ASIAN DEVELOPMENT BANK **RES: LAO 97012**

Reevaluation Study (Number 25)

REEVALUATION OF THE

VIENTIANE PLAIN RURAL ELECTRIFICATION PROJECT
Phase I (Loan No. 501-LAO[SF]) and
Phase II (Loan No. 642-LAO[SF])

IN THE

LAO PEOPLE'S DEMOCRATIC REPUBLIC

December 1997

CURRENCY EQUIVALENTS

Currency Unit – Kip (KN)

		At Appraisal	At Project Completion	At Postevaluation	At Reevaluation
			Phase I (Loan No. 501-LAO[SF])		
KN1.00	=	$0.10	$0.10	$0.0029	$0.001
$1.00	=	KN10.00	KN10.00	KN350.00	KN1,000.00
			Phase II (Loan No. 642-LAO)		
KN1.00	=	$0.10	$0.00133	$0.0014	$0.001
$1.00	=	KN10.00	KN750.00	KN697.00	KN1,000.00

ABBREVIATIONS

EdL	-	Electricité du Laos
EIRR	-	Economic Internal Rate of Return
FIRR	-	Financial Internal Rate of Return
GM	-	General Manager
GWh	-	Gigawatt-hour
HPO	-	Hydropower Office
kV	-	kilovolt
kWh	-	kilowatt-hour
LAO PDR	-	Lao People's Democratic Republic
LNGC	-	Lao National Grid Company
LPG	-	Liquefied Petroleum Gas
PEM	-	Postevaluation Mission
PPAR	-	Project Performance Audit Report
SFR	-	Self-financing Ratio

NOTES

(i) The fiscal year (FY) of the Government ends on 30 September.
(ii) In this Report, "$" refers to US dollars.

EXECUTIVE SUMMARY

The Vientiane Plain Rural Electrification Project was conceived within the context of the First Five-year Development Plan (1981-1985), which recognized the Vientiane Plain's potential for increasing food production and for establishing agro-industries. Under Bank technical assistance, a ten-year electrification program was developed to support the electrification of the rural areas in the Vientiane Plain. The Project comprised Phase I and Phase II of the program and covered the construction of a power distribution and transmission network in six districts of the Plain area.

Bank loans for Phase I (Loan No. 501-LAO[SF]) and Phase II (Loan No. 642-LAO[SF]) of the Project, amounting to $4.3 million and $6.3 million, respectively, were approved in the early 1980s. The Project aimed at increasing food production through electrified pump irrigation schemes, stimulating productive activities, and raising the standard of living of the rural population. The Project scope included the extension of 22 kilovolt (kV) and 0.4 kV distribution networks along with the necessary distribution substations and transformers.

Delays of two to three years in the completion of the two phases, and cost overruns of 18 to 22 percent, were incurred by the Project. Postevaluation of Phase I and Phase II reported changes in Project scope due to the shift in Project focus from agricultural and industrial loads, which were supposed to account for about 91 percent of system demand in the Project area, to residential loads. Designed primarily to supply electricity to major irrigation pumping stations and to existing and new industries to boost food production and accelerate industrialization, the Project's scope was later adapted to meet the electricity requirements of residential and village consumers. This resulted in the construction of more 400 V distribution lines and fewer 22 kV transmission lines than envisaged at appraisal, and in the provision of transformers not originally included in the Project scope.

The review of the Project's operational performance by the Reevaluation Mission showed that the load has grown significantly since Project completion. Connection of household consumers in the Project area has continued at the rate of about 3,000 annually, while agriculture and industry have developed at a much slower rate than forecast. The distribution system appeared to be well constructed and maintained to a reasonable standard.

Electricité du Laos (EdL's) financial performance has deteriorated in recent years due mainly to a decrease in the amount of energy available for export resulting from the dramatic increase in domestic electricity consumption, which is billed at low tariff rates. The average cost of rural electricity supply of about KN110 per kilowatt-hour (kWh) compared with the recently approved average tariff of KN55.12 per kWh indicates a negative financial internal rate of return for the Project. Reestimation of the economic internal rate of return, constrained by lack of Project-related data, gave only an indicative rate of 5.3 percent.

Several positive changes in the institutional setup of the power sector in the Lao People’s Democratic Republic have occurred in recent years. A Hydropower Office under the Department of Electricity was established to effectively plan and manage hydropower projects, particularly those meant for export. EdL was reorganized into a corporatized body in line with the need to strengthen its institutional capability to supply power to meet domestic demand. Institutional issues with respect to the Project are concerned with EdL's capability to manage and develop the distribution systems, both urban and rural.

No adverse impact on the environment resulted from the construction of the Project facilities. On the other hand, the Project produced some positive effects. It reduced to some extent the cutting of trees for firewood used for cooking.

Residential consumers were the main Project beneficiaries. They accounted for about 95 percent of the total number of consumers and more than 50 percent of total energy sales. These consumers use electricity mainly for lighting. However, a survey conducted under a recently completed Bank-financed TA indicated that a large number of households surveyed engage in some kind of commercial activity within the residential premises and are using electricity for other purposes in addition to lighting. The actual consumption of agriculture and industrial consumers in 1996 amounted to only 35 percent of total consumption compared with 91 percent projected for 1995. Enterprises established as a result of electrification increased employment opportunities in the Project area. A consumer sample survey conducted by the Reevaluation Mission with the assistance of EdL confirmed these findings.

