

I. TECHNICAL APPROACH

The context of this 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). The Study will look at both the short-term impacts of the project during the construction period, as well as the longer-term impacts once the project is in operation. The Study will analyze the specific impacts on goods and factor markets in the project area, impacts on these markets in the rest of the country, and impacts on the GOL's budget (both short-and longer-term). The Study will relate this project to the government's public development program in terms of financing, potential for crowding out, and prioritization. The Study will examine, in particular, the extent to which it is demonstrable that the institutional capacity exists or is credibly planned to ensure that revenues from the project will have the maximum impact in terms of poverty alleviation, and that planned environmental and social mitigation efforts are carried out.

In addition, the Study will analyze the structure of financing of the project to determine the profile of net resources available to the government, the risks associated with these flows, and the overall exposure risks implied by the project's financing structure on the government's credit worthiness and access to other sources of financing in the future, from both official and private sources. The Study will make an overall assessment of the economic viability of the proposed Nam Theun 2 project and make recommendations, where appropriate, to enhance the benefits to be derived from the project, or mitigate the negative impacts that are identified.

The Study is to be carried out in parallel with an Alternatives Study for power generation, the Environmental and Resettlement Assessments being conducted by the NTEC, and the Environmental and Social Action Plan for the Nakai Plateau watershed area, and will be coordinated closely with those efforts. Other study efforts supported by the World Bank with which it will be important to coordinate include the Public Expenditure Review; the Laos Forestry Project, the Hydropower Sector Strategy, and project identification activities relating to the Social and Environmental Project for the broader impact area of Nam Theun.

A. Detailed Plan

As determined by the Terms-of-Reference (TOR) for this assignment, the Economic Impact Study will be divided into five components (1) Project Evaluation, (2) Real Sector (Microeconomic)



Analysis, (3) Macroeconomic Analysis, (4) Overall Economic Analysis, and (5) Risk Analysis. The analytical approach of LBII to each of these components of the Study is outlined below, according to the tasks proposed for completion under each component.

(1) Project Evaluation

The objective of this component is to evaluate the economic rates of return from the project, both from the perspective of the project itself (or the Nam Theun Electric Company, NTEC), and from the perspective of the Lao economy (or the GOL). The Economic Study team will draw on data provided by the Nam Theun Electricity Consortium (NTEC), including the Environmental Assessment and Resettlement Program being prepared by the NTEC, under review by a technical panel of experts established by the World Bank; from the consultants responsible for the Environmental and Social Action Plan for the Nakai Plateau watershed area; and from the Alternatives Study team, which is responsible for calculating present values of net benefit streams for various energy supply alternatives. The Economic Study team will assess the reasonableness of these calculations in respect to Nam Theun 2 and refine them as necessary and feasible. (A more complete summary of data needs and anticipated sources is contained in section I.C)

Task 1: Categorize available cost and benefit data. In this task, available estimates of costs and benefits will be categorized to facilitate conversion to economic costs and benefits. The separation of cost and benefit data into functional categories, and as feasible, into subcategories distinguishing between local and foreign costs, and land, labor and capital, will facilitate the use of shadow prices (discussed below). It is our understanding that data on financial costs and benefits will be supplied by the NTEC. These are expected to include cost estimates of project construction, operation and maintenance. Estimates of environmental and social costs (and benefits) will be derived from the Environmental Assessment and Resettlement Program being prepared by the NTEC, and reviewed by a technical panel of experts established by the World Bank, from the Environmental and Social Action Plan for the Nakai Plateau watershed area; and from other ongoing activities such as the Alternatives Study and the Bank's Forestry Project. Where data or estimates about important concepts are not available, LBII will make reasonable estimates of the ranges and magnitudes involved, and carefully document all assumptions made in a computer model to be given to GOL authorities (see Task 6, below), so that these estimates can be refined and updated once the other studies can provide the requested data.

