

**RESTRICTED**

**PCR:LAO 16161**

**ASIAN DEVELOPMENT BANK**

*This Report has been prepared for  
the exclusive use of the Bank.*

**PROJECT COMPLETION REPORT**

**OF THE**

**XESET HYDROPOWER PROJECT**

**[Loan No. 846-LAO(SF)]**

**AND**

**XESET HYDROPOWER PROJECT (SUPPLEMENTARY)**

**[Loan No. 1063-LAO(SF)]**

**IN THE**

**LAO PEOPLE'S DEMOCRATIC REPUBLIC**

**February 1992**

## CURRENCY EQUIVALENTS

Currency Unit - Kip National (K)

### During Appraisal (April 1987)

<u>Official Rate</u>			<u>Commercial Rate</u>		
K	1.00	=	\$ 0.10	K	1.00 = \$ .02857
\$	1.00	=	K 10.00	\$	1.00 = K 35.00

### During Project Completion Review (August 1991)

K	1.00	=	\$ 0.001429
\$	1.00	=	K 700.00

- (i) For the purpose of cost comparison in this Report, local currency costs incurred were converted into US dollars at the rate prevailing during each transaction (see Appendix 2).

## Electrical Terminology

V (volt)	-	unit of voltage
kV (kilo-volt)	-	1,000 volt
A (ampere)	-	unit of electric current
W (watt)	-	unit of real power
kW (kilo-watt)	-	1,000 watts
MW (mega-watt)	-	1,000,000 watts
VA (volt-ampere)	-	unit of apparent power
Var (var)	-	unit of reactive power
kVA (kilovolt-ampere)	-	1,000 VA
MVA (mega-volt-ampere)	-	1,000 kVA
Wh (watt-hour)	-	unit of energy
kWh (kilo-watt-hour)	-	1,000 Wh
MWh (megawatt-hour)	-	1,000 kWh
GWh (giga-watt-hour)	-	1,000,000 kWh
Load Factor	-	Ratio of average power demand to maximum power demand
Firm Generating Capacity	-	Installed generating capacity less the reserve capacity

## Measures

ha	-	hectare
m	-	meter
km (kilometer)	-	1000 m
mm <sup>2</sup>	-	square millimeter

### Abbreviations

EdL	-	Electricite du Laos
EGAT	-	Electricity Generating Authority of Thailand
IDA	-	International Development Association
SIDA	-	Swedish International Development Authority
UNDP	-	United Nations Development Programme
VPRE 1	-	Vientiane Plain Rural Electrification Project (Phase I) [Loan No. 501-LAO(SF)]
VPRE 2	-	Vientiane Plain Rural Electrification Project (Phase II) [Loan No. 642-LAO(SF)]

### Notes

- (i) The fiscal year for the Government ends on 31 December.
- (ii) In this Report, "\$" refers to U.S. dollars.

PROJECT COMPLETION REPORT

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[Loan No. 1063-LAO(SF)]

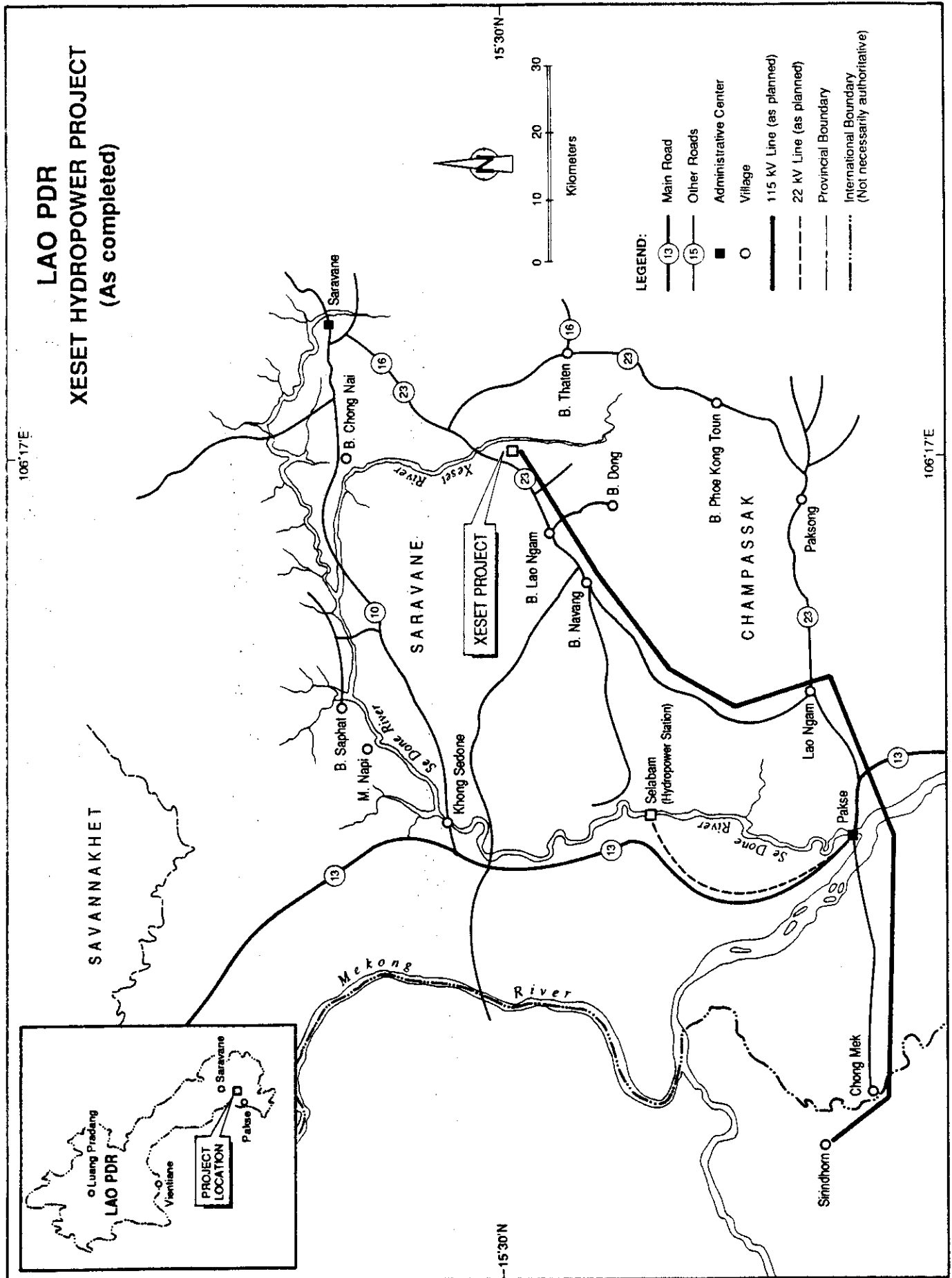
IN THE

LAO PEOPLE'S DEMOCRATIC REPUBLIC

Note: This Report was prepared by a Bank Mission comprising Mr. G. Rametsteiner, Project Engineer, (Mission Chief) and Ms. Cristina C. Meimban (Senior Assistant) who visited the Lao People's Democratic Republic in August 1991.

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BASIC DATAA.1. Loan Identification

1.	Country	Lao People's Democratic Republic
2.	Loan Number	846-LAO(SF)
3.	Project Title	Xeset Hydropower Project
4.	Borrower	Lao People's Democratic Republic
5.	Executing Agency	Electricité du Laos
6.	Amount of Loan	SDR 12,036,000

B.1. Loan Data

1.	Appraisal	
-	Date Started	21 May 1987
-	Date Completed	28 May 1987
2.	Loan Negotiations	
-	Date Started	14 September 1987
-	Date Completed	16 September 1987
3.	Date of Board Approval	27 October 1987
4.	Date of Loan Agreement	27 November 1987
5.	Date of Loan Effectiveness	
-	In Loan Agreement	25 February 1988
-	Actual	22 April 1988
-	No. of Extensions	One
6.	Loan Closing Date	
-	In Loan Agreement	30 June 1992
-	Number of Extensions	None
-	Actual	30 June 1992
7.	Terms of Loan	
-	Interest Rate	1% per annum
-	Maturity	40 years
-	Grace Period	10 years
8.	Terms of Relending	
-	Interest Rate	Bank's OCR Rate
-	Maturity	
-	(Number of Years)	20
-	Grace Period	
-	(Number of Years)	5
-	Second-step Borrower	Electricité du Laos

(iii)

9. Disbursements

a) Dates

<u>Initial Disbursement</u>	<u>Final Disbursement</u>	<u>Time Interval</u>
12 May 1988	(est.) 30 June 1992	49.5 months
<u>Effective Date</u>	<u>Original Closing Date</u>	<u>Time Interval</u>
22 April 1988	30 June 1992	50 months

b) Amount (\$ million) 1/

<u>Cat.</u>	<u>Original Allocation</u>	<u>Revised Allocation</u>	<u>Amount Cancelled</u>	<u>Amount Available</u>	<u>Net Amount Disbursed</u>	<u>Undisbursed Balance</u>
1	12,167,436	14,326,882	nil	14,326,882	14,187,265	139,617
2	283,090	283,090	nil	283,090	283,090	nil
3	101,469	101,469	nil	101,469	95,393	6,076
4	969,288	969,288	nil	969,288	895,212	74,076
5	<u>2,159,729</u>	<u>nil</u>	<u>nil</u>	<u>nil</u>	<u>nil</u>	<u>nil</u>
Total	<u>15,680,729</u>	<u>15,680,729</u>	<u>nil</u>	<u>15,680,729</u>	<u>15,460,960</u>	<u>219,769</u>

A.2. Loan Identification

1.	Country	Lao People's Democratic Republic
2.	Loan Number	1063-LAO(SF)
3.	Project Title	Xeset Hydropower Project
4.	Borrower	(Supplementary Loan)
5.	Executing Agency	Lao People's Democratic Republic
6.	Amount of Loan	Electricité du Laos SDR 2,097,000

B.2. Loan Data

1.	Appraisal	15 September 1990
-	Date Started	20 September 1990
-	Date Completed	
2.	Loan Negotiations	29 October 1990
-	Date Started	03 November 1990
-	Date Completed	05 November 1990
3.	Date of Board Approval	11 December 1990
4.	Date of Loan Agreement	19 December 1990
5.	Date of Loan Effectiveness	
-	In Loan Agreement	10 March 1991
-	Actual	14 June 1991
-	No. of Extensions	Two

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1/ As of 13 December 1991.



