

**Government of the
Lao People's Democratic Republic**

**ECONOMIC IMPACT STUDY OF
NAM THEUN 2 DAM PROJECT**

Volume I

**submitted by:
LOUIS BERGER INTERNATIONAL, INC.**

**1819 H Street, N.W.
Suite 900
Washington, D.C. 20006**

July 28, 1997

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Table of Contents

Executive Summary	i
1. Context of the study	i
2. Approach to analysis	i
3. Preliminary findings and conclusions	iii
4. Outline of the economic study	vi
Introduction	1
A. Context of the study	1
B. Approach to analysis	2
I. Project Evaluation	8
1. Conclusions and Base Case Assumptions	8
2. Costs and Benefits Utilized	11
3. Sensitivity Analysis	11
4. Avoided Cost Analysis	14
II. Microeconomic and Institutional Analysis	15
1. Preconstruction Activities	15
2. Construction Project Impacts on Local and Regional Markets	16
3. Impact of Demographic Pressures	18
4. Institutional Capacity	18
5. Role of BPKP	21
III. Macroeconomic Analysis	25
1. Background	25
2. Macroeconomic scenarios	26
3. Base-case scenario	26
4. Nam Theun 2 scenario	28
5. Net incremental government revenues	33
6. Impact on external balances	33
7. Macroeconomic risks	34
8. GOL implementation capacity	38
9. Income utilization scenarios	39
10. Strategy to mitigate institutional constraints	40

IV. Financial Risk Analysis 42

1. Financial and Contractual Arrangements 42
2. Project Financing Plan and Financial Model 45
3. Risk Allocation Framework 46
4. Outline of the Principal Negotiating Points Available to the GOL 47

V. Overall Economic Assessment 48

1. Economic and social strategy 48
2. Project evaluation 49
3. Institutional capacity constraints 49
4. Macroeconomic benefits and risks 51
5. Financial risks to the GOL 52
6. Nam Theun 2 and poverty alleviation 53
7. Model for reform 55

Appendix 1: Valuing the Social and Environmental Impacts of the Nam Theun 2 Hydroelectricity Project: A Preliminary Assessment

- Introduction 1
1. Preliminary estimates of pre-mitigation social and environmental costs of NT2 . . 1
 - 1.1 The Inundation area 1
 - 1.2 Nakai-Nam Theun National Biological Conservation area 2
 - 1.3 Downstream impacts on local inhabitants and water quality 3
 - 1.4 Construction and resettlement/regional health impacts 3
 2. Preliminary estimates for the cost and effectiveness of mitigation measures . . . 4
 3. Mitigation, compensation, and residual damages 5
 4. Institutional analysis 5
 5. Conclusions 6

Economic Impact Study Nam Theun 2 Hydroelectric Project

Louis Berger International, Inc.

Executive Summary

1. This Study's objective is to provide the Government of the Lao People's Democratic Republic (GOL) with a comprehensive and well-balanced analysis of the economic viability of the proposed Nam Theun 2 hydroelectric project, and of its potential to help alleviate poverty in Laos. Neither Louis Berger International, Inc. (LBII), which is responsible for the Economic Study, nor any one of the Study's team members, has approached this task with any prior views about its outcome, findings or recommendations.

1. Context of the Study

2. The context of the Economic Impact Study is the GOL's medium-term power development program, including its plan to provide 3,000 MW of hydro-electric power to Thailand by 2006. A private consortium of foreign investors has proposed a build, own, operate and transfer (BOOT) agreement to the GOL for a hydropower facility with the capability to generate 680 MW of electricity for sale to Thailand by 2004. The GOL would be one of the charter shareholders, with 25% of the equity, and would gain sole ownership of the dam after 25 years of operation. The GOL has requested that the World Bank support the proposed project.

2. Approach to Analysis

3. The Economic Impact Study is divided into five components: (1) Project Evaluation; (2) Microeconomic and Institutional Analysis; (3) Macroeconomic Analysis; (4) Financial Risk Analysis; and (5) Overall Economic Analysis. The results of these analyses are presented in sections I through V. These components draw upon a Preliminary Assessment of Environmental and Social costs, the results of which are presented in Appendix 1. The analysis is supplemented by several technical and reference annexes. Highlights of the LBII approach to analysis include:

4. **Reliance on market signals.** The Study relies on market signals as a primary basis for analysis, and for derivation of the "most likely" scenario should the project proceed as proposed. In contrast with projects financed wholly or mainly by the public sector, for example, many of the most obvious sources of risk have already been deemed acceptable by the private sponsors, *within the context of the contracts that they expect to negotiate*.¹ Similarly, the tariff structure to be negotiated would be likely to conform to market pressures currently at play in Thailand, which the Study examines in detail. There are cases where market signals are not present, however, such as

¹ Note that this places significantly more emphasis on the agreements or contractual arrangements that would underlie the Nam Theun 2 project, none of which has yet been negotiated or signed. Section 4 of the Study examines risks that the GOL will have to confront during the negotiations process.

in the estimation of construction costs, because as proposed the contract would be sole-source, rather than competitive. In this case, the analysis relies on construction cost estimates supplied by Lahmeyer International, an independent engineering consultant, rather than those of the project sponsors.

5. **Independent assessment of environmental and social costs.** Another area where market signals are not sufficient for economic analysis is in respect to the environmental and social costs of the project. The Study estimates preliminary ranges of costs that may be entailed by the construction of Nam Theun 2, where quantification is possible, in the anticipation that these may be refined and improved as the results of further study become available. The approach to biodiversity, which largely is not quantifiable, has been to acknowledge that there is a prospective offset involved in the development of the dam on the Nakai Plateau, which could entail loss of biodiversity, against the preservation of the much larger land area of the NBCA as pristine rainforest. In respect to quantifiable costs, based on international experience, it is estimated that between 10% and 50% of total environmental and social costs in similar projects are never mitigated. In an effort consciously to err on the side of conservative forecasting, the high end of this range is utilized, and attributed throughout the analysis as budgetary costs to the GOL.

6. **Economic and institutional risks.** Because of the large size of the project in relation to GDP, a number of potential macroeconomic risks were evaluated. One concern stems from the strategy increasingly to concentrate national foreign exchange earnings in hydropower, and the disincentives this might pose for other sectors. Another risk derives from the fact that all of the revenue coming to Laos from hydropower exports, including the proceeds from Nam Theun 2, would adhere to the GOL, which then would be the principal entity responsible for its re-investment. This ultimately raises concerns about the institutional capacity of the GOL itself to program the revenues effectively, for poverty reduction or otherwise.

7. **Independent evaluation of GOL's financial risks.** None of the contracts or agreements that would underlie the project has yet been negotiated or signed, and a previous power purchase agreement (PPA) has been allowed to expire. Despite the complexity of the proposed deal, the GOL has never availed itself of outside financial expertise to evaluate the structure of the draft agreements tabled by the private sponsors. Accordingly, it was determined that the Economic Study team would advise the GOL concerning contractual and financial risks that should be recognized during the negotiations process. A financial model has been developed that allows the impacts of various configurations of risk to the GOL to be analyzed in detail.

8. **Nam Theun 2 and poverty alleviation.** Consideration of the extent to which Nam Theun 2 might contribute to alleviating poverty in Laos requires particular care. The first question relates to the project's potential contribution to GDP growth, and hence to poverty alleviation. Also to be considered is the extent to which revenues from Nam Theun 2 could contribute indirectly to poverty alleviation in the context of an overall economic development strategy that would include improved targeting of expenditures and program implementation

capacity. The approach of the Study has been to distinguish among: (1) outcomes that would be caused directly by the project; and (2) outcomes over which implementation of the project may have some influence, either as a model, through conditionality attached to parallel financing by international financial institutions, or otherwise.

3. Preliminary findings and conclusions

9. The Economic Impact Study has arrived at a number of preliminary findings and conclusions, among which several are key:

10. **Project evaluation.** The economic cost-benefit analysis has determined that, under all but the most pessimistic of scenarios covering hydrology risk, tariff structure, inflation rates and other key variables, over the medium-term the Nam Theun 2 hydroelectric project would yield substantial net benefits to the GOL, above and beyond the income foregone from developing the Nakai Plateau as a basis for sustainable forestry and other agricultural production.² Under the "most likely" scenario, in net present value terms Nam Theun 2 would yield an economic return on the GOL's investment of approximately 3.5-to-one. In real terms, the project would yield an economic rate-of-return of 16.4%.

11. **Institutional mandate and structure.** In terms of institutional mandate and structure, there is overlap and confusion, problems compounded by lack of independent sources of financing and serious questions about potential conflicts-of-interest. Among the most troublesome, the Resettlement Committee (RC) depends almost entirely on project sponsors for its financing, a factor that places it in a peculiar position when representing public interests. Questions also arise concerning BPKP and how its role is to be re-defined as the revenue it derives from timber and wood products declines. Potential conflicts-of-interest, in particular BPKP's prospective participation in the RC while planning simultaneously to bid on contracts stemming from the resettlement program, should be resolved. As an autonomous state enterprise, BPKP should have a Board of Directors and fiduciary accountability to the Ministry of Finance to facilitate oversight of its activities.

12. **Implementation capacity.** The main issue confronting central and provincial government entities with responsibilities in the region is institutional implementation capacity. The amounts under discussion to accomplish GOL responsibilities directly related to Nam Theun 2 are of an order of magnitude larger than the provincial authorities and relevant GOL ministries are used to spending. Earlier studies have highlighted weak government institutions and rudimentary legal, administrative and institutional structures. One consequence is that the Bank and other stakeholders in Nam Theun 2 have begun to discuss the need for an 'autonomous institution' that

² This, and not the maintenance of the Nakai Plateau as a pristine national biodiversity conservation area, is what the Economic Study team believes is the most likely alternative outcome, should the Nam Theun 2 hydroelectric project not go forward. Conversely, the probability that the NBCA would be protected is greater in the case where Nam Theun 2 is built than in the case in which it is not.

would be responsible for environmental protection of the NBCA and possibly portions of the Nakai Plateau as well. This highlights the concern more generally that the implementation capacity of central government authorities will remain insufficient over the medium term. The Study discusses options to mitigate this constraint, including heavier reliance on concessions, private contracting and public-private partnerships. Nam Theun 2 could develop into a model of this approach.

13. **Macroeconomic benefits and risks.** Under conservative assumptions, the Nam Theun 2 project would contribute to increasing GDP by a cumulative total of 3.2% over the life of the project. Because it is an enclave project that would import most equipment, materials and consumables, and rely almost exclusively on foreign labor, the effect of the construction project on GDP would be broadly similar to an increase in government expenditures of \$100 million over a four-year period — an amount just about equivalent to the cost of the GOL's equity in the project. Expectations about the project's once-and-for-all increment to GDP through increased revenues that would adhere to the GOL budget should be scaled similarly to the magnitude of the GOL's contribution to equity, and not to the size of the total investment of \$1.4 to \$1.5 billion. The same logic applies to macroeconomic risks. Government deficits would be only marginally larger if Nam Theun 2 were built, and would remain well within tolerable ranges relative to GDP. Similarly, the current account deficit and the debt-service ratio would be only marginally affected by the project, and would also remain within acceptable ranges. These findings are all found to hold even under the most pessimistic of scenarios as applied to tariffs and hydrology.

14. **Export concentration.** The Lao strategy to rely increasingly on hydropower as a source of foreign exchange could carry risks. The principal concern is that too much foreign exchange flowing in from hydropower may cause exchange rate appreciation and harm other tradeable sectors, like agriculture and manufacturing. But this effect could be mitigated, at least in the short term, by increasing reserves. In the medium-to-long term this "Dutch Disease" effect could be managed by increasing Lao productivity, through continued economic liberalization coupled with targeted public investments to reduce physical and human capacity constraints. Although fears that the real exchange rate has been appreciating in the 1990s appear in light of recent data to have been largely unfounded, the experience of Indonesia, among others, suggests that Laos should begin now to articulate and implement a more broad-based and outward-oriented economic development strategy, to improve the efficiency of investment and diversify exports.

15. **Financial risks to the GOL.** A series of draft agreements was tabled in 1995 and 1996 which the team undertook to review. These had all been drafted by the private sponsors, and as such were taken to represent opening negotiating positions. There are a number of characteristics within those drafts that could bear closer scrutiny. An important concern is the GOL's interest in preserving its return from royalty and resource income in a manner acceptable to the private sponsors. Exposure to hydrology risk also requires review. The most significant issue has to do with the private sponsors' stated position that the project as currently configured does not meet required rates-of-return, and the expectation that the GOL will accommodate them in this regard.

Other issues include requests for remuneration of fairly substantial development costs and sponsors' fees, and the size of the GOL's equity participation in light of its other responsibilities as sovereign sponsor. Any final resolution of these issues should incorporate adequate compensation to the GOL for its land and water rights while compensating the developers for assuming the early stages of development risks of the project in the context of a sole-source negotiation.

16. **Nam Theun 2 and poverty alleviation.** A major question considered by the Economic Study is whether the Nam Theun 2 project would contribute to poverty alleviation in Laos. Both negative and positive influences attributable to the project were considered. One concern is that construction-project expenditures could cause price rises that would have an adverse impact on the rural-urban terms-of-trade. But because of its enclave nature, and because Laos has been largely successful in liberalizing prices and trade, there are few reasons to believe that the project would have any but the most short-term impact on local prices; whereas its impact on regional or national prices would be nil.³ Another concern is that rising hydropower exports could, through appreciation of the real exchange rate, impoverish other sectors, like agriculture, from which the majority of the population falling below the poverty line derives a subsistence. The best way to guard against this would be to implement an outward-oriented economic strategy and to target public investments toward relieving human and physical capacity constraints.

17. The Study finds that poverty alleviation attributable to Nam Theun 2's direct impact on economic growth, even under conservative assumptions, would be measurable and positive: The increment to GDP growth alone would reduce the number of persons falling below the poverty line by more than 13,000. This very likely understates the direct poverty-reducing impact of the project, because during the construction period increased demand for goods and services in the Nakai Plateau would provide additional sources of income for local residents, most of whom are subsistence farmers who have been experiencing increasing rice deficits in recent years. And, although the Nam Theun 2 programs for environmental protection and resettlement are still under negotiation, the government's goal is to make local residents better off, so that if implemented effectively these programs also would contribute to poverty alleviation.

18. **Utilization of net revenues for poverty alleviation.** The final source of potential poverty reduction to be derived from Nam Theun 2, of course, would be the net revenues that would accrue from the project to the GOL. Even under quite conservative assumptions concerning social and environmental mitigation costs, the net cash flow to the GOL (in 1996 dollars) would average \$33 million annually from project initiation throughout the life of the concession agreement. If applied solely to the GOL's planned capital expenditures in the current fiscal year, annual revenues of this magnitude would have represented an increase of 38% if the increment were applied solely to the social sector line items in that plan.

³ A notable exception might be local prices for consumer services, if Lao authorities invoked internal residency restrictions to limit labor mobility. Based on experience with prior hydropower projects in Laos, however, this appears unlikely.

19. The extent to which net incremental revenues from Nam Theun 2 could translate into poverty alleviation in Laos, however, would depend largely on GOL implementation capacity. Beyond identifying priority sectors for public investment, the GOL should articulate a strategy to confront evident institutional constraints. Among the measures that should be considered are: (1) establishing a transparent and consistent system to identify, prioritize and allocate public investments toward the most economically viable projects; (2) relying wherever possible on competitively-bid concessions and/or private contracting to build and operate needed infrastructure, utilizing fiscally sustainable subsidy schemes as necessary to extend access to poor and rural areas; and (3) offering competitively-bid public grants to provincial and local governments, and NGOs, awarded to the best proposals to target the provision of improved social services to the poor.

20. As part of such an implementation strategy, the GOL should consider the pluses and minuses of creating a "social fund" to which net incremental revenues from Nam Theun 2 would adhere. Such a fund could be responsible for implementation of specific elements of the GOL's social sector strategy under the policy direction of central government authorities, supplemented by donor financing and technical assistance. Experience in other countries indicates that social funds can move more quickly, with lower unit costs and stronger community participation, to supplement public institutional capacity under mechanisms that rely on implementation by both NGOs and private contractors.

21. **Model for reform.** Laos is at a crossroads in its development where it has already implemented a fairly comprehensive series of economic stabilization and structural adjustment measures, and is well on the way to making the transition from central planning to market systems. It has put forward an economic and social strategy to continue that process which would broaden the base of economic growth, and improve environmental sustainability, while relying on the gains from hydropower. Nam Theun 2 is an integral part of that strategy. The project, in addition to yielding substantial net economic benefits for the Lao PDR, is intended to demonstrate that private investments in Laos can and will meet international standards, not only of profitability and risk, but also of environmental and social responsibility. The former can be demonstrated by successful implementation of a large private concession led by credible foreign sponsors; the latter by strict adherence to the environmental and social standards of the World Bank. As designed, Nam Theun 2 could well become a model for future public-private partnerships that could help relieve Laos's human, physical and institutional capacity constraints, and usher in a period of sustained, rapid and environmentally and socially responsible economic development.

4. **Outline of the Economic Study**

22. The Economic Impact Study is presented in several sections, dealing with separate components of the analysis. The Introduction presents key questions and concerns that have been raised about the Nam Theun 2 project, and highlights LBII's approach to analysis. Section I, the Project Evaluation, presents the key findings and conclusions of the cost-benefit analysis.

Section II, the Microeconomic and Institutional Analysis, examines the likely impacts of the Nam Theun 2 project and of demographic pressures in the project area; and assesses the institutional capacity of the principal public sector institutions involved. Section III, the Macroeconomic Analysis, evaluates the indirect impacts of the Nam Theun 2 project through its projected effects on the GOL budget and balance-of-payments; and analyzes other potential macroeconomic benefits and risks in the context of Laos's economic development strategy. Section IV, the Financial Risk Analysis, identifies and assesses the nature of the financial risks of the project to the GOL, including those that should be recognized during negotiations with the developer. Section V, the Overall Economic Assessment, synthesizes the principal findings of the other four components, with special attention given to the potential for poverty alleviation. Appendix 1 summarizes the results of the Preliminary Assessment of Environmental and Social Costs. The report is supplemented by eight annexes comprised of technical working papers and reference documentation.

Abbreviation List

ADB	Asian Development Bank
BPKP	<i>Bolisat Phathana Khet Phoudoi</i> or Mountainous Region Development Corporation
BOOT	Build, Own, Operate, Transfer agreement
COD	Commercial Operation Date
EGAT	Electricity Generating Authority of Thailand
ERR/IRR	Economic Rate of Return / Internal Rate of Return
GOL	Government of Laos People's Democratic Republic
IBRD	International Bank for Reconstruction and Development
IDA	International Development Association
IMF	International Monetary Fund
IPP	Independent Power Producer
LBII	Louis Berger International, Inc.
MOU	Memorandum of Understanding
NBCA	National Biodiversity Conservation Area
NEM	New Economic Mechanism
NPV	Net Present Value
NTEC	Nam Theun Electricity Consortium
NT2	Nam Theun 2 Project
O & M	Operations and Maintenance
ODA	Official Development Assistance
PIP	Public Investment Program
PPA	Power Purchase Agreement
RC	Resettlement Committee
TOR	Terms of Reference

Economic Impact Study Nam Theun 2 Hydroelectric Project

Louis Berger International, Inc.

Introduction

1. This Study's objective is to provide the Government of the Lao People's Democratic Republic (GOL) with a comprehensive and well balanced analysis of the economic viability of the proposed Nam Theun 2 hydroelectric project. Neither Louis Berger International, Inc. (LBII), which is responsible for the Economic Study, nor any one of the Study's team members, has approached this task with any prior views about its outcome, findings or recommendations. Each member of the Study team has been committed to provide his or her analysis, and present options based on that analysis, solely from the standpoint of the interests of the Lao PDR.¹

A. Context of the Study

2. The context of the Economic Impact Study is the GOL's medium-term power development program, including its plan to provide 3,000 MW of hydro-electric power to Thailand by 2006 (1,500 MW of which is to be supplied by 2001), as agreed under a recent Memorandum of Understanding between the two countries. Within that context, a private consortium of foreign investors has put forward the Nam Theun 2 project, which would inundate approximately 450 square kilometers on Laos's Nakai Plateau, and build a hydropower facility with the capability to generate 680 MW of electricity for sale to Thailand by 2004. The project is proposed as a build, own, operate and transfer (BOOT) concession agreement, under which the GOL would be one of the charter shareholders, with 25% of the equity, and would gain sole ownership of the dam after 25 years of operation. The GOL has requested that the World Bank support the proposed project.

