

POWER

PRIORITIES AND PROPOSED SECTOR INVESTMENT PROGRAM



MINISTRY OF TRANSPORT, COMMUNICATION AND
PUBLIC WORKS



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PREFACE

This final version of the Sector Investment Program (SIP) for the Power Sector has been prepared under the direction and guidance of the Ministry of Transport, Communications and Public Works, in close collaboration with the Ministry of Planning and Finance.

The document is part of a larger exercise undertaken by the Government of Timor-Leste. Final versions of the SIP have been prepared for the following sectors:

- A. Basic Service Sectors
 - Education and Training
 - Health Care
- B. Production-related Sectors
 - Agriculture, Forestry and Fisheries
 - Natural Resources and Environment
 - Private Sector Development
- C. Basic Infrastructure and Housing Sectors
 - Communications
 - Power
 - Transport
 - Water Supply and Sanitation
 - Housing and Urban Development
- D. Governance-related Sectors
 - Public Sector Management
 - Local Government and Civil Society
 - Rights, Equality and Justice
 - Security, Peacebuilding and Reconciliation
 - External Relations and Cooperation

Supporting expenditure data and analysis has been provided by the Ministry of Planning and Finance. Unless otherwise specified, these data are drawn from two sources. CFET budget appropriations data has been provided by the Budget Office of the Ministry of Planning and Finance for FY2001/02 onwards. CFET data for FY1999/00 and FY2000/01 are estimated from aggregate data on CFET expenditures included in the National Development Plan. Information about external assistance to Timor-Leste that is included in the reports is obtained from the Registry of External Assistance (REA) database of the Ministry of Planning and Finance. Data for external assistance are as of December 31, 2004. These data have been made available through the generous cooperation of Timor-Leste's Development Partners. Donor data has been supplemented with information provided by individual government agencies that have responsibilities for particular donor-funded projects and programs. The information about these programs includes assistance channeled by donors through international and local NGOs, as well as programs implemented directly by individual donors. Some data provided by donors is provisional and subject to change as work on individual projects and programs progresses.

The data presented in these reports covers capital and recurrent expenditures and therefore aims to present a total picture of development spending in Timor-Leste. However, as the report indicates, information on these two categories is incomplete in a number of areas. Estimates have been made on the basis of information that is available.

This report reflects policies and programs for this sector as of February 2005.

TABLE OF CONTENTS

PREFACE	I
EXECUTIVE SUMMARY	IV
I. SETTING FOR THE POWER SECTOR.....	1
ACCESS TO ELECTRICITY	1
LEGAL AND INSTITUTIONAL FRAMEWORK.....	2
SERVICE PROVISION AND TARIFFS.....	3
II. POWER DEMAND AND SOURCES OF ENERGY.....	4
CURRENT SUPPLY AND DEMAND FOR POWER.....	4
PROSPECTIVE DEMAND FOR POWER	5
ENERGY SOURCES FOR POWER GENERATION.....	6
III. GOALS AND OBJECTIVES FOR THE SECTOR	9
GOALS AND OBJECTIVES	9
THE ELECTRIFICATION PROGRAM.....	9
OPTIONS FOR GENERATION AND TRANSMISSION.....	9
RURAL ELECTRIFICATION.....	10
ECONOMIC BENEFITS OF ELECTRIFICATION	11
IV. PROGRESS, ISSUES AND CHALLENGES.....	11
RECENT PROGRESS	11
ISSUES FOR THE IMMEDIATE FUTURE.....	13
CHALLENGES FOR THE MEDIUM TERM.....	14
V. DEVELOPMENT OF POWER UTILITIES AND PRICING POLICIES	15
DEVELOPMENT OF EDTL	15
OTHER SERVICE PROVIDERS	18
PRICING POLICIES.....	19
VI. PROGRAMS FOR THE MEDIUM TERM.....	19
LEGAL AND REGULATORY FRAMEWORK AND RURAL ELECTRIFICATION MASTER PLAN	19
RESOURCE ASSESSMENTS AND PLANNING STUDIES	21
PRIORITY INVESTMENTS IN THE POWER SYSTEM	23
POWER SYSTEM INVESTMENTS FOR THE MEDIUM TERM	24
PRIORITISING THE PROPOSED NEW PROGRAM AND INTERSECTORAL LINKAGES	26
VII. EXPENDITURE PROGRAMS AND FUNDING.....	27
CURRENT LEVELS OF EXPENDITURE.....	27
PROPOSED EXPENDITURE PROGRAM.....	28
CAPITAL AND RECURRENT EXPENDITURES.....	29
SOURCES OF FUNDING	30
VIII. SOURCES OF UNCERTAINTY	31
IX. ANNEX TABLES	32

ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
BOT	Build Own Transfer
CFET	Consolidated Fund for East Timor
CFL	Compact fluorescent lamps
EDTL	Electricidade de Timor-Leste
ESMAP	Energy Sector Management Advisory Programme
ERR	Economic rate of return
ETPA	East Timor Public Administration
ETTA	East Timor Transitional Administration
GWh	Gigawatt Hour
Km	Kilometer
KV	Kilovolt
kWh	Kilowatt hour
LNG	Liquefied natural gas
MPF	Ministry of Planning and Finance
MTCPW	Ministry of Transport, Communications, & Public Works
MW	Megawatt
NDP	National Development Plan
NORAD	Norwegian Aid Agency
NVE	Norway Water Resources and Energy Directorate
NPV	Net present value
PLN	Perusahaan Listrik Negara (the National Power Company of Indonesia)
PPIAF	Public-Private Infrastructure Advisory Facility
PSDP	Power Sector Development Plan
SIP	Sector Investment Program
SHS	Solar home systems
TFET	Trust Fund for East Timor
UN	United Nations
UNTAET	United Nations Transitional Administration for East Timor
USAID	United States Agency for International Development
Wp	Watts per panel (solar)
Wh	Watt Hours

EXECUTIVE SUMMARY

Accurate data is not available on the extent of access to electricity in Timor-Leste. Current estimates suggest that approximately 40,000 households have access to electricity, implying an electrification ratio of 20 percent. Roughly half of the electrified households are located in Dili and the immediate surrounding area. Only five percent of rural households are electrified (approximately 7,000 households) with the remaining 13,000 located in other cities and towns. Despite intensive rehabilitation efforts, the operational level of power systems in Timor-Leste remains low. Only service in Dili currently operates for 24 hours a day. All other grids operate for more limited periods each day—most often 6 hours a day.

Primary responsibility for service provision rests with Electricidade de Timor-Leste (EDTL), although a number of small community-based service providers have been set up under donor-funded programs. The plan for the medium-term is that EDTL would be transformed into a public corporation that will operate on a commercial basis. EDTL's financial position has been a cause for concern, although some improvements are evident. With the rapidly increasing installation of prepayment meters (and consequent loading reductions), there is some optimism that the budget subsidy can be reduced. Present projections adopted by the Budget Office are based on a CFET subsidy of \$5.4 million in FY2004/05 reducing to less than \$3 million in FY2008/09. These compare with the subsidies of \$7-8 million a year for much of the past five years.

Total installed peak load capacity is 19 MW at present, about 10 percent higher than in 1998. All power supply is based on diesel generation and imported fuel. The cost of the fuel is about 30 percent higher than prices in other comparable countries, largely because of the monopoly position of the current supplier – Pertamina. The combination of small diesel based generating capacities and high import prices for fuel means that the delivered price of power in Timor-Leste is high. It is currently estimated to be about 14 cents a kilowatt-hour. Commercial consumers and Government pay 20 cents a kilowatt-hour for their power and other customers pay 16 cents.

The Government policies for the development of the power sector center on four broad principles:

- The creation of a legal, regulatory and institutional framework that will support the sound development of the power industry over the medium and longer term.
- A sustained program of electrification aimed at providing the vast majority of households with access to power over the next 20 years.
- Development of lower cost, domestic sources of energy that can replace high cost, imported diesel.
- Enforcement of the principle that customers are expected to pay for the electricity services they receive, while recognizing that certain groups of consumers may require targeted subsidies.

This SIP proposes an ambitious program of work, including a series of studies, aimed at preparing the necessary legal, regulatory and administrative arrangement for the development of the power industry. Since the first draft of this SIP was prepared in November 2003 that has been good progress on the proposed program. These have related to the assignment of a number of the studies to various financing sources; commencement of operations of the EDTL Management Contractor (CEM); accelerated progress in the installation of prepayment meters; good progress in ongoing hydroelectric studies; and some progress in revenue collections. Significant progress has also been made in initiating power-related activities in the oil and gas sector. These include project appraisal and financing arrangements for the south coast oil and gas seep “demonstration projects”, and preparation of draft

prequalification and bidding documents for the establishment of temporary fuel storage facilities and supply of oil products as a transition step towards providing more competitively priced oil supplies to the country's power generating stations.

The Government is committed to a sustained program of electrification for the country. International experience clearly points to the close linkages between electrification and rural economic growth. The recent multi-agency Poverty Report on Timor-Leste estimated that providing electricity to all households in the country would reduce the incidence of poverty by 26 percent and increase consumption among the affected households by more than 20 percent. No formal target has been set as yet, but the expenditure programs in the SIP are based on the assumption that at least 80 percent of the population should have access to electricity within the next twenty years. After allowing for population growth, this implies a program that would connect an additional 230,000 households either to a grid or to local, off-grid arrangements including through mini-hydro, solar and wind power energy sources. With the use of appropriate electrification standards, the cost of such a program would probably be in the range of \$70 million at today's prices.

Under such a program, the installed peak load capacity would have to increase by an average of eight percent a year to about 110 MW over the 20 year period – an increase of some 90 MW. The capital cost of this program is not yet known with any degree of accuracy and will depend on the mix of thermal and hydro generation that is feasible. The SIP proposes several feasibility studies for particular infrastructure projects that, on completion, will give more reliable estimates of the capital costs of the program.

The Government attaches a very high priority to the development of lower cost domestic energy sources to replace expensive fuel imports that are currently running at about \$8 million a year for the power sector alone. The most promising opportunities are hydro resources and onshore oil and gas. The main hydro resource is Lake Ira Lalaro that, if developed, could provide about 27 MW of capacity at a low cost per kWh. After allowing for other mini- and micro-hydro projects, wind power and solar power, somewhere in the range of 40-60 MW of additional generating capacity would have to be met from thermal generation based on fossil fuels. A high priority is attached to further investigation of the known onshore oil and gas resources along the south coast of Timor-Leste. In the event that recoverable reserves are significant – and there is some basis for optimism here – these resources could be used to meet the needs of the power industry.

The Government recognizes the importance of ensuring the financial viability of the power industry. The annual costs of service provision and the amounts of investment required over the next 20 years are substantial. The difficulties created by the environment of free electricity in the recent past are gradually being overcome, and the expectation is that EDTL, under new management arrangements from January 2004, can, in a matter of a few years, move to the point where its operations are no longer subsidized from the national budget. Firm action to ensure that customers pay for services, together with steps to reduce the high price of imported fuel, could allow EDTL to generate a modest operating surplus within the next four years.

Over the past five years, a total of \$67 million was spent in the power sector, \$42 million of which was for the operating costs of EDTL. Most of the remainder went to rehabilitation of the power infrastructure. Power sector assets currently stand at approximately \$15 million at historical cost. Donors provided direct funding in the amount approximately \$14 million, almost all of which was for rehabilitation.

The expenditure program for the next five years set out in this SIP calls for total capital and recurrent outlays of approximately \$200 million, with the operating costs of EDTL accounting for about \$56

million. The program includes the Ira Lalaro hydro generation project and the transmission line from Los Palos to Dili, the total costs of which are currently estimated at about \$112 million. The remaining \$40 million of expenditures would go to studies related to the legal and regulatory framework, resource assessments, and feasibility and preparation studies for possible new projects and a start up of the country's national electrification program.

The proposed program would be developed in three distinct phases. For the immediate future, emphasis will continue on EDTL revenue collection and capacity building; accelerated investigation of the energy resource base, and continuing rehabilitation works in the system to improve efficiency and reliability. In approximately one year, with more accurate information on the domestic oil and gas resources and their cost of development, and with the feasibility results and costs of the 27MW Ira Lalaro Hydropower Project, informed decisions will be made on the country's optimal generation expansion program. With a clear strategy in place, emphasis would then move to an accelerated program of rural electrification beginning around FY2007/08, at a measured rate that will meet an electrification target of 80 percent of households by 2025.

Decisions on the overall funding arrangements for the proposed program can only be made as more accurate information becomes available of the costs of hydro development and whether the development of domestic oil and gas reserves is feasible. The capital cost of the program outlined in this SIP is estimated at about \$142 million, with only \$9 million of donor funding already committed under ongoing projects and programs, and \$2 million currently included in EDTL's budget for capital spending. The balance of about \$130 million would have to be raised from various public and private sources. The Government recognizes that the mobilization of funding on this scale will pose a major challenge. One option may be public-private partnerships that involve private investment in generation of thermal or hydro power and public investment in transmission and distribution. A shift to domestic oil and gas as the energy source for the power sector may have significant implications for public investment requirements in the sector over the medium-term. Generation capacity fueled by domestic oil and gas would likely be developed by the private sector ahead of the Ira Lalaro hydro project.

I. SETTING FOR THE POWER SECTOR

Access to Electricity

As recently as 1985 the electrification ratio of Timor-Leste was only 3.9 percent. By 1998, after 13 years of relatively intense efforts, 28.7 percent of all villages (sucos) were electrified and about 70 percent of the households in the electrified sucos were connected to the grid. Development was relatively rapid during the later years of Indonesian rule, and between 1996 and 1998 the length of 20 kV line increased from 485 km to 669 km, and low-voltage lines from 146.9 km to 836.3 km. Even then, East Timor had the second lowest electrification ratio of Indonesian provinces. The events of 1999 resulted in widespread destruction of almost all power sector assets, including administrative buildings, power stations, power lines and associated records and documentation. Even solar panels and connection boxes at individual home installations were purposely damaged.

Over the past five years there has been considerable progress in restoring electricity services to consumers, particularly in Dili. There are presently about 23,000 customer connections in Dili and its environs, with a consumer load of about 13.5 MW. Outside Dili, some 17,000 customers are connected to 57 isolated, small power grids. There are varying estimates of the number of households with access to electricity (Table 1). The 2001 Poverty Assessment Survey indicated that about 28 percent of the population (about 237,000 people) had access to electricity. This estimate is somewhat at variance with surveys carried out by the consultants who prepared the Power System Development Plan (PSDP) in mid-2003.¹ Based on independent surveys, they concluded that approximately 36,000 households had access to electricity in mid-2003 and estimated that the electrification ratio for households was 20.7 percent. The provisional results from the 2004 census about the number of households in the country imply that the electrification was probably about 19 percent in 2003.²

Table 1: Estimated Electrification Ratios in Timor-Leste

Indicator	PLN -1998	PSDP (mid-2003)
Electrified villages	127	184
Total villages	442	498
Electrification ratio (%)	28.7	36.9
Electrified households	38,133	36,471
Total households	189,600	175,860
Electrification ratio (%)	20.1	20.7

The PSDP consultant estimated that the network served 85 percent of households in Dili and the immediate rural surroundings. In other district capitals and their immediate rural outskirts, some 18 percent of households were electrified, but only five percent of rural households were electrified. The main reason for the large discrepancy with the 2001 Survey data is the widely differing estimate of rural households with electricity.