## (iv)

6. Loan Closing Date  
 - In Loan Agreement 30 June 1992  
 - Number of Extensions None
7. Terms of Loan  
 - Interest Rate 1 per cent  
 - Maturity 40 years  
 - Grace Period 10 years
8. Terms of Relending  
 - Interest Rate 6.36 per cent  
 - Maturity (Number of Years) Synchronous with the repayment period for Loan No. 846-LAO(SF)  
 - Grace Period (Number of Years)  
 - Second-step Borrower Electricité du Laos
9. Disbursements

## a) Dates

<u>Initial Disbursement</u>	<u>Final Disbursement</u>	<u>Time Interval</u>
24 September 1991	(est). 30 June 1992	9 months

<u>Effective Date</u>	<u>Original Closing Date</u>	<u>Time Interval</u>
14 June 1991	30 June 1992	12.5 months

b) Amount (\$ million) <sup>1/</sup>

	<u>Original Allocation</u>	<u>Revised Allocation</u>	<u>Amount Cancelled</u>	<u>Amount Available</u>	<u>Amount Disbursed</u>	<u>Net Undisbursed Balance</u>
1	2,027,000	2,027,000	nil	2,027,000	1,779,395	247,605
2	70,000	70,000	nil	70,000	1,232	68,768
Total	<u>2,097,000</u>	<u>2,097,000</u>	<u>nil</u>	<u>2,097,000</u>	<u>1,780,627</u>	<u>316,373</u>

C. Project Data

1. <u>Project Cost</u> (\$ million)	<u>Appraisal Estimate</u>	<u>Actual</u>
(a) Foreign Exchange Cost (incl. IDC)	34.30	44.93
(b) Local Cost	5.60	7.75
(c) Total Cost	39.90	52.68

<sup>1/</sup> As of 13 December 1991.

2. Financing Plan(i) Implementation Costs

	<u>Appraisal Estimates</u>			<u>Actual</u>		
	<u>Local</u>	<u>Foreign</u>	<u>Total</u>	<u>Local</u>	<u>Foreign</u>	<u>Total</u>
(a) Borrower Financed	5.60	-	5.60	7.75	-	7.75
(b) Bank Financed	-	15.50	15.50	-	17.89	17.89
(c) SIDA	-	17.04	17.04	-	23.40	23.40
(d) UNDP	-	1.76	1.76	-	2.64	2.64
(e) Norway	-	-	-	-	1.00	1.00
(d) Total	<u>5.60</u>	<u>34.30</u>	<u>39.90</u>	<u>7.75</u>	<u>44.93</u>	<u>52.68</u>

(ii) IDC Costs

(a) Borrower Financed	3.45	-	3.45	6.33	-	6.33
(b) Bank Financed	-	-	-	-	-	-
(c) Other External Financing	-	0.22	0.22	-	0.27	0.27
(d) Total	<u>3.45</u>	<u>0.22</u>	<u>3.67</u>	<u>6.33</u>	<u>0.27</u>	<u>6.60</u>

3. Cost Breakdown by Project Components (\$ Million)

	<u>Appraisal Estimates</u>			<u>Actual</u>		
	<u>Local</u>	<u>Foreign</u>	<u>Total</u>	<u>Local</u>	<u>Foreign</u>	<u>Total</u>
(a) Civil Works	1.20	12.00	13.20	1.30	13.81	15.11
(b) Hydraulic Steelworks	0.16	2.94	3.10	-	3.16	3.16
(c) Mechanical Works	0.13	4.14	4.27	-	19.74	19.74
(d) Electrical works	0.39	8.52	8.91	-	0.25	0.25
(e) Consulting works	-	1.76	1.76	-	1.76	1.76
(f) Physical Contingencies	0.19	2.28	2.47	0.12	-	-
(g) Price Escalation	0.08	1.16	1.24	-	-	-
(h) Recovery on Previous TA	-	0.10	0.10	-	0.10	0.10
(i) Project Cost Excl. IDC	2.15	32.90	35.05	1.42	43.76	45.18
(j) IDC	<u>3.45</u>	<u>0.22</u>	<u>3.67</u>	<u>6.33</u>	<u>0.27</u>	<u>6.60</u>
(k) Total Project Cost	5.60	33.12	38.72	7.75	44.03	51.78
(l) Refinancing of TA Loan	-	1.18	1.18	-	0.90	0.90
(m) Total cost for Financing	<u>5.60</u>	<u>34.30</u>	<u>39.90</u>	<u>7.75</u>	<u>44.93</u>	<u>52.68</u>

4. Project Schedule

	<u>Appraisal Estimate</u>	<u>Actual</u>
(a) Date of contract with Consultant	January 1987	7 July 1988
(b) Completion of Engineering Designs	April 1988	31 March 1989
(c) Equipment and Supplies Dates		
- First Procurement	April 1988	November 1987
- Last Procurement	June 1991	(est.) Dec. 1991
- Completion of Equipment Installation	30 June 1991	21 June 1991
(d) Start of Operations		
- Completion of Tests and Commissioning	31 May 1991	7 July 1991
- Beginning of Start-Up		
Unit 1	31 March 1991	5 February 1991
Unit 2	30 April 1991	15 March 1991
Unit 3	31 May 1991	07 May 1991
Unit 4	15 June 1991	07 June 1991
Unit 5	30 June 1991	21 June 1991

D. Data on Bank Missions

<u>Name of Each Mission</u>	<u>Date</u>	<u>No. of Persons</u>	<u>No. of Mandays</u>	<u>Specialization of members</u>
Pre-Appraisal	30 Sep 85-10 Oct 85	4	44	A, B, C, E
Appraisal	21 May 87-28 May 87	4	32	A, B, C, E
Review 1/	22 Jan 89-03 Feb 89	1	7	B
	20 Jun 89-29 Jun 89	1	10	A
	30 Nov 89-07 Dec 89	1	7	A
	22 Mar 90-05 Apr 90	2	15	A
	07 Oct 90-21 Oct 90	1	15	A
	15 Apr 91-26 Apr 91	1	12	A

## Loan Disbursement

PCR 2/	13 Aug 91-21 Aug 91	2	18	A, G
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Legend: A - Engineer  
 B - Financial Analyst  
 C - Counsel  
 D - Economist  
 E - Procurement/Consultant Specialist  
 F - Control Officer  
 G - Sr. Assistant

1/ Missions were mounted to review progress of Projects under several loans. Mandays shown are actual ones spent on this Project.

2/ PCR cum Review Mission - Loan No. 846-LAO(SF), 1063-LAO(SF) and 928-LAO(SF).

## I. PROJECT DESCRIPTION

### A. Objectives, Rationale and Scope

1. The main objective of the Project in the Lao People's Democratic Republic (Lao PDR), a run-of-river type hydropower installation on the Xeset River, with a gross head of 157 m and an annual energy generation capability of 181 GWh was to provide electricity for export to Thailand and also assist in meeting the local demand for electrical energy. Further, it was expected that the availability of indigenous hydropower for domestic/commercial consumption would replace imported kerosene and other fuels to save foreign exchange.

2. In its development effort for the period, FY1986-1990, the Government emphasized the improvement of electricity infrastructure in the Lao PDR. The Project, together with the IDA-financed Southern Provinces Electrification Project 1/ was expected to enhance the export earnings of Lao PDR through increased export of electricity to Thailand while supporting increased local electrification in the Saravane and Champassak provinces in Southern Laos leading to a more balanced regional development.

3. The following components were included in the Project as appraised:

- (i) A gated concrete weir across the Xeset River of about 10 m in height and a crest length of about 80 m, and a supplementary 12 m high earthdam approximately 300 m long;
- (ii) an approximately 1300 m waterway system including a tunnelled section;
- (iii) a surface powerhouse with three 13 MW and two 3 MW turbine generators and all ancillary electro/mechanical equipment including those for instrumentation, control and communication;
- (iv) A switchyard incorporating 6/115 kV generator transformers and 6/22 kV distribution transformer near the powerhouse with facilities for the outgoing 115 kV transmission line to Pakse substation and to the Thai grid; and
- (v) consultant services for implementation of the Project.

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1/ A credit of SDR 19.8 million was approved by IDA on 23 June 1987 for the Southern Provinces Electrification Project.

4. The Project location is shown in Map 1 on page (i) and the layout of the power station in Appendix 10.

5. The main events in the history of the Project are summarized in Appendix 1. During the whole Project cycle, a number of Bank missions were fielded. 1/

6. Electricité du Laos (EdL) was technically capable of assuming the responsibility of an Executing Agency for the Project, as in the case of previous Bank loans for the power sector in Lao PDR. 2/ For Project planning and implementation, adequate support through consulting services was provided.

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1/ Page (vi) Item D - Data on Bank Missions.

2/ Loan No. 65-LAO(SF) approved on 6 May 1971 (\$3.370 million) and Supplementary Loan No. 128-LAO(SF) approved on 3 March 1973 (\$1.350 million) and Loan No. 501-LAO(SF) approved on 21 October 1962 (\$4.300 million) and Loan No. 642-LAO(SF) approved on 11 October 1983 (SDR 5,968,000).

## II. EVALUATION OF IMPLEMENTATION

### A. Project Components

7. In July 1984, the Bank, IDA and the Government of Lao PDR agreed to proceed with detailed investigations for an integrated project to exploit the hydropower potential of the site fully. It was proposed to meet the regional demand for power, 1/ and provide transmission facilities for export of surplus power from Xeset to Thailand. The Bank would take on the responsibility for the development of the Xeset hydropower generation facilities, while IDA would develop and finance the transmission and distribution facilities.

8. A feasibility study 2/ confirmed the need for a large scheme and recommended the development of a 45 MW hydropower project. This recommendation was endorsed by representatives from the Government/EdL, SIDA, UNDP, and the Bank.

9. As envisaged in the Appraisal Report, all major contract packages 3/ were implemented without substantial change (see Appendix 3: Summary of Contract Awards).

10. The civil works contract financed by the Bank 4/ was awarded on the basis of international competitive bidding in accordance with the Bank's Guidelines for Procurement.

### B. Project Schedule

11. A comparison of the actual with the original implementation schedule is shown in Appendix 4. As appraised, the implementation started in January 1988 and despite some unexpected delays in the initial phase of physical works due to the closing of the border at Chong Mek, the need to repair roads before transporting equipment within Lao PDR, difficulties in importing cement and adverse geological conditions in the access tunnel, the Project was completed as envisaged in June 1991.

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- 1/ An earlier Bank-financed feasibility study TA No. 374-LAO in the amount of \$246,000 approved on 14 November 1980 recommended the construction of a small hydropower project of 2.6 MW which could meet the forecast load in Saravane Province.
- 2/ Technical Assistance Loan No. 698-LAO(SF) for SDR 986,845 equivalent to \$1.00 million at approval on 23 October 1984.
- 3/ The Project was subdivided into the following packages: Lot 1: Civil Works; Lot 2: Hydraulic Steelworks; Lot 3: Mechanical Works; Lot 4: Electrical Works; and Lot 5: Lighting, Small Power and Fire Alarm.
- 4/ As already recommended in the optimization study in March 1985 and endorsed by the representatives of potential donors, SIDA financed Lot 2 to Lot 4 and included supply, erection and commissioning of equipment procured in accordance with SIDA's procurement procedures.

