

ASIAN DEVELOPMENT BANK

PCR: LAO 27325

PROJECT COMPLETION REPORT

ON THE

**THEUN-HINBOUN HYDROPOWER PROJECT
(LOAN 1329 - LAO [SF])**

IN THE

LAO PEOPLE'S DEMOCRATIC REPUBLIC

December 2000

CURRENCY EQUIVALENTS

Currency Unit — Kip (KN)

		At Appraisal	At Project Completion
KN1.00	=	\$0.0014	\$0.000413
\$1.00	=	KN720	KN2,421

ABBREVIATIONS

ADB	-	Asian Development Bank
EdL	-	Electricité du Laos
EGAT	-	Electricity Generating Authority of Thailand
EIA	-	environmental impact assessment
EIRR	-	economic internal rate of return
EMCO	-	Environmental Management Committee Office
EMP	-	environmental management plan
EMU	-	Environmental Management Unit
FIRR	-	financial internal rate of return
GDP	-	gross domestic product
JV	-	joint venture
LA	-	licensing agreement
MDX	-	MDX Lao Public Company Ltd.
MIH	-	Ministry of Industry and Handicrafts
MOU	-	memorandum of understanding
NH	-	Nordic Hydropower AB
NGO	-	nongovernment organization
NORAD	-	Norwegian Agency for International Cooperation
PPA	-	power purchase agreement
RE	-	rural electrification
TA	-	technical assistance
THPC	-	Theun-Hinboun Power Company Ltd.
UNDP	-	United Nations Development Programme

WEIGHTS AND MEASURES

kV	(kilovolt)	-	1,000 volts
MW	(megawatt)	-	1,000,000 watts
kWh	(kilowatt-hour)	-	1,000 Wh

NOTES

- (i) The fiscal year (FY) of the Government ends on 30 September.
- (ii) In this report, "\$" refers to US dollars, and B refers to Thai baht.

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BASIC DATA

A. Loan Identification

1.	Country	Lao People's Democratic Republic
2.	Loan Number	1329-LAO(SF)
3.	Project Title	Theun-Hinboun Hydropower Project
4.	Borrower	Lao People's Democratic Republic
5.	Executing Agency	Theun-Hinboun Power Company Ltd.
6.	Amount of Loan	SDR40,846,656 equivalent to \$57.7 million
7.	PCR Number	PCR: LAO 570

B. Loan Data

1.	Appraisal	
	- Date Started	27 Jun 1994
	- Date Completed	12 Jul 1994
2.	Loan Negotiations	
	- Date Started	19 Sep 1994
	- Date Completed	21 Sep 1994
3.	Date of Board Approval	8 Nov 1994
4.	Date of Loan Agreement	1 Dec 1994
5.	Date of Loan Effectiveness	
	- In Loan Agreement	1 Mar 1995
	- Actual	19 Jan 1996
	- Number of Extensions	Two
6.	Closing Date	
	- In Loan Agreement	30 Jun 1998
	- Actual	14 Oct 1998
	- Number of Extensions	One
7.	Terms of Loan	
	- Service Charge	1 percent
	- Maturity (number of years)	40
	- Grace Period (number of years)	10
8.	Terms of Relending	
	- Second-Step Borrower	Electricité du Laos
	- Loan Amount	\$51,500,000
	- Interest Rate	6.21 percent
	- Maturity (number of years)	25
	- Grace Period	5
	- Second-Step Borrower	Theun-Hinboun Power Company Limited
	- Loan Amount	\$8,500,000
	- Interest Rate	10 percent
	- Maturity (number of years)	16
	- Grace Period	4

9. Disbursements

a. Dates

Initial Disbursement 23 Jan 1996	Final Disbursement 14 Oct 1998	Time Interval 2 years, 9 months
--------------------------------------------	------------------------------------------	-------------------------------------------

Effective Date 19 Jan 1996	Original Closing Date 30 Jun 1998	Time Interval 2 years, 5 months
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b. Amount (\$ million)

Item	Original Allocation	Last Revised Allocation	Amount Cancelled	Net Amount Available	Amount Disbursed	Undisbursed Balance
Civil Works	60.000	57.713	2.287	57.713	57.713	0.000
Total	60.000	57.713	2.287	57.713	57.713	0.000

10. Local Cost (Financed): none

C. Project Data

1. Project Cost (\$ million)

Source	Appraisal Estimate	Actual ¹
Total Cost	270.0	240.2

2. Financing Plan (\$ million)

Source	Appraisal Estimate	Actual ¹
Equity²		
Government/Electricité du Laos	66.0	66.0
Nordic Hydropower	22.0	22.0
MDX Lao Public Co. Ltd.	22.0	22.0
Subtotal	110.0	110.0
Debt		
Government	8.5	6.6
Commercial Loan	81.5	56.2
Export Credit	70.0	67.4
Subtotal	160.0	130.2

¹ As of March 2000.

² The loan was used to finance the major portion of the Government/Electricité du Laos equity.

3. Cost Breakdown by Project Component (\$ million)

Item	Appraisal		Actual	Savings/ (Overruns)
	Estimate	Estimate ¹		
Base Cost				
Preparatory Civil Works	10.0	11.2	12.7	(1.6)
Main Civil ² & Hydr. Steelworks	95.0	105.9	83.0	22.9
Mechanical Works	22.0	24.5	13.6	10.9
Electrical Equipment	43.0	48.0	36.7	11.2
Transmission Line	17.0	19.0	15.8	3.2
Environmental Mitigation	1.0	1.1	1.9	(0.8)
Project Management	3.0	3.3	2.6	0.8
Construction Supervision	9.0	10.0	11.5	(1.5)
Operation & Management Training	4.0	4.5	2.9	1.5
Financial Management Services			0.1	(0.1)
Total Base Cost	204.0	227.5	180.9	46.6
Contingencies	23.5		-	23.5
Financial Costs	32.4		20.2	12.2
Preparatory Costs				
Feasibility Costs	-		2.0	(2.0)
Final Design & Tender Documents	-		5.5	(5.5)
Total Preparatory Costs	-		7.5	(7.5)
Preoperational Expenses	6.8		17.0	(10.2)
Initial Working Capital	3.3		-	3.3
Financial Allocation³	-		14.7	(14.7)
Total Project Costs	270.0		240.2	29.8

¹ Base costs plus contingencies.

² The \$83.0 million *actual expenditures* comprise \$63.9 million for main civil works and \$19.1 million for hydraulic steelworks.

³ Contains reserves for debt service, revenue and amortization, as well as for operations & maintenance, and other reserves.

4. Project Schedule

Item	Appraisal Estimate	Actual
Date of Contract with Consultants		7 Dec 1994
Completion of Engineering Designs	Oct 1994	15 Dec 1994
Civil Works Contract		
Date of Award	Nov 1994	1 Nov 1994
Completion of Work	May 1997	31 Dec 1997
Equipment and Supplies		
First Procurement	Apr 1994	1 Nov 1994
Last Procurement	Mar 1995	26 Jul 1995
Completion of Equipment Installation		
Start of Operations		
Completion of Tests and Commissioning	Jun 1997	28 Feb 1998
Beginning of Start-Up	Jan 1998	31 Mar 1998

D. Data on Bank Missions

Name of Mission	Date	No. of Persons	No. of Person-days	Specialization of Members ¹
Consultation	17-20 Feb 1993	4	16	A, B, C, K
Fact-Finding	10-24 Jan 1994	5	70	D, I, E, K, F
Reconnaissance	21-24 Jun 1995	5	20	C, H, E, I, K
Appraisal	30 Jun-12 Jul 1994	4	52	D, E, I, K
Review ²	20-31 Jan 1997	1	2	I,
	12-23 June 1997	3	6	I, J, G
	10-21 Nov 1997	1	2	I
	5-12 May 1998	1	8	I
	18-25 Nov 1998	3	15	I, G, F
	9-18 Nov 1999	2	20	I, F
Project Completion Review ³	29 Feb-14 Mar 2000	3	38	I, L, M

¹ A - Program Director, B - Project Manager, C - Sr. Project Engineer, D - Sr. Financial Analyst, E - Sr. Counsel, F - Sr. Environment Specialist, G - Sr. Social Development Specialist, H - Sr. Cofinancing Officer, I - Project Engineer, J - Environment Specialist, K - Programs Officer, L - Asst. Project Analyst, M - Staff Consultant.

² Missions were fielded to review progress of projects under several loans. Person-days shown are actual days spent on this Project.

³ The Mission comprising S.W. Bauer, Project Engineer as Mission Leader; E. Panlilio, Assistant Project Analyst; and C. Posadas, Staff Consultant, arrived in the Lao PDR on 29 February 2000 and visited the project site on 2-3 March 2000. C. Posadas returned on 10 March 2000 via Bangkok, where she visited the offices of GMS Power Public Company Ltd. to obtain further economic and financial information on the Project. S.W. Bauer and E. Panlilio left the Lao PDR on 14 March 2000.

I. PROJECT DESCRIPTION

1. The main objective of the Project was to support economic growth in the Lao People's Democratic Republic (the Lao PDR) by enhancing foreign exchange earnings through the export of electric power to Thailand. The Project represented a new policy direction in the power subsector, which had been initiated through discussions with the Asian Development Bank (ADB). It was the first time that the Government of the Lao PDR formed a joint venture (JV) with the private sector for financing, constructing and operating a power plant.

2. The Lao PDR has exported surplus power from the existing Nam Ngum Hydropower Plant to Thailand since its commissioning in 1972. A memorandum of understanding (MOU) between the two countries, dated 4 June 1993, on developing 1,500 megawatts (MW) of electric power in the Lao PDR by year 2000 for export to Thailand, and the Lao PDR's new foreign investment policies paved the way for private sector participation in the development of the Lao PDR's hydropower resources as a major export commodity. The Project was the first to be implemented under this MOU, and the first major investment under the new foreign investment policies of the Lao PDR. Except for a minor local supply to the nearby area, the electric energy being produced is for export to Thailand.

3. The hydropower potential of the Nam Theun River had been recognized for a long time. In 1991, the Government started studies to identify a suitable project in central Lao PDR to export power to Thailand and provide a local supply. The project, initially, was conceived as a public sector project. A full feasibility study was started in 1992 and foreign investors joined in 1993. Project implementation started in November 1994, and the Project was completed well below the budget. Commercial operation commenced on 31 March 1998.

4. At the time of project formulation there was no legal framework in the Lao PDR allowing the establishment of this type of JV. ADB therefore assisted the Government through a small-scale technical assistance (TA) grant in establishing the required legislation.¹

5. The Project is located about 100 kilometers (kms) upstream of the confluence with the Mekong River on the border between Borikhamxai and Khammouan provinces. In this area, a narrow mountain ridge separates the Nam Theun basin from the lower Nam Hinboun. The project site is ideally suited to the establishment of a run-of-river hydropower station through transbasin diversion of water for about 10 km from the Nam Theun to the Nam Hai,² utilizing a difference in elevation of about 240 meters for the production of electric energy. As a result of its easy access, technical soundness, low cost of generation, and limited environmental impact, the Project ranked high among those considered for development by the Government and private sector sponsors. The intake is located in Borikhamxai Province on the Nam Theun, which is one of the largest tributaries of the Mekong in the Lao PDR, with a total catchment area of about 14,650 km². The powerhouse and the tailrace canal are located in Khammouan Province. The owner of the Project is the Theun-Hinboun Power Company Ltd. (THPC), a Lao PDR-registered company established for this purpose.

¹ TA 2054-LAO: *Theun-Hinboun Power Legal Advisor*, for \$100,000, approved on 4 January 1994, for a five-month legal adviser to assist in structuring legal agreements.

² The Nam Hai is a tributary of the Nam Hinboun, which joins the Mekong about 30 km upstream of Thakhek on the Thai border.

6. For the 210 MW rated capacity, the average annual generation potential is estimated at 1,645 gigawatt-hours (GWh) before the implementation of any upstream development, and at 1,356 GWh after commissioning of the planned upstream 600 MW Nam Theun 2 Hydropower Project. A compensation flow of 5 cubic meters per second (m³/s) is being released past the weir during dry periods. The river inflow to the intake exceeds the plant capacity on the average during about 230 days per year. After completion of the Nam Theun 2 Hydropower Project, the inflow to the Project will exceed the plant capacity on the average about 175 days per year.

7. The Project consists of the following components:

- (i) civil works associated with the intake weir, waterways, powerhouse, and auxiliary structure;
- (ii) supply and installation of 2 x 105 MW vertical shaft turbine generating units;
- (iii) supply and installation of station auxiliaries and switchgear;
- (iv) supply and installation of metal structures such as sluice and radial gates, trash racks, and penstocks;
- (v) construction of a 230 kilovolt (kV) double-circuit transmission line, 86 km long from the project site to Thakhek on the Thai border, including a metering station at Thakhek, and provision for a switching station and a future substation; and
- (vi) consulting services for feasibility, design, and project implementation.

A. Establishment of Theun-Hinboun Power Company, Ltd.

8. On 23 June 1993, the Government signed an MOU with the foreign sponsors MDX Lao Public Company Ltd. (MDX)³ and Nordic Hydropower AB (NH)⁴ to jointly develop the Project. Based on sound commercial and industrial practices consistent with the foreign investment incentives provided under the policies and laws of the Lao PDR, the parties agreed to establish a Lao PDR-registered company with the objectives to plan, design, finance, construct, own, operate, and maintain the Project primarily for sale of electricity under a long-term contract to the Electricity Generating Authority of Thailand (EGAT). The Government assigned to the State-owned power utility of the Lao PDR responsibility for nationwide generation, transmission, and distribution of electric power, with Electricité du Laos (EdL) to hold its interests in the Project. The shareholders and their respective ownership are (i) EdL with 60 percent, (ii) MDX with 20 percent, and (iii) NH with 20 percent. The structure of ownership of THPC is shown in Appendix 1.

9. Until the company could formally be established, a steering committee representing the sponsors was appointed to oversee further development of the Project. The main tasks to be supervised were (i) preparing the shareholders agreement and other documentation required to register the company, (ii) negotiating the license agreement (LA) with the Government, (iii) negotiating the power purchase agreement (PPA) with EGAT, (iv) arranging for project financing, and (v) monitoring design and procurement. The shareholders agreement was signed on 13 October 1994, and the company became registered on 7 November 1994. Following organizational resolutions by the shareholders, the first shareholders and board meetings were held 6-7 December 1994.