The Project remains sustainable. Future sustainability, however, will depend mainly on EdL's capability to maintain its financial viability. Factors adversely affecting EdL's financial viability include low domestic tariffs, high distribution losses, and high accounts receivable for domestic sales. Recently, the Government undertook some measures aimed at improving EdL's financial viability. These include adjustment in tariffs and conversion of EdL's loans into equity. The ongoing policy dialogue between the Bank and the Government continues to address these issues.

At postevaluation, Phase I was rated generally successful in providing electricity to major industrial and agricultural loads and to a wide coverage of households. The Project Performance Audit Report for Phase II rated that phase of the Project partly successful, taking into account the marginal economic returns and the absence of financial sustainability. The findings of the Reevaluation Mission indicate that people living in the Project reaped substantial benefits from their access to electricity, including increased learning opportunities and enhanced living standards. However, financial internal rate of return for the Project is expected to be negative because of insufficient sales revenues to recover rural supply cost. With a negative financial internal rate of return and an indicative economic internal rate of return of 5.3 percent, the Project is rated partly successful at reevaluation.

Some of the key issues and lessons that emerged from the experience of the Project showed that (i) rural electrification by itself does not lead to rural development without other infrastructural support such as transport and communications, market and credit, or other external stimuli; this implies that electrification alone has a limited role in the economic development of the rural area as a single catalyst of development; (ii) there is a need to resolve the level and structural problems of tariffs, particularly as the higher cost of rural supply tends to benefit the higher income, rather than the low-income, population groups; (iii) the Government's future development plan will have a significant impact on the financial operations of EdL and therefore the Government should adopt measures to ensure EdL's continued financial viability; (iv) project monitoring and reporting are important components in designing and preparing better projects in the future; and (v) project design, as well as the economic and financial implications for a project, should be thoroughly analyzed whenever a significant change in project focus occurs.

I. BACKGROUND

A. Objectives, Scope, and Rationale

1. The Project comprised Phase I and Phase II[1] of the Government of the Lao People's Democratic Republic's (Lao PDR's) 10-year program to construct a power distribution network in the Vientiane Plain. This program was part of a larger development plan aimed at further economic development of the Vientiane Plain, the most important economic area of the country. The Project area covered six districts in the Vientiane Plain in the Vientiane Province but excluded the four administrative districts of Vientiane municipality, which were already electrified. The districts included in the Project area were Hatsayfong, Saythany, Thourakhom, Phonehong, Keo-Oudom, and Naxaythong.

2. The objectives of the Project were to (i) increase food production through pump irrigation schemes; (ii) induce the development of agrobased and other industries; (iii) stimulate productive activities; and (iv) raise the standard of living of the rural population. The Project scope consisted of the extension of the 22 kilovolt (kV) and 0.4 kV distribution network, installation of necessary distribution substations and transformers in the Project area, and consulting services to assist in Project implementation. Phase I of the Project also included the setting up of a prestressed concrete pole manufacturing plant. The poles would be used mainly for transmission line support.

B. Implementation and Completion

3. The construction, including civil works and installation of lines/equipment, was carried out by Electricité du Laos (EdL) with consultants providing technical inputs during Project implementation. During implementation of both Phase I and Phase II, the Project experienced shortage of personnel, which contributed to the delay in its completion. In Phase I, the Project also experienced problems with the operation of the concrete pole manufacturing plant. The completion of the plant was delayed. After its commissioning, the plant experienced problems with equipment and raw materials.

4. Phase I of the Project was officially completed in December 1986, with an overall delay of three years. The final consumer connection, however, was completed in March 1987. Phase II was completed in March 1990 with an overall delay of 2 years and 11 months. The actual total cost of Phase I amounted to $7.2 million or 18 percent more than the estimated cost appraisal of $6.1 million. The actual total cost of Phase II was $10.3, which was 22 percent more than the appraisal estimate of $8.5 million.

II. POSTEVALUATION FINDINGS

[1] Phase II of the Project was merely an extension of the work of Phase I. It consisted of construction of additional transmission and overhead lines, substations, installation of additional transformers, and connection of additional houses in the same area as in Phase I.

5. Project Performance Audit Reports (PPARs) were prepared for the Project. A PPAR was prepared in August 1988,[1] one year and eight months after completion of Phase I in December 1986. The PPAR for Phase II was prepared in December 1991[2] or about one year and nine months after completion of Phase II in March 1990.

6. The PPARs for both Phase I and Phase II noted the lack of essential Project-related data. EdL's operational data were gathered and presented on a provincial basis and included data for Vientiane municipality. With no Project-specific benchmark and inadequate Project-related actual data, the incremental demand attributable only to the Project could not be ascertained. Thus, the PPAR for Phase I could not assess properly the operational and economic performance of the Project.