C. Implementation Arrangements

12. As agreed upon during loan negotiations 1/ EdL maintained during Project implementation a Project Management Office (PMO) headed by a full-time Project Manager. The manager was assisted by EdL engineering staff who have gained experience in construction and operation activities at the Nam Ngum Hydropower Project.

13. SIDA provided an expert as Project Adviser who assisted EdL in the overall planning, coordination and monitoring activities not only for Xeset Hydropower Plant but also in interrelated projects 2/ financed by IDA. Further, SIDA made available a team of experts which visited the site at six month intervals mostly in connection with the Bank's review mission, and discussed the pending issues with the Consultant's resident engineer and EdL officials involved in the implementation of the Project.

14. To facilitate communication from the site to EdL Headquarters in Vientiane and Consultant's Power office in Norway, a satellite ground station was procured under UNDP grant financing for consulting services for the Project. 3/

D. Project Costs

15. Including IDC, the actual Project cost 4/ amounted to \$52.68 million of which \$44.93 million was in foreign exchange and \$7.75 million, in local currency. 5/

16. When it appeared that a supplementary loan was needed because of cost overrun (which was mostly beyond the control of the Borrower and the Executing Agency) the original co-financiers were approached and grants from SIDA, UNDP and the Government of Norway were obtained in the amounts of \$6.23 million, \$0.88 million and \$1.0 million, respectively. For the Bank-financed civil works, a supplementary loan of \$3.0 million from the Bank's Special Funds resources to finance part of the foreign exchange cost required to complete the Project was provided. 6/

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- 1/ Loan Agreement, para 6.01 (e) and Schedule 6, para 1 and 2.  
2/ In particular the timely completion of the 115 kV transmission line from Xeset to Pakse with interconnection to the Thai grid at Sirindhorn power station financed under IDA Credit 1862-LA.  
3/ UNDP Grant in the total amount of \$2.640 million administrated by the Bank under TA No. 909-LAO.  
4/ See page (iv) - Project Data.  
5/ Appendix 2: Exchange Rates 1983-1991.  
6/ Loan No. 1063-LAO(SF) approved on 11 December 1990 in the amount of SDR 2.097 million.

17. The increase in cost for the Bank-financed civil works was due to unexpected delays encountered by the contractor in crossing the Lao-Thai border 1/, the unexpected geological conditions 2/ and the shortage of cement caused by an export embargo by Thailand on cement in early 1990. 3/ The cost estimates for the SIDA-financed components were exceeded because of unfavorable movement of the Swedish kroner against the U.S. dollar and higher than expected prices. SIDA fully financed these contracts. The price difference caused by higher than budgeted man-month cost of consulting services, was also financed by UNDP. The financial shortfall for consulting services, due to the redesign of tunnels to cope with the geological conditions, was met by a grant provided by the Government of Norway. The Government and EdL maintained their commitment to provide all required local cost financing. 4/

18. A reassessment of the financial and economic performance 5/ results in a reduced FIRR of 7.3 per cent and EIRR of 9.5 per cent compared with the original figures of 9.9 per cent for FIRR and 12.0 per cent for EIRR. The decline in the EIRR could be minimized in view of the additional benefit arising from a higher rate of increase in demand for electricity than originally envisaged for the Xeset area as a result of implementing the IDA-financed Southern Provinces Electrification Project. 6/

#### **E. Engagement of Consultants and Procurement of Goods and Services**

19. The engineering Consultants who had assisted EdL earlier in the preparation of the feasibility report for the Project (under TA No. 374-LAO) and had prepared the detailed design and tender documents for the Project under Loan No. 698-LAO(SF) were retained as proposed by EdL. The Bank, as the Executing Agency for the consulting services funded by UNDP, negotiated a satisfactory contract with this consulting firm in accordance with the Bank's Guidelines on the Use of Consultants. 7/

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- 1/ The contractor was mobilized in November 1988 but was unable to move equipment and materials across the Thai border with Laos at Chong Mek, due to Thai border crossing formalities which were only overcome in late January 1989. This delay, which kept mobilized men and equipment idle, caused excavation work to be carried out in the wet instead dry season with attendant higher unit costs.
- 2/ The changed rock formation encountered during excavation of the headrace and access tunnels.
- 3/ Cement for the Project was contracted from Thailand. In early 1990, Thailand placed an export ban on cement as major projects in Thailand were facing cement shortages. This ban was implemented on short notice and necessitated the ordering of cement from other countries.
- 4/ See page (v) - Financing Plan.
- 5/ Appendix 6 and 7 - FIRR and EIRR Recalculation in 1991.
- 6/ IDA Credit 1826-LAO approved on 23 June 1987.
- 7/ Loan Agreement, Schedule 5.



20. As envisaged at appraisal, the Project works were divided into five lots as shown in Appendix 3. The civil works contract financed by the Bank, was awarded on the basis of international competitive bidding in accordance with the Bank's Guidelines for Procurement. The other lots which were financed by SIDA and included supply, erection and commissioning of equipment, were procured in accordance with SIDA's procurement procedures.

21. EdL, the Executing Agency, was assisted effectively by the Consultants in all steps of procurement which were undertaken basically problem-free and without delay. 1/

#### F. Performance of Consultants, Contractors and Suppliers

22. The retention of the engineering Consultants who had accomplished a fully satisfactory level of work on the preparation of the Project proved beneficial. The experience and capability of their resident engineer at site and the good communication link with their home office in Norway by satellite 2/ contributed significantly resolving problem in the initial phase of civil works, caused by unexpected geological conditions that called for a redesign of the layout arrangements.

23. The civil contractor company was experienced and well equipped but could start the civil works only after a delay of three months. The delay was due to the lengthy procedures for obtaining clearance for crossing the Thai-Lao border. The difficult work conditions encountered at the site and the difficulty in obtaining cement from Thailand could have resulted in further delays in the execution of works. However, with increased mobilization of personnel and machinery under the careful coordination of the consultants, and support by EdL and the cooperation of the other contractors these difficulties were overcome and lost time was recovered and the Project was completed within the original schedule established at appraisal.

#### G. Conditions and Covenants

24. The status of compliance with loan covenants is given in Appendix 5. While EdL, has, in general, complied with the particular covenants in the Project Agreement 3/, those in the Loan Agreement 4/ could only be met marginally. This concerns the level of accounts receivable. Although it is now within the agreed three months of equivalent sales (due to the low receivable from EGAT), the receivables

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1/ See paragraph 13.

2/ The ground station financed by the UNDP grant and installed at Xeset site allowed direct communication by voice, telex and fax via the maritime satellite (INMARSAT).

3/ Article II.

4/ Schedule 6, paragraph 3 through 7.

from the Southern Provinces, Government enterprises, embassies and private individuals remain unacceptably high 1/. As a condition of supplementary loan effectiveness, the Government agreed to (i) prepare and implement a plan to reduce the accounts receivables from the Southern Provinces and other domestic sales categories to 3 months of equivalent sales; and (ii) allow EdL to offset amounts over 3 months of receivables in respect of Government electricity consumption against payable to the Government.

25. In FY1989, EdL's electricity distribution loss of 36 GWh was 19 per cent of the 186 GWh distributed at the 22 kV level in the Vientiane plain area. This is a reduction of 3 per cent from the loss of 22 per cent reported in FY1988, but power system analysis has shown that only 9 per cent of the loss in FY1989 can be attributed to technical causes. The recently installed computerized billing system identified the major causes for the high non-technical losses. The reasons are: defective meters, misreading of meters and some illegal connections. Monthly reports on EdL's operation show that the upgrading of the responsibilities and organization of the system loss reduction unit, agreed upon with the Bank, have a positive impact and further improvements can be expected.

26. Since the financial statements and the audit of such statements of EdL were found to be inadequate for monitoring the financial condition of EdL, the Bank formulated, in September 1990, the requirements for financial reporting and auditing in line with acceptable international accounting practices for utilities. The time-bound plan, agreed with EdL, (since it is not possible to change the established system rapidly) will show its first results in the report for FY1991.

#### H. Disbursements

27. The projected and actual disbursements are shown in Appendix 8. As the civil works progressed according to established schedule, payments to the civil contractor followed the anticipated disbursement schedule. When it became apparent that the cost overrun in civil works would require a supplementary loan, the Bank approved the necessary amount of SDR 2.097 million equivalent to \$3.00 million. 2/ Although disbursement for these funds has been slow because of delayed settlement of claims submitted by the civil contractor, it is anticipated that prior to the original closing date of the loans all funds will have been disbursed.

#### I. Environmental Impact

28. The implementation of the Project did not cause any significant adverse environmental impact. The limited waterflow over the 1.5 km river section between the weir and the power station is not a serious

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1/ At the end of 1990, the accounts receivable for EGAT, Southern Provinces and Vientiane grid were 2.32 months, 8.13 months and 6.69 months, respectively.

2/ Loan No. 1063-LAO(SF) approved on 11 December 1990.

impediment to the availability of water or fishing opportunities for the small population in the Project area. The water storage, although minimal with a surface area of 0.14 km<sup>2</sup>, increased the fish stock, benefitting local residents.

29. There was no necessity to relocate any persons. Land use alteration was negligible. The construction works, including site roads, required some clearing of vegetation, land re-shaping, and disposal of rock spoil from power tunnel excavation. SIDA financed an environmental monitoring study of the Project 1/ to assist in minimizing adverse environmental impact from the Project and identifying mitigation measures.

#### J. Project Benefits

30. The Project, which became operational in accordance with the original time schedule established during appraisal, will meet the entire power requirements of the Champassak and Saravane provinces 2/ where the potential electric power demand was severely suppressed at a peak limit of 1.2 MW in the Pakse area and to about 200 kW in Saravane town 3/. With electric power now available and the transmission and distribution facilities in place 4/ the potential economic growth through exploitation of the resources of these provinces will be accomplished.

31. The revenue from energy export to Thailand at a rate of US\$2.7 per kWh will increase the LPDR's major convertible foreign exchange income by about \$5.0 million per year.

#### K. Performance of Borrower and Executing Agency

32. The Executing Agency, EdL, was fully responsible for the implementation of the Project. As envisaged during appraisal, the increased activities of EdL not only in Vientiane but also in the Southern

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1/ SWECO 1988. The environmental impacts from the Xeset Hydropower Project in the Lao PDR.

2/ A feasibility study for the Southern Provinces Electrification Project financed by IDA, projected the 1986 energy demand of 6.5 GWh in these provinces which have about 16 per cent of the country's population and produce 24 per cent of the country's paddy output, to grow to 8.0 GWh by FY1991 and to 26.0 GWh by FY1999.

3/ Peak demand is expected to increase to about 6 MW in FY1999.