3. **Upside considerations.** There are a number of features of the proposed Nam Theun 2 project that tend to indicate that it is an attractive one, including:

- **Natural site.** The natural site appears to be very attractive for production of hydropower at quite low unit costs.
- **Small resettlement requirement.** The population that would have to be resettled is relatively small in number—from 900 to 950 families.
- **Credible foreign sponsors.** The foreign sponsors of the project—Électricité de France, Transfield of Australia, and three Thai companies, Italian Thai Development, Jasmine International and Phatra Thanakit—have very strong financial and technical credibility. The International Finance Corporation (IFC) also is considering its possible involvement.

¹ It can be stated categorically that there is no conflict-of-interest inherent to the conduct of this Study by Louis Berger International, Inc. (LBII), and in particular, that LBII has no significant involvement with the project's sponsors, the Thai Export-Import Bank, the Electricity Generating Authority of Thailand (EGAT), or any other similarly interested party.

- **EGAT's commitment.** The Electricity Generation Authority of Thailand (EGAT), the buyer of the electricity, also has bankable credibility, and appears fully committed to the conclusion of a Power Purchase Agreement (PPA).
- **NBCA preservation.** Preservation of the catchment area (or National Biodiversity Conservation Area) behind the proposed inundation area, which comprises an area seven times as large as that which would be inundated by the dam, is linked to the Nam Theun 2 project in several ways, including the fact that the World Bank is examining linkages between NBCA preservation and its possible provision of financing and guarantees to the Nam Theun 2 project.
- **Recent Lao PDR economic record.** Laos is developing a very good track record in economic stabilization, liberalization and management, which has resulted in strong economic growth rates; these are projected to continue for the foreseeable future.

4. **Downside considerations.** It is also the case, however, that there are a number of areas that give cause for concern about the proposed project, including:

- **Environmental and social costs.** The environmental and social track record of previous hydropower projects in developing countries has been poor.
- **Proximity to NBCA.** Preservation of the NBCA has derived so far mainly from its inaccessibility, which would be threatened by the adjacent Nam Theun 2 project.
- **Potential cost overruns and other risks.** Previous hydropower projects have demonstrated a tendency for cost overruns and lack of attention during project appraisal to electricity demand, financial exposure and other risks.
- **Sole-source contracting.** The project is proposed by the sponsors as a sole-source contract, removing the market discipline on pricing otherwise to be obtained by free and open competition.
- **Weakened market.** Technical innovations and EGAT's recent successes with its competitive bidding for Independent Power Producer (IPP) contracts may mean reduced prices for the electricity to be generated under the envisioned PPA.
- **Large size relative to GDP.** Nam Theun 2 is large enough to pose risks to the Lao economy relating to debt-servicing capacity and rising export concentration.
- **GOL institutional capacity.** All of the net revenues from Nam Theun 2 would adhere to the GOL, raising questions about its capacity to re-invest them effectively.

B. Approach to Analysis

5. The task of the Economic Impact Study is to sort through the relative merits and risks of the Nam Theun 2 project, including those listed above, utilizing a variety of quantitative and theoretical economic methodologies, to make an overall determination about the economic viability of the project and its potential to alleviate poverty.² The approach which is used is to draw upon a number of economic methodologies to shed light on the project's viability, on the

² The Terms of Reference (TOR) and Inception Report for the Economic Study are attached as Annex 8.

understanding that no single quantitative technique or economic theory can or should substitute for seasoned judgement. And, where judgement is called for in specification of scenarios and assumptions, conservative estimates have been utilized throughout.

6. The Study is divided into five components: (1) Project Evaluation; (2) Microeconomic and Institutional Analysis; (3) Macroeconomic Analysis; (4) Financial Risk Analysis; and (5) Overall Economic Analysis. The results of these analyses are presented in sections I through V, supplemented by an appendix providing a preliminary assessment of environmental and social costs, and several annexes. The remainder of this introduction highlights the logic of the approach utilized in key areas.

7. **Reliance on market signals.** One of the key elements of the project evaluation (section I) has been to rely wherever possible on market signals or tests as the basis for analysis. Cost-benefit analysis was developed initially to evaluate and choose among alternative public sector projects, which generally offer few, if any, market signals of viability. In contrast, the private sponsors of the Nam Theun 2 project are proposing to risk their own capital. Thus, many of the most obvious sources of risk—cost overruns, demand shortfalls or hydrological variation, for example—have already been deemed acceptable by the private sponsors, *within the context of the contracts that they expect to negotiate.*³

8. This, of course, does not relieve the GOL of evaluating all possible alternatives and risks pertaining to the investment of its own resources, but it does provide a market test of the Nam Theun 2 project's viability from the perspective of the investors, which would include the GOL. At the same time, it places additional weight on the importance of evaluating risks that are uniquely or mainly borne by the GOL. Thus, the approach of the Economic Study team has been to view cost-benefit analysis as only one among several economic tools to be applied to evaluation of the economic viability of the project; risks stemming from market impacts and institutional capacity are evaluated separately in section II; macroeconomic risks in section III, and contractual and financial risks in section IV.

9. Market signals are also utilized to evaluate demand. In particular, with the expiration of the previous PPA in 1996, the Economic Study has been tasked with putting together scenarios about the tariff structure most likely to be negotiated with EGAT. The best market signals in this case are the tariffs agreed under recent IPPs that EGAT has been negotiating, and other elements of Thailand's costs of producing energy domestically. As analyzed in detail in Annex 1, these "avoided costs," which tend to represent a substantial reduction in the tariff structure agreed

³ Note that this places significantly more emphasis on the agreements or contractual arrangements that would underlie the Nam Theun 2 project, none of which has yet been negotiated or signed. (See section 4 for evaluation of the risks involved to the GOL relating to various aspects of these negotiations.)

under the previous PPA, have been the basis for the calculation of the “most likely” tariff scenario for the project evaluation.⁴

10. In respect to construction costs, by way of contrast, there is no real market test of the sponsors’ figures, because the proposed contract would be sole-source. In such circumstances, it makes sense for the government to hire an outside general engineering consultant to provide independent cost estimates. This is the role being played by Lahmeyer International in respect to the Alternatives Study, and it is for this reason that the Economic Study’s analysis has employed Lahmeyer’s estimates of construction costs, rather than those of the private sponsors.

11. **Independent assessment of environmental and social costs.** The approach of the Economic Study to environmental and social costs was determined in part by necessity: No credible estimates of the environmental and social costs likely to derive from implementation of the Nam Theun 2 project had yet been made by the time of submission of this draft report.⁵ It was also felt, however, that independent estimates were essential. Thus, although not originally deemed an integral part of the TOR for the Economic Study, it was decided, in consultation with the GOL, to assign preliminary ranges to estimated costs of environmental and social impacts of the project, where those costs were amenable to quantification; and to identify and evaluate in qualitative terms those externalities that were not amenable to quantification. The intention was that this analysis would serve as a benchmark for more detailed analytical exercises that would follow, and would be amenable to updating and improvement as that process occurred.

12. The most important of externalities determined not to be amenable to quantification is biodiversity. As discussed in detail in Annex 2, the approach of the Economic Impact Study to the potential loss of biodiversity has been to acknowledge that there is an implicit linkage between Nam Theun 2 and the NBCA. In particular, the likelihood that the latter will be preserved is substantially increased by going forward with the project as currently designed—that is, with World Bank oversight and participation.⁶ Although not quantifiable, there is an implicit offset involved in the development of the dam on the Nakai Plateau, which could entail loss of biodiversity, against the preservation of the much larger land area of the NBCA as pristine

⁴ Recent discussions with senior representatives of the private sponsors confirm that the Economic Study’s tariff projections are in line with the tariff structure they would expect to negotiate with EGAT.

⁵ The Economic Study team have factored into the analysis the third draft of NTEC’s Environmental Action and Management Plan (EAMP), and its Resettlement Plan (RP), received in June 1997. Beyond this, a number of other studies are underway which contain assessments relating to environmental aspects of the project have been factored into account, including those being conducted by the International Union for the Conservation of Nature (IUCN) and Lahmeyer. Documentation in support of the appraisal of the Nam Theun Environmental and Social Project (NTSEP) will continue to be compiled during the remainder of 1997. The Environmental and Social Panel of Experts also anticipates completion of its report later this year.

⁶ The project’s private sponsors have indicated that they would not be willing to move forward with Nam Theun 2 without World Bank participation.

rainforest. In contrast, the most likely scenario should Nam Theun 2 not go forward is greater likelihood of deforestation of the NBCA and loss of biodiversity in both areas.⁷

13. Regarding quantifiable costs, the task of the Economic Study was to estimate preliminary ranges of potential environmental and social costs, determine the amounts that were likely to remain unmitigated, and attribute those amounts as budgetary costs to the GOL. Global estimates of the environmental and social costs attributable to the project were made, based on the best information available, in anticipation that they could be refined as more detailed studies were completed. These are presented in Appendix 1. The next step involved estimation of amounts likely to remain unmitigated. The difficulty arose that the amounts and contractual commitments concerning what would be mitigated by NTEC remained a subject of ongoing study and negotiations; as a result the private sponsors were unable to provide detailed budgeting as to what they were proposing to mitigate.

14. Accordingly, preliminary ranges were assigned to potential unmitigated environmental and social costs, independent of the private sponsors' plans and negotiations concerning mitigation of those costs. Based on international experience, it was estimated that between 10% and 50% of total environmental and social costs in similar projects are never mitigated. In an effort consciously to err on the side of conservative forecasting, the high end of this range was utilized in the calculation of the "most likely" economic rates-of-return scenarios, and attributed as budgetary costs that would have to be borne by the GOL. These costs are reflected fully in the quantitative analyses undertaken in sections I, III and IV.

15. **Economic risks.** Because of the large size of the project in relation to Lao's GDP, a number of potential economic risks need to be evaluated. The main concern stems from the strategy increasingly to concentrate national foreign exchange earnings in hydropower. One risk to this strategy has to do with exogenous shocks, such as hydrological shocks, which normally would not affect the macro economy, but can do so when there is heavy export concentration. The other risk has to do with the tendency for single-export concentration to increase because of currency appreciation—thereby adversely affecting other Laotian tradeables, including agriculture and manufacturing, and increasing the exposure to exogenous shocks still further. These risks, and measures that could be taken to mitigate them over the short-to-medium term, are evaluated in section III.

16. Another risk derives from the fact that all of the revenue coming to Laos from hydropower exports, including the proceeds from Nam Theun 2, would adhere to the GOL, which then would be the principal entity responsible for its re-investment. This ultimately raises concerns about the institutional capacity of the GOL itself to program the revenues effectively, for purposes of productivity enhancement or otherwise. A preliminary assessment of the GOL's

⁷ The Economic Study team believes that the most likely alternative in the event that the project does not go forward would be continued commercial harvesting of timber on the Nakai Plateau, and not its preservation as a pristine rainforest.

institutional capacity relating to managing the impacts of the Nam Theun 2 project is presented within section II. Analysis of the implications of GOL institutional capacity constraints, and a strategy for their mitigation, are presented in section III.

17. **Independent evaluation of GOL's financial risks.** The approach of the Economic Impact Study to evaluation of financial risks to the GOL was driven in part by necessity: None of the contracts or agreements that would underlie the project has been negotiated or signed. Although a series of draft agreements had been tabled in 1995 and 1996 which the team undertook to review, these had all been drafted by the private sponsors, and as such were taken to represent opening negotiating positions. Thus, it was necessary to begin the task of evaluating the allocation of various project risks under conditions in which the parties were still in the midst of negotiations about those risk allocations.

18. Indeed, despite the size of the proposed Nam Theun 2 project, its importance to Laos and the interest of international financial institutions in possible participation in its financing, the GOL had never had access to professional investment banking expertise to evaluate the structure of the agreements that had been tabled by the private sponsors. Nor has it had access to a financial model to cross-check the assumptions and projected results put forward by the private sponsors. Yet, as highlighted within section IV, there are a number of characteristics within those drafts, including, for example, substantial premiums attached to development costs, and the allocation of hydrological risk, that could bear closer scrutiny.

19. Accordingly, although this was not originally anticipated in the TOR, it was determined in consultation with the GOL that the Economic Study team should, within the context of section IV, advise the GOL concerning contractual and financial risks that should be recognized during the negotiations process. A financial model also was developed, which allows independent evaluation of NTEC's and the GOL's financial rates of return under the proposed project structure, and which could be utilized by the GOL to enhance its understanding of its risks and opportunities during the negotiation process.

20. **Nam Theun 2 and poverty alleviation.** Attribution of the impacts of Nam Theun 2 toward potential poverty alleviation requires particular care. The first question relates to the project's potential contribution to GDP growth, and hence to poverty alleviation. From the standpoint of macroeconomic forecasting, there are two main sources of GDP growth that would be associated directly with Nam Theun 2. The first, during the construction period, would come from increased demand for Lao goods and services.⁸ Because by design the project would be an enclave, it is estimated that domestic project procurement and spillover demand for Lao products would be modest—equivalent to, or slightly greater than, the GOL's equity contribution to the

⁸ Lahmeyer International has provided estimates of the construction project's probable procurement of Lao products and labor, from which increased demand attributable to the construction project can be derived.

project of around \$100 million.⁹ In keeping with the overall approach of the Economic Study, conservative assumptions are made to extrapolate the impact of these expenditures on GDP.¹⁰ The second source of GDP growth attributable to Nam Theun 2 are the revenues that would flow from the GOL's equity returns, royalties and taxes. These would have a once-and-for-all impact on GDP growth as the revenues came onstream, but thereafter would not contribute to increasing GDP growth rates above the levels forecast to occur in the absence of Nam Theun 2.

21. Also to be considered is the extent to which revenues from Nam Theun 2 could contribute to poverty alleviation in the context of an overall economic development strategy that would include improved targeting of expenditures and program implementation capacity. The approach has been to distinguish between: (1) outcomes that would be caused directly by the project; and (2) outcomes over which implementation of the project may have some influence, either as a model, through conditionality attached to parallel financing by international financial institutions, or otherwise. In the latter case, a number of strategic measures are outlined that could reduce or circumvent GOL institutional capacity constraints limiting the probability that the resources that would flow from Nam Theun 2 would be utilized effectively.

⁹ Of this contribution, it is likely that 40% would either be derived from concessional financing, or taken as an in-kind contribution, or both.

¹⁰ The assumption used is that the "multiplier" effect of the initial round of expenditures is one.

I. Project Evaluation

Introduction

1. The project evaluation utilizes cost/benefit analysis to calculate economic rates of return (ERRs) under various scenarios and from various perspectives. The results of this exercise are presented below, with further detail as to methodology, sources and uses of data, and the results of sensitivity analyses contained in Annex 1. This introduction highlights several key elements of the overall approach that has been employed. As defined in the Terms of Reference (TOR), the key tasks included in this ERR analysis include:

- Evaluate the economic rate of return ("ERR" or "IRR") of Nam Theun 2 from the point of view of the project and from the point of view of Laos (GOL).
- Categorize available cost and benefit data and estimate indirect costs and benefits.
- Complete a sensitivity analysis which analyzes the various rates of production, pricing assumptions, and other factors affecting the ERR calculation.
- Analyze, from the Regional view, the avoided cost of power by comparing the NT2 project with alternative projects that might substitute to meet Thailand's energy demand

2. A final area of analysis involved a comparative analysis with the ERRs of other similar projects in Laos and with alternative designs of this project, depending on the availability of adequate data. The project team has not received data on comparable projects from which it is possible to perform a comparative analysis. However, in background research, the project team has secured data on comparative costs of hydropower projects in Laos and other areas of Southeast Asia, and these are broadly comparable to the projected costs of Nam Theun 2.

3. Below we present the key findings and assumptions associated with each of the above TOR requirements. All findings are given in real terms utilizing 1996 dollars as a basis. In addition, results are given for two time periods: from 1997 to 2027, the expected length of the concession agreement; and from 1997 to 2050, the estimated life of the project. Section 1 presents the conclusions from the economic rate-of-return analysis, including the key assumptions associated with the "base case" scenario. Section 2 presents the different costs and benefits used in the two economic rate-of-return analyses (project perspective and GOL perspective). Section 3 presents the sensitivity analysis and resulting changes in the ERR from each perspective. Finally, Section 4 reviews the avoided cost of power from the Regional perspective. Annex 1 presents more detailed information about the analysis.

1. Conclusions and Base Case Assumptions

1.1 Overview

4. The cost/benefit analysis calculates the economic internal rate-of-return (referred to as "ERR" in this analysis) and net present value (NPV) for the Nam Theun 2 (NT2) project from a number of different perspectives, under several different scenarios. Under the "most likely" or base-case scenario, the NT2 project appears to be viable in terms of the economic rates of return for the project itself, from a global perspective, and more narrowly from the GOL's perspective.

In both perspectives, ERRs equal or exceed 16%, and the net present value (NPV) of the return on the GOL's initial investment of \$100 million is more than \$345 million over the life of the dam. This scenario assumes, among other things, that any construction cost overruns would be the contractual responsibility of the Turnkey Contractor; and that inflation would average 3% annually for U.S. dollars and 6% for Thai baht. Sensitivity analysis of the model indicates that the net present value of the project remains positive under all but the most pessimistic of scenarios.¹

5. From the project perspective the benefits are represented by power revenue. Costs include all the construction, environmental and social, operations and maintenance (O&M), and financial costs that ultimately will fall within the responsibility of the project. From the perspective of the GOL, benefits also include royalty and tax payments received from the sale of power from NT2. Additional costs may be incurred for items that are external to the corporate entity responsible for the project (NTEC) such as unmitigated environmental and social costs (e.g., unmitigated resettlement costs or the opportunity cost of the land to be inundated). One additional cost included is the lost value of generation from Theun-Hinboun.

1.2 "Base Case" Assumptions and Findings

6. The base case scenario is derived from the following set of assumptions. With regard to benefit streams, the tariff scenario is set to a level consistent with the most current information for an expected power purchase agreement, and the generation output is derived from a Lahmeyer + Worley engineering study. With regard to the cost streams, the base case utilizes construction costs as provided by Lahmeyer International, and O&M costs as projected by the private sponsors and financial costs as currently planned by the project participants. Concerning externalities (i.e., environmental and social costs and opportunity cost of land), the analysis assumes a "worst case" or "most expensive" scenario. The specific scenarios and assumptions from which the base case is derived and sensitivity analyses are compared are:

- Generation output level is 5,248 GWh/year.
- Tariffs are based on recent discussions with NTEC, the World Bank and the GOL. This information is also compared to recent tariff agreements for other, similar projects and on Thailand's avoided cost. The base case tariff assumes a constant nominal rate of 5.7 cents/kWh.
- No construction cost over-run, in accord with the draft concession agreement, which assigns any such costs solely to the Turnkey contractor.
- Thai inflation rates of 6% per year. US inflation rates of 3% per year.
- A real discount rate: 7% for the GOL (used only in the Net Present Value Analysis).

¹ Hydrological risk and differing tariff structures are evaluated further in both the macroeconomic and the financial risk components of the Study.

- Unmitigated environmental and social costs are 50% of the total estimated economic and social costs presented in the environmental analysis (See Appendix 1 and Annex 2 for details). The remainder of the total costs are treated as "mitigated" and are part of the construction budget.
- To pay for its equity share, the GOL obtains a loan of \$100 million. This amount is allocated as a cost to the GOL over four years.
- After the year 2027, the GOL assumes full ownership of the project. All costs projected to occur after 2027, including O&M costs and externalities, are projected to remain constant in real terms. Tariffs are based on Thailand's avoided cost

1.3 Base Case Results

7. Based on data and assumptions described previously, the results of the cost/benefit analysis are summarized in the following tables. These results show that from both perspectives the project has an ERR that is equal to or greater than 16% in real terms. The return from the project perspective over the life of the dam is most favorable with an ERR of 18.6% and NPV of \$566 million in real terms. From the perspective of the GOL, the ERR is 16.4% in real terms, and the NPV is \$345 million.