7. The PPARs for both Phase I and Phase II reported changes in the Project scope. In Phase I, changes involved the reduction in the scope of work in the 22 kV transmission lines, 400 volt (V) distribution lines and 22 kV/400 V substations, the increase in the number of house connections, and change in the design and capacity of the pole manufacturing plant to allow production of larger poles and increased total capacity of the plant.[3] In Phase II, the PPAR noted the change in the focus of the Project from agricultural and industrial loads, which were expected to account for about 90 percent of total systems demand during the life of the Project, to residential loads. This change resulted in the construction of more 400 V distribution lines and fewer 22 kV transmission lines than those envisaged at Project appraisal, and in the provision of transformers that were not in the original scope of the Project.[4] As noted in the PPAR for Phase II, these modifications on the Project were made without adequate analysis to reexamine the Project choices and to optimize the Project design.

8. The PPARs indicated that there were no significant institutional issues affecting the Project. Regarding financial issues, the PPARs noted the low domestic tariffs and high domestic arrears. In the context of increasing domestic sales resulting in lower export sales, the low domestic tariffs adversely affected EdL's overall earnings.

9. Overall, the PPAR for Phase I classified the Project as generally successful within the context of factors that could be postevaluated, e.g., implementation of the Project in accordance with appraisal plans and provision of electricity to intended consumers. Due to insufficiency of Project-related data, the PPAR for Phase I could not undertake an economic and financial evaluation of the Project. The PPAR for Phase II classified the Project as partly successful. The PPAR attempted to reestimate the economic internal rate of return (EIRR) of Phase II based on the Postevaluation Mission's (PEM) estimate of existing load and load growth and other available data. The PEM calculated an indicative rate of 7.4 percent compared with the 21.4 percent estimated at appraisal. However, because the PEM's review indicated that the Project would incur financial losses, the financial internal rate of return (FIRR) was not computed.

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1 PE-252: Vientiane Plain Rural Electrification Project (Loan No. 501-LAO[SF]).
2 PE-351: Vientiane Plain Rural Electrification (Phase II) Project (Loan No. 642-LAO[SF]).
3 PPAR (Phase I), page 4, paragraphs 15 and 16.
4 PPAR (Phase II), page 4, paragraphs 19-22 and Appendix 1.

III. REEVALUATION FINDINGS

A. Project Design

10. The Project was designed primarily to supply electricity to major irrigation pumping stations being planned by the Government as well as to existing and new industries, with the objective of boosting food production and accelerating industrialization in the Project area. However, because of changes in the country during Project implementation, particularly in respect of the Government's economic planning and capital spending and production in the Project area, changes in Project scope were made. These changes were agreed to by the Bank and the Government. These changes, involving mainly rearranging and adding load centers as well as strengthening residential loads, changed the nature of the Project to that of a conventional rural electrification project. These changes also reflected the dominance of residential consumers of electricity in the Project area.

11. The Mission's visual inspections of the lines and distribution facilities indicated that a simple, low-cost approach had been used in the Project area. The 22 kV lines constructed in Phase I and Phase II follow roads, rather than routes near to potential irrigation or direct routes across country to villages. Although this may well have been the simplest and most cost-effective approach to the design and construction of the system, it had tended to favor the development of domestic and industrial/commercial consumers along roads, but not prospective pumping loads due to the distance of the lines from major water sources. In Phase II, the most significant modification to the original design was the extension of feeder no. 8-2 by about 35 kilometers (km) to the east. This extension did not pass through any areas of high population density.

12. It is apparent that Phase I and Phase II designs tended toward small conductor sizes in relation to the line lengths. With these designs, adequate voltage control and losses could not be kept within acceptable limits if the forecast load growth in the Project area had occurred. Due to the low-voltage line lengths of 700 meters (m) or more, low-voltage lines are limited in their capacity to meet load growth.

13. The 12-m concrete poles adopted for the 22 kV lines have a top load rating of 100 kV and thus have relatively limited scope for expanded EdL use in the future. Nevertheless, they are cost-effective due to their overall low volume of concrete, ease of handling, and good performance to date. They have provided a cost-effective approach to initial electrification in the Project area. However, as load growth continues and the need for increase in conductor sizes occurs, some of the concrete poles will need to be duplicated or replaced to accommodate heavier conductors and higher wind loadings. Line crew safety, public safety, and reliability will also need to be considered as pole top loadings increase.

14. Since the initial selection of villages and electrification of areas under the Project, further electrification of villages has been carried out. Proposals submitted to EdL for consideration have undergone a simple evaluation process taking into account the cost of connection and the likely loads to be supplied, without full consideration of energy sales or likely revenue.

B. Operational Performance

1. Project Performance Monitoring

15. EdL had originally established a Load Monitoring Committee for the Project. One of the functions of this Committee was to compile statistics of main irrigation schemes, industries, and village-level data, particularly those pertaining to (i) power supply to new or existing irrigation pumping stations, (ii) power supply to new or existing industries, and (iii) load growth in villages. This committee was superseded by a Division of Statistics and Planning. However, this division was disbanded and compilation of Project-related statistics was discontinued.

16. Thus, at present, there are no readily available Project-related data in EdL on district, substation, and transformer loadings compiled for the Project area comprising the districts of Thourakhom, Phonehong, Keo-Oudom, Saythany, Naxaythong, and Hatsayfong. Data on consumer loads and energy sales are gathered on a grid basis. The Vientiane Grid, which services the six districts in the Project area, covers Vientiane Province, Luang Prabang, and Vientiane municipality. Project-related data are merged with overall grid data. Consequently, EdL is not able to readily access lists of new villages and new consumers by district to closely monitor changes in the overall distribution system and monitor Project results.

