the CSEB and central sector utilities to MPSEB.	Program Loan LA Schedule 5, clause 6	On 15. Nov 2000 the government of Chhattisgarh went ahead and created the Chhattisgarh State Electricity Board (CSEB). CSEB gained control of the assets, rights and revenues of Chhattisgarh region without accepting corresponding liabilities and ignoring the Government of India agreed-upon date of 14th April 2001 as the date for segregation (as per Government of India Order of 12th April 2001). Consequently, MPSEB was formed on 1st Jan 2001 Madhya Pradesh Electricity Board (MPEB) still exists with the undivided assets and liabilities. Audited and undisputed opening balances for the liabilities will be settled only after the settlement of the litigations pending in the Supreme Court of India.
7.	The State and MPSEB shall review with ADB the recommendations of the EISP study and other technical assistance, towards the restructuring of its power sector for its long-term administrative,	Program Loan LA Schedule 5, clause 7	The recommendations of the EISP-funded consultants were subsequently refined with the assistance of DFID-funded consultants and extensively discussed with ADB and other

	Covenant	Reference in Loan Documents	Status of Compliance
	financial, and economic viability, for implementation thereof and in a manner satisfactory to ADB.		stakeholders prior to implementation.
8.	The Borrower and the State shall assist in expediting issue of due permits and licenses for the effective functioning of the successor entities of MPSEB as required by law.	Program Loan LA Schedule 5, clause 8	Following the unbundling of MPSEB, five power sector companies were incorporated: Madhya Pradesh Power Generating Company Limited (Genco), Madhya Pradesh Power Transmission Company Limited (Transco), and three distribution companies (DISCOMs[2]). Genco has been vested with Madhya Pradesh's electricity generation assets and has taken over their operation. Transco has become the sole transmission company in the state. The three DISCOMs have taken over the distribution and supply activities in three geographic areas (east, central, and west). In June 2005, the companies started to operate independently. The formation of the Madhya Pradesh Power Trading Company Limited (Tradeco) for the bulk procurement of electricity from generators in order to sell to DISCOMs was announced in June 2006. All power purchase agreements for which MPSEB was the purchasing counterparty have been transferred to Tradeco.
9.	The State shall ensure that MPSEB, or its successor entities carry out meeting of all end consumers in the State, in a phased manner, for completion with four years from the Effective Date.	Program Loan LA Schedule 5, clause 9	Metering in 2006 for domestic consumers was 78%; this increased to 82% in 2009. For agricultural consumers, metering was 11%; this increased to 20% in 2009.
	<u>Transfer Scheme(s)</u>		
10.	(a) The State shall ensure that its power sector reforms and the preparation of the	Program Loan LA Schedule 5, clause	The employee transfer to the utilities was delayed due to the dispute over transfer of employees

	Covenant	Reference in Loan Documents	Status of Compliance
	Transfer Scheme(s) are undertaken with full information and participation of all stakeholders including but not limited to, consumers, utilities, employees and unions of MPSEB, and nongovernmental organizations. In doing so, the State shall also ensure that such participation includes information to stakeholders, procuring feedback on the same. (b) Recommendations of employees transfer under the Transfer Scheme(s) shall be in full participation and consultation of all affected, in accordance with the applicable laws and regulations of the Borrower State.	10	between MPSEB and Chatisgarh SEB, after the bifurcation of the state. After this issue has been resolved, the employees of MPSEB has been transferred to the respective companies vide state government order 30 November 2010.
11.	<u>Administrative Reforms</u> Within a period of fifteen months from the Effective Date, the State shall ensure that majority of the officers in the senior management of MPGenco, MPTransco, and one of the distribution companies, are recruited through open and competitive selection process by the board of directors of the respective companies.	Program Loan LA Schedule 5, clause 11	The chief managing directors (CMDs) for the distribution companies were appointed through an open competition by the selection committee as provided under the Electricity Reform.. The CMDs of Transco, Genco, and Tradeco are from MPSEB's technical cadre and the current CMDs of all three DISCOMs are from Indian Administration Service (IAS).. Most of the other senior staff members are from the erstwhile MPSEB.
12.	<u>Financial Reforms</u> The State shall make timely and adequate budgetary appropriations to meet its subsidy and subvertion payments so as to ensure that all dues are paid in cash to MPSEB and other utilities within not more than six (6) months of the raising	Program Loan LA Schedule 5, clause 12	

