

**REPORT AND RECOMMENDATION  
OF THE  
PRESIDENT  
TO THE  
BOARD OF DIRECTORS  
ON A  
PROPOSED LOAN  
TO THE  
KINGDOM OF CAMBODIA  
FOR THE  
GREATER MEKONG SUBREGION TRANSMISSION PROJECT**

**November 2003**

## CURRENCY EQUIVALENTS

(as of 30 September 2003)

Currency Unit	–	riel (KR)
KR1.00	=	\$0.00025
\$1.00	=	KR4,000

## ABBREVIATIONS

ADB	–	Asian Development Bank
EAC	–	Electricity Authority of Cambodia
EDC	–	Electricité du Cambodge
EIRR	–	economic internal rate of return
EVN	–	Electricity of Viet Nam
FIRR	–	financial internal rate of return
FY	–	fiscal year
GDP	–	gross domestic product
GMS	–	Greater Mekong Subregion
IPP	–	independent power producer
MEF	–	Ministry of Economy and Finance
MIME	–	Ministry of Industry, Mines, and Energy
MV	–	medium-voltage
NDF	–	Nordic Development Fund
NPV	–	net present value
O&M	–	operation and maintenance
PIC	–	project implementation consultant
PPA	–	power purchase agreement
REE	–	rural electricity enterprise
SDR	–	special drawing rights
VAT	–	value-added tax
WACC	–	weighted average cost of capital

## WEIGHTS AND MEASURES

GWh	–	gigawatt-hour
km	–	Kilometer
kV	–	kilovolt (1,000 volts)
kWh	–	kilowatt-hour (the energy of 1 kW of capacity operating for 1 hour)
MW	–	megawatt (1,000,000 watts)

## NOTES

- (i) The fiscal year (FY) of the Government ends on 31 December.
- (ii) In this report, "\$" refers to US dollars.

This report was prepared by a team consisting of M. Bristol, team leader; M. Huddleston, C. Litwin, D. Purka, R. Thami, and S.L. Tu.
--

## CONTENTS

	Page
LOAN AND PROJECT SUMMARY	ii
MAP	vii
I. THE PROPOSAL	1
II. RATIONALE: SECTOR PERFORMANCE, PROBLEMS, AND OPPORTUNITIES	1
A. Performance Indicators and Analysis	1
B. Analysis of Key Problems and Opportunities	3
III. THE PROPOSED PROJECT	6
A. Objectives	6
B. Components and Outputs	7
C. Special Features	9
D. Cost Estimates	10
E. Financing Plan	10
F. Implementation Arrangements	11
IV. PROJECT BENEFITS, IMPACTS, AND RISKS	14
V. ASSURANCES	18
A. Specific Assurances	18
B. Conditions for Loan Effectiveness	20
VI. RECOMMENDATION	20
APPENDIXES	
1. Project Framework	21
2. Sector/Subsector Analysis	23
3. External Assistance to the Electricity Sector	25
4. Electricité du Cambodge Financial Performance Projections	26
5. Cost Estimates and Financing Plan	31
6. Implementation Schedule, 2003–2008	32
7. Contract Packages	33
8. Financial Analysis	34
9. Economic Analysis	38
10. Summary Poverty Reduction and Social Strategy	43
11. Summary Resettlement Plan	47
SUPPLEMENTARY APPENDIXES (available on request)	
A. Terms of Reference for Consultants	
B. Resettlement Plan	
C. Summary Initial Environmental Examination	
D. Electricité du Cambodge's Generation Expansion Plan, 2005–2020	
E. Projections of EDC Financial Statements	
F. Financial Management Assessment of EDC	
G. Financial Analysis Supplement	
H. Economic Analysis: Transmission Line Component	
I. Economic Analysis: Bulk Distribution Component	

## LOAN AND PROJECT SUMMARY

<b>Borrower</b>	Kingdom of Cambodia
<b>Classification</b>	Poverty classification: Other Thematic: Economic growth, private sector development, and regional cooperation.
<b>Environment Assessment</b>	Category B. An initial environmental examination was undertaken.
<b>Project Description</b>	<p>Cooperation in the electric power sector has been an important feature of the Greater Mekong Subregion (GMS) program initiated by the Asian Development Bank (ADB) in 1992. The extension of trade in power between the GMS countries has been a primary objective of the Electric Power Forum and the Experts Group on Power Interconnection and Trade. Through these bodies, a master plan for interconnection between the GMS countries was devised that will lead to cost savings, security of supply, and environmental benefits. The Project, which consists of the installation of a 200-megawatt capacity transmission line from the Vietnamese border to Phnom Penh, will be the first component of the master plan to be implemented. Benefits will accrue to both countries: Cambodia will be assured of a more reliable, lower-cost supply of electricity than from any feasible alternative, and Viet Nam will accelerate the electrification of a remote region. During the initial years of the Project, Electricité du Cambodge (EDC) will be able to meet up to 60% of the demand for electricity in greater Phnom Penh via the transmission line with a significant reduction in its cost structure. In the medium term, the Project will improve EDC's financial viability, reduce pressure on tariffs, and help Cambodian industry to become competitive.</p> <p>A bulk supply distribution component will provide reliable medium-voltage supplies to villages along the transmission line route and encourage small private operators to invest in, and operate, connections to rural end-consumers. Private rural electricity enterprises have proved to be key to rural electrification. Assistance under this component will help them operate in the new, regulated environment.</p>
<b>Rationale</b>	<p>The high cost of electricity is one of the key obstacles to economic growth in Cambodia. EDC therefore needs an additional source of power at lower cost, such as imports from Viet Nam via a transmission line. This will initiate a virtuous cycle of lower costs that will allow EDC to become financially viable and to invest so as to meet growing demand. The transmission line, which will be funded under the loan, will reduce pressure to increase tariffs to achieve a reliable electricity supply, thereby encouraging companies that currently operate their own generators to switch to</p>

EDC's system. As demand grows, EDC will be able to generate power (or purchase power from independent power producers) using larger, more efficient generating units, and will eventually be able to reduce tariffs to levels that are competitive in the region. The Project will promote sustainable long-term growth for Cambodia and will build on the results of policy dialogue between the Government, ADB, and the World Bank on reducing barriers that are preventing the poor from connecting to a modern energy supply. EDC will introduce a lower-cost connection suitable for low-consumption customers, prepare user-friendly bills, and improve customer services.

The bulk supply distribution component will connect rural poor communities along the transmission line that may be affected by the construction. This component will substantially lower energy costs for rural households and bring direct benefits to the poor.

## Objectives

To stimulate trade and economic growth in the subregion by promoting the provision of sustainable and reliable electricity at affordable prices to consumers in Cambodia.

To promote socioeconomic development and poverty reduction in Cambodia by enhancing accessibility to electricity on the part of the poor by continuing to reduce the high up-front connection costs.

## Cost Estimates

The Project is estimated to cost \$95.0 million equivalent, comprising \$58.5 million in foreign exchange costs and \$36.5 million equivalent in domestic currency costs.

## Financing Plan

The proposed ADB loan of up to \$44.3 million equivalent will finance 46% of the total project cost, including \$8.8 million equivalent of the local currency cost. The World Bank will provide parallel cofinancing of \$16.0 million as part of its proposed Rural Electrification and Transmission Project and the Nordic Development Fund (NDF) will provide €10 million.

<b>Source of Funds</b>	<b>Foreign Currency</b> (\$ million)	<b>Local Currency</b> (\$ million)	<b>Total</b> (\$ million)
Asian Development Bank	35.5	8.8	44.3
World Bank	12.5	3.5	16.0
Nordic Development Fund	10.5	0.5	11.0
Government Counterpart Funds	0.0	23.7	23.7
<b>Total</b>	<b>58.5</b>	<b>36.5</b>	<b>95.0</b>

Source: Asian Development Bank staff.

## Loan Amount and Terms

ADB will provide a loan of up to SDR30.94 million (equivalent to \$44.3 million) from its Special Funds resources, on standard terms.

<b>Allocation and Relending Terms</b>	The borrower will relend the proceeds of the loan (except for \$300,000, which will be provided to EDC and the Electricity Authority of Cambodia as a grant) to the executing agency for a 20-year term, including a 5-year grace period, at an interest rate of 4.2%. The executing agency will bear the exchange risk on the relent amount.
<b>Period of Utilization</b>	Until 31 December 2008
<b>Estimated Project Completion Date</b>	30 June 2008
<b>Executing Agency</b>	Electricité du Cambodge
<b>Implementation Arrangements</b>	EDC will set up two project management units to separately implement the work funded by (i) ADB and NDF, and (ii) the World Bank. The director of the Corporate Planning and Projects Department will head both units, and both will have similar personnel structures.
<b>Procurement</b>	All procurement financed by ADB will be undertaken in accordance with ADB's <i>Guidelines for Procurement</i> . The major works for the ADB-financed portion of the Project will be procured from prequalified contractors for (i) a turnkey contract for the transmission line, and (ii) a turnkey contract for the substations at Takeo and west Phnom Penh. Procurement for project components financed by the World Bank and NDF will be made under their respective procurement guidelines.
<b>Consulting Services</b>	EDC will recruit and supervise the project implementation consultants (PICs) and all other consultants in accordance with ADB's <i>Guidelines on the Use of Consultants</i> and other arrangements satisfactory to ADB for the engagement of domestic consultants. The PICs will (i) prepare preliminary designs and documents to prequalify the bidders and for the bidding of the works, (ii) assist with evaluations, (iii) supervise construction, (iv) organize implementation of the resettlement plan, (v) recruit the independent resettlement monitoring organization, and (vi) undertake project performance monitoring and evaluation. The ADB-funded PICs will also handle the NDF-funded equipment. A total of 60 person-months of international and 60 person-months of domestic consultants will be required. In addition, 30 person-months of individual consulting services will be required for capacity building. The World Bank will engage consultants to implement its components of the Project using its own procedures.

**Project Benefits and Beneficiaries**

The economic net present value of the transmission line component is estimated to be \$201.3 million to Cambodia and about \$17.9 million to Viet Nam. Key beneficiaries in Cambodia include EDC, EDC's consumers in greater Phnom Penh, and indirectly the population at large through economic growth. In addition, the bulk supply component will provide electricity to about 14,200 households in Takeo Province. About 5,700 of these households are below the poverty line. Overall, the Project will provide a net economic benefit of about \$31.2 million to the poor in Cambodia.

**Risks and Assumptions**

Evaluation of key risks to the transmission line related to construction delays and increased costs, lower than expected demand for or availability of supply, or increased import price of electricity, demonstrated that the Project is economically and financially robust. The Vietnamese authorities have given an assurance that the linking transmission project in Viet Nam, funded by World Bank, will be completed ahead of this Project.

The viability of the bulk supply component depends on the assumed connection rate being attained, which in turn depends on sufficient numbers of private operators investing in the connection to individual households. The Project has a component to help potential small operators avail themselves of financial support and secure licenses, but if this does not succeed, this component can be scaled back with implementation commencing with the potentially most profitable areas close to Phnom Penh and Takeo.





## **I. THE PROPOSAL**

1. I submit for your approval the following report and recommendation on a proposed loan to the Kingdom of Cambodia for the Greater Mekong Subregion (GMS) Transmission Project. The project proposal is included in the country strategy and program update (2003–2005). The project framework is in Appendix 1.

## **II. RATIONALE: SECTOR PERFORMANCE, PROBLEMS, AND OPPORTUNITIES**

### **A. Performance Indicators and Analysis**

2. The Asian Development Bank (ADB) has played a leading role in GMS cooperation in the electric power sector as part of its program for economic cooperation in the GMS that ADB initiated in 1992. ADB assisted with the formation of the Electric Power Forum and the Experts Group on Power Interconnection and Trade and continues to support their activities. ADB is currently providing technical assistance to develop a regional power trade operating agreement. This agreement will contain rules and guidelines for technical coordination among GMS members, cross-border transmission pricing schemes, and specify the required institutional framework for advancing trade in power in the subregion under the Intergovernmental Agreement on Regional Power Trade in the GMS.<sup>1</sup>

3. Subregional electricity trade based on interconnected electric power networks will provide significant economic and environmental benefits for individual countries and for the entire subregion. Such trade will enable GMS members to (i) reduce national investments in power reserves maintained to meet peak demand, (ii) provide a more reliable supply of electricity, (iii) reduce operating costs, (iv) lower emissions of greenhouse gases and other pollutants, and (v) increase consumers' access to the cheapest sources of electricity in the subregion (Appendix 2).

4. In anticipation of the development of a policy framework for promoting trade in power in the region, starting in October 2000 and with ADB assistance, the regional indicative master plan on power interconnection in the GMS was developed to identify the physical power interconnections needed in the subregion up to 2020.<sup>2</sup> Of the identified power transmission interconnections needed, the interconnection between Cambodia and Viet Nam was programmed for 2003.

5. The electricity supply in Cambodia is currently fragmented and varies significantly across the country. Cambodia does not have a transmission grid, so systems, where they exist, are operated independently. Three main types of electricity supply are in operation: (i) the greater Phnom Penh system, (ii) the systems for provincial capitals and some other major towns, and (iii) the provisions for the rest of the country. Phnom Penh has a fully developed, reticulated system supplied by Electricité du Cambodge (EDC), which was established by royal decree in March 1996 as a result of dialogue with ADB and other development agencies. EDC is a limited liability company owned jointly by the Ministry of Industry, Mines, and Energy (MIME) and the Ministry of Economy and Finance (MEF). It has its own board of directors and operates with considerable independence except in the field of tariff setting. Its charter empowers EDC to

---

<sup>1</sup> All six members of the GMS signed the Intergovernmental Agreement on Regional Power Trade in the GMS at the First GMS Summit meeting on 3 November 2002.

<sup>2</sup> ADB. 2000. *Technical Assistance for Preparing the Regional Indicative Master Plan on Power Interconnection in the GMS*. Manila (TA No. 5920-REG, for \$630,000, approved on 10 July 2000).

provide a nonexclusive, full electricity service for the whole country. EDC supplies Phnom Penh from its own generators and from purchases from independent power producers (IPPs) located in the city suburbs. A 115-kilovolt (kV) transmission main distributes power between three substations, from where medium-voltage networks and low-voltage connections supply power to consumers throughout most of the city. Over the last decade the system has been gradually refurbished and expanded, and now provides a reasonably reliable service to its customers but at an average tariff of KR589/kilowatt-hour (kWh) (\$0.15/kWh).

6. EDC's high tariff results from the small size of the system and the rapid growth (in percentage terms) in demand in recent years. EDC owns and operates small, less than 5 megawatt (MW), generating units fueled by expensive light diesel or, more recently, by heavy fuel oil, which carries less tax and results in a 40% overall cost saving. The small demand and the small additional units required to meet incremental demand prevent EDC from realizing the economies of scale that larger generating units might obtain. EDC purchases more than 50% of its energy requirements from IPPs at a cost of \$0.11 to \$0.13/kWh, and also buys a small amount of energy from the private Kirirom hydroelectric plant at \$0.07/kWh. In addition, EDC incurs the costs associated with operating a utility, including technical and nontechnical losses of about 14%.

7. Until recently, the electricity systems in all provincial towns were operated by MIME's department offices. In most towns, the department offices owned the low-voltage distribution systems (they do not have any medium-voltage systems), and originally also owned the diesel-fueled generating sets. In some locations, IPPs have expanded low-voltage coverage and even operate the entire system; however, these systems are generally inadequate, unsafe, and expensive with an average tariff of KR2,100/kWh (\$0.53/kWh). The exceptions are where EDC has taken control of the systems and rehabilitated them using grants and concessional loans. Until recently, EDC only operated the systems in Phnom Penh and the urban areas of Kandal, Kompong Cham, Siem Reap, and Sihanoukville. During 2000, it took over the operations in Takeo and Battambang. In these EDC operated areas, the systems are safe, are more reliable, and provide 24-hour per day service, but the tariffs are higher than in Phnom Penh and range from KR800/kWh to KR1,200/kWh (\$0.20/kWh to \$0.30/kWh).

8. The availability of electricity away from the central areas of the provincial towns is erratic. Rural electricity enterprises (REEs) serve small towns and some villages.<sup>3</sup> These are private entrepreneurs who have set up small, usually second-hand, petrol- or diesel-fueled generating sets, which supply up to a few hundred local residents and small commercial establishments. Estimates indicate that Cambodia has 600 REEs, although comprehensive data are not available. Many REEs provide a service to re-charge automotive batteries, which residents beyond the reach of wired systems use to supply domestic electricity. The cost of energy from batteries is generally more than \$1/kWh. Where no REE service is provided, the more prosperous residents and entrepreneurs have their own small petrol generators. Statistics on connection rates are unreliable, but officially the national electricity ratio (i.e., the proportion of households connected to a wired supply) is estimated to be about 15%. Currently REEs operate under difficult business conditions, with limited access to capital and an uncertain regulatory environment that results in tariffs that are higher than EDC's provincial tariffs. This means that many poor consumers find the costs of electricity to be beyond their reach. This constrains demand, with consequent implications for rural development and poverty reduction. Details of external assistance to the electricity sector are in Appendix 3.

---

<sup>3</sup> REEs include small private providers in urban areas.

9. MIME's Energy General Directorate is responsible for coordinating electricity sector policy and planning. To implement policy as it relates to the power sector, in January 1999 MIME published its power sector strategy for the period up to 2016 and updated the strategy in 2000. In 2001, the Government promulgated the new Electricity Law of Cambodia, which defines the management and regulation of activities in relation to the supply and consumption of electricity. One of the main purposes of the law was to establish the Electricity Authority of Cambodia (EAC) as an autonomous public agency to regulate electricity service and to govern the relationship between the delivery, receipt, and use of electricity. The law stipulates that it is EAC's responsibility to set tariffs to ensure that consumers will benefit from the proposed lower costs of supply and will be protected from monopolistic pricing.