4/ The Southern Provinces Electrification Project financed under IDA-Credit 1826-LA approved on 23 June 1987 to be completed during 1993.

Provinces 1/ and in Luang Prabang 2/, made organizational changes within EdL headquarters necessary. The project department of EdL headed by a project director was further enhanced and the number of personnel increased to 115. The full-time site managers at Xeset and at Pakse reported directly to the Project Manager at EdL Headquarters who was effectively assisted by a foreign adviser provided by SIDA. 3/

33. EdL site organization included technical supervision and administration personnel who had been trained locally under the SIDA agreement. During the implementation phase of the power plant facilities, Lao technicians were assisting the contractors/manufacturers in installation and tests of equipment. The Project implementation was at no time hampered by any administrative or other organizational obstacle.

#### L. Performance of the Bank

34. EdL considered the action taken by the Bank on project implementation matters timely and adequate. Review and approval of tender documents, evaluation reports and other project-related documents were expeditiously processed by the Bank. In March 1990, when right-of-way problems for the 115 kV line section from Chong Mek border to Sirindhorn power plant 4/ threatened the availability 5/ of the line by that target

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- 1/ In compliance with L.A. Schedule 6, para 9 which envisaged that EdL will assume operational control over the electricity undertakings and supply utilities in the Southern Provinces of Savannakhet, Champassak and Saravane, the Government directed EdL in May 1987 to ensure future satisfactory operation and maintenance of Xeset Hydropower Project.
  - 2/ In connection with the extension of the 115 kV transmission line from Nam Ngum to Luang Prabang under Loan No. 928-LAO(SF) approved on 6 December 1988. This Project is scheduled for completion in 1993.
  - 3/ The Specific Agreement dated 5 December 1987 between Laos PDR and the Government of Sweden provided a grant for technical components of the Project. Under a separate Technical Assistance Agreement, SIDA made resources available to finance (i) a full time project adviser stationed in Vientiane; (ii) a team of experts to carry out periodic reviews of the Project; and (iii) a program to train personnel to operate the Xeset Hydropower Station.
  - 4/ The works on the 115 kV transmission line (under the Southern Provinces Electrification Project - IDA Credit 1826-LA approved on 23 June 1987) from Xeset to Chong Mek included a 115/22 kV substation at Pakse and the Mekong River Crossing over a length of about 1.0 km were progressing well at the time.
  - 5/ Commissioning of the three 13 MW into at Xeset Hydropower Station could not have been performed without connection to the Thai grid. The available load at Pakse, however, was sufficient to complete load tests on the two 3 MW units.

date, the Bank assisted EGAT's management in obtaining the approval for the clearance of line route from the Thai Forestry Department 1/.

35. There was excellent cooperation between the Bank, the Executing Agency and the co-financiers. The Bank, acting as the lead agency, was responsible for the coordination of the input of foreign resources (SIDA and UNDP) into the Project. When additional funds for the extension of consulting services from November 1990 to June 1991, were needed 2/, the Bank helped to secure an additional grant from the Government of Norway. Bank staff carried out periodic review missions jointly with the team of experts made available by SIDA.

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1/ The line became operational in April 1991.

2/ To effectively assist and coordinate the testing and commissioning of all electro-mechanical equipment and technical components during that period, the Consultants were requested to delegate experts and specialist to site. Additional man-months were also to be made available to compile comprehensive manuals and maintenance instructions together with "as-built" drawings.

### III. CONCLUSIONS AND RECOMMENDATIONS

#### A. Conclusions

36. The Project, in conjunction with the ongoing IDA-financed Southern Provinces Electrification Project, is an essential component of the strategy adopted by the Government to achieve important social and economic objectives in the area.

37. Several unforeseen events 1/ resulted in higher than expected cost which had to be met by supplementary financing from the Bank 2/ and other donors. In spite of the difficulties encountered, the original implementation schedule as established during appraisal was met and the Project completed in time. This was possible through the excellent cooperation of all involved in the Project. 3/

#### B. Recommendations

##### Project Related

##### (i) Future Monitoring

38. The program to train personnel to operate the power station was part of an agreement between the Ministry of Industry and Handicraft and SIDA signed in June 1989. On-the-job training and English courses at Nam Ngum hydropower station, followed by specific instruction in Sweden, were provided for EdL engineers, technicians and future plant operators. For further experience, the trainees assisted the contractor/erectors during the testing and commissioning phase of the equipment. Two instructors followed up the performance of the trainees for a further six month period after commissioning and a foreign technical assistant was hired for one year, from February 1991, to assist and train the operators and maintenance crew. Once this program is concluded, a computerized maintenance management system will be introduced to facilitate the periodic servicing of equipment and easy identification of spare parts. EdL personnel at the power station will then be in a position to assume full operation and maintenance responsibility. Training of new staff and future monitoring of the application of the training program shall be carried out periodically.

##### (ii) Covenants

39. Covenants relating to accounts receivable and system losses 4/ were only partly met during the Project implementation; the preparation

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1/ See paragraph 17.

2/ Supplementary Loan No. 1063-LAO(SF) approved on 11 December 1990.

3/ See paragraph 23.

4/ See paragraph 24 and 25.

and audit of the financial statements of EdL and EdL's future financial performance 1/ are being closely monitored under Loan No. 928-LAO(SF): Nam Ngum-Luang Prabang Transmission Project. 2/ This should be followed up by future review missions for Loan No. 928-LAO(SF).

(iii) Further Actions or Follow-up

40. The loan closing date for the original loan is the original one of 30 June 1992. This is also the loan closing date for the supplementary loan. Disbursements under both loans will be completed in the first quarter of 1992. The loan accounts can therefore be closed by 30 June 1992.

(iv) Additional Assistance

41. The assistance provided by SIDA and the Bank for satisfactory independent operation of the power plant by EdL personnel was adequate. However, further improvement in EdL's organizational structure is necessary. Under IDA Credit Not. 1826-LAO, a study of EdL's organization and management has been carried out. 3/ The results of this study have been reviewed by the Government and it is expected that, with the assistance of Consultants, some reorganization will be implemented during 1992. This should be followed up by future review missions for Loan No. 928-LAO(SF).

(v) Timing of PPAR Preparation

42. The Project became fully operational by the end of June 1991. A full year's operation should be allowed for an accurate assessment of the hydropower plant. Consequently, a mission for the Project Performance Audit Report (PPAR) could be scheduled for the second half of 1992.

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- 1/ Appendix 9. In particular, the achievement of a self-financing ratio, on a three year average of capital investment, of 23 per cent for 1991 and 22 per cent thereafter [Project Agreement, Section 2.16 of Loan No. 928-LAO(SF)] and the target that EdL's net revenues for each year will be at least at 1.1 times the debt service requirements for that year as stated in Project Agreement, Section 2.15 of Loan No. 928-LAO(SF) should be met.
- 2/ Nam Ngum-Luang Prabang Transmission Project was approved on 6 December 1988 in the amount of SDR 8.314 million.
- 3/ The consultants started their task in June 1990 and submitted their findings and conclusions in January 1991. This first stage of the study included an analysis of the current situation, an assessment of the future requirements and a proposal of a possible new organization suitable to the Ministry and EdL management.

General

(vi) Project Appraisal

43. The timely completion of the Project showed that the implementation arrangements agreed at the time of appraisal and Project scheduling as well as the confidence shown in the technical and administrative capability of the Executing Agency, were realistic. The increase in the cost of the Bank-financed civil works due to unexpected geological conditions could not be anticipated 1/ when the Project was jointly appraised by the Bank and SIDA in August 1987.

(vii) Project Implementation

44. The contract packages, well defined during appraisal, made it possible for all stages of Project implementation to be expeditiously carried out. Adequate reporting on work progress allowed close monitoring of all activities by the Bank and when problems arose, remedies could be proposed without any delay. The implementation arrangements 2/, agreed upon during Project appraisal and rigorously followed, were beneficial to the overall progress in the implementation of the Project.

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1/ See paragraph 17.

2/ See paragraph 12.



**APPENDIXES**

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PROJECT HISTORY

Main Events

1987

- Bank's Fact-Finding Mission
- May - Bank's Appraisal Mission with participation from SIDA and UNDP.
- 27 October - The Board approved a loan of SDR 12.036 million (\$15.5 million equivalent).
- 27 November - The Loan Agreement was signed.
- 05 December - SIDA signed its grant agreement with the LPDR for SEK 145,000. The SIDA Grant will be used to finance hydraulic steelworks, mechanical works, and electrical works including spare parts.
- 17 December - UNDP approved a grant of US\$1.76 million to finance consulting services for the Project.

1988

- 22 February - Bank commenced contract negotiations with Norconsult for engineering consultancy.
- 14 March - Loan effectiveness was extended from 25 February to 22 April 1988 as the Loan document ratified by the Supreme People's Assembly of Lao PDR has not been received and the UNDP Prodoc has not been signed.
- 15 April - Memorandum of Understanding between SIDA and EdL signed in Stockholm.
- 22 April - Loan declared effective.
- 31 May - Prequalification of civil works contractors completed by EdL.
- 20 October - Request from Lao PDR to Thai authorities for opening border crossing at Chong Mek.
- 01 December - Civil works contract signed.

1989

- 26 January - Chong Mek Border Crossing opened.
- 14 March - Last signed contract for Lot 5 - Lighting - Small Power and Fire Alarm (SIDA financed) received by the Bank.

1990

- 15 August - Received from Lao PDR request for a Supplementary Loan equivalent to 3.129 million to cover overrun in Civil Works.
- 11 December - The Board approved a loan of SDR 2,097,000 million supplementary loan to cover overrun in Civil Works.

1991

- 15 January - Trial run and commissioning of the units started.
- 31 January - Hydraulic Steelworks were completed.
- 5 February - Unit 1 (3 MW) commissioned and ready for start-up.
- 21 June - All units tested and commissioned.

VIENTIANE PLAIN RURAL ELECTRIFICATION PROJECT (PHASE III)  
Exchange Rates 1983-1990  
(Kip per \$)

END OF	1983	1984	AUG 1985	SEPT 1986	DEC 1987	AUG 1988	DEC 1988	MAR 1989	JUN 1989	SEPT 1989	DEC 1989	MAR 1990	JAN 1991
Official (Financial)	10	10	10	10									
Commercial	35	35	35	35	95	95	380	450	450	550	641		
Aid Programs (Local Cost Financing)			95	95							700	750	700
Private Remittances (Laotian)			270	270	270	380	380	450	550	550	641		
Parallel Market	140	250	400	450	550	550	600	600	700	700	700		

Source: Lao PDE Authorities and EdL.