³ MDX is owned to 90 percent by GMS Power Public Company Limited, then known as MDX Power Public Company Limited. The remaining 10 percent of MDX is owned by the Thailand Crown Agents.

⁴ Nordic Hydropower AB is beneficially owned by Statkraft A.S. of Norway and Vattenfall AB of Sweden.

B. License Agreement

10. At project preparation, the legal framework of the Lao PDR was inadequate for the Project to be realized under commercial financing (para. 4). Hence, the Government and THPC entered into a LA with the status of a decree. The LA authorized THPC to plan, finance, construct, own, and operate the Project for a period of 30 years from the start of commercial operation. Unless both parties agree to extend the term, the Project will be transferred to the Government, or its nominee, free of charge at the end of 30 years. The LA contains provisions on the rights and obligations of the parties. The most important provisions focus on exclusive rights for THPC, tax and royalty obligations of THPC, and responsibility for environmental and social impact mitigation.

11. THPC is protected under the LA against any upstream activities and diversions detrimental to it, except for implementation of the planned Nam Theun 2 Hydropower Project. In return for being granted this license, THPC is obliged to pay a royalty of 5 percent of gross revenues to the Government. THPC was granted a tax holiday of almost five years commencing with the start of commercial operations at the end of March 1998 up to the end of the year 2002, after which it will pay 15 percent tax on its taxable income. The Government assumed the responsibility for environmental impacts including compensation to affected parties, but THPC would pay the cost of such mitigation measures and compensation up to an amount of \$1.0 million. This amount was later increased to \$2.6 million.

C. Power Purchase Agreement

12. The Project was first officially presented to EGAT and the Coordination Committee on Electricity Cooperation of Thailand in November 1993. Tariff negotiations followed, and an agreement was reached in June 1994. As EGAT at this stage was in the process of developing a standard grid code that would apply to all purchase of power from domestic as well as foreign independent power producers, the full PPA was not signed until 19 June 1996.

13. The PPA is valid for 25 years from the start of commercial operation with an option for renegotiating the tariff after 10 years. It is based on the take-or-pay principle by which EGAT undertakes to purchase 95 percent of the Project's available energy output. The tariff is a pure energy tariff denominated in dollars, of which 50 percent is payable in dollars and 50 percent in baht at the exchange rate on the execution date of the PPA.⁵ In the first year of operation, the tariff was \$0.0484 per kilowatt-hour (kWh). Thereafter it was to increase at a fixed rate of 1 percent per annum. The point of delivery is at the border between the Lao PDR and Thailand near Thakhek.

D. Planning and Engineering

14. The criteria for identifying a suitable project were (i) favorable economy, (ii) fast implementation, and (iii) no serious adverse environmental and social impacts. The conclusion of the first Fact-Finding Mission to the area was that a project generally in line with those criteria and the technical solution later implemented would be highly viable. Thereafter the Hydropower Office of the Ministry of Industry and Handicrafts (MIH) awarded Norpower (later merged with Norconsult International A.S.) a contract to execute a feasibility study, which was financed by the Norwegian Agency for International Cooperation (NORAD) as a TA on a grant basis to the Government. The United Nations Development Programme (UNDP) provided a grant for site

⁵ \$1.00 = B25.35.

investigations at that stage. The feasibility study was completed in May 1993 and confirmed that the Project would fully satisfy the requirements.

15. The Government started to prepare to implement the Project and ADB confirmed its financial support. The Government invited MDX and NH to establish a JV Company with EdL to further develop and implement the Project. Planning of the Project, from then on known as Theun-Hinboun Hydropower Project, proceeded concurrently with the formation of THPC and preparation of the final design and tender documents for all procurement and construction works. In March 1994 MIH awarded a contract to Norconsult (now merged with Norpower) with EdL as Executing Agency. This phase of the Project was also financed by NORAD. In December 1995, Norconsult was retained by THPC as consultant for detailed design and construction supervision including follow-up during the defects liability period. This work was financed mainly through a soft loan to the Government by the Nordic Development Fund.

II. EVALUATION OF IMPLEMENTATION

A. Project Components

16. The components of the Project are summarized in para. 7. The financial implications of necessary design changes are discussed in para. 26, their technical justification is described in para. 28 and further details are in Appendixes 2, 3 and 4. For a better understanding of project implementation, the components may also be categorized according to contract packaging (paras. 17 - 23):

17. **Preparatory Civil Works.** The works executed under Contract C1: Preparatory Civil Works comprised (i) access roads to the powerhouse, to the dam site, and to the tunnel adits; (ii) excavation for the powerhouse and at the dam site; and (iii) the operators' village.

18. **Civil Works.** The works executed under Contract C2: Civil Works comprised all civil works for the Project not included in Contract C1, notably; (i) weir, (ii) spillway, (iii) diversion tunnels, (iv) powerhouse, and (v) tailrace canal.

19. **Hydraulic Steelworks.** The works executed under Contract H1: Hydraulic Steelworks comprised (i) delivery and erection of the penstock; (ii) trash rack; (iii) trash rack cleaner; and (iv) all gates at the weir, the intake, and the draft tube gates in the powerhouse.

20. **Mechanical Works.** The works executed under Contract M1: Mechanical Works comprised (i) turbines including governors and inlet valves; (ii) cooling water system; and (iii) drainage system in the powerhouse.

21. **Electrical Works.** The works executed under Contract E1: Electrical Works comprised (i) generators, transformers, switchgear at the power plant and at Thakhek switching station; and (ii) control systems, machine hall cranes, telecommunication equipment, including power line carrier, 22 kV transmission line to the intake, and electrical installations at weir and intake.

22. **230 kV Transmission Line.** The works executed under Contract T1: 230 kV Transmission Line comprised, except for the works described in para. 23, all works for the 86 km long 230 kV transmission line from the powerhouse switchyard to the Mekong crossing at Thakhek, including the suspension tower at the Lao PDR riverbank. The works also included all civil and mechanical works at Thakhek switching station.

23. **230 kV Transmission Line (Supplementary Contract).** The works executed under Contract T2: 230 kV Transmission Line comprised the foundation works for four of the eight tower sites on the limestone ridge.⁶

B. Implementation Arrangements

24. The organization chart of THPC is shown in Appendix 5. To oversee project implementation, the board of THPC appointed an executive committee consisting of three members, each representing one shareholder. International competitive bidding procedures were used for all goods to be procured under the project. ADB-financed items⁷ were procured in accordance with ADB's *Guidelines for Procurement*.

25. As provided in the MOU, dated 23 June 1993, (i) MDX was assigned the task of financial manager; and (ii) NH, with (a) Statkraft SF as executing party, the task of project manager; (b) Norconsult International A.S. as executing party, the contract for consulting services; and (c) Vattenfall AB as the executing party, the contract for training, and project operation and maintenance. Support staff for THPC administration and secondment to the engineer for technical supervision of the works were engaged on fixed-term contracts. The majority of technical inspectors seconded to the engineer were provided by EdL. In view of these arrangements, initially no officers for project management were appointed. In preparation for the operational phase, a general manager was engaged in August 1997.

C. Project Costs

26. The overall project cost, including both foreign exchange and local currencies, was estimated at loan appraisal at \$270.0 million equivalent. The actual cost was about \$240.2 million, resulting in savings of about \$29.8 million. The most important savings of about \$22.9 million were due to substantially lower than estimated tender prices for the main civil works and hydraulic steelworks. The savings comprised about \$10.9 million for mechanical works, and about \$11.2 million for electrical equipment (Basic Data, C, item 3). Despite the difficulties due to the crossing of the limestone ridge, transmission line savings of about \$3.2 million were realized. The most important cost overruns (about \$5.5 million) were incurred in preparing the final design and tender documents, and were due to, among others, elaboration of new tender documents for the T2 contract for the transmission line (paras. 46-48) and a T4 transmission line contract never awarded, introduction of the reregulation pond, change in weir height, elimination of one gate in the weir, and other environmental measures. The apparent cost overrun of \$14.7 million under Financial Allocation was not an overrun but rather a different form of financing.⁸ The final implementation costs are summarized in Appendix 6.⁹ The financial structure of financing this cost is shown in Appendix 7. Currency exchange rates during project implementation are shown in Appendix 8.

⁶ The foundation of the other four towers were executed under Contract T1 (para. 22).

⁷ ADB actually financed EdL's capital and provided a sub-loan to THPC via the Ministry of Finance.

⁸ These costs normally are taken from first earnings of the Project. In the case of Theun Hinboun, money that was still available was used for establishing various reserves.

⁹ The numerous contract variations required in the course of project implementation reflect the dynamic management style during this stage. The variations were arranged by the Implementing Agency, THPC, without any ADB involvement.

D. Project Schedule

27. The chronology of the major events in implementing the Project is given in Appendix 9 and the implementation schedule, as originally planned and as actually executed, is presented in Appendix 10.

28. As during the rainy season lasting generally from mid-May to mid-October access and working conditions may be very difficult, great care was taken to schedule implementation of the works, particularly the access roads and the diversion weir, mostly during the dry season (mid-October to mid-May). Fortunately, the weather conditions during construction of these works were generally average and only in September 1995 was the access to the site interrupted for a few days due to flooding of Road No. 13. In mid-September 1996, a typhoon hit the Nam Theun catchment and caused a sharp rise of the Nam Theun water level, which reached elevation 408.8 m at the damsite. This elevation was 0.3 m above the design flood level determined for the diversion weir, corresponding to a design discharge capacity of about 9,650 m³/s. The observed flood peak was estimated at about 10,700 m³/s. As a result, certain adjustments were made to the design of the diversion weir, including raising the design floodwater level from elevation 408.5 m to 410.0 m.

29. Appendix 10 shows that most activities experienced some delays. The most notable ones were delays in (i) commencing procurement of the main civil and hydraulic steel works (over 8 months); (ii) completing the civil works for the weir and intake (seven months), the power house (16 months), and the switchyard (seven months); and (iii) erecting the draft tubes and units (over six months), and commissioning the units (six months). Circumstances leading to the delays are described in paras. 38-48 and the associated Appendixes.

E. Engagement of Consultants and Procurement of Goods and Services

30. **Preparatory Civil Works.** Contract C1: Preparatory Civil Works, was awarded to JV Vianini Lavori-Vianini Thai Construction and Development Co Ltd., of Thailand, on 1 November 1994, for an estimated \$9.3 million.

31. **Civil Works.** Contract C2: Civil Works was awarded to JV Recchi S.p.A.-CMC, of Italy, on 26 July 1995, for an estimated \$69.2 million including the nominated subcontract H1:Hydraulic Steelworks.

32. **Hydraulic Steelworks.** Contract H1: Hydraulic Steelworks was transferred as a nominated subcontract under Contract C2 on 26 July 1995 and awarded to ATB Caldereria S.p.A. of Italy on 12 May 1995, for an estimated \$18.8 million.

33. **Mechanical Works.** Contract M1: Mechanical Works was awarded to Kvaerner Energy A.S. of Norway on 2 February 1995, for an estimated \$12.9 million.

34. **Electrical Works.** Contract E1: Electrical Works was awarded to ABB Generation AB of Sweden on 26 July 1995, for an estimated \$32.3 million.

35. **230 kV Transmission Line.** Contract T1: 230 kV Transmission Line was awarded to Thai Development Associates Co. Ltd. on 15 March 1995, for an estimated \$13.1 million.¹⁰

¹⁰ Including a span over the Mekong River.

36. **230 kV Transmission Line, Foundation Works on Limestone Ridge.** In early 1997, the employer deleted the foundation works for four tower sites on the limestone ridge crossing from Contract T1 in order to secure completing the line on time. This work, with an option for further extension, was assigned to John Holland Lao in a separate Contract T2: 230 kV Transmission Line on 14 March 1997, for an estimated \$2.9 million.

37. **Supervision of Project Implementation.** Four contracts were awarded as follows: (i) Contract A1: Project Management to Nordic Hydropower AB (Statkraft SF) on 7 December 1994, for \$2.6 million; (ii) Contract A2: Consulting Services to Norconsult International A.S. on 7 December 1994, for \$11.5 million; and (iii) Contract A3: Operation, Maintenance and Training to NH (Vattenfall AB) on 14 December 1996, for \$2.9 million.¹¹

F. Performance of Consultants, Contractors, and Suppliers

38. Some difficulties during construction can be attributed to the extremely short period for planning, final design, and preparing documentation for the construction and procurement contracts between completion of the feasibility study in May 1993 and assignment of the first construction contract in late 1994. As a result, the tender documents for Contract C1: Preparatory Civil Works had to be prepared before the detailed investigations for the ground conditions were completed. Furthermore, negotiations for the PPA with EGAT lasted up to mid-1996, i.e., almost one year after all contracts for construction and procurements had been assigned. Since the PPA contained design criteria and requirements not known at the time the contracts were assigned, a number of variations to the design became necessary. The main consequences were inclusion of circuit breakers at Thakhek switching station to satisfy EGAT's criterion for power system stability, and other changes to the electrical and mechanical equipment imposed by detailed requirements of the PPA and EGAT's new grid code. In addition, the PPA's requirement for a peaking mode of operation created the need for a reregulating pond at the outlet of the tailrace canal.

1. Preparatory Civil Works

39. After the notice to commence was given on 1 November 1994, already well after the commencement of the dry season lasting generally from mid-October to mid-May, the main challenge was to perform during the rest of the 1994/95 dry season the initial mobilization at all sites and a significant amount of the preparatory civil works.

40. As the contractor started work preparations at his own risk one month before the notice to commence was issued, he was able to mobilize in an efficient manner. However, the contractor could not completely follow the very tight time schedule for all the works to be completed within the 1994/95 dry season. One reason was the difficult road conditions and ongoing works to complete Road No. 8, which hampered his transports (Appendix 2). Some of the works extended into the 1995 rainy season and due to the above average rains in 1995 were completed under less favorable conditions than planned. The works most affected were the foundation works for the powerhouse, which because of complicated ground conditions required a technically more advanced solution than originally foreseen; completing the access road to the damsite; and road and pipe works in the operators' village.

¹¹ Also awarded was Contract A4: Financial Management Services, to MDX on 15 July 1998, for \$0.08 million. As the services to be provided under that contract started only on the commercial operations date, it had no bearing on the implementation.