	Covenant	Reference in Loan Documents	Status of Compliance
	of the claim by MPSEB and other utilities.		
13.	(a) The State shall make timely and adequate budgetary appropriations to meet its rural electrification subsidy/subvention payments based on the MOU. (b) The State shall continue to make timely and adequate budgetary appropriations to meet MPSEB's balance of receivables (excluding past due till 31 August 2001) from municipalities and other local and State bodies/authorities so as not to exceed the immediately preceding one month's equivalent of sales at any time with effect from 1 January 2002.	Program Loan LA Schedule 5, clause 13	This has been complied with. There was a onetime settlement of municipal dues in 2002. However, since then the municipal dues have been accumulating in the balance sheets, with occasional set-offs against the receivables of MPG.
14.	<u>Program Implementation and Benefit Monitoring</u> (a) The State and MPSEB shall undertake together with ADB, periodic reviews during the program implementation, to evaluate the scope, implementation arrangements, progress and achievement of the objectives of the Program in accordance with ADB's Project Performance Management Systems Handbook. (b) For the purposes of clause (a) of this paragraph, MPSEB shall set up the Program Implementation and Benefit Monitoring Unit (BMU) within three months of Effective Date. Responsibilities of BMU shall additionally include monitoring of impact of the reforms under the Program	Program Loan LA Schedule 5, clause 14	This has been complied with as MPG cooperated with Asian Development Bank (ADB) review missions and provided all relevant information ADB required.

	Covenant	Reference in Loan Documents	Status of Compliance
	on end-consumers, particularly those below the poverty line. Using consulting services BMU will undertake an in-depth qualitative and quantitative assessment of the impacts of the Program on end-consumers.		
2.	**Project Loan** <u>Project Execution and Implementation</u> The Project Management Unit (PMU) established in May 2001 by MPSEB and headed by a senior MPSEB officer shall implement and supervise the project.		
3.	(a) MPSEB shall expand the staff strength of the PMU to correspond with the increased workload under the project. Except for exceptional organizational requirements, the staff assigned to the PMU shall be retained for the entire duration of the project implementation in the PMU and any vacancy in the PMU shall be filed before such vacancy is made effective. (b) The PMU shall be delegated the powers of decision making and accountability allowing MPSEB's field units to be directly responsible for supervision of Project Parts.		
	<u>Consulting services</u>		

	Covenant	Reference in Loan Documents	Status of Compliance
4.	MPSEB shall engage under its own financing, domestic consultants to (i) implement Part D of the project, within four months of Effective Date; and (ii) to carry out the Benefit Monitoring of the Project and the Program in accordance with paragraph 8 of this Schedule and paragraph 14 of the Program Loan Agreement.		(i) Consultants for Part D for benefit monitoring were appointed in May 2004 and they submitted the final report to MPSEB on April 2006.
15.	<u>Environmental Issues</u> (a) Within four months of Effective Date, MPSEB shall establish a fully functional social and environmental management cell to the satisfaction of ADB. (b) The State and MPSEB shall ensure that the Project is undertaken and al Project facilities operated and maintained, in compliance with all applicable laws, rules and regulations of the Borrower and the State, and the Environmental Assessment Requirements of ADB. All transformers and capacitors purchased under the Project shall be Poly-Chlorinated Biphenyls-free and this requirement shall be included in the bid documents. MPSEB shall ensure that all environmental clearances are obtained from the relevant statutory authorities of the Borrower, the State and all environmental mitigation measures set forth in the initial Environmental Examination is undertaken during Project Implementation. (c) MPSEB shall provide ADB annual reports on the monitoring results, permits, licenses		Within 2 months of loan effectiveness, MPSEB established the Social and Environmental Management Unit in May 2002. This unit has been adequately staffed. Complied with. The project file maintained by South Asia