According to the latter, some 12 percent of rural households were electrified in 2001. More recent information suggests that about 5,400 households are connected to electricity in the subdistricts with at least as many waiting for connections when power supply is available.

¹ A Power Sector Development Plan for Timor-Leste covering a 20-year development period was prepared under the direction of Asian Development Bank (ADB).

² There is uncertainty over the precise number of households that are electrified. The PSDP consultants used a figure of 175,860 for the number of households in Timor-Leste in mid-2003. Based on the provisional results from the 2004 census, the number of households in Timor-Leste is estimated at about 189,000 in mid-2003. A detailed discussion of the demographic projections used throughout all the SIPs is included in Annex I of the overview report on the SIP exercise.

Legal and Institutional Framework

The legal framework. Progress in re-establishing electricity services after the events of 1999 was hampered by something of a legal vacuum that was not fully addressed by early regulations issued by the United Nations Transitional Authority of Timor-Leste (UNTAET). The general legal principle of UNTAET's initial Regulation 1999/1 was that the laws that applied in Timor-Leste prior to the 25th of October 1999 would continue to apply. However, Indonesian law contained explicit references to Indonesian agencies no longer in authority in Timor-Leste, including the state-owned electricity authority (PLN). UNTAET therefore established Electricidade de Timor Leste (EDTL) from the remnants of the PLN power system and associated staff, placing international personnel in managerial positions. The UN led intensive efforts to restore the power system with bilateral support from the governments of Australia, Japan, Norway, Portugal, United Kingdom and the United States. The Asian Development Bank (ADB) administered assistance to the power sector under the Trust Fund for Timor-Leste (TFET).

Progress in re-establishing legal frameworks and managerial capacities was slower than anticipated. It was not until June 2001 that EDTL's relationship to the Timor-Leste Public Administration (ETPA) was legally defined, and not until August 2001 - immediately prior to the end of the UN administration - that EDTL gained the right to charge Dili consumers for electricity. This right was extended to customers in the districts only in February 2003. Responsibility for the administration of EDTL was transferred to East Timor Transitional Administration (ETTA) in August 2001 and after independence in May 2002, to the Government of Timor-Leste.

Four main laws have shaped the development of the electricity sector since 1999. These are as follows:

- The initial Regulation 1999/1 of UNTAET, which sets the general legal principle that the laws that applied in East Timor prior to the 25th of October 1999 would continue to apply.
- The UNTAET Tariff Directive effective in August 2001, giving EDTL the right to charge consumers for electricity services in Dili and including provisions for tariff setting, billing and collection, connection and disconnection.
- The Basic Law for the National Power System enacted in May 2003, which defines the role of the Government in the power system and delegates most of its tasks to a Regulatory Authority, and favors outsourcing of the electricity services to the private sector through a long-term Concession Contract.
- Directive No. 7/2002 and the Ministerial Decree No.1/2003, which specifies electricity services, fees and charges, and collection of fees and charges.

While the Basic Law specifies general principles and overall responsibilities, it is designed to be complemented by Decrees and Directives in various areas. Progress and plans in preparing and implementing such complementary legislation is discussed later in this report.

Sector responsibilities within Government. The Ministry of Transport, Communications and Public Works (MTCPW) administers the power sector. MTCPW is divided into 12 directorates and three administrative offices covering various infrastructure sectors from water and power to telecommunication and ports. MTCPW has a permanent Vice Minister and two secretaries of state: one for Electricity and Water, the other for Public Works. Power sector administration is under the Directorate for Electricity Services.

As in most other countries, the management of the power sector also requires close coordination with other branches of government. In Timor-Leste, power sector operations need to conform to

Government policies and regulations particularly in regard to: (a) the priorities and responsibilities for development of indigenous energy resources; (b) the provision of water rights for development of hydropower plants; (c) environmental impacts and management of power system expansion and operation; and (d) the rights and responsibilities relating to acquisition of land and resettlement. Government preference for development of indigenous resources is clear from existing policy documents and legislation. It is also clear that the responsibility for providing rights for development of onshore oil and gas is with the Minerals and Energy Directorate of Department of Development and Environment. Responsibilities for provision of water rights, environmental obligations, and rights and obligations in relation to land acquisition and resettlement are not yet fully defined.³

Service Provision and Tariffs

Responsibilities for service provision. Responsibility for the provision of electricity services has evolved rapidly since 1999. Most of the early power system restoration works were carried out with the assistance of the UN and several bilateral and multilateral agencies. Coordination of these activities under ETTA was carried out through a ‘Special Electricity Coordination Committee’. This Committee was later converted to a ‘Power Sector Steering Committee.’ The Committee was very active during the rehabilitation period, but last met in November 2002. It consists of permanent members from the Government and private sector representing the country’s stakeholders. Members from the international community act as advisors and observers with no voting rights.

In May 2003, a new organizational structure was established for EDTL, and 205 staff positions were advertised with targeted reduction of 26 positions from the previous level. Existing staff needed to re-apply for their positions. EDTL is led by a Director, and is divided in two directorates (one for technical operations and the other for administration and finance) and the following six departments: Planning and Projects Department; Production Department; Distribution Department; District Services and O&M Department; Administration and Finance Department; and Commercial Department. EDTL currently has a staff of 229 persons against an authorized complement of 364. Permanent placement of existing staff is being undertaken and revised staffing norms and structures are being developed. Recruitment is in process for vacant positions, but actions in this regard have been slow. The current focus is on operations, with very few staff devoted to system planning and expansion.

In March 2004, Companhia de Electricidade de Macau (CEM) assumed the management of EDTL for a three-year management contract. The contract is designed to improve EDTL’s technical and financial performance, as well as to provide systematic training to its staff. In the medium-term, the Government intends to convert EDTL into an autonomous public company. Legislation for the corporatization of EDTL is essentially complete, and a presentation in March 2004 to the Council of Ministers by the author of the legislation has satisfactorily addressed some issues that had delayed the formal adoption of the legislation into law. In the present situation, however, a potential conflict between the corporatization of EDTL and the Management Contract is foreseen. The Government is giving consideration to deferral of the formal legislation until the completion of the Management Contract. The Power Sector Steering Committee will be replaced by an EDTL Board of Directors when the above legislation is approved.

A number of small entities at the district level have also been set up under donor-funded programs to provide power to local communities. Rehabilitation projects funded by Portugal and

³ For a more complete discussion of issues related to the management and development of the country’s natural resources, see the SIP for Natural Resources and Environment.

Japan, and the ADB-led Emergency Infrastructure Rehabilitation Project, supported the development of these local service providers.

Tariffs. Current tariffs were established in Ministerial Decree No 1/2003 of MTCPW. The decree provides that all consumers must have an adequate kWh meter installed, obligates EDTL to organize an adequate metering and billing system in the country, establishes disconnection rights for cases of non-payment and delayed payment, and specifies procedures for legalization of informal connections. The following tariffs were set:

- Commercial consumers and Government agencies, \$0.20/kWh.
- Domestic and social sector consumers, \$0.16/kWh.

Tariffs remain unchanged and there is no immediate plan for tariff revision. For consumers who are not metered and are located outside the Dili system, the decree establishes a system of flat rate charges based on duration of daily service and amperage of connection. The flat rates vary from \$3 per month for low-income consumers with a two-amp connection and six-hour daily provision of power in the district systems to \$25 per month for a six-amp connection above four amps and 24-hour access to power in Dili.

II. POWER DEMAND AND SOURCES OF ENERGY

Current Supply and Demand for Power

In 1998, total peak load of Timor-Leste was reported at 17.1 MW. Power sales stood at 66.87 GWh per annum, 60 percent of which was residential consumption and less than four percent industrial consumption. District capitals outside Dili accounted for about 22.4 percent of power consumption, while the share of rural areas was only 4.5 percent. No precise information on the present situation is available. Table 2 gives rough estimates, based on the PSDP report. It suggests that peak load was about 18.6 MW in 2002, some 9 percent above the 1998 level.

Table 2: Power Generation in Timor-Leste, 2002
(estimated)

Service Area	Power Generation (net)		Peak Power (net)	
	GWh	Percent	kW	Percent
Dili	53.3	84.7	12,500	67.2
District capitals	8.5	13.5	5,234	28.1
Rural areas	1.1	1.7	878	4.7
Total	62.9	100.0	18,612	100.0

The estimates in Table 2 suggest that Dili currently accounts for about 85 percent of power consumption in Timor-Leste compared with 78 percent in 1998. Rural areas account for one percent. There is no reliable information on how power consumption is divided among residential, commercial, industrial and public sectors. Lack of information stems from shortcomings in the billing system and use of fixed connection and flat rates.

Currently, all electricity generation in Timor-Leste is through diesel engines burning high-speed diesel oil. Timor-Leste has only one bulk import terminal for oil products, located in Dili. This is operated by Pertamina, the Indonesian national oil and gas company. Other companies presently are not allowed to use the bulk import terminal. As a result, Pertamina is responsible for about 80 percent of all imported oil products. A few other companies import small amounts of oil, mainly from Australia. Pertamina's import prices appear to be considerably higher than those paid by non-subsidized consumers in Indonesia and by comparable countries in the South Pacific (see further discussion of this point in Chapter IV).

Despite intensive rehabilitation efforts, the operational level of the system is still low. Even with implemented and on-going rehabilitation projects, EDTL still has insufficient generation capacity

in many areas, and regular load shedding is practiced. Some areas are also without electricity due to damaged distribution lines that have not been rehabilitated, although in many cases rehabilitation would be relatively simple. In the majority of the power systems there is little or no spare capacity. The lack of collections among these systems is also a significant barrier to their rehabilitation. For the sub-district systems, piloting of institutional arrangements involving the community and the local administration leveraging EDTL's technical expertise is considered a necessary next step.

Dili's present demand of about 13.5 MW is supplied by diesel generator capacity of about 16 MW in Comoro power station. Comoro power station has several medium-speed diesel engines. Due to the poor status of power supply and high electricity tariffs, Dili has a captive diesel generator capacity of about 10.2 MW, of which about 4.4 MW is in production and 5.8 MW remains as standby. Power supply in Dili has been erratic because of generation equipment failures at Comoro Power Station and distribution problems (generally overloading). Generation capacity has been maintained by using six Norway-financed 1 MW high-speed diesel units designed for peaking service, but continued base-load use of these is costly, and will shorten their lives considerably. The Government has obtained funding for one additional 2.8 MW generator from TFET funds (MAK IV in the amount of about \$1 million). A 4 MW generator for Dili is also being procured under Japanese bilateral financing. The Dili system had been operating 24 hours per day, but to conserve fuel, service has been reduced to 20 hours daily (4 AM to Midnight), pending better revenue collection. Power consumption is expected reduce as a result of the accelerated installation program for pre-payment meters, and introduction of the CFL lamp replacement program.

Between 2001 and 2004, 39 rural power centers ranging in capacities between 50 kW and 900kW were rehabilitated by a consortium of donors (ADB under TFET, Japan and Portugal) at an estimated cost of about \$6.8 million. The district capitals and rural areas are supplied through a cumulative operational capacity of 12.1 MW using high-speed diesel engines. There is no transmission grid in Timor-Leste and the highest distribution voltage level is 20 kV. A recent ADB survey indicated that among the existing 35 sub-district stations, only five stations are presently operating and producing electricity.⁴ Some of the stations have never been properly commissioned due to incomplete specification and/or installation of equipment, but a majority has stopped operating because of lack of funds from communities to pay for fuel. Many installations have fewer than 200 customer connections, which results in an average monthly cost per household that exceeds affordability. More than half of these systems were restored with insufficient connections to ensure affordability per connection. Sustainability in these systems requires that connections be expanded via additional investment in distribution capacity, which is judged to be feasible in most cases.

Prospective Demand for Power

The growth of future power demand will depend on the country's economic growth, the technical and financial performance of EDTL, and on the extent to which the present very low levels of rural electrification can be systematically increased. This, in turn, will depend on national expenditure priorities, and the availability of domestic and external financing for the power sector. A Power Sector Development Plan (PSDP) for Timor-Leste covering a 20-year development period has been prepared, at the request of the Government.⁵ Given the uncertainties concerning the country's projected economic growth rate and resources likely to be available for power sector development, different power demand scenarios were studied by the consultant.

⁴ Asian Development Bank, *Subdistrict Power Stations in Timor-Leste*. Staff paper, August 2004.

⁵ The Plan was prepared by Electrowatt-Ekono, in cooperation with Sinclair Knight Merz, under the direction of the Asian Development Bank.

The study establishes the basis for future development of the power sector including generation, transmission, distribution and electrification, and additionally discusses institutional and policy issues. The PSDP includes plans, cost estimates and economic analysis for various scenarios.

The Government has not yet completed its review of these various scenarios and has not finalized its own internal load forecasts. For the purposes of the SIP exercise, the PSDP scenario proposing that 80 percent of household have access to electricity by 2025 is the one that most closely corresponds to the objectives of the National Development Plan. Table 3 sets out the load forecast for this scenario and compares it with a scenario that assumes slower expansion because of funding constraints.

Table 3 suggests that over the next two decades, Timor-Leste will need to plan for somewhere in the range of 50 to 100 MW of additional generation capacity, depending on the growth in demand and the pace of electrification. The capital cost of this additional capacity, not including the cost of transmission and distribution, is likely to be in the range of \$35 million to \$70 million at current prices for diesel generation.

Table 3: Forecasts of Load Growth in Timor-Leste

Scenario	Electrification Ratio (%)		Peak Load Forecast (MW)				Load Growth 2002-2025 (% p.a.)
	2002	2025	2002	2010	2020	2025	
Constrained expansion	21	50	18.6	28.0	39.5	75.2	6.3
80% electrification target	21	80	18.6	37.5	75.0	108.6	8.0

The cost of service for the target “80 percent scenario” is calculated by the PSDP at 13.7 c/kWh, on the basis that diesel oil continues to be tax-free. Continued reliance on relatively high cost diesel generation could be a deterrent to economic growth and competitiveness. A key issue for the Government therefore is the prospect for developing alternative, cheaper sources of energy for power generation and the future cost of generation.

Energy Sources for Power Generation

It is clear that Timor-Leste should look to indigenous energy resources for potentially economical power generation. Of these, hydropower, wind and onshore oil and gas are the most promising.

Hydropower. Timor-Leste is a mountainous country with good rainfall indicating a potential for hydropower. Previous studies, reviewed in the PSDP, identified five schemes with a total installed capacity of about 80 MW and annual energy generation of 434 GWh. The most feasible of these, based on least cost generation planning, is the 27 MW Ira Lalaro hydropower project on the eastern tip of the island. The scheme is based on the Ira Lalaro Lake, which would provide natural storage for the plant, resulting in an expected high annual capacity factor of about 80 percent.⁶ Due to the steep topography of the country, there are few opportunities to form artificial reservoirs. All the other identified schemes are of run-of-river type, which might however still prove to be economical for fuel displacement, given the high costs of diesel generation.

