Economic Critique of Nam Theun-Hinboun Hydropower Project and Electricity Development in Laos: Proposal for an Alternative Path to Development 6.5.96

Recommended Citation

Economic Critique of Nam Theun-Hinboun Hydropower Project and Electricity Development in Laos: Proposal for an Alternative Path to Development

Thomas Adams
Senior Consultant, Borealis Energy Research Association
Prepared for Probe International
June 5, 1996

This report was prepared at the request of Probe International. The purpose of the report is to address the process of electricity development in Laos and to propose an alternative approach. The purpose of the proposed alternative development path is to facilitate electricity development which will be sustainable over the long term and will be beneficial for all the citizens of Laos. The paper is intended to expand the scope of discussions about options for electricity development in Lao People's Democratic Republic (PDR) and to contribute to the debate by outlining relevant aspects of the experience with electricity development in Canada.

Investment Risks of the Nam Theun-Hinboun Hydropower Project
The Nam Theun-Hinboun Hydropower Project is proposed in the Asian Development Bank (ADB) report RRP: Lao 27325, dated October 1994. All references here are to this report unless otherwise noted. My analysis of this report suggests that the project is very likely to fail as an investment and to result in a net financial liability of significant magnitude. My critique focuses on the ascribed purpose of the project and on two of the key financial assumptions.

The Theun-Hinboun Hydropower Project, as proposed by the ADB, addresses a faulty objective. As described in the project document, the primary objective is "economic growth". Economic growth is in fact a byproduct of successful investment, not its purpose. Whereas, the proper purpose of investment is to profitably serve a particular market.

Projects that ultimately result in the consumption of more economic value than they produce can, for a time, produce economic activity through the expenditure of invested funds. However, if value equivalent or exceeding the invested capital is not created over the long term, the project will damage the economic interests of Laos. By reframing the purpose of the Theun-Hinboun project as profitably serving an Electricity Generating Authority of Thailand (EGAT) contract, the shortcomings of the ADB proposal become clear.

I have analysed the ADB report and the prospects of the Theun-Hinboun project as a successful investment by examining the economic assumptions and the analysis in the ADB report in light of the experience with other major hydropower projects in Laos.

Inadequate Analysis of Price Risk
The ADB report fails to provide an adequate analysis of revenue risk for the project. The report indicates that the Nam Ngum and Xeset projects generate average revenues of 3.5 ›/kWh and 2.9 ›/kWh respectively. However, the revenues for the Theun-Hinboun project are calculated on the basis of 4.3 ›/kWh a premium of 23% and 48% respectively over the value of electricity from existing projects. The only sensitivity analysis in the ADB report for the impact on profitability due to a reduction in revenues tests for a 10% reduction in rates (Table 7). In my opinion, the analysis should have covered the range of actual experience with export prices. Without this analysis, proponents may have projected revenues in excess of actual.

The project's revenue risk may be adversely affected by the fact that the proposed facility has its output dedicated for export. EGAT, the customer for 95% of Theun-Hinboun's electricity and about half of all of the electricity output of Laos, has a keen interest in ensuring that all of its suppliers construct facilities at their own risk to supply EGAT's needs. Some risk may exist from the unbalanced negotiating position of EGAT in its relationship with Laos. Once the project is completed, price negotiations, which are anticipated in the contract, may reflect EGAT's strong bargaining position.

Output Estimate Excessive
Under the proposed contract, the project is expected to produce at an 85% annual capacity factor (actual output divided by theoretical output assuming continuous full production), an estimate that appears unduly optimistic. To test the ADB's assumption about output from Theun-Hinboun, I compared capacity factor forecasts for the project against the experience with Nam Ngum and Xeset, the other major hydropower facilities in Laos. I calculate that these existing projects generated electricity in 1993 and 1995 at average annual capacity factors of less than 48% to 64% respectively.

The report's treatment of capacity factor for Theun-Hinboun is extremely optimistic and inconsistent with experience. In the ADB's analysis, the capacity factor assumed for the project is 87%. The design of Theun-Hinboun, as described in the ADB report, is similar to the Xeset project, which has virtually no electricity output during extended periods in the dry season, thereby necessitating electricity imports from Thailand to supply the Xeset grid.

In discussing the environmental plans for the diversion from the Nam Theun, the ADB describes a program to release water to the downstream Theun during the dry season rather than divert the water to the Nam Hinboun, in order to mitigate impacts on downstream fish populations (p. 24). Such releases during the dry season would be inconsistent with achieving the targeted capacity factor.