2. Civil Works, Including Hydraulic Steelworks

41. The notice to commence was issued on 26 July 1995. However, mobilization throughout 1995 was unsatisfactory. By the end of December 1995 all major works, which according to the contractual program should have been in progress at that time, were delayed by 6-12 weeks. Among the causes of the delays were late arrival of equipment at the site, lack of adequate equipment and skilled operators, and lack of experienced staff for site management. During the first months of 1996, progress on the works improved somewhat, but time was still lost compared with the revised work programs presented by the contractor during this period. In early May 1996, the engineer issued a formal notice to the contractor to take steps deemed necessary to expedite progress to comply with the contractual time for completion. The first realistic work program was presented by the contractor at the end of May 1996. Soon thereafter, THPC started negotiations with the contractor for a supplementary agreement including certain financial support and incentive measures intended to accelerate implementation and recover lost time. The incentive depended on the achievement of a number of revised intermediate milestones and an ultimate milestone aiming at project completion in accordance with the target program of the PPA between THPC and EGAT.

42. By mobilizing additional human resources and equipment, both site management and production capacities were significantly improved and the contractor was able to keep up with his work program of May 1996. A supplementary agreement was signed in December 1996 and the contractor succeeded to comply with all the revised intermediate milestones as well as the ultimate milestone of the agreement. As a result, the commercial operation date assumed in the PPA was achieved and the works were taken over by THPC on 1 May 1998, with the two years defects liability period running from that date. The contractors for Contract C2, including Nominated Subcontract H1, and Contract T1 were not able to keep their original contractual time schedules. However, this did not delay the start of commercial operation, which was determined by the date of completing the transmission system including the Thai portion of the line. Further details are in Appendix 3.

3. Mechanical Works

43. The delay in the civil works for the powerhouse resulted in delayed access for the erection of the draft tubes and the inlet cones and later, in a revised schedule for the main erection of the turbines and the auxiliary equipment. An additional complication was the limited load capacity of a number of bridges on Road No. 8 (Appendix 2) requiring some bypasses for the heaviest transports, which could only be carried out in the dry season. Most heavy items arrived at the site in May 1996, with a very narrow margin to the onset of the rainy season. However, the contractor accommodated the changed circumstances in the early phases of erection in his approach and was able to accelerate the progress of implementation works as soon as access was allowed. THPC took over Turbine No. 1 on 15 February 1998 and Turbine No. 2 on 27 February 1998, with the defects liability periods running two years from those dates. THPC took over Generator No. 1 on 16 February 1998 and Generator No. 2 on 1 March 1998, with the defects liability periods running two years from the same dates.

4. Electrical Works

44. The contractual erection schedule of electrical works was revised in accordance with the revised overall implementation schedule. As the changes were made well ahead of the start of erection, they did not result in any serious problem for the contractor.

45. In August 1997, it was discovered that control cables with stranded conductors generally suffered from earth faults¹² caused by poor quality insulation. In total about 3,000 m of cable was affected; the earth faults were on all 1.5 square millimeter (mm²) and 2.5 mm² conductor control cables with stranded conductors. As most of the cables had already been installed, all had to be replaced. A new batch of cables with stranded conductors was ordered, but tests performed before shipment showed that the new cable had the same type of fault. It was thus decided to replace the faulty cables with solid conductors cables. By mobilizing additional personnel, the electrical works contractor managed to complete the replacement work without serious implications for the ongoing installation and commissioning activities.

5. 230 kV Transmission Line

46. While work on most of the transmission line in the flatland could be implemented without particular difficulties, it was clear at the tender stage, that the 5 km wide limestone ridge crossing for the erection of eight towers would be a demanding task. To ensure that detailed design and construction of this part would be completed on time, the contractual time schedule assumed that the contractor would perform the detailed topographical survey across the limestone ridge before the onset of the rainy season in 1995. However, the contractor did not start this part of the work before late 1995 in the beginning of the next dry season.

47. In the contractual time schedule, both the foundation works and tower erection were expected to be completed during the 1995/96 dry season. However, by the end of that dry season, only the survey work had been completed and no construction work had started. From being a limited, but demanding part of the work, the stretch across the limestone ridge thus became critical for overall completion of the line. After the first months of the 1996/97 dry season elapsed without significant improvement in progress of the works, THPC decided to delete parts of the foundation works across the limestone ridge from Contract T1: 230 kV Transmission Line, and assign the construction of the foundations of the four most demanding tower sites to another experienced contractor in a separate Contract T2, signed in February 1997.

48. From this point, progress improved significantly. It was too late, however, to complete the line within the contractual date for energizing -1 July 1997- and the line became ready for energizing only at the end of December 1997 in accordance with the revised overall implementation schedule. The six months delay from the contractual schedule did not influence the date of commercial operation. THPC took over the transmission line on 29 December 1997, with defects liability period running two years from that date. Further information is in Appendix 4.

G. Conditions and Covenants

49. The status of compliance with the key conditions and covenants of the Loan Agreement is presented in Appendix 11. For reasons described in paras. 51-53, some environmental and social impacts have not yet been fully mitigated to the satisfaction of ADB. Plans on how to resolve the issue of environmental and social impacts are presented in paras. 55-58. Other important covenants concerning project implementation and reporting have been complied with.

¹² Earth faults occur if a poorly insulated wire touches ground, thus resulting in an "earth fault".

H. Disbursements

50. The projected disbursement schedules were not explicitly available from the existing documentation and those for the ADB loan could only be deduced from the least-cost analysis performed during appraisal.¹³ Appendix 12 shows that the first actual disbursements in the last quarter of 1994 corresponded initially to the appraised amounts. During 1995 and 1996, however, presumably because of implementation delays discussed earlier, disbursements were substantially delayed until the middle of 1996. From then on, there were no additional delays in disbursements until project completion. Due to cost savings, the total disbursement was about \$29.8 million less than the appraised Amount.

I. Environmental and Social Impacts

51. As virtually no baseline data were available in the Lao PDR during the elaboration of the environmental impact assessments (EIAs), this fact should have been addressed by endeavoring to collect as much data as possible. However, as much of that portion of the environmental investigation was left to local personnel with limited experience, baseline data collection was poor and affected the Project.

52. The first EIA of April 1994 appeared inadequate in scope, and a summary EIA to complement the findings of the first EIA, was circulated to the ADB Board in June 1994. During the project construction period, THPC established the Environmental Management Committee Office (EMCO) comprising local staff to manage mitigation and compensation issues. Additionally, a number of international and local environmental and social specialists were recruited during project construction to support EMCO and undertake specific environmental and social impact and/or monitoring studies.

53. While the establishment of EMCO was a good concept, it did not attain the level of performance required during project implementation because of low staff capacity and inadequate supervision from the international specialists. In particular, it failed to expand the environmental management plan (EMP) into a detailed and comprehensive document following the completion of detailed project design. Any management plan will always meet unforeseen situations, but in the case of the Project the impact of such unforeseen circumstances was exacerbated by the failure to revise, elaborate, and then implement a comprehensive EMP. As a result, THPC had to deal with impacts as they occurred, rather than in a strategically planned manner. This became a serious issue primarily from the start of project operation when flows were diverted to the Nam Hai-Nam Hinboun system.

54. At project completion and official inauguration of the Project, the nongovernment organization (NGO) International Rivers Network published a report¹⁴ describing unmitigated project-related environmental and social impacts. ADB immediately reacted by fielding a Special Review Mission in May 1998. The Mission confirmed there were unmitigated impacts, but concluded that there was no emergency situation. The Mission discussed with THPC and EMCO measures that had to be implemented immediately and endeavored to initiate their rapid execution, including compensation. In November 1998, ADB fielded another Special Review Mission and left with THPC an agreed-upon action plan comprising steps to take to promote

¹³ As during appraisal only annual estimates were given, for the sake of simplicity in the present analysis, they were assumed to be disbursed in equal quarterly amounts.

¹⁴ Shoemaker, B. 1998. Trouble on the Theun-Hinboun. A Field Report on the Socio-Economic and Environmental Effects of the Nam Theun-Hinboun Hydropower Project in Laos. International Rivers Network, April.

comprehensive mitigation and monitoring. While ADB continued close monitoring of the situation in another Special Review Mission in November 1999, it appeared that, although THPC had completed numerous mitigation arrangements, there were still substantial shortfalls due once again to a lack of capacity of the consultants and EMCO to adequately undertake the required tasks. It was then agreed with THPC to engage an international environmental consultant with a proven track record and substantial Lao PDR experience to investigate the matter and to prepare a comprehensive EMP.

55. The EMP was completed in May 2000. It analyzed the Project's impacts on biophysical and socioeconomic fundamentals, and established a detailed comprehensive 10-year plan for mitigating and compensating for adverse impacts. The main features of the plan are as follows:

- (i) establishing of a 12-person unit, staffed by qualified professional and technical experts, some recruited internationally; paying competitive salaries; and providing an adequate budget to manage and execute the 10-year EMP;
- (ii) studies and trials of all features of the present new ecologies and hydrological regimes in the downstream source river Nam Kading;¹⁵ the head pond, the surge pond, and the downstream recipient rivers Nam Hai and Nam Hinboun with a view to modifying current discharge volumes and patterns with the following objectives: (a) creating two new river systems - the donor and recipient river systems – with flow regimes that enable them to function as aquatic ecosystems with high biological productivity, reasonable biological diversity, and high public utility; and (b) identifying key engineering and operational modifications that permit the rivers to function as described. Important studies and trials include (a) trials of the most effective riparian release; (b) studies of a reregulating reservoir capable of full weekly reregulation on the Nam Hai River; (c) trials of surge pond operations to accelerate erosion, so that the Nam Hai channel stabilizes sooner; (d) studies of a fish bypass to surmount the head pond weir; and (e) trials of head pond management to reduce public health hazards and increase fishery productivity;
- (iii) investigating all outstanding claims for production system losses (mostly riverbank gardens and fisheries), for usufruct rights impairment (water supply, hunting/gathering, land, some trees) in a systematic fashion through village mitigation committees; and
- (iv) mitigating and compensating for established losses and impairments, chiefly by developing new production system techniques and opportunities that will prevent recipient dependence, but rather promote local initiatives and capacities to take advantage of new opportunities.

56. The EMP recommends that the mitigations be aimed at householders to provide them with low-risk, affordable, and sustainable ways to replace those parts of their production resources that have been lost or impaired. These small steps are expected to become a foundation for widespread socioeconomic growth in the region, eventually enabling villagers to exploit some of the new commercial opportunities now available; for example, by applying rural electricity supplies, irrigating the Nam Hai plain with power station discharge water, and using the terrestrial and waterway infrastructure to commercialize cropping (e.g., sericulture, agro-forestry, production of fruit, etc.).

¹⁵

The Nam Hinboun downstream of the diversion weir is known as Nam Kading.

57. It is not possible for THPC to prevent the use of its infrastructure for logging, which is currently being done largely to implement the Government's National Rural Development Program (NRDP). The construction of roads in areas of valuable commercial timber will, unless that timber lies inside a conservation area, eventually create unsustainable pressure for that land to be cleared for agricultural production. The EMP suggests developing a strategic vision of all changes taking place in the project area, many of which have been catalyzed by the project works. It is suggested that other sources, such as ADB through loan and TA, should work with THPC to develop this understanding, which would harmonize THPC mitigation measures with local implementation of the NRDP and the overall patterns of regional change.

58. THPC has accepted the EMP as proposed and at the time of preparation of the present report is already recruiting its core team of managers. This is a welcome event, and should lead to timely, positive changes in the views of the stakeholders both within and outside the Lao PDR. THPC has also accepted a high degree of international scrutiny of its activities, which should ensure the levels of transparency and accountability now expected in these matters. An example is the posting the 10-year EMP on the ADB website to allow international reviews and comments.¹⁶

J. Performance of the Borrower and the Executing Agency

59. The performance of the Borrower was satisfactory. The performance of the Executing Agency for project implementation, THPC, with respect to financial management and technical project implementation may be considered exemplary. The Project was completed on time, and substantially below the budget. THPC reacted quickly to mitigate the impacts of the Asian economic crisis of 1997. As a result, the Project did not suffer any delays or substantial additional costs. THPC also reacted quickly to the inability of some of its contractors to maintain the original project implementation schedule by proposing adequate measures such as acceleration measures in the main civil works contract and elaborating the supplementary transmission line contract for the foundation works over the limestone ridge. Concerning environmental mitigation measures, THPC was not quite as successful during project implementation. However, it is making up for its initially less successful performance in this respect (paras. 55 - 58).

K. Performance of ADB

60. ADB cooperated well with the Borrower and EdL in formulating the Project and processing the loan. In view of the professional management arranged by THPC during project implementation, ADB follow-up was primarily with respect to environmental and social issues, which was intensified at project completion (para. 54). ADB will continue monitoring environmental and social mitigation measures until they have been completed to its satisfaction.

III. EVALUATION OF INITIAL PERFORMANCE AND BENEFITS

61. In evaluating initial performance and benefits, the financial internal rate of return (FIRR) and the economic internal rate of return (EIRR) determined for the Project considered an implementation period of five years and a project life of 25 years, as stipulated during project appraisal. All benefits and costs are expressed in constant terms. A standard conversion factor

¹⁶ http://www.adb.org/Documents/Profiles/LOAN/theunboun/theun_hinboun_plan.pdf: The Theun-Hinboun Power Company's Mitigation and Compensation Program.

(SCF) of 0.90 was used to convert financial costs of non-tradable items into economic terms.¹⁷ Appendixes 13 and 14 provide the FIRR and EIRR calculations, respectively, and the underlying assumptions are in Appendix 15. The actual and projected financial statements are in Appendix 16.

A. Financial Performance of Theun–Hinboun Power Company

1. Demand Forecast

62. The demand forecast assumed export sales at start of operation in March 1998. The projected sales of electricity to EGAT are based on 95 percent of the net electrical output at the delivery point and the applicable tariff. Maximum electricity generation was based on the estimated water flows after a minimum release of 5 m³/s to Nam Kading. Tariffs were in accord with the PPA between EGAT and EdL. Financial benefits were measured at the tariff in effect in 1998 for sales in the country and at the export price to Thailand of \$0.043 negotiated in 1994, escalated by 3 percent until January 1998 and by 1 percent annually thereafter. In accordance with the PPA, 50 percent electricity sales were in dollars and 50 percent in baht.

2. Capital Costs

63. Capital costs are incurred net of interest during construction, and taxes and duties for this Project have been waived. In the cost estimates, 100 percent of the investment was denominated in foreign currency.

3. Operation and Maintenance

64. The hydropower station is operated by NH under a five-year operation and maintenance agreement, and financial management is carried out by MDX. The Project incurred maintenance costs of about \$3.7 million in 1998, which corresponded to about 1.5 percent of the \$240.2 million capital costs of the Project. During appraisal, the maintenance cost was assumed to be about 2 percent of the appraised capital cost of \$270.0 million.