⁶ Between 1985 and 1989 a group of consultants employed by PLN carried out comprehensive studies on the Ira Lalaro hydropower project. The studies concluded the project was technically feasible and economically attractive, with an output of about 27 MW, likely to generate an average of 190 GWh of energy per annum. Generation plans for the region show that PLN intended that the project be constructed and commissioned in FY1999/00. The PSDP consultants also concluded that Ira Lalaro was the most feasible of previously studied hydropower projects. As the SIP for Natural Resources and Environment points out, the Ira Lalaro ecosystem may have some unique features. Careful assessment of the potential environmental impact of a hydro project in the area will therefore be required.

Under its existing Norway-financed contract, ‘Norway Water Resources and Energy Directorate’ (NVE) is presently undertaking a series of hydropower studies, aimed at priority ranking hydropower options for early development. These include: Ira Lalaro (27MW), Gariuai (350kW); Baucau (300kW), Gleno (30-40MW), Belulic (14MW) and Lacro I (9-10MW); Lacro II & III (40MW). NVE’s draft final feasibility report is expected in early in 2005, and bidding documents for the first ranked project by mid-2005.

Micro- and mini-hydro is likely to have a significant role in electrification of isolated villages or groups of villages unlikely to be connected to the grid within a 10 or 15-year time frame. A mini- and micro-hydro resource assessment study is proposed in the present SIP program to identify such areas. Norway has indicated a willingness to support this work after the results of its current hydrology study are available later this year.

Wind power. Another domestic renewable energy source with substantial future power generation potential is wind. A USAID-funded wind project has been on-going in the “NTT Province” of Indonesia that also includes West Timor. Based on West Timor data, the PSDP study concluded that wind power is probably not economic in coastal areas, but it may prove to be economic in the uplands and mountains of Timor-Leste both for grid connected and off-grid applications. An interesting feature of the wind resources is that the dry season from April to October is also the windy season, which means that there would be good complementarities with hydropower generation. Potential locations for a 10-15 MW wind power project were identified at Ira Lalaro in eastern Timor-Leste, and at Foho Bagarkoholau (and nearby mountaintops), some 10 km south of Dili. Indications are that it would not compete with hydropower at current wind generator equipment costs, but these are gradually reducing with improved technology and increased market penetration. Carbon Credits may accrue to Timor-Leste from a suitable wind project. Based on a consultant’s detailed report on wind power in Timor-Leste, a study of wind power potential is included in this SIP program. To date there has been no expression of donor interest in this program.

Offshore oil and gas. Timor-Leste has considerable offshore oil and especially gas reserves in Timor Sea. The utilization of these resources for domestic power generation is presently not considered feasible due to their long distance from the shore, water depth between the gas fields and Timor, and small size of the power system. This situation could change if the LNG facility for Greater Sunrise gas field were to be built in Timor-Leste, which would allow the utilization of gas in a more feasible way. However, this is contrary to the current plans of the developer, who plans floating LNG facilities.

Onshore oil and gas. The potential for onshore oil and gas-fuelled generation, at least in the southern coastal areas, is considered promising, and if significant reserves are found, this could offer an attractive alternative to a program of hydropower/diesel generation.⁷ More than 30 documented oil and gas seeps in Timor-Leste give a clear indication of hydrocarbon potential in the area. A small number of oil wells were drilled in the 1970s, but these wells are now capped. In 2003 and early 2004, onshore (and immediately offshore) magnetic and gravimetric studies were undertaken by PetroChina (under Chinese bilateral assistance). One option for the further exploration of these reserves would be to tender selected areas to private developers. The past willingness of prospective developers (some with access to earlier exploration data) to invest in south coast oil and gas exploration gives rise to positive expectations regarding the successful development of these reserves. This work awaits key policy decisions. The oil-related legislation necessary for such an approach is expected to be ready in 2005. Decisions could then be made on

⁷ See the SIP for Natural Resources and Environment for a more detailed discussion of the petroleum resources of the country.

the most appropriate mechanisms for further exploration. Subsequently, decisions can then be arrived at on the likely future path of national power generation development – i.e. hydropower generation (in the public sector) versus thermal generation indigenous oil-gas fuelled, most likely in the private sector.

In the meantime, TFET allocated funding of \$1 million for an Oil and Gas Demonstration Project.⁸ However, the oil-related component of the project was suspended in anticipation of comprehensive plans for the wholesale development of on-shore oil resources. A demonstration project for gas seep harvesting at Aliambata (47 km from Viqueque town on the south coast) is currently under preparation using Japanese grant funds available through the World Bank. A project management consultant has been engaged and hiring of technical consultants to sample the volume and composition of gas is near completion. Subsequently, the feasibility of power generation using the gas will be conducted. The project is expected to benefit from carbon credits from the Community Development Carbon Fund (CDCF).

Geothermal potential. Preliminary studies reported in the PSDP lead to the conclusion that it is unlikely that there are any large, hot geothermal systems. Several moderately hot springs were located during the study, but these are likely to have a deep-seated tectonic origin and therefore will not have significantly greater temperature at depth. However, the Springs on Atauro Island, which could be an ideal location for an up-market eco-tourism resort, appear to indicate the existence of a higher temperature, possibly magmatic-related geothermal system, recharged by seawater. Therefore, it may well be possible to develop this resource to power a small generator to supply the resort at a premium price, and the local residents with surplus power at low marginal cost.

Solar power potential. Solar power offers good potential for off-grid electrification in Timor-Leste. There were some solar home systems installed around 1996-1997; however, many of these have been damaged, either purposely or due to lack of maintenance. Considering the low population densities and low incomes in the rural areas in Timor-Leste, solar home systems would be a lower-cost electrification option compared to grid extension for small hamlets of households remote from the grid where main requirement is for lighting. A typical solar home system involving a 50 Wp panel would provide electricity for a daily average consumption of 150 Watt-hours; that is, a 25 watt load for six hours per day. Such a system would therefore be sufficient to produce enough electricity for lighting, radio and television for a small household. Operation and maintenance costs are low. However, due to the high capital cost the total production costs for a standard 50 Wp solar home system are in a range of \$1.25 per kWh, or about \$5.50 per month. In order to make the cost of solar home system more affordable to the poor rural households, capital subsidies would be required.

A Solar Demonstration Project is to be carried out using 50 sets of solar equipment donated by an Australian NGO. Selected locations may be community centers, schools, health care centers. Final project formulation is not yet complete.

Other resources for power generation. Indications are that there are insufficient biomass reserves in Timor-Leste to allow commercial utilization as energy sources. Coal /oil fired steam power generation, off-shore gas and nuclear power are large-scale options, and are not considered feasible for Timor-Leste, given the small size of the power system.

⁸ See the SIP for Natural Resources and Environment for further details on this project.

III. GOALS AND OBJECTIVES FOR THE SECTOR

Goals and Objectives

The issues and challenges facing the power sector were recognized and addressed in the May 2002 National Development Plan (NDP) and in subsequent policy developments. The Government's vision for 2020, as stated in the NDP is that "people will no longer be isolated because there will be good roads, transport, electricity and communications in the towns and villages in all the regions of the country". Further, the NDP recognizes that "an effective system of infrastructure and services is crucial for agricultural productivity and poverty reduction, a determinant of business investment, instrumental to human development, and the foundation for private sector development", and the need "to plan for, provide and manage physical infrastructure that is efficient, cost-effective, and financially sustainable, and which supports the social and economic development priorities of the people Timor-Leste."

This Vision carries the following implications for the power sector:

- The power sector will create and maintain reliable and affordable power supplies which meet the needs of immediate areas served, to support economic productivity and quality of life, throughout Timor-Leste.
- Supplies will be developed to achieve the lowest possible costs in the long run, tapping the economic potential of indigenous resources to displace costly imported fuels. The indigenous resources to be developed may include natural gas, hydropower, solar, and others.

The Electrification Program

No specific numerical or percentage targets were set out in the NDP for the electrification of the country. There is, however, a compelling case for strong expansion of electrification, consistent with implementation capacities and funding availability. As noted earlier, for the purposes of the SIP exercise, the Government has adopted a scenario aimed at ensuring that at least 80 percent of households have access to electricity by 2025. Revised demographic projections that reflect the provisional results of the 2004 census suggest that about 270,000 households would have to be connected to electricity by 2025 if this plan is to be met. Under this program, installed capacity would grow by an average of eight percent a year and increase to 110 MW by 2025 (Table 4).

Table 4: Expansion Plan for Electrification

Indicator	2002	2007	2010	2020	2025	Annual Increase (% p.a.)
Total households ('000)	183.3	211.4	229.8	304.4	335.0	2.7
Electrification ratio (%)	20	30	40	70	80	
Households electrified (000s)	36.5	63.4	91.9	213.1	268.0	9.0
Total power supply (GWh)	62.9	109.3	158.4	350.0	505.0	9.5
Total demand (MW)	18.6	30.0	40.0	80.0	110.0	8.0

Options for Generation and Transmission

The PSDP study envisages the development of a mixed hydro-diesel generation system and, over the 20-year planning period, gradual interconnection of the separate systems into a single grid. According to this plan, the existing diesel based system would be reinforced in the short-term and, as soon as possible, supplemented by the 27 MW Ira Lalaro hydropower plant and associated 132 kV transmission line to Dili. This transmission line would allow connection of the major towns along the way (Baucau, Los Palos) and, depending on power demand growth, possibly Manatuto and some smaller towns and villages. Under the proposed program, the hydropower

plant and transmission line would become operational by 2010. After commissioning of Ira Lalaro, new generation in the interconnected system could be hydropower (Gariaui, Gleno, Belulic or Laelo), heavy fuel oil fired diesel generators, or wind depending on relative economics of these technologies at the time of investment decisions. After the Ira Lalaro - Dili interconnection, the next major transmission investment would be the Dili south 132 kV transmission line connecting the district capitals of Aileu, Gleno, Maliana, Same and Suai to Dili.

However, discovery of substantial oil and gas reserves in the southern coastal area, could change significantly the overall configuration of the power sector development. Initial thermal power plants could be constructed in the South, with a north-south 132 kV transmission lines to Dili, connecting load centers along the route. It is important therefore that the exploration and licensing activities in relation to onshore oil and gas be sharply accelerated so that the results are known prior to commencement of major generation investments in Ira Lalaro.

Rural Electrification

The PSDP report discusses various possibilities for rural electrification. Typically, electrification with grid extension incurs the highest investment costs, but also provides the greatest potential for income-earning activities and social benefits of electrification. As the economic benefits of grid extension are higher due to its larger income-generating potential, the first priority, based on purely economic considerations, would be to electrify those parts of the country earmarked for grid extension, i.e. the main population centers. For social reasons, however, it may be better to advance grid and off-grid electrification in parallel. Off-grid electrification, typically based on solar home systems, has relatively low potential for income-generating activities. The two electrification methods are normally complementary. Grid extension is used in main population areas and village centers, while solar home systems are used for electrification of more isolated areas. In parts of Timor-Leste with low population densities, solar home systems are likely to be the only feasible solution for electrifying small hamlets of 5-30 households at least a few kilometers from the existing grid, as well as very small villages remote from the power grid.

Prior to connection to the main system, generation in the rural power systems would continue to be diesel based, except in those areas where micro hydro or small wind installations are found to be economically feasible in comparison to diesel generation. Proposals for study of these options are discussed in Chapter VI.

Rural distribution in Timor-Leste has been based on PLN standards. These standards were designed many years ago for urban distribution and have been extended into rural areas virtually unchanged. The PSDP consultants consider that by adopting a design more appropriate to the requirements of rural communities, the cost of rural distribution could be halved. Cost reductions can be achieved through the use of smaller conductor sizes for MV lines appropriate to anticipated loads, increased span lengths, a more flexible approach to overhead line routing, use of single-phase spur lines to remote villages, and wherever possible, use of single-phase instead of three-phase transformers.

A feature of rural electrification programs is that they require considerable capital expenditure and are typically not able to generate sufficient revenue to cover operating and capital replacement costs. Because of this, the PSDP report recommends that the program is financed and supervised by a rural electrification agency (or fund) that is separate from the commercial operations of EDTL. The latter would then manage the program on an agency basis through a separate unit within the organization. The rural electrification fund/agency would receive financing for its activities from the Government, or grants or loans with subsidized interest rates from the donor community. Subsidies would be targeted at providing access to electricity, i.e. subsidizing the cost of connection (currently estimated at \$500–\$1,000 per household), which

rural households rarely can afford. The fund could also be used to provide subsidies to communities or the private sector in case of concessioning of distribution areas (whether on-grid or off-grid) to them.

Economic Benefits of Electrification

Results of economic analyses for the load growth scenario based on 80 percent electrification by 2025 using a combination of hydropower and diesel generation are summarized in Table 5.⁹ The PSDP overall program shows acceptable economic internal rate of returns (ERR). However, since the PSDP study, preliminary evaluations of benefits for the Ira Lalaro hydro project have become available from the work of the Norway-funded feasibility study. These preliminary results put the cost of Ira Lalaro at \$83.1 million, not including financial costs associated with the project. The net present value (NPV) is estimated at \$30.2 million, which is substantially lower than that used in the PSDP study, while the ERR is estimated at 13.5 percent. The cost of energy supplied from Ira Lalaro is estimated at US 6.4 cents per kWh, which would be roughly comparable to the costs of thermal generation. Separate calculations for an expansion program based primarily on onshore oil and gas are not yet available, but would very likely show higher economic rates of return.

Table 5: Economic Benefits from Expansion Program Based on Hydro and Diesel

Project or program	ERR (%)	NPV (\$ millions)
New diesel engines		
Outside Dili	< 0	-33.0
Hydropower projects		
Ira Lalaro	19.3	44.4
Gleno	14.9	3.1
Wind power projects	10.0	0.0
Oil pipeline to Comoro	28.3	1.1
Program for 80% electrification	14.2	37.1

Note: ERR refers to economic rate of return and NPV to the net present value of benefits from the investment.

consumption and poverty reduction.¹⁰ The relevant simulation indicated that if electricity were to be expanded to all households in the country there would be a 26 percent reduction in the poverty headcount and an increase of 21 percent in real per capita consumption among affected households. Results were similar whether newly electrified households were in urban or rural areas. These effects were the fourth highest among 17 interventions evaluated. The effect on national consumption and poverty levels was equally striking. Expanding electrification to all households would increase national per-capita consumption by 13 percent overall, with much of this increase occurring in rural households where an overall increase of 17 percent was projected.

IV. PROGRESS, ISSUES AND CHALLENGES

Recent Progress

Electricity sector emergency plan. The Electricity Sector Emergency Plan incorporated in the Electricity Sector Policy Paper was designed to achieve the preconditions for full corporatization and commercialization of EDTL. It dealt with the subjects of: (a) EDTL billing and collections;

⁹ In these analyses, the economic benefit is considered to be the current retail cost of power and does not take into account consumer surplus, thus it is considered to be a lower bound of the economic benefit of electrification. ERRs with consumer surplus taken into account would be somewhat higher.

¹⁰ See Government of Timor-Leste et al., *Timor Leste: Poverty in a New Nation: Analysis for Action*. 2003.

(b) commercialization of EDTL; (c) upgrading of the capacity of the Comoro Power Station; (d) preventive maintenance at Comoro power station; (e) training of Timorese maintenance staff. For the long term, it was considered that sector objectives and development targets of the electricity sector could best be achieved through a concession of the national power system under a BOT arrangement with a private investor. The Plan provided for a maximum of 20 years for the Build-Operate-Transfer (BOT) contract and the establishment of a public regulatory authority with the responsibility to monitor the concession contract and to prepare the legislation and regulations for the electricity sector. It was considered that the need for sector regulation could best be met by merging the regulating authorities for the electricity, water and sanitation and telecommunications sectors into one authority, which would regulate all the activities and public service providers in these sectors irrespective of whether they are publicly or privately owned.