17. The following data on the Project's operational performance are based on the REM's review of EdL's overall operation and data, discussions with officials of service centers of EdL responsible for the six districts in the Project area, and visual inspections of some facilities (poles, feeder and service lines, transformers and substations) in the Project area. EdL's overall operational data are shown in Appendix 1.

2. Operational Performance

18. Since completion of the Project, the load in the Project area has grown significantly. The main factors contributing to this growth include connection of new domestic consumers to existing low-voltage distribution lines, connection of new villages by small 22 kV and/or low-voltage system extensions, and increases in consumption by existing consumers. Since the initial construction in the Phase I and Phase II areas, connection of consumers, mainly households, has continued at the rate of about 3,000 per year in the Project area.

19. Agriculture and industry in the Project area have developed at a much lower rate than forecast at appraisal of Phase II. By 1995, agriculture and industrial consumption was projected to be 91 percent of total consumption. In 1996, actual consumption by agriculture and industrial consumers amounted to only about 35 percent of total consumption in the Project area. Data on energy sales and by consumer category in the four regions[1] of Vientiane Province where the Project area is located is drawn in Appendix 2.

20. Since 1989 and after making a general assessment of likely loads and the cost of line extensions, EdL has been implementing a general policy of charging villages or consumers 30 percent of the low-voltage line construction cost for new electrification. More recently, EdL adopted a policy of selecting houses and/or villages for electrification by defining an upper limit on construction cost equivalent to $650 per house. Taking into account other

[1] These regions also cover other districts not included in the Project area.

hidden costs such as administration costs related to the new connections, it is likely that EdL is spending more than $2 million per year on new connections.

21. The shift of focus away from irrigation and industrial loads during Project implementation may have caused underestimation of peak loads originally estimated at appraisal. It has also resulted in low energy consumption during daytime in many areas and high evening peaks. Especially during the dry season, farmers operate their irrigation pumps and several industrial establishments continue operations even during nighttime. Consequently, there is overloading in some parts of the system during nighttime due to industrial and pumping loads, which are now coincident with peak domestic loads, particularly in areas along the Mekong River. The rapid growth of evening peak demand has increased voltage drops and losses especially in the low-voltage system. The high evening peaks have necessitated an increase in conductor size to provide sufficient capacity to meet present demands.

22. Although system performance has been relatively reliable, it has now reached the stage where peak loads are near design limits in some parts of the system. EdL is starting to replace transformers installed during Project implementation to accommodate bigger loads in the area. In one region in the Project area, EdL schedules transformers for replacement whenever they reach 70 percent of capacity.

3. Maintenance

23. The distribution system appears to be well constructed and in sound physical condition. There is no evidence of broken insulators, conductor binding, or pole installation problems. Generally, all parts of the system have been installed and maintained to a reasonable standard. The Project distribution system is generally reliable, with few faults. Faults are immediately remedied by the concerned service center.[1]

24. Service centers are adequately staffed at present to carry out minor repairs, undertake new domestic installations, and small systems extensions. However, they have a limited number of ladders, vehicles, cranes, and other maintenance and repair equipment. Their present stock of equipment will eventually limit their capability to adequately maintain the system as the number of consumers and the age of the distribution system hardware increase.[2] The centers do not have large stores, heavy vehicles, cranes and auger vehicles to carry out major works. When they encounter major technical problems or need to carry out major works, such as repair of storm damage to lines and poles, the service centers request heavy equipment, materials, and staff from EdL. EdL has a large maintenance base, training center, meter testing, transformer maintenance, and storage facility east of Vientiane municipality. Trucks, cranes and augers, and bulk materials are located at this site.

C. Financial Performance

25. In recent years, EdL's financial position has deteriorated mainly because of an increase in domestic electricity consumption. Although exported energy has continued to

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[1] Service centers are regional offices of EdL that are responsible for installation of electrical connections, routine repair and maintenance of the distribution system in their respective region, meter reading, billing, and collection of bills.

[2] Under a recently approved Bank loan to the Lao PDR for Power Transmission and Distribution Project, $522,000 is allocated for the procurement of maintenance equipment for EdL.

account for the major portion of total revenues, increased domestic consumption reduced the amount of energy available for export. Data on generation, sales, and export revenues for selected years covering a 15-year period are presented in Table 1. From 86 percent of total generation in 1980, the share of export sales dropped to 71 percent in 1990 and to 62 percent in 1995. With the significant increase in electricity export price beginning in 1982, export sales revenues peaked in 1985 at $29 million, but have declined since then.

Table 1. Electricity Generation, Export and Domestic Sales, and Revenue from Exports, Selected Years

Item	Fiscal Year to 31 December			
	1980	1985	1990	1995
Electricity Generated (GWh)	886	907	833	1,085
Export Sales (GWh)	766	716	595	676
% of Export Sales to Total	86	79	71	62
Domestic Sales (GWh)	85	130	165	338
% Domestic Sales to Total	10	14	20	31
Revenues from Export Sales ($'000)	8,050	29,394	18,153	20,881

GWh = Gigawatt hour.