SCENARIOS and ASSUMPTIONS			
Generation	Average	Unmitigated Env&Social	High
Tariff	5.7	Const Noml Const. Cost Adjustment	0%
GOL Finance	\$100: 1998 - 2002	Thal Inflation Rate	6%
GOL Equity %	25%	US Inflation Rate	3%
GOL Real Disc%	7%	NT2 Real Disc %	9%

RESULTS (1996 M\$)		
	NT2	GOL
Years 1997 - 2027		
IRR	18.4%	15.1%
NPV	468	136
Years 1997 - 2050		
IRR	18.6%	16.4%
NPV	566	345

2. Costs and Benefits Utilized

8. For analytical purposes, overall costs are categorized as follows: pre-construction costs, construction, environmental and social, and operations and maintenance/administrative. Annex 1 presents detailed cost categories and estimates. The pre-construction costs include all development costs, returns, and fees incurred prior to the start of project construction. The construction costs are mainly the physical construction of NT2, but also include such things as insurance and contingency funds. From the GOL perspective, the cost of their equity portion (\$100 million) is used to represent the GOL's contribution to the project. Finally, operations and maintenance/administrative costs include O&M, insurance, overhaul reserves, and NTEC administrative costs. An additional source of costs include the lost power generation from Theun-Hinboun. NT2 will divert water away from the Nam Theun river and therefore reduce the amount of power generated and sold by the downstream Theun-Hinboun. The value of this lost generation is included as a cost.

9. With regard to environmental and social costs, there are "budgeted" and "nonbudgeted" line items included in the analysis. The budgeted environmental and social costs are those costs which are mitigated and accounted for by NTEC. The nonbudgeted environmental and social costs consist of two subcategories of costs or "externalities" to NTEC that are wholly borne by the Government of Laos. The first subcategory is "unmitigated economic and social costs" which cover losses and damages associated with resettlement and ecosystems. The second subcategory is "opportunity cost of land" which estimates losses in future timber revenues and carbon values.

10. The sources of data for these cost categories are as follows: pre-construction—Lahmeyer International; construction—Lahmeyer International; environmental and social—NTEC; externalities—Louis Berger International (see Appendix 1); operation and maintenance—SBC Warburg; financial—SBC Warburg.

11. The benefits presented in the base case from the project perspective are the revenues collected from the energy output (the product of generated output by the tariff rate). The benefits accrued to the GOL are royalties, taxes, and their equity share of the investment.

3. Sensitivity Analysis

12. This section presents the results of sensitivity tests on several assumptions and scenarios. For each sensitivity test, the results for the base case are shown along with results of variations in each variable tested. In addition, two other cases are developed to gauge the bounds for overall results: a "rosy" case where all variables are optimistic and a "nightmare" case where all are pessimistic. While these two cases are not likely outcomes, they are illustrative of where the base case falls within the entire range.²

²The study team also considered the risk of sedimentation of the dam, but found that no comprehensive studies of this risk had been completed. Senior NTEC representatives told the study team that siltation of the dam would not pose a serious problem, even if the NBCE were logged, for at least 50 years. Nonetheless, the team recommends that further independent study of this risk should be done.

3.1 Generation Levels

13. Generation levels were determined from an engineering simulation from historical weather patterns and a monte carlo simulation of the future. Five scenarios were drawn from the monte carlo simulation. The low generation scenario was further modified to show the effects of a five year drought in the second through sixth year of operation. All scenarios include an average, expected generation level in the first year.

Sensitivity Test Results (1996 M\$)								
CASE	1997-2027				1997-2050			
	NT2		GOL		NT2		GOL	
	IRR	NPV	IRR	NPV	IRR	NPV	IRR	NPV
<i>Low with drought</i>	15.5%	\$331	11.9%	\$90	15.8%	\$429	14.1%	\$299
<i>Low 30%</i>	18.3%	\$464	15.0%	\$134	18.5%	\$561	16.3%	\$342
<i>Average</i>	18.4%	\$468	15.1%	\$136	18.6%	\$566	16.4%	\$345
<i>High 70%</i>	18.5%	\$472	15.2%	\$138	18.6%	\$571	16.5%	\$349
<i>High 10%</i>	18.6%	\$479	15.4%	\$142	18.8%	\$579	16.6%	\$353

3.2 Tariff Scenarios

14. The tariff scenarios are based on Thailand's estimated avoided costs and recent information on tariff agreements for similar projects. The high tariff scenario is based on the fully allocated cost of coal fired generation using imported coal. This models Thailand's long term avoided cost. The low tariff scenario is based on the lowest tariff from the Nam Ngum 2 and Nam Ngum 3 projects with further subtractions made to account for power quality and time of delivery. Two additional scenarios with tariffs begin equal to the base case but include a renegotiated tariff fifteen years after operation. One of these assumes a downward renegotiation of 10%. The other assumes a renegotiation upward of 5%.

Sensitivity Test Results (1996 M\$)								
CASE	1997-2027				1997-2050			
	NT2		GOL		NT2		GOL	
	IRR	NPV	IRR	NPV	IRR	NPV	IRR	NPV
<i>Nam Ngum (-)</i>	18.3%	\$418	14.1%	\$90	18.5%	\$517	15.9%	\$299
<i>Coal</i>	19.1%	\$509	16.0%	\$155	19.3%	\$608	17.1%	\$364
<i>5.7 Const. Nom'l</i>	18.4%	\$468	15.1%	\$136	18.6%	\$566	16.4%	\$345
<i>5.7/+5% in yr 15</i>	18.3%	\$453	14.8%	\$123	18.5%	\$550	16.2%	\$333
<i>5.7/-10% in yr 15</i>	18.4%	\$475	15.2%	\$143	18.6%	\$593	16.7%	\$395

3.3 Construction Costs

15. It may be argued that the fixed price nature of the turnkey construction contract reduces much of the potential for cost risk, and furthermore that the inclusion of contingency funds further dampens over-run risk. It is for this reason that the base case assumes no cost over-run. However, in order to test the sensitivity of results to the possibility of a construction cost overrun, two cost overrun scenarios are tested. These include construction cost overruns of 10% and 20%.

Sensitivity Test Results (1996 M\$)								
CASE	1997-2027				1997-2050			
	NT2		GOL		NT2		GOL	
	IRR	NPV	IRR	NPV	IRR	NPV	IRR	NPV
No Cost Overrun	18.4%	\$468	15.1%	\$136	18.6%	\$566	16.4%	\$345
10% Overrun	16.8%	\$418	10.8%	\$82	17.1%	\$516	13.0%	\$291
20% Overrun	15.5%	\$368	8.1%	\$28	15.8%	\$466	11.0%	\$237

3.4 Inflation Rates

16. The projected US rate of inflation is 3% and the Thai inflation is 6%. Sensitivities were tested by adding and subtracting 1% to both US and Thai inflation. Therefore the low inflation scenario includes a US inflation rate of 2% and a Thai inflation rate of 5%. The high inflation scenario includes a US rate of 4% and a Thai rate of 7%. It is important to remember that these represent long term inflation rates.

Sensitivity Test Results (1996 M\$)								
CASE	1997-2027				1997-2050			
	NT2		GOL		NT2		GOL	
	IRR	NPV	IRR	NPV	IRR	NPV	IRR	NPV
Base Case	18.4%	\$468	15.1%	\$136	18.6%	\$566	16.4%	\$345
Low Inflation	20.4%	\$621	17.2%	\$203	20.6%	\$774	18.3%	\$529
High Inflation	16.4%	\$337	12.9%	\$82	16.6%	\$399	14.4%	\$213

3.5 Externalities—Environmental and Social Costs; Opportunity Cost of Land

17. There are two key variables that are relevant to the economic analysis and are considered externalities—environmental and social costs and the opportunity cost of land. For both variables, the base scenario assumes the highest costs, on the understanding that these may be refined in the future as better data become available about these costs and the developer's intentions to mitigate them.

18. For environmental and social costs (which include the opportunity cost of land), the base case assumes that 50% of the total environmental and social costs are unmitigated by the project. Another scenario (and one that would greatly reduce the GOL's costs) assumes that only 10% of the costs are unmitigated and covered by the GOL. In addition, a scenario showing no unmitigated environmental and social costs is included.

Sensitivity Test Results (1996 M\$)								
CASE	1997-2027				1997-2050			
	NT2		GOL		NT2		GOL	
	IRR	NPV	IRR	NPV	IRR	NPV	IRR	NPV
High Costs	18.4%	\$468	15.1%	\$136	18.6%	\$566	16.4%	\$345
Low Costs	18.8%	\$489	16.9%	\$163	19.0%	\$589	17.8%	\$376
No Env&Soc Cost	18.9%	\$495	17.3%	\$171	19.1%	\$595	18.2%	\$384

3.6 End-of-Spectrum Perspectives: "Rosy" and "Nightmare"

19. In summary, the base case scenario combines the "most likely" benefit streams with "most likely" direct cost estimates and "pessimistic" externalities projections. In order to provide some context for analytical reference, it is possible to set all the assumptions to most pessimistic or "nightmare" and most optimistic or "rosy". The probability of all variables being either optimistic or pessimistic is very low. However, this analysis may be useful for demonstrating the full range of analysis. The set of assumptions associated with each scenario and resulting IRRs are presented below:

Variable	Rosy	Nightmare
Generation Output	Highest 10%%	Lowest 10%+drought
Tariff	Coal	Nam Ngum (-)
Construction Cost Over-Run	0%	20%
Thai/US Inflation rates	5%/2%	7%/4%
Unmitigated Env & Social Cost	0%	50%

Sensitivity Test Results (1996 M\$)								
CASE	1997-2027				1997-2050			
	NT2		GOL		NT2		GOL	
	IRR	NPV	IRR	NPV	IRR	NPV	IRR	NPV
Base Case	18.4%	\$468	15.1%	\$136	18.6%	\$566	16.4%	\$345
Rosy	21.8%	\$709	20.3%	\$265	21.9%	\$866	21.0%	\$600
Nightmare	11.1%	\$112	4.1%	(\$69)	11.7%	\$173	8.2%	\$63

4. Avoided Cost Analysis

20. The Regional perspective is included in this analysis by comparing the NT2 project with alternative projects that might substitute to meet Thailand's energy demand. A natural gas fired combustion turbine may provide the marginal resource in the short-term, but the gas supply is not expected to be adequate to meet Thailand's long-term power requirements. Generation from imported coal is the most likely source to provide Thailand's long term power growth. The levelized cost and the base case tariff for Nam Theun 2 is less than the expected long-term cost of coal fired generation.

II. Microeconomic and Institutional Analysis

Introduction

1. The microeconomic analysis component examines the likely impacts of the Nam Theun 2 hydroelectric project on the real sector of the Lao economy, especially on prices and employment in the project area.¹ Other impacts also are examined, including those deriving from demographic pressures in response to increased economic opportunities in the area. The institutional capacity of Bolisat Phathana Khet Phoudoi (BPKP), the provincial governments, and the central government, to manage the impacts of the project are assessed. Findings and tentative recommendations are presented in the final section. Further analytical detail and supportive documentation may be found in Annex 3.

1. Preconstruction Activities

2. A question implicit to the analysis of the projected impacts of the Nam Theun 2 project has to do with its relationship to current logging on the Nakai Plateau. There seems to be no question that BPKP embarked on an accelerated logging program in 1993 in anticipation of the approval of the Nam Theun 2 dam project. This was offset by a halt to logging activities in the much larger catchment area behind the planned inundation area, in anticipation of its being retained as a national biodiversity conservation area (NBCA). This fits within the larger context of the Lao PDR's national economic strategy progressively to replace exports and government revenues from logging with higher receipts from hydroelectric power; and gradually to reduce logging quotas to levels compatible with sustainable forestry harvesting.

1.1 Direct impacts

3. In some respects BPKP's logging activity is an enclave project similar to that envisioned by Nam Theun 2 project developers. Almost all of the logging itself is contracted out to Vietnamese or other foreign concessions. Thus, the direct employment impacts on the local area are minimal, and the impact on local wages also has been negligible. Price impacts on consumer goods and services in the Nakai Plateau also appear to have been minimal, in part because there is a relatively good highway network; and because commercial trade is essentially open. In both Nakai and Lak Sau (BPKP's regional headquarters), consumer goods imported from other parts of Laos, and from Thailand, are plentiful, and appear to be no more costly than in Vientiane. Local producers also are very active in supplying goods and services in the local markets visited in both towns.

1.2 Indirect impacts

4. The indirect impacts of BPKP's logging program on local and regional markets include the company's investments in wood processing plants, hotels, restaurants, and other businesses; and

¹ An assessment of the potential impact of revenues from Nam Theun 2 in terms of relative prices at the national level—the "Dutch Disease" effect—is presented in component 4, 'Macroeconomic Analysis.'

a significant in-migration to take advantage of new market opportunities, centered in particular on Nakai and Lak Sau towns. This growth has all the hallmarks of a boom town syndrome, including microentrepreneurs selling their goods in the open-air markets; as well as some of the social ills, such as prostitution. But BPKP, in its role of local authority, apparently engages in a conscious effort to minimize the threat to traditional village organizational stability and authority in the surrounding region.

5. One area of immediate concern, however, has to do with protection of wildlife in the area, and indeed one can easily find rare species for sale in the local open-air markets and restaurants. The in-migration of Lao population, and probably of foreign logging crews as well, can only have meant increased demand for these products (and also supply, for many new residents and workers hunt). Without implementation of an organizational and enforcement structure to prevent encroachment on the wildlife population, these new demographic pressures could multiply the threat to wildlife in the Nakai Plateau and in the NBCA as well.

2. Construction Project Impacts on Local and Regional Markets

6. Although the Nam Theun 2 construction project is designed essentially as an enclave development, this will reduce, but not eliminate, the impacts of the project on local goods, services and labor markets. This section examines the likely effects on local and regional prices and employment of the increases in demand for goods and services and population attributable to the Nam Theun 2 construction project. The probable impacts of demographic pressures on social cohesion and biodiversity are also considered.

2.1 Potential institutional/infrastructural bottlenecks

7. There appear to be few if any bottlenecks to the supply of consumer goods and services with the potential to cause shortages and/or significant price rises related to the construction phase of the Nam Theun 2 project. The transport network already is relatively good to both Nakai and Lak Sau towns. Internal commercial trade and prices in Laos are virtually unrestricted, and have been since the late 1980s. This will allow Lao producers to expand sales to meet increases in demand in the project area. Foreign trade and the exchange regime also have been substantially liberalized, so that imports can help to stem local or regional shortages and price increases that otherwise might arise.

8. Bottlenecks to the supply of nontradeables, which for purposes of this analysis are taken to mean consumer services, could be a more serious source of concern. But as long as the authorities do not seriously restrict labor mobility, in-migration seems like a strong possibility in response to the increased demand for services in the Nakai Plateau, and this will tend to minimize price increases in nontradeables.²

² Where bottlenecks appear most likely to arise is in the supply of public goods and services that would not be financed or provided by the project itself, and hence would fall under the responsibility of the GOL. The sources and nature of these potential bottlenecks are discussed more fully in Annex 3.

2.2 Impact on relative prices

9. The Nam Theun 2 project would not have a significant impact on relative prices of consumer goods in the local or regional area, because the project is designed as an enclave that would import most of its supplies. Regarding spillover demand, following price and trade liberalization there are relatively few bottlenecks to the importation of these products from other regions of Laos or from neighboring countries that would cause shortages or relative price shifts. And, as long as the authorities do not attempt to begin restricting labor mobility, in-migration seems like a strong possibility in response to the increased demand for consumer services in the Nakai Plateau, and this will tend to minimize price increases in the prices of those services.

10. These conclusions are supported by recent experience in other hydro projects, such as Theun Hinboun, as well as observation of the impact on relative prices of BPKP's accelerated logging campaign in the Nakai Plateau since 1993.

2.3 Employment impacts

11. Similarly, the direct employment impacts of the construction project on the local area and region would be minimal, in part because the project is designed as an enclave which would import equipment, materials and most of the labor that would be required. In other hydro projects, the employment of Lao labor has generally been confined to unskilled labor categories, and this pattern would be likely to persist in this case. In addition, most of the unskilled labor would likely be drawn from other regions of Laos, and not from the Nakai Plateau. This would tend to minimize the impact of the project on selected labor skills categories and wages in the Nakai Plateau.

2.4 Indirect impacts

12. Although the local impact of the project on relative prices would be minimal, as would direct employment in construction crews, there would be significant indirect impact, in the form of increased demand for consumer goods and services, leading to increased local employment opportunities and income. It is to be expected that local residents as well as businesses within the region more broadly would derive additional income from these opportunities. But based on observation of the indirect, or "multiplier" economic impacts of other hydropower projects during the construction phase, like Theun-Hinboun, these would be of minimal importance in comparison to national GDP. Periodic surveys of local and regional households and enterprises could be instituted to monitor these developments. Another indirect impact would be increased demand for public infrastructure and services outside the project compound. NTEC representatives have said the project would place significant emphasis on planning for these contingencies, although responsibility for them remains to be worked out.

3. Impact of demographic pressures

3.1 Social impacts

13. The demographic pressures likely to derive from immigrant laborers would probably be minimal over the medium-term, because of fairly stringent visa restrictions. But during the construction period both they and Lao immigrants to the area could pose serious demographic pressures. As evidenced by experience in sites near other hydro projects, such pressures can have deleterious social impacts. One serious concern has to do with the rise of prostitution and the potential for accompanying social diseases, such as AIDS. This would have to be monitored very carefully by local authorities and the Ministry of Health, possibly with the help of local NGOs.

3.2 Impact on biodiversity

14. Another impact of demographic pressures on the Nakai Plateau would be the strong potential for loss of wildlife due to hunting and deforestation. The principal means by which these areas have been protected until recent years has been inaccessibility. This would be lost should the project go forward as planned, in which case the NBCA, as well as reserved areas of the Nakai Plateau, would have to be protected by more active measures. The GOL plan to invoke internal residency restrictions does not look practical. Without promulgation of effective environmental protection policies and enforcement, loss of biodiversity would be a real risk. This, more than any other factor, has driven proposals to put into place an 'autonomous institution' under the proposed NTSEP loan from the World Bank, to carry out this mandate.

4. Institutional Capacity

15. This report highlights key aspects of the structure and activities of a number of public-sector institutions key to the management of the impacts of Nam Theun 2, including the Resettlement Committee (which includes provincial and local authorities), the Ministry of Agriculture and Forestry, the Ministry of Health, the Ministry of Education and BPKP. The objective is to derive a preliminary assessment of the extent to which these institutions are prepared to manage those impacts of Nam Theun 2 which fall either wholly or partly outside the purview of the private sponsors.

16. In reality, this demarcation is difficult to draw, because the exact nature of NTEC's contractual responsibility for such things as mitigation of environmental and social impacts, provision of physical infrastructure, and monitoring of project implementation is still under negotiation. Nonetheless, there are several areas in which responsibility for action on the part of Lao authorities would appear to be necessary, including resettlement, mitigation of social and environmental impacts, environmental protection, and re-defining the role of BPKP. These are discussed in relation to the currently envisioned structure of responsibilities for mitigation and management of project impacts on the part of BPKP, provincial authorities and central government ministries.

4.1 Resettlement

17. The GOL would retain primary responsibility for resettlement of the 900 or more families in the area to be inundated. A number of issues are suggested by the manner in which this committee is structured, including the contractual relationship with NTEC, the participation of BPKP, local participation in the planning process and monitoring of resettlement implementation. A related issue has to do with responsibility for the ancillary infrastructure that would be needed outside the project compound.