	Covenant	Reference in Loan Documents	Status of Compliance
	and clearances obtained for the project. In case any violation of laws and standards cited, the report shall also include certification from the relevant authority that such violation has been cured or an acceptable plan for correction thereof has been approved.		Department (SARD) does not contain such an annual monitoring report.
6.	Land Acquisition MPSEB shall ensure that in case of any specific land acquisition under the project, the (i) Land Acquisition and Compensation Plan (where there is no settlement), and (ii) the Land Acquisition and Resettlement Framework (where there is resettlement), for the various subprojects as agreed upon with ADB, are implemented and due compensation is paid to those affected in accordance with ADB's Involuntary Resettlement Policy and ADB's Handbook on Resettlement, 1998 as amended from time to time.		The land acquisition and compensation framework was submitted in July 2002 to ADB. The same framework was used for land acquisition for the additional works approved in 2004.
7.	Progress Review ADB shall review the implementation and operation of the project based on the reports provided and meet with the Borrower, the State and MPSEB semi-annually to review the Project progress.		Complied with.
8.	Program Implementation and Benefit Monitoring (a) Without limiting the generality of paragraph 7 of this Schedule, the State		Complied with.

	Covenant	Reference in Loan Documents	Status of Compliance
	and MPSEB shall undertake together with ADB, periodic reviews during the project implementation, to evaluate the scope, implementation arrangements, progress and achievements of the objectives of the Project in accordance with ADB's Project Performance Management System Handbook. (b) For the purposes of clause (a) of this paragraph, MPSEB shall set up a Project Implementation and Benefit Monitoring Unit (BMU) within three months of Effective Date. Responsibilities of BMU shall additionally include monitoring of impact of the Project components on end-consumers, particularly those below the poverty line (the blue-card holders as issued by the State). Using consulting services BMU will undertake an in-depth qualitative and quantitative assessment of the impacts of the Project on end-consumers.		
9.	<u>Social Issues</u> The State and MPSEB shall allow all end-consumers below the poverty line (the blue card holders as issued by the State) to make their payments for electricity connection charges including up-front charges associated with electricity connections in twelve monthly installments.		The consumers are billed as per the regulatory guidelines on the supply code.
	<u>Assessments with successor entities of MPSEB</u>		

	Covenant	Reference in Loan Documents	Status of Compliance
	Owing to the functional segregation of the MPSEB under the Program, if at any time in the interest of proper implementation of the Project it is found necessary by ADB, the State and MPSEB, MPSEB shall transfer its rights obligations under this Loan Agreement and the Project Agreement to its successor entities as required, with prior approval of and on such terms, conditions and arrangements as acceptable to ADB, whereof such successor entities, shall be deemed to be substituted for MPSEB for the purpose of this Loan Agreement and Project Agreement.		Complied with.

Sources: Independent Evaluation Mission; ADB. 2001. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to India for the Madhya Pradesh Power Sector Development Program*. Manila; ADB. 2008. Completion Report.

EX POST ECONOMIC AND FINANCIAL ANALYSES

A. Economic Assessment

1. Ex-post economic and financial analyses were carried out for the project loan. The project loan consisted of six components, but economic analysis was undertaken only for component A (distribution improvement), component B (conversion of selected distribution feeders to 11 kV), and component C (transmission improvement). Component D (revenue management system) and component F (project implementation support) were not financed by ADB, and component E (installation of 3-phase meters) does not have identifiable economic benefits. Hence, these components were not included in the ex post economic and financial analyses.

1. Quantification of Economic Benefits

2. **Component A.** This component was designed to reduce bottlenecks and network constraints in the medium-voltage network caused by underinvestment in the previous decade. Component A (i) increased the capacity of the medium-voltage (33 kV and 11 kV) distribution network to cater to increasing consumer demand; (ii) improved the quality of the power supply by reducing feeder lengths to improve the voltage profile; and (iii) increased the number of substations, reduced the length of low-voltage (LV) lines, and reduced the technical losses in the distribution network. Although economic benefits occurred from project outcomes (i) and (ii), only the economic benefits attributable to (iii) are considered for ex post economic analysis as a conservative way of estimating the economic benefits. It was difficult to quantify the economic benefits associated with (ii) (improved quality of supply). The economic benefits associated with (i) (increased network capacity) were also not considered because increased network capacity alone would not result in economic benefits in the absence of a corresponding increase in generation and transmission capacity.