26. Table 2 shows EdL's financial performance while Appendix 3 shows the details of EdL's financial statements from 1991 to 1996. Revenues from export sales comprised 80 percent of total revenues in 1991 and 65 percent in 1996. Revenues from domestic sales, on the other hand, rose from 18 percent of total revenues in 1991 to 23 percent in 1996. Operating expenses increased from KN9,486 million in 1991 to KN27,239 million in 1996, or an increase of 187 percent. Despite its favorable operating income in 1996, EdL incurred a net loss after tax of KN1,315 million due mainly to the adjustments in depreciation of fixed assets pertaining to previous years. Similarly, due to further adjustments in depreciation, EdL is projected to incur a smaller loss in 1997 compared to 1996.

Table 2. Financial Data, 1991-1996

Item	Fiscal Year to 31 December					
	1991	1992	1993	1994	1995	1996 (est.)
Electricity Generated (GWh)	834	752	920	1,199	1,085	1,248
Export Sales (GWh)	563	459	596	829	676	792
Export Sales Growth (%)		-18	30	39	-18	17
Domestic Sales Growth (%)		17	1	6	21	12
Distribution Losses - Laos (%)	19	15	17	27	24	n.a.
Export Sales (KN million)	12,376	12,107	15,045	20,489	20,881	27,619
Domestic Sales (KN million)	2,793	5,056	5,952	6,559	8,002	9,698
Operating Income	5,924	6,773	8,562	10,435	9,553	14,968
Net Income After Tax	1,590	1,612	765	3,785	3,833	-1,315
Total Operating Revenues (KN million)	15,410	17,607	21,479	27,586	29,496	42,207
Operating Ratio	0.62	0.62	0.60	0.62	0.68	0.65
Current Ratio	2.93	3.20	1.34	1.04	1.29	2.73
Debt/Debt plus Equity Ratio	0.47	0.50	0.49	0.48	0.57	0.61
Accounts Receivable - Exports (mo.)	1.02	0.67	0.72	0.90	1.83	2.86
Accounts Receivable - Domestic (mo.)	7.63	7.66	5.73	5.62	3.60	4.02
Self-financing Ratio - 3 yr avg (%)		24	43	12	-18	-12
Debt-service Coverage Ratio (times)		1.85	1.55	.96	1.0	1.21

GWh = Gigawatt hour.

27. Although EdL's profitability during the period was at a satisfactory level, with operating ratio averaging 63 percent, its liquidity during the period was uneven. Self-financing ratio (SFR) peaked in 1993 but deteriorated starting in 1994. By 1995, SFR was negative or way below the covenanted level of 20 percent. Throughout the period, EdL was unable to meet the

covenanted level of accounts receivable for domestic sales of three months of annual sales due to problems in collecting accounts from domestic consumers and consumers from the government sector. Investments in system expansion projects that were financed largely with debt accounted for the decline in EdL's debt-service ratio from 1.85 times in 1992 to 1.21 in 1996.

28. EdL's financial viability, both in terms of profitability and liquidity, has been adversely affected by a combination of factors. These include low domestic tariffs, high distribution losses, and high accounts receivable for domestic sales. Recently, the Government undertook some measures aimed at improving EdL's financial viability. It approved an increase in domestic tariffs that would be effective on 1 October 1997. This increase would bring EdL's average revenues to about KN55.12 per kilowatt-hour (kWh) compared with the previous level of KN25.52 per kWh, and would result in improved rates of return, debt service ratio, and self-financing ratio. Moreover, it agreed to convert $30 million of its debt into equity in EdL during 1997 and 1998. It also agreed not to require any dividend payments from EdL if such payments would result in a breach by EdL of any financial covenant with the Bank.

D. Institutional Impact

29. In recent years, several changes in the institutional setup of the power sector in the Lao PDR have occurred. These changes resulted from the continuing policy dialogues of multilateral agencies, including the Bank, with the Government as well as from recent developments in the sector such as the Government's policies on private sector participation, electricity exports to neighboring countries, and subregional cooperation in power sector activities. The most recent changes in the sector involved the establishment of the Hydropower Office (HPO) under the Department of Electricity of the Ministry of Industry and Handicraft and the reorganization of the EdL from being a government department to that of a corporatized body.

30. The organization of HPO was in response to a need to effectively plan and manage hydropower projects particularly those meant for export. This responsibility was undertaken previously by the Government with the EdL acting as the Executing Agency. However, the Government's recent emphasis on the development of hydropower for electricity export and the positive response of the private sector to the Government's active promotion of hydropower as export-oriented business substantially increased EdL's workload beyond its capacity to handle.

31. The reorganization of EdL into a corporatized body was in line with the need to strengthen its institutional capability to undertake its core business activity of supplying power to meet domestic demand. As reorganized, EdL now possesses a juridical personality with autonomy in its business activities (Appendix 4). It is now under the management of a Board of Administration with the Ministy of Industry and Handicraft providing overall supervision. Based on the draft of the EdL Charter, the Minister of Finance appoints the seven members of the Board. The Minister of Finance also appoints the general manager (GM) of EdL on the recommendation of the Board. The GM of EdL is also a member of the Board.