Additionally, according to the report, the height of the diversion dam will not allow the level of the head pond to rise beyond the natural high water mark (p. 12). This design means that the output is directly reliant on natural river flows since the diversion dam will not have the capacity to store a large inventory of water. In the dry season, when the Nam Theun is prone to extended periods of minimal flows, electricity production will taper off sharply with the reduction in river flows.

In summary, there appears to be little likelihood of the project achieving its targeted capacity factor of 87%. This assessment is based on experience to date with the output of Laos hydropower, the potential for environmental constraints to maintain downstream flows in the dry season, and the run-of-the-river design applied to a seasonal watershed.

It is worth noting that for Ontario Hydro, with 68 hydropower stations, most large modern stations achieve capacity factors in the range of 20% to 60% in normal years. With a few special exceptions, particularly large facilities on the lower Great Lakes which are huge natural reservoirs, the only hydropower facilities to achieve capacity factors comparable to those forecast for the Theun-Hinboun project are small facilities which were not designed to utilize

peak river flows. Many of these small facililities spill significant amounts of water in normal years.

In my opinion, the Theun-Hinboun Power Company (THPC), the joint venture agency which is majority controlled by EdL, would be extremely unwise to "guarantee" an availability of 85% as noted under the proposed licence agreement (p. 11). However, it is unclear what penalties may prevail in the event of a failure of the project to perform to the "guarantee" level.

As with the failure to perform adequate sensitivity analysis for the impact upon profitability in response to changes in the electricity sale price, the ADB report only provides limited sensitivity analysis for the impact of reduced output. The report only analyses a 20% reduction in output. In my opinion, the analysis should have assessed the impact of a 50% capacity factor. This failure to perform sensitivity analysis is a particularly serious oversight given the absence of long-term hydrology data for the Nam Theun.

Based on my analysis of the revenue and capacity factor assumptions, I believe that a very substantial risk exists that the proposed Theun-Hinboun project, as configured in the ADB report, will fail to return its capital. The ADB report is seriously deficient in its analysis of the major economic uncertainties affecting the project.

EdL: The Case for Reform

Although the electricity industry in Lao PDR is a key economic sector, providing a substantial portion of the foreign exchange earnings of the country and serving the growing domestic market, the industry is extremely weak. The financial structure of the ADB proposed Theun-Hinboun project reflects this weak condition.

EdL is dependent on high levels of foreign assistance. As quantified in Appendix 1, the total ADB and aid assistance to the Laos electricity sector for the period from October 1987 to August 1994 was $72,179,000 (expressed as an arithmetic sum of dollars of the year). This sum is very high considering that total annual revenues in these years never exceeded approximately $32.4 million. For the purposes of analysing the efficiency of EdL, it is useful to consider the conceptual case where the value of the aid received is recognized as an input cost. If the value of aid capital was recognized as a cost, EdL would be forced into bankruptcy or severe restructuring and rationalization. EdL's interest coverage ratio, which is currently positive, is a function of aid support rather than internal efficiency.

EdL's weakness is underscored by the proposed financial structure of the Theun-Hinboun project. Although EdL acts as a nominal equity investor, putting up 60% of the so-called "equity" capital in THPC, in fact an ADB loan, recycled through the Laos government, pays for EdL's share.

The Theun-Hinboun model proposed in the ADB proposal has some merits. The participation of private capital through MDX Laos Company and Nordic Hydropower AB may provide the project with access to additional technical and managerial input in addition to their capital contribution. However, 83.8% of the project capital, $226 million of its total estimated cost of $270 million in 1994 dollars, is ultimately borrowed by the government of Laos and therefore is a risk to the public purse. With the vast majority of the project capital supplied by government of Laos, the project cannot be considered a "private sector" project. The 60/40 debt/equity ratio claimed by the ADB is unjustified. The actual debt/equity ratio of the project is 83.8/16.2.

Toward an Efficient Electricity Sector in Lao PDR

In the interests of containing risk against the public purse and fostering sustainable development, the government of Laos should explore an alternative model for electricity development.

As economic conditions improve in Laos, the demand for electricity may rapidly increase. If aid dollars become less accessible in future years, EdL, in its current operating and financial condition, will find it impossible to meet those demands. The future development prospects of Laos depend to a significant degree on the electricity sector being economically efficient and acting as a net contributor to the nation's wealth, as well as effectively providing service to meet the growing electricity needs of the nation's citizens. In my opinion, the well-being of citizens of Laos is being jeopardized if their government fails to dramatically reform the Laotian electricity sector to improve its efficiency on the assumption that future aid will continue to pay for mistakes.