Action plan. On the basis of the Electricity Sector Policy an Action Plan was developed. Many of the above-listed issues were addressed through the contractual arrangements for a three-year Power Sector Management Contract that is expected to provide the foundations for a more sustainable, commercialized utility operation over the long term. For some immediate rehabilitation needs (Comoro power station upgrade and maintenance), an interim short-term management contract was concluded with Jacobsen Electro and financed by the Government of Norway. Table 6 above sets out the elements of the Action Plan, original scheduling and actual implementation as at September 2003.

Table 6: Power Sector Action Plan

Action	Original Schedule	Action/ Update	Remarks
Approval of Electricity Sector Policy Paper	September 2002	18 September 2002	Completed
Emergency contract with electricity sector company for EDTL billing and collection organization and training	October 2002	Installation of 10,000 prepayment meters started in July 2003	Installation of only about 600-700 meters completed against October 2003 target of 3,000. Council of Ministers has ordered rapid acceleration and enforcement.
Initiation of a 3-year Management Contract with EDTL. (Production, distribution and commercialization of EDTL)	October 2002	Negotiated contract approved by Council of Ministers on October 29, 2003	Management Contract with CEM commenced on March 1, 2004.
Executive Order to convert EDTL into Autonomous Public Company	October 2002	Considered by Council of Ministers September, 2003. Returned for revision	Basic Law for the National Power Supply (Electricity Law) approved by Council of Ministers and promulgated by President in November 2003.
Government authorization for EDTL to lease generating capacity for Dili to reduce power cuts	November 2002	November 2002	Purchase of six 1 MW diesels for EDTL (\$1.8m, NORAD)
Launch international public tender for a 20-year BOT on all operations of EDTL (production, distribution, and commercialization).	December 2002	July 2002 Award foreseen later after completion of PSDP & Hydropower studies	Deferred for consideration after 3-year Management Contract. Institutional and Regulatory Study proposed under SIP initiative.
Establishment of Regulatory Authority for the Electricity Sector (possibly multi-sector regulator) to regulate the sector and to monitor the BOT concession contract	October 2003	Foreseen in 1-2 years	Institutional and Regulatory Study proposed under SIP initiative.

Issues for the Immediate Future

The Government faces a number of challenges in the immediate future, early action on which can have significant implications for the financial position of the industry and the national budget. These relate to the high cost of fuel imports, low collection rates from EDTL customers, and lack of staff capacities for management and implementation of power sector related programs.

High cost of imported diesel fuel. In the short term, there is little alternative to diesel generation, but overall fuel costs, already elevated due to high world market prices, are increased further because of inefficient procurement and high handling charges at the Pertamina terminal. EDTL imports about 22 million liters of fuel per year through the Pertamina terminal. In 2003 the price was about 34 cents per liter, which was about nine cents per liter above the price paid by non-subsidized consumers in Indonesia for the same product. This was also about equal to the median price attained under competitive bidding procedures in Samoa. Potential savings of at least \$2 million a year could be realized from competitive procurement of oil for EDTL. If the Samoan price was achieved for all imports of fuel (for the power and transport sectors combined) overall annual savings might approach \$5 million per year. Not all of these savings would accrue to the Government, but the Government might be able to claw back some of the private sector gains by increasing fuel taxes which are currently among the lowest in the Pacific.¹¹

For more cost effective diesel procurement and delivery to power generation facilities, the Government has prepared pre-qualification and draft bidding documents for the supply of high-speed diesel oil, petroleum products and a storage facility for Government-use fuel at Hera port in preparation for an international competitive bidding exercise. Scope of services /supply will be to provide about 2 – 2.5 million liters of high speed diesel and lubricating oil fuel to the country's 29 power stations, including those in Atauro Island and the Oecussi enclave. Bidding documents will be finalized and issued once prequalification is completed.

This exercise is considered an intermediary step as the Government considers various other options for procurement of fuel supplies. These include (a) extending the scope of this procurement to all Government oil products; (b) competitive procurement of a contractor to operate Pertamina terminal to cover all oil imports (assuming Government successfully completes negotiations with Indonesia to take over the terminal); (c) competitive procurement of a contractor to provide all oil products to Timor-Leste for say a five year period. Questions remain as to the future of the Pertamina terminal and the possibility of constructing alternative terminals and other in-country storage facilities for which Government prior approvals will be needed.

Demand side management. Timor-Leste also has considerable potential for reducing non-essential electricity consumption by demand side management. No sophisticated methods are required. One of the most effective initiatives would be promotion of energy-efficient lamps (fluorescent lamps). The use of Compact Fluorescent Lamps (CFL's) and fluorescent tubes as direct replacements for traditional incandescent bulbs can have immediate benefits for EDTL, the village-based community power schemes and the consumers themselves. A survey by the JICA mission of 13 Japan-financed community-run power stations indicates that approximately 57 percent of the installed lamps (by wattage) are traditional incandescent type. Replacing these by CFLs or tubes can reduce power consumption by up to 46 percent, substantially reducing fuel import costs and making the operation of both EDTL and the village-based power schemes immediately more sustainable. Assuming, for instance, that 20,000 consumers (half of the total) would replace three 60 watt bulbs by 11 watt high-efficiency fluorescent lights, this would result in annual savings in EDTL's fuel bill of \$550,000 at current fuel prices. In addition, this would

¹¹ For further discussion of the implications of lower fuel import costs for the transport sector and possible gains from a fuel tax, see the SIP for the Transport Sector.

reduce the peak loading by 2.9 MW, and capital investment in generation capacity by \$1.7 million. A consumer's monthly electricity bill would reduce by \$3.65. If the lamps would be given to the consumers free of charge, assuming a cost of \$1.50 per lamp, the total investment would be \$90,000, with a simple payback of just a couple of months. EDTL intends to include both new and existing consumers in this program.

TFET funding of \$90,000 is being utilized to distribute three CFLs to each EDTL customer participating in the pre-payment meter program. The program will be administered by EDTL. The contracting process is nearing completion and the lamp distribution is expected to commence in the coming weeks.

Other cost reducing initiatives. The cost of transporting fuel to Comoro power station, at two cents per liter, is unduly high because of inefficient road transport from the Pertamina terminal. About \$370,000 per year could be saved through construction of a pipeline, the construction cost of which is estimated at less than \$1 million. The cost structure of EDTL is also affected by the low generation efficiencies. These stem from the large proportion of energy that is generated by high speed rather than medium speed diesel engines. Technical losses in the Dili system reportedly are in order of 15 percent, rather than the 5-6 percent that could be expected in such a small concentrated system.

Low collection rates for delivered energy. Despite tariff levels that should be generally adequate to support the operation of the existing system, EDTL continues to require substantial subsidies from the Government budget. The financial position of EDTL can be improved significantly through better collections from consumers. Poor collections stem from: (a) incorrect meter readings arising from non-standardization of meters and inexperienced meter readers; (b) non-functional or faulty meters; (c) informal connections with no meter installed; (d) billing system problems, including an incomplete and inaccurate customer database and inadequate maintenance of the billing system due to lack of skilled IT personnel; (e) difficulties in collecting payments as a result of the loss of consumer discipline during the extended period of free electricity under UNTAET; (f) reluctance of consumers to pay what they consider to be incorrect bills, and (g) limitation of power and power cuts to large industrial and commercial consumers.

Lack of managerial capacity of EDTL. The human resources vacuum that resulted from the 1999 events has exacerbated difficulties faced in restoring power sector operations. When the power system was operated as a branch of PLN, management and workers were mainly Indonesian, most of whom left Timor-Leste in 1999. As noted earlier, EDTL has an authorized staffing level of 364 positions; however, more than 130 positions remain unfilled. Among existing staff, there are only two engineers (the Director and Technical Operations Director), and less than a dozen qualified technicians. Most staff is middle school graduate level.

Challenges for the Medium Term

In the medium to long term, the Government is faced with three main challenges:

- Identifying and developing economical, indigenous energy resources that will allow lower energy generation costs and reduced dependence on imported fuels.
- Providing electricity to 80 percent of the population who are currently not served.
- Developing a legal and regulatory framework that will minimize development and operation costs and maximize the mobilization of capital from both public and private sources.

The broad outlines of the available options for developing indigenous energy sources and for electrification of the country were discussed in Chapter II. More detailed discussion of the program for the medium-term to address these issues is set out below in Chapter VI.

V. DEVELOPMENT OF POWER UTILITIES AND PRICING POLICIES

Development of EDTL

EDTL management contract. As part of the Electricity Sector Policy approved in September 2002, the Government decided to outsource the management of all EDTL's operations under a Management Contract for a period of three years. The contractor is expected to implement urgent measures to improve the overall technical and financial performance of the utility and to provide systematic training to the local staff. After certain preparatory technical assistance (tariff studies, asset valuation and preparation of draft Management Contract) tender invitations for the management contract were issued, and three proposals were received in March 2003. After somewhat protracted evaluation and negotiations, the Council of Ministers approved the negotiated contract on October 29, 2003. There is a strong emphasis on training in the contract and fixed fees are related only to training. There are no fixed fees involved for management, and payments to the contractor will be related to improved technical and financial performance only. The contractor's performance will be measured against key performance indicators as set out in Table 7.

Table 7: EDTL Management Contract

Key Performance Indicator	Description	Target over three year contract
Reliability Index (Dili only)	Average availability of 20kV feeders in Dili	From 93-98% to 97-99.4%
Distribution Efficiency Index (Dili only)	Energy billed/Energy distributed	From less than 30 % to 80 %
Generation Efficiency Index (Dili only)	Average heat rate	For every 1/1000 of decrease of the index, a predefined bonus will be paid
Financial Performance Index: Government Subsidy	Base line subsidy of \$6.4 million	For reducing subsidy contractor will be paid 25% of reduction in first year, 20% in second year and 15% in third year

The Management Contractor (CEM, Macau) arrived in Timor-Leste in early January 2004 and assumed in-line control of operations effective March 1, 2004. Certain transitional difficulties were encountered. These include:

- shortages of tools, equipment, instruments, communications, vehicles and other equipment essential for the efficient operation and maintenance of the power network;
- generator problems.
- serious shortages of skilled manpower in EDTL, which as noted earlier operates with a staff complement considerably below the authorized level;
- inadequate warehousing and training facilities;
- malfunctioning computerized billing system;

Action has been taken to address these problems with accelerated procurement of equipment mainly for the Dili system under TFET funding (\$1.39 million) and Japanese funding (\$1.2 million). Both these procurement processes are nearing completion. Steps are also being taken to strengthen EDTL through staff reassignment and recruitment to make up its budgeted staff complement. Intensive training has now been commenced by the Management Contractor (MC). The old power-plant building (adjacent to EDTL offices) has been converted into warehousing and training facilities. And the contractor is planning installation of a LAN communications network for EDTL. In general, the MC is being constrained by limited investment funds and slow procurement procedures. The reliability indices for 20kV feeders have risen above targets across the board. The distribution efficiency has risen from 3.8c/kWh at the beginning of the contract to 7.97c/kWh in December 2004. The generation efficiency has improved with 0.263 liters being used to produce a kilowatt-hour in December 2004 compared to 0.292 liters at the beginning of the contract. Collections have increased dramatically from \$3.4 million in FY03-04 to \$3.2 million in the first seven months of FY04-05, equivalent to a 60 percent increase on an annualized basis.

EDTL has been concentrating on installing new meters, replacing defective meters, registering informal consumers, expanding and correcting its customer database and improving the payment discipline with the large commercial customers in Dili. In an attempt to increase the collection rate Government also contracted for the supply and installation of 10,000 pre-payment meters accounting for half the consumers in Dili. During 2003, installation of prepayment metering met considerable consumer resistance, and by December 2003 only about 1,000 meters had been installed. Subsequently, EDTL passed responsibility to the Suco (administrative area) councils for obtaining cooperation in their areas. As a result, the pace of installation increased rapidly. Norway subsequently agreed to finance an additional 17,000 meters to meet the needs of the program. By end January 2005, about 19,500 meters have been installed, and installation is continuing at a rate of about 500 per week. Residential power consumption in the connected areas is dropping noticeably, and overloading of electricity feeders is abating as a result of the installation program and more frugal use of electricity. It is also planned to provide the CFLs under the Lamp Replacement Program to the prepayment meter recipients as a further incentive.

Financial position of EDTL. The historical and projected financial position of EDTL is set out in Table 8. This shows significantly increased collections starting from FY2001/02, but the substantial drain on the Government budget has continued because of increased quantities of power being generated, higher fuel prices and in FY2002/03 the need to contribute \$1.9 million of government resources towards the purchase of the 10,000 meters.

Table 8: Financial Performance of EDTL
(In US\$ thousands)

Category	Actual				Budget forecast				
	FY2000/01	FY2001/02	FY2002/03	FY2003/04	FY2004/05	FY2005/06	FY2006/07	FY2007/08	FY2008/09
Revenues	258.0	1,997.0	2,932.2	3,528.0	5,628.0	7,378.0	8,227.0	8,827.0	9,500.0
Recurrent expenses									
Salary and wages	363.0	309.0	309.3	268.5	416.0	438.0	460.0	483.0	507.0
Goods and services	7,523.0	7,722.0	8,843.1	9,306.4	10,223.0	10,479.0	10,785.0	10,988.0	11,228.0
Total expenses	7,886.0	8,031.0	9,152.4	9,574.9	10,639.0	10,917.0	11,245.0	11,471.0	11,735.0
Operating balance	(7,628.0)	(6,034.0)	(6,220.2)	(6,047.0)	(5,011.0)	(3,539.0)	(3,018.0)	(2,644.0)	(2,235.0)
Capital expenditures	493.0	822.0	2,198.1	141.9	391.0	427.0	367.0	407.0	450.0
Overall balance (= CFET subsidy)	(8,121.0)	(6,856.0)	(8,418.3)	(6,188.9)	(5,402.0)	(3,966.0)	(3,385.0)	(3,051.0)	(2,685.0)
Memo items:									
Revenue growth (% increase)		774.0	146.8	120.3	159.5	131.1	111.5	107.3	107.6
Revenues as % of recurrent expenses	3.3	24.9	32.0	36.8	52.9	67.6	73.2	77.0	81.0
CFET subsidy as % total CFET budget	15.9	13.4	16.4	12.1	10.6	7.7	6.6	6.0	5.2

Source: Audited financial statements of EDTL and Budget Office records.

Note: FY03 capital expenditures included \$1.9 million of Government contribution to prepaid meters.

Public and non-public revenue collections lagged in the first four months of FY2003/04 and were a cause for concern. However, power sector cost recovery improved at end 2003 with December revenues amounting to \$346,000.¹² Total collections reached \$3.5 million by end-June, 2004 as a result of increased emphasis on collections (but still about \$2 million lower than original FY2003/04 budget estimate). The Management contractor is expected to pursue sharp reductions in these subsidies. As noted earlier, other than for training payments, the Management Contractor is remunerated entirely from reductions in Government subsidy to EDTL.