## **B. Analysis of Key Problems and Opportunities**

10. Economic growth will only be sustained if Cambodia's industry becomes more competitive. The high cost of electricity has been identified by the Government as a barrier to increased competitiveness. From a national perspective, the electricity sector suffers from several basic deficiencies, namely: (i) the high tariffs for all consumers regardless of supplier; (ii) the limited extent of wired system coverage; and (iii) the high up-front costs for new consumers, which particularly affect the poor.

11. In spite of its high tariffs, EDC's financial performance has been weak, mostly because of the persistent nonpayment of electricity bills by the Government and the Government's inaction on adjusting tariffs to a level that would permit EDC to meet its annual revenue requirements. EDC has not recorded a net profit in the past nine years and has accumulated losses of KR113 billion (\$28.3 million equivalent) during this period.

12. EDC's growing accounts receivable are a source of concern, as they reduce EDC's cash flow and its ability to cover its operational expenses, notably, fuel and power purchases. As of the end of July 2003, total accounts receivable, including current bills, amounted to approximately KR98 billion (\$24.5 million), of which Government and municipal accounts receivable accounted for 70%, equivalent to 4.9 months of average sales, well above ADB's loan covenant of 3 months of average sales. For the past 2 years, EDC has been forced to borrow from commercial banks to finance its fuel and power purchase expenses. This process of using high-cost commercial debt to finance operational expenses is not financially sustainable.

13. A similar accumulation of arrears occurred in 1999–2000. At that time, the Government committed in the Loan Agreement to (i) require ministries to establish individual contracts with EDC, (ii) have MEF make direct payments to EDC for the ministries' electricity bills, and (iii) have EDC cut off defaulting ministries to prevent the accumulation of large arrears by ministries and ensure timely and regular payments to EDC. However, these measures were insufficient to ensure payment, as (i) the budget allocation to ministries has been insufficient to cover their costs, (ii) the ministries used their electricity allocations for other expenditures, and (iii) the Treasury did not disburse funds in a timely manner even when bills were approved and funds were available. Nevertheless, the measures have reduced the number of ministries and municipalities that are in arrears and the total level of Government arrears.

14. As ADB requested, the Government has submitted a time-bound action plan to address these issues. The action plan outlines steps to be taken by various Government agencies (MEF, MIME, EAC, and EDC) to improve EDC's financial position. The plan includes the following remedies: (i) offsetting KR48.6 billion of Government and municipal arrears against EDC

liabilities, and as of 2004, increasing line ministries' budget allocations (which cannot be used for other expenditures) to enable them to pay for their electricity consumption; (ii) having MEF refund EDC KR40.3 billion of VAT paid for inputs, and subsidizing EDC for future VAT assessments until the VAT law can be changed; (iii) having EAC agree to examine the structure and levels of EDC's tariffs and to consider an automatic adjustment mechanism to reflect changes in the costs of fuel and foreign exchange; and (iv) reducing operating costs by having EDC procure its fuel supply competitively, improve the merit dispatch order of generation stations, convert an existing generation unit to heavy fuel oil, rationalize its 5-year staffing plan, and attempt to renegotiate PPAs with existing IPPs once new supply is commissioned in early 2005. These combined measures should improve EDC's overall financial position and reduce its accounts receivable to below the covenanted level of 3 months. EDC has agreed to submit quarterly progress reports on its collections, and should receivables begin to increase, ADB, EDC, and MEF will review the payment mechanism.

15. Another factor contributing to high tariffs is that the cost of electricity from existing IPPs is higher than EDC's own generating costs. The 2001 Electricity Law requires that private sector participation should result from transparent, competitive processes; however as a private power policy is still in a draft stage, competition is not mandatory at this time so the IPP contracts were not awarded as a result of competitive bidding. Whether the contracts entered into are the most advantageous arrangement for EDC is therefore not clear. Some concerns have arisen that the Government may enter into contracts for new supplies that would conflict with the optimum use of the project transmission line. Therefore, as a result of policy dialogue, the Government has given an assurance that it will not enter into any new IPP contracts for supplies that are not included in the current least-cost plan for generation expansion without discussion with ADB.

16. EDC's contract with a new IPP that will take effect in 2005 will help reduce its average cost of generation in the short term and overcome some supply constraints.<sup>4</sup> Therefore EDC will be able to continue to increase electricity sales in 2004–2006. This will reduce some of the financial pressure on tariffs and help EDC meet its operating expenses in the short term. Financial analysis has determined that EDC's existing tariffs are sufficient to ensure that its consolidated revenues meet its operating expenses during this period. Its revenues are also sufficient to meet minimum debt-service coverage ratios. However, EDC will continue to sustain net losses because of interest expenses and taxes until the transmission line has been commissioned and supply is sufficient to facilitate sales growth. Appendix 4 provides details about EDC's financial performance and projections.

17. EDC needs additional sources of supply at lower cost, such as imports from Viet Nam via a transmission line. This will initiate a virtuous cycle of lower costs that will allow EDC to become financially viable and enable it to invest to meet growing demand, thereby reducing the pressure to increase tariffs to achieve a reliable electricity supply and encouraging companies that currently operate their own generators to switch to EDC's system. Thus as demand grows, EDC will be able to generate power from larger, more efficient generating units or purchase power from IPPs, and will eventually be able to reduce tariffs to a level that is competitive in the region.

---

<sup>4</sup> EDC has signed an 18-year PPA with Khmer Electric Power Corp. for a supply of 32 MW capacity at an average cost of 8.1 cents/kWh.

18. The limited coverage of a wired supply is being addressed by ADB's on-going loan<sup>5</sup> to rehabilitate the electricity systems in eight provincial towns and a follow-up project in the pipeline for 2005<sup>6</sup> to rehabilitate and expand the systems in the remaining provincial towns. The World Bank is taking the lead in rural electrification under a component of this project credit that will set up a rural electrification fund to subsidize construction costs for REEs. ADB will contribute to rural electrification through the bulk supply distribution component of this Project, which focuses on villages along the transmission line route. The Project includes capacity building to encourage REEs to invest in connections to end-consumers using the rural electrification fund. The Government has acknowledged that REEs are essential for widespread rural electrification.

19. The level of up-front costs is at least as important a factor as tariff levels in preventing the poor from accessing electricity supply even when it is available, therefore the Government has reached agreement with EDC to reduce connection costs. As a result of policy dialogue, EDC has agreed to introduce a lower capacity, cheaper meter for new, low-consumption customers. Further assessment of up-front costs will be conducted under the Project. Assistance will also be provided to EDC to make its bills more consumer-friendly.

20. As early as 1999, MIME was aware that a low-cost, indigenous source of generation could not be economically developed in the short term. Therefore the Government entered into a power trade agreement with Viet Nam, under which EDC and Electricity of Vietnam (EVN) would construct a new high-voltage transmission line linking the two countries, and EDC would purchase a maximum of 80 MW of power commencing in 2003, increasing to 200 MW in 2008. The terms and conditions were incorporated into a power purchase agreement (PPA) signed in 2000. The agreement will provide EDC with access to electricity at well below the cost of EDC's own generation or purchase from existing IPPs. Implementation of the agreement was delayed pending Cambodia's ability to secure financing. At the request of the Government of Cambodia, ADB approved project preparatory technical assistance for the Project.<sup>7</sup> The transmission line will also benefit Viet Nam, because the assured exports to Cambodia will justify construction of the 90-kilometer (km) line on the Vietnamese side of the border and help accelerate the electrification of the remote southwest area of the country.

21. People living close to transmission lines are often adversely affected, yet receive no benefits. Impacts occur during construction because of an influx of traffic and construction workers, and long-lasting impacts are visual and a change in the physical environment compared with the before project situation. These impacts may lead, if not to outright opposition to the line, at least to resentment that no benefits flow to those affected. The Project is addressing this concern by means of the bulk supply distribution component. Since the on-going loan (footnote 5) was processed, in 2000, the number of REEs providing a simple electricity supply has increased in both rural and urban areas. Under the Project, positive action is being taken to encourage participation by REEs along the transmission line route by EDC providing them with a reasonably priced, reliable supply to sell to end-consumers.

---

<sup>5</sup> ADB. 2000. *Report and Recommendation to the President to the Board of Directors on a Proposed Loan to the Kingdom of Cambodia for the Provincial Power Supply Project*. Manila (Loan 1794-CAM(SF), for \$18.6 million, approved by the Board on 5 December 2000).

<sup>6</sup> Second Power Distribution Project for \$26 million

<sup>7</sup> ADB. 2003. *Technical Assistance to the Kingdom of Cambodia for the Power Distribution and Greater Mekong Subregion Transmission Project*. Manila (TA No. 4078-CAM, for \$730,000, approved on 10 January 2003).

22. The Government's Second Socioeconomic Development Plan 2001–2005 targets (i) economic growth for poverty reduction, (ii) development of the private sector, and (iii) good governance. This is supported by the national poverty reduction strategy (2003–2005). The country strategy and program update identifies three priority areas for ADB support, namely rural economic development, human resources development, and private sector development. The proposed project is fully consistent with ADB's and the Government's strategy for the sector and with ADB's subregional strategy.

23. Previous projects in the power sector in Cambodia have required minimal resettlement. However, on a number of road projects, poorly implemented resettlement plans have led to significant delays and hardships for the very people who should have benefited from the development interventions. Furthermore, the monitoring of resettlement implementation has been inadequate to address these deficiencies, thus the Project has been designed to ensure that the significant resettlement required will be implemented in accordance with the resettlement plan. The project implementation consultants (PICs) will include international and domestic specialists who will coordinate implementation of the resettlement plan and will hire and supervise the independent monitoring organization. A separate technical assistance project is in the pipeline for 2004 to develop a national resettlement policy, a decree, and technical guidelines as well as to provide capacity building.<sup>8</sup>

### **III. THE PROPOSED PROJECT**

#### **A. Objectives**

24. The first of the Project's two objectives is to promote the provision of sustainable and reliable electricity at affordable prices to consumers in Phnom Penh and along the transmission corridor. This will be achieved by facilitating the importation of up to 1,490 gigawatt-hours (GWh) of electricity per year by constructing a 200 MW capacity high-voltage transmission line from the Vietnamese border to Phnom Penh. The border price will average \$0.06/kWh (or a delivered price to the medium-voltage system in Phnom Penh of \$0.078/kWh, which includes losses, operation and maintenance, and all taxes). This will provide urgently needed additional reliable capacity. This facility will provide a sustainable and reliable electricity supply at a lower cost than any alternative, will improve EDC's financial position, and will eventually ease pressure for tariff increases. Electricity will also be supplied to Takeo township and to rural villages and communities close to the proposed transmission line that are currently not serviced.

25. The second purpose is to enhance accessibility to power by the poor by promoting a pro-poor policy environment in the sector. This will be achieved through a number of capacity building components. Currently the lowest capacity connection and meter in Phnom Penh is 10 amperes, which is well in excess of the requirements of poor households. EDC has committed to making a lower-cost, 5-ampere connection available to low-use customers in Phnom Penh, and EDC is willing to allow customers to amortize the connection costs over a 10-month period as it has in the provinces.

---

<sup>8</sup> *Enhancing the Resettlement Legal Framework and Capacity Building* for \$400,000.

## **B. Components and Outputs**

### **1. Infrastructure Component**

26. The project area consists of the provinces of Takeo and Kampong Speu and the municipality of Phnom Penh. The Project will link to a similar project in Viet Nam to allow the importation of power from Viet Nam. The proposed route for the transmission line is on the Bassac River floodplain, which forms part of the Mekong lowlands. The entire route is flat, and seasonal flooding occurs over an estimated 60% of the route, with flood levels up to 3.5 meters at the southern end. The project area has a monsoon-dominant climate, with one distinct wet and dry season each year. The route traverses a total of 15 districts, 37 communes, and 120 villages. Settlements are characterized by villages of 50 to 250 households located on land marginally higher than surrounding paddy fields, either on an isolated feature or along roadsides. Takeo, with a (population of 39,000, is the only large township within the vicinity of the route, excluding Phnom Penh. Approximately 95% (365 hectares) of the right-of-way is privately owned land, but few landholders actually hold any form of land title because of Cambodia's recent history. The average rural landholding size is 0.4 hectare, with most holdings consisting of a house block and paddy area.

27. The infrastructure component of the Project will consist of a high-voltage transmission system comprising a 220 kV double-circuit transmission line connecting to 115 kV lines that will provide the final connection into Phnom Penh. The 109 km of 220 kV transmission line will generally run in a southerly direction from Phnom Penh to the border, within 250 meters of the Phnom Penh-Kampot railway line to Takeo for 59 km and within 2 km of national road number 2 from Takeo to the border for 50 km. Substations will be constructed at west Phnom Penh (connection of the 220 kV line to the 115 kV line) and at Takeo. The substations will provide a 22 kV supply to the surround areas and to villages along the transmission line route.

28. The double-circuit 220 kV transmission line will comprise conductors hung from self-supporting steel lattice towers designed to allow for the periodic flooding prevalent along the proposed route. The towers are likely to be between 34 and 40 meters high with an average span of around 350 meters. The conductors will be selected to provide each circuit with a capacity of 200 MW between the Vietnamese border and Takeo and of 400 MW between Takeo and Phnom Penh to allow for the eventual connection to Kampot. The two double-circuit 115 kV lines will comprise conductors of the same type used on the existing transmission line between substations GS1 and GS2. Poles will be around 21 meters high and spaced 220 meters apart, on average. Connection to the grid will include stringing a second circuit onto the existing 115 kV towers around Phnom Penh.

29. The project transmission line will link to a new substation at Chau Doc on the Vietnamese side of the border and then, via a 90 km, 220 kV transmission line, to the existing substation at Thot Not. The World Bank will finance the line and the Chau Doc substation through funds reallocated from an existing International Development Association credit.<sup>9</sup> These Vietnamese facilities are scheduled for completion by the end of 2005 and will be used to meet domestic demand until the interconnection with the Project transmission line is complete in 2007.

---

<sup>9</sup> International Development Association. Transport, Distribution, and Disaster Reconstruction Credit No. 3034.

## **2. Bulk Supply Distribution Component**

30. The project preparation technical assistance included a study to evaluate whether electrification of the villages close to the transmission line route could be included as a project component. A range of options was considered comprising both geographical and technical alternatives. Including the cost of possible interruptions to operation of the transmission line, the least-cost option is to include villages located within 1 km on both sides of the right-of-way and to supply each village with a 22 kV supply using a single-wire, earth-return system, which is suitable for low-density loads and can be economically expanded with increasing demand. The 22 kV system will run north and south from the Takeo substation and south from the West Phnom Penh substation, and will thus serve the entire transmission line route. Each line will be within the economically maximum length of about 40 km. The 22 kV system will be operated by EDC, which will supply bulk power to a convenient point in each village. Points of distribution to end-users will be constructed and operated by REEs, which will be selected and licensed in accordance with EAC's procedures.<sup>10</sup>

## **3. Resettlement**

31. Implementing and monitoring of the Resettlement Plan is included in the project cost. Land acquisition is required for the two substations and access roads, and for towers along the transmission lines, affecting approximately 634 households. One hundred sixty-four of these will be severely affected including 15 farmers on sub-station land, and 148 houses and one commercial enterprise that will need to be relocated. In addition approximately 7,000 productive trees will be cleared from the ROW. Except for land required for towers, the land within the ROW will continue to be used for agricultural purposes. Compensation for all lost assets will be paid in cash at replacement cost, and socio-economic rehabilitation measures will be provided to improve the resettlers' livelihoods or restore them to pre-project conditions.

## **4. Capacity Building**

### **a. Resident Financial Management Adviser**

32. EDC will retain a resident financial management adviser to improve its financial and accounting functions and performance reporting ability. An additional 10 person-months of consulting services will be required during 2004 and 2005. Other major activities of the adviser will include further implementing EDC's financial recovery plan, establishing information systems in provincial units, and strengthening EDC's internal audit capability by providing training.

### **b. Demand Management and Consumer Services**

33. The objective of the demand management program is to promote the efficient use and conservation of energy. Placed within EDC's public relations unit, the program will include targeted information designed to help consumers with energy savings options. The consumer services program will include (i) training staff in customer relations; (ii) developing quality and efficiency standards in relation to customer service; (iii) improving coordination with the repair department to remedy faults more quickly; (iv) instigating an information program to inform

---

<sup>10</sup> Electricity Authority of Cambodia. 2002. *Procedures for Issuing, Receiving, Suspending, Revoking or Denying Licenses, Under the Electricity Law of Cambodia*. Phnom Penh.



low-demand consumers about the cheaper, 5-ampere connection; and (v) reviewing EDC's business practices, emphasizing connections for the poor and the implementation of recommendations for change, including assistance with modifications to EDC's billing software.

**c. Private Sector Participation**

34. To provide electricity in rural areas along the transmission route and promote private sector participation, EDC will provide REEs with a medium voltage supply. The proposed capacity building will support EDC in mobilizing private providers in the Project area, help them apply for licenses and access the capital funds necessary for investments in low-voltage supply.

**d. Strengthening of Environmental Management and Social Safeguards**

35. EDC has established a social and environmental unit within the Corporate Planning and Projects Department. The Project will help build the capacity of this unit by financing higher-level education for one social and one environmental specialist from EDC staff.

**e. Implementation Support for the Electricity Authority of Cambodia**

36. The Project will fund an individual resident adviser to provide implementation support as EAC begins to monitor licensees and review tariff applications. The consultant's scope will include designing an information campaign for stakeholder groups, providing operational and logistical support to EAC, and reviewing initial operational guidelines to determine their effectiveness.