Task 2: Estimate indirect costs and benefits. There may be areas where there are costs and benefits attributable to the proposed Nam Theun 2 project, but these costs and benefits are not pertinent to the rate-of-return analysis from the perspective of the NTEC. If it is the case that such impacts are projected to be significant, they should be factored into the analysis of the



economic rate-of-return from the perspective of Lao society (the GOL). Indirect impacts that may be identified could derive from a variety of sources, including the incremental impacts (both costs and benefits) of logging in the dam basin area, woodlands protection in the catchment area, the potential to contribute to additional flooding downstream, the construction and utilization of ancillary infrastructure and irrigation capacity, and increases in hunting, recreation/tourism and secondary employment. In each case, the key to estimation and analysis of incremental impacts will be to construct plausible scenarios with and without the Nam Theun 2 project.

This is one of the areas where coordination among the various studies relating to Nam Theun 2 will be essential. It is our understanding that the Alternatives Study team will utilize data provided by the NTEC, and will attempt to identify and quantify any "residual" environmental or social impacts not accounted for in the NTEC data. The Economic Study team will: (a) assess the reasonableness of the NTEC and Alternatives Study estimates of environmental and social costs and benefits; (b) where estimates are not provided, estimate the ranges of the costs (and benefits) of potentially significant environmental and social impacts, based on available information and prior studies; (c) incorporate the high and low ends of those ranges into the economic rate-of-return analysis as alternate scenarios; and (d) recommend further investigation and refinement of those estimates, as warranted, that might be accomplished for example in the context of preparing the Social and Environmental Project for the broader Nam Theun area. Where quantification of important concepts is not possible, general magnitudes will be gauged, and incorporated into the text of the analysis. All assumptions and estimates will be carefully documented in an accompanying table to that alternative calculations can be made based on different assumptions or data.

Task 3: Estimate and apply shadow price ratios. Shadow prices are applied to capture the true opportunity cost or value to the economy of resources to be applied to, or income to be derived from, the project under consideration. This technique is used to correct for price distortions or market imperfections which may skew financial prices, such as foreign exchange restrictions, non-market wages rates, and taxes or subsidies. It is our understanding that the importance of such distortionary factors such as foreign exchange restrictions, price distortions and non-market wage rates may, however, be fairly minimal in the Lao economy. A priori, we understand that the main corrections may be limited to making sure that taxes and tariffs are removed from prices and perhaps making some adjustment to the price of Lao labor.

Task 4: Estimate economic rates of return. The stream of economic costs and benefits over the life of the Nam Theun 2 project will be used to calculate the economic rates of return both from the perspective of the project entity (NTEC) and from that of the GOL (Lao economy). In addition, comments to the draft Inception Report have requested that a scenario be created that



would represent the Thai view, based on replacing anticipated power revenues in the rate-of-return analysis from the project entity's perspective with the opportunity cost to Thai consumers of obtaining the energy domestically. Each of the scenarios will be calculated utilizing economic-rate-of-return (ERR) analysis as well as net present-value (NPV) analysis.

At the most basic level, the project entity rate-of-return evaluation would include (a) power revenues less the costs of constructing and operating Nam Theun 2; (b) either the incremental environmental damage (unmitigated), or the remaining incremental environmental damage plus the costs of mitigation measures; (c) the costs of resettlement; and (d) the costs of the incremental infrastructure needed to support the Nam Theun 2 project. A key question for analysis will be how the costs of items (b), (c) and (d) are to be shared between NTEC and the GOL.

The "Thai view" would involve replacing power revenues in the project-level analysis with the avoided marginal costs of adding capacity to produce power in Thailand (less any incremental costs to Thailand of obtaining the incremental power needs from Laos). It is our understanding that World Bank staff will provide the revenue assumptions needed to construct this alternative scenario.

Finally, the Economic Study team will estimate the economic rate-of-return to the Lao economy itself. This will include incremental revenues and costs to the GOL, including royalties, resource levies and dividends, less any costs accruing to the GOL for assuming obligations not covered by the NTEC for environmental resettlement/social costs, infrastructure costs, as well as debt-service costs entailed by any borrowing for acquisition of equity in the NTEC. To the extent that indirect impacts attributable to the Nam Theun 2 project are projected to be significant, and are amenable to quantification, these will be factored into the ERR analysis from the Lao economy (GOL) perspective (see Task 2, above). Costs and benefits will be consistent with those assumed in calculating net revenue flows to the government in component (3) *Macroeconomic Analysis*.