The projections in Table 8, prepared jointly by the Management Contractor and the Budget Office, indicate that revenues are projected to more than double while recurrent expenses are projected to remain close to their current levels. The Government subsidy is projected to decline from \$6.2 million in FY2003/04 to less than \$3 million by FY2008/09, equivalent to about five percent of the CFET budget – substantial improvement on the level of 16 percent in recent years. The rapid installation of residential prepayment meters is expected to continue improving collections over time, and also to reduce loading on generators and feeders. This in turn will reduce system losses and improve further EDTL's financial position.¹⁴

Concessioning of EDTL. The Basic Law for the Power Sector allows the Government to assume many alternative development paths for organization of the sector and is generally conducive towards private sector participation. However, in line with the Power Sector Policy document of September 18, 2002, it foresees the launching of an international public tender for a 20-year BOT on all operations of EDTL. The concessioning of EDTL option is not presently under consideration pending completion of the proposed Public-Private Infrastructure Advisory Facility (PPIAF) financed Legal, Regulatory and Administrative Study.

The Government is aware that the PSDP consultants (and a number of donors) do not support a shift to a concession, mainly because it is unlikely to generate the benefits Governments expects of privatization, such as proceeds of asset sales, increased competition and consequent dynamism and efficiency in operations. Overall, risk premiums are likely to be high, considering the lengthy term of the concession, perceived political, legal and contractual risks of a newly independent state, and technical and O&M issues associated with poorly maintained distributed assets. Consequently, a fixed long-term concession might not be competitive with more short-term and less binding alternatives for involving the private sector in the development of the power sector in Timor-Leste. A number of other specific concerns have arisen:

- The current assets of EDTL represent only a small core of ultimate sector assets. Future operations will be heavily focused on system expansion and require high capital investments, such as for the Ira Lalaro project, and a strong focus on not-so-profitable rural electrification, which may not occur given the private operator's aim to maximize returns by concentrating on profitable areas.

¹² In the latter part of 2003 the Government took resolute action to improve collections. In their meeting of 29 October 2003, the Council of Ministers instructed full and immediate enforcement of power disconnections and installation of pre-paid meters with police assistance as necessary.

¹⁴ Subsequent to the preparation of these financial forecasts, the cost of fuel has risen as a result of high international prices for oil. As of July 2004, for example, the average price of fuel was 40.4 US cents a liter, compared with the 34 US cents a liter at the time the forecasts were prepared. At the current price, the cost of fuel in FY2004/05 would be about \$9.4 million rather than the \$8 million now in the financial forecast. In December 2004, the average price of diesel was 49.3 US center per liter.

- Since major investments are scheduled around years 2010 and 2017, the time span is too long to estimate investment programs to the accuracy level required for a sensible financial analysis of the BOT offer for 20 years.
- In order to allow other operators in the sector, for example to implement mini-grid and hydropower schemes and to take advantage of potential Government and donor funding at concessional terms to facilitate access to electricity for the rural poor, the contractual and legal arrangements for the BOT concession would be extremely complicated.
- The perceived legal risk associated with the BOT concession would be high, given that much of the basic legislation is still under preparation, completely untested and without precedent in Timor-Leste.
- The BOT agreement would probably need to be fully backed by international agencies, as the Government's ability to provide sufficient guarantees might be limited.
- EDTL is a small company, and the business prospects offered by a concession to operate the national power system would not be attractive to large, well-established international and regional players. Consequently, international bidding might be restricted to less known and smaller players who might be prepared to assume higher risks for higher returns, but be less professional and experienced in utility operations and international investments. The response to the bidding for the three-year management contract (where much less risk is involved) is somewhat indicative in this respect.

Other Service Providers

In rural areas, local communities operate some of the power systems. These were established under the rehabilitation projects financed by the Portuguese and Japanese governments, and the ADB-led Emergency Infrastructure Rehabilitation Program. While some have operated successfully, others have since encountered problems and have asked for EDTL assistance. There have been no improvements in the operation of community based systems. In principle, each community is responsible for setting flat rate tariffs for its consumers, but these tariffs are only sufficient to provide diesel for operation and basic local maintenance (oil, filters etc.). Tariffs are not designed to cover the cost of depreciation, network expansion or major maintenance. The culture of payment for electricity services which was planned has not eventuated with only three communities successfully operating their systems. The development of institutional mechanisms for revenue collection in the rural systems is considered an important step towards EDTL involvement.

The current planning of the Government and EDTL is to gradually take over these systems, a move that is supported by the PSDP consultant report, mainly to facilitate the long-term development of the power system. Community representatives are also of the view that EDTL- or Government-paid operators are necessary to enable successful operation of their systems, rather than the present reliance on volunteers. As noted earlier, EDTL is concentrating its limited resources on establishing reliable and financially viable power supplies in Dili and other major towns. There is no set timeframe for EDTL to assume responsibility for these rural networks, which will continue to be operated by the communities themselves. However, EDTL take-over of rural networks is under active consideration by the Council of Ministers.¹⁵

¹⁵ In taking over community-run systems, EDTL would need to avoid introducing heavy and costly utility-type organizations that rural consumers cannot afford. The PSDP report suggests a combination of the best of both by continuing to utilize the villagers for day-to-day operation and billing functions so that communal loyalty remains. EDTL could take over the ownership, management, fuel supply, maintenance and planning functions, once its institutional capacity is adequate.

Pricing Policies

The PSDP consultants consider the current electricity tariff level and structure to be appropriate to the current situation in Timor-Leste. However, in the longer run they recommend a cost-based tariff structure with indexation of tariffs to fuel prices. In the absence of the latter provision, there is danger that self-generation will become a more feasible option for the larger customers, which would have a negative impact on EDTL and the economy as a whole.

VI. PROGRAMS FOR THE MEDIUM TERM

In order to address the challenges facing the power sector – some of which require urgent action – a program consisting of a number of studies and power system investments has been formulated. The main elements of the program are (i) high-priority studies for legal, regulatory, institutional framework; (ii) high-priority resource assessment, planning, feasibility and project preparation studies; (iii) high priority power system investments; and (iv) medium-term power investment projects. Proposals for investigation of onshore oil and gas that might be used by the power sector are dealt with more fully in the draft SIP for Natural Resources and Environment.

Legal and Regulatory Framework and rural electrification master plan

There are two high priority studies that the Government is about to commence. One relates to the legal and regulatory framework required for sound development of the power sector; the other relates to a rural electrification master plan and implementation plan. PPIAF funding for the first study and ESMAP-ASTAE¹⁶ support for the second has been committed. The studies were advertised jointly and consultants have been selected. The studies are expected to conclude by December 2005. An important objective of joint implementation is the training of 8-10 Timorese professionals in planning, regulatory, and implementation roles.

Legal, regulatory and administrative framework study. In view of the above-mentioned reservations about a long-term BOT concession, the Government proposes to carry out a review of the envisaged institutional and regulatory framework of the power sector leading to detailed recommendations as to the best combination of options for achieving efficient development and operation of the power sector through a partnership of public, private and community participants. The proposed study would be done in two phases.

Phase 1 – Power Sector Institutional Framework Review. This study would review the structure of the power sector. There are two main options: (a) a closed structure where all electricity is provided by a vertically integrated regulated monopoly whether public or private (EDTL or concessionaire); or (b) a principal buyer option where the main transmission grid would be owned and operated by EDTL, while the separate functions of generation, distribution and supply (billing, collection and customer service) for both grid-connected and off-grid systems could be through public, private or community participants with all operations supervised by a regulator. In principle, there could be a combination of the two options but, as noted by the PSDP consultant, regulation would then be extremely complicated.

The future role of EDTL participation in electrification of the country, whether as public participant or public partner should also be considered as part of the review. Phase 1 activities would include the: (a) design of a rural electrification framework; (b) basic design of government functions of regulation and rural electrification; (c) if a rural electrification fund is

¹⁶ ESMAP is the UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP) administered by the World Bank. ASTAE, the Asia Alternative Energy Programme, is also administered by the World Bank.

recommended, develop the basic design for such a fund, covering responsible entities, sources of funds, arrangements for financial management, lending and grant operations, etc. The basic design studies would also consider EDTL organization insofar as it is necessary to carry out its own rural electrification responsibilities, conform with proposed rural electrification framework and to interface and partner with other sector participants. This review would be followed by a second phase consisting of development of detailed design of government functions associated with the proposed institutional structure, and assistance in establishment of the government component of the framework.

Phase 2 - Detailed Design / Establishment of Government Institutional Framework. (a) Detailed Design of Institutional Arrangements. Based on Government decisions concerning the Phase 1 recommended options, the second phase of the study would be designed to assist Government to carry out detailed design of the envisaged institutional arrangements including: drafting of relevant sections of decrees and policy documents; development of detailed regulations; development of operations manuals for Rural Electrification Fund; development of solicitation documents, draft concession contracts etc. It is assumed that the Management Contractor would assist EDTL to implement necessary changes to its organization and operations.

(b) Establishment of a Power Sector Regulatory Function. It is assumed that regulatory staff would be appointed at the outset of the Detailed Design Phase (key staff should preferably have also been involved in the Basic Design Phase). On the job training while developing detailed design of regulations would be accompanied by formal training programs, study tours and seconding to similar regulation entities in relevant countries. This phase would end with initial regulator operations carried out in conjunction with First Rural Electrification Project and regulation of EDTL at end of Management Contract period.

(c) Electricity Law Revision and Complementary Decrees. In parallel with second phase studies of the above modules, the existing Basic Law would be reviewed and any necessary changes drafted to conform to the adopted institutional, regulatory structure for the sector. For example it is not clear whether the concessioning out of distribution and supply functions are permitted under the current law. Decrees or regulations needed to complement the basic law, such as those pertaining to the responsibilities for government functions of regulation and the rural electrification fund would also be drafted.

Rural electrification master plan and implementation manual. The PSDP study concluded that in the long term, connection to the grid would be the most economical solution for the majority of households in the country. However, it also recognized that for smaller more remote villages mini-grids based on micro hydropower, wind or diesel might be more economical in the short term (pre-grid) or in some cases even for the longer term. It also noted that for some smaller villages the cost of grid-based electrification may be prohibitive and solar home systems may be the most economical alternative. The PSDP provided useful guidance on likely economical forms of electrifying areas depending on load size and density and distance from the grid; it also suggested criteria to be used in prioritizing rural electrification. The Government proposes to build on the PSDP study by carrying out rural electrification planning down to the sub-district level. Funding from ESMAP and ASTAE for this study is committed.

The proposed project would develop a plan for electrifying each sub-district in the country, determining how it is likely to be electrified and when. The plan would have three main purposes: (a) prioritizing areas for grid extension; (b) defining areas that could be more economically developed by locally resource based mini-grids; and (c) defining areas that are unlikely to be feasible for grid based development even in the longer term, enabling alternative electrification arrangements such as solar home systems to be made for these areas which could

proceed in parallel with conventional grid extension and mini-grid establishment. The planning would take into account resource assessments described above, population size, distance from the grid and from other load centers, etc. The plan would be in varying levels of detail depending on when electrification is likely to occur, being very detailed for say the first five years of rural electrification with progressively less detail for the later years. The intention would be to update the plan on a rolling basis. This activity will build capacity among a cadre of practitioners (who will become trainers for other practitioners) through hands-on training in the development of the rural electrification planning study and the rural electrification design and implementation manual as well as through study tours.

Rural electrification standards. As noted earlier, only 20 percent of households in Timor-Leste have access to electricity. The Government intends to address this situation in the decade ahead with a sustained program of rural electrification. Before this program is launched it will be important to review current standards that were designed many years ago for urban distribution and have been extended into rural areas virtually unchanged. As the foregoing discussion highlighted, the PSDP consultant considers that, if a design appropriate to the requirements of rural communities were to be adopted, the cost of rural distribution could be halved. In addition, appropriate standards for small generating units need to be established to ensure that investments are cost effective and supply reliability is appropriate to the area served. The activities foreseen under the project include: (a) a study of similar countries where cost-effective rural electrification standards are in use to collect information on the relevant standards applied and to see practical application of the standards; (b) selection of one set of standards as a model and adaptation for Timor-Leste. The study of rural electrification standards has been subsumed into the rural electrification master plan and implementation manual discussed above.

Resource Assessments and Planning Studies

As the discussion in Chapter II indicated, Timor-Leste may be able to tap renewable sources of energy supply for the proposed electrification program. Before major investments are made in additional generation capacity and transmission, a series of studies are needed to assess the extent of the resource base and to plan for the electrification of the country.

Wind resource assessment study.¹⁷ Before carrying out a feasibility study of grid and off-grid wind generation, better data needs to be obtained on the adequacy and persistence of the wind resources in accessible wind farm sites. The PSDP review of relevant data relating to wind resources of Timor-Leste concluded that in the uplands and mountains there is likely to be good potential. The best locations may have average wind speed in excess of eight meters per second and wind power density of 600 W/m² or more. However, more on-site measurements will be required to verify these promising figures. The measurement period should preferably cover several years to conclude if there are remarkable year-to-year variations, due for example to El Niño. No funding source has yet been identified for these wind power studies.

Based on rough estimates of production costs the PSDP consultant concluded that compared to hydropower schemes such as Ira Lalaro, wind power will not be the least-cost option for supplying power to the grid, at least not in the short term. Moreover, wind power should not be seen as an alternative for hydro schemes, but rather as a complement to them. However, the situation could change in comparison to later less economical hydropower plants particularly if wind resources prove to be better than anticipated and/or if the trend towards reducing investment costs continues. CDM carbon credits would also serve to improve financial viability in comparison to diesel. Subsequent feasibility studies would need to consider other factors such as

¹⁷ The funding for this study is included in the SIP for Natural Resources and Environment.

restrictions and extra costs caused by the bad road connections and handling capacity of large and heavy components at the Dili harbor.

With regard to off-grid applications, there may be cases where these are feasible in the short term, both in the uplands and mountains, and along the eastern/southern coast. Preliminary estimates indicated that for small villages with no more than 30 households, a local wind system would be competitive against grid extension in windy areas if the required transmission line length is more than one km. In less windy areas, the wind system breaks even at the transmission line length of around three km for small villages. For large villages of around 200 households, wind systems would be more cost effective than distribution line extension at the distance of seven km in windy areas and 15 km to 20 km in less windy areas.

Mini- and micro- hydropower resource inventory. A more thorough assessment of micro hydropower resources is required to provide input to the 'National Rural Electrification Planning Study' proposed below. The PSDP consultant reported that at three villages between Maubisse and Ainaro substantial tributaries of the Belulic river cascade from the face of Tatamailau and are likely to provide good opportunities for low-cost micro hydro installation. Similar opportunities might exist for perhaps 50 sites in the higher parts of the country. Similarly, a Norwegian mission previously identified a number of micro hydro sites, some of these based on spring fed rivers with a relatively constant flow throughout the year. One of them is at Baucau where a 350 kW scheme could be developed relatively easily and quickly, capable of producing three GWh per annum. The same team also found other springs that appear to have very good micro hydro potential. Micro hydro is likely to have a significant and continuing role in rural electrification in a number of isolated locations with mountainous terrain and high rainfall. In these areas, where grid connection would not occur for many years if ever, micro hydro can provide the opportunity for mini-grid development. Even if these areas are eventually connected to the main grid, the micro hydropower project can continue to function as a supplier of power to the main grid. NORAD has indicated that it will finance this study and, as noted earlier, will commence the work in late 2005 after completion of its ongoing hydrology study.