NOTE: Following the devaluation of the Kip in January 1980, a parallel foreign exchange developed. The Government decided in January 1982 to apply the commercial rate of K 35.00 to \$ 1.00 to its transactions, including import and export with officially devaluing the Kip again. In August 1985, the Government adopted a rate of K 95.00 to \$1.00 for cost financing with aid programs. In August 1987, this rate of K 95.00 to \$1.00 was prevailing for financial transactions except for private remittances and the parallel market. This multiple exchange rate system was substantially abandoned with setting up of a single official rate of K 380 to \$1.00 in August 1988. After further devaluations, the official and parallel market rate was established at K 700 to a US dollar in December 1989 and K 750 in March 1990.

## **XESET HYDROPOWER PROJECT**

### **Summary of Contract Awards**

<b>LOT NO.</b>	<b>TITLE OF CONTRACT</b>	<b>CONTRACTOR</b>	<b>CONTRACT VALUE</b>	<b>FINANCING</b>
1	Civil Works	Vianini Lavori- Vianini Thai Joint Venture	US\$ 16,601,317.00	ADB/EdL
2	Hydraulic Steelworks	Mitsui & Co.	Y 427,021,162.00	SIDA
3 & 4	Mechanical and Electrical Works	ABB Brown Boveri Nohab-KMW	SwKr 121,000,000.00	SIDA
5	Lighting, Small Power and Fire Alarm	Vianini Lavori- Vianini Thai Joint Venture	US\$ 242,002.28	SIDA

(Reference in text: page 3, paragraph 9  
and page 6, paragraph 20)

Appendix 4

XESET HYDROPOWER ENGINEERING LOAN  
IMPLEMENTATION SCHEDULE

PARTICULARS	1987	1988	1989	1990	1991
Design and preparation of Tender documents	A M J J A S O N D [Solid Bar]	J F M A M J J A S O N D [Solid Bar]	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
Pre-qualification of Tenderers (Civil Works)	[Solid Bar]	[Solid Bar]	[Solid Bar]		
Civil Works		A B C D [Solid Bar]			E [Solid Bar]
Hydraulic Steel Works	A B C [Solid Bar]	A B C [Solid Bar]	D [Solid Bar]		E F [Solid Bar]
Mechanical Works	A B C [Solid Bar]	A B C [Solid Bar]	D [Solid Bar]		E F [Solid Bar]
Electrical Works	A B C [Solid Bar]	A B C [Solid Bar]	D [Solid Bar]		E F [Solid Bar]
TA for Consulting	C [Solid Bar]				

LEGEND:

ORIGINAL SCHEDULE  
[Solid Bar]

ACTUAL  
[Dashed Bar]

A - BID INVITATION  
B - BID CLOSING  
C - CONTRACT AWARD

D - COMMENCEMENT OF CONSTRUCTION/ERECTION  
E - COMPLETION  
F - COMMISSIONING/TAKING OVER

(Reference in text: page 3, paragraph 11)

STATUS OF COMPLIANCE WITH LOAN COVENANTS

<u>Section</u>	<u>Matter</u>	<u>Status</u>
PA 2.05 (a)	Obtain and maintain, or make other arrangements satisfactory to the Bank for insurance of the Project against such risks and in such amounts as shall be consistent with sound practice.	Government assets are self insured as per government policy.
PA 2.05 (b)	Insure the goods to be imported for the Project and to be financed out of the proceeds of the Loan against hazards incident to the acquisition, transportation and delivery thereof to the place of use or installation and for such insurance any indemnity shall be payable in a currency freely usable to replace or repair such goods.	Complied with.
PA 2.06	Maintain records and accounts adequate to identify the goods and services; to record the progress of the Project (including the cost thereof) and to reflect in accordance with consistently maintained sound accounting principles, its operations and financial condition.	Complied with.
PA 2.08(b)	Furnish quarterly reports to the Bank on the execution of the Project and on the operation and management of the Project Facilities.	

(Reference in text: page 6, paragraph 24)

- 21 -

PA 2.09 (a)	i. Maintain separate accounts for the Project and the Edl overall operations.	Complied with.
	ii. Have financial statements audited annually by auditors acceptable to the Bank and furnish to the Bank a certified copy of such audited statements in English within nine months of the end of Edl's financial year.	Complied with.
PA 2.09 (b)	Furnish to the Bank not later than six months after fiscal year financial projections (including income statements, cash flow statements and balance sheets) for the succeeding five years.	Complied with.
PA 2.15	Maintain net revenue at a level of at least 1.1 times its actual and forecast debt requirements.	Complied with.
PA 2.16 (i)	Generate adequate revenue to cover all operating expenses including maintenance, administration and depreciation, taxes and interest.	Complied with.
PA 2.16 (ii)	Produce net internal cash generation sufficient to meet all debt repayments and to finance a reasonable proportion of any capital expenditure that may be undertaken within the scope.	Complied with. "Reasonable Proportion" was agreed as 20 per cent.
PA 2.17 (a)	Inform the Bank of increases in domestic tariffs in sufficient time to allow comment thereon.	Complied with.
PA 2.17 (b)	Inform the Bank of any changes in tariffs under the agreement dated 21 October 1981 between Edl and EGAT.	Complied with.



LA Sch. 6-1, 6-2,	Set up project management facility headed by a Project Manager who will be responsible to coordinate project implementation.	Complied with.
LA Sch. 6-3.	Collect accounts receivables from Savannakhet and Khammouane provinces.	Complied with. Not applicable anymore since provincial EdL are under EdL Vientiane.
LA Sch. 6-4	Take action as agreed with the Bank to reduce accounts receivable to at least 3.8, 3.4 and 3.0 months of sales equivalent by the end of FYs 1988, 1989 and 1990 respectively.	Complied with.
LA Sch. 6-6	Implement by 30 June 1988 Tata Consulting Engineer's August 1982 recommendations on accounting systems and procedures.	Complied with.
LA Sch. 6-5	Take action as agreed with the Bank to reduce system losses.	Being complied with.
LA Sch. 6-12	Engage consultants to review Edl's organization, management and financial system.	Complied with.
LA Sch. 6-16	Test, calibrate and replace consumer meters serviced by Edl in accordance with a program agreed with the Bank.	Complied with.

# XESET HYDROPOWER PROJECT FIRR RECALCULATION IN 1991

YEAR	XESET CAPITAL OUTLAY	DIST CAPITAL OUTLAY	TOTAL O&M	TOTAL CASH OUTLAY	S.LAOS DEMAND	SELABAN HYDRO	XESET TO LAOS	LAOS PRICE	LAOS BENEFIT	XESET TO THAI	THAI SALES	THAI PRICE	THAI BENEFIT	TOTAL GWh	TOTAL BENEFIT	NET FLOW
1988	1.21			1.21												-1.2
1989	24.67			24.67												-24.7
1990	19.72			19.72												-19.7
1991	7.08	0.25	0.27	7.60	11.0	8.0	4.2	0.03	0.1	130.9	126.9	0.0290	3.7	135.8	3.8	-3.8
1992		0.30	0.55	0.85	16.0	8.0	9.2	0.04	0.3	170.2	165.1	0.0279	4.6	181.0	4.9	4.1
1993		0.00	0.55	0.55	24.0	21.0	6.2	0.04	0.3	173.8	168.6	0.0269	4.5	181.0	4.8	4.2
1994		0.66	0.58	1.24	35.0	21.0	17.2	0.04	0.8	160.8	156.0	0.0290	4.5	181.0	5.3	4.0
1995		0.41	0.59	1.00	48.0	21.0	24.0	0.04	1.1	152.8	148.2	0.0290	4.3	181.0	5.4	4.4
1996			0.59	0.59	61.0	21.0	24.0	0.04	1.1	152.8	148.2	0.0290	4.3	181.0	5.4	4.8
1997			0.59	0.59	64.1	21.0	24.0	0.04	1.1	152.8	148.2	0.0290	4.3	181.0	5.4	4.8
1998			0.59	0.59	67.3	21.0	24.0	0.04	1.1	152.8	148.2	0.0290	4.3	181.0	5.4	4.8
1999			0.59	0.59	70.6	21.0	24.0	0.04	1.1	152.8	148.2	0.0290	4.3	181.0	5.4	4.8
2000			0.59	0.59	74.1	21.0	24.0	0.04	1.1	152.8	148.2	0.0290	4.3	181.0	5.4	4.8
2001			0.59	0.59	77.9	21.0	24.0	0.04	1.1	152.8	148.2	0.0290	4.3	181.0	5.4	4.8
2002			0.59	0.59	81.7	21.0	24.0	0.04	1.1	152.8	148.2	0.0290	4.3	181.0	5.4	4.8
2003			0.59	0.59	85.8	21.0	24.0	0.04	1.1	152.8	148.2	0.0290	4.3	181.0	5.4	4.8
2004			0.59	0.59	90.1	21.0	24.0	0.04	1.1	152.8	148.2	0.0290	4.3	181.0	5.4	4.8
2005			0.59	0.59	94.6	21.0	24.0	0.04	1.1	152.8	148.2	0.0290	4.3	181.0	5.4	4.8
2006			0.59	0.59	99.4	21.0	24.0	0.04	1.1	152.8	148.2	0.0290	4.3	181.0	5.4	4.8
2007			0.59	0.59	104.3	21.0	24.0	0.04	1.1	152.8	148.2	0.0290	4.3	181.0	5.4	4.8
2008			0.59	0.59	109.5	21.0	24.0	0.04	1.1	152.8	148.2	0.0290	4.3	181.0	5.4	4.8
2009			0.59	0.59	115.0	21.0	24.0	0.04	1.1	152.8	148.2	0.0290	4.3	181.0	5.4	4.8
2010			0.59	0.59	120.8	21.0	24.0	0.04	1.1	152.8	148.2	0.0290	4.3	181.0	5.4	4.8
2011			0.59	0.59	126.8	21.0	24.0	0.04	1.1	152.8	148.2	0.0290	4.3	181.0	5.4	4.8
2012			0.59	0.59	133.2	21.0	24.0	0.04	1.1	152.8	148.2	0.0290	4.3	181.0	5.4	4.8
2013			0.59	0.59	139.8	21.0	24.0	0.04	1.1	152.8	148.2	0.0290	4.3	181.0	5.4	4.8
2014			0.59	0.59	146.8	21.0	24.0	0.04	1.1	152.8	148.2	0.0290	4.3	181.0	5.4	4.8
2015			0.59	0.59	154.1	21.0	24.0	0.04	1.1	152.8	148.2	0.0290	4.3	181.0	5.4	4.8
2016			0.59	0.59	161.9	21.0	24.0	0.04	1.1	152.8	148.2	0.0290	4.3	181.0	5.4	4.8
2017			0.59	0.59	169.9	21.0	24.0	0.04	1.1	152.8	148.2	0.0290	4.3	181.0	5.4	4.8
2018			0.59	0.59	178.4	21.0	24.0	0.04	1.1	152.8	148.2	0.0290	4.3	181.0	5.4	4.8
2019			0.59	0.59	187.4	21.0	24.0	0.04	1.1	152.8	148.2	0.0290	4.3	181.0	5.4	4.8
2020			0.59	0.59	196.7	21.0	24.0	0.04	1.1	152.8	148.2	0.0290	4.3	181.0	5.4	4.8
	52.68															86.4

Notes:

- Capital outlay includes actual disbursements by year in FY 1991 dollars for a 45 MW power plant, the estimated cost of a 115 KV transmission line plus US\$0.06/incremental kWh for distribution in the Xeset distribution area.
- Operation and maintenance expenditure is at 1% of project cost for generation and transmission and 4% for distribution.
- The benefit for Lao PDR is calculated using the current tariff of 19 Kip for 1991 and increasing this tariff by 25% and maintaining it thereafter. Distribution losses have been imputed at 15% of energy available for sale. Only benefits from sale of firm power (24 GWh per year) to the local market are included.
- Thailand sales (at 115 KV) are estimated to be 97% of available generation to account for transmission loss.
- Lao demand, currently supported by small hydro and diesel plants is expected to grow at about 10% per year.
- Thailand benefit is based on the negotiated 1991 sale price of \$0.029 per kWh deflated at Bank rates of escalation until the next price negotiation from which the tariff is expected to be maintained at \$0.029/kWh in real terms.