4. Results of Financial Performance

65. THPC's key financial indicators since the start of operations to date are summarized in Table 1. They show that THPC is profitable and maintains a comfortable debt servicing capacity. The analyses show that the company will earn an average return on equity of about 32.8 percent¹⁸ during the projection years. However, the projected debt-service ratio of 46.5 percent in 2006 is higher than the appraisal ratio of 7.4 during the same year. This was a result of the longer term commercial borrowings that THPC had to resort to during the economic crisis.¹⁹

¹⁷ This SCF was issued in February 1998 for the Lao PDR by ADB's Economics and Development Resource Center, Project Economic Evaluation Division (EDRC).

¹⁸ Net income after income tax 407,647-(17,489+29,317)/10 years /110,000 equity (Appendix 16, pages 1 – 2).

¹⁹ In the Basic Data, C, 2, the actual debt of \$130.2 million is substantially less than the debt of \$160.0 million estimated at appraisal. This is particularly true for the actual commercial loan amount of \$56.2 million compared with the estimated amount of \$81.5 million. On the other hand, in Table 1, the actual and projected debt-equity ratios in 1999 and 2006 are much higher than the appraised ratios in the same years. This apparent inconsistency is due to the following: (i) THPC had to resort to 12-year loans, rather than 10-year loans as assumed at appraisal, which resulted in a reduced debt balance in 2006; (ii) at appraisal it was assumed that earnings were retained, whereas in the projections it was assumed that all earnings were declared as dividends (hence a lower equity position); and (iii) there was an erroneous calculation of the debt-equity ratio during appraisal, where the debt/equity was computed as debt/equity plus liabilities. As a result, the debt-equity ratio computed at appraisal cannot be compared with the present calculations.

Table 1: Financial Highlights

Item	1998 Appraisal	2006 Appraisal	1998 Actual	1999 Actual	2006 Projecte d
Debt-Service Ratio (times)	2.1	3.1	2.0	2.7	3.1
Debt : Equity (%)	53.5	7.4	53.7	108.0	46.5
Return on Equity (%)	33.0	19.6	15.9	15.9	31.2
Current Ratio ^a (times)	1.8	2.8	2.3	2.5	3.6

^a Current assets / current liabilities.

66. The projected financial statements with prior three-year actual statements (Appendix 16) indicate that THPC's financial performance is exceptional. The Project is highly profitable, as net profits are expected to accumulate substantially during the operating years. From 1998 to 2009, total revenues and net income will reach \$736.6 million and \$407.6 million, respectively. Cost of sales and overhead relative to revenues are considered low. After paying shareholders \$393.9 million in dividends over 12 years, THPC will still retain \$13.8 million²⁰ in unappropriated earnings. Shareholders are projected to recover their investment through dividend payments as early as the sixth year of commercial operations. At the end of 12 years,²¹ virtually all debt will have been paid and profitability will depend on tariff negotiations with EGAT and whether EGAT moves to a pooling system.

67. The FIRR analysis (Appendix 13) compared the capital, operation and maintenance costs, and taxes, with the revenues from energy sales. The devaluation of the baht, however, and the impacts of the 1997 Asian economic crisis - resulting in a decrease in energy sales to Thailand - adversely affected export revenues. Despite these circumstances, THPC's financial performance was favorable. THPC's recalculated FIRR is 19.5 percent, compared with 18.7 percent at appraisal. EdL will earn about \$46.4 million (Appendix 14, Income from Investment) between the start of its operations in 1998 until 2000, and is projected to reach about \$28.6 million annually over the projection period ending 2022.

68. The Project's positive performance relative to expectations at appraisal is due to the following: (i) cost underrun of about \$29.8 million²² associated with the capital costs of the Project, (ii) timely commissioning of the Project, and (iii) higher than expected cost savings. The positive project implementation performance has offset the effects of decreased electricity sales resulting from (i) low generation due to low water flows, and (ii) below 95 percent dispatches to EGAT.

B. Economic Performance

69. The economic evaluation was made from the perspective of the Lao PDR economy. Since the Project assumes exporting almost all of its output to Thailand, the economic analysis

²⁰ In the projected statement of income and retained earnings, it was assumed that dividends constituted 75 percent of retained earnings. This is based on dividend payment of almost 75 percent in 1999.

²¹ At the time of the Project Completion Review Mission, the debt amortization schedule of the various loans was not available. The Mission estimates the various debts to be amortized over 12 years.

²² At Fact-Finding, total project cost was estimated at \$280.0 million, but was reduced to \$270.0 million at appraisal. The actual project cost at the end of project implementation was \$240.2 million.

measures as benefits all revenue expected to be received by the country in the form of net profits, royalties, and taxes. The Project's EIRR (Appendix 14) was calculated at 30.8 percent, compared with the 23.6 percent at appraisal. In 1999, the first year of full operations, Government earnings from the Project were \$20.4 million (Table 2), contributing about 1.5 percent of the gross domestic product (GDP) and 6.8 percent of Government expenditure during that year. THPC is expected to contribute to the Lao PDR economy about \$21.2 million (Table 2) in year 2000, increasing to about \$40.9 million in year 2022.²³

Table 2: Government Revenues and Expenditures

Item	1998 Actual	1999 Actual	2000 Projected
Revenues from Project ^a (KN billion)	33.9	126.5	169.8
Revenues from Project ^a (\$ million)	12.6	20.4	21.2
GDP (KN billion)	3,290.0	8,287.0	12,800.0
Project revenues as % of GDP	1.0	1.5	1.3
Government Expenditures (KN billion)	1,068.0	1,837.0	2,539.0
Project revenues as % of Government Expenditures	3.2	6.8	6.7
Exchange Rate (KN / \$)	2,685.0	6,203.0	8,000.0

^a Project revenues consist of income from investment, taxes, and royalty payments that THPC has contributed to the Government.

C. Attainment of Benefits

70. The Project has had a favorable impact on the Lao PDR economy through export of electricity to Thailand and through rural electrification (RE) in the surrounding areas. During the construction period, substantial employment opportunities were available and well used by the population. Some personnel reached a semiskilled level, which improved their opportunities for obtaining work in general. Some permanent jobs for local people in operating and maintaining the plant and other facilities were also created. Lao PDR technical staff received theoretical and practical training within the country and in Sweden, and on-the-job training during implementation and commissioning of the Project. The establishment of a modern school and medical service greatly improved the living conditions in the area. RE, improved access roads, and the possibility to develop irrigation schemes will further improve the livelihood of a larger population.

71. With the substantial funds earned from THPC, EdL subsidizes electricity tariffs for the poor population on a country wide basis and supports its various power generation and distribution projects. Through these subsidies, the Project also enables EdL to ensure equitable distribution of power nationwide. At the end of the project life after 25 years, THPC will transfer the project facilities to EdL.

72. It appears, that the one overarching benefit expected by the impacted villagers is electricity. Upon a request by EdL, provided EdL treats this as an advance against dividends THPC is prepared to provide the required electricity for this purpose. The required RE is to be implemented by EdL, which has included some project impacted areas under a RE project financed by a loan from the World Bank. However, regions outside the World Bank-financed RE

²³ Income from THPC investment in 1999 was about 20 percent of EdL's budget. In 2000, THPC's contribution to EdL's budget will be 26 percent.

project still require about \$0.5 million in additional funds, and THPC is considering advancing these funds from future dividends due to EdL.

IV. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

73. With its timely completion and a cost saving of about \$29.8 million compared to the cost estimate at appraisal the Theun-Hinboun Hydropower Project has been successful. The modern plant operates at high efficiency and with high economic and financial returns. The actual and projected financial performance show that THPC has favorable liquidity, profitability, and leverage position.²⁴ The equity investment is expected to be fully returned within six operating years of the Project. To date, the Project has been highly profitable for both the Lao PDR and the private investors of THPC, and its contribution is expected to continue to promote the macroeconomic stabilization efforts in the country.

74. The Project had an important impact on capacity building in EdL as most of the professional operating staff were acquired from EdL. The staff underwent several years of training under supervision by NH in the Lao PDR and Sweden. Senior EdL staff serve on the board of directors of THPC and are gaining experience on how a private sector organization works. The Government and EdL also received legal advice on preparing and negotiating licensee agreements and PPAs, which benefited the Lao PDR as a whole and not just EdL. Unfortunately, the social and environmental mitigation staff did not receive the benefit of training outside the Lao PDR under the Project. However, EdL and EMCO staff did receive training under a separate ADB-supported TA.²⁵ Although THPC had undertaken a number of mitigation measures, the pace and effectiveness of their implementation have been hampered by lack of a comprehensive mitigation plan. Preparation of the 10-year EMP and THPC's stated strong determination to implement the EMP in full are crucial in remedying the situation.

B. Lessons Learned

75. The Project has been remarkably successful in financing arrangements, project implementation, and coordination between all parties concerned and should serve as an example of how to implement private sector projects that will eventually be turned over to a government.

76. The development of ADB-sponsored hydropower projects, especially transbasin diversions such as Theun-Hinboun, should be done in a regional (e.g., river basin) planning context to fit them into an overall development scenario, thus maximizing beneficial development impacts in the project area while minimizing unintended adverse impacts.

77. During project design, and particularly during implementation of project preparatory TA, sufficient time should be allocated to the preparation of EIAs and EMPs. EIAs and EMPs that are prepared with a relatively low person-month allocations, as in the case of the Project, typically are generic, include little primary information, lack systematic and robust analysis of impacts, frequently jump to conclusions about impacts, and do not justify or describe mitigating

²⁴ Debt/equity position.

²⁵ TA 3133-LAO: Strengthening Social and Environmental Management, for \$950,000, approved on 22 December 1998.

measures in detail. This sets the stage for problems during implementation and operation. To minimize problems, improved tracking of the evolution and disposition of environmental and social recommendations in the EIA and other documents throughout the project design and implementation phases is necessary. This could be done by preparing a checklist that is continuously updated, especially during frequent review missions of adequate duration.

78. Establishing adequate baseline environmental and social conditions and thoroughly analyzing potential impacts during project design are essential. In particular, the baseline data will allow more efficient, accurate, proactive instead of reactive, and cost-effective management of impact mitigation/compensation and monitoring.

79. Establishing an adequately staffed and budgeted environmental management unit (EMU), ready to execute environmental and social mitigation, compensation, and monitoring measures systematically during the design and construction periods, as well as after project completion during normal operations, is essential for complex hydropower projects. This would include regular revision and updating of the EMP, a resettlement and implementation action plan, and similar documents to ensure that they remain valid and adapt to changing conditions throughout the construction period and beyond. It may also be advisable to retain the services of an expert panel, NGO, or another third party to regularly monitor and guide the EMU. In countries with limited indigenous capacity for environmental management, special measures, such as retaining recognized experts, including a fishery expert, for periodic trouble-shooting during project preparation, design, and construction, may be particularly useful.

80. The EMU should work with the project-affected communities in a participatory manner, not intermediaries. Its activities should be undertaken in a transparent manner, and outputs made available to all stakeholders and the public at large. This should include regular environmental reporting to a level of detail and clarity that allows outside reviewers to track the actual progress made in mitigation, compensation, and monitoring.

C. Recommendations

1. Project Related

81. **Future Monitoring.** Presently, with the technical and financial management being assured by MDX and NH, daily operations run properly. Careful monitoring by ADB is advisable of the environmental and social impacts that will continue to evolve over the next 10 years. ADB should consider undertaking annual reviews at least over the next 2-3 years in addition to considering other measures relating to possible ADB support as presented in the 10-year EMP.

82. **Covenants.** With the exception of the environmental covenants, all covenants have been fulfilled. An EMP has now been completed (para. 55) and it is of utmost importance that the recommendations of the EMP be executed with the full support of THPC.

83. **Follow-up Actions.** While overall success has been achieved, it is proposed that a gradual shift in the administrative and technical management be undertaken for eventual transfer of the Project to the Government. Persistent efforts should be made to allow EdL to increase its power generation and transmission capacity through resources generated by the Project.

84. It is recommended that, at the expiration of the contracts with MDX and NH in March 2001 and December 2002, respectively, the financial administration and technical management be put to public tendering. It is furthermore suggested that Lao PDR personnel be more

involved in these activities to ensure transfer of technology. It is expected that THPC will advance the funds required for RE in the vicinity of the Project from future dividends due to EdL.

85. It is important that the EMP be actually executed by THPC as agreed upon. It is recommended that ADB carefully monitor the performance of THPC in this respect as it may serve as an excellent example of a systematic mitigation effort in a river diversion scheme in a developing country.

86. **Additional Assistance.** The Project has been implemented and is operating to the full satisfaction of its owners. Therefore, besides possible assistance associated with the EMP, no further additional assistance is required.

87. **Timing of Project Performance Audit Report.** A project performance audit report should be prepared only when all the environmental and social mitigation measures foreseen in the EMP have commenced and are being implemented to the satisfaction of ADB and the owners of THPC. It is expected that this might be the case in 2-3 years.

2. General

88. **Project Appraisal.** During project appraisal, implementation was possibly evaluated too optimistically. The lack of engineering, environmental, and social evaluation capacity in a country like the Lao PDR might have been taken more into consideration.