**f. Tariff Review Study of Phnom Penh Operations**

37. ADB will finance the services of two consultants to help EDC undertake a comprehensive review of its long-term tariff structure and rates for Phnom Penh and for those areas to be connected to the transmission grid. The objective is to help EDC determine appropriate tariff levels for its Phnom Penh operations to meet its financial objectives, taking into account the long-run marginal cost of supply, and to address any financial cross-subsidies from provincial operations.

**C. Special Features**

38. The Project has several features that derive from its subregional nature. It will form the basis for future international transmission links between Cambodia and its neighbors, as envisaged in the GMS master plan on power interconnections (footnote 2). In addition to providing Cambodia with its lowest-cost source of power, the Project will benefit Viet Nam by increasing the economic viability of the linking transmission line on the Vietnamese side of the border. With the reasonably assured load of 200 MW supplied by the project transmission line to Cambodia, it will be economic to install new generating plant and transmission systems to serve the remote part of southwest Viet Nam, which would otherwise remain underserved. The Project also requires the main construction contractor to help EDC operate the transmission line for the first year and to provide structured training in high-voltage operation and maintenance both in Cambodia and abroad. Power supplied from Viet Nam will be sourced from hydroelectric and conventional steam generation and from increasing use of indigenous natural gas in combined-cycle thermal plants. This will defer the commissioning of additional diesel-fired generation in Cambodia. Thus the region will save on foreign exchange requirements and reduce environmental pollution.

39. This Project has two other interesting features. First, it combines the promotion of subregional economic growth with poverty targeting to provide direct benefits to the poor by reducing the often prohibitively high initial connection costs. Second, the design of the Project creates opportunities for private sector participation in rural electrification by providing a reliable supply of reasonably priced electricity from EDC-owned sources in each village along the transmission line route and investing in the distribution system for sales to end consumers. This will promote the business environment at the local community level.

40. ADB and the World Bank have harmonized the financial covenants for EDC. The emphasis is on improving EDC's cash flow. This requires that covenants under the existing loan (ref footnote 5) be repealed to reflect the financial covenants for the Project.

## D. Cost Estimates

41. The total cost of the Project is estimated at \$95.0 million equivalent, comprising \$58.5 million equivalent (62%) in foreign exchange costs and \$36.5 million equivalent (38%) in domestic currency costs. The cost estimates are based on 2003 price levels for base costs and include physical contingencies, price contingencies, taxes and duties, and interest charges during construction. Physical contingencies have been estimated at 10% of base costs and price contingencies were calculated using ADB's current rates of inflation for foreign goods and services. The cost estimates are summarized in Table 1 and detailed in Appendix 5.

**Table 1: Summary of Project Cost Estimates**

Item	Foreign Exchange	Local Currency	Total Cost
<b>A. Base Cost</b>			
1. Infrastructure (transmission system)	45.0	7.0	52.0
2. Resettlement	0.0	2.5	2.5
3. 22-Kilovolt Bulk Supply Distribution Component	1.4	1.4	2.8
4. Capacity Building	0.8	0.2	1.0
5. Project Implementation Consultants	2.4	0.8	3.2
6. Taxes and Duties	0.0	15.0	15.0
<b>Subtotal (A)</b>	<b>49.6</b>	<b>26.9</b>	<b>76.5</b>
<b>B. Contingencies</b>			
1. Physical	4.4	2.5	6.9
2. Price	2.7	1.5	4.2
<b>Subtotal (B)</b>	<b>7.1</b>	<b>4.0</b>	<b>11.1</b>
<b>Interest during Construction</b>	<b>1.8</b>	<b>5.6</b>	<b>7.4</b>
<b>Total</b>	<b>58.5</b>	<b>36.5</b>	<b>95.0</b>
Percentage of Total	62	38	100

Source: Asian Development Bank staff.

## E. Financing Plan

42. ADB will provide a \$44.3 million loan from its Special Funds resources to finance the 220 kV components of the Project plus the bulk supply distribution component, representing 46% of total project costs. The loan will finance \$35.5 million of the foreign exchange cost of the Project, including interest on the loan during construction, and \$8.8 million of domestic currency costs. For the 115 kV system grid substations in Phnom Penh, the World Bank will provide \$16.0 million (17% of total project costs) of parallel cofinancing. The Nordic Development Fund

(NDF) will provide €10 million (about \$11 million equivalent) in cofinancing for a portion of the substation equipment, representing 12% of total project costs. The Government will fund \$23.7 million of domestic currency costs representing 25% of total project costs. Table 2 shows the proposed financing plan.

**Table 2. Proposed Financing Plan**

Source of Funds	Foreign Currency		Local Currency		Total	
	\$ Million	% of Total Costs	\$ Million	% of Total Costs	\$ Million	% of Total Costs
Asian Development Bank	35.5	37	8.8	9	44.3	46
World Bank	12.5	13	3.5	4	16.0	17
Nordic Development Fund	10.5	12	0.5	0	11.0	12
Government Counterpart Funds	0.0	0	23.7	25	23.7	25
<b>Total</b>	<b>58.5</b>	<b>62</b>	<b>36.5</b>	<b>38</b>	<b>95.0</b>	<b>100</b>

Source: Asian Development Bank staff.

43. The ADB loan will have a maturity of 32 years, including an 8-year grace period, with an interest rate of 1% during the grace period and 1.5% during principal amortization and other terms and conditions as set forth in the Loan and Project agreements. The World Bank will provide cofinancing as part of its Rural Electrification and Transmission Project. The International Development Association World Bank loan will have a maturity of 40 years, including a 10-year grace period, with 1% interest. The NDF loan will be denominated in euros and will have a maturity of 40 years, including a 10-year grace period, 0.75% service charge, and 0.50% commitment fee on undisbursed amounts.

44. The borrower will be the Kingdom of Cambodia, and the proceeds of the loan will be re-lent to EDC pursuant to a subsidiary loan agreement with terms and conditions acceptable to ADB. MEF will re-lend the ADB loan, excluding \$300,000 plus contingencies, to EDC for a loan of 20 years maturity, including a 5-year grace period, at an interest rate of 4.2%. MEF will re-lend the World Bank and NDF loans together with its own contribution on the same terms. MEF will provide a grant to EDC for capacity building for REEs (\$100,000 plus appropriate contingencies). MEF will also provide a grant of \$200,000 plus appropriate contingencies to EAC for capacity building. EDC agrees to bear the Government's foreign exchange risk of the proposed loans.

## **F. Implementation Arrangements**

### **1. Project Management**

45. As the executing agency, as well as the owner and operator of the facilities and the beneficiary of most of the institutional capacity building, EDC will be responsible for project implementation and coordination. Two ADB-funded projects have been completed in the power sector,<sup>11</sup> and a third is on-going (ref footnote 5). For both completed loans, the project implementing agency was Electricité du Phnom Penh, EDC's predecessor, which demonstrates that EDC has the capability to successfully implement similar power generation and distribution

<sup>11</sup> ADB. 1992. *Report and Recommendation of the President to the Board of Directors on Proposed Loan to the Kingdom of Cambodia for the Special Rehabilitation Assistance Energy Sector Component*. Manila (Loan 1199-CAM[SF], for \$18.4 million, approved on 26 November 1992).

ADB. 1994. *Report and Recommendation of the President to the Board of Directors on a Proposed Loan to the Kingdom of Cambodia for the Power Rehabilitation Project*. Manila (Loan 1345-CAM[SF], for \$28.2 million, approved on 15 December 1994).

projects. EDC will set up two project management units to separately implement the work funded under ADB and NDF procurement guidelines and World Bank procurement guidelines. The director of the Corporate Planning and Projects Department will head both project management units, and both will have similar staffing arrangements, including a project manager, substation managers, and a manager for resettlement and the environment. Units will be based at EDC's head office in Phnom Penh, with a site office in Takeo.

## **2. Implementation Period**

46. The Project will be implemented over 5 years, beginning in the second quarter of 2004. Completion of physical works is expected by the third quarter of 2007, to be followed by a 9-month period of training of EDC staff by the contractor in the operation and maintenance of the transmission line. Loan closing will be on 31 December 2008. Resettlement work will commence shortly after the appointment of the PICs, with fieldwork to confirm affected households and compensation rates. Resettlement activities associated with the substations can be completed relatively quickly, because the size and location of the substations is already known. However, under the turnkey contract for the transmission line, the contractor will identify the exact locations for the supporting steel towers only after the completion of detailed design. Therefore resettlement associated with tower locations cannot be completed until about month 24. Works funded by ADB and NDF will be coordinated with those funded by the World Bank. Reinforcement of the 115 kV ring around Phnom Penh and the upgrading of grid substations and grid extensions around Phnom Penh will be completed by 2006 and will be used to expand and strengthen EDC's existing system.

47. Capacity building activities will commence shortly after loan effectiveness and will continue until mid 2006. The implementation schedule is given in Appendix 6.

## **3. Procurement**

48. The 220 kV portion of the works will be undertaken under one turnkey contract for construction of the line and a second turnkey contract for the Takeo and West Phnom Penh substations. Both contracts will be awarded using international competitive bidding. Contractors will be prequalified using ADB procedures and the contracts will be awarded using ADB's *Guidelines for Procurement Under ADB Loans*. Preference will be given to domestic contractors and domestically manufactured goods procured under international competitive bidding. Appendix 7 provides details of procurement packages.

49. Several standard pieces of electrical equipment and materials, such as the transformers and capacitor banks, will be purchased under a supply of goods contract in accordance with NDF procedures and will be installed by the substation turnkey contractor. The 115 kV lines and works funded by the World Bank will be procured under World Bank guidelines and will interface with the ADB-funded works at the boundary of the 115 kV West Phnom Penh substation.

## **4. Consulting Services**

50. The services of the PICs will cover (i) preliminary design of the works, (ii) preparation of prequalification and bidding documents, (iii) assistance with prequalification and tender evaluation, (iv) approval of contractors' detailed designs, (v) supervision of construction and (vi) to monitor and evaluate project performance. The PICs will include an international and a domestic resettlement specialist to coordinate all resettlement activities, provide capacity building for all agencies involved in resettlement, and recruit and supervise the independent

monitoring organization. These activities will be included in a consulting services package with a total of 120 person-months (60 person-months of international consultants and 60 person-months of domestic consultants). The PICs will be engaged using ADB's advance procurement procedures so that survey and design work can commence soon after loan effectiveness. Outline terms of reference for consulting services are given in Supplementary Appendix A. A quality- and cost-based procedure will be used for engaging firms and other arrangements satisfactory to ADB will be used to engage domestic consultants. Individual consultants (totaling 35 person-months) will be engaged to undertake the capacity building components of the Project. All consultants for the ADB-funded portion of the works will be engaged in accordance with ADB *Guidelines on the Use of Consultants*. ADB-funded consultants will handle works funded by NDF. Consultants for the World Bank-funded component will be engaged using World Bank procedures.

## **5. Disbursement Arrangements**

51. Disbursements of ADB funds under the Project will be mainly for turnkey contracts and will be made in accordance with ADB's *Loan Disbursement Handbook*. An imprest account will be used to purchase small items, such as those associated with the capacity building components.

## **6. Accounting, Auditing, and Reporting**

52. Within 6 months of the end of each fiscal year, EDC will submit to ADB audited project accounts containing detailed descriptions of the sources of receipts and expenditures and imprest account statements. Also within 6 months of the end of each fiscal year, EDC will submit unaudited copies of EDC's consolidated financial statements which will consist of an income statement, balance sheet, statement of cash flows and statement of changes in equity. EDC will submit audited copies of EDC's consolidated financial statements within 9 months of the end of each fiscal year.

53. EDC will continue its current practice of hiring external auditors to audit its annual financial statements and project accounts and to provide a memorandum on issues identified during the audit process. These will be attached to the respective reports. For future contracts and revisions, the auditors' terms of reference will be approved by ADB prior to the commencement of work. The accounts will be prepared using international accounting standards and the audit will be carried out using international auditing standards. The auditors will be required to provide an opinion on EDC's compliance with ADB's financial covenants and indicate the details of the actual calculations for all ratios in conformity with the definitions contained in the Loan and Project agreements.

54. Project progress reports will be submitted by EDC to ADB on a quarterly basis. The reports will include a description of (i) the physical progress of the Project; (ii) any problems encountered and anticipated along with suggested corrective actions; (iii) an updated bar chart in an acceptable format to show progress, including progress on implementation of the resettlement plan; (iv) the reasons for any delays in project implementation and recommendations for corrective action; and (v) a summary of financial accounts for the Project, including project expenditures during the period and year-to-date and total expenditures. EDC will submit a project completion report to ADB and NDF within 3 months of Project completion. Aside from an assessment of the execution and operation of the Project, this report will indicate compliance with the loan covenants and include the results of the project performance and evaluation program.

## **7. Monitoring and Evaluation**

55. A number of measurable performance targets have been selected in accordance with ADB's project performance monitoring and evaluation system. The number of electricity customers and demand in various categories will be monitored using EDC's consumer database, with a separate category for poor consumers. Efficiencies in utility operations will be measured by data on electrical losses, sales lost through breakdowns, employee-customer ratios, and average cost of service. The degree of compliance with financial covenants will provide an indication of EDC's performance throughout the implementation period. In Phnom Penh, monitoring will include an assessment of the effectiveness of the demand management and consumer services component of the Project, particularly with respect to (i) increasing connections to the poor, (ii) improving responses to customer complaints, and (iii) repairing supply breakdowns more rapidly.

56. Performance monitoring and evaluation will also be carried out for the bulk supply distribution component along the transmission line route. Within the first year of connections, a baseline survey will be carried out to monitor (i) connection rates among the poor and the nonpoor, (ii) electricity expenditures, (iii) up-front charges, (iv) affordability of tariffs, and (v) ability of households to sustain monthly payments. Two years after the baseline survey an impact survey will be carried out to monitor the Project's sustainability and development impacts.

## **8. Project Review**

57. A midterm review, to be carried out 2 years after loan effectiveness, will focus on the capacity building, environmental, resettlement, and training aspects of the Project, partly to ensure that EDC has adequate human and other resources necessary to manage the facilities when they are completed. Particular attention will be paid to progress made in selecting REEs for the 22 kV bulk supply component of the Project, awarding operating licenses, and setting consumer tariffs.

## **IV. PROJECT BENEFITS, IMPACTS, AND RISKS**

58. The forecast demand for the transmission line analysis suggests that demand will grow at about 10% to 12% per year in the first five years of the Project. In the longer term, the growth in electricity demand will level out and remain at around 5% per year, i.e., about 1% above the predicted growth of gross domestic product. The forecast suggests that demand will exceed distribution capacity in the period before the transmission line has been commissioned. Thus there will be significant unmet electricity demand when the transmission line is operational. By this time, EDC will be in a better position to connect new consumers using funds from the World Bank credit and from savings arising from the lower-cost Khmer Electric Power IPP project due to be commissioned in 2005. The analysis shows that the capacity of the transmission line would be fully utilized by 2017, although the system will require new peaking capacity by 2014.

59. A financial analysis was carried out for the transmission line component and the bulk supply distribution component (Appendix 8). The weighted average costs of capital (WACCs) have been estimated for both EDC and a typical private REE because of the mix of investment required in the bulk supply distribution component. The WACC for EDC is approximately 6%, based on its debt leverage and access to multilateral concessional loans. The WACC for a typical REE is approximately 13%, because of its more restricted access to debt and then only at commercial rates. The evaluation period for both components was 2004–2035.

60. For the transmission component, the analysis assumes that tariffs remain at the same average rate (approximately \$0.15/kWh) over the life of the transmission line. After accounting for the full costs of meeting additional demand via the transmission line, the Project generates a significant net return, suggesting that it is viable from a financial perspective. The net present value (NPV) of the Project is estimated to be about KR2,506 billion (\$626.5 million), which is equivalent to a financial internal rate of return of approximately 35%. This provides a comfortable financial margin above the WACC of 6%.

61. For the distribution component, the assumption is that electricity will be supplied to a corridor about 1 km wide on both sides of the transmission line. All project benefits and costs were discounted at a rate equivalent to the composite WACC for EDC and a typical REE. The distribution lines are assumed to be commissioned in 2007 and in service until 2035, when the lines are assumed to have reached the end of their economic lives. For this new prospective service area, to be operated by an REE, a tariff has been derived based on cost recovery that assumes a bulk supply tariff from EDC of \$0.19/kWh and a distribution tariff of approximately \$0.09/kWh. This bulk rate incorporates the lower average energy cost of EDC supply and the recovery of capital costs of new 22 kV lines. The analysis indicates that the distribution of electricity is viable, with an NPV of KR1 million and a financial internal rate of return of 12.6% compared to the composite WACC of 9.5%.

62. The economic analysis was undertaken on the basis that the next lowest-cost alternative would meet the demand that would otherwise be met by the supply from the transmission line. Incremental and nonincremental benefits were evaluated together with the benefits associated with the increased reliability of supply that the transmission line would provide. These benefits were evaluated against the costs of the transmission line, taking into account costs related to distribution to end-consumers. The analysis suggests that the transmission line is the most economically viable option and yields an NPV of \$201.3 million and an economic internal rate of return of 32%.

63. Sensitivity and risk analyses were undertaken with respect to identified project risks. The results suggest that the Project's economic viability remains robust with respect to these risks. Analysis of the institutional risk that may affect the utilization of the transmission line indicates that the load would need to fall to 135 GWh per year compared to a typical value of 1,400 GWh/year, to reach the economic internal rate of return threshold of 12%. While this level is well below the import needs from 2008 onward, the PPA between Cambodia and Viet Nam will include a minimum load requirement of 300 GWh per year. This level of utilization will ensure a comfortable margin in meeting the transmission line's economic and financial viability.