Discount rates to be utilized in the net present-value calculations will depend on the perspective of the analysis. The objective is to represent the true opportunity cost of capital, although this can be difficult to estimate in practice, and hence requires a good deal of judgement in application. From the project entity's perspective, the best proxy may be the market interest rate available to the NTEC in Laos. The analysis will examine information available in this regard in light of the internal rate-of-return on marginal investments the NTEC might face in alternative hydropower projects. In particular, the Alternatives Study is supposed to carry out net present-value calculations on a series of alternative hydropower investments, and these assumptions and results should be helpful in shedding light on what the opportunity cost of capital may be for the NTEC. Examination of the assumptions made in cost-benefit analyses completed for previous hydropower



projects, including Nam Himboun, could also prove fruitful.

From the perspective of the GOL (or Lao economy), ex ante the best proxy for the true cost of capital would be the market interest rate. For several reasons, however, including thin or distorted capital markets, it may be that the "market" rate of interest does not serve as a good proxy for the marginal efficiency of investment in the Lao economy. As to the GOL itself, it may have access to lower interest rates through concessionary loans or other financing from international financial institutions, and so it may be that the best measure of the discount rate from the GOL's perspective would be less than the "market" rate. Again, the Economic Study team will endeavor to ensure that assumptions made about the discount rate from the GOL perspective will be transparent and consistent with the assumptions made in other, previous or parallel, studies.

Finally, as to the 'Thai view' perspective, the best proxy for the true cost of capital is likely to be the commercial interest rate in Thailand, given that capital markets in that country are fairly robust. EGAT itself, however, given its strong international reputation, may face a somewhat lower interest rate than that which prevails generally on Thai capital markets.

Task 5: Conduct sensitivity analysis. Sensitivity analysis will be undertaken of the various risks that the project may encounter. The baseline scenario will be derived from the most likely estimate of the variables. Important variables will be estimated with realistic scenarios for optimistic and pessimistic conditions. The scenarios will be based on information obtained from the World Bank, the GOL, the NTEC and EGAT. The Alternatives Study also has been tasked with conducting net present-value calculations on Nam Theun 2, and with conducting sensitivity analysis of those calculations, so that coordinating the Economic Study sensitivity analysis with those of the Alternatives Study team will be important.

Among the risks that will be examined are demand-side risks. In particular, the price or prices at which the power generated by Nam Theun 2 can be sold will need to be estimated, since the previous Power Purchase Agreement between EGAT and the NTEC has expired. The eventual tariff to be negotiated and the output to be supplied to EGAT will have to be subjected to alternative scenarios. An assessment of Thailand's power demand forecast, such as that to be performed under the Alternatives Study, including price forecasts and current and planned resources (gas combustion turbines, coal plants, etc.) should shed light on the parameters of these alternative scenarios.

Long-term historical weather conditions or an estimate of possible hydrological and operating



scenarios under different weather conditions will be utilized to assess hydrological risks to output supply. Other potential supply-side risks include possible construction delays, cost overruns, operating problems, dam failures and siltation.

Task 6: Document model and provide training. An analytical model will be developed that is capable of evaluating the rate-of-return of Nam Theun 2 as well as alternative projects both from the perspective of the government of Laos and of each project itself. The model will be structured to estimate the rate-of-return for Nam Theun 2 or alternative projects from both a financial and an economic perspective. The model will be developed in an electronic workbook format. All data, estimates, assumptions and scenarios utilized in the Project Evaluation component will be carefully documented, and the model given to the GOL. Preliminary training on use of the model will be accomplished while the Study team is in the field.