3. As ADB financing to expand the distribution network was combined with funding from the central government's Accelerated Power Development and Reform Program (APDRP) and both projects were implemented concurrently, it is difficult to attribute economic benefits (reduction in technical losses) to either the ADB-financed or APDRP-financed investments. Hence, the economic benefits (reduction in technical losses) attributable to overall investment in the distribution sector, for which ADB had financed a significant share, were considered for economic analysis. The pro rata share of these economic benefits based on the proportion of the overall investment in distribution financed by this project was used for computing the economic internal rate of return (EIRR).

4. For the purpose of ex post economic analysis, only the reduction in technical losses was considered (Table A6.1) because electricity sales lost due to commercial losses could still be utilized for useful economic activities. Although no precise data were available regarding the extent of technical losses as a proportion of total losses, it was conservatively assumed that the technical losses were 40% of the total distribution losses in 2002 and commercial losses in terms of gigawatt-hours (GWh) did not increase during 2002–2007. As the total energy consumption increased during 2002–2007, the implication is that the share of commercial losses as a proportion of total electricity sales decreased during that period.

5. It was further assumed that distribution losses as a percentage of energy inflow to the network increased in the absence of any investments at the same rate as the increase in the energy inflow to the network.

Table A6.1: Quantification of Technical Loss Reduction due to Component A

L	2002	2007
Total distribution losses (%) in Madhya Pradesh	38.6	32.1
Total energy inflow to distribution network (GWh)	27,083	35,148
Total distribution losses (GWh)	10,454	11,282
Commercial losses (60% of total distribution losses in 2002)	6,272	6,272
Technical losses (GWh)	4,182	5,010
Technical losses as % of electricity sales	15.44	14.25
Technical losses (%) in the absence of network investments	15.44	18.38
Technical losses in the absence of network investments (GWh)	4,182	6,460
Reduction in distribution losses (GWh)	1,450	
Total investment in distribution network, 2002–2007 (Rs million)		
- ADB-financed project	3,040	
- APDRP Project	1,307	
Technical loss reduction attributable to ADB-financed project (GWh)	1,014	

ADB = Asian Development Bank, ARDRP = Accelerated Power Development and Reform Program, GWh = gigawatt hour.
Source: Estimated of Independent Evaluation Mission.

6. **Component B.** Component B primarily aimed to reduce the commercial and technical losses associated with electricity distribution in rural areas by converting LV feeders and installing small distribution transformers for each agricultural consumer. The commercial losses (electricity theft) were virtually eliminated (Table A6.2) by preventing illegal connections to the LV network, and the technical losses were reduced because technical losses were lower in medium-voltage feeders than in LV feeders.

Table A6.2: Quantification of Technical Loss Reduction due to Component B

	2002	2007
Total distribution losses in feeders converted to HVDS (%)	55.0	15.0
Commercial losses (%)	33.0	2.0
Technical losses (%)	22.0	13.0
Energy sales of feeders converted to HVDS (GWh)	33.0	42.6
Energy losses due to technical losses (GWh)	9.3	6.4
Technical losses in the absence of HVDS (%)	22.0	28.3
Energy losses due to technical losses in the absence of HVDS (GWh)	9.3	16.0
Technical loss reduction attributable to the investment (GWh)	9.6	

GWH = gigawatt hour, HVDS = high voltage distribution system.
Source: Estimated of Independent Evaluation Mission.

7. **Component C.** This component was designed to expand the capacity of the transmission network by increasing the 400/220 kilovolt (kV), 220/132 kV, and 132/33 kV substations and increasing the coverage of the 220 kV and 132 kV networks. While these improvements improved the voltage profile, network stability. and availability, the quantifiable benefits were due to the reduction in transmission losses. The transmission losses as a percentage of energy inflow dropped from 7.93% in 2002 to 4.09% in 2007 (Table A6.3) It is estimated that without the transmission investments funded by ADB, the losses would have reached 11% by 2007.