32. Under the new organization structure of EdL, four deputy GMs and three staff officers report to the GM. This new organization structure is a significant improvement over the previous one where a large number of operational and staff officers reports directly to the GM. One of the major features of the new structure of EdL is the office for joint-venture projects, which reports directly to the GM. This office is responsible for all activities (project planning,

negotiation, implementation) pertaining to EdL's participation in joint-venture agreements with private sector organizations. The creation of this office reflects both the Government's and EdL's thrust toward greater private sector participation in power sector development.

33. In addition to the above changes, other changes in the institutional setup of the power sectors are being considered by the Government. These include the organization of the Lao National Grid Company (LNGC),[1] further changes in the functions and organization structure of EdL[2] after the organization of the LNGC, and establishment of a regulatory framework under which HPO, LNGC, EdL, and private sector enterprises operating independently or under joint venture with the Government can operate effectively and in a coordinated manner.

34. With respect to the Project, the institutional issues that will affect the Project have something to do with EdL's capability to manage and develop the distribution systems, both urban and rural. Although technical skills, management capability and commitment of staff are available within EdL to plan and manage the distribution system throughout its franchise area, several factors adversely affect effective distribution system management within EdL. These are as follows:

1. Technical Information System

35. The absence of a fully established technical information system makes system planning, decision making, and interdepartmental coordination difficult. At present, EdL management and staff require considerable effort to obtain information about technical parameters and operating data for the system. These technical data are retained at the service centers, substations, and various operating departments, rather than at a centralized database center. Thus, accessing these data is difficult and cumbersome.

2. Drawings and System Records

36. At present, EdL does not have comprehensive distribution system drawings. The EdL technical department has started to computerize the drawings using the SwedNet system, but it has only one workstation, one operator, and another operator in training overseas. The service centers have simple line route drawings showing approximate line routes for the 22 kV distribution and distribution transformer locations. In view of the large amount of distribution system information still unrecorded and the number of new villages and households expected to be electrified, there is sufficient justification to increase the number of workstations and SwedNet operators for the computerization of the distribution systems drawings and records.

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[1] The Bank approved a technical assistance grant (TA No. 2728-LAO) for $600,000, on 23 December 1996 to finance the study for the establishment of LNGC.

[2] The Bank-financed study (TA No. 2569-LAO:*Corporate & Finance Development of Electricité du Laos* , for $340,000, approved on 15 May 1996) was recently completed and a tripartite meeting to discuss the consultants' draft final report was held in May 1997. The consultants' report contains recommendations on EdL's organization aimed at strengthening its institutional capability.

3. Mapping

37. Effective planning, designing, and management of the distribution system require that EdL maintain up-to-date aerial or satellite photographs for the purpose of accurately mapping transmission and distribution lines, defining the locations and sizes of villages, and planning future electrification. EdL should also consider the use of low-cost systems as an aid to starting accurate drawing and mapping systems. This is necessary at this early stage of the system's development to avoid duplication of efforts, additional costs, and inefficiencies as the distribution system develops.

4. Office Layout

38. The physical layout of offices, with management and departments located in three separate buildings, limits the level of informal management interaction on a day-to-day basis. Lack of informal interaction among EdL's officers and staff prevents quick discussions with minimum of bureaucracy to deal with technical, commercial, and planning issues affecting more than one department. Formal interdepartmental meetings and the preparation of agendas and minutes are time-consuming and not effective for day-to-day issues, but are appropriate for major issues and decision making.

E. Socioeconomic Impact

1. Project Benefits

39. The Project benefits mainly residential consumers as a result of the shift in Project focus (paras. 7 and 10). The 1996 consumer profile in the Vientiane Grid, which covers the Project area, shows that residential consumers account for about 95 percent of the total number of consumers and more than 50 percent of total energy sales. These consumers use electricity mainly for lighting. In a survey carried out in Vientiane Province, including the Project area, under TA No. 2569-LAO: Corporate and Financial Development of EdL, it was noted that about 42 percent of households surveyed engaged in some kind of commercial activity from their residential premises. This suggests that a large number of residential consumers use electricity for purposes other than lighting.

40. Irrigation consumers account for less than 1 percent of the total number of consumers and about 14 percent of total sales compared with the revised estimate of 23 percent envisaged at appraisal of Phase II of the Project. There are no available data to indicate the extent of increase in food production in the Project area as a result of the use of electrified pump irrigation schemes, although it can be assumed that food production did increase.

41. Industrial consumers at present account for about 2 percent of the total number of consumers and about 21 percent of total sales compared with the 68 percent of sales estimated during appraisal of Phase II. New enterprises established after electrification of the Project area include a cement factory, sawmills, canneries, sugar mills, ice and furniture making factories, and handicrafts.

42. In addition, electrification of the Project area increased the wider use of electrical appliances such as television sets, radios, flatirons, and refrigerators thus enhancing learning opportunities and improving the living standards of domestic consumers. The establishment of commercial and industrial enterprises increased employment opportunities in the Project area.