18. Among the issues that must remain unresolved, pending negotiations between NTEC and the GOL, are the amounts NTEC will contribute for resettlement, what it will spend them for, and what would be the scope and nature of parallel expenditures to come from IDA financing under the proposed NTSEP project. Nonetheless, one or two observations can be made at this point. On past experience, indirect impacts of the project will include significant demographic pressures, and the GOL will need to explore the extent to which NTEC should cover at least part of the cost of the ancillary infrastructure and services for the mushroom towns that are bound to spring up near the project site. The residual will fall to the GOL, and prior planning for these costs and responsibilities will be essential.

19. The mandate of the RC was evolving during the period in which the Economic Study team carried out its analysis, in parallel with conceptualization of the proposed NTSEP project. RC representatives told the Study team that, as currently envisioned, the committee would be largely advisory in nature, and in particular that it would not be responsible for awarding contracts. Nonetheless, current NTEC proposals envision expenditures on all resettlement activities amounting to \$33 million dollars, shared roughly equally between the project and parallel financing to come from the NTSEP project. A Resettlement Management Unit (RMU) would be set up under the RC that would be responsible for expenditures of NTSEP funds. To the extent that the RC is expected to supervise the activities of the Resettlement Management Unit (RMU), or that the committee discusses RMU plans and deliberations concerning any contracts to be extended with NTSEP financing, it could be inappropriate for BPKP, as a member of the RC, to bid on contracts that might be awarded by the RMU. A similar potential for conflict-of-interest could arise in respect to BPKP plans to bid on works contracts to be awarded by NTEC or its Turnkey contractor, given NTEC's participation in the RC. These issues should be resolved in the context of coming to grip with the scope and nature of BPKP's future role, should the Nam Theun 2 project go forward.

20. Local participation in the planning process relating to the Nam Theun 2 project has been stressed by the World Bank and other institutions, but judging by the consultation process that the Study team joined, better approaches could be found to information dissemination and gauging the real concerns of local residents. The planned structure of working groups is encouraging, but it is also true that both the RC and NTEC bear a special responsibility to assure that this communication process is as value-neutral and accessible as possible, so that the concerns of local residents can be fairly represented. The RC, which currently is almost wholly dependent on

NTEC, is placed in a peculiar position in respect to sampling and conveying the views of local stakeholders.

21. Based on the interviews carried out by the Study team, much remains to be done in terms of sorting out the respective responsibilities of NTEC and the GOL, and differences over approach, already observable, are likely to continue to arise during implementation. Under these circumstances, external monitoring of resettlement program implementation is strongly advised.

4.2 Mitigation of social and environmental impacts

22. In principle, NTEC should bear financial responsibility for mitigation of all social and environmental impacts attributable to the project. Based on international experience, however, the Study team estimates that under the best of circumstances, 10% of such costs are never mitigated; under the worst of circumstances, 50%. The Study team has utilized the higher figure as a first estimate of the cost that would be attributed to the GOL, first, because NTEC's budget to cover these costs is still being negotiated; and second, because the institutional division of implementation responsibilities also remains to be defined.

23. Based on the very preliminary review of institutional capacity carried out in this Study, however (see Annex 3), other than the RC, public sector institutions appear not to have begun the process of planning to manage the project's impacts. The health impacts, in terms of potential increases in malaria and AIDS, could be significant, for example, but the Ministry of Health apparently has undertaken no contingency planning or budgeting, nor has it studied the health impacts of hydropower projects at other sites. Institutional responsibility for the construction of ancillary infrastructure, health clinics and schools is hazy and overlapping among BPKP, provincial authorities and GOL ministries like the Ministry of Education; and again, there appears as yet to have been no contingency planning or budgeting.

24. More fundamental, the amounts that are under discussion for inclusion in budgets for environmental and social mitigation and protection are of an order of magnitude larger than the budgets that provincial authorities and relevant GOL ministries are used to spending, calling into question their institutional capacity to manage the responsibilities that might fall to them. This would argue for substantial reliance on contracting out to private and non-profit groups to meet those responsibilities falling under the GOL's domain. To date, however, the institutional structure and capacity to carry out these responsibilities may be characterized as rudimentary.

4.3 Environmental protection

25. As currently structured, it is clear that the MOAF has neither staff, budget nor experience to undertake environmental protection in the Nakai Plateau and in the NBCA. These responsibilities, however, would definitely increase, both during and after the construction of the Nam Theun 2 hydropower facility. It is for this reason that the World Bank and other stakeholders in Nam Theun 2 have begun to discuss the need for an 'autonomous institution' that would be responsible for environmental protection of the NBCA and possibly portions of the

Nakai Plateau as well. Unfortunately, these discussions were in too preliminary a stage to allow assessment within the context of this report.

26. The GOL's initial position, however, that most of the protection that would be needed could be accomplished through reliance on internal residency restrictions, appears neither practical nor desirable. Other means should be found to enforce forestry and wildlife protection, including the possibility of hiring rangers specifically for that purpose. Again, given the GOL's thin institutional capacity in this area, much of the work of the 'autonomous institution' would probably have to be contracted out to private or non-profit entities.

5. Role of BPKP

27. Much of the economic and institutional analysis of the Nam Theun 2 project skirts the intrinsic importance of the Mountainous Region Development Corporation (or *Bolisat Phathana Khet Phoudoi*, usually referred to by its Lao acronym, BPKP). Yet BPKP is one of the Lao PDR's most significant institutions in terms of national exports and central government revenue, and it is the predominant Lao institution in respect to logging and rural development in the Central Region, which includes the Nakai Plateau and the NBCA. And so the question of how this institution is to evolve, as its principal source of revenue—logging and wood products—declines, is a serious consideration for the sustainability of the project's proposed institutional structure.³

5.1 Institutional mandate

28. BPKP is a state-owned company chartered in 1985 by a decree of the Lao PDR's Party Central Committee, with the mandate to develop the Central Region of the country. It is essentially owned and operated by the armed forces headquartered in the region. It is a net contributor to the national budget. Since 1993 it has been given sole harvesting rights to the region's timber resources, from which (including its wood processing activities) it derives 80% - 90% of its revenue. BPKP contributes substantially to the central government's budget, because the company is required to make timber royalty payments on all trees felled.⁴ In fact, BPKP's timber royalties have amounted to roughly 8% - 10% of total government revenues since full-scale logging operations began on the Nakai Plateau in 1994.

³ Most of the information in this section derives from interviews with Dr. Maydom, BPKP's First Vice President. This is supplemented by a Financial Statement supplied by BPKP in March 1997 and figures from the Ministry of Finance, the World Bank and the IMF.

⁴ The Economic Study team confirmed in field trips to the region that a very careful system of marking felled trees to identify them for tax purposes was in place and being utilized.

5.2 Logging in the Nakai Plateau.

29. Logging in the Nakai Plateau actually began before the Nam Theun 2 project came under consideration, beginning as early as 1985. At first, only selective cutting of trees more than 200 years old was approved, under quotas allowing 30,000 cubic meters per year to be harvested. During this period, BPKP was required to engage in an extensive re-forestation program. Then, in 1993, a decision was made to go forward with the Nam Theun 2 project, at about the same time that a Memorandum of Understanding was signed with Thailand to supply 1,500 MW of electricity, and the timber harvesting quota was increased to 300,000 cubic meters. It appears that between 1994 and 1996, about 70% of the Nakai Plateau's harvestable timber was logged, although care appears to have been taken to harvest the largest trees first.⁵

30. A review of BPKP's Financial Statement (see Annex 3) clearly indicates the change in the company's fortunes which resulted from this decision. BPKP's total income in U.S. dollars averaged about \$10 million annually during 1991 - 1993; during 1994 - 1996 it averaged more than \$37 million annually. Nonetheless, the principal beneficiary of this increase appears to have been the central government, royalties to which increased by more than twelve-fold, from \$1.5 million on average during 1991 - 1993 to \$19.1 million on average during 1994 - 1996. By way of contrast, the company's rural development activities in the Central Region rose less quickly than did its total income; and its reported net profits fell on average by more than half.

5.3 Rural development activities.

31. Although no written statement of BPKP's rural development activities or plans had been made available by the time this draft report went to press, Dr. Maydom told the team that these have centered on rural infrastructure—mainly rural roads, but also housing, irrigation systems for paddy rice farmers, electrification, schoolbuildings and health clinic facilities.

5.4 Business interests.

32. Given its mandate to develop the Central Region, and no initial budget, BPKP's business activities have centered on establishing joint-venture and concession arrangements with foreign partners. Key among these have been the concessions granted to Vietnamese concerns to fell and haul the trees, a method that has apparently been the predominant one for accomplishing the harvesting of trees on the Nakai Plateau. Hence, little Lao employment is utilized for logging, although BPKP's wood processing plants apparently have generated substantial employment.⁶

⁵ Policy and quotas for timber harvesting are set annually by the Prime Minister's office. It should be noted the decision to clear-cut the Nakai Plateau came in the context of an overall policy promulgated in 1993 to restrict commercial logging in the NBCA.

⁶ Members of the team visited a plywood factory joint-venture with a Hong Kong company that employed 800 workers.

33. Other BPKP joint ventures have included granite and marble quarrying, and shoemaking. The general policy is to take a 30% stake in the activity, in return for site preparation and contributions of some raw materials. BPKP also has opened several discotheques, restaurants and guest houses. None of these activities is covered in detail in its annual report.

5.5 Role in resettlement.

34. BPKP is also positioning itself to bid on contracts for infrastructure development stemming from the Nam Theun 2 project. Dr. Maydom said that BPKP would actively seek contracts stemming from resettlement activities in such areas as road-building and construction of housing, irrigation systems, clinics and schools.

35. BPKP is also one of the principal entities represented on the GOL's Resettlement Committee which, under the direction of the State Planning Committee, has been given line responsibility for all Nam Theun 2 resettlement activities. Although the mandate and by-laws of this institution have yet to be fully defined, GOL officials anticipate that the Resettlement Management Unit (RMU) that reports to it will be responsible for letting contracts for infrastructure development and other activities relating to resettlement.

5.6 Role in environmental protection

36. BPKP will retain sole commercial harvesting rights to all trees on the Nakai Plateau, including those on land owned individually or communally by the resettlers. In addition, Dr. Maydom envisions that the company will have a significant role to play in respect to protection of the NBCA. BPKP further defines its role as helping to implement the GOL's policy to restrict swidden agriculture in the area. Although currently in abeyance pending appraisal of the NTSEP project, the GOL's policy is to consolidate the population of the NBCA area into several sites to which access roads would be built by BPKP, and then encourage them to shift from swidden production in part by constructing irrigated paddies, also to be built by BPKP. BPKP also sees itself as a bidder on some of the contracts that would be forthcoming from the NTSEP exercise, including for example, forestry protection.

5.7 Role in poverty alleviation.

37. BPKP expects its principal responsibility for development of the Central Region to continue during and after the construction of the Nam Theun 2 dam, and so it must be factored into account in all decisions having to do with rural development and poverty alleviation in the region. In accordance with that role, during the past three years BPKP has reported contributing on average more than \$4 million per year to rural development activities.

5.8 Institutional oversight and fiduciary accountability

38. There are some potential discrepancies in respect to the financial figures reported by BPKP in comparison with those from other sources which give cause for concern about its

fiduciary accountability. The Economic Study team were told that, in accordance with the Enterprise Law, a Board of Directors should be established to oversee BPKP, and that further, a Ministry of Finance official should be placed within the company as Chief Financial Officer. These legal requirements have not so far been met.⁷ Instead, the singular control exerted by the central government on BPKP's activities are certificates that are issued by the MOF allowing it to move cut timber (which are the basis for collection of timber royalties).

5.9 BPKP's future role.

39. It is not at all clear how BPKP's role should or will evolve as its principal source of revenue—logging and wood products—declines. What is clear is that, just to continue its operations at current levels, BPKP will have to diversify its business activities away from a dependence on wood products. This, in fact, is the company's explicit strategy. Nonetheless, BPKP's commercial interests will continue to be to maintain higher logging quotas than are commensurate with a sustainable harvesting regime. This will be true particularly while it retains the monopoly rights to commercial logging in the Central Region.

40. More broadly, the role of BPKP will need to be re-defined if the company is to evolve from a state development institution into a for-profit company. Its rural development and poverty alleviation activities represent a loss to its accounts that a for-profit company would find hard to justify. Other potential conflicts between its commercial interests and its public governance functions, in particular its participation in the RC while planning simultaneously to bid on resettlement contracts, should be resolved. As an autonomous state enterprise it should have a Board of Directors and fiduciary accountability to the Ministry of Finance to facilitate oversight of its activities.

⁷ This also applies to the state-owned companies with similar mandates in the Northern and Southern Regions of Laos.

III. Macroeconomic Analysis

Introduction

1. The macroeconomic analysis assesses the indirect impacts of the Nam Theun 2 project through its projected effects on the GOL budget and balance-of-payments. It also applies theory and cross-country comparative analysis to look at possible impacts on the exchange rate. This section projects the impact of net incremental government revenues from the project; examines the likely impact of the project on external balances; analyzes the development implications of the revenue stream; and assesses Laos's economic strategy of increasing reliance on hydropower in the context of its ability to program the revenues effectively. Further detail is provided in Annex 4.

1. Background

2. Since 1986, the Lao PDR has been successful substantially in stabilizing the economy; in liberalizing trade, prices, interest rates and the exchange regime; and in making considerable progress in the task of re-defining the public sector's role in the economy. Although Laos remains one of the world's poorest countries with a per capita income of \$374, implementation of this strategy has produced sustained GDP growth rates of 5% - 8% during the 1990s, and significant increases in per capita income, while inflation has fallen to single-digit levels. Laos will join ASEAN in 1997, and aims to join WTO as soon as possible thereafter.

Lao PDR

Nominal GDP ('96)	\$1.85 billion
Real GDP Growth	1994: 8.1%
	1995: 7.1%
	1996: 6.8%
GNP per capita ('95)	\$374
Population ('95)	4.8 million
Inflation ('96)	7.3%
Budget deficit/GDP ('96)	13.0%
Foreign financing/GDP('96)	5.1%

1996 figures preliminary

Source: IMF

3. The GOL's economic strategy is to continue making progress in economic transformation through, among other measures, broadening the tax base and improving the effectiveness of public investment. It also envisions progressive reduction in the nation's dependence on timber exports and royalties to levels commensurate with sustainable commercial forestry, replacing and significantly augmenting those revenues with hydro-power exports and royalties. Some of the new revenues will be utilized for a concerted effort, with the support of international institutions, to protect national rainforests. The social strategy seeks to ensure equitable distribution of the economic benefits to be derived from rapid economic growth through provision of improved access to, and quality of, education, health, agricultural extension and communication services. Over the medium term, domestic sources of financing would slowly begin to replace Official Development Assistance (ODA) as the primary source of financing for public investments. GOL officials are looking to revenues from hydropower to help finance this strategy.

2. Macroeconomic Scenarios

4. The economic projections described in this section are based on the Lao PDR's economic strategy, utilizing a simplified Laos Revised Minimum Standard Model - Extended (RMSM-X)¹ to forecast macroeconomic outcomes. The main thrust is the continuation of the transformation of the Lao economy to a market-oriented one with reform measures that will alleviate the supply constraints inherent in a planned economic system. Increased investments, both foreign and domestic, and a significant rise in hydropower production, primarily for export, will sustain the high economic growth rates achieved in the first half of the 1990s throughout the projection period.

5. In all, four economic scenarios are forecast. The first, "base" scenario assumes that Nam Theun 2 is not built. The second assumes that it is, under the "most likely" scenario utilized in both the cost-benefit analysis and the financial risk analysis (sections I and IV). The third and fourth scenarios are derived from sensitivity analyses that also are run in sections I and IV, to examine what the impacts would be on the macro accounts of the "worst case" scenarios regarding cost overruns and hydrological risk.

3. Base-case scenario

6. Under the base-case scenario (that is, without Nam Theun 2), real GDP at market prices is projected to continue growing at a healthy rate of 7% until 1999, and 6.5% thereafter. The key to achieving these growth rates lies in the maintenance of macroeconomic stability and continuing investment in infrastructure, especially hydropower, roads and telecommunications.

7. **Sectoral growth.** Growth rates in agriculture are projected to rise from less than 3% in 1996 to more than 4.5% on average throughout the projection period. To attain this, incentives will have to be improved and rural infrastructure extended and strengthened. Nonetheless, other sectors of the Lao economy are projected to expand faster than the agricultural sector. Much of GDP growth will be attributable to industrial sector expansion, which is projected to increase by 8% annually in the early 2000s, resulting from greater investment, especially private investment, in the garment, agro-processing, mining, chemical and hydropower sectors. As the needs of the country expand and diversify, more private commercial enterprises will be set up to satisfy these needs. The share of services and other sectors of the economy will increase slightly from about 25% percent in 1995 to more than 30% in the 2000s.

8. Consumption constituted nearly 100% of GDP in 1995. Although consumption will grow by about 4% - 5% during the projection period, this share is projected to decline to 82% by 2006,

¹ The RMSM-X is a simple, savings-driven, open, Harrod-Domar-type growth model used extensively within the World Bank.

as the trade deficit declines from nearly 20% of GDP to around 2% in the 2000s. The goal is for both public and private investment to respond to the signals of the marketplace, with public investment concentrated in infrastructure, education and health care. Private domestic investment is projected to expand from 5.5% of GDP in 1995 to around 12% in the 2000s, with a concomitant decline in the share of public investment in the economy.

9. **Public sector outlook.** The GOL's macroeconomic strategy, supported by an IMF program, is to maintain tight financial policies to lower annual inflation to between 4% and 5%, and to increase domestic savings through further fiscal consolidation and efforts to enhance private savings. Key to that objective will be further strengthening of the domestic tax base, supplemented by hydropower revenues, as reliance on timber royalties diminishes and the authorities shift away from trade taxes. To achieve these goals, the overall fiscal deficit (excluding grants) is expected to improve during the latter part of the 1990s, declining from about 8% of GDP in 1996 to less than 3% in the 2000s.

10. **Money and prices.** Lao authorities will continue to maintain a prudent stance in monetary policy, with the effect of reducing growth in the monetary supply from 21% in 1996 to 16% in 1997 and stabilizing thereafter at less than 15%. Continued macroeconomic stability will lead to growing public confidence in the banks and more movement from the informal sector to the formal sector.

11. **Balance-of-payments and debt.** Trade and foreign investment will remain strong during the projection period. Although nominal exports grew modestly in 1996 (by 3.7%) in part because of European Union limitations placed on importation of garments from Laos, export earnings are projected to pick up with robust growth in electricity exports in particular. Exports of timber and wood products, which are expected to account for more than 40% of merchandise exports in 1997, will decline in the 2000s in line with the GOL policy to restrict logging. Exports of manufactured and agro-industrial products will boost total export growth with an effective export promotion policy (and completion of bilateral treaties) in lucrative foreign markets like the USA. Total exports will grow at an average rate of 5% annually in 2000-2006 and will continue to improve in later years.

12. The strong export performance from hydropower will be matched by higher imports of investment goods in the period 1996-2000. Real import growth will average around seven percent during this period with higher import requirements for intermediate goods and raw materials. This will result in a high current account deficit during this period averaging around 16% of GDP but the deficit will be reduced to less than 5% of GDP in 2006 and will continue to fall thereafter.

13. In the capital account, capital grants are projected to increase marginally through 1999 and decline thereafter to around \$60 million in 2006. Foreign direct investments, including in particular those related to hydropower projects, will increase substantially in 1996-1998 and will average \$40 million in the early 2000s.

14. Although Lao debt is calculated to be more than \$2.1 billion, the bulk of this is in nonconvertible currencies, payment of which (to republics of the former Soviet Union) is currently under re-negotiation. The market expectation is that much, if not all, of this debt will be forgiven. Taking convertible currencies only, Lao debt amounted to just \$803 million in 1996. Of this, \$756 million was owed to multilateral institutions (IDA, the ADB, and the IMF) and \$22 million was bilateral debt to the Japanese government. There was no commercial debt of any magnitude. Until 1996 virtually all of Laos's debt had been borrowed on a concessional basis, with the result that the average interest rate paid was about 1.5% in 1996. Accounting nonconvertible debt-service on a cash basis, the ratio of total debt-service to exports of goods and services (plus workers' remittances) is projected to rise from about 6% in 1996 to 9.9% in 2003, and then to decline, under the base-case scenario.