64. The bulk supply distribution component will significantly reduce the current high cost of electricity and improve the quality of supply to poor communities along the transmission line route. Four supply options for providing reliable electricity services to these communities were assessed. The economic analysis suggests that the single-wire earth-return lines for the electrification of communities within 1 km on each side of the transmission line would be the most economically viable option. The component will electrify 14,200 households over the lifetime of the Project, of which 5,700 are poor, and yield an NPV of \$5.3 million and an economic internal rate of return of 25%. The sensitivity analysis revealed that economic viability is sensitive to the number of connections made by REEs.<sup>12</sup>

---

<sup>12</sup> Takeo Province currently has 14 REEs, but the field survey found only two private providers in the 100 villages surveyed.

65. The distributional analysis suggests that most transmission line benefits accruing to the poor will occur as a result of economic growth and employment. In contrast, most benefits resulting from the bulk supply distribution component will come from connecting the poor. A necessary condition for the poor to receive these benefits will be that they can afford to connect and to sustain their connections. Overall, the Project yields an economic NPV of \$224.4 million. Cambodia will receive 92% of these benefits i.e. \$206.6 million, comprising \$201.3 million from the transmission component and \$5.3 million from the bulk supply component. The poor in Cambodia will receive 15% of the Cambodian benefits, amounting to \$ 31.2 million. The details of the economic analysis are given in Appendix 9.

66. Existing official poverty data suggest that 15% of the population in Phnom Penh lives below the poverty line. The number of poor consumers with EDC connections was estimated using a threshold of 30 kWh/month per household. This is in line with international comparisons and the poor's ownership of appliances. Data show that about 15% of EDC's residential consumers are poor, which implies that EDC is connecting a proportionate share of the poor in Phnom Penh. However, the incidence of poverty in Phnom Penh is likely to be higher than official statistics indicate, because many of the poor reside in squatter areas with no formal land tenure and are not registered with local authorities. As a consequence, EDC is unable to connect these consumers directly. Instead, these poor are connected through wholesalers and pay tariffs well above the lifeline tariff.

67. Poor households may face difficulties in meeting the up-front costs associated with connection. To address this barrier for the poor, EDC will offer lower-capacity connections at 5 amperes instead of 10 amperes to better accommodate the low consumption levels of the poor. This would reduce up-front charges, including connection fees and consumption deposits, from about \$29 to \$ 14. In addition, EDC will carry out an in-depth assessment on the need for allowing up-front charges to be paid in installments.

68. The transmission line will allow EDC to expand the electricity distribution network in Phnom Penh to surrounding areas and to offer a more reliable supply. This is likely to significantly increase the number of industrial, manufacturing, and commercial consumers connected to EDC's grid. A cheaper and more reliable source of electricity would allow these sectors to compete better in international markets and to expand production. These sectors' increased ability to compete is particularly important given Cambodia's entry into the World Trade Organization, which requires a phasing out of preferential trading arrangements. The manufacturing sector is an important source of wage income for the poor in Phnom Penh and for remittances to rural areas. Continued expansion of this sector would probably be important for absorbing a growing labor force, especially those with lower education levels. The expansion of other industrial activities based on agriculture would also be important for poverty reduction, as it directly links to demand for agricultural produce and the incomes of the rural poor.

69. A detailed rural socioeconomic survey of possible project beneficiaries of the bulk supply distribution component indicates that poverty in the area is widespread, ranging from 25% to 75%. Providing rural poor households with electricity from the transmission line will result in a roughly 25% decrease in expenditure on electricity. This is despite a substantial increase in consumption, which would result from increased reliability, quality, and a 24-hour supply. A reliable supply of electricity is expected to increase economic activity and have a generally positive welfare impact. Appendix 10 provides details of the social and poverty analysis.



70. The Project will cause significant involuntary resettlement. It will use paddy land for two substations and take over land occupied by productive trees. The impact has been minimized by routing the transmission line away from built-up areas. Transmission line right-of-way will be permanently cleared of structures and trees, but only the small areas under each tower and pole will be permanently acquired. The rest of the right-of-way will remain the property of the current landowner, who will be able to maintain its current use. Transmission line alignments determined during the feasibility study will be fine-tuned during detailed design and finalized during project implementation. Adequate compensation, relocation assistance, and income restoration measures have been designed to restore lost incomes and living standards. A summary resettlement plan is given in Appendix 11 and the full resettlement plan in Supplementary Appendix B.

71. The Project has been assessed as falling into environment category B. A summary of the initial environmental examination is provided in Supplementary Appendix C. The construction and operation of the proposed Project are unlikely to have any major adverse environmental impacts. A low-impact route has been selected for the transmission line, with an emphasis on avoiding settlements, minimizing line length, and providing easy access to the line for construction and maintenance. By generally following the Phnom Penh-Kampot railway from West Phnom Penh to Takeo then national road 2 to the Viet Nam border, the route avoids significant biophysical and socioeconomic impacts. The bulk distribution component will have a minimal impact because the 22 kV lines will be mounted on wooden poles located on the public easement for existing roads. Small (5 meter x 5 meter) areas of land will be required for substation construction, and any impacts will be fully compensated in accordance with the resettlement plan. The initial environmental examination provides specific mitigation measures and environmental monitoring requirements and an environmental management plan. It also includes a requirement for the executing agency to prepare a detailed environmental management plan prior to construction and outlines the institutional arrangements necessary for conducting and monitoring the implementation of the environmental management plan.

72. The Project has been designed to minimize economic, social, and financial risks. The key risks and mitigation measures include the following:

- (i) Additional generating or transmission capacity could be constructed within Cambodia and/or EVN may not make the necessary capacity and energy available to Cambodia as and when required. As a result of policy dialogue, EDC has agreed to strengthen the PPA with EVN to ensure that the necessary capacity and energy will be available, has committed to importing at least 300 GWh of energy annually, has provided its current generation expansion plan to ADB, and has agreed to discuss any deviations from the plan with ADB prior to committing to any new projects.
- (ii) Construction delays could occur on the Vietnamese and/or Cambodian parts of the transmission line. EVN has committed to finalize construction by 2006, well in advance of the commissioning date for the project transmission line, and the implementation schedule for the Cambodian component is realistic.
- (iii) Problems may arise because of the lack of private sector providers for the distribution component. Moreover, private providers may not be able to finance the necessary capital requirements. Mitigation factors include support to potential private providers throughout the process of applying for licenses with EAC and applying for subsidized funds from the rural electrification fund. Should these measures be unsuccessful, this component can be scaled back with

implementation commencing with the potentially most profitable areas close to Phnom Penh and Takeo.

- (iv) Tariffs and connection charges may not provide sufficient incentives for large-scale consumers to switch from their own power sources to EDC's supply. However, the Project will allow EDC to maintain lower tariffs than would have been the case without the Project. In addition, consultants will carry out a tariff review that will help EDC to price tariffs and connection charges properly to ensure connections.
- (v) Compensation, resettlement, and income restoration measures may not be delivered as agreed, thereby impoverishing affected people and delaying the commencement of civil works. The PICs will include specialists that will help EDC implement the resettlement plan and the PICs will engage the independent monitoring organization.

## **V. ASSURANCES**

### **A. Specific Assurances**

73. In addition to the standard assurances, the Government has given the following assurances, which are incorporated in the legal documents.

- (i) Financial matters:
  - (a) All financial calculations and ratios shall be applied in respect of EDC's operations on a consolidated basis. The financial covenants will be reviewed upon commissioning of the Project transmission line and amendments will be made as appropriate. If no amendments are agreed, then the following conditions will continue to be applied.
  - (b) A minimum debt-service coverage ratio of 1.2 shall be achieved in FY 2004–2006 and of 1.3 in FY 2007, which shall be maintained thereafter.
  - (c) A maximum debt to equity ratio of 1.5 to 1.0 shall be achieved in FY 2004 and maintained thereafter.
  - (d) EDC's total accounts receivable shall be maintained at a level that does not exceed the equivalent of 3 months of average sales revenue beginning in FY 2004 and maintained thereafter. EDC will submit quarterly reports analyzing its accounts receivable and take into account ADB's comments on each report.
  - (e) EDC shall ensure a revenue break-even for FY 2004 and maintain it thereafter, which means that operating revenues are equivalent to or not less than the sum of total operating expenses and the amount by which debt-service requirements exceed the provision for depreciation.
  - (f) The Borrower shall ensure that the time-bound action plan to improve EDC's finances dated 24 October 2003 as agreed on by the Government and ADB is fully implemented in accordance with the dates given in the plan.
  - (g) Within 6 months of the effective date, the Government will submit to ADB a draft subdecree with guidelines for EAC to set tariffs. Within 6 months of receipt of ADB's comments, the Government will promulgate the subdecree.
  - (h) Within 3 months of the promulgation of the subdecree on tariff-setting guidelines, EDC will apply to EAC for tariff review and approval for the

- Phnom Penh electric transmission grid, such that the proposed tariffs will eliminate cross-subsidies between Phnom Penh and EDC's provincial units.
- (i) Within 6 months of the end of each fiscal year, EDC will submit to ADB audited project accounts. Also within 6 months of the end of each fiscal year, EDC will submit unaudited copies of EDC's consolidated financial statements. EDC will submit audited copies of EDC's consolidated financial statements within 9 months of the end of each fiscal year.
  - (ii) System losses:  
EDC will maintain transmission and distribution losses at a level not exceeding 16% in FY 2004 and thereafter.
  - (iii) EDC's corporate plan:
    - (a) No later than 3 months prior to the commencement of each fiscal year commencing in FY 2005, EDC will furnish ADB with a draft corporate plan that sets forth EDC's development plans and investment requirements for the next 10 years.
    - (b) EDC shall abide by the generation expansion development plan program 2005–2020 as updated from time to time and agreed to with ADB (provided in Supplementary Appendix D). All projects implemented by the private sector included in the plan will only be undertaken after a transparent bidding process.
  - (iv) Customer services:  
Within 3 months of the effective date, EDC shall make available 5-ampere connections to low-income residential consumers in the area of the Phnom Penh electric transmission grid, and within 12 months of the effective date, EDC shall provide ADB with a report on the need for allowing connection charges in Phnom Penh to be paid in installments and implement the recommendations in accordance with an agreed timetable.
  - (v) Resettlement and social matters:  
The Government shall update the resettlement plan in accordance with the requirements of ADB's policy on involuntary resettlement and submit it to ADB for approval before any land acquisition activities begin. The PICs' resettlement specialists and the independent monitoring organization shall be mobilized before the commencement of any land acquisition activities, including the detailed measurement survey. The Government will take all measures necessary to implement the approved, updated resettlement plan to ADB's satisfaction. No civil works shall commence in a specified geographic area prior to EDC having satisfactorily completed all matters covered by the approved, updated resettlement plan.
  - (vi) Environmental matters:  
EDC shall be responsible for ensuring that the Project fully complies with ADB's environmental assessment guidelines and the Government's environmental laws and regulations throughout the implementation period. EDC will bear full responsibility for ensuring that the Project

complies with best environmental practices and meets the mitigation and monitoring requirements described in the initial environment examination report.

(vii) Legal Framework:

Within 12 months of the effective date, MEF shall investigate and make recommendations to the council of ministers (COM) on changes to the laws on VAT such that all electricity providers, including EDC, are subject to the same VAT regime. Within 6 months after COM receives these recommendations, MEF shall request COM to submit the recommendations to the National Assembly for approval.

**B. Conditions for Loan Effectiveness**

74. The PPA between EVN and EDC relating to the transmission line will be reconfirmed and amended to include measures that will ensure the Project's financial and economic viability.

**VI. RECOMMENDATION**

75. I am satisfied that the proposed loan would comply with the Articles of Agreement of ADB and recommend that the Board approve the loan in various currencies equivalent to Special Drawings Rights 30,941,000 to the Kingdom of Cambodia for the Greater Mekong Subregion Transmission Project from ADB's Special Funds resources with an interest charge at the rate of 1% per annum during the grace period and 1.5% per annum thereafter; a term of 32 years, including a grace period of 8 years; and such other terms and conditions as are substantially in accordance with those set forth in the draft Loan Agreement and Project Agreement presented to the Board.

Tadao Chino  
President

21 November 2003

## PROJECT FRAMEWORK

Design Summary	Performance Indicators/Targets	Monitoring Mechanisms	Assumptions and Risks
<b>Goals</b> To stimulate trade and economic growth in the subregion and to promote poverty reduction in Cambodia	Economic growth to achieve or exceed Government targets and to meet Millennium Development Goals	Macroeconomic and socioeconomic data  Trade statistics	Government pursues cross-border trade in the subregion and pro-poor policies
<b>Purposes</b> To promote the provision of sustainable and reliable electricity at affordable prices to consumers in Cambodia  To enhance accessibility for the poor by promoting a pro-poor policy environment in the sector	EDC to trade sufficient energy to ensure the financial and economic viability of the Project  EDC to offer lower-cost, 5-ampere capacity connections and to assess the need to allow connection fees to be paid in installments	Metering of energy trade; EDC to follow agreed generation expansion plan  Monitoring by ADB of the consumer services upgrade component of the Project	Compliance with the power purchase agreement between Cambodia and Viet Nam  Assumes that the EDC program to encourage rural electricity enterprises is successful
<b>Outputs</b> 220 kV transmission line from the Vietnamese border to Phnom Penh and substations at Takeo and West Phnom Penh and reinforcement of 115 kV transmission ring  22 kV feeders around Phnom Penh and Takeo; bulk supply to affected communities living along the transmission route  An environment and resettlement unit established in EDC  Households affected by the infrastructure development fully resettled according to the resettlement plan	Commissioning and operation of the 115 kV ring by December 2006 and of the transmission line by October 2007  Bulk supply connections to 20 villages along the transmission corridor by October 2007  Unit established and staffed with one environmental and one resettlement specialist  3,700 affected households resettled and compensated by 2006  Implementation of the resettlement plan prior to the commencement of works in each area	Project progress reports and completion report  Socioeconomic surveys; EDC consumer statistics  ADB review missions  Project progress reports and review missions  Surveys of affected people  Independent monitoring reports	Commitment from the Vietnamese authorities that they will implement their section of the Project as agreed with the Cambodian authorities  Components funded by the World Bank and the Nordic Development Fund are not delayed  Government will support the resettlement plan and provide adequate staff and resources for implementation  Affected people will accept the compensation packages offered  Relocated affected people will be able to purchase replacement land

Design Summary	Performance Indicators/Targets	Monitoring Mechanisms	Assumptions and Risks
<b>Activities</b> Engagement of implementation consultants to design and supervise construction of the works and update and supervise implementation of the resettlement plan  Construction of the transmission line and bulk supply distribution works  Implementation of the agreed financial action plan for EDC  Capacity building of the Electricity Authority of Cambodia and EDC	Consultants appointed during second quarter of 2004; resettlement specialists and IMO mobilized before detailed measurement survey started and resettlement plan updated  Works completed and line commissioned by Oct 2007  Completed by the end of 2004  Resident financial manager in place by mid-2004  All capacity building completed satisfactory by June 2006	ADB review missions  Quarterly progress reports  Project completion report  Reports from the resident financial adviser and from EDC on accounts receivable progress  IMO monitoring reports  Consultants' quarterly reports and ADB review missions	Performance by the implementation consultants will be satisfactory  No major land acquisition or resettlement problems occur  Rural electric enterprise owners will be trained and will invest in consumer connections from EDC's bulk supply  Risk that the agreed action plan will not be implemented  Risk that capacity building does not succeed
<b>Inputs</b> Consulting services Construction activities Capacity building	Consultants 4.0 Infrastructure 89.8 Capacity building 1.2 <b>Total \$95.0</b>	EDC's audited project accounts  ADB review missions  Report from IMO	Cost escalation and exchange rate movements do not cause cost overruns; counterpart budget is available when required; competent consultants are recruited and their advice followed; counterpart staff are available

ADB = Asian Development Bank, EDC = Electricité du Cambodge, IMO = independent monitoring monitor, kV = kilovolt.  
Source: Asian Development Bank staff.

## SECTOR/SUBSECTOR ANALYSIS

### A. Overview of the Greater Mekong Subregion Power Sector

1. Some statistics related to energy use are given in Table A2.1.

**Table A2.1: Greater Mekong Subregion Selected Indicators, 2001**

Indicator	Cambodia	Lao PDR	Myanmar	Thailand	Viet Nam	Yunnan
Land Area (square kilometers '000)	181	237	677	513	332	394
Population (million)	12.0	5.2	49.0	62.4	78.0	41.9
GNP/capita (\$/capita)	260	280	—	1960	370	750 <sup>a</sup>
GDP (\$ billion)	3.1	1.4	—	123.9	28.6	—
GDP Growth (%) <sup>b</sup>	4.5	5.5	5.8	5.9	6.8	8.0 <sup>c</sup>
Electricity Use (KWh/capita/year)	35	113	60	1,300	257	606
Electrification (%)	15 <sup>d</sup>	34	15	82	70	92
Installed Capacity (MW)	150 <sup>e</sup>	634	1,173	22,300	7,300	7,600
Average retail tariff (\$/kWh)	0.14	0.04	0.02	0.07	0.06	—

— = not available.

GDP = gross domestic product, GNP = gross national product, Lao PDR = Lao People's Democratic Republic.

<sup>a</sup> Based on the People's Republic of China. Yunnan's GNP per capita is estimated at two thirds of the national average.

<sup>b</sup> Figures are for 2000.

<sup>c</sup> Applies to the People's Republic of China.

<sup>d</sup> Estimated. Excluding households using automotive batteries.

<sup>e</sup> This figure is uncertain because of the high incidence of privately owned generators.

Source: Asian Development Bank data.