2. Socioeconomic Survey

a. Survey Respondents

43. A sample survey of households and commercial/industrial users was conducted with the assistance of EdL. The respondents, totaling 1,300, comprised 1,034 households and 266 commercial and industrial users, and were selected from both the electrified and non-electrified areas. Appendix 5 presents the highlights of the sample survey.

b. Household Respondents

44. The survey showed that the majority of the households (72 percent of husbands and 67 percent of wives) worked as farmers. The others were office employees, traders, teachers; a few belonged to the medical profession. Total household income per month averaged KN100,000. About 98 percent owned their houses, which were mostly made of wood and housed on average four to six persons. About half of the respondent household heads/spouses completed primary education, about 20 percent finished secondary education, and less than 10 percent completed higher education. The electrified households use electricity mostly for lighting purposes and for operating household appliances such as electric fan, television, refrigerator, and radio cassette. Firewood was still largely used for cooking and, to some extent, such fuels as kerosene and liquefied petroleum gas (LPG) were also used. Monthly kilowatt hour consumption averaged at 100 kWh, with the average monthly bill at KN5,000. The nonelectrified households primarily use wood and kerosene for fuel. Fuel use for lighting and cooking costs these households from KN1,000 to KN10,000 per month. The main reasons cited for not having electricity were the absence of power lines and high cost of connection. A very high percentage (83 percent) indicated their intention to connect to electricity in the future.

c. Commercial/Industrial Respondents

45. The survey results indicated that the sample commercial/industrial users were engaged mostly in rice mills work, furniture making, and ice and brick manufacturing. These establishments on average operated for one to five hours a day, were owned or managed mostly by females (64 percent of respondents in the category), and largely employed family members. Nearly 60 percent paid an average tariff of KN1 to KN50 per kWh. Annual consumption averaged 10,000 kWh. A 1 to 10 percent increase in production after electrification was reported by about 45 percent of the respondents, closely followed by some 37 percent reporting a 50 to 100 percent production increase. Among the nonelectrified

commercial/ industrial users, an average diesel consumption per month of less than 100 liters was reported by 48 percent of the respondents. For another 42 percent, monthly consumption averaged 100 to 500 liters. Overall, an average monthly bill of up to KN50,000 was paid by the users. The nonelectrified commercial/industrial respondents generally expressed interest in connecting to electricity when it becomes available.

F. Financial and Economic Reevaluation

46. The inadequacy of Project-related data, specifically those pertaining to energy sales to consumers in various categories in the six districts covered by the Project area as well as changes made in the original schemes, makes it difficult to reestimate the FIRR and the EIRR of the Project. As discussed in para. 16, Project-related data, including sales, are gathered grid-wise. Meanwhile due to the absence of an established technical information system (para. 34), it was not possible to obtain details of technical and cost information on the various changes made to the original distribution system implemented under the Project.

1. Financial Internal Rate of Return

47. A recently completed Bank-financed study[1] estimated that the average cost of rural supply in the Lao PDR is about KN110 per kWh, depending on the nature of the load and the consequential load factor. This average cost, when compared with the recently approved average domestic tariff revenue of about KN55.12 per kWh, clearly indicates that EdL incurs a financial loss from its rural consumers who are being subsidized by urban consumers and by export sales to Thailand. Thus, the FIRR for the Project, even if it could be properly calculated, would be negative.

2. Economic Internal Rate of Return

48. The Reevaluation Mission attempted to reestimate the Project's EIRR based on available data gathered from recent reports by Bank-financed consultants for current Lao PDR projects and recently completed Bank-financed studies. An indicative EIRR of 5.3 percent was reestimated. This is slightly lower than the Phase II PPAR estimate of 7.4 percent. The economic analysis is given in Appendix 6.

[1] Corporate and Financial Development of Electricité du Laos, April 1997.

G. Environmental Impact

49. The Project had minimal adverse impact on the environment. The electric poles, feeder lines, transformers, and substations were installed along existing roads. On the other hand, the Project had some positive effects on the environment. It reduced to some extent the cutting of trees for firewood which was the local population's main fuel for cooking before electrification of the Project area.

H. Impact on Women

50. Although the Project did not have specific developmental goals for women, the electrification of villages in the Project area nevertheless brought a number of benefits to women. It induced the establishment of a number of cottage-industry-type small- and medium-sized enterprises in the Project area, thus providing employment opportunities to women. The electrification of well pumps and rice mills lightened the workload of women, thus enabling them to undertake other economic, household, and leisure activities.

I. Project Sustainability

51. As mentioned earlier, the Project facilities are well maintained and in sound working condition (para. 23). Thus, from a technical viewpoint, the Project remains sustainable. The Project's sustainability will depend mainly on EdL's capability to remain financially viable, which will enable it to allocate adequate funds to effectively operate and maintain the Project facilities. Although revenues from its rural supply operations are inadequate to recover the associated costs of such operations, EdL remains financially viable through its revenues from export sales. It's financial viability, however, is adversely affected by low domestic tariffs, high distribution losses, and high accounts receivable. Measures to address these issues are subjects of ongoing Bank-financed studies and policy dialogue between the Bank and the Government.