Feasibility and Pre-investment Studies

The Government also attaches a high priority to moving ahead with feasibility studies for various power generation and transmission programs. By taking a simultaneous approach with resource assessments and power investment feasibility studies, the Government would be able to make informed and timely decisions on the best options for further development of the power sector as soon the results of the resource assessments are available (in approximately 18-24 months). The various project preparation activities will build on earlier studies and be closely coordinated with earlier-mentioned proposed new studies.

Preparation studies Ira Lalaro hydropower project. The feasibility study update has been completed with funding from NORAD. The PSDP report also confirmed the necessity of additional geo-technical studies, and also recommended update and elaboration of the Environment Impact Assessment and consideration of alternative designs for Ira Lalaro. The project also includes the preparation of bid documents.

Preparation studies for Baucau mini hydropower plant. A feasibility study also supported by NORAD is underway. A recent Norwegian mission (October 2002) identified several micro hydro schemes that appeared to have good potential. One of them is close to Baucau Town where a 350 kW, 3 GWh/year scheme could be developed to utilize water flowing from a spring (after water supply needs have been met). Estimates comparing the cost of diesel generator and a hydropower plant of the same size showed that hydropower energy would be less expensive than diesel generation. The consultant's contract also includes preparation of bid documents.

First rural electrification project preparation. The Government's intention is to move ahead with a strong program for rural electrification in the decade ahead. Preparatory activities for the First Rural Electrification Project are therefore needed. These will involve:

- Setting up institutional arrangement for project preparation.
- Identification of potential areas to be electrified through both grid extension and various off-grid technologies. These choices would be guided by or done in parallel with the rural electrification master plan and implementation manual study.
- Prepare preliminary designs and cost estimates for potential electrification areas.
- Based on agreed selection criteria, prioritize electrification programs and define the physical scope of sub-projects.
- Prepare environmental assessments, acquisition/resettlement plans and baseline social-economic surveys.
- Consider appropriate institutional and financing models (including need for subsidies) for various components taking into account investor interest and availability of finance.
- Prepare bidding documents for procurement of first tranche of equipment in the case of public development and/or documents for soliciting concessionaires in case of private development.
- Prepare comprehensive implementation strategy for individual projects. For publicly developed projects, this would include: (a) implementation schedules; (b) organizational and personnel arrangement for project management during implementation; and (c) setting-up management system for project implementation. Similar but not identical arrangements would be needed for private development.

Priority Investments in the Power System

The Government is proposing a number of high priority, new investments in the power system. These include the Dili Generation and Distribution Project, the District and Sub-district Rehabilitation Program, and the Lamp Replacement Program. A number of other specific investments discussed below are proposed for the medium term.

Dili generation and distribution. While the Dili generation and distribution system is now generally restored and returned to operation, further investment is needed to supplement generation capacity at Comoro Power Station, and also to reinforce and improve reliability of the Dili distribution system. The Comoro Power Plant has four medium-speed and eight high-speed diesel units. One of the medium-speed units is out of service and, based on a JICA mission's assessment, is not repairable. As a result, the newer high-speed units financed by NORAD are being run at high capacity on a sustained basis. This will accelerate degradation of their output and lifetime.¹⁸ Additional investment in distribution is needed to address the earlier mentioned problem of high technical losses that are currently estimated at around 15 percent.

Rehabilitation/upgrading is presently underway with Japanese and TFET funds. With \$1.2 million in JICA support, EDTL expects a new 4 MW medium-speed generator to be installed by end-2005 at Comoro Power Plant. JICA is also concluding a distribution reinforcement project in Dili which has replaced 50 transformer stations and autoreclosers. With TFET support through the World Bank, EDTL is scheduled to replace the medium speed 2.8 MW MAK 4 engine at Comoro at an estimated cost of \$1 million. Bids have been invited and the engine is scheduled to

¹⁸ High-speed diesel engines have lower generation efficiencies and are normally used for standby duty and short-term operation.

come on-stream by mid-2005. EDTL is also using \$0.3 million in TFET support for the rehabilitation of switchgear, sub-transmission and distribution lines and auxiliaries in Dili to reduce losses.

Comoro relocation. The Comoro Power Station in Dili consumes about 18.5 million liters of diesel oil per year. The oil is transported by truck from the wharf to the Comoro Power Station, a distance of about two to three kilometers at a cost of about \$370,000 per year. The PSDP consultant proposed oil supply pipeline from the wharf to the Comoro Power Station as an alternative to trucking, the estimated cost of which was about \$1 million. The Government has subsequently decided that the Comoro Station should be relocated to the Hera Port area. The program includes a notional \$6 million for the development of the site and pipelines for fuel transport ashore and storage. The first step would be a site survey and assessment of requirements. The proposed program includes \$100,000 for this work to be undertaken in FY2005/06.

Lamp replacement program. Demand side management actions to improve the efficiency of energy use are considered crucial for reduction of current large oil import costs and improved profitability of utilities. As noted earlier, the use of compact fluorescent lamps (CFLs) and fluorescent tubes as direct replacements for traditional incandescent bulbs are projected to achieve significant savings. A calculation on the benefits of using CFLs is also presented in the PSDP report, indicating the installation of 60,000 CFLs in Dili would result in annual savings in EDTL's fuel bill of \$550,000 and deferred capital investment in generation capacity of about \$1.7 million. The cost of the lamps would be about \$90,000 indicating a simple payback of a few months. TFET has committed \$90,000 for this program and, under a World Bank project, EDTL has invited bids. Distribution of lamps to customers participating in the pre-payment meters program is expected to be completed by mid-2005.

District and sub-district rehabilitation program. Electricity services have still not been restored to some villages that were served with electricity before the outbreak of violence in 1999. In four cases, this is due to destroyed power stations and lines; in several other cases the main reason is damaged distribution lines that could be rehabilitated with only small investments. This rehabilitation program could also demonstrate the new rural electrification distribution standards.

Japan (JICS) is installing four additional generators in rural areas, but no more funding is presently available for distribution extension from existing isolated networks. ADB is presently installing final distribution extension to the 14 sucos rehabilitated under its Emergency Infrastructure Rehabilitation Project. Priority must be placed on a successful solution to the administration of the community operated systems before additional funding can be put in place.

Power System Investments for the Medium Term

First rural electrification project. This project will follow from the feasibility study described above. It is envisaged that this first rural electrification expansion project would include both grid-connected and off-grid components and pilot the policy reforms described in the Rural Electrification Framework project description. The proposed project would aim to provide grid connections to about 21,000 households and install solar home systems (SHS) to another 7,000 households. The project would be implemented over a three to four year period and is estimated to cost about \$8.7 million.¹⁹

¹⁹ With revised standards for rural electrification, the average cost of connection to the grid is estimated at \$330 per household. For SHS installation, the average cost is estimated at \$250 per household.

Suai oil well associated power plant. This investment would proceed if sufficient oil were produced from the rehabilitated Suai oil well. The associated power plant would be installed in the Suai power station (a short distance away from the well) to generate power either from the oil or gas produced from the well, or possibly both (dependant on quantities). Preliminary survey indicates the output from the oil well rehabilitation could support a power plant of 400 kW.

Gas seep harvesting and associated power plant. Natural gas seeps occur at Aliambata on the south coast of Timor-Leste in Viqueque district. Timor-Leste can benefit from carbon credits from these seeps if the gas (mostly methane) is flared and, if feasible, used to generate electricity using a suitable gas engine-driven generator set. The electricity could be supplied to adjacent villages and possibly Viqueque town through a 20kV line.²¹ A preliminary survey indicates the seep harvest could support a power plant of 600kW.

A demonstration project for gas seep harvesting at Aliambata (47 km from Viqueque town on the south coast) is currently under preparation using Japanese grant funds available through the World Bank. A project management consultant has been engaged and hiring of technical consultants to sample the volume and composition of gas is near completion. Subsequently, the feasibility of power generation using the gas will be conducted. TFET funds (\$0.54 million) for the capture of gas and power generation have been allocated. The Aliambata project is intended as a demonstration that could be replicated to the other well-known, and apparently prolific, gas seeps elsewhere in Timor-Leste (estimated to be up to 30 in number).

132kV transmission reinforcement. The project – as yet undefined – would be for the evacuation of power to Dili from a major generation source. This could be Ira Lalaro Hydropower or alternatively a southern coast indigenous oil /gas generation facility (or facilities). It would also supply power to adjacent load growth areas. The project would be preceded by a feasibility study. The medium-term generation and transmission plan for Timor-Leste currently recognizes two alternative scenarios:

- *Scenario 1.* The development of a mixed hydro-thermal generation system and gradual interconnection of the separate systems into a single grid over a 20-year period. The existing diesel-based system would be reinforced in the short term and as soon as possible supplemented by the 27 MW Ira Lalaro hydropower plant and associated 132 kV transmission line to Dili, a distance of some 190 km. This transmission line would allow connection of the major towns and other load growth areas along the way. It is assumed that the hydropower plant and transmission line would become operational by 2010.
- *Scenario 2.* If significant quantities of oil and gas are proven onshore and near-shore in the southern coastal area, such reserves could be used for: (i) fuelling local diesel generating stations (that are very costly to supply with oil from Dili); (ii) fuelling larger generating stations and evacuating power by 132kV transmission to Dili and adjacent load growth areas; or (iii) a combination of the above plus export if justified by recoverable reserves.

The first 132kV Transmission Expansion Project would therefore likely comprise either an East–West 132kV line from Ira Lalaro to Dili or a north–south 132 kV line from the southern coastal area to Dili. Power supplies to adjacent load growth areas would be reinforced in either case.

²¹ See the SIP for the Natural Resources and Environment for a more detailed discussion of the proposed Gas Seep Demonstration Project.

Ira Lalaro hydropower project. The original estimate contained in the 1989 PLN study put the cost of the Ira Lalaro Project at \$52.5 million. A Norwegian Water and Energy Directorate mission that visited Timor-Leste in late-2002 recommended the Ira Lalaro hydropower scheme as a priority project because of its obvious capacity to generate low cost electricity. The mission estimated the cost at about \$160 million, including the transmission line, which represented approximately one third of the cost estimate. The PSDP consultants subsequently estimated the total project cost at about \$60 million, of which \$42 million would be for the hydropower plant and \$18 million would be for the 190 km transmission line to connect the plant to the Dili system. The Government believes that the PSDP estimate is more realistic, provided that procurement packaging is appropriate and international competitive bidding is employed. More precise cost estimates of the investment costs would be available from the ongoing feasibility study.

Prioritising the Proposed New Program and Intersectoral Linkages

In formulating the investment program outlined in this SIP, the government agencies responsible for the power sector established a clear set of priorities for the program. The priority projects for the proposed program are summarized in Table 9 and are described in some detail in the companion publication entitled "Sector Investment Program: Profiles of Proposed New Projects."

The total program involving 10 projects and programs calls for total new commitments of \$152 million over the next five years, \$1.35 million of which comprise the high priority program that the Government wants to launch this year. The expectation is that implementation of the high priority program would be completed in FY2004/05.

Table 9: Priorities for Proposed New Program
(In US\$)

Priority Ranking	Donor Funding	Start Date	Proposed Total Amount for Program					Total	
			FY2004/05	FY2005/06	FY2006/07	FY2007/08	FY2008/09		
A. High Priority Program									
Equipment for Comoro power station	Japan	FY2004/05	1,200,000					1,200,000	
Oil products procurement study		FY2004/05	150,000					150,000	
Total proposed			1,350,000	-	-	-	-	1,350,000	
Disbursements			1,350,000	-	-	-	-	1,350,000	
B. Programs for the Medium-term									
Comoro station relocation	ADB	FY2005/06		6,000,000				6,000,000	
District & sub-district rehabilitation		FY2005/06		2,800,000				2,800,000	
Guruwai mini-hydro project		FY2005/06		925,000				925,000	
Ira Lalaro power station		FY2005/06		83,100,000				83,100,000	
Rural electrification (project preparation)		FY2005/06			700,000			700,000	
Ira Lalaro transmission line		FY2006/07			28,800,000			28,800,000	
Rural electrification I		FY2007/08				8,700,000		8,700,000	
Dili south transmission line		FY2008/09					20,000,000	20,000,000	
Total proposed				-	92,825,000	29,500,000	8,700,000	20,000,000	151,025,000
Disbursements					13,325,000	36,700,000	47,700,000	31,400,000	129,125,000
C. Total proposed									
Total disbursements			1,350,000	92,825,000	29,500,000	8,700,000	20,000,000	152,375,000	
			1,350,000	13,325,000	36,700,000	47,700,000	31,400,000	130,475,000	

Source: Annex Tables 2 and 5.

The program for the medium-term includes \$152 million of new commitments. These are dominated by three large projects: the Ira Lalaro hydropower station (currently estimated by Norwegian consultants at \$83.1 million), the associated transmission line (currently estimated by Norwegian consultants at \$28.8 million) and the Dili south transmission line (notionally estimated at \$20 million). As noted elsewhere in this SIP, decisions on the timing of the Ira Lalaro plant and transmission line depend on the outcome of the ongoing investigation of onshore and near-shore oil and gas reserves. In the event that these are significant, it is possible that the next phase of expansion in generation capacity will involve one or more thermal stations based on domestic petroleum resources. In this event, the Government may look to the private sector for financing and operation of these thermal stations with power being sold to EDTL.

The Government is very aware of the importance of strengthening linkages between agencies responsible for the power sector and the activities of other ministries and agencies. It is widely known that electricity service has good income-producing potential for the rural population; however, electricity is only one pre-requisite for these income-producing activities, and if the other pre-requisites are lacking, such as capital or access to land, provision of electricity service alone may have little impact. The Government recognizes that specific actions will be needed to maximize the impact of the program. A key issue that has emerged from many rural electrification projects worldwide is the importance of greater coordination and/or integration of rural electrification with programs that provide water, health and education services, and that develop small-scale agriculture and small business. In many cases, the full potential of electrification has not been realized due to uncoordinated development efforts.

Steps are being taken to strengthen linkages between the planning and execution of power sector and other programs that benefit from the introduction of electric power. The proposed development of an electrification plan on a district-by-district basis will play an important role in planning for other services to coincide with the introduction of electricity in various parts of the country.

VII. EXPENDITURE PROGRAMS AND FUNDING

Current Levels of Expenditure

Over the five year period ending FY2003/04, a total of \$67 million has been spent on the power sector (Table 10). Donors have funded about one-third of the outlays directly – although their indirect support has been much higher as a result of the CFET budget support provided by some members of the donor community.

Table 10: Government and Donor Expenditures in the Power Sector, FY1999/00 Through FY2003/04 (US\$)

Source of Funding	Annual Disbursements					Total	
	FY1999/00	FY2000/01	FY2001/02	FY2002/03	FY2003/04	Amount	Percent
Donor programs	351,609	5,084,550	5,121,520	2,930,296	7,497,131	20,985,106	31.2
EDTL financed expenses	-	258,000	1,997,000	2,932,156	3,527,962	8,715,118	13.0
CFET appropriations	7,500,000	8,121,000	6,856,000	8,418,264	6,557,336	37,452,600	55.8
Total	7,851,609	13,463,550	13,974,520	14,280,716	17,582,429	67,152,824	100.0

Source: Annex Table 1.