2. Implementation of the indicative master plan for interconnection would maximize the advantages of power trading between the Greater Mekong Subregion countries. The costs of increased high-voltage transmission lines would be outweighed by reduced new generating capacity due to noncoincidence of peak loads and shared reserve margins. Operating costs would be reduced least-cost dispatch on a regional (rather than a national) basis,<sup>1</sup> reliability would be increased, and greenhouse gas emissions would be reduced.

### B. Cambodia's Energy Sector

3. Cambodia has two indigenous sources of energy, i.e., biomass, which provides 85% of current energy consumption, and hydropower, which is still largely undeveloped. A 1-megawatt (MW) hydropower plant serves Banlung, the capital of Rattanakiri Province and the 12 MW Kirirom hydropower plant, which was rehabilitated in 2001, is located about 120 kilometers west of Phnom Penh. Imported petroleum products supply the balance of energy demand.<sup>2</sup> The consumption of primary energy for domestic and light industry, transport, and electricity production is 87%, 9%, and 4%, respectively.

4. The major energy source nationwide is fuelwood, which most people, especially in rural areas, use for cooking. Nonelectrified households use kerosene for lighting, mainly in the countryside, and for cooking in urban areas. The number of liquefied petroleum gas stoves is

<sup>1</sup> Indigenous natural gas is used for power generation in Myanmar, Thailand, and Viet Nam. Hydropower has been developed, and significant potential exists in Myanmar, Lao PDR, Viet Nam and Yunnan Province. All these sources do, or can, provide energy at low cost than can be produced in Cambodia.

<sup>2</sup> Despite concerted exploration efforts, no oil reserves have been found in Cambodia. One company has a concession to drill at greater depths areas already unsuccessfully explored, and gas has recently been discovered in undetermined quantities.

believed to be increasing in Phnom Penh, but the cost of gas cylinders and new stoves is an impediment to widespread proliferation of this relatively clean fuel. Liquefied petroleum gas represents only about 0.2 % of national energy requirements.

### **C. Electricity Subsector**

5. The Asian Development Bank recommenced lending to Cambodia in 1992, and initially focused on providing emergency generating and distribution facilities in Phnom Penh.<sup>3</sup> This was followed by the rehabilitation of electricity systems in parts of Phnom Penh and the two important provincial towns of Sihanoukville and Siem Reap.<sup>4</sup> An on-going loan, approved in 2000, will expand and replace the inadequate electricity generation and distribution systems in eight other provincial capitals.

### **D. Electricité du Cambodge**

6. Electricité du Cambodge (EDC) is a state-owned corporation jointly owned by the Ministry of Industry, Mines, and Energy and the Ministry of Economy and Finance. Its board of directors, which meets each month, is made up of representatives of the Ministry of Industry, Mines, and Energy; the Ministry of Economy and Finance; and the Ministry of Justice along with the managing director of EDC, two private sector representatives, and one representative of EDC's employees. The Ministry of Industry, Mines, and Energy representative acts as the board's chair. EDC prepares annual corporate plans and budgets.

7. EDC is increasing its responsibility for power supply in the provinces. It assumed responsibility for the power systems in Sihanoukville, Siem Reap, and Kompong Cham in 1999. In 2000, it assumed control of existing systems in Takeo and Battambang and will own and operate the systems in eight other provincial capitals that are being rehabilitated under Asian Development Bank financing.

8. Phnom Penh, which has a population of about 1 million, has the only relatively large power system in the country and accounts for 70% of the country's electricity consumption. EDC's power system in Phnom Penh serves about 150,000 consumers with a peak demand of around 100 MW. It has about 52 MW of diesel plants and purchases up to 57 MW of power from two independent power producers. In September 2003, EDC signed a power purchase agreement with a third independent power producer, the Khmer Electric Power Company, for supply from a 32 MW heavy fuel oil fired plant.

---

<sup>3</sup> ADB. 1992. *Report and Recommendation of the President to the Board of Directors on a Proposed Loan to the Kingdom of Cambodia for the Special Rehabilitation Assistance Project*. Manila (Loan 1199-CAM[SF], for \$67.7 million, approved on 26 November 1992).

<sup>4</sup> ADB. 1994. *Report and Recommendation of the President to the Board of Directors on a Proposed Loan to the Kingdom of Cambodia for the Power Rehabilitation Project*. Manila (Loan 1345-CAM[SF], for \$28.2 million, approved on 15 December 1994).



## EXTERNAL ASSISTANCE TO THE ELECTRICITY SECTOR

Table A3.1: Multilateral and Bilateral Loans

Item	Project	Amount (\$ million)	Date of Approval
<b>Asian Development Bank</b>			
1199-CAM(SF)	Special Rehabilitation Assistance (energy sector component)	18.4	26 November 1992
1345-CAM(SF)	Power Rehabilitation Project	28.2	15 December 1994
1794-CAM(SF)	Provincial Power Supply Project	18.6	13 November 2000
<b>World Bank</b>			
IDA Credit 2550 KH	Emergency Rehabilitation Project	6.9	November 1993
IDA Credit 2782 KH	Phnom Penh Power Rehabilitation Project	40.0	October 1995
Japan International Cooperation Agency	Rehabilitation and Upgrading of Electricity Supply Facilities for Phnom Penh, Phase II	31.0	June 1996
<b>Total</b>		<b>143.1</b>	

IDA = International Development Association.  
Source: Asian Development Bank data.

Table A3.2: Asian Development Bank Technical Assistance

TA Number	Project	Amount (\$ '000)	Date of Approval
TA 0026	Phnom Penh High Voltage Transmission (ADTA)	80.0	2 April 1970
TA 2243	Power Sector Manpower Development and Training (ADTA)	500.0	15 December 1994
TA 2629	Power Rehabilitation II (PPTA)	450.0	20 August 1996
TA 3256	Update of Power Rehabilitation II Project Preparation Study (PPTA)	150.0	17 September 1999
TA 3298	Developing the Strategy for ADB's Involvement in Cambodia's Power Sector (ADTA)	150.0	16 November 1999
TA 3453	Development of a Strategy for Management of Provincial Power Supply (ADTA)	150.0	8 June 2000
TA 4078	Power Distribution and Greater Mekong Subregion Transmission Project (PPTA)	730.0	10 January 2003
TA 4169	Capacity Building of Electricity Authority of Cambodia (ADTA)	240.0	2 September 2003
<b>Total</b>		<b>2,450.0</b>	

ADB = Asian Development Bank, ADTA = advisory technical assistance, PPTA = project preparatory technical assistance, TA = technical assistance.  
Source: Asian Development Bank data.

## ELECTRICITE DU CAMBODGE FINANCIAL PERFORMANCE AND PROJECTIONS

### A. Past Performance

1. Electricité du Cambodge's (EDC's) financial performance has been consistently weak. It has not made a profit in the past 9 years and during that time has accumulated losses of KR113 billion. This is primarily because tariffs have been insufficient to cover the variable cost of supply and other operating inputs. The situation improved with tariff increases in 1999 and 2000, but since then EDC has not earned sufficient revenue to record a return on invested capital or a profit. Financial performance has been further adversely affected by the slow collection of accounts receivable from Government departments and from municipalities.

2. Since 1994, EDC's sales have grown from 82 gigawatt-hours (GWh) to 418 GWh, yet despite this fivefold growth in sales volume, EDC did not record a profit. This is because tariffs have been insufficient to cover revenue requirements. Returns on average net fixed assets are low (0.7% in 2002), but have improved from the negative returns experienced prior to the tariff increases allowed in 1999 and 2000, which also promoted some improvement in gross margins. This enabled EDC to record an operating profit of around KR7 billion for the first time in 2002; however, this was reduced to a net loss by interest expenses of KR13 billion. In 2001 and 2002, tariffs were sufficient to allow EDC to barely recover the cost of supply, but still provided no return on capital.

3. Sales to Government ministries and departments account for around 13% of revenue. Some ministries currently take longer than 7 months to pay their bills. The collection cycle has deteriorated significantly in the last 18 months, despite an action plan to address the problem devised in 2000. Table A4.1 shows the ageing of accounts receivable balances as of 31 December 2002.

**Table A4.1: Aged Accounts Receivable as of 31 December 2002**  
(KR billion)

Customer Category	> 90 Days	60–90 Days	30–60 Days	< 30 Days	Total
Government,	47	3	3	5	58
Commercial, Hotel	2	0	0	2	4
Residential	1	0	0	5	6
Foreign Nationals	1	0	0	0	1
Industry, MV	1	0	0	3	4
Other	7	1	2	3	13
<b>Total</b>	<b>59</b>	<b>4</b>	<b>5</b>	<b>18</b>	<b>86</b>

MV = medium voltage.

Source: Electricité du Cambodge.

4. Cash shortfalls arising from the poor collection rate are requiring EDC to resort to short-term borrowing from local commercial banks at high interest rates (approximately 13% per year). These short-term borrowing arrangements contravene the Asian Development Bank's (ADB's) and the World Bank's negative pledge requirement that no other lender shall have a priority claim over EDC's assets. EDC's total accounts receivable balance grew from KR54 billion in 2000 to KR111 billion in 2003.

5. Debt-service coverage ratios were acceptable in 1999 and 2000 (1.8 and 3.0, respectively), but have declined since then. EDC had no effective debt-service coverage in 2002, as its net income before interest expense was negative. From a historical perspective,

this is not a serious problem, because EDC has not accumulated much long-term debt and is still evolving into a mature utility with a consistent and stable revenue base. While cash flow issues may constrain EDC's ability to service its debt somewhat, it is not overextended from a balance sheet perspective. The long-term debt-equity ratio was only 0.5 at the end of 2002 despite the continued erosion of equity from accumulating losses. While this balance erodes as additional debt is incurred, this trend is not an immediate concern in relation to EDC's solvency.

6. EDC's revenue requirements consist of the cost of supply (fuel and power purchases), operating costs, and an allowance for return of capital invested in plant and equipment (depreciation). A return on capital is added to provide a rate of return on the equity invested in the business by the Government and to meet interest payments. In this instance, a rate of return of 6.5% to net fixed assets has been applied. Tariffs have historically never been sufficient to allow EDC to earn any return on capital. Table A4.2 shows that EDC's tariffs have consistently fallen short of revenue requirements, which include a 6.5% return on capital.

**Table A4.2: Electricité Du Cambodge's (Phnom Penh System)  
Revenue Requirements and Tariffs, 1998–2002**  
(KR billion)

Item	1998	1999	2000	2001	2002
Fuel Cost	177	124	163	76	89
Power Purchase Costs	218	269	311	378	361
Other Operating Costs	116	85	95	73	82
Depreciation	53	55	61	65	66
Return on Capital (6.5%)	49	59	76	61	63
Total Revenue Requirement	613	591	706	653	661
Average Retail Tariffs (KR/kWh)	371	493	570	588	589
Tariff Surplus (Shortfall)	-65%	-20%	-24%	-11%	-12%

kWh = kilowatt-hour.

Source: Electricité du Cambodge.

7. Table A4.2 also shows EDC's increasing reliance on power purchased from three independent power producers (IPPs) since 1998. Note that EDC purchases the fuel for the IPPs (which merely convert the fuel into power), so that EDC bears all increases in fuel prices.

8. Until EDC can regularly adjust tariffs to reflect fuel price changes, it is unlikely to earn a consistent return on its invested capital. However, EDC's provincial operations initially set tariffs at cost-recovery levels, which does strengthen its consolidated revenue base. In addition, EDC has signed an agreement for 32 megawatts (MW) of new supply priced at 8.1 cents/kWh, which is well below current IPP prices. This will lower the average cost of generation beginning in 2005. As indicated in table A4.3, until 2010, EDC's consolidated revenues will cover its essential operational expenses (excluding any return on capital).

**Table A4.3: Forecast Revenue Requirements and Tariffs, 2003–2013 (Consolidated)**  
(KR billion)

Item	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Fuel Cost	113	163	72	164	71	74	81	87	89	88	85
Power Purchase Costs	386	334	423	301	407	405	405	405	408	412	418
Other Operating Costs	60	58	55	68	53	53	54	55	56	56	57
Depreciation	71	61	69	74	71	64	60	56	53	50	48
<b>Total Revenue Requirement</b>	<b>631</b>	<b>615</b>	<b>619</b>	<b>607</b>	<b>602</b>	<b>597</b>	<b>599</b>	<b>602</b>	<b>605</b>	<b>606</b>	<b>607</b>
Forecast Average Tariffs (KR/kWh)	579	624	633	641	645	648	653	658	660	661	660

KWh = kilowatt-hour.

Source: Asian Development Bank staff.

9. In the medium term, the transmission line will substantially reduce EDC's average cost of supply to the extent that revenue requirements from 2008 onward are well below tariff levels. At this point, EDC will be able to consider reducing its retail tariffs, while still earning a profit and expanding its system in provincial areas as well as in Phnom Penh.

10. While retail tariffs in Phnom Penh are high relative to those in other developed urban systems in Asia, tariffs in the provinces are much higher because of the systems' small size and isolated nature. The regulator, the Electricity Authority of Cambodia (EAC) has indicated that tariffs for Phnom Penh (and those areas eventually to be connected to the Phnom Penh transmission grid, such as Kampong Speu and Takeo) will be evaluated separately from EDC's provincial units, with the objective that tariffs should be set at a level that makes each independent operation self-sustaining. EDC's consolidated revenue indicates that it covers its operational expenses, but this masks the tariff disparities. The disparity between tariffs in EDC's different service areas will need to be addressed to ensure equitable rates based on EAC's guidelines. This process will be enhanced through ADB's separate technical assistance to EAC to establish a clear and transparent tariff-setting methodology.

## **B. Projected Performance**

11. Table A4.4 presents EDC's projected financial performance (detailed financial statements are provided in Supplementary Appendix E). The base case financial forecasts show EDC making moderate losses over the next five years. This is because tariffs barely cover operational expenses and operating profits are insufficient to cover interest expenses, foreign exchange losses, and taxes or to earn any return on capital. Once the transmission line has been commissioned in 2007, performance will improve dramatically. EDC's cost of supply will be reduced by the lower cost of imported power and it will be able to meet demand that will remain unsatisfied until 2008 because of supply constraints.

12. Base case financial forecasts have been developed for EDC using assumptions that ADB believes represent the most likely outcome given EDC's current circumstances and outlook. Demand forecasts for Phnom Penh are according to those discussed in Appendix 9 (based on historical growth trends and forecasts prepared by EDC); however, demand will be somewhat constrained during 2004–2007 because of EDC's supply limitations. Once the transmission line is commissioned, supply should be sufficient to meet all demand. Phnom Penh tariffs are assumed to remain unchanged, although the average tariff changes to reflect different growth rates in various customer categories. Further increases occur in provincial unit tariffs as provided for in the EDC branch expansion plan. While projections after 2008 indicate the potential for tariff reductions, no changes have been assumed at this time.

13. In Phnom Penh, an additional 32 MW of capacity is expected in 2005, but a shortfall occurs in relation to anticipated demand in 2004–2006, before the Viet Nam line is commissioned. The transmission line is assumed to be operational from the start of 2007. Based on the power purchase agreement, the average purchase price from Viet Nam will be 7.82 cents/kilowatt-hour (kWh). For the forecast period up to 2016 new capacity will be provided by Kam Chai Hydroelectric Project from 2014 at an estimated cost of supply of \$0.06/kWh. The international price of crude oil affects both EDC's fuel cost and the cost of power purchases. The base case assumes a price of \$25 per barrel for the forecast period (\$30 in 2003). It incorporates the fuel price reductions (8.70 cents/KWh to 5.52 cents/KWh) achieved by converting EDC's C6 unit (18 MW) to heavy fuel and future plans to convert EDC's C5 unit (10 MW) to heavy fuel in late 2005. Sales volume will continue to grow rapidly over the next 10

years, particularly following completion of the transmission line in 2007. Sales will reach 1,876 GWh in 2013 compared with 532 GWh in 2003. EDC will face a number of challenges to achieve this growth.

14. ADB will apply a revenue break-even covenant and debt-service coverage ratio, debt-equity ratio, and accounts receivable covenants beginning in fiscal year (FY) 2004. The debt-service coverage ratio is at 1.5 (the lowest point) in 2004, and then remains at or above 1.8 for the remainder of the forecast period. However, the sufficiency of internal funds generated to service debt, particularly between 2003 and 2006, is heavily dependent on improving and maintaining the collection of Government and municipal accounts receivable. Minimum covenants have been set for the short term (FY 2004 until FY 2008) until the transmission line is fully operational and EDC should have 10 to 12 months of operating data to evaluate. Once the transmission line is fully operational, EDC and ADB will review the covenants to determine more appropriate performance measures based on profitability, self-financing a higher percentage of investments, and issuing some dividends to the Government. These covenants have required that certain financial covenants be included in Loan 1794-CAM(SF): Provincial Power Supplies be repealed.

### **C. Risks and Sensitivities**

15. With the commissioning of a new IPP in 2005, EDC assumes it can connect several key industrial and commercial customers, resulting in sales growth of 12% in 2005 and 16% in 2006. Should this IPP not materialize, EDC's growth will be constrained to 10% in 2005, and operation of the Jupiter IPP would have to be extended to avoid serious load shedding. Once the transmission line becomes operational in 2007, sales growth would be constrained to the number of new connections that could be made each year. EDC will experience sustained net losses through 2008, but it would only miss its revenue requirements in 2006 (by 1%), and debt-service coverage would still be within covenanted levels.

16. The costs of both EDC's own generation and of its power purchases vary with changes in the fuel price. If the fuel price is \$30/barrel instead of \$25 over the forecast period, EDC will not meet its revenue requirements in 2004 and 2005 (shortfalls of 2% and 1%, respectively), but would still meet the minimum debt-service coverage ratio. If EAC permits a fuel pass-through mechanism in the tariff-setting guidelines, this would mitigate the risks of fuel price shocks.