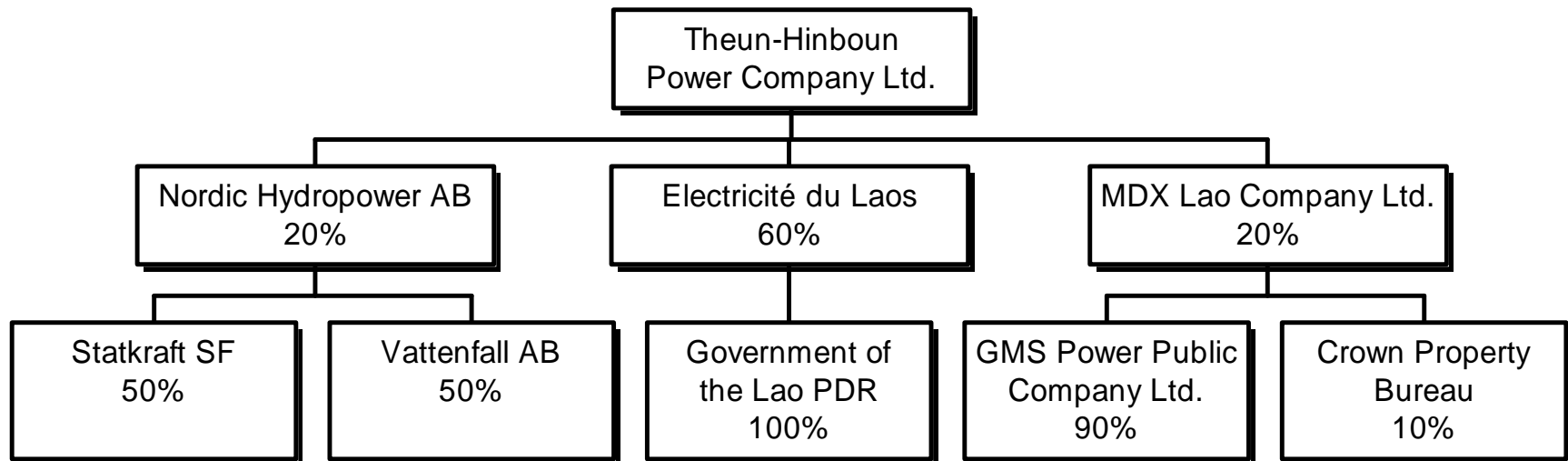
89. **Project Implementation.** It may be safely assumed, that would the Project, when facing the various major difficulties during implementation as described in the report, have been a public sector project and administered as is customary for such projects, it might still be under construction today. Due to the very proactive and innovative approach by THPC when these difficulties had to be overcome, the Project has been completed more or less within its original schedule and at cost savings of \$29.8 million. As such, it has become a good example of how a Project should be implemented under adverse conditions from the technical, managerial, and financial points of view.

90. **Future Projects.** It is recommended that for future projects, the income distribution effects of royalties, dividends, and taxes accruing to the Government from hydropower plants be analyzed from a social perspective, including poverty reduction impacts.

APPENDIXES

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OWNERSHIP STRUCTURE OF THEUN-HINBOUN POWER COMPANY



PUBLIC ACCESS ROADS

A. Construction of New Road No. 8

1. The 51 kilometer long new Road No. 8 branching-off from Road No. 13 at Ban Lao past the powerhouse area¹ and uphill Phou Hai was still under construction and partly in a very bad condition when construction works Contract C1 started in November 1994. Road No. 8 Construction Company Ltd., which was in charge of the road construction, had the necessary modern construction equipment at its disposal. However, the repair of damages that occurred in the previous rainy season and the works to complete the road proceeded very slowly due to the company's lack of funds to cover construction materials and fuel. To hasten the progress of the works and ensure serviceability of the road during the coming rainy season in 1994/95, Theun-Hinboun Power Company (THPC) extended financial and technical support for Road No. 8. By the onset of the rainy season, improvement of the problem stretches of the road had advanced far enough to allow undisturbed traffic during the rainy season except for short interruptions caused by local flooding and a few mud slides from the cuts on the section uphill from the powerhouse.

2. The new bridge across Nam Theun at Ban Thabak opened to regular traffic in October 1995. THPC continued its financial support during the 1995/96 dry season as a loan, later converted into a grant and included in the project costs, to enable the construction company to complete the bituminous surface nearly all the way from Ban Lao to the powerhouse by the end of May 1996. In certain periods, however, heavy transports to the site were obstructed by detours made worse by rain.

B. Reconstruction of Road No. 13

3. Road No. 13 from Pakxan to Thakhek was in the middle of complete reconstruction when construction works started for the Project in late 1994. Road reconstruction proceeded through the dry seasons 1994/95 and 1995/96. A number of detours south and north of Ban Lao hampered traffic to the site from both Vientiane and Thakhek during this period. As a result, an alternative ferry service across the Mekong was established at Ban Bounkouang to minimize transport along Road No. 13.

4. As part of the reconstruction program, new bridges with 80-ton load capacity were constructed to replace all old low-capacity bridges between Vientiane and Thakhek. This work proceeded faster than was foreseen in 1994 and all bridges between Vientiane and Ban Lao were completed in early 1996, just in time to allow the heaviest electromechanical items to be transported across Friendship Bridge at Ban Thaddeua and further along Road No. 13 and Road No. 8 to the site, thus avoiding the more risky route across the Mekong by ferry.

¹ The address of the Project is "km 43, Road No. 8, Khammouan Province".

CIVIL WORKS, INCLUDING HYDRAULIC STEELWORKS

1. The most serious problem in the performance of the civil works contractor was his slow mobilization and its impact on the works during the first 10 months after the assignment of the contract. This unfortunate situation appeared to be primarily due to inadequate mobilization of equipment and human resources right from the start, to poorly qualified project management of the contractor: his lack of experience in the Southeast Asian market, limited availability of local skilled labor, financial constraints, and inadequate planning of the works. As a result, (i) intermediate milestones were not met and liquidated damages started to accumulate; (ii) the contractor had to mobilize substantial additional equipment and personnel to be able to recover time lost, which increased his costs; and (iii) the work program for the weir site, the powerhouse building, and penstock excavation, which was scheduled in the dry seasons only, had to be extended through the rainy seasons at higher risks and costs to the contractor. Although the contractor gradually strengthened his site organization during the first months of 1996, it was only when he replaced his project manager in March 1996 and presented his first realistic work program of a professional standard in late May 1996 that the situation improved.
2. By mid-1996 it became evident that liquidated damages for unachieved intermediate milestones would soon accumulate to the maximum limit of 10 percent of the contract price, as stipulated in the contract, and that the contractor from that point onward should plan implementation of the works with the aim of minimizing further losses. This most probably would have resulted in a serious delay in the completion date. Theun-Hinboun Power Company (THPC) considered either (i) terminating the contract, or (ii) starting negotiations with the contractor for an incentive package so as to recover lost time and be able to achieve the 31 March 1998 date of commercial operation assumed in the Power Purchase Agreement (PPA). THPC decided to follow the latter option and, subsequently, a supplementary agreement to Contract C2: Civil Works, was negotiated and signed in December 1996.
3. The supplementary agreement provided (i) compensation for all presented and potential claims from the contractor up to the date of signing, (ii) certain provisions for financial support, (iii) an incentive package releasing the contractor from the already accumulated liquidated damages, (iv) an additional bonus amount depending on his achieving a number of revised intermediate milestones, and (v) an ultimate milestone for the plant ready for operation. As a consequence of signing this supplementary agreement, the contractor achieved all the important milestones, including the start date for commercial operations as stipulated in the PPA.
4. The very tight work program in May 1996, based on continuous activity on most sites during the rainy season, was open to unforeseen events. The most serious problems that faced the contractor after May 1996 were (i) overtopping of the damsite cofferdams, which, occurring three times during the 1996 wet season, interrupted the works for weeks and damaged some equipment; (ii) periodic shortages in the supply of construction materials, especially cement and reinforcement, which appeared mainly to be a financial problem, and also a problem of logistics since several transporters were reluctant to use Road No. 8; (iii) road conditions and restricted access to certain works as a result of torrential rainfall, flooding, and landslides; (iv) collapse of the entrance to the intermediate construction adit in August 1996; (v) buckling of one section of the steel lining in the penstock tunnel during concreting in May 1997; (vi) slow supply and erection works of the hydraulic steelworks subcontractor; and (vii) slow progress in painting the penstock. After the supplementary agreement became effective, the contractor completed his works in an efficient and professional manner.

230 kV TRANSMISSION LINE

1. The problems encountered by the transmission line contractor during construction were mainly due to his inadequate mobilization of the necessary equipment and planning and, to some extent, his lack of financial resources. Another difficulty was due to a number of unexploded ordnance encountered in the survey work in Nam Hai valley in May 1995. This discovery was inconvenient for the contractor, but it was resolved through shifting his resources to the other side of the limestone ridge until the area was cleared. He therefore did not lose any time. For the works on the limestone ridge, the serious delay was mainly due to lack of work experience under similar conditions. The result was that the work, which if properly planned with sufficient resources and carried out in a professional way could have been performed under favorable conditions in the dry seasons, was extended inefficiently through three rainy seasons with reduced outcome and at additional costs to the contractor.

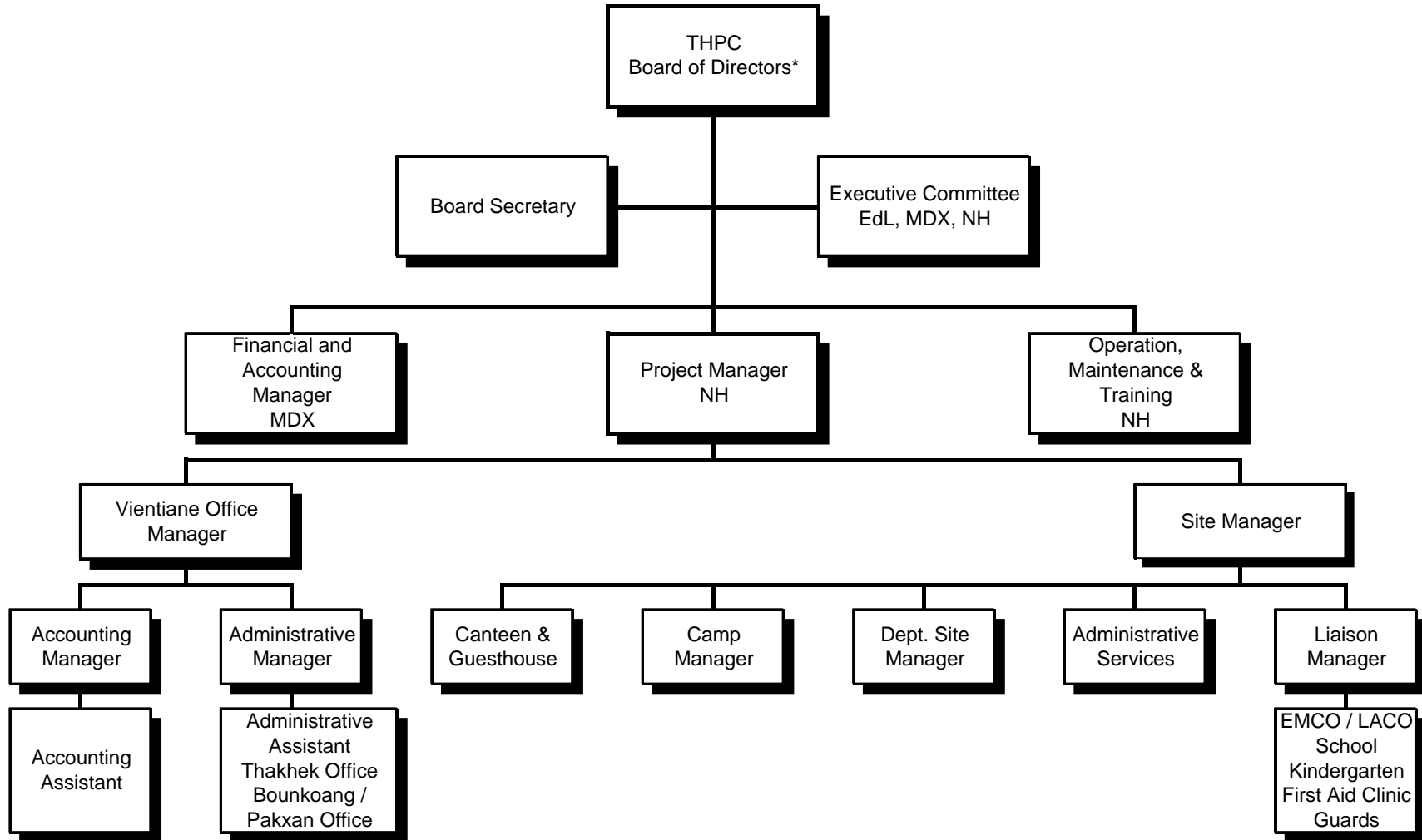
2. The contractor's resurvey across the limestone ridge scheduled before the rainy season in 1995 was not completed before February 1996. The resurvey necessitated correction of the alignment shown on the tender drawings and increasing the number of towers on the ridge from six to eight. The contractor was very reluctant to proceed with the works on the ridge, insisting the work was "impossible" and claiming "not foreseeable physical obstructions." He then started, on his own account, a survey of an alternative 18 kilometer longer route from the Nam Hai valley through the Nam Hinboun gorge and further along Nam Hinboun toward Ban Hinboun. The Engineer, however, rejected the alternative route as it required multiple river crossings with narrow gorges subject to slides and did not meet the technical specifications. The Engineer thus urged the contractor to start the work on the ridge crossing. By the end of 1996, it became clear that the contractor would not be able to perform the work across the ridge without support from others. THPC decided to invite new contractors to bid for the foundation work across the ridge. In April 1997, the T2 Contract for foundations for four towers, with option for two or four more, was signed. Foundation works for all tower sites on the ridge were completed in August/September 1997.

3. Progress of work on the flatland suffered as well for various reasons. Unsatisfactory housing caused very high rates of malaria among the crews during the rainy seasons. Because of that, and combined with poor planning, foundations for six towers on the northern section between Nam Hinboun and the limestone ridge, and for four towers in a swampy area in Pathen Valley had to be constructed under difficult circumstances during flood periods in 1997. The works on the northern section were completed only after assistance by the T2 contractor.

4. Caused by breach of approved stringing procedures, two accidents occurred during stringing across the limestone ridge section. Parts of the pulling equipment broke, and twice one of the phase conductors fell down and was destroyed. This caused a critical lack of spare conductors, and one drum required to complete the work was brought in by air freight from Norway within two weeks. The contractor eventually supplied new spares from Thailand.

5. Despite lack of progress by the T1 Contractor, the transmission line was completed in time for energizing by the end of December 1997 because THPC mobilized the T2 Contractor at the right moment. The 1997 date was six months later than the contractual schedule, but it permitted the T1 Contractor to comply with the revised overall implementation schedule based on the program of the Power Purchase Agreement.

THEUN-HINBOUN POWER COMPANY (THPC) ORGANIZATION CHART



* During Construction Period up to 24 August 1997, thereafter General Manager
 EdL = Electricité du Laos, EMCO = Environmental Management Committee Office, LACO = Labor Committee Office , MDX = MDX Lao Public Company Ltd.,
 NH = Nordic Hydropower AB.