BASE FIRR

7.3%

XESET HYDROPOWER PROJECT  
EIRR RECALCULATION IN 1991

YEAR	XESET CAPITAL (M\$)	DIST CAPITAL (M\$)	TOTAL O&M (M\$)	TOTAL CASH (M\$)	S.LAOS DEMAND GWh	SELABAN TO LAOS GWh	XESET TO LAOS GWh	LAOS VALUE (\$/MWh)	LAOS BENEFIT (M\$)	XESET TO THAI GWh	THAI SALES GWh	THAI PRICE (\$/MWh)	THAI BENEFIT (M\$)	XESET TOTAL GWh	TOTAL BENEFIT (M\$)	NET FLOW (M\$)
1988	1.21			1.21												-1.2
1989	24.67			24.67												-24.7
1990	19.72			19.72												-19.7
1991	7.08	0.30	0.27	7.65	11.0	8.0	4.9	0.11	0.5	130.9	126.9	0.0290	3.7	135.8	4.1	-3.5
1992	0.00	0.35	0.55	0.91	16.0	8.0	10.8	0.11	1.0	170.2	165.1	0.0290	4.8	181.0	5.8	4.9
1993	0.00	0.00	0.55	0.55	24.0	21.0	7.2	0.11	0.7	173.8	168.6	0.0290	4.9	181.0	5.6	5.0
1994	0.00	0.78	0.58	1.36	35.0	21.0	20.2	0.11	1.9	160.8	156.0	0.0290	4.5	181.0	6.4	5.0
1995		0.23	0.59	0.82	48.0	21.0	24.0	0.11	2.2	157.0	152.3	0.0290	4.4	181.0	6.7	5.8
1996			0.59	0.59	61.0	21.0	24.0	0.11	2.2	157.0	152.3	0.0290	4.4	181.0	6.7	6.1
1997			0.59	0.59	64.1	21.0	24.0	0.11	2.2	157.0	152.3	0.0290	4.4	181.0	6.7	6.1
1998			0.59	0.59	67.3	21.0	24.0	0.11	2.2	157.0	152.3	0.0290	4.4	181.0	6.7	6.1
1999			0.59	0.59	70.6	21.0	24.0	0.11	2.2	157.0	152.3	0.0290	4.4	181.0	6.7	6.1
2000			0.59	0.59	74.1	21.0	24.0	0.11	2.2	157.0	152.3	0.0290	4.4	181.0	6.7	6.1
2001			0.59	0.59	77.9	21.0	24.0	0.11	2.2	157.0	152.3	0.0290	4.4	181.0	6.7	6.1
2002			0.59	0.59	81.7	21.0	24.0	0.11	2.2	157.0	152.3	0.0290	4.4	181.0	6.7	6.1
2003			0.59	0.59	85.8	21.0	24.0	0.11	2.2	157.0	152.3	0.0290	4.4	181.0	6.7	6.1
2004			0.59	0.59	90.1	21.0	24.0	0.11	2.2	157.0	152.3	0.0290	4.4	181.0	6.7	6.1
2005			0.59	0.59	94.6	21.0	24.0	0.11	2.2	157.0	152.3	0.0290	4.4	181.0	6.7	6.1
2006			0.59	0.59	99.4	21.0	24.0	0.11	2.2	157.0	152.3	0.0290	4.4	181.0	6.7	6.1
2007			0.59	0.59	104.3	21.0	24.0	0.11	2.2	157.0	152.3	0.0290	4.4	181.0	6.7	6.1
2008			0.59	0.59	109.5	21.0	24.0	0.11	2.2	157.0	152.3	0.0290	4.4	181.0	6.7	6.1
2009			0.59	0.59	115.0	21.0	24.0	0.11	2.2	157.0	152.3	0.0290	4.4	181.0	6.7	6.1
2010			0.59	0.59	120.8	21.0	24.0	0.11	2.2	157.0	152.3	0.0290	4.4	181.0	6.7	6.1
2011			0.59	0.59	126.8	21.0	24.0	0.11	2.2	157.0	152.3	0.0290	4.4	181.0	6.7	6.1
2012			0.59	0.59	133.2	21.0	24.0	0.11	2.2	157.0	152.3	0.0290	4.4	181.0	6.7	6.1
2013			0.59	0.59	139.8	21.0	24.0	0.11	2.2	157.0	152.3	0.0290	4.4	181.0	6.7	6.1
2014			0.59	0.59	146.8	21.0	24.0	0.11	2.2	157.0	152.3	0.0290	4.4	181.0	6.7	6.1
2015			0.59	0.59	154.1	21.0	24.0	0.11	2.2	157.0	152.3	0.0290	4.4	181.0	6.7	6.1
2016			0.59	0.59	161.9	21.0	24.0	0.11	2.2	157.0	152.3	0.0290	4.4	181.0	6.7	6.1
2017			0.59	0.59	169.9	21.0	24.0	0.11	2.2	157.0	152.3	0.0290	4.4	181.0	6.7	6.1
2018			0.59	0.59	178.4	21.0	24.0	0.11	2.2	157.0	152.3	0.0290	4.4	181.0	6.7	6.1
2019			0.59	0.59	187.4	21.0	24.0	0.11	2.2	157.0	152.3	0.0290	4.4	181.0	6.7	6.1
2020			0.59	0.59	196.7	21.0	24.0	0.11	2.2	157.0	152.3	0.0290	4.4	181.0	6.7	6.1

52.68

BASE EIRR

123.30

9.5%

Notes:

- Capital outlay includes actual disbursements by year in FY 1991 dollars for a 45MW power plant, the estimated cost of 115 kV transmission line plus US\$0.06/incremental kWh for distribution in the Xeset distribution area.
- Operation and maintenance expenditure is at 1% of project cost for generation and transmission and 4% for distribution.
- The benefit for Lao PDR includes consumer surplus and has been calculated at \$0.11 based on the alternate cost of producing the equivalent outputs. Distribution losses of 15% have been imputed to calculate energy available for sale. Only benefits from sale of firm power (24.5GWh) are used for the local market.
- Thailand sales (at 115 kV) are estimated to be 97% of available generation to account for transmission loss. Lao demand, currently supported by small hydro and diesel plants, is expected to grow at about 10% per year.
- Thailand benefit is based on the negotiated 1991 sale price of \$0.029 per kWh.

**PROJECTED AND ACTUAL DISBURSEMENTS**

**LOAN NO. 846-LAO(SF): XESET HYDROPOWER PROJECT**

(IN \$ MILLION)

CALENDAR	QUARTER	PROJECTED DISBURSEMENT	PROJECTED CUMULATIVE	ACTUAL DISBURSEMENT	ACTUAL CUMULATIVE
1987	V	0.000	0.000	0.000	0.000
1988	I	0.000	0.000	0.000	0.000
	II	0.800	0.800	0.728	0.728
	III	0.300	1.100	0.199	0.927
	IV	0.100	1.200	0.005	0.932
1989	I	3.500	4.700	3.319	4.251
	II	1.500	6.200	1.365	5.616
	III	2.000	8.200	2.070	7.686
	IV	1.300	9.500	1.000	8.686
1990	I	1.500	11.000	1.502	10.188
	II	1.500	12.500	1.532	11.720
	III	1.100	13.600	1.129	12.849
	IV	1.200	14.800	1.244	14.093
1991	I	0.700	15.500	0.651	14.744
	II			0.346	15.090

**LOAN NO. 1063-LAO(SF): XESET HYDROPOWER PROJECT  
(SUPPLEMENTARY)**

1991	I			0.000	0.000
	II			0.000	0.000
	III			2.414	2.414
	IV			0.220	2.634
1992	I			0.220	2.854

(Reference in text: page 7, paragraph 27)

**ELECTRICITE DU LAOS  
INCOME STATEMENT  
(\$ Thousand)**

Year ended 31 December	ACTUAL				PROJECTED				
	1987	1988	1989	1990	1991	1992	1993	1994	1995
Total energy generation (GWh)	567	553	698	870	1,013	1,060	1,074	1,074	1,174
Bulk purchases			19	21	28	35	43	52	52
Sales (GWh)	524	503	660	828	967	1,017	1,034	1,033	1,130
Energy losses	7.5%	9.0%	8.0%	6.9%	6.5%	6.4%	6.7%	7.5%	7.8%
Gross increase in sales (GWh) %	-35.2%	-4.0%	31.2%	25.5%	16.9%	5.2%	1.6%	-0.1%	9.4%
Average tariff (US\$/kWh)	0.037	0.027	0.023	0.027	0.029	0.032	0.034	0.036	0.038
Increase in average tariff %	-16.6%	-28.4%	-14.2%	18.4%	7.0%	9.3%	5.7%	6.1%	6.9%
<b>Revenue</b>									
Electricity sold	19,557	13,436	15,125	22,473	28,096	32,291	34,686	36,573	42,977
Other revenue	1,721	1,209	260	291	326	365	409	458	513
Operating revenue	21,278	14,645	15,385	22,764	28,422	32,656	35,095	37,211	43,490
<b>Operating Expenses</b>									
Purchased power			681	672	783	1,083	1,383	1,731	2,170
Salaries and allowances	973	602	491	520	616	832	882	935	991
Business turnover tax			20	64	99	144	216	319	448
Administration	1,168	508	248	265	284	303	325	347	372
Operation and maintenance	2,673	1,592	935	3,956	5,708	5,760	7,909	7,947	9,259
Depreciation	5,516	6,736	5,150	5,753	6,845	7,645	9,113	10,571	11,471
Total operating expenses	10,330	9,438	7,525	11,230	14,335	15,767	19,828	21,850	24,711
<b>Operating Income/Loss</b>	19,048	5,207	7,860	11,533	14,086	16,889	15,268	15,362	18,781
Interest expense	169	2,356	2,066	1,667	1,983	1,822	5,115	7,375	7,806
<b>Income After Interest</b>	10,799	2,852	5,794	9,866	12,103	15,068	10,153	7,987	10,975
Export tax			1,518	3,901	4,784	5,308	5,293	5,038	5,542
Income tax	2,625	1,967	3,708	291	408	675	461	378	797
<b>Income After Tax and Interest</b>	8,154	885	568	5,674	6,911	9,085	4,399	2,571	4,637
Dividend	6,860								
<b>Net Income</b>	1,294	885	568	5,674	6,911	9,085	4,399	2,571	4,637
Adj. to depreciation for prior years			-2020						
Extraordinary expenses			136						
<b>Net Income After Adjustments</b>	1,294	885	2452	5,674	6,911	9,085	4,399	2,571	4,637
Transfer from Gov't equity			-1884						
<b>TRANSFER TO RETAINED EARNING</b>	1,294	885	568	5,674	6,911	9,085	4,399	2,571	4,637
<b>Operating Ratio (a)</b>	49%	64%	49%	49%	50%	48%	56%	59%	57%
<b>Rate of Return on Amfa-Hist (b)</b>	11%	4%	3%	9%	8%	8%	6%	5%	6%
<b>Average net fixed assets (at cost)</b>	75,848	78,801	79,104	81,036	110,483	136,202	167,856	198,401	214,289