17. If the construction of the line is delayed by 1 year, EDC would still meet its financial covenants, but sales growth would be constrained in FY 2007. Even to achieve 10% sales growth, EDC would need to run all its diesel- and heavy fuel oil-fired generating plants to meet the shortfall.

18. The projections assume that the action plan in relation to the collection of Government accounts receivable is fully implemented in 2003. However, if Government and municipal accounts receivable accumulate again to the equivalent of 5 months of average sales, EDC will still meet its revenue-based covenants despite shortfalls in net operating cash from FY 2004 to FY 2009. This would precipitate increases in payables to IPPs and fuel suppliers and a vicious cycle of arrears.

19. A risk assessment of EDC's financial management practices is attached as Supplementary Appendix F.

TableA4.4 Summary of Electricité du Cambodge Consolidated Financial Statements and Projections, 2000–2013

Item	Audited 2000	Audited 2001	Audited 2002	Estimated 2003	Forecast 2004	Forecast 2005	Forecast 2006	Forecast 2007	Forecast 2008	Forecast 2009	Forecast 2010	Forecast 2011	Forecast 2012	Forecast 2013
Average Riel/USD Exchange Rate	3,800	3,895	3,915	4,000	4,063	4,126	4,190	4,256	4,322	4,390	4,459	4,528	4,599	4,671
Generation - GWh	359	501	564	617	692	778	908	1,061	1,269	1,441	1,617	1,796	1,978	2,166
Average Retail Tariff (Riel/kWh)	660	626	623	579	624	633	641	645	648	653	658	660	661	660
Average Retail Tariff (US cents/kWh)	17.3	16.1	15.9	14.5	15.4	15.4	15.3	15.2	15.0	14.9	14.8	14.6	14.4	14.1
<b>Income Statement Summary</b>														
Electricity Sales (GWh)	305	415	477	532	596	672	785	919	1,099	1,247	1,400	1,556	1,713	1,876
Sales Growth (%)	11.3	35.9	15.0	11.6	12.1	12.7	16.8	17.1	19.6	13.5	12.3	11.1	10.1	9.5
Electricity Sales	201	260	297	308	372	426	503	593	712	815	921	1,026	1,132	1,238
Operating Income (Loss)	(17)	8	6	(29)	3	6	22	34	48	58	67	73	78	81
Net Income/(Loss) Before Tax	(17)	(4)	(6)	(43)	(10)	(9)	(1)	(0)	8	16	26	33	40	46
Less: Income Taxes	2	1	0	3	3	3	4	4	5	6	6	7	0	0
Net Income (Loss)	(19)	(5)	(6)	(45)	(13)	(12)	(5)	(4)	3	10	19	26	40	45
<b>Cash Flow Summary (Kr billion)</b>														
Net Cash from Operating Activities	13	7	17	55	18	40	65	67	93	103	115	126	151	160
Net Cash Flow from Financing	8	1	68	15	102	80	199	89	13	(51)	(56)	(55)	(85)	(84)
Net Cash Used for Investing	(17)	(3)	(98)	(54)	(129)	(107)	(245)	(132)	(123)	(70)	(74)	(76)	(79)	(83)
Increase (Decrease) in Cash and Cash Equivalents	4	5	(13)	16	(8)	12	18	24	(18)	(18)	(14)	(5)	(13)	(7)
<b>Balance Sheet Summary (Kr billion)</b>														
Total Fixed Assets	439	418	478	493	583	647	838	908	964	963	962	960	956	952
Total Current Assets	119	159	192	128	137	164	205	254	267	276	289	310	325	344
Total Assets	558	577	669	621	720	811	1,043	1,162	1,231	1,239	1,251	1,270	1,281	1,296
Total Current Liabilities	120	127	138	113	119	130	150	163	193	217	243	270	299	330
Long-Term Debt	120	130	131	158	188	275	497	620	671	660	644	627	579	529
Total Equity	317	320	400	350	413	405	396	379	367	361	364	373	403	437
Total Liabilities and Equity	558	577	669	621	720	811	1,043	1,162	1,231	1,239	1,251	1,270	1,281	1,296
<b>Key Performance Indicators</b>														
Debt Service Coverage Ratio (Times)	1.7	2.7	1.1	0.3	1.5	2.2	2.3	2.3	2.6	1.8	1.9	2.0	1.9	2.0
Return on Average Net Fixed Assets (%)	(4.4)	1.9	1.3	(6.2)	0.3	0.9	2.8	3.7	4.9	5.8	6.7	7.3	7.9	8.1
Long-term Debt to Equity Ratio	0.5	0.5	0.4	0.45	0.46	0.68	1.26	1.63	1.83	1.83	1.77	1.68	1.44	1.21
Receivables Collection Period (months)	3.8	4.0	4.6	3.0	2.9	2.9	2.8	2.7	2.7	2.7	2.6	2.6	2.6	2.6
Accounts Payable Period (months)	5.9	4.6	4.2	3.7	3.4	3.4	3.3	3.2	3.2	3.1	3.1	3.1	3.1	3.1
Current Ratio	0.99	1.26	1.39	1.13	1.15	1.26	1.37	1.56	1.38	1.27	1.19	1.15	1.09	1.04

Source: Electricité du Cambodge financial forecasts.

**COST ESTIMATES AND FINANCING PLAN****Table A5.1: Summary of Cost Estimates**  
(\$ million)

<b>Item</b>	<b>Foreign Currency</b>	<b>Local Currency</b>	<b>Total</b>
<b>Base Costs</b>			
<b>A. Infrastructure</b>			
220 kV Transmission Line	14.82	2.72	17.54
Takeo Substation	4.88	0.88	5.76
West Phnom Penh Substation	13.02	1.92	14.94
National Control Center	3.60	0.40	4.00
Spares and Equipment	0.60	0.00	0.60
High-Voltage Line O&M (12 months)	1.40	0.00	1.40
Reinforcement of 115 kV system	3.27	0.74	4.01
Modifications to GS1, GS2, and GS3	3.37	0.38	3.75
<b>B. Resettlement and Land Acquisition</b>	0.00	2.50	2.50
<b>C. 22 kV Bulk Supply Distribution</b>	1.39	1.39	2.78
<b>D. Capacity Building</b>			
EDC Resident Financial Management Adviser	0.15	0.00	0.15
EDC Demand Management and Consumer Services	0.29	0.13	0.42
Private Sector Participation	0.00	0.10	0.10
Resettlement	0.03	0.03	0.06
EAC Operational Support	0.20	0.00	0.20
EDC Tariff Review	0.10	0.00	0.10
<b>E. Project Implementation Consultants</b>	2.43	0.81	3.24
<b>F. Taxes and Duties</b>	0.00	14.99	14.99
<b>Subtotal Base Costs</b>	<b>49.55</b>	<b>26.99</b>	<b>76.54</b>
<b>G. Contingencies</b>			
Physical	4.40	2.45	6.85
Price	2.76	1.50	4.28
<b>H. Interest During Construction</b>	1.76	5.63	7.39
<b>Total</b>	<b>58.47</b>	<b>36.57</b>	<b>95.04</b>

Percentage of total costs

62

38

EAC = Electricity Authority of Cambodia, EDC = Electricité du Cambodge, kV = kilovolt, O&amp;M = operation and maintenance.

Source: Asian Development Bank staff.

**Table A5.2: Financing Plan**  
(\$ million)

<b>Source of Funds</b>	<b>Foreign Currency</b>	<b>Local Currency</b>	<b>Total</b>
Asian Development Bank	35.5	8.8	44.3
World Bank	12.5	3.5	16.0
Nordic Development Fund	10.5	0.5	11.0
Government Counterpart Funds	0.0	23.7	23.7
<b>Total</b>	<b>58.5</b>	<b>36.5</b>	<b>95.0</b>

Source: Asian Development Bank staff.

## IMPLEMENTATION SCHEDULE, 2003–2008

Task		2003		2004				2005				2006				2007				2008			
		Qtr		Qtr				Qtr				Qtr				Qtr				Qtr			
		3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
	<b>Infrastructure</b>																						
1.	Loan Effective				◆																		
2.	Advance Procurement of Consultants		■	■																			
3.	Appoint Implementation Consultants				◆																		
4.	Implement Resettlement Plan				■	■	■	■	■	■	■	■	■	■	■								
5.	Preliminary Design			■	■																		
6.	Submit Draft Design Report						↓																
7.	Advertise for Prequalification					↓																	
8.	Prequalification of Turnkey Contractors					■	■																
9.	Prepare and Approve Bidding Documents					■	■																
10.	Bidding and Contract Award						■	■	■														
11.	Construction																						
	220 kV Transmission Line									■	■	■	■	■	■	■	■	■	■				
	West Phnom Penh Substation									■	■	■	■	■	■	■	■	■	■				
	Takeo Substation									■	■	■	■	■	■	■	■	■	■				
	22 kV Bulk Power Distribution									■	■	■	■	■	■	■	■	■	■				
	115 kV Ring Reinforcement							■	■	■	■	■	■	■	■	■	■	■	■				
	National Control Center							■	■	■	■	■	■	■	■	■	■	■	■				
	Modifications to Existing Substations							■	■	■	■	■	■	■	■	■	■	■	■				
	220 kV Line Energized																	◆					
	High Voltage Operation and Maintenance													■	■	■	■	■	■	■	■	■	■
	<b>Capacity Building</b>																						
12.	EDC Financial Administration Adviser						■	■	■	■	■	■	■	■	■								
	Demand Management and Consumer Services						■	■	■	■	■	■	■	■	■								
	Private Sector Participation							■	■	■	■	■	■	■	■								
	Strengthen Environmental / Social Safeguards					■	■	■	■	■	■												
	Tariff Study for Phnom Penh					■	■	■	■	■	■	■	■	■	■								
	EAC Tariff Setting and Monitoring					■	■	■	■	■	■	■	■	■	■								
13.	Loan Closing																						◆

EAC = Electricity Authority of Cambodia, EDC = Electricité du Cambodge, kV = kilovolt, MIME = Ministry of Industry, Mines, and Energy, Qtr = quarter.



**CONTRACT PACKAGES**

<b>Item</b>	<b>Contract Amount (\$ million)</b>	<b>Financed by</b>	<b>Procurement Method</b>
Turnkey contract for 220 kV line (including spare parts and training) and bulk supply distribution along transmission line	22.2	ADB	ICB
Turnkey contract for substations at Takeo and West Phnom Penh and 22 kV feeders	12.7	ADB	ICB
Supply of transformers, shunt capacitor banks, and other substation equipment	10.0	NDF	NDC own method
115 kV system, national control center, and modifications to GS1, GS2, and GS3 substations	12.0	WB	WB own method

ADB = Asian Development Bank, ICB = international competitive bidding, kV = kilovolt, LCB = local competitive bidding, NDF = Nordic Development Fund, WB = World Bank.  
Source: Asian Development Bank staff.

## FINANCIAL ANALYSIS

### A. Introduction

1. A financial analysis of both project components—the transmission line and the bulk supply distribution—has been carried out. The weighted average cost of capital (WACC) has been estimated for both Electricité du Cambodge (EDC) and a private rural electric enterprise (REE) because of the mix of investment required in the distribution component. Based on this analysis, both the transmission component and the distribution component are financially viable.

### B. Weighted Average Cost of Capital

2. Two different WACCs have been calculated: one for EDC and one for an REE. The cost of debt is assumed to be the same for all three cofinanciers (the Asian Development Bank, the Nordic Development Fund, and the World Bank), as the same re-lending terms from the Ministry of Economy and Finance to EDC will be applied. While the nominal re-lending rate is 4.2%, the tax-adjusted cost is 3.8% (the corporate tax rate is 9%).

3. In terms of estimating the cost of equity, the lack of functioning debt and equity markets in Cambodia hampers the ability to derive the true cost of equity. The lack of a Government bond rate means that the risk free rate has been benchmarked from rates in Thailand, where the yield on 10-year bonds is currently around 3.5%. Given the less developed nature of Cambodia's economic and financial infrastructure, adopting an increment on the risk free rate in Thailand to reflect this country risk is appropriate. Using reference rates from neighboring countries, a country risk premium of 6.8% has been calculated, which results in a risk free rate of 10.3%. A market risk premium of 11% has been calculated to reflect the additional market, tax, and country risk of Cambodia above a market risk premium reference rate. Therefore the nominal cost of equity for Cambodia is approximately 21.3%. Adjusting for local inflation, the real cost of equity is 14.4%.

4. Through the Government, EDC has access to the low-cost multilateral debt and the ability to maintain a higher leverage for its projects (80% levered). Therefore the WACC for EDC can be calculated as shown in Table A8.1.

**Table A8.1: Weighted Average Cost of Capital for Electricité du Cambodge**

<b>Source of Funds</b>	<b>Financing (\$ million)</b>	<b>Weighting (%)</b>	<b>Real Cost (%)</b>	<b>Minimum Rate Test (%)</b>	<b>Composite Capital Cost (%)</b>
Asian Development Bank Loan	44.3	46.6	3.8	3.5%	1.9
World Bank Loan	16.0	16.8	3.8	3.5%	0.7
Nordic Development Fund Loan	11.0	11.6	3.8	3.5%	0.4
Government Counterpart Funds	23.7	25.0	14.4	—	3.0
<b>Total</b>	<b>95.0</b>	<b>100.0</b>			<b>6.0</b>

— = not available.

Source: Asian Development Bank staff.

5. Local private sector operators in rural areas, such as REEs, have no direct access to the concessional lending. In addition, REEs have to use a higher percentage of equity funding

because of the underdeveloped status of commercial banking in Cambodia. Leverage of 50% has been assumed. Limited credit is available from a handful of commercial banks, but at a much higher cost (a real rate of approximately 11.6%). The WACC for REEs can be approximated as shown in Table A8.2.

**Table A8.2: Weighted Average Cost of Funds for Rural Electricity Enterprises**

Item	Weighting (%)	Real Cost (%)	Composite Capital Cost (%)
Debt	50.0	11.6	5.8
Equity	50.0	14.4	7.2
<b>Weighted Average</b>			<b>13.0</b>

Source: Asian Development Bank data.

6. The distribution component of the Project must incorporate the costs of capital. EDC is investing in 22 kilovolt (kV) feeders from the high-voltage substations in West Phnom Penh and Takeo to the 22 kV bulk supply transformers. From that point, the REEs are assumed to invest in the low-voltage distribution lines, purchase electricity from the 22 kV network, and distribute the electricity to consumers. For the distribution component the calculations have assumed a 50/50 split in investment costs, and hence, the resulting cost of capital is the average of 6% for EDC and 13% for the REEs, i.e. 9.5%.

### C. Demand Forecasts and Sales Revenues for Phnom Penh

7. A model was developed to forecast the trend in electricity consumption for five sectors of the Cambodian economy between 2003 and 2019. Analysis of the forecasts revealed that demand would exceed generating capacity (specifically, peak supply) until the transmission line was constructed. Supply currently consists of the 52-megawatt (MW) capacity of EDC's diesel or heavy-fuel reciprocating engines and 57 MW of contracted independent power producer capacity in Phnom Penh. When a new 30 MW independent power producer is commissioned in 2005, EDC will reduce the use of its own generation plant except for meeting peak demand. In addition, the implied growth in demand will likely strain EDC's ability to connect sufficient customers to achieve the modeled increase in demand. Consequently, the load forecasts were revised downward to accord with expected generation in 2004–2007 and to better reflect EDC's resource constraints. This suggests that Cambodia will have some unmet electricity demand by the time the transmission line is commissioned. Thus the strong forecast growth in demand on the line implied by the forecasts is reasonable, given that the unmet demand is quite significant.

### D. Transmission Component

8. A financial analysis of the transmission component was undertaken by valuing the energy supplied by the transmission line at the prevailing average tariff of KR589 per kilowatt-hour (kWh) in Phnom Penh. In line with the assumptions in EDC's financial model, the average real tariff was assumed to remain constant throughout the forecast period while incorporating changes in the composition of total demand served. The cost of meeting this demand was taken to be (i) the capital cost of the transmission line, including physical contingencies and taxes and duties, but excluding price contingencies and interest during construction (approximately \$75 million); (ii) the quantity of energy imported from Viet Nam, valued at the average purchase price of \$0.07/kWh, including import duties and value-added tax (VAT); (iii) the operation and maintenance (O&M) of the transmission line, valued at 2% of the capital cost of the transmission line; (iv) the O&M distribution cost of \$0.005/kWh; and (v) the return on and of distribution

capital, estimated at \$0.017/kWh. An estimated 2% in transmission losses and 13.5% in distribution losses were subtracted from the amount of energy imported to determine net revenues from energy sales. All project benefits and costs were discounted at a rate of 6%, the calculated WACC for EDC.

9. After accounting for the full costs of meeting the additional demand via the transmission line, the Project generates a significant net return, suggesting that it is viable from a financial perspective (Supplementary Appendix G provides more details). The net present value of the Project is estimated to be about KR2,506 billion, which is equivalent to a financial internal rate of return (FIRR) of approximately 35.3%.

10. The financial results for the transmission component have been tested for the key variables for the project. The analysis of the impact of risks faced by the Project indicates that even if extreme events occur, such as stagnant growth for five years or a construction delay of four years, the Project remains financially viable by a comfortable margin. A significant increase in the cost of imported energy from Viet Nam would also not undermine the Project's viability. Table A8.3 presents the sensitivity results.