FINAL IMPLEMENTATION COSTS
Table A6.1: Summary of Final Implementation Costs

DESCRIPTION	AMOUNT (\$)
Preparatory Costs	
- Feasibility Study	1,986,960
- Final design and tender documents	5,468,750
Implementation Costs	
- CONTRACT C1, Preparatory Civil Works Contractor: Joint Venture Vianini Lavori - Vianini Thai.	12,741,869
- CONTRACT C2, Civil Works Contractor: Recchi CMC Joint Venture	63,927,936
- NOMINATED SUBCONTRACT H1, Hydraulic Steelworks Contractor: ATB Caldereira SpA	19,089,303
- CONTRACT M1, Mechanical Works Contractor: Kvaerner Energy A.S.	13,645,880
- CONTRACT E1, Electrical Works Contractor: ABB Generation AB	36,712,740
- CONTRACT T1, 230 kV - Transmission Line Contractor: TEDA Company	12,723,491
- CONTRACT T2, 230 kV-Transmission Line Contractor: John Holland Lao	3,038,661
Subtotal	161,879,879
- CONTRACT A1, Project Management Nordic Hydropower AB (Statkraft SF)	2,591,060
- CONTRACT A2, Consulting Services Norconsult International A.S.	11,529,652
- CONTRACT A3, Operation, Maintenance and Training Nordic Hydropower AB (Vattenfall AB)	2,914,886
- CONTRACT A4, Financial Management Services GMS	80,894
Subtotal	17,116,492
- Pre-Operational Expenses	17,009,053
- LACR Land Acquisition, Compensation, and Reclamation	1,921,533
- Financial Costs	20,180,439
- Financial Allocation	
Reserves - Depth Service, Revenue and Amortization	11,227,905
Reserves - O&M	2,500,000
Other Reserves	950,875
Subtotal	14,678,781
Total	240,241,888

Table A6.2: Breakdown of Final Implementation Costs

CONTRACT C1, Preparatory Civil Works
Contractor: Joint Venture Vianini Lavori - Vianini Thai.

Bill no.	Description	Amount (\$)
1	Preliminary and general	1,320,340
2	Powerhouse	395,101
3	Damsite	217,516
4	Access road to powerhouse	79,368
5	Access road to damsite	1,872,639
6	Access road to tunnel adits	405,899
7	Operators' village	4,143,442
8	Dayworks	40,824
	Subtotal	8,475,129
Variation Orders (VO)		
		Baht
VO C1/1	Foundation work in powerhouse	37,390,265
VO C1/2	Additional equipment for secant pile wall	5,175,000
VO C1/3	Additional exploratory drilling work	467,001
VO C1/4	Power supply to employer's temporary camp & fuel supply	22,014
VO C1/6	Supply of stand-pipe piezometers	52,900
VO C1/7 & 10	Delivery and installation of television antenna network	1,684,849
VO C1/8 & 9	Foundation works for temporary bridge at dam site	281,172
VO C1/11	Increased bitumen on roads and parking areas	3,972
VO C1/12	Supply water treatment for operators village	139,311
VO C1/13	Miscellaneous material supply to THPC	13,498
		Baht 44,303,013
		Equivalent in \$ 1,752,049
	Subtotal	926,966
		2,679,015
Additional Costs		
	Settlement of claims dated 05.03.96	1,300,000
	Water supply C1/L1-2-3	97,724
	Water supply agreement dated 03.07.98	190,000
	Subtotal	1,587,724
	Total	12,741,869

Table A6.2: Breakdown of Final Implementation Costs (Cont'd.)

CONTRACT C2, Civil Works
Contractor: Recchi CMC Joint Venture

Bill No.	Description	Amount (\$)	
1	Preliminary and general	12,791,947	
2	Roadworks	1,056,013	
3	Dam and intake	8,492,994	
4	Tunnels	11,755,857	
5	Penstock in trench	3,352,319	
6	Powerhouse	5,912,631	
7	Switchyard service building	503,234	
8	Tailrace canal	5,502,829	
9	Other works	386,986	
10	Dayworks	793,798	
11	Hydraulic steelworks	2,386,375	
	Subtotal	<u>52,934,983</u>	52,934,983
Variation Orders (VO)			
VO C2/1	Preassembling area for penstock	45,595	
VO C2/3	Generator building	30,000	
	Subtotal	<u>75,595</u>	75,595
Additional Costs			
	Claims no. 16, 12 and 22	140,000	
	Supl. agreement, claims settlement	2,000,000	
	Supplemental agreement	4,930,000	
	Price adjustment	1,836,616	
	Interest on late payment	10,742	
	Reserve	2,000,000	
	Subtotal	<u>10,917,358</u>	10,917,358
	Total	<u>63,927,936</u>	63,927,936

Table A6.2: Breakdown of Final Implementation Costs (Cont'd.)

NOMINATED SUBCONTRACT H1, Hydraulic Steelworks

Contractor: ATB Caldereira SpA

Item No.	Description	Amount (\$)	
1 (A)	Trash racks / trash rake	861,020	
(B)		59,710	
2 (A)	Intake gates	676,100	
(B)		104,230	
3 (A)	Radial gates	1,924,570	
(B)		342,860	
4 (A)	Flap gate	164,750	
(B)		18,740	
5 (A)	Rubber gates	2,230,890	
(B)		108,350	
6 (A)	Sand flushing gates	1,463,260	
(B)		180,470	
7 (A)	Water level gauging	90,310	
(B)		10,650	
8 (A)	Draft tube gates	380,760	
(B)		40,040	
9 (A)	Penstock / steel lining	4,473,990	
(B)		4,703,290	
11 (A)	Dam and Intake cranes	497,920	
(B)		46,450	
12 (A)	Hydraulic units / control equipment	444,230	
(B)		27,410	
	Subtotal		18,850,000
<p>(A) Detailed engineering, manufacturing, shop testing and free on board delivery. (B) Insurance, transportation, erection, installation, site tests, and commissioning.</p>			
Variation Orders (VO)			
VO H1/1	Item 9: Variation of penstock length	(35,620)	
VO H1/3	Item 6: Position indicators for sand flushing gates	125,000	
VO H1/4	Sliding gate in reregulating pond	66,000	
	Subtotal		155,380
Additional Costs			
27.01.98	Adjustment of dam design and other supply items.	39,000	
16.03.98	Additional works: davit, hoist covers, rails, stoppers	18,000	
16.03.98	Modify intake gate control system	10,775	
16.03.98	Reduction for painted radial gate hydraulic brackets	(5,000)	
12.06.98	Interest on late payment	21,147	
	Subtotal		83,922
	Total		19,089,303

Table A6.2: Breakdown of Final Implementation Costs (Cont'd.)

CONTRACT M1, Mechanical Works
Contractor: Kvaerner Energy A.S.

Item No.	Description	Amount (\$)	
3.1 (a)	Turbines	5,612,627	
3.1 (b)		1,439,601	
3.2 (a)	Governors	739,081	
3.2 (b)		299,125	
3.3 (a)	Inlet valves	2,735,656	
3.3 (b)		212,490	
3.4 (a)	Cooling water equipment	774,512	
3.4 (b)		556,657	
3.5 (a)	Drain water equipment	136,881	
3.5 (b)		165,535	
3.6 (a)	Workshop equipment	124,473	
3.6 (b)		73,362	
	Subtotal	12,870,000	12,870,000
<p>(a) Detailed engineering, manufacturing, shop testing, and free on board delivery. (b) Insurance, transportation, erection, installation, site tests, and commissioning.</p>			
Variation Orders (VO)			
VO M1/1	Item 3.3: Adjustments of locking mechanism	(2,935)	
VO M1/2	Payment for revision of work program	500,000	
VO M1/3	Item 3.3: Additional spare parts	14,834	
VO M1/4	Direct acceleration cost + bonus	100,000	
	Subtotal	611,899	611,899
Additional Costs			
S.S. M1/9	Delayed erection of draft tubes and inlet pipes	29,632	
S.S. M1/13	Additional shipping requirements	43,522	
S.S. M1/20	Kinetico, lime removal filter	4,821	
fax 30.10.97	Drain pumps, price reduction	(10,000)	
S.S. M1/22	Delayed start-up of spiral casing erection	17,403	
S.S. M1/25	Hydropower performance monitoring system	44,829	
	Prolonged erection period	20,774	
	Reserve	13,000	
	Subtotal	163,981	163,981
	Total		13,645,880

Table A6.2: Breakdown of Final Implementation Costs (Cont'd.)

CONTRACT E1, Electrical Works		
Contractor: ABB Generation AB		
Item No.	Description	Amount (\$)
C2.2	Generators	8,887,481
C2.3	Transformers etc.	5,025,969
C2.4	230 kV switchgear	4,939,100
C2.5	22 kV switchgear	2,117,303
C2.6	Station supply	1,625,684
C2.7	Control and protection	2,991,716
C2.8	Cables	1,675,323
C2.9	Main earthing	512,620
C2.10	22 kV transmission line	674,902
C2.11	Lighting, etc.	690,176
C2.12	Fire alarm system	272,061
C2.13	Cranes	1,950,248
C2.15	Telecommunication	937,417
	Subtotal	32,300,000
Variation Orders (VO)		
VO E1/1	Increase of the generator design runaway speed	18,952
VO E1/2	Changes to local supply Transformer T3	93,400
VO E1/3	Additional energy metering equipment and protection relays	114,037
VO E1/4	Upgrading of the powerhouse station supply system	87,340
VO E1/5	Optical fiber cable communication system	273,304
VO E1/6	Additional telephone, tailwater, and lighting equipment	37,254
VO E1/7	Preparation of civil information drawings for Thakhek S/S	24,260
VO E1/8	Extension of switchgear and auxiliary equipment in Thakhek S/S	2,373,740
VO E1/9	Adjusted milestones	500,000
VO E1/10	Additional PLC communication equipment	510,000
VO E1/11	Spare parts for the PLC communication system	28,000
VO E1/12	Supply and installation of additional cable ladders	20,594
VO E1/13	Program for calculation of forgone net electric output	20,725
VO E1/14	Rescheduled program for tests on completion for the E1 Contract	225,000
VO E1/15	Omission of fireproof paint on cables	(2,683)
VO E1/16	Delivery and installation of warning sirens at the dam and tailrace area	8,410
VO E1/17	Additional water level sensors	11,140
VO E1/18	Add. spare parts for 22 kV Transm. line and software prog.(HPC-IMS/SQL)	12,580
VO E1/19	Spare parts for Thakhek and credit for telephone cables	5,430
	Subtotal	4,361,483
Additional Costs		
	Interest on late payment	119,118
	Extended shipping requirements	43,155
	Compensation for transformer losses	(111,016)
	Subtotal	51,257
	Total	36,712,740

Table A6.2: Breakdown of Final Implementation Costs (Cont'd)

**CONTRACT T1, 230 kV - Transmission Line
Contractor: TEDA Company**

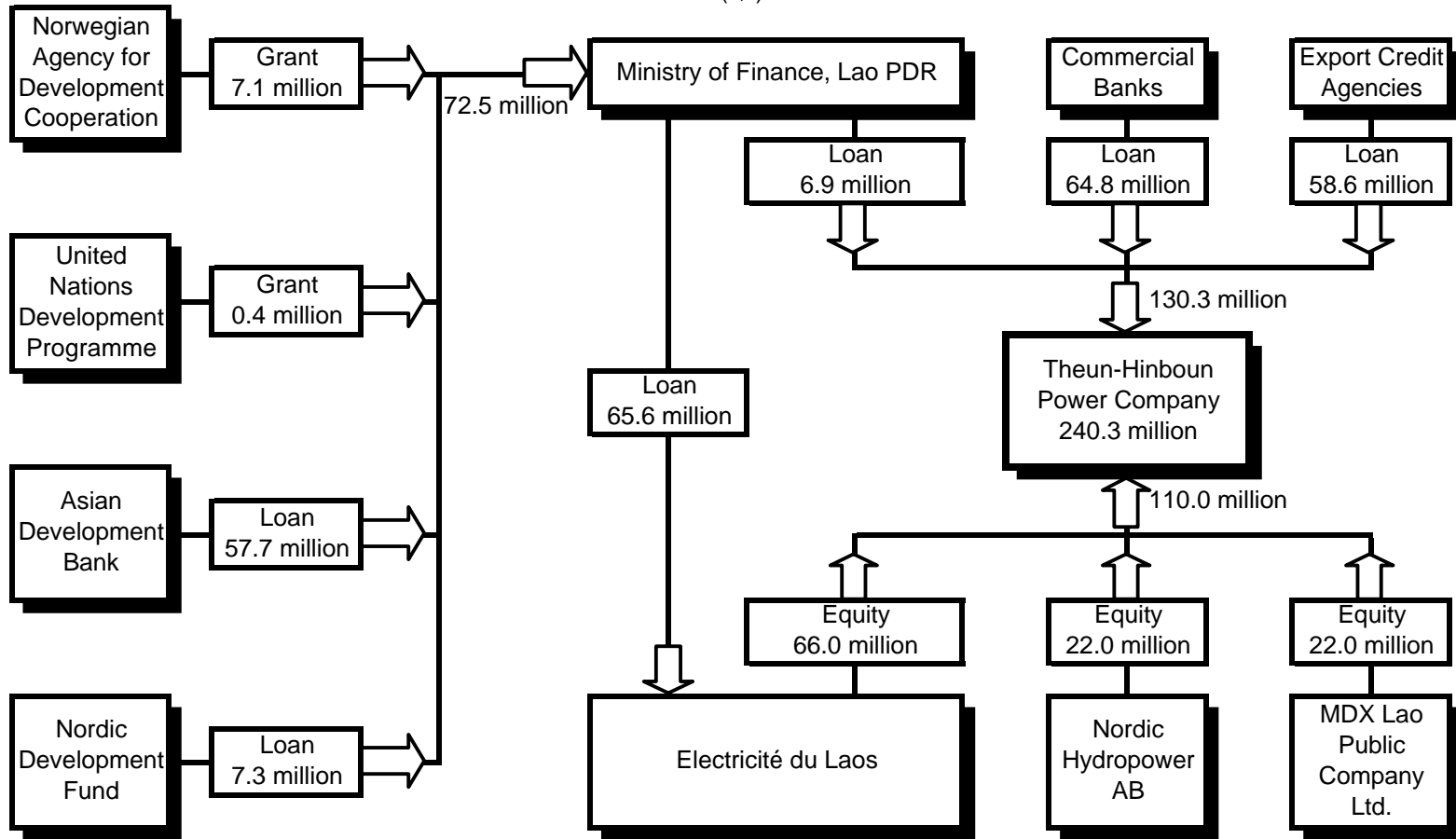
Item No.	Description	Amount (\$)
Part I: Theun Hinboun-Thakhek		
1	Temporary and general	-
2	Preliminary work	295,011
3	Foundations	2,546,829
4	Foundation testing	-
5	Tower design	15,000
6	Towers	3,643,480
7	Tower tests	-
8	Earthing	139,983
9	Insulator strings	678,279
10	Conductors and earth wire	3,706,249
11	Dayworks	970,088
12	Spare parts and tools	459,499
13	Thakhek Switching Station	1,234,874
	Subtotal	13,689,292
Part II: Mekong Crossing		
1	Temporary and general	-
2	Preliminary work	6,450
3	Foundations	91,989
4	Towers	132,480
5	Earthing devices	4,810
6	Insulator strings	-
7	Conductors and earth wire	-
8	Dayworks	-
9	Spare parts and tools	58,471
	Subtotal	294,200
Total Accrued Contract T1		13,983,492
Less: Liquidated Damage		-1,260,000
Total		12,723,492

Table A6.2: Breakdown of Final Implementation Costs (Cont'd.)