(a) Operating cost (excluding interest)/revenues.

(b) Net operating income using historical depreciation charge and before interest but after tax/net average asset base (at cost).

(Reference in text: page 12, paragraph 39)

**ELECTRICITE DU LAOS  
BALANCE SHEET  
(\$ Thousand)**

Year ended 31 December	ACTUAL					PROJECTED				
	1987	1988	1989	1990	1991	1992	1993	1994	1995	
<b>Fixed Assets</b>										
Gross fixed assets at cost	115,784	122,231	123,823	131,856	190,276	191,989	263,638	264,889	308,639	
Less: accumulated depreciation	168,470	42,769	45,078	48,530	52,637	57,224	62,691	69,034	75,916	
Net fixed assets	78,140	79,462	78,745	833,327	137,639	134,765	200,947	195,855	232,723	
Work in progress	6,095	10,276	33,182	65,453	30,937	58,974	23,565	53,964	47,894	
Total fixed and other assets	84,235	89,738	111,927	898,780	168,576	193,739	224,512	249,819	280,617	
<b>Current Assets</b>										
Cash and bank	6,155	2,880	2,534	3,415	4,263	4,898	5,264	5,582	6,524	
Trade receivables - net	13,019	5,649	8,311	5,691	7,106	8,164	8,774	8,993	10,510	
Unadjusted advances	2,217	9,250	2,226	2,293	2,362	2,432	2,505	2,581	2,658	
Inventories	4,394	2,145	1,688	1,772	1,861	1,954	2,052	2,154	2,262	
Recoverable from Government	0	136	0	0	0	0	0	0	0	
Total current assets	25,785	20,060	14,759	13,171	15,592	17,448	18,595	19,310	21,954	
<b>Current Liabilities</b>										
Accounts payable	621	715	3,501	1,369	1,873	2,030	2,679	2,820	3,310	
Other current liabilities	7,225	7,267	6,145	4,553	5,684	6,531	7,019	7,194	8,408	
Current portion of long term	0	4,340	1,496	1,721	2,014	3,856	5,535	6,241	7,008	
Total current liabilities	7,846	12,322	11,142	7,643	9,571	12,417	15,233	16,255	18,726	
Net current assets	17,838	7,737	3,617	5,528	6,021	5,032	3,363	3,055	3,228	
Total Assets	102,073	97,475	115,544	154,307	174,597	198,771	227,874	252,874	283,845	
Government investment	58,672	47,060	43,433	45,057	43,365	45,001	52,489	51,176	49,966	
Major repairs reserve	8,369	9,906	10,727	12,878	15,466	18,374	21,869	25,948	30,386	
Retained earnings	3,925	4,810	5,378	11,052	17,963	27,048	31,447	34,018	38,654	
Total equity	70,966	61,776	59,538	68,987	76,794	90,423	105,805	111,142	119,006	
Long term debt - foreign	27,578	36,841	52,504	82,044	94,819	107,591	123,356	144,072	168,488	
Government working capital support	3,529	3,197	4,997	4,997	4,997	4,613	4,248	3,902	3,359	
- less current	0	(4,340)	(1,496)	(1,721)	(2,014)	(3,856)	(5,535)	(6,241)	(7,008)	
Total long term debt	31,107	35,698	56,005	85,320	97,802	108,348	122,069	141,733	164,839	
Total Capital Employed	102,073	97,475	115,544	154,307	174,597	198,771	227,874	252,874	283,845	
E&OE	0	0	0	0	0	0	0	0	0	
DEBT/(DEBT/EQUITY) (a)	30%	37%	48%	55%	56%	55%	54%	56%	58%	
CURRENT RTIO (b)	3.3	1.6	1.3	1.7	1.6	1.4	1.2	1.2	1.2	
QUICK RATIO (c)	2.7	1.5	1.2	1.5	1.4	1.2	1.1	1.1	1.1	

(a) Total debt/total debt + equity.

(b) Total current assets/total current liabilities.

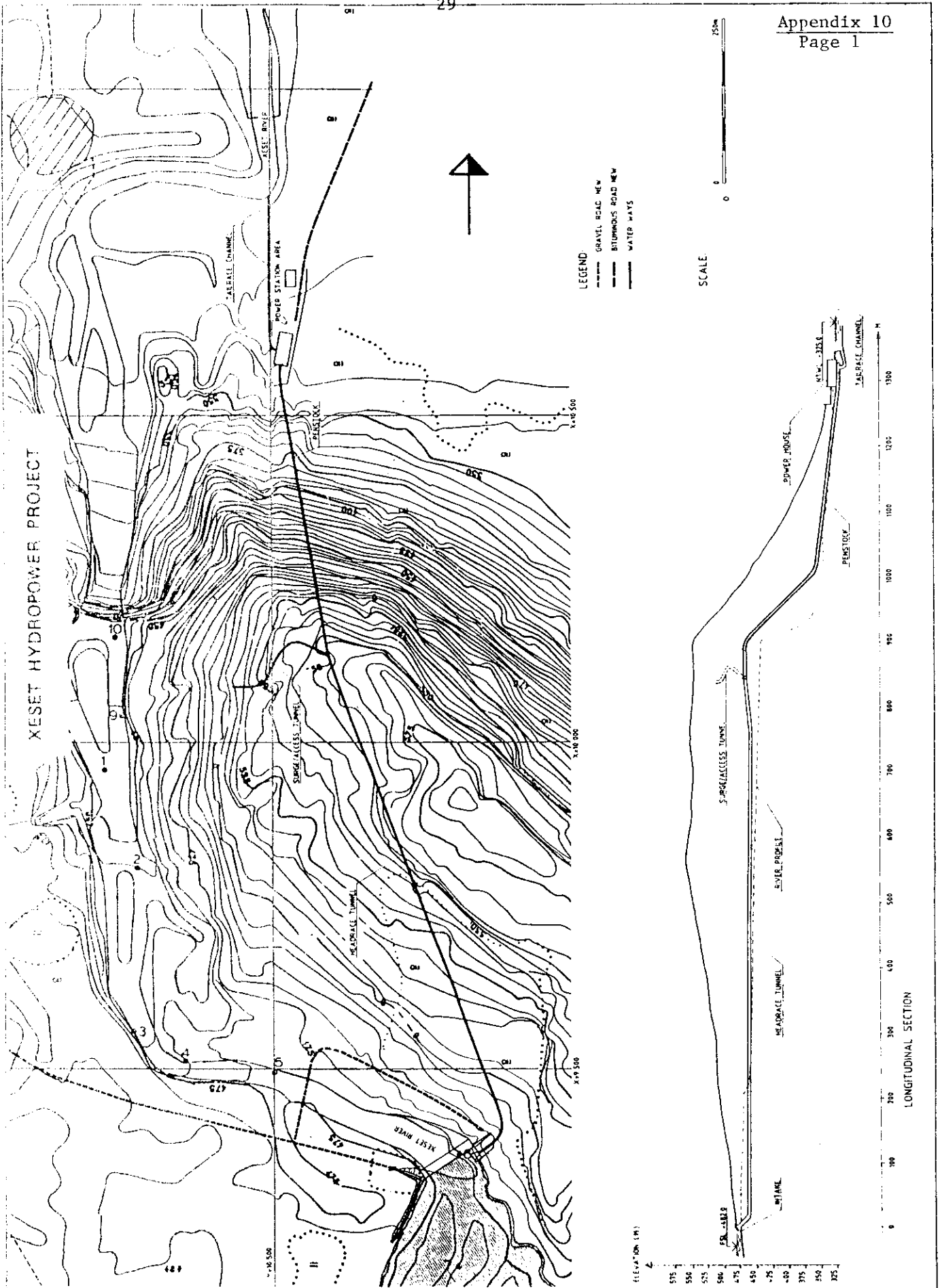
(c) Total current assets less inventories/total current liabilities.