4. Nam Theun 2 scenarios

15. Under the "most likely" Nam Theun 2 scenario, the projected effects of the project on economic growth would derive from two sources. The first source would be procurement by the construction project of Lao equipment, consumables and materials, and expenditures on Lao products by both Lao and foreign construction-project workers. Table 1 details projected construction-project procurement from Lao sources, based on data derived from construction cost estimates by Lahmeyer International. It is also assumed that foreign workers would spend 10%, and Lao workers 50%, of their salaries on the purchase of Lao products. Under these estimates and assumptions, Lao procurement would total about \$122 million (in 1996 dollars) over the four-year construction period.

16. Expenditures of this magnitude would represent a share in GDP ranging between 1 and 2 percent during the construction period, falling to zero in 2003 with construction project demobilization. Lao procurement expenditures would contribute to GDP growth as construction project expenditures increased, and then would have to be replaced by other sources of expenditure as the construction project phased down.²

17. The second source of GDP growth attributable to Nam Theun 2 are the net revenues that would flow from the GOL's equity returns, royalties and taxes, once costs were subtracted. Table 2 shows the net incremental revenues that would accrue to the GOL from the Nam Theun 2 project under the most likely scenario, expressed in 1996 U.S. dollars, once debt payments and

² Taking into consideration the high import propensity of the Lao economy, and in line with the overall approach of making conservative economic assumptions, it is assumed that these expenditures would generate no second-round expenditure effects --- that is, that the GDP multiplier is one.

**Table 1: NTEC Construction Costs
(1996 \$ millions)**

		1999	2000	2001	2002
Construction Costs		\$96	\$199	\$199	\$96
Equipment					
Lao	12.50%	\$12	\$25	\$25	\$12
Foreign	41.40%				
Consumables					
Lao	0.80%	\$1	\$2	\$2	\$1
Foreign	2.70%				
Materials					
Lao	4.10%	\$4	\$8	\$8	\$4
Foreign	26.20%				
Labor					
Lao	4.40%				
o/w 50%		\$2	\$4	\$4	\$2
Foreign	7.80%				
o/w 10%		\$1	\$2	\$2	\$1
Total Lao Procurement		\$20	\$41	\$41	\$20
% 1996 GDP		1.05%	2.20%	2.20%	1.05%
Memo item:					
1996 GDP		\$1,848			

Source: Lahmeyer International estimates.

Table 2
Net Incremental Revenues to the GOL
Most Likely Nam Theun 2 Scenario
(1996 \$ millions)

Average 1998-2027	1998-2005	2006-2010	Cumulative 2011-2015	2016-2020	2021-2025
\$32.8	\$34.1	\$112.5	\$208.6	\$245.4	\$280.2

other costs (including unmitigated environmental and social costs) were subtracted out. These revenues would produce a once-and-for-all increment to GDP as they came onstream, but thereafter would not contribute an increment to the GDP growth *rate* above the level projected to occur in the base case.³ Because of the likelihood that a significant proportion of the revenues would be invested, it is not possible to project with accuracy when their impact would be felt in terms of increasing GDP. Time lags might be entailed in the translation of investment into output, but it is also the case that the impact on GDP might be brought forward by expectations of future income flows, and by borrowing against those flows to invest in earlier years.

18. Smoothing these impacts on GDP over time, it is estimated that the net result of these two sources of growth would be to increase the GDP growth *rate*, above and beyond the rate forecast under the base case scenario, by about .5% per year during the construction period, and by about .6% annually during the two years following the commencement of operations. This assumes that some of the effect of the increase in net revenues to the GOL would be brought forward in terms of impact on GDP (offsetting the negative impact of debt payments in the early years). Nonetheless, the projection of Nam Theun 2's impact on the growth rate following the demobilization of construction crews is broadly consistent with the magnitude of average net incremental revenues over the 30-year life of the project (\$33 million in 1996 dollars), which if received in 1996, would have represented about 1.8% of GDP.

19. **Sensitivity Analysis.** As presented in Table 3, with additional detail provided in Annex 4, two alternative projections accompany the "most likely" scenario, both of derive from pessimistic scenarios presented in sections I and IV. These are included to illustrate the outer bounds of the downside risks that arise from either a significant cost overrun or drought. It should be stressed that the probabilities attached to these outcomes are low, and that they are

³ In real terms the share of net incremental revenues from Nam Theun 2 to GDP would in fact decline over time, because GDP is projected to grow faster than net incremental revenues.

Table 3: Macroeconomic Impacts of Nam Theun 2 – Various Scenarios

	1998	1999	2000	2001	2002	2003	2004
Net Incremental Revenues to GOL (Mln USD)							
Without Nam Theun 2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Most Likely Scenario with NT2	-0.6	-3.0	-4.3	-5.7	-9.0	21.7	22.7
Construction Cost Overrun Scenario	-0.6	-3.0	-4.3	-5.7	-10.3	19.3	20.3
Hydrology Risk Scenario	-0.6	-3.0	-4.3	-5.7	-9.0	21.7	-9.3
Government Surplus/Deficit (% of GDP)							
Without Nam Theun 2	-7.4%	-7.0%	-5.8%	-5.1%	-3.2%	-2.3%	-1.0%
Most Likely Scenario with NT2	-7.5%	-7.6%	-6.5%	-5.6%	-4.0%	-3.7%	-3.5%
Construction Cost Overrun Scenario	-7.5%	-7.6%	-6.5%	-5.6%	-4.1%	-3.7%	-3.5%
Hydrology Risk Scenario	-7.5%	-7.6%	-6.5%	-5.6%	-4.0%	-3.7%	-4.0%
Government Expenditure (% of GDP)							
Without Nam Theun 2	25.9%	26.1%	23.8%	22.9%	21.0%	20.0%	18.6%
Most Likely Scenario with NT2	26.0%	26.3%	24.0%	23.2%	21.4%	22.5%	21.7%
Construction Cost Overrun Scenario	26.0%	26.3%	24.0%	23.2%	21.5%	22.5%	21.8%
Hydrology Risk Scenario	26.0%	26.3%	24.0%	23.2%	21.4%	22.5%	21.7%
Current Account Surplus/Deficit (% of GDP)							
Without Nam Theun 2	-16.2%	-13.1%	-11.7%	-10.7%	-9.9%	-8.9%	-8.1%
Most Likely Scenario with NT2	-16.9%	-14.2%	-12.8%	-11.3%	-10.7%	-9.1%	-8.0%
Construction Cost Overrun Scenario	-16.9%	-14.2%	-12.8%	-11.3%	-10.7%	-9.2%	-8.1%
Hydrology Risk Scenario	-16.9%	-14.2%	-12.8%	-11.3%	-10.7%	-9.1%	-8.6%
Debt Service / Total Exports (GFS + Workers Rem.)							
Without Nam Theun 2	7.5%	8.2%	8.4%	8.7%	9.6%	9.9%	9.5%
Most Likely Scenario with NT2	7.5%	8.3%	8.6%	8.6%	9.5%	9.5%	9.1%
Construction Cost Overrun Scenario	7.5%	8.3%	8.6%	8.6%	9.6%	9.7%	9.3%
Hydrology Risk Scenario	7.5%	8.3%	8.6%	8.6%	9.5%	9.5%	9.2%
Net Incremental Revenues/ Total Revenues							
Without Nam Theun 2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Most Likely Scenario with NT2	-0.2%	-0.7%	-1.1%	-1.3%	-2.0%	4.2%	4.3%
Construction Cost Overrun Scenario	-0.2%	-0.7%	-1.1%	-1.3%	-2.3%	3.8%	3.8%
Hydrology Risk Scenario	-0.2%	-0.7%	-1.1%	-1.3%	-2.0%	4.2%	-1.8%
Net Incremental Revenues/Total Expenditures							
Without Nam Theun 2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Most Likely Scenario with NT2	-0.1%	-0.5%	-0.8%	-1.0%	-1.6%	3.5%	3.6%
Construction Cost Overrun Scenario	-0.1%	-0.5%	-0.8%	-1.0%	-1.9%	3.1%	3.2%
Hydrology Risk Scenario	-0.1%	-0.5%	-0.8%	-1.0%	-1.6%	3.5%	-1.5%
Net Incremental Revenues/Total Investment							
Without Nam Theun 2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Most Likely Scenario with NT2	-0.1%	-0.6%	-0.8%	-0.9%	-1.4%	3.1%	3.0%
Construction Cost Overrun Scenario	-0.1%	-0.6%	-0.8%	-0.9%	-1.6%	2.7%	2.7%
Hydrology Risk Scenario	-0.1%	-0.6%	-0.8%	-0.9%	-1.4%	3.1%	-1.2%
Memo Item: GDP Growth							
Without Nam Theun 2	7.0%	7.0%	6.5%	6.5%	6.5%	6.5%	6.5%
Most Likely Scenario with NT2	7.0%	7.5%	7.0%	7.0%	7.0%	7.1%	7.1%

Table 3: Macroeconomic Impacts of Nam Theun 2 – Various Scenarios

	2005	2010	2015	2020	2025
Net Incremental Revenues to GOL (Mln USD)					
Without Nam Theun 2	0.0	0.0	0.0	0.0	0.0
Most Likely Scenario with NT2	23.7	56.9	86.1	99.5	130.4
Construction Cost Overrun Scenario	21.2	52.3	85.3	98.8	129.7
Hydrology Risk Scenario	-8.4	56.9	86.1	99.5	130.4
Government Surplus/Deficit (% of GDP)					
Without Nam Theun 2	0.3%	0.9%	0.7%	0.6%	0.5%
Most Likely Scenario with NT2	-3.0%	-2.1%	-1.4%	-0.8%	-0.6%
Construction Cost Overrun Scenario	-3.1%	-2.2%	-1.4%	-0.8%	-0.6%
Hydrology Risk Scenario	-3.5%	-2.2%	-1.5%	-0.8%	-0.6%
Government Expenditure (% of GDP)					
Without Nam Theun 2	17.3%	15.9%	15.5%	15.3%	15.0%
Most Likely Scenario with NT2	21.2%	20.4%	19.9%	19.5%	19.1%
Construction Cost Overrun Scenario	21.3%	20.4%	19.9%	19.5%	19.1%
Hydrology Risk Scenario	21.2%	20.4%	19.9%	19.5%	19.1%
Current Account Surplus/Deficit (% of GDP)					
Without Nam Theun 2	-6.4%	-2.6%	-1.6%	-0.2%	0.4%
Most Likely Scenario with NT2	-6.3%	-1.1%	0.1%	0.0%	0.2%
Construction Cost Overrun Scenario	-6.4%	-1.2%	0.1%	0.0%	0.2%
Hydrology Risk Scenario	-6.9%	-1.1%	0.1%	0.0%	0.2%
Debt Service / Total Exports (GFS + Workers Rem.)					
Without Nam Theun 2	8.7%	8.0%	8.7%	7.1%	5.6%
Most Likely Scenario with NT2	8.5%	8.2%	7.7%	6.6%	5.1%
Construction Cost Overrun Scenario	8.7%	8.4%	7.7%	6.6%	5.1%
Hydrology Risk Scenario	8.7%	8.2%	7.7%	6.6%	5.1%
Net Incremental Revenues/ Total Revenues					
Without Nam Theun 2	0.0%	0.0%	0.0%	0.0%	0.0%
Most Likely Scenario with NT2	4.3%	6.4%	5.8%	4.0%	3.1%
Construction Cost Overrun Scenario	3.8%	5.9%	5.7%	3.9%	3.1%
Hydrology Risk Scenario	-1.6%	6.4%	5.8%	4.0%	3.1%
Net Incremental Revenues/Total Expenditures					
Without Nam Theun 2	0.0%	0.0%	0.0%	0.0%	0.0%
Most Likely Scenario with NT2	3.7%	5.8%	5.4%	3.8%	3.0%
Construction Cost Overrun Scenario	3.3%	5.3%	5.3%	3.8%	3.0%
Hydrology Risk Scenario	-1.3%	5.7%	5.3%	3.8%	3.0%
Net Incremental Revenues/Total Investment					
Without Nam Theun 2	0.0%	0.0%	0.0%	0.0%	0.0%
Most Likely Scenario with NT2	2.9%	4.5%	4.3%	3.1%	2.5%
Construction Cost Overrun Scenario	2.6%	4.2%	4.3%	3.1%	2.5%
Hydrology Risk Scenario	-1.0%	4.5%	4.3%	3.1%	2.5%
Memo Item: GDP Growth					
Without Nam Theun 2	6.5%	6.5%	6.5%	6.5%	6.5%
Most Likely Scenario with NT2	6.5%	6.5%	6.5%	6.5%	6.5%

shown mainly for the purpose of indicating what the implications would be for macro accounts under the most pessimistic of circumstances. (See Annexes 1 and 5 for more complete treatment of the assumptions and implications of these scenarios.)

5. Net incremental government revenues

20. Although the GOL expects a stream of revenues from the project, once implemented, there are also a number of expenditures that would be associated with it. Revenues will come in the form of royalty fees, resource levies, and the GOL's equity share⁴ of income from electricity sales to Thailand. The RMSM Nam Theun 2 scenarios utilize the estimates of these revenue inflows from the results of the financial model (see Annex 5). Government expenditures directly related to the project include debt-service payments on GOL borrowings to finance its equity contribution in the project. Beyond this, in keeping with sections I and IV of the Economic Study, unmitigated environmental and social costs are attributed as GOL expenditures.

21. As summarized in Table 3, under the most likely Nam Theun 2 scenario, the GOL's net revenues would be negative initially because of the obligation to service debt associated with the GOL's equity purchase, averaging -\$4.5 million annually through 2002. These flows would quickly turn positive as production began. Under the hydrology risk scenario, on the other hand, it is assumed that the worst pattern of rainfall witnessed during the past 30 years would occur at a critical point during the first years of operation. In this case, net losses to the GOL would continue until 2008, whereupon net incremental revenues would revert to those of the most likely scenario. The cost overrun scenario shows consistently lower net revenues to the GOL than would be the case in the most likely scenario.

22. Government deficits would be larger under the Nam Theun 2 scenarios than if the dam were not built, but would remain well within tolerable ranges in terms of maintaining a conservative fiscal stance, even under the most pessimistic of scenarios --- an aspect that should provide considerable comfort about the risks to macroeconomic stability posed by the dam.

6. Impact on external balances

23. The debt-service payments attributable to the Nam Theun 2 project depend on the mix of the GOL's sources of financing for its purchase of \$100 million in project equity. The most likely scenario regarding this borrowing is that the GOL takes \$60 million from commercial sources with maturity of 12 years, grace period of 4 years and interest rate of 3 percent over LIBOR. The

⁴ It is likely that revenues from Nam Theun 2 would be deposited in an offshore account and divided among the parties involved according to the terms of the concession agreement. The GOL's income would be classified as foreign investment income.

remaining \$40 million is assumed to be borrowed on IDA terms: Maturity of 35 years, grace period of 10 years and interest rate of 0.75%. This would increase both total debt and debt-service as compared with the base case (without Nam Theun 2) scenario. These expenditures would be offset by the inflows from the GOL's share in income from the project, which vary by scenario, as discussed above.

24. The current-account deficit in the balance-of-payments in proportion to GDP is projected under the base case scenario to decline quite rapidly during the forecast period, from more than 16% in 1998 to around 3% in the 2010s. The net impact of the Nam Theun 2 project on this trend would be marginally higher deficits during the construction period, which would then fall to an even smaller deficit in 2009, amounting to 2.2% of GDP. From 2010 onwards the inflows from the Nam Theun 2 project would keep the current account deficit lower than would be the case without Nam Theun 2. Virtually identical trends would be projected to occur under the two most pessimistic scenarios, which, again, should provide considerable comfort about the risks involved in Nam Theun 2 in respect to developments in the external sector.

25. Similarly, the ratio of debt-service to exports (including remittances) remains well within the range of levels that would normally be considered commensurate with sustainable debt financing, particularly in light of the overwhelming proportion of this which is on concessional terms. This ratio would be only marginally affected by the occurrence of either of the two most pessimistic scenarios relating to Nam Theun 2.

7. Macroeconomic risks

26. Under all but the most pessimistic of scenarios, Nam Theun 2 would yield substantial net revenues to the GOL beginning shortly after the production of electricity started. Nonetheless, there are several macroeconomic risks inherent to the GOL's economic strategy to rely on hydropower as the main source of foreign exchange revenues which should be factored into account in the evaluation of Nam Theun 2 as it contributes to that strategy. These may be categorized into two types: Those deriving directly from factors that might adversely affect hydropower revenues; and those stemming from hydropower export dependence itself, including its effect on the competitiveness of other Laotian exports. Each of these risks is considered in turn.

27. **Single-buyer risk.** One of the principal risks to be considered in respect to the Nam Theun 2 project has to do with its structure, by design, to export all, or nearly all, of the electricity produced to a neighboring country --- Thailand; and within Thailand, to a single buyer, EGAT. This concern arises in part because of the small size of the Laotian economy in comparison to its neighbors; and more important, because it pertains to the entire Laotian hydropower export strategy, which relies almost exclusively on sales to Thailand.⁵

⁵ It is important to re-iterate here that there are substantial benefits to be derived from entering into contractual relationships with EGAT as well, including its very strong, and bankable, financial reputation.

28. Single-buyer risk may arise from several sources. One is EGAT's monopsony power over the prices it is willing to pay. The reality is that, as discussed in Annex 1, although Power Purchase Agreements (PPAs) frequently extend over periods of 15 - 25 years, they also frequently are re-negotiated as market conditions change. Much will depend on the evolution of Thailand's unfulfilled electrical energy needs, and the price that it is willing to pay to meet them. This will in turn depend in part on the course of Thailand's economic growth, as well as on its increasing inclination to rely on Independent Power Producers (IPPs), who represent competitors to Laotian power sales.⁶

29. A second source of risk inherent for Laos relates to the inability of domestic demand to absorb the electrical production of Nam Theun 2 should the market in Thailand be closed due to regional political or military conflict. One case with some similarities is the El Cajon hydroelectric project, built in Honduras in the late 1970s and early 1980s. In this case, project appraisers projected optimistically that domestic electricity demand would be sufficient to absorb El Cajon's increment to national output, despite its very large size in proportion to GDP. This failed to materialize as forecast, in part because regional conflict reduced domestic economic growth and development. Given its size, the facility might have looked to regional exports, but the main destination of the exports would have been Nicaragua, whose ability to pay for the electricity also collapsed during the conflict. The upshot of this, and failure to anticipate exchange risks adequately, was that El Cajon turned into a serious balance-of-payments loss for Honduras.⁷

30. Consideration of this case should be balanced, however, by review of the successful experience of Laos itself, which has been exporting electricity to Thailand from the Nam Ngum hydroelectric plant, approximately 80 km north of Vientiane, since 1971. As GOL officials are quick to point out, Thailand's purchase of power from Nam Ngum has never been interrupted, despite the military conflict in Southeast Asia and its aftermath. The critical difference with the Nicaraguan example appears to be that there was no economic collapse in Thailand during or after the Southeast Asian conflict. In the Nam Theun 2 case, most of the financial risk would be borne by private investors; and, as evidenced by the private sponsors' willingness to risk their own capital, the likelihood that such a collapse would occur in Thailand is to be considered extremely remote.

31. **Single-export risk.** The second area of concern stems from the strategy to concentrate export capacity in a single product --- hydropower. An example of what to avoid would be those countries that relied heavily on copper exports in the 1960s and 1970s (eg., Chile, Zaire, Zambia), and thereby were left vulnerable to dramatically falling copper prices as technologies shifted. As discussed above, Laos's hydropower-export strategy exposes the nation's external accounts to

⁶ This concern has been modeled explicitly within the sensitivity analysis of the project evaluation of Nam Theun 2 as a re-negotiation of the PPA to Laos's disadvantage after the fifteenth year of operation.