**TableA8.3: Sensitivity Results on Transmission Component**

		Financial Internal Rate of Return
Variable	Assumption	(%)
Base Case		35.3
Demand Growth	No growth in demand for 5 years	30.7
Construction Delays	Imports from the transmission line do not begin until 2011	24.3
Industrial Consumers	Growth in demand is only 50% of the rate predicted	31.0
Transmission Line Construction Costs	15% increase in capital costs	32.5%
Import Price from Viet Nam	Increased by 15% in 2012	33.5

Source: Asian Development Bank staff.

## **E. Distribution Component**

11. A bulk supply distribution system was considered for three alternative areas i.e. 1 kilometer, 2 kilometer and 5 kilometer wide areas on both sides of the transmission line. The 1 kilometer wide zone was shown to be the economically most beneficial. A financial analysis was undertaken of a bulk supply arrangement financed under the loan coupled with private sector reticulation. Demand was estimated for consumers located within 1 kilometer on both sides of the transmission line. Poor households were calculated to consume approximately 90 kWh per year and nonpoor households about 330 kWh per year. The benefits from this network were estimated by valuing the energy demand supplied through the distribution line at the estimated cost to supply. This cost consisted of two components: EDC's estimated cost of supplying bulk energy to a private service provider and the REE's estimated cost of reticulating electricity. Based on discussions with the regulator in Cambodia, the tariff was derived so as to incorporate (i) a bulk energy supply cost for electricity supplied at 22 kV by EDC; (ii) a return on EDC's investment in the distribution line up to the transformer; (iii) the recovery of O&M costs on the distribution line set at 2% of the line cost; (iv) a return on the REE's investment in the low-

voltage component; and (v) the recovery of the REE's O&M costs on the line, estimated at 2% of the construction costs.

12. The bulk energy supply cost was calculated to include both EDC's supply of energy from the imports from Viet Nam and diesel-fired generation in Phnom Penh. A unit border cost of energy imported from Viet Nam of \$0.06/kWh was assumed. EDC's generation was estimated to average \$0.11/kWh based on the operation of existing units and of supply by independent power producers. The calculations assumed that VAT and import duties are charged on these inputs. The supply price also includes a return on EDC's investment in the transmission line and covers the costs of operating and maintaining the transmission line, estimated at 2% of the capital cost of the transmission line.

13. In calculating the cost of capital items involved in the supply of energy, the return of and on, capital was calculated using an annuity approach. The annuity was calculated such that the discounted present value of the annuity over the life of the asset equals the cost of the investment. These annuities were calculated using a weighted average cost of capital of 6% for EDC and 13% for the REE. O&M costs on the distribution network were set at 2% of the capital cost of the distribution line. Losses of 8.5% were assumed.

14. The cost of meeting the demand on the distribution line was taken to be (i) the capital cost of \$5.1 million for construction of the distribution line to the low-voltage level; (ii) the quantity of energy imported from Viet Nam, valued at the average bulk supply price of approximately \$0.084/kWh; (iii) the O&M on the distribution network, valued at \$0.055/kWh; (iv) the line loss of 2% of energy dispatched from Viet Nam for use in the respective zones; and (v) the connection cost, valued at \$7.50 per connected customer. Energy imports include 10% VAT and 7% import duties, and an average level of taxes and duties of 15% was assumed to apply to the construction cost of the distribution line.

15. All project benefits and costs were discounted at a rate equivalent to the composite WACC for EDC and an REE. The analysis was run from 2006, when the distribution lines are assumed to be constructed, until 2035, when the lines are assumed to be at the end of their economic lives. The analysis indicates that the distribution of electricity is marginally viable, with the distribution of electricity estimated to achieve an FIRR of 12.6% (above a composite WACC of 9.5%). Select sensitivity cases were modeled on the financial returns of the distribution component. Any overruns in capital costs in the low-voltage systems would result in adjustment to the consumer tariffs, therefore those risks would be mitigated once construction had been completed. However, a sensitivity case was run in which connections to the system were half of those expected (which could be due to such barriers as connection costs or high tariffs). This would result in an FIRR that would make the project unviable. Asian Development Bank assistance with consumer services and REE support should help mitigate these risks.

## **ECONOMIC ANALYSIS**

### **A. Introduction**

1. An economic analysis was carried out for the two components of the Project within Cambodia plus the connecting transmission line in Viet Nam to allow a distributional analysis of net benefits between the two countries. The analysis for Cambodia is based on the assumption that the next lowest-cost alternative would meet the demand that would otherwise be met by the transmission line. The bulk supply distribution component that will electrify communities along the transmission line route in Cambodia was analyzed as an incremental component to the transmission line. Four alternatives for supply were analyzed to ensure that electricity demand in rural areas would be met by a least-cost alternative. The economic internal rate of return (EIRR) for the least-cost option was calculated on the basis that demand would not be met by an alternative source of supply (i.e., the without project case).

### **B. Transmission Line**

#### **1. Demand Forecast**

2. A model was developed to forecast electricity demand for five sectors in Phnom Penh between 2004 and March 2038. These sectors include residential, Government, industrial, hotels and commercial entities, and other. The demands for each sector were forecast based on historical monthly data on consumption for Phnom Penh. Demands were hypothesized to be influenced by the real price of electricity and by population and economic growth. The growth in demand from the commercial and hotel sector and the industrial sector was also assumed to be influenced by growth in real gross domestic product (GDP) in the world's seven leading economies (the Group of Seven). The data, specification of the model, and tests are described in Supplementary Appendixes H and I.

3. The results suggest that the main drivers of electricity demand are population and domestic economic growth. Global economic growth, as measured by growth in the Group of Seven countries, is found to be the main driver for growth in consumption in the hotel and commercial sectors. The price elasticities have the expected signs and were found to be generally low or not statistically significant. The consumer category most sensitive to price was industry.

4. The estimated coefficients from the regression model were used to forecast demand. The demand forecasts suggest a significant growth in demand of between 10.% and 12.5% during the first 5 years of the Project. In the longer run, growth in demand will slow down to about 5%. The increase in demand in the first years of the Project is due to a significant increase in the number of large-scale consumers. This will result in a change in the sectoral composition of demand. The share of demand from the hotel and commercial and the industrial sectors is expected to grow from 30% of total demand in 2004 to about 50% in 2017.

5. The forecast revealed that demand would exceed generating capacity in the time before the transmission line is constructed. Consequently, demand forecasts were revised downward for 2004–2007 to better reflect EDC's ability to connect new consumers. This suggests that Phnom Penh will have unmet electricity demand by the time the transmission line is operational. By this time, Electricité du Cambodge will be in a better position to connect new consumers. The analysis shows that the capacity of the transmission would be fully utilized by 2017, although the system would require new peaking capacity in 2014.

## 2. Least-Cost Alternatives

6. A least-cost alternative was developed to meet the demand that would otherwise be supplied through the transmission line. The feasible least-cost alternative is a conventional heavy fuel oil engine plant followed by single-cycle and combined-cycle gas turbines fueled by heavy fuel oil. These were phased in such a way that they would meet the growing demand that would otherwise be met by supply from the transmission line. Thus in the following analysis, the without project scenario is assumed to be the next lowest-cost alternative to the transmission line.

7. The long-run marginal costs for the least-cost alternative and for the transmission line were calculated for each consumer category. The results suggest that the long-run marginal cost for the transmission line would result in a lower cost of supply for all consumer categories, ranging from 4.9% lower costs for the Government sector to 3.3% for residential consumers, compared with the alternative.

## 3. Project Benefits

8. The benefits taken into account for assessing the economic viability of the Project included (i) the additional demand created through lower tariffs than would be the case without the transmission line, (ii) the lower cost of production associated with nonincremental demands, and (iii) the value of increased reliability and quality of supply associated with the transmission line.

9. Incremental demands were evaluated by comparing demand with the transmission line and with the next lowest-cost alternative. The incremental benefits were valued at the average demand price with and without the Project for each consumer category. If the higher cost of supply associated with the least-cost alternative to the transmission line was passed on to consumers, tariffs would need to rise by 9% for poor residential consumers and about 5% to 6% for other consumer categories. However, the low price elasticities combined with rather small tariff changes result in extremely small incremental benefits.

10. Nonincremental demands arising from the lower cost of production with the transmission line were calculated by deducting the incremental demand from the total demand supplied by the transmission line. Benefits associated with nonincremental demand were evaluated at the long-run marginal cost with and without the Project. These benefits account for 92% of total gross benefits from the Project.

11. The reduction in lost load was estimated by comparing the reliability of the transmission line with the expected reliability of the least-cost alternative. The forced outage rate for the least-cost alternative was assessed to be about 3.7% of expected demand in 2007 and assumed to remain at this rate throughout the study period. In contrast, the forced outage rate of the transmission line was assessed to be 0.04%.

12. An unexpected interruption to supply can impose large costs on consumers and on society at large. The value of the lost load is also likely to vary across consumer categories. Lost load for residential and Government consumers was evaluated at the average tariff, while the value of the lost load to commercial and industrial customers was evaluated at the cost of self-generation. Benefits associated with lost load account for 7% of total gross benefits.

#### **4. Project Costs**

13. Project costs were converted to economic prices by removing taxes on imported energy and value-added tax and duties on imported capital equipment. Traded goods were brought to domestic prices using the calculated shadow exchange rate factor. The costs of the Project include (i) the capital cost of the transmission line, including costs for resettlement; (ii) the cost of energy imported from Viet Nam; (iii) the transmission line loss of 2%; and (iv) operation and maintenance of \$0.0014 per kilowatt-hour (kWh), including labor costs, on the transmission line. In addition, distribution losses of 13.5% and operation and maintenance costs of \$0.0038/kWh on the distribution network were accounted for.

#### **5. Economic Internal Rate of Return**

14. Taking into account the economic costs and benefits, the Project yields a net present value (NPV) of \$201.26 million to the Cambodian economy and an EIRR of 32%. All net benefits are discounted by the 12% economic discount rate. The NPV reflects the difference in net benefits between the transmission line and the next lowest-cost alternative.

#### **6. Viet Nam**

15. For the works in Cambodia to bring benefits to Cambodia, the Project also needs to be linked to the transmission line in Viet Nam. The economic analysis conducted for the Vietnamese part gives an NPV of \$17.85 million and an EIRR of 20%. This analysis is presented in Supplementary Appendix H.

#### **7. Bulk Supply Distribution Component**

16. The bulk supply distribution component was identified to provide benefits to rural communities in Takeo Province that could be adversely affected by the transmission line and would otherwise not benefit from it. The incidence of poverty in these communities ranges from 25% to 75%, and the population density in the area is low. Households currently face high energy costs for a poor quality of supply from batteries and kerosene.

17. An analysis of four different supply options suggested that the conventional single-wire, earth-return line would be the least-cost option. Three areas adjacent to the transmission line were assessed for electrification. The most economically viable option gave an NPV of \$5.33 million and an EIRR of 25%. This would include electrifying an estimated 14,200 households, of which 5,700 would be poor, over the lifetime of the Project. The detailed economic analysis of the bulk supply distribution component is provided in Supplementary Appendix I.

#### **8. Risk and Sensitivity Analyses**

##### **a. Transmission Line Risks**

18. A sensitivity analysis was undertaken to determine how sensitive the economic viability of the transmission line is with respect to key parameters used in the economic analysis. The sensitivity analysis indicates that the conclusion of economic viability is robust with respect to significant changes in all tested parameters. The results of the sensitivity analysis are given in Table A9.1.



**Table A9.1: Sensitivity Results**

Variable	Switching Value	Change (%)
Population, Real GDP, GDP in the Group of Seven	0.393	(60.7)
Import Price	1.665	66.5
Construction Cost	4.860	386.0

GDP = gross domestic product.

Source: Asian Development Bank staff.

19. Sensitivity analysis was also undertaken with respect to key project risks to examine the probability of the Project becoming economically unviable (Table A9.2). The results indicate that the viability of the Project remains robust to key risks.

**Table A9.2: Sensitivity Analysis of Project Risks**

Deviation from Base Case	Modeling Assumption	NPV (\$ million)	PIR	FIRR	EIRR
None	Base case	201.262	0.168	0.354	0.325
Economic Recession	Zero growth in demand for 5 years	179.741	0.173	0.308	0.289
Construction Delays	Zero imports to 2011	150.668	0.181	0.244	0.241
Large-Scale Customers Do Not Connect	Growth in industrial demand 50% less than predicted	135.407	0.206	0.311	0.276
Elasticities Mis-specified	Price elasticities doubled and growth elasticities halved	100.736	0.214	0.203	0.205
Construction Costs	15% increase in construction costs	193.436	0.178	0.326	0.300
Import Prices	Price increase of 15% in 2012	157.833	0.196	0.336	0.303

EIRR = economic internal rate of return, FIRR = financial internal rate of return, NPV = net present value, PIR = poverty impact ratio.

Source: Asian Development Bank staff.

20. In addition, an analysis of institutional risk with respect to the utilization of the transmission line was undertaken. The results indicate that utilization would need to fall to 135 gigawatt-hours per year to reach the EIRR threshold of 12%. While this level is well below Cambodia's import needs, the power purchase agreement between Cambodia and Viet Nam will include a minimum load requirement of 300 gigawatt-hours per year. This level of utilization will ensure a comfortable margin in maintaining the economic viability of the transmission line.

21. A risk analysis was undertaken with respect to the risk factors used in the sensitivity analysis. Imposed distributions on selected variables are reported in Supplementary Appendix H. The results of the risk analysis show that the expected EIRR would fall from 32% to about 27%. The probability of the EIRR falling below the discount rate of 12% is less than 5%.

#### **b. Bulk Supply Distribution Component Risks**

22. The sensitivity analysis undertaken for the bulk supply distribution component revealed that the number of connections would be the key project risk. This finding and the socioeconomic conditions in the project area suggest that the affordability of connection costs may need to be addressed through payment in installments. The results of the risk analysis show that the expected EIRR falls to 14% as a result of imposing distributions on the key risk variables. The probability that the EIRR will fall below the 12% discount rate is 8.4%. Thus this

component is more sensitive to risks than the transmission line. Further details of risk and sensitivity analysis are given in Supplementary Appendix I.

### **c. Distributional Analysis**

23. A distributional analysis was carried out for the transmission line and for the bulk supply distribution component. Reduction in lost load was identified as the key benefit for consumers in Phnom Penh. As a consequence of assuming no change in the existing tariff structure, nonincremental benefits, which account for the majority of total benefits, accrue to Electricité du Cambodge. While the poor will experience direct benefits from improved reliability, most benefits to the poor are indirect. These benefits are likely to be realized through the employment opportunities resulting from the expansion of the industrial sector and through other economic growth effects.

24. The majority of benefits to the poor from the bulk supply distribution component are direct. Nonincremental benefits of the bulk supply distribution component will accrue to end-consumers. End-consumers will also experience a significant reduction in the price they pay for electricity and in the time associated with traveling to recharge batteries.

25. Overall, the Project will yield an NPV of net benefits of \$224.44 million. Cambodia will receive 92% of these benefits. The poor in Cambodia will receive 15.1% of these benefits, amounting to \$31.2 million. This share is in excess of the poor's share of GDP in Phnom Penh, but less than the poor's share of GDP for the country as a whole.

## SUMMARY POVERTY REDUCTION AND SOCIAL STRATEGY

### A. Linkages to the Country Poverty Analysis

Sector identified as a national priority in country poverty analysis? Yes	Sector identified as a national priority in country poverty partnership agreement? Yes
<p><b>Contribution of the sector/subsector to reduce poverty in Cambodia:</b></p> <ol style="list-style-type: none"> <li>1. The poor in Cambodia are heavily burdened by their lack of access to modern energy sources. Living in fuel poverty means that households spend a large proportion of their scarce cash income on alternative sources of energy, with lower efficiency are exposed to inadequate and smoky lighting, have less access to information, are constrained in terms of village social activity, and spend long hours producing manual energy. It also means that vaccines, medications, and animal vaccines cannot be stored nearby; that children have less time for studying; and that people feel unsafe at night. Fuel poverty particularly affects the poor, because their cash incomes are scarce, their workloads are heavy, and their opportunity cost of time is high. Inadequate and expensive sources of energy affect the economic viability of activities pursued by the poor. It reduces their ability to diversify livelihoods and income activities. Access to modern energy will significantly reduce the vulnerability of poor households, reduce their expenditure on energy, increase their quality of life, provide increased access to information, and help reduce their workloads.</li> <li>2. Electricity is a key input into food processing, small-scale enterprises, and other industrial and commercial activities important for economic growth and employment. A reliable electricity supply will reduce the barriers to expansion and will lead to productivity enhancements. Increased commercial activity in rural areas is key to reducing poverty. An improved electricity supply will remove a significant constraint to economic growth in the target provinces. This will better enable the poor to capture the benefits of economic growth.</li> <li>3. Access to a reliable source of electricity supply is scarce among both the urban and rural poor in Cambodia. Existing data suggest that only 15% of the population has access to a reliable source of electricity. To support the Government's efforts to reduce poverty the electricity demand of the poor must be addressed as an integral part of the poverty reduction strategy. Vice versa, any strategy for power development must address how to provide electricity services to the rural and urban poor.</li> </ol>	

### B. Poverty Analysis

**Poverty Classification: "Other"**

**Thematic Classification: Economic Growth/Regional Cooperation**

#### Data and Information Sources:

4. The poverty assessment and socioeconomic profile are based on a rural electrification survey in the targeted project area for the bulk supply distribution component. This was complemented by data from a nationwide rural electrification survey, by statistics derived for Phnom Penh from the Cambodian socioeconomic survey in 1999, and by secondary data sources and studies of urban poverty in Phnom Penh. In addition, visits were conducted to consult with the urban and rural poor.