**ELECTRICITE DU LAOS**  
**SOURCE AND APPLICATIONS OF FUNDS**  
**(\$ Thousand)**

	ACTUAL				PROJECTED				
	1987	1988	1989	1990	1991	1992	1993	1994	1995
<b>Source of Funds</b>									
Operating Income	10,948	5,207	7,860	11,533	14,086	16,889	15,268	15,362	18,781
Depreciation	<u>5,516</u>	<u>6,736</u>	<u>3,130</u>	<u>5,603</u>	<u>6,695</u>	<u>7,495</u>	<u>8,963</u>	<u>10,421</u>	<u>11,321</u>
Internal cash generation	16,464	11,943	10,990	17,136	20,781	24,384	24,231	25,783	30,102
Government contribution	6,514	(11,868)	(2,394)	1,624	(1,692)	1,636	7,488	(1,313)	(1,210)
Loans from official lenders	2,539	9,895	19,775	31,456	14,383	14,402	19,256	25,905	30,114
Government working capital loans	<u>0</u>	<u>0</u>	<u>2,029</u>	<u>132</u>	<u>113</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Sub-Total	9,053	(1,973)	19,410	33,212	12,804	16,038	26,744	24,592	28,904
<b>Total Source of Funds</b>	<u>25,517</u>	<u>9,970</u>	<u>30,400</u>	<u>50,348</u>	<u>33,585</u>	<u>40,422</u>	<u>50,975</u>	<u>50,375</u>	<u>59,006</u>
<b>Application of Funds</b>									
<b>Debt Service</b>									
Interest charged to operations	169	2,356	2,066	1,667	1,983	1,822	5,115	7,375	7,806
Repayment loans	<u>54</u>	<u>964</u>	<u>4,340</u>	<u>2,048</u>	<u>1,721</u>	<u>2,014</u>	<u>3,856</u>	<u>5,535</u>	<u>6,241</u>
Total debt service	223	3,320	6,406	3,715	3,704	3,836	8,971	12,910	14,047
Capital expenditure (excl. IDC)	9,680	10,554	25,731	37,324	19,554	27,100	32,220	29,540	34,785
Interest during construction	<u>0</u>	<u>0</u>	<u>0</u>	<u>2,920</u>	<u>4,200</u>	<u>2,500</u>	<u>3,870</u>	<u>1,960</u>	<u>2,745</u>
	9,680	10,554	25,731	40,244	23,754	29,600	36,090	31,500	37,530
Taxes payable	2,625	1,967	5,226	4,193	5,192	5,983	5,754	5,416	6,339
Dividends payable	6,860	0	0	0	0	0	0	0	0
Major repairs exceeded	590	74	0	150	150	150	150	150	150
Working capital add (-decrease)	5,538	(5,761)	(6,964)	2,136	2,136	10	10	398	940
Cash	(661)	(3,275)	(346)	881	849	366	366	317	942
Other than cash	6,199	(2,486)	(852)	(1,101)	(1,101)	(1,387)	(1,387)	(484)	(278)
<b>Total application of funds</b>	<u>25,517</u>	<u>10,152</u>	<u>30,400</u>	<u>50,438</u>	<u>50,348</u>	<u>50,974</u>	<u>50,974</u>	<u>50,374</u>	<u>59,004</u>
E&OE	0	0	0	0	0	0	0	0	0
DEBT SERVICE COVERAGE RATIO (a)	31.6	3.7	1.0	2.1	1.9	3.1	1.5	1.4	1.4
SELF-FINANCING RATIO-MIDDLE									
3 YEARS (b)	-0.5%	59.2%	-0.8%	34.1%	37.2%	53.3%	33.2%	22.2%	26.4%

(a) Internal cash generation less increases in working capital, major repairs expenditure, and dividends taxes/debt service including IDC but excluding capitalized debt.

(b) Internal cash generation less increases in working capital, major repairs expenditure, dividends, debt service (excluding capitalized debt) and taxes for the current year/average annual capital expenditure (incl. IDC) for the previous, the current and the subsequent year.

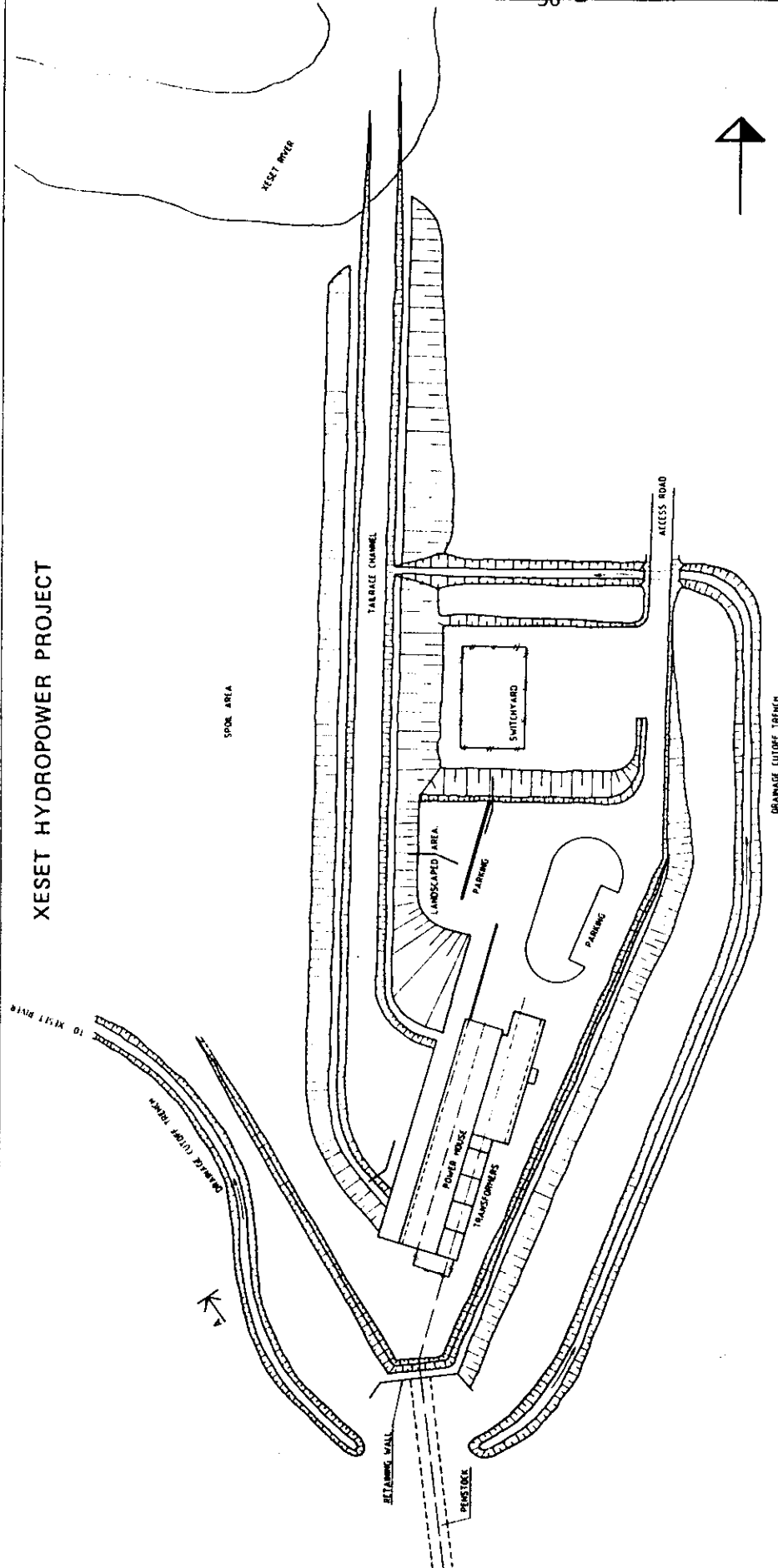




SCALE



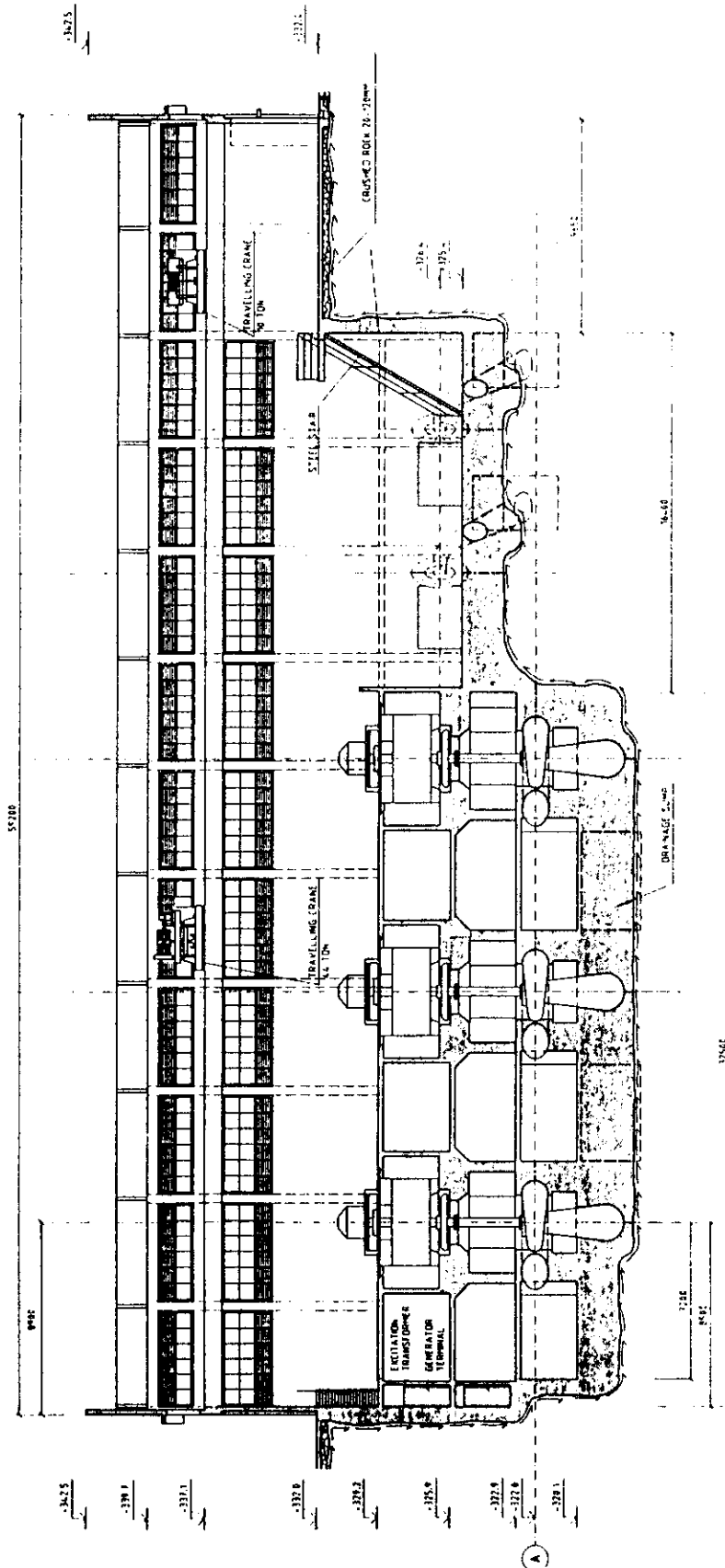
XESET HYDROPOWER PROJECT



Power Station Area - General Layout

XESET HYDROPOWER PROJECT

⑤ ④ ③ ② ①



Power house - Units' Arrangement

Architectural section drawing of a building, likely a bridge structure, showing internal layout, elevations, and dimensions. The drawing includes a cross-section with a central staircase and a spiral staircase. Key features include a "TRAVELLING CRANE 11 TON AND RIG" and a "STILL GARDENWAY". Elevation markers such as -372.2, -371.1, -370.8, -371.6, -371.8, -371.1, -370.7, and -370.5 are shown. Dimensions include 1950, 7500, 24,054, 7700, and 1940. A note at the bottom right reads "GATES FOR DRAFT TUBE GATE".

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## Power house - Units' Arrangement



## Power House - Units' Arrangement