CONTRACT T2, 230 kV-Transmission Line
Contractor: John Holland Lao

Item No.	Description	Amount (\$)	
1	Mobilization	108,966	
2	Personnel	385,700	
3	Plant and equipment	347,976	
4	Materials, etc.		
4.1	Helicopter charter	703,267	
4.2	Materials, consumables	150,730	
4.3	Hired in plant	18,690	
4.4	Subcontractor	98,431	
4.5	Others	19,161	
	Overhead & profit	274,938	
	Corporate overheads	63,236	
	Share of cost savings	389,453	
	Subtotal	2,560,547	2,560,547
Variation Orders (VO)			
T2 VO1	Reestablishment of access to Tower no. 200		
	VO1-1	52,665	
	VO1-2	93,348	
	VO1-3	21,528	
	T2/9	57,531	
	T2/12	114,792	
		339,865	
T2 VO2	Footpath access limestone ridge	116,593	
	Subtotal		456,457
Additional Costs			
01.06.98	Interest on late payment	21,657	
	Subtotal		21,657
	Total		3,038,661

FINANCIAL STRUCTURE OF THEUN-HINBOUN POWER COMPANY (\$)



CURRENCY EXCHANGE RATES, 1994 - 2000
(KN / \$)

Month	1994	1995	1996	1997	1998	1999	2000
Jan	718.00	720.00	925.00	970.00	2538.00	4339.00	7470
Feb	718.00	720.00	925.00	970.00	2437.00	4428.00	7480
Mar	718.00	725.00	925.00	1010.00	2421.00	5330.00	
Apr	718.00	725.00	925.00	1018.00	2470.00	6680.00	
May	718.00	745.00	927.00	1018.00	3232.00	7640.00	
Jun	718.00	782.00	927.00	1078.00	3420.00	9390.00	
Jul	718.00	782.00	927.00	1171.00	3562.00	9300.00	
Aug	718.00	920.00	927.00	1300.00	3790.00	5800.00	
Sep	718.00	923.00	927.00	1450.00	4130.00	6710.00	
Oct	720.00	925.00	927.00	1746.00	4180.00	6710.00	
Nov	720.00	925.00	942.00	1814.00	4165.00	7605.00	
Dec	720.00	925.00	952.00	2130.00	4239.00	7605.00	

CHRONOLOGY OF MAJOR EVENTS

Date	Event
1993	
17-20 Feb	- ADB Consultation Mission was fielded in the Lao People's Democratic Republic (PDR), to discuss with the Government various options available for financing the project.
4 Jun	- Memorandum of Understanding (MOU) was signed between Government of Thailand and Government of the Lao PDR on development of 1,500 MW by year 2000.
23 Jun	- MOU for the joint venture company was signed between the Government of the Lao PDR, Nordic Hydropower AB, and MDX Public Company Ltd.
24-26 Aug	- ADB Mission visited the Lao PDR to assist the Government in holding the first meeting of the Steering Committee set up to expedite implementation arrangements for the Project. The main objective of the meeting was to review the progress made on the Project since signing of the MOU and allocate specific responsibilities and a time frame for future work.
8-11 Nov	- The second Steering Committee Meeting was held in Thailand.
1994	
4 Jan	- ADB approved a small-scale advisory technical assistance in the amount of \$100,000 for a legal adviser to assist the Government in structuring the legal agreements.
7 Apr	- MOU on the 25-year power purchase agreement between Thailand and the joint-venture partners was signed.
14-16 Apr	- The Steering Committee Meeting was held in the Lao PDR.
24 Jun	- ADB's management review meeting was held and advance procurement action for Contract C2: Civil Works and retroactive financing for 10 percent of the value of the contract were approved.
28 Jun	- Prequalification of contractors for Contract C2: Civil Works was advertised.
30 Jun-12 Jul	- The Appraisal Mission was fielded.
1 Jul	- Tender documents for Contract C1: Preparatory Civil Works were issued.
15 Jul	- MOU between Theun-Hinboun Power Company (THPC) sponsors and Electricity Generating Authority of Thailand (EGAT) on commercial terms of power purchase agreement was executed.
29 Jul	- Tender documents for Contract M1: Mechanical Works were issued.

Date	Event
31 Aug	- ADB's Staff Review Committee meeting was held.
2-15 Sep	- The last Steering Committee Meeting was held in Oslo, Norway.
5 Sep	- Tender bids opening for Contract C1: Preparatory Civil Works.
19-21 Sep	- Loan negotiations were held at ADB headquarters in Manila.
13 Oct	- Shareholders Agreement, Articles of Association and Project Authorization, and License Agreement were executed.
15 Oct	- Tender documents for Contracts E1: Electrical Works and T1: 230 kV Transmission Line were issued.
15 Oct	- Deadline for submission of application for prequalification for Contract C2: Civil Works.
31 Oct	- Tender bids opening for Contract M1: Mechanical Works.
1 Nov	- Contract for C1: Preparatory Civil Works, was awarded and notice to commence was issued.
8 Nov	- ADB approved Theun-Hinboun Hydropower Project for SDR40.853 million (\$60.0 million equivalent).
1 Dec	- The Loan Agreement between ADB and the Government of the Lao PDR and the Project Agreement between ADB and THPC were signed.
6-7 Dec	- The first meeting of THPC's Board of Directors was held.
7 Dec	- Contract C1: Preparatory Civil Works and Agreements A1: Project Management and A2: Consulting Services were signed.
19 Dec	- Tender documents for C2: Civil Works and H1: Hydraulic Steelworks were issued.
1995	
23 Jan	- Tender bids opening for Contract T1: 230 kV Transmission Line.
2 Feb	- Contract M1: Mechanical Works was awarded.
15 Feb	- Tender bids opening for Contract E1: Electrical Works.
15 Mar	- Contract T1: 230 kV Transmission Line was awarded.
20 Mar	- Tender bids opening for Contract H1: Hydraulic Steelworks.
29 Mar	- The request to extend the loan effectiveness date from 31 March 1995 to 30 June 1995 was approved.
29 Mar	- Contract M1: Mechanical Works was signed.
20 Apr	- Tender bids opening for Contract C2: Civil Works.
5 May	- Foundation stone ceremony
25 May	- Contracts E1: Electrical Works and H1: Hydraulic Steelworks were

Date	Event
	awarded.
2 Jun	- Contract T1: 230 kV Transmission Line was signed.
21-24 Jun	- ADB Reconnaissance Mission was fielded and visited Thailand and the Lao PDR to assist the Government in forming a joint-venture company with two private sector partners.
26 Jul	- Contract C2: Civil Works was awarded.
14 Sep	- Contracts C2: Civil Works and H1: Hydraulic Steelworks were signed.
13 Nov	- Nordic Development Fund approved a loan of SDR5.0 million (\$7.3 million equivalent) for project implementation consultant.
1996	
5 Jan	- The second request for extension of loan effectiveness from 28 December 1995 to 31 March 1996 was approved.
19 Jan	- The loan was declared effective.
14 Dec	- Agreement A3: Operation, Maintenance and Training was signed.
1997	
31 Dec	- Transmission line was energized.
1998	
18 Jan	- First power was exported to EGAT.
31 Mar	- The Project started commercial operation.
4 Apr	- The Project was officially inaugurated.
15 Jul	- Agreement A4: Financial Management Services was signed.
14 Oct	- Loan 1329-LAO(SF) was closed with a net loan amount of SDR40,846,656.36.

COMPLIANCE WITH MAJOR LOAN COVENANTS

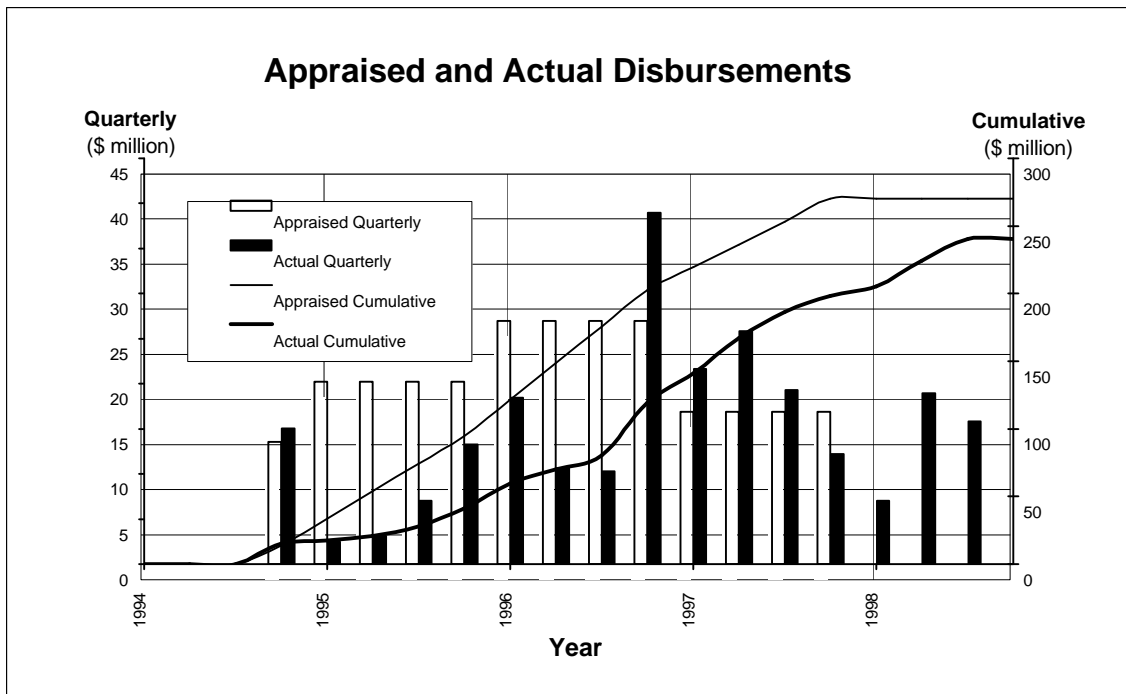
Covenant	Reference	Remarks
1. The Borrower will, in consultation with ADB prepare, or cause to be prepared, a post-construction environmental audit of the Project, including a study of the Project's impact on downstream fisheries. The Borrower will ensure that appropriate measures are undertaken to mitigate any negative environmental impact the Project may have on such fisheries.	LA, Schedule 5, para. 4	An Environmental Audit Report of the Project was prepared. The report on fisheries still requires recommendations for actions to be taken.
2. The Borrower will implement, or cause to be implemented, an environmental management program for the Project-affected area satisfactory to ADB, which includes measures for (i) environmental protection; (ii) site rehabilitation; (iii) management of protected areas; (iv) fishery management; (v) compensation of local residents; (vi) community safety, health and education; (vii) worker health and safety; and (viii) monitoring.	LA, Schedule 5, para. 5	Under implementation.
3. Theun-Hinboun Power Company will submit quarterly reports to the Asian Development Bank.	PA, Section 2.08 (b)	Complied with
4. Three months after physical completion of the Project, THPC will submit a project completion report to ADB.	PA, Section 2.08 (c)	Complied with
5. THPC will submit audited financial statements within six months after the end of the fiscal year.	PA, Section 2.09 (a)	Complied with

LA = Loan Agreement, PA = Project Agreement.

APPRAISED AND ACTUAL DISBURSEMENTS
(\$ million)

Year	Quarter	Appraised		Actual	
		Quarterly	Cumulative	Quarterly	Cumulative
1994	I				
	II				
	III				
	IV	13.5	13.5	15.1	15.1
1995	I	20.3	33.8	2.5	17.6
	II	20.3	54.0	3.2	20.7
	III	20.3	74.3	7.0	27.7
	IV	20.3	94.6	13.3	41.0
1996	I	27.0	121.5	18.4	59.5
	II	27.0	148.5	10.6	70.1
	III	27.0	175.5	10.3	80.4
	IV	27.0	202.5	39.0	119.4
1997	I	16.9	219.4	21.7	141.0
	II	16.9	236.3	25.9	166.9
	III	16.9	253.1	19.3	186.2
	IV	16.9	270.0	12.2	198.5
1998	I		270.0	7.0	205.5
	II		270.0	18.9	224.4
	III		270.0	15.8	240.2
	IV		270.0		240.2
Total		270.0		240.2	

Source: Asian Development Bank



FINANCIAL INTERNAL RATE OF RETURN
(\$ million)

Year	Costs			Benefits				Net Cash Flow
	Project ^a	O&M ^b	Total	Foreign Sales		Local Sales		
				Energy Sold (GWh)	Gross Benefits ^c	Energy Sold (GWh)	Gross Benefits ^d	
1994	41.06		(41.06)					(41.06)
1995	14.95		(14.95)					(14.95)
1996	50.20		(50.20)					(50.20)
1997	93.82		(93.82)					(93.82)
1998	20.03	3.72	(23.75)	1,212.16	42.52	0.08	0.04	18.81
1999		5.10	(5.10)	1,438.77	58.53	0.08	0.04	53.47
2000		3.59	(3.59)	1,470.60	59.77	1.20	0.06	56.24
2001		3.01	(3.01)	1,486.20	60.96	1.30	0.06	58.01
2002		2.81	(2.81)	1,486.10	61.56	1.50	0.07	58.82
2003		8.18	(8.18)	1,486.00	62.87	1.60	0.08	54.77
2004		8.30	(8.30)	1,489.30	63.73	1.80	0.09	55.52
2005		9.25	(9.25)	1,494.03	64.52	2.03	0.10	55.37
2006		9.37	(9.37)	1,498.77	65.32	2.28	0.11	56.06
2007		14.96	(14.96)	1,503.52	67.00	2.56	0.13	52.17
2008		15.39	(15.39)	1,508.30	67.67	2.88	0.15	52.43
2009		16.65	(16.65)	1,513.08	68.35	3.24	0.17	51.87
2010		16.84	(16.84)	1,517.88	69.03	3.65	0.19	52.38
2011		22.51	(22.51)	1,522.70	69.72	4.11	0.22	47.43
2012		23.01	(23.01)	1,527.53	70.42	4.62	0.25	47.65
2013		24.35	(24.35)	1,532.38	71.12	5.20	0.28	47.06
2014		24.62	(24.62)	1,537.24	71.83	5.85	0.32	47.53
2015		30.36	(30.36)	1,542.12	72.55	6.58	0.36	42.55
2016		30.94	(30.94)	1,547.02	73.28	7.40	0.41	42.74
2017		32.36	(32.36)	1,551.93	74.01	8.32	0.47	42.12
2018		32.71	(32.71)	1,556.85	74.75	9.36	0.53	42.57
2019		38.53	(38.53)	1,561.79	75.50	10.53	0.60	37.57
2020		39.20	(39.20)	1,566.75	76.25	11.85	0.68	37.74
2021		40.69	(40.69)	1,571.72	77.01	13.33	0.78	37.10
2022		41.13	(41.13)	1,576.71	77.78	15.00	0.88	37.54
Total	220.06	497.57	(717.63)	37,699.45	1,696.06	126.34	7.06	985.49

FIRR = 19.52%

GWh = gigawatt-hours, O&M = operation & maintenance.