Operating expenses of EDTL, which amounted to \$42 million over these past five years, account for 63 percent of total spending (Table 11). The single largest expenditure item during this period has been for fuel, which accounted for more than half of total spending in the sector. Capital spending, mainly for generation in Dili, amounted to about \$23 million. About \$2 million of donor funding was spent on technical studies and other assistance.

Table 11: Expenditures by Program Category for the Power Sector, FY1999/00 Through FY2003/04 (US\$)

Program	Funding Source			Total	
	CFET	EDTL	Donors	Amount	Percent
Studies and technical assistance	-	-	1,894,000	1,894,000	2.8
Generation & transmission	3,864,000	290,998	17,291,106	21,446,104	31.9
Rural electrification			1,800,000	1,800,000	2.7
Operations					
Fuel	28,310,055	7,096,226	-	35,406,281	52.7
Other operating expenses	5,278,545	1,327,894	-	6,606,439	9.8
Sub-total	33,588,600	8,424,120	-	42,012,720	62.6
Total	37,452,600	8,715,118	20,985,106	67,152,824	100.0

Source: Annex Table 1.

Proposed Expenditure Program

Proposed total expenditures in the power sector are projected at about \$200 million for FY2004/05 through FY2008/09, \$56 million of which is EDTL operating expenses. The balance of \$130 million represents new spending on the studies, resource assessments, technical assistance and power generation, transmission and distribution over the next five years that were summarized in Chapter VI. Largely as a result of concerted efforts over the past year the pipeline of ongoing projects has been strengthened to some extent, with some \$11 million of donor funding expected to disburse under projects that have already been approved. This represents a significant improvement in the pipeline of power projects compared to the situation at end 2003, for example.

The proposed program would be developed in three distinct phases:

- For the immediate future, emphasis will continue on EDTL revenue collection and capacity building; accelerated investigation of the energy resource base, and continuing rehabilitation works in the system to improve efficiency and reliability.
- In approximately one year, with more accurate information on the domestic oil and gas resources and their cost of development, and with the final estimates of the cost of the 27MW Ira Lalaro Hydropower Project, informed decisions will be made on the country's optimal generation expansion program.
- With a clear strategy in place, emphasis would then move to an accelerated program of rural electrification beginning around FY2006/07, at a measured rate that will meet an electrification target of 80 percent of households by 2025.

The key features of the proposed expenditure program are as follows:

- A significant improvement in the financial position of EDTL with operating losses projected to decline to about \$3 million by FY2008/09 (Annex Table 3).
- The proposed program includes a provisional allocation of \$83.1 million for the Ira Lalaro Hydro Project and \$28.8 million for the transmission line from Los Palos to Dili, some or all of which may have to be funded by the public sector. However, if domestic oil and gas resources are significant, there would be a major change in the financing picture for the power sector. In these circumstances, the required amount of public funding for power generation would be substantially reduced, since the private sector would be expected to develop the oil and gas resources and associated power generation.
- Investments in other programs would amount to about \$30 million, including the above mentioned \$11 million of ongoing donor programs and \$7.4 million for the proposed rural electrification program.

Table 12: Allocation of Proposed Program Expenditures, FY2004/05 Through FY2008/09
(In US\$)

Program	Annual Expenditures					Total	
	FY2004/05	FY2005/06	FY2006/07	FY2007/08	FY2008/09	Amount	Percent
Policy and planning							
Ongoing	1,175,000	275,000	-	-	-	1,450,000	0.7
Proposed new	150,000	-	-	-	-	150,000	0.1
Sub-total	1,325,000	275,000	-	-	-	1,600,000	0.8
Power generation							
Ongoing	5,666,718	-	-	-	-	5,666,718	2.8
EDTP capital expenditures	391,000	427,000	367,000	407,000	500,000	2,092,000	1.0
Proposed new	1,200,000	13,325,000	33,500,000	34,000,000	11,600,000	93,625,000	47.0
Sub-total	7,257,718	13,752,000	33,867,000	34,407,000	12,100,000	101,383,718	50.9
Transmission and distribution							
Ongoing	3,643,840	-	-	-	-	3,643,840	1.8
Proposed new	-	-	2,500,000	12,000,000	14,800,000	29,300,000	14.7
Sub-total	3,643,840	-	2,500,000	12,000,000	14,800,000	32,943,840	16.5
Rural electrification							
Ongoing	-	-	-	-	-	-	-
Proposed new	-	-	700,000	1,700,000	5,000,000	7,400,000	3.7
Sub-total	-	-	700,000	1,700,000	5,000,000	7,400,000	3.7
EDTL operations							
Ongoing	10,639,000	10,917,000	11,245,000	11,471,000	11,735,000	56,007,000	28.1
Total power sector							
Ongoing (excl EDTL)	10,485,558	275,000	-	-	-	10,760,558	5.4
EDTL operations	10,639,000	10,917,000	11,245,000	11,471,000	11,735,000	56,007,000	28.1
EDTL capital expenditures	391,000	427,000	367,000	407,000	500,000	2,092,000	
Proposed new	1,350,000	13,325,000	36,700,000	47,700,000	31,400,000	130,475,000	65.5
Total	22,865,558	24,944,000	48,312,000	59,578,000	43,635,000	199,334,558	100.0

Source: Annex Tables 1, 3, and 5.

Capital and Recurrent Expenditures

Expenditures in the power sector have been disaggregated into capital and recurrent outlays. Table 13 summarizes the results of these estimations. Several important issues emerge from the analysis. First, during the past five years, recurrent expenditures – most of which were the operating expenses of EDTL – accounted for two-thirds of total spending in the power sector. The recurrent expenses of the power sector were equivalent to about 14 percent of the entire CFET budget for these five years. The amount of capital spending was a little over \$20 million, with most of that going to rehabilitation of existing power systems. Two-thirds of total outlays were funded from the CFET budget and EDTL's own revenues, mainly for the subsidy from CFET for EDTL operations.

The second point is the next five years would see a major shift in expenditure allocations within the sector with a greatly increased emphasis on creating new capacity in the power sector. The Government's commitment to accelerate the development of indigenous energy sources and expand access to electricity throughout the country could, as noted above, require outlays of about \$200 million during this period, depending on whether Ira Lalaro goes ahead. In this scenario, capital expenditures would rise to about \$140 million for the five-year period. Capital spending in the power sector would be equivalent to about six percent of GDP in this period. At the same time, the burden of the power sector subsidy on the CFET budget would be sharply reduced. EDTL revenues would rise steadily throughout the period and would cover about 80 percent of operating expense by FY2008/09, compared with only one-third in the recent past.

The third issue that arises is that this ambitious program of capital spending will necessarily generate substantially larger requirements for capital replacement and maintenance expenditures

following the creation of these assets. Once final decisions are taken on whether Ira Lalaro or thermal generation will be the next major investment in the power sector, it will be possible to develop more refined estimates maintenance and capital replacement outlays for the medium-term.

Table 13: Summary of Proposed Capital and Recurrent Expenditures for the Power Sector (US\$)

Category	FY1999/00-FY2003/04		FY2004/05-FY2008/09		Total	
	Amount	Percent	Amount	Percent	Amount	Percent
Recurrent spending						
Donors	1,894,000	2.8	1,450,000	0.7	3,344,000	1.3
CFET/EDTL	42,012,720	62.6	56,007,000	28.1	98,019,720	36.8
Proposed new	-	-	83,250,000	41.8	83,250,000	31.2
Sub-total	43,906,720	65.4	140,707,000	70.6	184,613,720	69.3
Capital spending						
Donors	19,091,106	28.4	9,310,558	4.7	28,401,664	10.7
CFET/EDTL	4,154,998	6.2	2,092,000	1.0	6,246,998	2.3
Proposed new	-	-	47,225,000	23.7	47,225,000	17.7
Sub-total	23,246,104	34.6	58,627,558	29.4	81,873,662	30.7
Total expenditures						
Donors	20,985,106	31.2	10,760,558	5.4	31,745,664	11.9
CFET/EDTL	46,167,718	68.8	58,099,000	29.1	104,266,718	39.1
Proposed new	-	-	130,475,000	65.5	130,475,000	49.0
Total	67,152,824	100.0	199,334,558	100.0	266,487,382	100.0
Total expenditures	67,152,824	100.0	199,334,558	100.0	266,487,382	100.0
Memo item						
EDTL revenues	8,715,118	13.0	39,610,000	19.9	48,325,118	18.1

Source: Annex Table 6.

Sources of Funding

Japan has been a major supporter of the power program, with Norway taking an increasingly active role in the sector as well. The increased support from Norway has provided a very important cushion against the decline in the role of TFET in the coming years. The Government is also pleased that two new donors have been mobilized for the power sector program. These are the Public-Private Infrastructure Advisory Facility (PPIAF), a multi-donor source of funding relating to infrastructure, and the Energy Sector Management Advisory Programme (ESMAP), a joint World Bank - UNDP source of funding for the energy sector. Funding commitments recently agreed upon with PPIAF and ESMAP amount to \$0.9 million. These funds would be used for the high priority studies on the legal and regulatory framework and rural electrification.

As Table 14 indicates, the funding likely to be available from ongoing donor programs, CFET and EDTL revenues is projected at \$69 million for the next five years – only marginally higher than the \$67 million of spending in the past five years. Central to successful efforts to fund these requirements will be revenue collections from consumers. These are projected to be almost \$30 million for the four-year period and as noted earlier, would increasingly cover the operating costs of EDTL. In the event that fuel costs can be lowered through the use of international competitive bidding and by the demand management measures outlined in Chapter VI, the fuel savings to EDTL would approximate \$3 million a year by FY2006/07. Strong action on revenue collections, in combination with these cost reducing initiatives, could result in some additional savings.

The Government recognizes the major challenge involved in raising the \$130 million of new funding that would be needed if the power program were to go ahead beginning with Ira Lalaro and the transmission line to Dili, the combined cost of which is currently estimated at about \$112 million. Given current expectations about future levels of development and technical assistance

that are likely to be available to Timor-Leste, it is very unlikely that these two projects could be fully funded from programs of grant assistance. One possible option may be a public-private partnership in which the Government assumes responsibility for the transmission program and private investors develop the hydro-generation on a Build-Operate-Transfer (BOT) basis. The attractiveness of the Ira Lalaro project for private investment remains to be determined, as do the terms and conditions under which such investment might go forward. These and other possible options will require very careful study before any final decisions are made on funding strategies.

Table 14: Sources of Funding for Power Sector Expenditure Program
(n US\$)

Source of Funds	FY1999/00-FY2003/04		FY2004/05-FY2008/09		Total	
	Amount	Total	Amount	Total	Amount	Total
Donor programs ongoing						
Japan	11,528,017	17.2	4,175,123	2.1	15,703,140	5.9
Norway	4,168,676	6.2	3,178,054	1.6	7,346,730	2.8
TFET	4,170,000	6.2	1,930,000	1.0	6,100,000	2.3
PPIAF	250,000	0.4	1,150,000	0.6	1,400,000	0.5
Other donors	868,413	1.3	327,381	0.2	1,195,794	0.4
Sub-total	20,985,106	31.2	10,760,558	5.4	31,745,664	11.9
EDTL revenues	8,715,118	13.0	39,610,000	19.9	48,325,118	18.1
CFET appropriations	37,452,600	55.8	18,489,000	9.3	55,941,600	21.0
Total available funding	67,152,824	100.0	68,859,558	34.5	136,012,382	51.0
Proposed new programs	-	-	130,475,000	65.5	130,475,000	49.0
Total funding	67,152,824	100.0	199,334,558	100.0	266,487,382	100.0

Sources: Annex Tables 1, 3, and 5.

VIII. SOURCES OF UNCERTAINTY

The proposed development program for the power sector faces a number of uncertainties. Some of the more important ones are as follows:

- The largest uncertainty at this time is whether thermal generation on the south coast or development of Ira Lalaro will be the most cost-effective means of adding the next 30 MWs or so of generation capacity in the medium term. If the country has substantial onshore and/or nearshore oil and gas resources that are suitable for use by the power sector, investment in Ira Lalaro can probably be deferred. The preliminary estimates put the cost of generation at Ira Lalaro at \$3 million a megawatt. Assuming recoverable reserves are adequate, thermal generation on the south coast may be possible for around \$1 million a megawatt.
- The size of the investment requirements for the power infrastructure is therefore uncertain. The capital costs of many of the elements of the proposed program included in this SIP are rough estimates and can only be firmed up once the necessary feasibility studies are completed. The amount and type of financing that will be required for the power program cannot be determined with accuracy until estimates of investment requirements are firm.

The projections in the proposed program assume sustained improvement in EDTL revenues and an associated sharp reduction in the subsidy from the CFET budget that then frees up resources for other development objectives. Failure to meet these revenue targets will put additional pressures on the CFET budget and undermine potential donor support for other elements of the power development program. On the expenditure side, there is a risk that the cost savings from various initiatives outlined in the SIP will be offset by higher fuel prices.

IX. ANNEX TABLES

Annex Table 1: Actual and Proposed Expenditure Programs for the Power Sector
(In US\$)

Program	Annual Expenditures										Total			
	FY1999/00	FY2000/01	FY2001/02	FY2002/03	FY2003/04	FY2004/05	FY2005/06	FY2006/07	FY2007/08	FY2008/09	FY1999/00-FY2002/03		FY2003/04-FY2006/07	
											Amount	Percent	Amount	Percent
Policy, planning, management														
Donor programs	-	-	277,000	1,267,000	350,000	1,175,000	275,000	-	-	-	1,894,000	2.8	1,450,000	0.7
Proposed new programs	-	-	-	-	-	150,000	-	-	-	-	-	-	150,000	0.1
Sub-total	-	-	277,000	1,267,000	350,000	1,325,000	275,000	-	-	-	1,894,000	2.8	1,600,000	0.8
Generation														
Donor programs	-	3,680,987	4,799,692	1,663,296	5,029,731	5,666,718	-	-	-	-	15,173,706	22.6	5,666,718	2.8
Proposed new programs	-	-	-	-	-	1,200,000	13,325,000	33,500,000	34,400,000	11,600,000	-	-	94,025,000	47.1
Sub-total	-	3,680,987	4,799,692	1,663,296	5,029,731	6,866,718	13,325,000	33,500,000	34,400,000	11,600,000	15,173,706	22.6	99,691,718	49.9
Transmission and distribution														
Donor programs	-	-	-	-	2,117,400	3,643,840	-	-	-	-	2,117,400	3.2	3,643,840	1.8
Proposed new programs	-	-	-	-	-	-	-	2,500,000	12,000,000	14,800,000	-	-	29,300,000	14.7
Sub-total	-	-	-	-	2,117,400	3,643,840	-	2,500,000	12,000,000	14,800,000	2,117,400	3.2	32,943,840	16.5
Rural electrification program														
Donor programs	351,609	1,403,563	44,828	-	-	-	-	-	-	-	1,800,000	2.7	-	-
Proposed new programs	-	-	-	-	-	-	-	700,000	1,700,000	5,000,000	-	-	7,400,000	3.7
Sub-total	351,609	1,403,563	44,828	-	-	-	-	700,000	1,700,000	5,000,000	1,800,000	2.7	7,400,000	3.7
EDTL operations														
Revenues	-	258,000	1,997,000	2,932,156	3,527,962	5,628,000	7,378,000	8,227,000	8,827,000	9,550,000	8,715,118	13.0	39,610,000	19.8
Operating expenses	7,000,000	7,886,000	8,031,000	9,152,350	9,574,945	10,639,000	10,917,000	11,245,000	11,471,000	11,735,000	41,644,295	62.0	56,007,000	28.0
Capital expenditures	500,000	493,000	822,000	2,198,070	141,928	391,000	427,000	367,000	407,000	500,000	4,154,998	6.2	2,092,000	1.0
CFET appropriations	7,500,000	8,121,000	6,856,000	8,418,264	6,557,336	5,402,000	3,966,000	3,385,000	3,051,000	2,685,000	37,452,600	55.8	18,489,000	9.3
Total														
Donor programs	351,609	5,084,550	5,121,520	2,930,296	7,497,131	10,485,558	275,000	-	-	-	20,985,106	31.2	10,760,558	5.4
EDTL financed expenses	-	258,000	1,997,000	2,932,156	3,527,962	5,628,000	7,378,000	8,227,000	8,827,000	9,550,000	8,715,118	13.0	39,610,000	19.8
CFET appropriations	7,500,000	8,121,000	6,856,000	8,418,264	6,557,336	5,402,000	3,966,000	3,385,000	3,051,000	2,685,000	37,452,600	55.8	18,489,000	9.3
Proposed new programs	-	-	-	-	-	1,350,000	13,325,000	36,700,000	48,100,000	31,400,000	-	-	130,875,000	65.5
Total	7,851,609	13,463,550	13,974,520	14,280,716	17,582,429	22,865,558	24,944,000	48,312,000	59,978,000	43,635,000	67,152,824	100.0	199,734,558	100.0

Source: Annex Tables 2, 3 and 5.