⁷ An internal ex-post evaluation by the World Bank roundly criticized project appraisers for not considering risks to their demand forecasts when pronouncing the project viable.

electricity pricing shifts, such as that which may be occurring now in Thailand as IPPs come on line. It also exposes the country to such things as hydrological risk: A prolonged drought, for example, could have serious repercussions for a Lao economy in which hydropower was the main foreign exchange earner.⁸

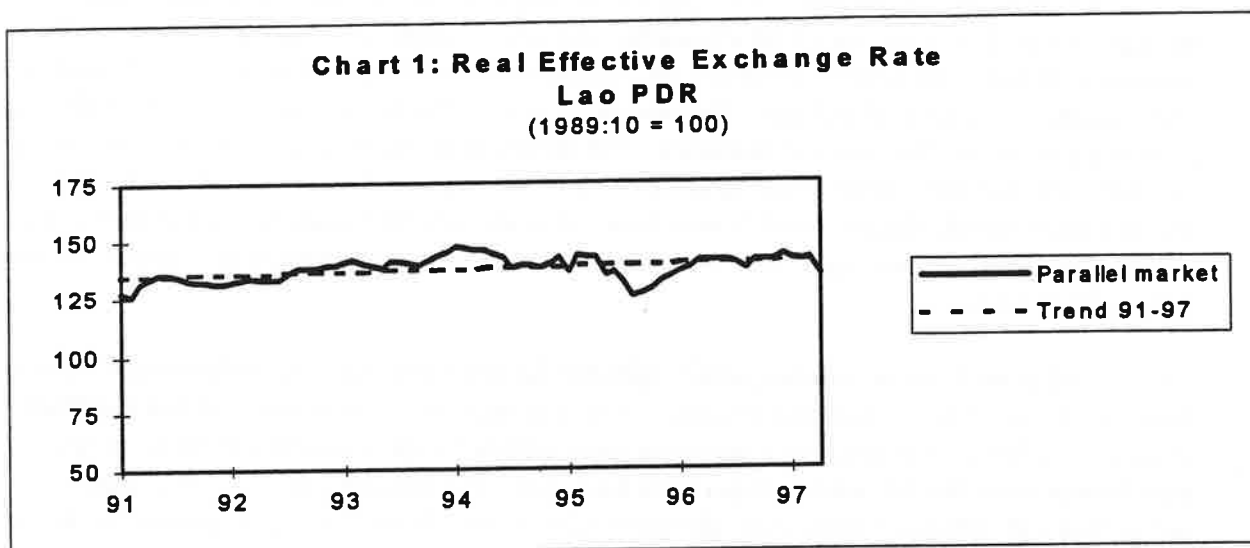
32. A second, more subtle, concern stems from the "Dutch Disease" effect. All else equal, a large increase in net foreign exchange revenues from the export of a single product --- in this case, hydropower --- will produce an appreciation of the real exchange rate. This, in turn, will tend to undermine the export competitiveness of other sectors, such as manufacturing and agriculture; and to encourage increases in imports. Thus, even if exogenous shocks are avoided for a period, large increases in export revenue derived from a single product will tend to engender even more export concentration, leaving the economy more exposed to the risk of future exogenous shocks.

33. **Analysis of the "Dutch Disease" risk.** Analysis of this risk may proceed in two parts: First, examination of the concern that there already is a tendency for the real exchange rate to appreciate, and second, what to do to mitigate the risks of such a trend in the future. Chart 1 shows the trend in the 1990s of the IMF-calculated "real effective exchange rate" (REER), which adjusts the nominal rate for differentials in inflation rates among Laos's principal trading partners. Although there was a substantial devaluation of the Kip in 1989 which appears to have overshot the long-run equilibrium rate by a substantial margin,⁹ subsequent to the correction that occurred in 1990, the trend of the REER in Laos appears to have been quite flat. The IMF paper cited in footnote 9 provides evidence to support the view that Lao export competitiveness has not suffered: Output growth was strong from 1989 - 1994, and export performance "quite robust," despite the correction. The paper also provides some analysis about what can keep exports competitive, even in the presence of an appreciating real exchange rate, suggesting that "rapid trade payments liberalization and technological progress" may have allowed Laos to remain competitive even during the 1989 - 1994 period. (The analysis goes on to argue that "... appreciation of the internal terms-of-trade neither hampered total output growth nor unduly directed resources toward nontradables.")

34. **Lao productivity and the "Dutch Disease."** This should not be taken to mean that the potential for a "Dutch Disease" effect related to the strategy to rely increasingly on hydropower revenues over the medium term should not be of concern to Lao authorities. But, as implied by the IMF analysis, there are a number of ways in which such an effect may be mitigated. In the short term, authorities can build foreign exchange reserves. This central banking authorities have in fact been doing in the Lao PDR; and with reserves currently covering just over three months' worth of imports, there is room to expand these holdings further. The more pressing question,

⁸ Hydrological risk has been modeled explicitly for purposes of sensitivity analysis within sections 1, 3 and 4. As with market shifts, however, the broader implications of this risk for the hydropower export strategy as a whole are beyond the scope of this analysis.

⁹ As reported in 'The Lao People's Democratic Republic: Systemic Transformation and Adjustment,' IMF Occasional Paper 137, Washington, D.C., May 1996, p. 52.



however, is how the risk of the “Dutch Disease” effect can be mitigated over the medium-to-long term. The answer, from economic theory, is that the impacts of real exchange rate appreciation on competitiveness may be offset by productivity increases in the economy. The principal avenues available to public sector authorities to help achieve productivity increases are economic restructuring and reform; and effective investment in physical and human capital.

35. The Indonesian experience with the economic impact of petroleum export revenues is directly relevant to Laos’s strategy to rely on hydropower (or “white-oil”) exports.¹⁰ The oil booms of the 1970s gave rise to very large increases in Indonesia’s gross savings. During the years of high oil revenues, Indonesian authorities avoided the worst impacts of “Dutch Disease” by devaluing the exchange rate periodically, and accompanied this with tight monetary and fiscal policies. Roughly half of total government resources were devoted to development expenditures, with an explicit policy to promote infrastructure projects with high-productivity returns. In addition, Indonesia pursued a strategy of converting a large portion of its oil revenues into basic education, with the result that human capital, measured by average years of schooling, rose from 1.6 years in 1960 to 4.6 years by 1985. This, of course, also increased Indonesian productivity. After the oil price busts of the mid-1980s, Indonesia shifted from inward-looking to export-oriented economic policies, replacing oil revenues with growing earnings from agricultural and manufacturing exports.

¹⁰ This section draws on a paper by Michael Roemer entitled ‘Dutch Disease and Economic Growth: The Legacy of Indonesia,’ HIID discussion paper no. 489, June 1994.

36. There are export concentration risks inherent to the hydropower strategy; but the magnitude of the risk depends on the share of the single export in relation to GDP, and it can be managed through a combination of measures. Impacts of rising hydropower revenues on the nominal exchange rate may be mitigated by currency sterilization, accompanied by maintenance of stable monetary and fiscal policies. This approach was followed by Cameroon, which held the bulk of its oil income in overseas accounts. But in this case, oil revenues represented one-eighth of GDP, whereas net income from Nam Theun 2 would represent at most 1.8% of Laos's GDP, and this share would decline steadily over time. It is also an open question whether over the medium term central banking authorities actually could withstand political pressures to release the accumulated reserves.

37. Under such circumstances, and despite the fact that hydropower still represents a small fraction of Lao GDP, it would be prudent to take measures that could correct for the "Dutch Disease" tendency of hydropower revenues, even without implementation of Nam Theun 2. The main lesson from the Indonesian experience for Laos is the importance of emphasizing productivity-enhancing investments, alongside a business climate friendly to private investment and export diversification. The question of how to implement such a strategy is critical, however, in light of the fact the all hydropower revenues would adhere to the GOL.

8. GOL Implementation Capacity

38. Based on interviews the Study team held in the Education, Health and Agriculture and Forestry Ministries, and the findings in section II of this report, implementation capacity appears to be a serious constraint. This finding correlates with the findings of a recent review of public expenditures by the World Bank, which highlights weak government institutions and a very limited number of trained staff, a situation exacerbated by rudimentary legal, administrative and institutional structures.¹¹ As noted in the Bank's public expenditure review, the GOL needs actively to identify and cut low-priority public investments, while improving implementation in the context of a re-orientation of its public expenditure program toward improved efficiency and equity. In particular, the Bank review recommended constraining the public expenditure program by about 15% to fit within the available resource envelope. Levels of expenditure would for the most part remain unaffected by the Bank's recommendations, with the exception of amounts programmed for transport and communications infrastructure, and rural development.

39. As for the composition of expenditures, the Bank supported a shift in priorities in favor of social spending, including education and health in particular; and encouraging greater private sector participation and investment where there was no particular rationale for public sector involvement. Within specific sectors, the GOL was encouraged to establish and utilize prioritization criteria. Among the suggested strategic measures recommended to address the

¹¹ Lao PDR Public Expenditure Review: Improving Efficiency and Equity in Spending Priorities, World Bank 16094-LA (1997).

latter process were to (1) determine the appropriate role, if any, of the GOL in the project; (2) utilize cost-benefit analysis to determine the economic viability of projects; (3) leverage private investment wherever possible; (4) assure that recurrent operations and maintenance expenses are met; (5) recover project costs where feasible and desirable from users and beneficiaries; and (6) evaluate project or program impacts on the poor. (It is understood that for the most part the GOL plans to implement these recommended adjustments in its PIP.)

9. Income utilization scenarios

40. Even under quite conservative assumptions concerning social and environmental mitigation costs, the net cash flow to the GOL (in 1996 dollars) would average \$33 million annually from project initiation throughout the life of the concession agreement. If applied solely to the GOL's planned capital expenditures in the current fiscal year, annual revenues of this magnitude would have represented an augmentation of 12% of the resource envelope available under the public investment plan; or an increase of 38% if the increment were applied solely to the social sector line items in that plan. The principal issue is, how effectively can the GOL spend incremental income of this magnitude to achieve its economic and social development goals?

41. To come to grip with this question, the Economic Study considers the following scenarios about how the net cash flow to the GOL from Nam Theun 2 could be managed:

- Tax cuts
- More rapid reduction of ODA
- Build reserves, or hold funds in overseas accounts
- Finance an accelerated program of public investments

42. **Tax cuts.** In regard to tax cuts, it would be unwise to cut tax rates, because in real terms the revenue from Nam Theun 2 would be a once-and-for-all increment to the GOL budget. This means that either tax rates would have to be raised again in subsequent years, or the growth of future expenditures would have to be reduced below levels currently planned. The alternative would be to implement an annual tax rebate that would transfer the net revenues from Nam Theun 2 to enterprises or individual taxpayers. But the impact of this over time on economic behavior would decline as the real value of the transfer declined in proportion to national income. And, depending on how the rebate was managed, it might turn out to be a regressive option.

43. **More rapid reduction of ODA.** Another alternative would be to slow down and progressively replace ODA with domestic sources of financing. This is a laudable goal over the long-term, as the country's per capita income increases, and payments on its long-term debt to international financial institutions begin to come due. Over the medium-term, however, the Lao PDR should continue to avail itself of concessional financing of the sort that, currently, allows it to repay its average overseas loan based on an interest rate of 1.5%.

44. **Build foreign reserves.** Another option would be for Laos to build up its foreign exchange reserves, and hold those reserves in overseas banking accounts to ensure that they maintain their real value. This certainly would be an appropriate tool to utilize for macroeconomic management in the short term. Nonetheless, it would mean that the revenues from Nam Theun 2 would have no development impact in Laos; and it is an open question whether central banking authorities could withstand political pressures to disburse the funds.

45. **Accelerate public investment.** The final option would be to utilize the incremental revenues from the Nam Theun 2 project for an accelerated public investment program in Laos. This, presumably, is the option that provides the underlying rationale for proceeding with implementation of the project. To put the matter in perspective, if applied to the GOL's planned capital expenditures in the current fiscal year, annual revenues on the order of \$33 million could have allowed the GOL to re-instate almost the entire amount cut from the current public investment program during the public expenditure review process. Whether doing so would be a wise decision, however, is an open question. This highlights the principal risk, which is that without significant improvement in the ability of the GOL to identify, prioritize and implement public sector projects, the increased net revenues from Nam Theun 2 could end up financing a series of white-elephant public investment projects.

46. It is also true, however, that the GOL still has available to it several years to put into place a comprehensive strategy to improve implementation capacity in respect to public sector investment projects. As noted in the Bank's recent public expenditure review, the GOL needs actively to identify and cut low-priority public investments, while improving the effectiveness of investment projects in the context of a re-orientation of its public expenditure program toward improved efficiency and equity. To accomplish this, the GOL must strive to avoid the potential that increasing GOL expenditures might "crowd out" private ventures; authorities would need to assure that public sector projects and investments do not compete with private sector production. And, beyond identifying priority sectors for public investment, the strategy must articulate measures that the GOL intends to take to ensure that implementation will succeed.

10. Strategy to mitigate institutional constraints

47. Among the measures that should be considered to ensure effective implementation of the government's economic development and poverty alleviation strategy are (1) establishing a transparent and consistent system to identify, prioritize and allocate public investments toward the most economically viable projects; (2) relying wherever possible on competitively-bid concessions and/or private contracting to build and operate needed infrastructure, utilizing fiscally sustainable subsidy schemes as necessary to extend access to poor and rural areas; and (3) offering competitively-bid public grants to provincial and local governments, and NGOs, awarded to the best proposals to target the provision of improved social services to the poor.

48. As regards infrastructure, GOL institutional capacity limitations could be mitigated or circumvented even in the short-to-medium term through implementation of a strategy to rely on private-sector implementation and/or ownership. What this would mean would be a concentrated effort to rely on private concessions for telecommunications, electrification, toll roads, and so on. The point here is that public investment can be channeled to these sectors without necessarily meaning that the GOL must build or operate the services. The Nam Theun 2 model is a good one in respect to investment of public funds in concessions that are operated by foreign investors; and its success would greatly enhance the GOL's credibility in respect to future such undertakings.

49. Regarding social expenditures, as discussed section V, the overall economic assessment, institutional capacity constraints could be mitigated or reduced by resorting to such concepts as free and open bidding for school and health clinic construction contracts; agricultural extension services contracts; and so on. A strategy to compensate for thin GOL implementation capacity could also involve policies to encourage public-private partnerships in the provision of services like basic education and outpatient clinic services, which without at least partial public financing may not be financially viable (although they would have to be demonstrably economically viable). As part of such an implementation strategy, the GOL also should consider the pluses and minuses of creating a "social fund" to which net incremental revenues from Nam Theun 2 would adhere. (Further detail about this option is provided in Annex 4.)

IV. Financial Risk Analysis

Introduction

1. The objectives of the Financial Risk Analysis are twofold: first, to identify and assess the nature of financial risk of the Nam Theun 2 Hydropower Project (the "Project") that would be undertaken by the Government of the Lao People's Democratic Republic (the GOL); and second, to assess the implications of the government's risks for the Lao economy. The methodology of and approach to the analysis incorporate five critical areas:

- review of the existing draft financial and contractual agreements;
- review of the technical, commercial and cost assumptions;
- review of the project financing plan and financial model;
- evaluation of the risk allocation framework as currently proposed; and
- outline of the principal negotiating points available to the GOL.

2. The Risk Analysis was conducted through a review of the Project's draft agreements made available to the Economic Study Team by the GOL and the Nam Theun Electric Corporation (NTEC), the private consortium formed to develop the Project. This was supplemented by a review of the project's financing plan and financial model currently under development by NTEC and its financial advisor, SBC Warburg; and discussions held in Laos with designated officials of the GOL, NTEC, SBC Warburg, the Electric Generating Authority of Thailand (EGAT) and the World Bank during the January 12-31, 1997 field visit and the subsequent July 7-17, 1997 follow-up visit.

3. Given that most if not all of the Project's major contractual agreements either have expired or are in the early stages of negotiation or renegotiation, our assessment of the risk of the Project to the GOL provides the most value in highlighting issues that deserve significant attention as the contractual agreements undergo further negotiation and review and move to final form.

4. What follows below is a summary of the principal points which are discussed more fully in Annex 5.

1. Financial and Contractual Arrangements

5. The GOL's role in the Project is that of both sovereign sponsor and equity shareholder in the NTEC consortium, with a currently assumed 25% shareholder equity provision. This dual role produces a significant conflict since the interests of the GOL as a sovereign sponsor can often run counter to the interests of NTEC as project developer. The GOL has indicated that its interest in participating as an equity investor are driven primarily by a desire to increase the overall return to the Government. In general, the GOL does not want to be constrained or limited to seeking returns simply from royalty payments or resource levies. In effect, they have concluded that an equity investment is the most direct route to satisfying this objective.

6. While we recognize the GOL's point with respect to increasing their overall return, by participating on an equity level they, in effect, step into the shoes of the developer. The primary concern is the constraint this places on the GOL's ability to negotiate a risk allocation approach which is in the best interest of the Government and the Lao P.D.R. A second, although no less significant concern, is the additional risk assumed by the GOL in the event that the Project were to face serious difficulties requiring additional equity funding or a loss of investment.
7. Among the many open issues facing the NTEC consortium, the expiration of the EGAT Power Purchase Agreement (PPA) is of significant concern primarily due to the subsequent positive response which EGAT received from private sector developers as part of its Independent Power Production (IPP) Program in terms of tariffs which fall below those negotiated in the expired EGAT PPA. While EGAT's Board has indicated that it will continue to treat the Project as a base-load source of supply, it has recently notified the GOL that it wishes to delay the commissioning of the Project until 2004. Furthermore, with respect to the tariff structure, notwithstanding offsetting issues related to the quality of power received from the Project and diversification of fuel supply, discussions with EGAT indicate that it will be difficult from a marketplace perspective to negotiate a tariff with NTEC that exceeds that which tends to prevail in the IPP program.
8. With respect to the construction contract, the GOL indicated that it has not, to date, participated in the negotiation of the Turnkey Contract. In regard to cost over-runs, a preliminary review of the contract indicates that NTEC would be exposed to additional costs related to ground conditions outside of a "Defined Work Area," for Force Majeure events, and for lack of adequate water during acceptance testing. The Operating and Maintenance Agreement, the principal contractual relationship which governs the life of the Project beyond the completion of construction and acceptance testing, should be carefully aligned with the EGAT PPA with regard to scheduled and forced outages.
9. Of significant concern in the current draft of the Concession Agreement, which follows some of the earlier provisions of the GOL Heads of Agreement, are provisions concerning the offsets to the Royalty Payments and Resource Levies due to the GOL in the event that the Project were to suffer an economic downturn due to changes in the hydrology. Specifically, a reading of the concession documents reflects the provision that the Royalty Fee and the Resource Levy would be subject to offset in the event the Project were unable to meet debt service or O&M payments. Our discussions with NTEC indicated that this concept could also include the Project's inability to achieve a "hurdle" rate of return for the developers under the Base Case scenario.
10. While the Royalty Payments due to the GOL are payable from the Commercial Operation Date (COD), the Resource Levy is currently structured with a 5-year holiday. Furthermore, both sources of income are significantly back-loaded given the phased-in structure with 5-year increments. In general, while the later years of operation are often considered "less risky" than the development and construction phases, this significantly exposes the GOL to the risk of a renegotiated tariff structure in the later operating phase of the project, a prospect not unheard of

in the current power market. Conversely, the developer's provisions for 2-to-1 reimbursement of development costs by COD, in addition to receiving sponsor fees, significantly front-loads the developer's return. While the developer deserves early compensation for accepting the development risk of the Project, the GOL should seek a closer alignment of its interests with NTEC in the operating phase of the concession.