(2) Real Sector (Microeconomic) Analysis

The Microeconomic Analysis component is intended to examine the impacts of the project on the real sector of the economy, especially in the project area. The impact analysis will also examine the institutional capacity of the BPKP, the provincial governments and the central government to manage the impacts of the project, and make recommendations for improvement where appropriate.

Task 1: Assess construction project impact on regional economy. Although the 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. The analysis will examine the likely effects of the immigrant labor force from Viet Nam and Thailand on the local markets and environment during the construction period, including their spillover demand for various products, especially the food market. It will also examine the potential for their hunting extensively or utilizing other natural resources in the area, and consider the possibility that a proportion of them will remain with their families as long-term immigrants. The Study team also will assess the impacts of the project on the town of Thakek as the primary transshipment and staging area. It is anticipated that a site visit to Thakek will be essential. The Study will also identify probable bottlenecks in terms of either goods and services, local infrastructure or government institutions, and make recommendations for remedial actions to mitigate their effects. The analysis will pay particular attention to projection of needed infrastructure or institutional development expenditures. It is understood that the GOL Statistics Department will be able to provide some baseline data concerning the provinces of the affected region. It is also understood that the NTEC will provide information on the sourcing of materials and labor, and planned



payments procedures to immigrant laborers, including offshore payments. A site visit to Nam Himboun, to examine the experience of constructing a smaller hydro-power facility, should prove extremely useful to the task of projecting the magnitudes of expenditures necessary to mitigate the local bottlenecks associated with the project.

Task 2: Assess ancillary economic impact on region. There will be other impacts on the provinces of the affected region that will not be directly related to construction of the dam itself but which will result indirectly from the project. The second task will be to identify and assess these impacts on the region. It is understood that estimation of the cost of relocating approximately 900 families from the dam basin will be conducted by the NTEC in the context of its Environmental Assessment and Resettlement Plan, and that this document is to be reviewed by a panel of experts constituted by the World Bank. The extent to which project planning calls for relocation of these families within or outside the region obviously will have an impact on regional development, however, and should be factored into regional development plans. In addition, the incremental logging that will occur in anticipation of the reservoir basin being flooded, which is not an enclave activity, entails potentially large impacts. Such impacts might be felt in local goods, services and labor markets, including changes in relative prices and/or bottlenecks. They also might include increased employment and income in the region. Other ancillary project impacts would include those associated with the future phase-down of the logging and dam construction operations, due to demobilization of employment and related services. It is anticipated that the Environmental Assessment and Resettlement Plan will provide the Economic Study team with estimates of environmental impacts of the logging operation, and that information about incremental logging revenues and their utilization may be provided by the BPKP, a state-owned enterprise established to promote economic development in the Center Region. To the extent data are not available, LBII will make reasonable estimates of the ranges and magnitudes involved, as feasible.

Task 3: Assess regional plans and institutional capacity. The BPKP holds the logging concession for the reservoir basin and other areas, has built several wood processing plants and is planning other industrial and tourism projects. It plans to work closely with the provincial authorities and the NTEC to provide needed infrastructure and other services. The Study team will examine the BPKP program and the provincial governments' plans for the region to see how they are affected by the project. This should provide the opportunity to study the longer-term opportunities for regional development offered by the project and include these among the benefits to the economy, to the extent that they can be quantified. These may involve tourism, expansion of irrigation downstream from the powerhouse, and local industries (including wood processing, if a sustainable cutting program can be established, which the Environmental Study should address). There is also the question of how net revenues from the logging operation, or a



proportion of the future revenues from the sale of hydro-electricity from Nam Theun dam, could be utilized to promote regional economic development. Recommendations for regional development activities will be made where appropriate. The institutional capacity of the BPKP and the provincial authorities also will be assessed, in particular in relation to the capacity to implement environmental and social impact mitigation measures. Conclusions will be drawn based on the analysis concerning the probable impacts of the project on sustainable development and poverty alleviation in the region, and recommendations for institutional strengthening made where appropriate.