IV. KEY ISSUES

A. Project Design

52. It is usually argued that rural electrification will bring economic development to an area. Yet international experiences show that in the absence of other infrastructural elements, such as transport and communications, market, and credit or other external stimuli, the economy of an electrified rural area grows relatively slowly. These have led to the conclusions that (i) electrification alone is unlikely to cause economic development in a rural area, or to the extent and pace usually envisaged during project planning; and (ii) electricity supply as a single catalyst of development has a very limited role in the economic development of the rural area. The actual results of the Project support these conclusions. Although some industries were established after the electrification of the Project area, and irrigation pumps were electrified, economic development in the area was much slower than was envisaged at Project appraisal. This is indicated by a much lower proportion of industrial and agricultural consumption (35

percent to total consumption) in 1996 than the 91 percent of total consumption in 1995 envisaged at appraisal of Phase II. Thus, the Project experience supports previous indications that availability of complementary infrastructure and services is a necessary condition to achieving developmental benefits frequently predicted for rural electrification.

53. In some cases governments may be compelled politically or by social pressure to electrify rural areas to provide the local population with modern amenities and raise their standard of living. However, in cases where economic viability is an important concern, it is imperative that rural electrification be implemented in areas where high growth of energy demand could be expected and where connection costs are low. Further, areas to be prioritized for electrification should have a higher density of potential consumers and evidence of extensive use of alternative energy for carrying out existing economic activities.

B. Tariffs

54. Domestic tariffs have been a long standing issue in the Bank's lending in the power sector in the Lao PDR. The main concern about these tariffs is their inadequacy to yield sufficient revenues to recover cost. Particularly in respect of rural electric supply, present tariffs are still much below the cost of supply (para. 46). Recently, the Government increased average domestic tariff by more than 100 percent to about KN55.12 per kWh (para. 27) with effect from 1 October 1997. This rate, however, is still below the average long-run marginal cost of supply of KN116 per kWh for residential consumers and KN66 per kWh for agricultural consumers.

55. In addition to the level of tariffs, structural problems of tariffs need to be resolved. These problems, which cause inefficiency in revenue generation, involve the categorization of consumers, cross subsidization among consumers, and application of time-of-use rates. Regarding rural supply, there is still a question of whether supply to rural areas should require a special tariff. This question arises, considering that the cost of rural supply is much higher than the cost of supply to other categories of consumers and those benefiting from electrification in these areas are mainly the higher income, rather than the low-income, population groups. The ongoing policy dialogue between the Bank and the Government continues to address the issue of tariffs.

C. Rural Electrification Plan and EdL's Financial Viability

56. Under its power development plan,[1] the Government intends to extend electric supply to 78,000 households in 2,300 villages by the year 2000, or to about 15,000 households per year. The successful implementation of this plan requires that EdL remain financially strong. The electrification of a large number of rural consumers who use only small amounts of electricity will require a large capital investment. When the plan is completed, EdL will incur high operation and maintenance costs relative to electricity demand. Thus, the Government's rural electrification plan will have a significant impact on the financial operations of EdL which, under its present mandate as a corporatized agency, must always maintain financially viable operations. Clearly, the Government's plan for national rural electrification requires consideration and adoption of measures that will ensure EdL's financial viability. These measures include tariff increases and, as required, capital injections and subsidies (whether direct or indirect). This issue is also covered in the ongoing policy dialogue between the Bank and the Government.

[1] Power Development Plan to the Year 2000 and Strategic Policy to the Year 2010.

D. Project Monitoring and Reporting

57. The absence of Project-related data makes it difficult to properly review the actual operational performance and evaluate the socioeconomic impact of the Project. It also prevents learning lessons from the past that help in the design of future projects. Thus, it is important that in future design of rural electrification projects, appropriate benchmarks, systems, procedures, and organizational arrangements for reporting the operational performance of the project should be developed.

V. CONCLUSIONS

A. Overall Assessment

58. As noted by PEM, the focus of the Project during its design and appraisal was changed during Project implementation from agricultural and industrial loads to residential loads. The modification was made without a reevaluation of the financial and economic implications. In 1996, the proportion of industrial and agricultural consumption to total consumption was only about 35 percent which was below the 91 percent reestimated for 1995 during appraisal of Phase II. Of the 35 percent, about 14 percent was accounted for by the agricultural or irrigation consumers and 21 percent by industrial consumers. These numbers suggest that some agricultural and industrial developments did occur in the Project area, but not to the extent envisaged during appraisal of the Project. The absence of Project-related data, however, makes it difficult to properly evaluate the impact of the Project.

59. Despite the foregoing, it is clear that people living in the Project area enjoy real benefits from the supply of electricity including such nonquantifiable benefits as enhancing learning opportunities and raising the living standards of domestic consumers. However, with a negative FIRR and an indicative EIRR of 5.3 percent only, the Project is classified as partly successful.

B. Lessons Learned

60. Project experience highlights two important lessons: (i) rural electrification by itself does not lead to rural development, and (ii) there is need to provide appropriate benchmarks as well as a Project performance monitoring and reporting system. The first lesson suggests that complementary infrastructure and services need to be available or provided before anticipating broad developmental benefits from rural electrification. The second lesson indicates the importance of project monitoring and reporting, not only for updating technical records but also for designing and preparing better future projects. The Project also highlights the need to undertake a thorough reevaluation of the design as well as the economic and financial implications of the Project whenever there is a significant change in Project focus.

C. Follow-up Actions

61. Appropriate follow-up actions are now being undertaken by the Bank on improving the technical, institutional, and financial capabilities of EdL (paras. 50, 54, and 55). This study has not identified other follow-up actions.

APPENDIXES