Annex Table 2: Summary of Donor Funded Programs Completed, Ongoing and Under Preparation for the Power Sector
(In US\$)

Sub-sector/Project	Donor	Annual disbursements										Total		
		FY1999/00	FY2000/01	FY2001/02	FY2002/03	FY2003/04	FY2004/05	FY2005/06	FY2006/07	FY2007/08	FY2008/09	Disbursed	Approved	
Policy, planning & management														
Power Sector Development Plan	ADB			277,000	23,000	100,000							400,000	400,000
Design study for power sector rehabilitation	Japan				413,000								413,000	413,000
Management contract for Comoro station	Norway				831,000								831,000	822,000
Legal & regulatory framework study	PPIAF					250,000	750,000						1,000,000	1,000,000
Power sector institutional framework review	PPIAF						300,000	100,000					400,000	400,000
National rural electrification master plan														
World Bank	World Bank						30,000						30,000	30,000
ASTAE funding	ASTAE						75,000	75,000					150,000	150,000
ESMAP funding	ESMAP						20,000	100,000					120,000	120,000
Sub-total		-	-	277,000	1,267,000	350,000	1,175,000	275,000	-	-	-		3,344,000	3,335,000
Generation														
Rehabilitation of Comoro Power Station	Japan		2,100,343	2,100,242									4,200,585	4,200,585
Comoro power rehabilitation phase II	Japan					1,988,800							1,988,800	1,988,800
TA for Comoro Power Station	Japan												-	-
Electrical Engine System Service	Japan			5,375	5,375								10,750	10,750
Comoro power plant	Japan					2,120,482	3,180,723						5,301,205	5,301,204
Rebuild main town power plants	USA				265,000	165,000							430,000	430,000
Emergency Infrastructure Rehabilitation I	TFET		1,580,644	2,105,430	483,926								4,170,000	4,170,000
MAC IV engine for Comoro power station	TFET						1,000,000						1,000,000	1,394,000
Associated gas seep power plant	TFET						540,000						540,000	540,000
Energy Mission to Timor-Leste	Thailand				5,282	14,083							19,365	19,365
Energy project	Thailand					19,048	27,381						46,429	46,429
Engine & electronic service systems	Norway			588,645	903,713	312,390							1,804,748	1,588,770
Ira Lalaro hydropower plant (feasibility study)	Norway					204,964	614,891						819,855	819,854
Bacau minihydro plant (feasibility study)	Norway					204,964							204,964	204,963
Laclo hydro study	Norway						153,723						153,723	153,723
Inventory of mini/micro hydro resources	Norway						150,000						150,000	150,000
Sub-total		-	3,680,987	4,799,692	1,663,296	5,029,731	5,666,718	-	-	-	-		20,840,424	21,018,443
Transmission and distribution														
CFL lamp replacement program	TFET						90,000						90,000	90,000
Rehabilitation of EDDL distribution system	TFET						300,000						300,000	300,000
Rehabilitation of power distribution in Dili	Japan					994,400	994,400						1,988,800	1,988,800
Ira Lalaro transmission feasibility study	Norway						350,000						350,000	350,000
Prepaid meters	Norway					1,123,000							1,123,000	1,000,000
Prepaid meters II	Norway						1,909,440						1,909,440	1,909,440
Sub-total		-	-	-	-	2,117,400	3,643,840	-	-	-	-		5,761,240	5,638,240
Rural electrification program														
Rehabilitation of Rural Power Stations	Japan	351,609	1,403,563	44,828									1,800,000	1,800,000
Sub-total		351,609	1,403,563	44,828	-	-	-	-	-	-	-		1,800,000	1,800,000
Total		351,609	5,084,550	5,121,520	2,930,296	7,497,131	10,485,558	275,000	-	-	-		31,745,664	31,791,683

Source: Registry of External Assistance.

Table 3: Summary of EDTL Cash Flow
(In US\$)

Category	Annual Appropriations										Total	
	FY1999-00	FY 2000-01	FY2001-02	FY2002-03	FY2003-04	FY2004-05	FY2005-06	FY2006-07	FY2007/08	FY2008/09	1999/00-03/04	2004/05-08/09
Revenues	-	258,000	1,997,000	2,932,156	3,527,962	5,628,000	7,378,000	8,227,000	8,827,000	9,550,000	8,715,118	39,610,000
Operating expenses												
Salaries & wages	360,000	363,000	309,000	309,264	268,521	416,000	438,000	460,000	483,000	507,000	1,609,785	2,304,000
Goods & services	6,640,000	7,523,000	7,722,000	8,843,086	9,306,424	10,223,000	10,479,000	10,785,000	10,988,000	11,228,000	40,034,510	53,703,000
Fuel	6,000,000	6,800,000	6,925,000	7,949,656	7,731,625	8,150,000	8,176,000	8,376,000	8,484,000	8,618,000	35,406,281	41,804,000
Other	640,000	723,000	797,000	893,430	1,574,799	2,073,000	2,303,000	2,409,000	2,504,000	2,610,000	4,628,229	11,899,000
Total expenses	7,000,000	7,886,000	8,031,000	9,152,350	9,574,945	10,639,000	10,917,000	11,245,000	11,471,000	11,735,000	41,644,295	56,007,000
Operating balance	(7,000,000)	(7,628,000)	(6,034,000)	(6,220,194)	(6,046,983)	(5,011,000)	(3,539,000)	(3,018,000)	(2,644,000)	(2,185,000)	(32,929,177)	(16,397,000)
Capital expenditures (CFET)	500,000	493,000	822,000	2,049,000	-	-	-	-	-	-	3,864,000	-
Capital expenditures (EDTL)	-	-	-	149,070	141,928	391,000	427,000	367,000	407,000	500,000	290,998	2,092,000
Capital expenditures	500,000	493,000	822,000	2,198,070	141,928	391,000	427,000	367,000	407,000	500,000	4,154,998	2,092,000
Total deficit (CFET subsidy)	7,500,000	8,121,000	6,856,000	8,418,264	6,557,336	5,402,000	3,966,000	3,385,000	3,051,000	2,685,000	37,452,600	18,489,000

Source: Audited EDTL accounts for FY2000/01 and FY2001/02, EDTL financial statement for FY2002/03 and Budget Office. Numbers for FY1999/00 are rough estimates.

Annex Table 4: Sources of Funding for the Power Sector
(In US\$)

Source of Funding	Annual disbursements										Total	
	FY1999/00	FY2000/01	FY2001/02	FY2002/03	FY2003/04	FY2004/05	FY2005/06	FY2006/07	FY2007/08	FY2008/09	Disbursed	Approved
Donors												
Japan	351,609	3,503,906	2,150,445	418,375	5,103,682	4,175,123	-	-	-	-	15,703,140	15,703,139
Norway	-	-	588,645	1,734,713	1,845,318	3,178,054	-	-	-	-	7,346,730	6,998,750
TFET	-	1,580,644	2,105,430	483,926	-	1,930,000	-	-	-	-	6,100,000	6,494,000
PPIAF	-	-	-	-	250,000	1,050,000	100,000	-	-	-	1,400,000	1,400,000
United States	-	-	-	265,000	165,000	-	-	-	-	-	430,000	430,000
ADB	-	-	277,000	23,000	100,000	-	-	-	-	-	400,000	400,000
ASTAE	-	-	-	-	-	75,000	75,000	-	-	-	150,000	150,000
ESMAP	-	-	-	-	-	20,000	100,000	-	-	-	120,000	120,000
Thailand	-	-	-	5,282	33,131	27,381	-	-	-	-	65,794	65,794
World Bank	-	-	-	-	-	30,000	-	-	-	-	30,000	30,000
Sub-total	351,609	5,084,550	5,121,520	2,930,296	7,497,131	10,485,558	275,000	-	-	-	31,745,664	31,791,683
Government												
CFET appropriations	7,500,000	8,121,000	6,856,000	8,418,264	6,557,336	5,402,000	3,966,000	3,385,000	3,051,000	2,685,000	55,941,600	55,941,600
EDTL revenues	-	258,000	1,997,000	2,932,156	3,527,962	5,628,000	7,378,000	8,227,000	8,827,000	9,550,000	48,325,118	48,325,118
Sub-total	7,500,000	8,379,000	8,853,000	11,350,420	10,085,298	11,030,000	11,344,000	11,612,000	11,878,000	12,235,000	104,266,718	104,266,718
Total	7,851,609	13,463,550	13,974,520	14,280,716	17,582,429	21,515,558	11,619,000	11,612,000	11,878,000	12,235,000	136,012,382	136,058,401
CFET as % of total	95.5	62.2	63.4	79.5	57.4	51.3	97.6	100.0	100.0	100.0	76.7	76.6

Source: Annex Tables 2 and 3.

Annex Table 5: Proposed New Projects and Programs for the Power Sector
(In US\$)

Proposed Program	Possible Funding Source	Proposed Amount	Annual Disbursements					Total
			FY2004/05	FY2005/06	FY2006/07	FY2007/08	FY2008/09	
Policy, planning, management								
Oil products procurement & distribution study		150,000	150,000					150,000
Sub-total		150,000	150,000	-	-	-		150,000
Renewable energy development program								
Guruwai mini hydro plant		925,000		925,000				925,000
Ira Lalaro hydropower plant		83,100,000		12,000,000	30,000,000	30,000,000	11,100,000	83,100,000
Sub-total		84,025,000	-	12,925,000	30,000,000	30,000,000	11,100,000	84,025,000
Thermal power generation								
Comoro station relocation		6,000,000		100,000	2,500,000	3,400,000		6,000,000
Equipment for Comoro power station (4 MW)	Japan	1,200,000	1,200,000					1,200,000
District and sub-district rehabilitation		2,800,000		300,000	1,000,000	1,000,000	500,000	2,800,000
Sub-total		10,000,000	1,200,000	400,000	3,500,000	4,400,000	500,000	10,000,000
Transmission and distribution								
Ira Lalaro-Dili transmission line		28,800,000			2,500,000	12,000,000	14,300,000	28,800,000
Dili south transmission line		20,000,000					500,000	500,000
Sub-total		48,800,000	-	-	2,500,000	12,000,000	14,800,000	29,300,000
Rural electrification								
Rural electrification I (project preparation)	ADB	700,000			700,000			700,000
Rural electrification I		8,700,000				1,700,000	5,000,000	6,700,000
Sub-total		9,400,000	-	-	700,000	1,700,000	5,000,000	7,400,000
Total		152,375,000	1,350,000	13,325,000	36,700,000	48,100,000	31,400,000	130,875,000

Source: MoPF Project Information Profile Database.

Annex Table 6: Classification of Power Sector Expenditures by Type of Expenditure
(In US\$)

Category	Annual disbursements										Total	
	FY1999/00	FY2000/01	FY2001/02	FY2002/03	FY2003/04	FY2004/05	FY2005/06	FY2006/07	FY2007/08	FY2008/09	FY1999/00-03/04	FY2004/05-08/09
On-budget expenditures												
Recurrent spending												
Donors	-	-	277,000	1,267,000	350,000	1,175,000	275,000	-	-	-	1,894,000	1,450,000
CFET/EDTL	7,000,000	7,886,000	8,031,000	9,152,350	9,943,370	10,639,000	10,917,000	11,245,000	11,471,000	11,735,000	42,012,720	56,007,000
Proposed new	-	-	-	-	-	150,000	-	-	-	-	-	150,000
Sub-total	7,000,000	7,886,000	8,308,000	10,419,350	10,293,370	11,964,000	11,192,000	11,245,000	11,471,000	11,735,000	43,906,720	57,607,000
Capital spending												
Donors	351,609	5,084,550	4,844,520	1,663,296	7,147,131	9,310,558	-	-	-	-	19,091,106	9,310,558
CFET/EDTL	500,000	493,000	822,000	2,198,070	141,928	391,000	427,000	367,000	407,000	500,000	4,154,998	2,092,000
Proposed new	-	-	-	-	-	1,200,000	13,325,000	36,700,000	48,100,000	31,400,000	-	130,725,000
Sub-total	851,609	5,577,550	5,666,520	3,861,366	7,289,059	10,901,558	13,752,000	37,067,000	48,507,000	31,900,000	23,246,104	142,127,558
Total on-budget expenditures												
Donors	351,609	5,084,550	5,121,520	2,930,296	7,497,131	10,485,558	275,000	-	-	-	20,985,106	10,760,558
CFET/EDTL	7,500,000	8,379,000	8,853,000	11,350,420	10,085,298	11,030,000	11,344,000	11,612,000	11,878,000	12,235,000	46,167,718	58,099,000
Proposed new	-	-	-	-	-	1,350,000	13,325,000	36,700,000	48,100,000	31,400,000	-	130,875,000
Total	7,851,609	13,463,550	13,974,520	14,280,716	17,582,429	22,865,558	24,944,000	48,312,000	59,978,000	43,635,000	67,152,824	199,734,558
Off-budget donor expenditure	-	-	-	-	-	-	-	-	-	-	-	-
Total expenditures	7,851,609	13,463,550	13,974,520	14,280,716	17,582,429	22,865,558	24,944,000	48,312,000	59,978,000	43,635,000	67,152,824	199,734,558
Memo item												
EDTL revenues	-	258,000	1,997,000	2,932,156	3,527,962	5,628,000	7,378,000	8,227,000	8,827,000	9,550,000	8,715,118	39,610,000

Source: Annex Tables 2, 3 and 5.

Note: Capital and recurrent expenditures include those funded from EDT revenues as well as those funded from the CFET budget subsidy.