Task 4: Examine impact on national markets. Task 4 will be to examine the extent to which the impacts of the Nam Theun dam project on national goods and factor markets result in significant pressures on prices or shortages in supply. Based on the results of Tasks 1 and 2, the first step will be to identify likely effects within the region itself in terms of price increases or shortages of goods or important categories of skilled manpower. To the extent that national markets or distribution networks are inflexible, and recourse to imports is limited, inflationary pressures could result. The analysis will endeavor, by examining the historical record in prior dam construction operations in Laos, to assess the likelihood of such a "Dutch Disease" inflationary effect occurring, and the magnitude of the impact should it occur. Should data from the national Census permit comparisons of household consumption baskets in the rural provinces affected by the project with representative urban areas, the analysis will examine the impact of the project on rural/urban terms-of-trade. The analysis also will examine the extent to which short-term shortages or price increases could result in development of the capacity of Lao entrepreneurs to enter new markets created by rising demand. Measures which could enhance the prospects for Lao entrepreneurs to benefit from the increased opportunities engendered by the project will be suggested, where appropriate.

Task 5: Assess long-term monitoring capabilities. Successful implementation of a project of this size, scope and complexity will depend on careful integration and co-ordination among numerous authorities and economic agents. Establishment of a monitoring system would allow the NTEC, BPKP, provincial authorities and the central government, as well as the World Bank, to track implementation of the project and its ancillary impacts, and identify early enough to apply corrective measures any bottlenecks or problems which may threaten its success. Local institutions will be evaluated for their capacity to perform this function, and recommendations will be made, as appropriate, for the establishment of an effective impact monitoring system. In particular, the Study team will develop a set of indicators and time-bound benchmarks according to which it will be possible to assess (a) how the project itself is progressing, and (b) how undertakings in the areas of environmental mitigation, resettlement and regional development/poverty alleviation are progressing.



(3) Macroeconomic Analysis

The Macroeconomic Analysis will assess the indirect impacts of the Nam Theun 2 project through its projected effects on the GOL budget and balance-of-payments. It will also apply theory and cross-country comparative analysis to look at possible impacts on the exchange rate. The analysis undertaken in this component will be coordinated closely with GOL and World Bank staff responsible for modeling and forecasting scenarios using the RMSM model. The RMSM model will be used as a tool to evaluate various scenarios relating to the potential risks to the Nam Theun 2 project, and to quantify the projected macroeconomic outcomes in a consistent framework. The product from this exercise will in turn be utilized to examine the potential risks to the GOL entailed by the Nam Theun 2 project under *Component 5: Risk Analysis*.

It is important to be clear about the limitations of the RMSM model, which cannot be used to shed light on microeconomic outcomes such as the effectiveness of public expenditures, impacts on poverty alleviation, or relative price shifts. Neither is RMSM adequate to analyze the links between local wage pressures and resource constraints and impacts on the overall economy. As regards quantitative analysis of microeconomic outcomes attributable to the proposed Nam Theun 2 project, one means to accomplish this would be to build a Computable General Equilibrium (CGE) model for Laos. Bank staff have informed LBII, however, that the available data are simply not sufficiently detailed at this time to permit the construction of such a model. Building the data base necessary to construct a CGE model has been a multi-year task in other countries of Southeast Asia, and we would consider such an exercise to be beyond the scope of and resources available for this assignment. Nonetheless, the Economic Study team will examine the potential to build a CGE model for Laos and provide an estimate of the level of resources that would be required to undertake it.

Task 1: Estimate net incremental government revenues. The first task of the macroeconomic analysis component will be to estimate the net revenues accruing to government attributable to the impacts of the Nam Theun 2 project. Estimates of net revenue flows to the central government will be derived from the results of the first two components, the Project Evaluation and the Real Sector (Microeconomic) Analysis. Although payments for hydropower exports will accrue largely to an off-shore account, the residual amounts following pay-outs to the NTEC's foreign investors as spelled out in the project agreement will accrue to the balance-of-payments of the GOL. Technically, these amounts will fall under investment income rather than exports. Once the Nam Theun 2 dam is turned over to Laos under the project agreement, however, all electricity sales to Thailand will be recorded as exports.