11. With respect to GOL's role as an equity shareholder, we note that at 25% of the portion of the project's total capital costs funded through equity investments, the government is seeking the second largest stake in the equity allocation, which places it ahead of Transfield, the Project's lead developer. In addition, no provision appears to have been made for giving credit to the GOL's contribution of water and land rights as an in-kind contribution rather than a cash contribution towards the equity funding, though our discussions with senior GOL officials suggest that this may be a provision for further negotiation. NTEC subsequently put forward an offer to provide \$20 million of the equity in return for the GOL's contribution of equity in-kind.

12. The GOL appears to have limited sources from which to seek funding for its equity commitment on favorable terms. At present, barring participation by the World Bank through a loan from IDA, commercial lenders appear to be the most likely source, though on terms which will be far less advantageous than the concessionary rates afforded sovereign borrowers at the World Bank. Furthermore, we are not aware of any discussions with respect to provisions for contingency funding in the event that the GOL were called upon to fund additional costs either in its role as sovereign sponsor under the Concession Agreement or as a NTEC shareholder. Once NTEC's budgeted contingency funds are exhausted, should the project suffer additional costs due to over-runs or delays, the GOL's position as a significant shareholder would require it to fund its pro-rata share of these additional costs.

13. Consideration should be given to the type of security and guarantees that the GOL might be expected to provide to the Thai banks (or other commercial or market-based lenders) which it may approach for funding of its equity investment. It is highly likely that the GOL will be required to provide a sovereign guarantee for these loans; a commercial loan of \$60 million or more would probably bring Laos to the limit of its commercial debt carrying capacity for several years. Conversely, IDA type loans are less likely to pose a constraint on additional GOL borrowing since the terms are generally of a structure that has minimal impact from a servicing perspective.

14. Since the writing of the Draft Final Report, the economy in Thailand has continued to weaken. In addition, Thailand's central bank has reduced the exchange rate restrictions on the calculation of the value of the Baht effectively devaluating the currency relative to other major currencies such as the U.S. dollar. This has occurred against a Thai background of reported continued deterioration of the financial strength of the banking sector. In this regard, the government has eased restrictions on financial institution mergers in order to allow healthy institutions to acquire ones in need of additional capital in order to support deterioration of loan portfolio quality.

15. While we fully expect the Thai government to continue to respond in a prudent fashion to the current situation, we believe that the crisis in the banking sector will likely result in further constraints on the availability of private market funding for the project. This will impact both the project's debt financing as well as commercial financing of the GOL's equity participation.

16. The Project is currently expected to seek a Partial Risk Guarantee from the World Bank in order to facilitate senior debt financing from international banks. Depending on the outcome of the negotiation, the GOL would most likely face contingent liability exposure (in addition to that which it undertakes as an equity investor) for its sovereign contractual obligations under the Concession Agreement through the provisions of a counter-guarantee with the World Bank. The most significant and potentially problematic of these is its role in relocating the Lao people living in the inundation area. The GOL is not expected to provide counter-guarantees for Export Credit Agency (ECA) financing, nor is it expected that it will need to provide a sovereign guarantee for the Project's debt financing given the non-recourse nature of the Project structure and the participation of the IFC as lender of record.

17. As the discussions and negotiations progress, the GOL should give careful consideration to the total package of obligations which private market lenders might seek to include in the partial risk guarantee policy or in any other form of political risk insurance. These need to be weighed along side of the risks it will assume as an equity investor.

2. Project Financing Plan and Financial Model

18. In general, the Project Financing Plan appears to be well established and soundly conceived. Significant sources of financing are expected from Australian and Thai ECAs. In our discussions with NTEC staff and financial advisors from SBC Warburg, it came to light that the current tariff assumptions as taken from the expected PPA, when combined with the costs associated with the 680 Megawatt configuration, generate returns that are below the stated 15 % hurdle rates of the developers. While we have not undertaken an independent verification of the calculations contained in the SBC Warburg model, we note that these returns do not account for the sponsor fees, nor do they incorporate the returns generated by the 2:1 ratio of reimbursement for development costs.

19. We also note, subject to verification as further development budget assumptions are made available, that the costs associated with environmental and social mitigation are included in the SBC Warburg model as "dollars of the day" values, with no indexing for inflation. This potentially under-funds these costs significantly.

20. The Study Team subsequently constructed an independent version of the Project's Financial Model in order to incorporate the impact of the project financing costs on the scenarios run within the Cost/Benefit Analysis Model. (Please see Annex 5) This analysis incorporates Project capital and O&M cost data as provided by the Alternative Power Supply study under the

direction of the Lahmeyer Engineering Consulting group and has been updated to incorporate the 680 Megawatt configuration currently under consideration by NTEC. The model closely follows the financing assumptions as established in the SBC Warburg Model. Base-case internal rates-of-returns (IRR) at the Project level were 20.88 (IRR), 22.74% at the PDG level, and 23.12% at the GOL level. The Project is, however, sensitive to hydrology risk and more significantly, to downside impacts to the construction costs.

21. Worst Case Hydrology data, developed as a "break-even" scenario based on a 5 year drought event, reduce the equity return to 16.24% at the Project level and 17.91% at the PDG level; minimum debt coverage falls to .97x. Reductions in Royalty Fees through a 5 year holiday in the early phase of operation allowed the Project to maintain a minimum 1.0x coverage under these worst case conditions.

22. With respect to construction cost overruns, a 30% overrun resulted in a Project IRR of 15.72%, a PDG IRR of 17.11% and a GOL IRR of 19.27%. We note that in this case, the GOL equity share is increased to \$162.98 million from an assumed \$100.19 million in the Base Case.

23. A more complete discussion of the findings of the Financial Model is contained in the Annex 5 of Volume II.

3. Risk Allocation Framework

24. With respect to risk allocation, the Project appears to allocate risks among all parties in a manner generally accepted for large scale infrastructure developments of this nature. The most notable exception to this approach appears to be the GOL's exposure to a reduction in Royalty Payments and Resource Levy in the event that revenues experience a shortfall. As an example, since the GOL is exposed to hydrology risks as a significant equity shareholder, one might argue that it should be insulated from this risk in its role as a sovereign sponsor.¹

25. A Risk Allocation Matrix is included in Annex 5 which analyzes the current risk allocation framework across the Project's Development, Construction and Operating Phases.

26. As the GOL evaluates its role in the Project, it needs to balance its direct exposure to the Project with its indirect exposure. Its direct exposure is primarily through the financing it must undertake to fund its equity investment in NTEC. Its indirect exposure is multi-dimensional and incorporates its commitments as the sovereign sponsor under the Concession Agreement compounded by the role the GOL assumes as an NTEC shareholder.

¹ The GOL cannot diversify its portfolio to allocate this risk, as can the project sponsors, because a drought would be likely to affect all of its hydropower projects, not just Nam Theun 2.

4. Outline of the Principal Negotiating Points Available to the GOL

27. The GOL faces a complex negotiation as it sets forth to negotiate the Concession Agreement with the Project Development Group and moves toward a renegotiated PPA with EGAT. Many additional underlying contractual agreements accompany these arrangements and will require careful evaluation and review. The most striking issue facing the GOL at this stage is its interest in preserving its return from Royalty and Resource income in a manner which is acceptable to the developers and which allows the Project access to non-recourse financing in the international markets. Exposure to hydrology is well understood in hydropower projects provided that the PPA provides acceptable relief which in its current draft allocates some portion of hydrology risk to EGAT through the Power Purchase Guarantee provisions. A significant issue is the developer's stated position that the Project as currently configured does not meet its hurdle rates of return and their expectation that the GOL will accommodate them in this regard. Our financial model analysis does not support this view. Subsequent discussions held with the Project Development Group appear to indicate a higher degree of sensitivity with respect to the developer's compensation from the Sponsor Fee and Development Cost reimbursement provisions. A larger concern is perhaps the Project's ability to generate acceptable debt service coverages under the criteria to be imposed by the project lenders. In this regard, the GOL might face pressure to allow reductions in the Royalty Fee and Resource Levy in order to prevent a debt service default.

28. Any final resolution of these issues should incorporate adequate compensation to the GOL for its land and water rights while compensating the developers for assuming the early stage development risks of the project in a sole source negotiation.

V. Overall Economic Assessment

Introduction

1. This section assesses the potential contribution of the Nam Theun 2 project to the Lao economy as a whole, taking into account both the macro- and the micro-economic analyses. The overall assessment integrates the preliminary findings and conclusions from the Economic Study's four components. Special attention is given to evaluation of the extent to which the Nam Theun 2 hydro-power project would contribute to poverty alleviation in Laos.

1. Economic and social strategy

2. The context of the Economic Impact Study is the GOL's medium-term power development program, including its plan to provide 3,000 MW of hydro-electric power to Thailand by 2006. A private consortium of foreign investors has proposed a build, own, operate and transfer (BOOT) agreement to the GOL for a hydropower facility with the capability to generate 680 MW of electricity for sale to Thailand by 2004. The GOL would be one of the charter shareholders, with 25% of the equity, and would gain sole ownership of the dam after 25 years of operation. The GOL has requested that the World Bank support the proposed project. That support could take several forms, including partial project financing from the IFC; a partial guarantee of GOL undertakings to the project (including resettlement) from the IBRD; and parallel financing of part of the GOL's equity participation through a loan from IDA. All are under active consideration.

3. The Nam Theun 2 hydroelectric project is the largest and most preeminent of any project under consideration in Laos today, representing a total investment about three-quarters as large as annual GDP. As such its evaluation should also be placed within the context of the Lao PDR's national economic and social strategy. This emphasizes rapid economic growth, under the New Economic Mechanism, which by 1997 had succeeded substantially in stabilizing the economy; in liberalizing trade, prices, interest rates and the exchange regime; and in making considerable progress in the task of re-defining the public sector's role in the economy. Although Laos remains one of the world's poorest countries, implementation of this strategy has produced sustained GDP growth rates of 5% - 8% during the 1990's, and significant increases in per capita income, while inflation has fallen to single-digit levels. Laos will join ASEAN in 1997, and aims to join WTO as soon as possible thereafter.

4. Laos's economic strategy also envisions a progressive reduction in the nation's dependence on timber exports and royalties to levels commensurate with sustainable commercial forestry, replacing and significantly augmenting those revenues with hydro-power exports and royalties, while further strengthening the domestic tax base. Some of the new revenues will be utilized for a concerted effort, with the support of international institutions, to protect national rainforests. This would include preservation of the National Biodiversity Conservation Area (NBCA), the large catchment area east and north of the site that would be inundated to form the Nam Theun 2 facility.

5. The social strategy seeks to ensure equitable distribution of the economic benefits to be derived from rapid economic growth through provision of improved access to, and quality of, education, health, agricultural extension and communication services. The strategy follows the East Asian model of emphasizing productivity-enhancing investments, as opposed to income transfers, as a method to alleviate poverty, relying instead on the traditional extended family to continue to provide the main social safety net. Over the medium term, domestic sources of financing would slowly replace Official Development Assistance as the primary source of financing for social sector expenditures. GOL officials are looking to revenues from hydropower to help finance this strategy.

2. Project evaluation

6. The Economic Study's project evaluation has determined that, under all but the most pessimistic of scenarios covering hydrology risk, cost overruns, tariff structure, inflation rates and other key variables, over the medium-term the Nam Theun 2 hydroelectric project would yield substantial net benefits to the GOL, above and beyond the income foregone from developing the Nakai Plateau as a basis for sustainable forestry and other agricultural production.¹ Under the "most likely" scenario, in net present value terms Nam Theun 2 would yield an economic return on the GOL's investment of approximately 3.5-to-one. In real terms, the project would yield an economic rate-of-return of 16.4%.

7. This is the case even though the procedure utilized throughout the Study has been to impose the highest estimate of the range of potential unmitigated environmental and social costs attributable to the project, and to allocate these as costs that would require current budgetary expenditures of the GOL. The economic benefits of the project to the GOL also are positive and substantial in net-present-value terms in comparison to the investment that it would make to secure its 25% share in the venture. In other words, the early net costs that the GOL would sustain during the construction period — mainly to finance its contribution to equity in the project — are more than offset by the discounted net benefits to be received from dividends, royalties and taxes later on.

3. Institutional capacity constraints

8. The project evaluation leads to the conclusion that the Nam Theun 2 project would yield substantial net benefits to Laos, while at the same time providing the resources that would be required over the medium term to mitigate the project's social and environmental impacts,

¹ This, and not the maintenance of the Nakai Plateau as a pristine national biodiversity conservation area, is what the Economic Study team believes is the most likely alternative outcome, should the Nam Theun 2 hydroelectric project not go forward. Conversely, the probability that the NBCA would be protected is greater in the case where Nam Theun 2 is built than in the case in which it is not.

improve environmental policy and protect national rainforests. One of the primary questions for consideration of the Economic Study team has to do with the capacity of Lao's public sector to meet these latter responsibilities.

9. The objective of the institutional analysis was to derive a preliminary assessment of the extent to which relevant public institutions were prepared to manage those impacts of Nam Theun 2 which would fall either wholly or partly outside of the purview of the private sponsors. It is also true, however, that the review provided an early indication of the extent to which the public sector would be capable of targeting expenditures effectively once electricity production began.

10. In brief, in terms of institutional mandate and structure, there is overlap and confusion, problems compounded by lack of independent sources of financing and serious questions about potential conflicts-of-interest. Among the most troublesome, the Resettlement Committee depends almost entirely on NTEC for its financing, a factor that places it in a peculiar position when representing the interests of local and provincial stakeholders vis-a-vis the project developer. Yet, in practice, the ability of those stakeholders to represent their interests outside this channel has not been developed. The RC's ability to negotiate effectively with NTEC concerning what the developer will and will not finance in terms of social-costs mitigation is similarly affected.

11. Questions also arise concerning the predominant public-sector institution in the region — BPKP — and how its role is to be re-defined as its principle source of revenue — timber and wood products — declines. BPKP's commercial interests will continue to fall in the direction of maintaining higher logging quotas than are commensurate with a sustainable harvesting regime, as long as it retains the monopoly rights to commercial logging in the Central Region. More broadly the role of BPKP will need to be re-defined if it is to evolve from a state development institution into a serious for-profit company. Its rural development and poverty alleviation activities represent a loss to its accounts that a for-profit company would find hard to justify. Potential conflicts-of-interest, in particular its participation in the RC while planning simultaneously to bid on resettlement program contracts, should be resolved. As an autonomous state enterprise, BPKP should have a Board of Directors and fiduciary accountability to the Ministry of Finance to facilitate oversight of its activities.

12. The main issue confronting central and provincial government entities with responsibilities in the region is absorptive capacity. Indeed, other than the RC, the relevant GOL line ministries appear not to have begun the process of planning to manage the project's impacts, nor for the environmental protection regime that would accompany its implementation. More fundamental, the amounts that are under discussion to accomplish GOL responsibilities are of an order of magnitude (i.e., up to 1,000%) larger than the provincial authorities and relevant GOL ministries are used to spending. It is for this reason that the World Bank and other stakeholders in Nam Theun 2 have begun to discuss the need for an 'autonomous institution' that would be responsible for environmental protection of the NBCA and possibly portions of the Nakai Plateau as well.

13. This may be the best means to ensure that environmental protection is accomplished effectively; nonetheless, it tends to confirm the concern that the implementation capacity of central government authorities will remain insufficient over the medium term. This would be true not just in respect to environmental protection, but also to economic development and poverty alleviation. This finding correlates with the findings of a recent review of public expenditures by the World Bank, which highlights weak government institutions and a very limited number of trained staff, a situation exacerbated by rudimentary legal, administrative and institutional structures. This suggests that, to be successful, the GOL's economic and social strategy will have to be complemented by an implementation strategy that compensates for thin public sector capacity. One way to do this would be to heavily rely on private sector concessions and contracting for infrastructure development, and complement this with public-private partnerships to achieve goals in the social sector.

4. Macroeconomic benefits and risks

14. Consideration of macroeconomic benefits or risks is not usually done in the context of a single infrastructure project. In this case these are examined because the potential benefits include an added impetus to economic growth and net revenues that can be programmed by the GOL to enhance the nation's economic and social development strategy. The risks relate to concerns about the project's impacts on macroeconomic accounts, based mainly on the concern that the country is small and the project would be relatively large; a related concern has to do with the GOL's overall strategy to concentrate on the development of hydropower exports as a principal source of foreign exchange earnings.

15. The macroeconomic analysis has projected that, under conservative assumptions, the Nam Theun 2 project would contribute to increasing GDP growth by a cumulative total of 2% over the four-year period of construction, and then by another 1.2% as net revenues began to come onstream. The main point to keep in mind is that, despite the price tag of \$1.4 to \$1.5 billion attached to Nam Theun 2, the effect of the construction project on GDP would be broadly similar to an increase in government expenditures of \$100 million over a four-year period — an amount just about equivalent to the cost of the GOL's equity in the project. To keep the matter in perspective, this is just about half the annual expenditure that is currently expected to derive from the World Bank's IDA portfolio in Laos over an equivalent period. Expectations about the project's financial returns to Laos similarly should be scaled to the magnitude of the GOL's contribution to equity, and not to the size of the total investment.

16. The same logic applies to macroeconomic risks. The Study has determined that government deficits would be only marginally larger under the Nam Theun 2 scenarios than if the dam were not built, and would remain well within tolerable ranges in terms of maintaining a conservative fiscal stance. The current account in the balance-of-payments would experience marginally higher deficits during the construction period, but then would fall to levels lower than those projected without the project. The ratio of debt-service to exports would remain well

within the range of levels commensurate with sustainable debt financing, particularly in light of Laos's current reliance almost exclusively on concessional borrowing. Moreover, even under the most pessimistic of scenarios as applied to cost overruns and hydrology risk, macroeconomic indicators would be only minimally affected, a finding which should provide considerable comfort about the macroeconomic risks involved in the project.

17. As to the risks involved in concentrating foreign exchange revenues in a single export, it is clearly the case that Laos should articulate and implement an outward-oriented economic development strategy. Continued progress in economic liberalization, combined with productivity-enhancing investments to reduce human and physical capacity constraints, and increasing reliance on economic growth led by the private sector, all would contribute to reduce the risks involved in Laos's export dependence on hydropower in the medium-term. In light of constraints on the absorptive capacity of the public sector, one means to implement such a strategy would be to rely on public-private partnerships, including concessions involving private foreign investment. If negotiated successfully, Nam Theun 2 could be a model for such partnerships in the future.

5. Financial risks to the GOL

18. None of the contracts or agreements that would underlie the Nam Theun 2 project has yet been negotiated or signed. Although a series of draft agreements had been tabled in 1995 and 1996 which the team undertook to review, these had all been drafted by the private sponsors, and as such were taken to represent opening negotiating positions. Indeed, one of the most striking discoveries of the financial risk analysis was that, despite the size of the proposed Nam Theun 2 project, its importance to Laos and the interest of international financial institutions in possible participation in its financing, the GOL had never had access to professional investment banking expertise to evaluate the structure of the agreements that had been tabled by the private sponsors. Yet, as highlighted within section IV, there are a number of characteristics within those drafts that could bear closer scrutiny.

19. The GOL faces a complex negotiation process. An important issue at this stage is the GOL's interest in preserving its return from royalty and resource income in a manner acceptable to the private sponsors. Exposure to hydrology risk also requires review. The most significant issue has to do with the private sponsors' stated position that the project as currently configured does not meet required rates-of-return, and the expectation that the GOL will accommodate them in this regard. Other issues include requests for remuneration of fairly substantial development costs and sponsors' fees, and the size of the GOL's equity participation in light of its other responsibilities as a sovereign sponsor. Any final resolution of these issues should incorporate adequate compensation to the GOL for its land and water rights while compensating the developers for assuming the early stages of development risks of the project in the context of a sole-source negotiation.