#### Poverty Profile and Issues: Phnom Penh

5. The Cambodian socioeconomic survey indicates that about 15% of the population in Phnom Penh lives below the poverty line of \$0.63/capita/day. However, many low-income residents are not registered with local authorities, and as such are not part of the official statistics. As a consequence, the poverty incidence in Phnom Penh is likely to be higher. The poor often reside in squatter areas with insecure land tenure, and therefore may face a higher cost of and/or more difficulties in accessing services, including electricity, garbage collection, and water. Some poor are unable to meet up-front charges to access electricity services in one installment. These costs include connection fees, consumption deposits, and costs associated with wiring. Findings from field visits to poor areas in Phnom Penh indicate that the poor living in squatter areas both in the central districts and in the outskirts of Phnom Penh access services through a wholesaler at far higher costs than with a direct Electricité du Cambodge (EDC) connection. The tariff for electricity supplied by a wholesaler ranges from \$0.30/kilowatt-hour (kWh) to \$0.45/kWh, compared with a lifeline tariff of \$0.09/kWh offered by EDC. This means a monthly expenditure of \$7.5 to \$13.5 for 30 kWh rather than the \$2.6 that they would have paid with direct EDC access. The figure of 30 kWh is an approximate upper estimate of a poor's household consumption based on the affordability of appliances.
6. In other cases, the poor who cannot overcome barriers to connect will access electricity services by sharing

connections. This also depletes the ability of lifeline tariffs to target the poor, because their consumption would be measured by one meter shared by at least one other household. With a single meter, a household consuming 50 kWh/month would have an electricity bill of \$4.4; however, if the household shares this connection with another household, the monthly bill for the 50 kWh consumed by each household would increase to \$5.6, 27% higher than with a single connection.

7. Thus institutional constraints and up-front costs may lead to inefficient targeting of subsidies. Existing evidence suggest that this may be the case for the electricity sector in Cambodia, which means that the nonpoor may be benefiting more from the subsidies than the poor. The economic cost of the subsidies in terms of distortions and/or forgone expenditure alternatives more effective in reaching the poor is costly and is borne by both poor and nonpoor.

#### **Bulk Supply Distribution Project Area**

8. Communities along the transmission line route are vulnerable to such external shocks as flooding and drought. Poverty levels are consequently high. The district-level incidence of poverty ranges from 27.6% to 44.3%. The incidence of poverty in the project targeted communities along the transmission line ranges from 25% to 75%. The average incidence is about 40%.
9. Table A10.1 shows the socioeconomic profile by poverty classification of a random sample of the expected project beneficiaries. Poor households are more likely to be headed by a woman or a member of an ethnic minority, to be dependent on growing rice as a source of income, and to have lost more work days to illness than the nonpoor. Education levels for both poor and nonpoor are low as reflected in the average years of schooling.

**Table A10.1: Household Profiles**

Item	Poor Households		Nonpoor Households	
	Number	Share (%)	Number	Share (%)
Total	192		319	
Female Household Head	34	17.7	44	13.8
Non-Khmer (ethnic minority)	3	1.6	1	0.3
Main Occupation Is Growing Rice	133	69.3	214	67.1
Average Number of Years Schooling of Household Adult Members	3.76		3.64	
Average no. of days lost to illness in the last 3 months	0.75		0.66	

Source: Project preparatory technical assistance field survey along the transmission line route.

#### **Connecting the Poor:**

10. To ensure that the poor can fully benefit from investments in the electricity sector they need to have direct access to electricity services. Institutional issues such as land tenure tend not to be a barrier to accessing electricity services in rural Cambodia; however, the up-front costs associated with connection, including connection charges, consumption deposits, and wiring may add up to an unaffordable amount. The survey included an assessment of possible barriers to connection, including the affordability of up-front charges. Of the households along the transmission route, 12.5% indicated that they would not be able to afford up-front connection costs. Most households would be able to use their own savings to connect, while others would need to borrow money or sell livestock (Table A10.2). Rural electricity Entrepreneurs (REEs) will be responsible for supplying to end-consumers. Allowing consumers to pay the connection fee in installments could be an important measure to increase connections. In rural Cambodia, this business practice is often implemented to increase the number of consumers.

**Table A10.2: Means to Pay for Up-Front Charges**

<b>Payment Mode</b>	<b>Primary Sources</b>	<b>Secondary Source</b>
Use of own savings	361	30
Borrow from friends and relatives	19	41
Borrow from moneylender or others	2	6
Sell livestock	45	141
Sell other assets	12	30
Pay after good crop	2	50
Other	9	25
Simply cannot afford KR140,000	67	27

Source: Project preparatory technical assistance field survey along the transmission line route.

11. To promote connections for the poor in Phnom Penh, EDC has agreed to offer a 5-ampere capacity connection rather than a 10-ampere connection to better accommodate the low consumption levels by the poor. This will reduce the connection fee from \$15.5 to \$7.8 and reduce the consumption deposit from \$13 to \$6.5. Overall, this will reduce the up-front outlay by more than \$14. This is a significant reduction for a poor household. Under the loan, EDC will assess whether installment payments will still need to be introduced to connect the poor in Phnom Penh. EDC has, in principle, approved installment payment of connection fees, but implementation will take place in accordance with the findings of a more in-depth analysis of the affordability of up-front costs.

#### **Impacts in Rural Areas:**

12. The most immediate and direct impact of providing reliable electricity services to the poor is the effect on expenditure savings in relation to energy (Table A10.3). In general, the poor's consumption is determined by the affordability of appliances. However, the improved reliability and cash savings will induce households to consume more electricity. Most households, including the poor, indicated that they would purchase a color television if they had access to reliable electricity. Even with the expected increase in consumption levels resulting from providing poor households with access to grid electricity, cash savings will be significant. Monthly electricity expenditure is expected to drop by more than 25% and income shares spent on electricity will fall from around 30% to less than 20%.

**Table A10.3: Immediate Impact on Poor Rural Households - Cash Savings (Average \$/month)**

	<b>Electricity consumption</b>	<b>Electricity expenditure (\$)</b>	<b>Share of total HH expenditure (%)</b>	<b>Share of HH cash income (%)</b>
Without Project	4 kWh	4.44	6	30
With Project	7.2–13.2 kWh	2.06–3.78	1–2	19

KWh = kilowatt-hour.

Source: PPTA field survey along the transmission line route

13. Other impacts of electrification on the poor in Cambodia include benefits of increased social activity in the villages, increased access to information and the enjoyment that television brings, ability for children to study at night and the ability to better store vaccines and other medications. While many of these social benefits are difficult to quantify and are perceived welfare impacts stated by the poor themselves, they do reflect improvements in the quality of life and are equally important to expenditure savings. Given the history of violence in Cambodia, proper lighting in the evening also gives a sense of safety. Many of the social benefits occur at the community level and have "public good" characteristics and as such they do not exclude households in electrified villages that are not connected.

**C. Participation Process**

Stakeholder analysis prepared	A stakeholder analysis was undertaken during the social assessment and has contributed to the resettlement planning process.
Participation strategy	The resettlement plan includes a detailed public participation and consultation strategy for further resettlement planning, implementation, and monitoring and evaluation.

**D. Social Safeguards and Other Social Risks**

<b>Subject</b>	<b>Significant, Not Significant, Uncertain, None</b>	<b>Strategy to Address Issues</b>	<b>Plan Prepared</b>
Resettlement	Significant	The Project will significantly affect more than 200 people through relocation and loss of productive income. A resettlement plan has been prepared to provide for compensation for all losses at replacement cost and for social and economic rehabilitation.	Resettlement plan.
Gender	Not significant	Vulnerable women heads of households will be provided with special assistance under the resettlement plan. An income restoration program for households losing sugar palm trees will include assistance for women to develop alternative livelihoods.  The increased reliability of street lighting in Phnom Penh and street lighting for the first time in villages along the transmission route, will increase the sense of security, particularly of women, and reduce restrictions on social and livelihood activities.	Provision is made in the resettlement plan.
Affordability	Yes		Installed capacity will be better matched to the low consumption levels of the poor. This will reduce up-front costs associated with connection fees and deposits. Installment payments will be implemented based on an in-depth affordability assessment.
Labor	None	None.	None.
Indigenous Peoples	None	No indigenous (ethnic minority) households are among the affected people, although about 1% of households surveyed along project alignments are non-Khmer.	No separate output.
Other Risks/ Vulnerabilities	None	None.	None.

## SUMMARY RESETTLEMENT PLAN

1. **Scope of Land Acquisition and Resettlement.** The main components of the Project would require land acquisition of 8.94 hectares (ha) severely affecting 15 paddy rice farmers, and 148 houses and 1 commercial enterprise, which would need to be relocated (see Table A11.1). Sixteen percent of structures can be moved out of the right of way (ROW) onto the remaining land of their owners behind the ROW. The remaining 84% must move to another location within the same village. There are also approximately 7,000 economically valuable trees to be cleared from the ROWs. A total of 634 affected households have been identified as losing land and/or structures. Except for land required for towers, the property owners can retain ownership of the land within the ROW and can continue to use it for agricultural purposes.

**Table A11.1: Scope of Land Acquisition and Resettlement for Transmission Project**

Components	Total land acquired (ha)	Of which paddy land	Affected households	Affected population	Demolished floor spaces (m2)	Relocated households	Relocated persons
220kV Line	3.70	3.37	370	2,100	4682	<b>140<sup>3</sup></b>	800
115kV Line	0.04	0.04	100	500	305	9	45
<b>Subtotal</b>	<b>3.74</b>	<b>3.41</b>	<b>470</b>	<b>2,600</b>	<b>4987</b>	<b>149</b>	<b>845</b>
WPP Substation	3.35	3.35	8	45	0	0	0
Takeo Substation	1.85	1.85	7	35	0	0	0
<b>Subtotal</b>	<b>5.20</b>	<b>5.20</b>	<b>15</b>	<b>80</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Total</b>	<b>8.94</b>	<b>8.61</b>	<b>485</b>	<b>2,680</b>	<b>4987</b>	<b>149</b>	<b>845</b>

Notes: 1. These are all subject to verification during the Detailed Measurement Survey process

2. Affected population numbers based on average household sizes

3. One of these is a commercial operation

Source: Project Preparatory Technical Assistance.

2. **Scope of the Resettlement Plan.** This summary resettlement plan covers all project components that involve land acquisition, compensation, and resettlement: the 220- and 115-kilovolt transmission lines and the West Phnom Penh and Takeo substations and related access roads. A census and inventory of lost assets was conducted in 2001, together with a socioeconomic survey of 25% of affected households. The census was updated in 2003, as was the inventory of assets for the severely affected relocating households and severely affected households losing agricultural land within the 30-meter right-of-way of the transmission lines and the substation sites. An resettlement plan (Supplementary Appendix C) has been prepared for the Project in compliance with the Asian Development Bank's (ADB's) *Policy on Involuntary Resettlement (1995)* and *Handbook on Resettlement: A Guide to Good Practice and the World Bank's OP 4.12*. The resettlement plan will be updated following detailed design during project implementation.

3. **Policy Framework and Entitlements.** The policy framework and entitlements have built upon the laws of Cambodia, principally the country's 1993 Constitution, 2001 Land Law, and 2001 Electricity Law 2001; the draft national resettlement policy that was prepared with ADB's assistance;<sup>1</sup> ADB's *Policy on Involuntary Resettlement* (1995); the World Bank's operating procedure 4.12; and Government-approved resettlement plans for other ADB and World Bank projects. Provisions and principles adopted in the resettlement plan will supersede the provisions of any relevant decrees wherever a gap exists. In the case of discrepancies between the Government's procedures and the ADB's requirements, ADB's requirements will apply.

4. **Project Principles.** The following basic principles have been adopted for the Project:

- (i) The acquisition of land and other assets and the resettlement of people will be minimized as much as possible by identifying possible alternative project designs and appropriate social, economic, operational, and engineering solutions that have the least impact on populations in the project area.
- (ii) The populations affected by the Project are defined as those who may stand to lose, as a consequence of the Project, all or part of their physical and nonphysical assets, including homes, homesteads, productive lands, commercial properties, tenancy, income-earning opportunities, social and cultural activities and relationships, and other losses that may be identified during the process of resettlement planning.
- (iii) All those affected will be entitled to be compensated for their lost assets, incomes, and businesses at full replacement cost and will be provided with rehabilitation measures sufficient to help them improve, or at least maintain, their preproject living standards, income-earning capacity, and production levels.
- (iv) All affected populations will be equally eligible for compensation and rehabilitation assistance, irrespective of tenure status, social or economic standing, and any other factors.

5. **Entitlement Matrix.** The entitlement matrix for the Project (Table A11.2) summarizes the main types of losses and the support entitlement for each type of loss.

**Table A11.2: Summary Entitlement Matrix**

Types of Losses	Entitlements
<b>Land</b>	
Agricultural land	Cash compensation at replacement cost at current market value. All land transactions will be free from taxes, registration, or transfer costs.
Residential and commercial land	Cash compensation at replacement cost at current market value. Where more than eight households in one village or local area want replacement land, they will be entitled to a standard plot on a fully serviced resettlement site at a location acceptable to those affected.

<sup>1</sup> ADB. 2000. *National Resettlement Policy Enhancement and Capacity Building*. Manila (TA-5935-REG, for \$500,000, approved 20 September 2000).



Types of Losses	Entitlements
Temporary damage to crops, land, structures, or private or communal infrastructure caused by construction	Cash compensation at replacement cost and/or restoration to its original condition or better.
<b>Standing Crops and Trees</b>	
Standing crop	Cash compensation at market rate for loss of crops.
Trees, fruit	Cash compensation at market rate based on the type, age, and productive value of the trees.
<b>Lost Income and Wages</b>	
Lost business income during the transition period until business is re-established	Lump sum cash compensation of actual income lost by small businesses. Lump sum cash compensation according to tax declarations of large businesses.
Lost wages during the transition period until the place of employment is re-established	Lump sum cash equivalent to three months salary.
<b>Agricultural Laborers</b>	
Income restoration measures, farm laborers, severely affect farmers and owners of productive trees	Lump sum cash equivalent to three months salary and assistance to find alternative employment.  Severely affected farmers will be entitled to income restoration measures i.e. agricultural extension assistance from Ministry of Agriculture and Rural Development to increase productivity on remaining land or diversify to new technologies, learn a new livelihood.  Severely affected owners of productive trees will be entitled to income restoration measures of microfinance and training in alternative livelihoods provided through existing nongovernment organization programs in the project area.
Cost of living allowance for severely affected households and farmers	Lump sum of \$40 or equivalent of 40 kilograms of rice per household.
Transportation allowance for relocating households	Lump sum of \$40 or sufficient to cover the cost of transporting new and salvaged materials and personal possessions, whichever is greater.
Special allowance for socially or economically vulnerable households	A \$20 allowance plus additional cash and other assistance as needed, based on identified needs and priorities. Households with more than one factor of vulnerability will be entitled to a \$20 allowance for each factor. For example, households that are extremely poor and headed by a woman would be entitled to \$40.
Relocation costs for relocating rented houses	Lump sum of cash equivalent to three months rent, assistance to locate another house to rent, transportation allowance, and a cost of living allowance.

Source: Project Preparatory Technical Assistance.

**6. Vulnerable Groups.** The social analysis shows that all those affected are Khmer. One-quarter of all households surveyed during the socioeconomic survey and one-third of severely affected households were found to belong to a vulnerable group (female-headed, extremely poor, returnees, elderly, disabled, and children without means of support). Special attention will be given to identifying and addressing the needs of vulnerable households.

7. **Income Restoration.** Agricultural households that are severely affected through a loss of 20% or more of their productive land should be entitled to replacement land of equal productivity. However, all farmers losing land for substations have indicated a preference for cash compensation rather than land. They will also be entitled to agricultural extension assistance for increasing productivity or diversifying the use of their remaining land. Severely affected owners of productive trees will be assisted with microcredit and alternative livelihood development through existing non-government organizations in the Project area. Loss of business and wages will be compensated during the transition period.

8. **Participatory Process of Resettlement Planning and Implementation and Grievance Mechanism.** Extensive consultation has taken place since the first surveys were undertaken in 2000. Further resettlement planning and implementation will follow a participatory approach of consultation to finalize replacement costs, relocation and income restoration options, monitoring and evaluation of impacts and benefits, and design and participation in a grievance mechanism.

9. **Disclosure.** Key information in the resettlement plan, including compensation and rehabilitation options, have been disclosed to the affected households and communities in the form of a resettlement information brochure. The final resettlement plan, or its summary, will also be displayed in a form and language that they can understand in an accessible place. The resettlement plan or this summary will be posted on ADB's website.

10. **Institutional Arrangements.** Resettlement planning, implementation, and monitoring will be done under the guidance of consultants. The Project will assist Electricité du Cambodge (EDC) to establish and build the capacity of a social and environmental unit. EDC will put institutional arrangements in place to ensure effective and timely design, planning, consultation, and implementation in relation to the land acquisition, compensation, resettlement, and rehabilitation program.

11. **Monitoring the Resettlement Plan Implementation and Impacts.** EDC and the Ministry of Economy and Finance will be responsible for monitoring internal resettlement. Before any resettlement activities commence, the project implementation consultants will contract a suitably qualified nongovernment organization, social science institute, or domestic consultant to carry out independent monitoring and evaluation of the resettlement process and its impacts.

12. **Cost Estimates.** Replacement costs and rates have been established in consultation with village administrations in the project areas. Final rates acceptable to those affected will be determined through further consultation during the detailed measurement survey. The estimated cost for resettlement planning, resettlement plan updating, implementation, and income restoration is \$2.5 million.

13. **Implementation Schedule.** All resettlement activities will be coordinated with the civil works schedule. The Government and ADB will not approve the commencement of civil works for any component to be financed from the loan proceeds until the Government has satisfactorily completed compensation payments and relocation to new sites in accordance with the approved resettlement plan for that component and has ensured that rehabilitation assistance is in place.