Table A6.3: Quantification of Technical Loss Reduction due to Component C

	2002	2007
Transmission losses(%)	7.93	4.09
Transmission losses in the absence of investments (%)	7.9	11
Energy flow (GWh)	27,083	35,148
Transmission losses (GWh)	2,332	1,499
Transmission losses in the absence of investments (GWh)	2,332	3,905
Reduction in technical losses (GWh)	2,406	

GWh = gigawatt hour.
Source: Estimated of Independent Evaluation Mission.

8. It was also conservatively assumed that the reduction in transmission/distribution losses as a result of ADB-financed investments would be frozen at the levels achieved in 2007 for the rest of the lifetime of network investments, as any further increase in electricity flows would require additional investments to achieve further reduction in transmission/distribution losses.

2. Valuation of Economic Benefits

9. The reduction of distribution losses due to the ADB investments in the project results in economic benefits. Madhya Pradesh had been suffering from electricity shortages, and any electricity saved due to reduction in losses would have resulted in the reduction of unserved electricity. It is likely that part of the reduction in unserved energy would have resulted in nonincremental energy consumption to replace captive power generation by industries and the use of diesel generators by commercial consumers, as well as incremental energy consumption by industrial, commercial, as well as residential consumers due to increased availability of electricity and increased household connections due to the expanded distribution network.

10. As per ADB's guidelines for economic analysis, incremental benefits needed to be valued at the consumer's willingness to pay and the non-incremental benefits by replacement cost. The consumer's willingness to pay is likely to be much higher than the prevailing tariff as proven by several studies undertaken in India and elsewhere. The cost of generating electricity using captive power plants and small diesel generators is in the range of Rs10–12 per kWh and higher than the prevailing electricity tariffs. Hence, as a conservative measure, the economic benefits due to reduction in transmission and distribution losses were valued at the average electricity tariff of 2007 applicable to different consumer categories. As a further conservative measure, it was assumed that there would not be an increase in electricity tariff in real terms after 2007 and the tariff would remain constant in real terms. Table A6.4 shows the 2007 electricity tariffs for different consumer categories used for valuing the economic benefits.

Table A6.4: Average Electricity Tariffs and Energy Consumption of Various Consumer Categories

Consumer Category	Average Tariff (Rs/kWh)	Energy Consumption (GWh)	% of Consumption
Domestic	3.36	3,915	20.3
Agricultural	2.39	6,341	32.8
Low voltage Commercial/Industry	4.72	1,905	9.9
High-voltage industry	4.56	7,148	37.0

GWh = gigawatt hour, kWh = kilowatt hour.
Source: Estimated of Independent Evaluation Mission.

3. Economic Costs

11. Economic analysis was carried out using the world price numeraire. The economic costs were derived from the financial costs by deducting taxes and duties. The costs were separated into foreign exchange and local currency costs. Local costs were further separated and a specific conversion factor of 0.85 was used for unskilled labor. The remaining local costs were converted to border price level by applying a standard conversion factor of 0.9. Annual operating and maintenance costs were also calculated in economic prices as a percentage of the total capital investment cost. The financial cost in the project completion report (PCR) was used as the basis for deriving the economic cost of the project.

12. A summary of the economic analysis of the three project components is given in Table A6.5.

Table A6.5: Summary of the Economic Analysis of Three Project Components

	EIRR (%) at RRP	EIRR (%) at PCR	EIRR (%) at PPER
Component A : 33 kV and 11 kV network rehabilitation	29.3	23.6	46.6
Component B : Conversion of selected LV feeders to 11 kV	16.8	15.1	8.5
Component C : Reinforcing and augmenting 220 kV and 132 kV transmission system	25.3	24.0	48.0

EIRR = economic internal rate of return, PCR = project completion report, PPER = program performance evaluation report, kV = kilovolt, LV = low voltage, RRP = report and recommendation of the president.
Source: Estimated of Independent Evaluation Mission.