6. Nam Theun 2 and poverty alleviation

20. A major question considered by the Economic Study is whether the Nam Theun 2 project would contribute to poverty alleviation in Laos. Both negative and positive influences attributable to the project were considered. One concern is that construction-project expenditures could cause price rises that would have an adverse impact on the rural-urban terms-of-trade. This could adversely affect poverty alleviation efforts because the rural population also tends to be more poor. But because of its enclave nature, and because Laos has been largely successful in liberalizing prices and trade, there are few reasons to believe that the project would have any but the most short-term impact on local prices; whereas its impact on regional or national prices would be nil.² Another concern is that rising hydropower exports could, through appreciation of the real exchange rate, impoverish other sectors, like agriculture, from which the majority of the population falling below the poverty line derives a subsistence. But the Nam Theun 2 project would yield revenues too small in comparison to GDP for this concern to hold much weight. As regards the hydropower sector more generally, the best way to guard against this would be to implement an outward-oriented economic strategy and to target public investments toward relieving human and physical capacity constraints. The Lao PDR's social strategy would be entirely compatible with this approach.

22. The Study finds that poverty alleviation attributable to Nam Theun 2's direct impact on economic growth, even under conservative assumptions, would be measurable and positive: Under conservative assumptions, the increment to GDP growth alone would reduce the number of persons falling below the poverty line by more than 13,000. This very likely understates the direct poverty-reducing impact of the project, because during the construction period increased demand for goods and services in the Nakai Plateau would provide additional sources of income for local residents, most of whom are subsistence farmers who have been experiencing increasing rice deficits in recent years. And, although the Nam Theun 2 programs for environmental protection and resettlement are still under negotiation, the government's goal is to make local residents better off, so that if implemented effectively these programs also would contribute to poverty alleviation.

23. The final source of potential poverty reduction to be derived from Nam Theun 2, of course, would be the net revenues that would accrue from the project to the GOL. Even under quite conservative assumptions concerning social and environmental mitigation costs, the net cash flow to the GOL (in 1996 dollars) would average \$33 million annually from project initiation throughout the life of the concession agreement. If applied solely to the GOL's planned capital expenditures in the current fiscal year, annual revenues of this magnitude would have represented an augmentation of 12% of the resource envelope available under the public investment plan; or an increase of 38% if the increment were applied solely to the social sector line items in that plan.

² A notable exception might be local prices for consumer services, if Lao authorities invoked internal residency restrictions to limit labor mobility. Based on experience with prior hydropower projects in Laos, however, this appears unlikely.

To put these figures in perspective, it is estimated currently that each additional \$1 million could provide full immunization series to 67,000 Lao children, or finance the construction of 40 kilometers of rural roads.

24. The extent to which net incremental revenues from Nam Theun 2 could translate into poverty alleviation in Laos, however, would depend largely on GOL absorptive capacity. The risk is that in the absence of a strategy to mitigate its demonstrably thin institutional capacity, increased GOL revenues could end up financing a series of white-elephant public investment projects. As noted in the Bank's recent public expenditure review, the GOL needs actively to identify and cut low-priority public investments, while improving the effectiveness of investment projects in the context of a re-orientation of its public expenditure program toward improved efficiency and equity. It also should articulate an implementation strategy for achieving its economic development and poverty alleviation objectives.

25. The poverty alleviation strategy that the GOL has put forward follows the East Asian model of stressing productivity-enhancing public investments over income transfers as measures to alleviate poverty, relying instead on the extended family network as the principal safety net. Thus, the strategy emphasizes human capital development through targeted public investments in education, health and agricultural extension, coupled with reduced constraints to broad-based income growth through investments in physical infrastructure. These elements of the strategy are completely consistent with, and complementary to, an outward-oriented economic development strategy led by broad-based private sector growth. Nonetheless, beyond identifying priority sectors for public investment, the strategy requires articulation of measures that the GOL intends to take to ensure that implementation will succeed in light of institutional capacity constraints.

26. Among the measures that should be considered to ensure effective implementation of the poverty alleviation strategy are (1) establishing a transparent and consistent system to identify, prioritize and allocate public investments toward the most economically viable projects; (2) relying wherever possible on competitively-bid concessions and/or private contracting to build and operate needed infrastructure, utilizing fiscally sustainable subsidy schemes as necessary to extend access to poor and rural areas; and (3) offering competitively-bid public grants to provincial and local governments, and NGOs, awarded to the best proposals to target the provision of improved social services to the poor.

27. As part of such an implementation strategy, the GOL should consider the pluses and minuses of creating a "social fund" to which net incremental revenues from Nam Theun 2 would adhere. Such a fund could be responsible for implementation of specific elements of the GOL's social sector strategy under the policy direction of central government authorities, supplemented by donor financing and technical assistance. Experience in other countries indicates that social funds can move more quickly, with lower unit costs and stronger community participation, to supplement public institutional capacity under mechanisms that rely on implementation by both NGOs and private contractors.

7. Model for reform

28. Laos is at a crossroads in its development where it has already implemented a fairly comprehensive series of economic stabilization and structural adjustment measures, and is well on the way to making the transition from central planning to market systems. It has put forward an economic and social strategy to continue that process which would broaden the base of economic growth, and improve environmental sustainability, while relying on the gains from hydropower. Nam Theun 2 is an integral part of that strategy. The project, in addition to yielding substantial net economic benefits for the Lao PDR, is intended to demonstrate that private investments in Laos can and will meet international standards, not only of profitability and risk, but also of environmental and social responsibility. The former can be demonstrated by successful implementation of a large private concession led by credible foreign sponsors; the latter by strict adherence to the environmental and social standards of the World Bank. As designed, Nam Theun 2 could well become a model for future public-private partnerships that could help relieve Laos's human, physical and institutional capacity constraints, and usher in a period of sustained, rapid and environmentally and socially responsible economic development.

Appendix

Valuing the Social and Environmental Impacts of the Nam Theun 2 Hydroelectricity Project: A Preliminary Assessment

Appendix 1

Valuing the Social and Environmental Impacts of the Nam Theun 2 Hydroelectricity Project: A Preliminary Assessment

Introduction

1. The proposed reservoir would flood approximately 450 km² and require the involuntary resettlement of 4-5,000 people. The primary objectives of this preliminary assessment are to: value and monetize as many of the environmental and social costs of the project as possible; identify the costs and assess the effectiveness of measures to mitigate these costs; to provide estimates for residual (unmitigated) costs; and assess the institutional capacity to carry out mitigation efforts. Social and environmental impacts will occur both inside and outside the project area. For this analysis, we divide the impacts into seven areas, based primarily on geographic location: the inundation area; the Nakai Biological Conservation Area; downstream in the Nam Theun; downstream in the Nam Phit/Xe Bang Fai; the construction area; the resettlement areas; and regional health impacts.

1. Preliminary Estimates of Pre-Mitigation Social and Environmental Costs of NT2

2. The following estimates are for the net costs with the implementation of the project, but without mitigation efforts. These estimates are preliminary and based upon incomplete information. These should be interpreted only as indicative of the magnitude of the impacts and not authoritative.

1.1 The Inundation Area

3. *Income Loss* The total annual income gained from agriculture and other income generating activities in the inundation area is somewhat less than \$100 per capita. To account for uncertainty and limitations in the process of measurement, we use a range of \$100-150 per capita. Assuming 4,500 people in the area of the plateau to be inundated, this equals \$450,000-675,000 per year in lost productive capacity.

4. *Dislocation Costs* We estimate that the displaced people's willingness to accept compensation (which includes compensation for both income and psychic costs) could approach double the lost income, thus we add another \$450,000 to 675,000 in annual costs for the non-income (psychic) costs of dislocation and changed way of life.

5. *Timber* Based on a mean annual increment of 1.6 to 2.0 m³ per hectare, we estimate that a sustainable cut of between 48,000 to 60,000 m³ per year would have been possible over a relevant area of 30,000 hectares. (It is reported that half of the inundation area had been cut prior to 1996 and that some of the areas previously cut had been done so selectively, leaving significant quantities of commercial timber.) Prices for standing timber (stumpage values) are estimated at between \$40 and \$60 per m³. This would have produced an annual profit of between \$1.9 and \$3.6 million dollars.

6. *Terrestrial Habitats and Recreational Benefits* Using a combined tourist pharmaceutical and international transfer value of \$100 per hectare per year, we estimate that the premium on the land, in addition to the timber, for terrestrial habitat, biodiversity, and existence values of this land is \$75-\$125 per hectare per year. This figure, in a sense, captures the "option value" of the land—the value of retaining future use options for the land (tourism and biodiversity protection). We apply these values, to an area of land equal to 30% of the inundation area, or 13,500 hectares, as the amount of land that might reasonably capture these values at any one point in the future.

7. *Potential Benefits of the Reservoir* The reservoir may increase the annual catch for the area's fisheries. Estimates for the annual net increase in the catch is in the range of 400 to 650 tons¹ per year with an average price of \$1.50 per kilogram (Draft Resettlement Action Plan, May 1997). Assuming the cost of catching the fish at half the price, this yields an annual benefit of \$0.3-0.5 million per year. This is equivalent to a net present value in 1998 of \$3 to \$5 million dollars.

8. *Carbon Sequestration* Carbon storage losses will occur as a result of the timber cutting and the effort to remove biomass from the reservoir before inundation. This will result in the release of greenhouse gases equivalent to 25-40 million tons of carbon dioxide. Because it is implausible to suggest that Laos might be compensated in some way for all the carbon released, we value only the lost potential for sequestering carbon with the regrowth of trees in the inundation area. We assume regrowth of 2-3 m³ per year and a carbon content estimate of .225 tons of carbon per m³ of wood. This yields a carbon value of \$200,000 to \$300,000 per year.

9. *Aquatic Ecosystems* The project will entail the loss of much of the aquatic ecosystem on the Nakai plateau. The ecosystem includes the habitats of endangered species, putting these species at an increased risk of extinction. Given the limited information, the most plausible approach for assessing the magnitude of the impact on these aquatic ecosystems is to estimate values for the entire ecosystems, rather than the specific species, imputing a value for these aquatic ecosystems in relation to terrestrial habitats. We assume that one kilometer of river is equal, in conservation terms, to 50 hectares of terrestrial habitat. The length of rivers affected by the project total approximately 400 kilometers. Using the same logic as was used in calculating the biodiversity and potential tourism values for the terrestrial habitats, at \$75-125 per terrestrial hectare per year. These assumptions yield a damage estimate of \$1.5-2.5 million per year for the lost biodiversity and eco-tourism potential of these aquatic ecosystems.

1.2 Nakai-Nam Theun National Biological Conservation Area

10. The effect of the project on the NBCA, without mitigation efforts, has two categories of impacts, influencing the NBCA in opposite directions: (1) The increased demand for land and forest products will increase pressure on the NBCA; (2) the larger economic pressures based on the demand for natural resource revenues will diminish. Depending on which impact is more

¹ The RAP cites a projected range for the reservoir fishery of 500 to 750 tons per year and a current estimated catch of 100 tons per year.

significant, the impact of the project, without mitigation, could go either way. Based on the available information, it is our opinion that the revenue effect is a larger constraint, and hence, the prospects for protection are greater in the presence of the project.

1.3 Downstream Impacts on Local Inhabitants and Water Quality

11. *Nam Theun* Documentation of the impacts on this region is scant, though human impacts are likely to be low in economic terms, as this area is virtually unpopulated.

12. *Nam Phit/Xe Bang Fai* The most serious concerns in this area are the losses of houses and fields from the increased water flows and the possible increase in flooding. Clearly, the probability of flooding will increase in the Mahaxai district. However, flooding in the confluence area of the Xe Bang Fai and Mekong rivers will decrease because of decreased water levels in the Mekong as a result of water impounded in the NT2 reservoir. No estimates have been made for the impact on downstream inhabitants of the Nam Phit and Xe Bang Fai. The impact on local fisheries' production could be substantial, but data are lacking.

13. *Water Quality* Changes in water quality will affect both the composition of rivers and surrounding ecosystems and the productivity of these resources. The valuation estimate for aquatic ecosystems effectively captures much of this category.

1.4 Construction and Resettlement/Regional Health Impacts

14. The environmental and social costs associated with the mass movement of people are based on the conversion of land, over-exploitation of resources, and pollution of water and land. While these impacts can have important consequences locally, their impact is unlikely to be large in terms of the project.

15. Without mitigation, the inhabitants of the region will suffer an increased probability of contracting diseases exacerbated by the reservoir, including malaria and schistosomiasis. The increased population in the area, in combination with poor sanitation, could result in the elevated incidence of numerous diseases such as gastro-intestinal diseases, dengue, and opisthorchiasis. Given the lack of primary data and disease projections, we are left to make broad, indicative estimates of the costs of potential increases in illness. In the United States, based on policy decisions and the willingness to pay to reduce risks to life, it is estimated that societal compensation for wrongful loss of human life averages between two and five times the net present value of expected lifetime earnings. If a similar measure is applied to Laos, the annual economic loss would be approximately \$2-4 million per year. The cost of illness can be valued by lost productivity, using wages as a proxy for productivity, and the cost of treatment. If the workforce in the province is 100,000 and the unmitigated increase in illnesses from the project accounts for an additional lost workday per worker per year, at a wage rate of \$1 per day, the economic cost of illness is equal to another \$0.1 million per year. The true magnitude of these risks is poorly understood and deserves further study.

2. Preliminary Estimates for the Cost and Effectiveness of Mitigation Measures

16. The estimated costs of mitigating the impacts mentioned in the previous section range straightforward engineering cost figures to the cost of implementing more complex social intervention that may span over a decade or more.

17. *Resettlement* Compensation for the material losses can be made by providing land, houses, schools, health posts, roads, electricity, etc. The proposed budget for resettlement is approximately \$15 million in total. The difficulty arises in providing a new, untested means of subsistence. In this case, agro-forestry has been proposed as a new income base. The prospect of failure in making the transition from a non-cash economy to the marketplace is substantial. If resettlement fails to successfully provide a sustainable livelihood to 10% of the families, the residual damages would be approximately \$0.09-0.13 million per year.

18. *Biodiversity* The mitigation measure for offsetting biodiversity losses is the increased protection of the NBCA. The with-project with-mitigation scenario unambiguously produces the best possibility of preserving the NBCA (we estimate this probability as between 50% and 75%). Population pressures and economic pressures are both reduced in this scenario. However, tremendous uncertainty still remains regarding the fate of people within the NBCA and hence the wildlife of the area. Other possible mitigation measures include increasing the amount of water released into the Nam Theun, building fish ladders, preventing the introduction of exotic species into the reservoir, and possibly funding the creation of plantations to offset the loss of forests. One figure for the project's contribution to the cost of protection is \$30 million over 30 years. While the probably net effect of the project and mitigation actions on biodiversity is positive, we include an estimate of residual biodiversity damages based on the uncertainty of the proposed mitigation.

19. *Downstream Impacts* Construction of a channel to receive the out-take water and prevent the damage to the Nam Katang has an incremental cost. This is an accepted part of the normal construction process, entailing minimal residual effects on the Nam Katang. Assistance in providing irrigation has been proposed as one mitigation measure for flooding. The proposed budget for irrigation and electricity supply downstream totals \$3 million. We consider that this impact can be fully mitigated with no residual damages expected.

20. *Regional Health* Mitigation can consist of both avoiding the spread of disease and the treatment of those infected. The large behavioral element in the prevention of HIV makes its mitigation subject to a high degree of uncertainty. The provisional budget for health impacts is \$15 million but includes other construction-related costs.

21. *Water Quality* The full removal of biomass from the inundation area will prevent some of the damage that might be caused by eutrophication. Another proposed mitigation measure is the construction of the channel such that it aerates the water on its way out.

22. *Costs Associated with Construction* Funding will be drawn from the construction budget to address many of the negative impacts that could arise during construction.

23. *Project Benefits as Mitigation Measures* The project could have considerable benefits in addition to the costs. The availability of irrigation water and the potential for tourism are two examples in addition to the fisheries production in the reservoir. These are subject to substantial uncertainty. One possible approach would be to have the project make contributions to a general mitigation fund; these contributions would be diminished when project benefits come to fruition.

3. Mitigation, Compensation, and Residual Damages

24. It is judicious to anticipate both cost over-runs in the mitigation plans which are being made and unanticipated costs. Special care must be taken to clearly define the terms and responsibility for any additional costs and in the event of non-performance of mitigation efforts. Estimating the potential magnitude for residual damage costs is undoubtedly a tenuous exercise. However, a review of international experience with large dams applied to the context of Laos and Nam Theun II allows us to estimate a plausible range of values. At this point, our best estimates are that the GOL should anticipate residual damages of 10%-50% of the pre-mitigation damage estimates. This applies to all costs except for the lost timber harvests and carbon values. This is based on an assessment of the probability of success in preventing mitigating these impacts. For example, a recent review of 50 World Bank financed dam projects indicates that resettlement was carried out with reasonable success in half the cases. The potential revenues of the project are several times the quantifiable environmental and social costs. Equity and prudence suggest that all social impacts should be fully mitigated or compensated (everyone affected by the project should be at least as well off and preferably better off), and the net environmental impacts should be clearly positive.

4. Institutional Analysis

25. Enhancing and strengthening the institutions charged with carrying out the social and environmental mitigation plans is perhaps the biggest challenge for achieving success in these areas. The breadth and intricacy of the mitigation agenda, which is being based upon international standards, is greater than that previously undertaken by the various agencies, both public and private, that comprise the current capacity within Lao PDR. While it is difficult to predict the success of these measures with a high degree of confidence, it is possible to delineate those particular aspects of institutional arrangements that are most conducive to success.

26. Social and environmental measures must be commensurate with and appropriate to the Laotian development agenda and according to international standards. Institutional strengthening and capacity development should complement the larger efforts being carried out across the nation and contribute to institutional strengthening beyond the boundaries of this project.

27. For managing the NBCA a body has been proposed consisting of representatives from the Department of Forestry, the Provincial Governor's office, the BPKP, the IUCN, and NTEC. The actual availability of financing is not likely to be the most serious limitation for addressing social and environmental concerns. There is the potential for leakages in the disbursement of funds. In

the management of the NBCA, proposals for some type of environmental trust fund have been forwarded. This would put the power for disbursement of financing with an independent board composed of representatives of many sectors.

28. A model seems to be developing for the allocation of responsibility for resettling the inhabitants of the inundation area. The RMU is responsible for planning the process. The financing for resettlement comes from NTEC. The social aspects are being carried out by the Lao Women's Union, the Provincial government, BPKP, and NTEC, and by giving the villagers themselves a voice by affording them with different options. Technical inputs will come through NTEC. The provision of social services will be carried out by the Provincial government. Infrastructure (roads, houses, etc.) will be constructed by the BPKP. The Provincial government will coordinate the actual moving of people to new sites. The oversight and monitoring role, however, does not seem to have been settled yet.

29. The other large impediment to protection—the opportunity cost of not cutting the timber—is partially mitigated by the terms of the NTEC contract: the largest portion of Laos's revenues will come well into the future, lending a strong incentive to avoid timber cutting in the area to protect the catchment area of the dam and ensure its value 25 years hence when it reverts to Laotian ownership. One possible avenue of increased protection is through the declaration of the NBCA as a World Heritage Site. The mitigation offered for irreversibly changing the ecosystems of the plateau and rivers is the protection of this area. Given that this is not assured, institutional arrangements should include a recourse in the event of failure. One such guarantee is earmarked financing paid into a fund devoted solely to activities in the NBCA.

5. Conclusions

30. The potential social and environmental costs, without mitigation, for which we have estimates are in the range of \$80-160 million in present value terms, with a round mean of \$95 million. Of this, \$20-40 million is attributable to the opportunity costs of land. As there is no planned mitigation for these costs, they should be considered a part of Laos's contribution to the project. Most of the other \$60-120 million in costs can, in practice, be mitigated. There is, however, a substantial degree of uncertainty involved in the actual implementation and follow-up for these measures. A mitigation budget of \$60-75 million for resettlement, biodiversity, construction, health, and downstream impacts (not counting the channel construction) should be nearly adequate, in financial terms, to address the cost of the impacts, either through mitigation, offsets, or compensation. In an optimistic scenario, unforeseen costs would not be more than an additional \$10-20 million, which would be drawn from a social/environmental contingency fund. In a pessimistic scenario, additional expenditures of \$35-50 million would be required for mitigation efforts, reducing the profitability of the project. Depending upon the actual structure of the contract, the GOL could be left with considerable residual damages not addressed through the NTEC budget. This could range from \$1-3 million per year.