^a Excludes interest charges during construction.

^b Includes tax after 2003.

^c Includes preoperating expenses of \$ 34.2 million and \$ 6.86 long-term loans and acquisition costs.

^d Gross Benefits have been affected by the devaluation of the baht since 50 percent of revenues are paid in Thai currency.

ECONOMIC INTERNAL RATE OF RETURN
(\$ million)

Year	Government Equity Costs	Benefits			Net Cash Flow	
		Income from Investment ^a	Royalty	Taxes		Total Benefits
1994	5.12				(5.12)	
1995	4.58				(4.58)	
1996	14.46				(14.46)	
1997	30.32				(30.32)	
1998	4.93	10.49	2.13		7.69	
1999		17.60	2.79		20.39	
2000		18.26	2.96		21.22	
2001		20.54	3.02		23.56	
2002		21.84	3.02		24.86	
2003		19.56	3.05	5.75	28.36	
2004		20.52	3.08	5.46	29.06	
2005		21.24	3.16	6.24	30.64	
2006		22.31	3.19	6.56	32.06	
2007		23.04	3.23	6.78	33.05	
2008		24.10	3.27	7.09	34.46	
2009		25.14	3.31	7.40	35.85	
2010		25.39	3.45	7.47	36.31	
2011		25.65	3.49	7.55	36.68	
2012		25.90	3.52	7.62	37.04	
2013		26.16	3.56	7.70	37.42	
2014		26.42	3.59	7.78	37.79	
2015		26.69	3.63	7.85	38.17	
2016		26.95	3.66	7.93	38.55	
2017		27.22	3.70	8.01	38.93	
2018		27.50	3.74	8.09	39.32	
2019		27.77	3.77	8.17	39.72	
2020		28.05	3.81	8.25	40.11	
2021		28.33	3.85	8.34	40.52	
2022		28.61	3.89	8.42	40.92	
Total	59.40	595.28	83.87	148.46	827.61	768.20

EIRR = 30.80%

^a Income from Investment is estimated based on 60 percent equity contribution of the Lao PDR in Theun-Hinboun Power Company Ltd. This represents 60 percent of net profits generated annually from the Project.

ASSUMPTIONS IN FIRR AND EIRR ANALYSES

A. Financial Internal Rate of Return

1. Costs were calculated as total capital investment for the Project, net of interest charges during construction, and operations & maintenance costs for the Project estimated in 2000 terms. Taxes were included in the costs from 2003 onward, when exemption is lifted.
2. Income flows were calculations based on gross revenues in constant 2000 terms.
3. No residual value was assumed at the end of the project life.

B. Economic Internal Rate of Return

4. The assumed life of the project was 25 years.
5. Costs were calculated as Government contribution. A standard conversion factor of 0.9 was used to reduce financial costs to economic costs.
6. Benefits were estimated as Government revenues, calculated as net profit share, royalties, and tax in constant 2000 terms.
7. No residual value was assumed at the end of the project life.
8. Exchange rates assumed for the projections were \$1 = B40 = KN8,500.

PROJECTED FINANCIAL STATEMENTS

Table A16.1: Projected Statements of Income & Unappropriated Retained Earnings
With Actual 3-Year Statements for the Prior Years 1997 - 1999
(\$ '000)

Particulars ^a	Actual		Projected										Total
	1998	1999 ^a	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
Revenues:													
Net sales	41,888	58,565	59,152	60,353	60,956	61,566	62,329	63,101	63,883	64,675	65,476	66,287	728,232
Other income	634	1,625	620	610	590	560	540	631	639	647	655	663	8,413
Total Revenues	42,522	60,190	59,772	60,963	61,546	62,126	62,869	63,732	64,522	65,321	66,131	66,950	736,645
Cost & Expenses:													
Cost of sales	11,057	4,320	4,936	3,730	3,394	3,012	3,418	3,110	2,760	3,132	2,850	2,529	48,248
Royalty expenses	-	2,790	2,958	3,018	3,018	3,048	3,078	3,155	3,194	3,234	3,274	3,314	34,080
Depreciation & amortization expenses	-	8,510	9,383	9,197	9,197	9,197	9,197	9,197	9,197	9,197	9,197	9,197	100,668
Selling & administrative expenses	3,788	2,862	3,105	1,509	983	1,011	1,040	1,262	1,278	1,293	1,310	1,326	20,767
Interest expenses	10,189	12,390	9,145	9,274	8,558	7,489	6,439	5,390	4,341	3,291	2,242	1,193	79,941
Total Cost & Expenses	25,034	30,873	29,527	26,728	25,150	23,757	23,173	22,115	20,770	20,148	18,873	17,559	283,704
Net income before income tax	17,489	29,317	30,245	34,235	36,397	38,369	39,696	41,618	43,752	45,174	47,258	49,391	452,941
Income tax	-	-	-	-	-	5,755	5,460	6,243	6,563	6,776	7,089	7,409	45,294
Net income after income tax	17,489	29,317	30,245	34,235	36,397	32,614	34,237	35,375	37,189	38,398	40,170	41,982	407,647
Unappropriated retained earnings, beginning	-	7,989	9,606	22,794	37,950	54,007	68,538	83,740	101,248	117,671	132,659	146,904	-
Retained earnings before cash dividends	17,489	37,306	39,851	57,029	74,347	86,621	102,775	119,115	138,437	156,069	172,828	188,886	407,647
Appropriated for cash dividends	9,500	27,700	17,057	19,079	20,340	18,083	19,035	17,867	20,766	23,410	25,924	28,333	247,094
Unappropriated retained earnings, end	7,989	9,606	22,794	37,950	54,007	68,538	83,740	101,248	117,671	132,659	146,904	160,553	160,553

^a Unaudited financial statements.

Table A16.2: Projected Balance Sheets
With Actual 3-Year Balance Sheets for Prior Years 1997 - 1999
(\$ ' 000)

Assets ^a	Actual			Projected									
	1997	1998	1999 ^a	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Current Assets:													
Cash on hand & in banks	1,759	31,155	34,226	41,616	55,364	70,733	84,741	99,630	116,675	132,545	147,200	160,909	174,008
Accounts receivable-trade	-	9,722	8,545	11,529	11,763	11,880	11,999	12,148	12,298	12,451	12,605	12,761	12,919
Other currents assets	956	614	1,994	2,011	2,052	2,073	2,093	2,119	2,145	2,172	2,199	2,226	2,254
Total Current Assets	2,714	41,490	44,765	55,155	69,179	84,686	98,834	113,897	131,119	147,168	162,004	175,897	189,181
Hydroelectric power project-net	-	172,932	165,224	157,553	149,883	142,213	134,542	126,872	119,202	111,532	103,861	96,191	88,521
Hydroelectric power project in progress	165,349	-	-	-	-	-	-	-	-	-	-	-	-
Equipment-net	370	251	186	-	-	-	-	-	-	-	-	-	-
Other Assets:													
Pre-operating expenses-net	30,793	33,123	32,098	31,073	30,048	29,022	27,997	26,972	25,946	24,921	23,896	22,871	21,845
Term loan acquisition costs-net	7,261	7,186	6,684	6,183	5,681	5,179	4,677	4,176	3,674	3,172	2,671	2,169	1,667
Advance payment-project construction	5,543	5	-	-	-	-	-	-	-	-	-	-	-
Total Other Assets	43,596	40,314	38,782	37,255	35,728	34,201	32,674	31,147	29,620	28,093	26,566	25,039	23,512
Total Assets	212,029	254,989	248,956	249,964	254,791	261,100	266,051	271,916	279,941	286,793	292,432	297,127	301,214
Liabilities & Equity													
Current Liabilities:													
Accounts payable	7,084	143	-	-	-	-	-	-	-	-	-	-	-
Current portion of long-term debt	3,487	11,176	9,884	9,480	9,480	9,480	9,480	9,480	9,480	9,480	9,480	9,480	9,480
Accrued exp., retention payable, short-term debt	9,869	5,887	5,233	3,405	2,556	2,289	2,189	2,333	2,330	2,239	2,371	2,301	2,220
Payable to shareholders, related companies	3,711	1,191	469	-	-	-	-	-	-	-	-	-	-
Total Current Liabilities	24,151	18,396	15,585	12,886	12,037	11,770	11,670	11,814	11,811	11,719	11,852	11,782	11,700
Long-Term Debts	77,878	118,603	113,765	104,285	94,804	85,324	75,843	66,363	56,883	47,402	37,922	28,441	18,961
Shareholders' Equity:													
Share capital	110,000	110,000	110,000	110,000	110,000	110,000	110,000	110,000	110,000	110,000	110,000	110,000	110,000
Unappropriated retained earnings	-	7,989	9,606	22,794	37,950	54,007	68,538	83,740	101,248	117,671	132,659	146,904	160,553
Total Shareholders' Equity	110,000	117,989	119,606	132,794	147,950	164,007	178,538	193,740	211,248	227,671	242,659	256,904	270,553
Total Liabilities & Equity	212,029	254,989	248,956	249,964	254,791	261,100	266,051	271,916	279,941	286,793	292,432	297,127	301,214

^a Mission estimates based on interviews with Greater Mekong Subregion management

Table A16.3: Projected Cash Flow Statements
With Actual 3-Year Cash Flow Statements for Prior Years 1997 - 1999
(\$ '000)

Particulars	Actual			Projected										Total
	1994-97	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
Cash Inflows:														
Shareholders' equity	110,000	-	-	-	-	-	-	-	-	-	-	-	-	110,000
Shareholders' advances, loans	3,711	-	-	-	-	-	-	-	-	-	-	-	-	3,711
Loan drawdowns	81,365	48,314	-	-	-	-	-	-	-	-	-	-	-	129,679
Other inflows	-	2,642	-	-	-	-	-	-	-	-	-	-	-	2,642
Net sales	-	32,167	50,020	47,623	48,590	49,076	49,567	50,181	50,803	51,432	52,070	52,715	53,368	587,611
Collection of receivables	-	-	9,722	8,545	11,529	11,763	11,880	11,999	12,148	12,298	12,451	12,605	12,761	127,701
Interest income	-	634	1,625	620	610	590	560	540	631	639	647	655	663	8,413
Total Cash Inflows	195,076	83,757	61,367	56,788	60,729	61,429	62,007	62,720	63,582	64,370	65,167	65,975	66,792	969,758
Cash Outflows:														
Pre-op. costs & expenses (net of accrued exp.)	37,136	2,249	-	-	-	-	-	-	-	-	-	-	-	39,385
Adv. payment for plant construction, contractor	5,791	-	-	-	-	-	-	-	-	-	-	-	-	5,791
Plant constr. (net of retention, pay, acc. int.)	149,313	14,976	-	-	-	-	-	-	-	-	-	-	-	164,289
Prepaid expenses & current accounts	708	82	1,380	17	41	21	21	26	26	27	27	27	28	2,430
Equipment	370	-	-	-	-	-	-	-	-	-	-	-	-	370
Payment of acc. exp., short-term debt	-	-	-	1,828	849	267	100	(144)	3	91	(132)	70	82	3,013
Payment of shareholders' advances, loans	-	2,520	722	469	-	-	-	-	-	-	-	-	-	3,711
Cost of sales	-	11,057	4,320	4,936	3,730	3,394	3,012	3,418	3,110	2,760	3,132	2,850	2,529	48,248
Royalty expenses	-	-	2,790	2,958	3,018	3,018	3,048	3,078	3,155	3,194	3,234	3,274	3,314	34,080
Selling & administrative expenses	-	3,788	2,862	3,105	1,509	983	1,011	1,040	1,262	1,278	1,293	1,310	1,326	20,767
Income tax	-	-	-	-	-	-	5,755	5,460	6,243	6,563	6,776	7,089	7,409	45,294
Total Cash Outflows	193,317	34,672	12,075	13,312	9,146	7,682	12,947	12,877	13,799	13,913	14,330	14,619	14,687	367,377
Net cash inflows before debt service	1,759	49,085	49,292	43,476	51,582	53,747	49,060	49,843	49,783	50,457	50,837	51,355	52,105	602,381
Deb service	-	10,189	18,521	19,029	18,754	18,038	16,969	15,920	14,870	13,821	12,772	11,722	10,673	181,279
Cash before dividends	1,759	38,896	30,771	24,447	32,828	35,709	32,091	33,923	34,912	36,636	38,066	39,633	41,432	421,102
Dividends	-	9,500	27,700	17,057	19,079	20,340	18,083	19,035	17,867	20,766	23,410	25,924	28,333	247,094
Net cash inflows during the year	1,759	29,396	3,071	7,390	13,749	15,369	14,008	14,888	17,045	15,870	14,655	13,709	13,099	174,008
Cash balance, beginning	-	1,759	31,155	34,226	41,616	55,364	70,733	84,741	99,630	116,675	132,545	147,200	160,909	
Cash balance, end	1,759	31,155	34,226	41,616	55,364	70,733	84,741	99,630	116,675	132,545	147,200	160,909	174,008	