13. The recalculated EIRRs for components A and C in the project performance evaluation report (PPER) exceeded the estimates in the report and recommendation of the President (RRP) and the PCR. In the RRP and the PCR, a share (10%) of the incremental electricity sales was considered as attributable to the contribution from the reduction of distribution and transmission losses respectively. This approach is methodologically flawed

as it is not correct to apportion a share of incremental sales to technical loss reduction because there is no relationship between the share of incremental sales considered for economic benefits and the technical loss reduction brought about by the project investments. Due to the arbitrary nature of this approach, the incremental sales attributed to loss reduction are underestimated and result in lower EIRR estimates.

14. In the PPER, a more robust methodology for quantifying the reduction in technical losses with and without the project investments was used. The incremental sales were assumed equal to the technical loss reduction achieved.

B. Financial Assessment

15. For the financial assessment, a methodology consistent with the economic assessment was used. For components A and C, the incremental sales were assumed to arise from the reduction in technical losses as the investments funded by the project were not meant to reduce commercial losses. Hence, incremental sales attributable to ADB-financed investments were equal to the incremental electricity sales shown in Table A6.6. However, these incremental sales were valued at the net realized per unit of electricity injected to the transmission system as against the electricity tariff used in economic analysis.

16. For component B, however, conversion of rural LV feeders to 11 kV resulted in virtual elimination of commercial losses and significant reduction in technical losses. Hence, the financial losses arising from reduction in both commercial and technical losses were taken into account in the financial analysis of component B. 17.This is to account for the high degree of electricity losses and collection and billing inefficiencies because only a portion of electricity losses avoided resulted in financial revenues to MPSEB. The financial cost of capital expenditure is used for the financial analysis. Table A6.7 is a summary of the financial analysis.

Table A6.6: Quantification of Incremental Sales due to Component B

	2002	**2007**
Total distribution losses in the feeders converted to HVDS (%)	55	15
Energy sales of the feeders converted to HVDS (GWh)	33	42.6
Aggregate commercial and technical losses (GWh)	40.3	7.5
Incremental sales due to aggregate commercial and technical loss reduction (GWh)	32.8	

GWh = gigawatt hour, HVDS = high voltage distribution system.
Source: Estimated of Independent Evaluation Mission.

Table A6.7: Summary of Financial Analysis

	FIRR (%) at RRP	FIRR (%) at PCR	FIRR (%) at PPER
Component A : 33 kV and 11 kV network rehabilitation	15.5	14.5	32.8
Component B : Conversion of selected LV feeders to 11 kV	10.3	10.0	20.3
Component C: Reinforcing and augmenting 220 kV and 132 kV transmission system	23.8	11.1	36.6

FIRR = financial internal rate of return, kV = kilovolt, LV = low voltage, PCR = project completion report, PPER = program performance evaluation report.
Source: Estimated of Independent Evaluation Mission.

18. The financial internal rate of return (FIRR) was compared with the weighted average cost of capital (WACC) to ascertain the financial viability of the project. The project was financed by an ADB loan and domestic debt. The ADB loan was provided to MPSEB in the form of a local currency loan by the government of India at an interest rate of 10.6% and the domestic debt was raised at an interest rate of 11%. The computation of the WACC is shown in Table A6.8.

Table A6.8: Weighted Average Cost of Capital

	Amount (RS, million)	Interest Cost (%) before Tax	Interest Cost (%) after Tax	Weighted Interest Cost (%)
Asian Development Bank loan	5,689	10.6	7.4	6.12
Domestic commercial loan	1,190	11	7.7	1.33
Weighted average cost of capital				7.45

Source: Estimated of Independent Evaluation Mission.

19. The FIRR of components A and C were lower than the EIRR, but significantly exceeded the WACC and can be considered financially viable. The FIRR was lower than the EIRR because a certain proportion of the incremental electricity sales arising from technical loss reduction attributable to project-financed investments did not translate into electricity sales because there was a high degree of commercial losses. However, the FIRR for component B exceeded the EIRR because financial benefits resulting from reduction in both commercial and technical losses after converting LV feeders to 11 kV feeders exceeded the economic benefits where only the technical loss reduction was considered. It can be deduced that component B had higher financial than societal benefits to the utility as it reduced electricity theft and pilferage, and components A and C had lower financial than economic benefits because of the prevalence of electricity theft.