Hazards of Speculating in the Changing Electricity Industry

Electricity analysts are generally coming to accept that electricity investments, once considered safe, are very speculative. The electricity business is technically demanding and capital intensive. World electricity prices are generally static, or are falling, and are likely to fall significantly in the future. Developing technologies, such as combined-cycle gas turbines (which utilize fuel very efficiently, first in a gas turbine and then in a steam turbine),

and market liberalization are the two key drivers in this trend. Some market participants anticipate that electricity can be profitably delivered to U.S. markets from gas-fired cogeneration units at 2›/kWh to 2.5 ›/kWh. If real electricity prices from new sources fall, as some analysts suggest, many existing investments in electricity generation facilities could become imperilled. If the value of production from an existing investment falls below its costs of production, the invested capital becomes stranded. The result is that some or all of the invested capital may be lost.

Governments in many parts of the developed world, such as several jurisdictions in Canada and the U.S., are now recognizing that many earlier investments in the electricity sector are now stranded, or is at risk of becoming so, because of the availability of cheaper sources of supply.

Large scale hydropower investments are capital intensive. Hydropower technology is not advancing, while its competing options are enjoying improvements in efficiency and cost. Hydropower investments require long lead times which, in and of themselves, increase investment risk due to the difficulties in forecasting. The environmental and social impacts of large scale hydropower projects are now recognized more widely in Canada. Consequently, large scale hydropower development is increasingly being recognized as a technology of a foregone era.

In Canada, where extensive untapped hydropower sites still exist, electricity development has nonetheless shifted toward cogeneration and combined-cycle gas turbines. This trend away from large scale hydropower is particularly evident in those jurisdictions within Canada where market competition and private electricity investment is most advanced, particularly British Columbia and Alberta.

Rural electrification no longer relies on the development of large scale power grids. Rapid progress in photovoltaic technology, and other micro-generation technologies, is cutting the cost of electricity in locations remote from developed power grids. The government of Laos should be alert to the fact that in some areas, rural electrification is not best achieved through central grid development.

The water resources of Laos represent one of the nation's greatest assets. However, the government should not assume that the only or best method to realize this value is through electricity development. Future or competing uses of Laotian rivers could be lost in order to achieve electricity development, only to discover that hydropower has lost its competitiveness in the regional and local energy markets.

Learning from the Canadian Experience with Public Power

In Canada, where there are a variety of publicly owned and privately owned utilities, the exposure to stranded investment cost as a portion of total invested capital is higher with the publicly owned utilities than with the private. The worst example is the publicly owned utility Ontario Hydro, which has probably one of the largest portfolios of stranded or strandable electricity investments in the world. Maurice Strong, former Secretary-General of the 1992 U.N. Conference on Environment and Development, currently an advisor to the President of the World Bank, and former Chairman of Ontario Hydro from 1993 until 1995 who started the utility's transition toward privatization, described Ontario Hydro as a "corporation in crisis".

A key reason for the exposure of the public to stranded costs in Canada, costs which are, or may be, borne by both ratepayers and taxpayers, has been the application of government loan guarantees for publicly owned utility borrowing. Insulated from the scrutiny of credit markets, the utilities tended to ignore the risk of investments they undertook. Unwittingly, the utilities saddled themselves with risk-laden investments.

Another key reason for the public's high stranded cost exposure was that the provincial governments, as owners and guarantors of utilities as well as their regulators, have operated under conflicting interests. Governments sought to curry favour with the electorate by artificially suppressing electricity prices, a process that thwarted efficiency and undermined the long-term interests of the citizenry. Governments sought to stimulate the economy with megaprojects, which usually were uneconomic. Governments also sought to buoy their own enterprises by conferring on the electricity sector sweeping self-policing powers and rights of expropriation. For a time, these special powers concealed the real costs of the utilities and protected them from competition but, in the end, allowed inefficiency to pervade these organizations.

Another key reason for the high stranded cost exposure was the lack of accountability of public officials. The normal business incentives to pursue success and avoid failure have not applied. Those who made grave investment errors were never effectively responsible for their decisions since none of their own money was at stake. All of these mistakes have crippled many of our publicly owned utilities.

In Canada, public ownership was meant to provide public control. In fact the privately owned utilities, such as TransAlta, have turned out to be much more closely controlled by the public through effective arm's-length regulation, and have generally done a better job of serving the public interest.

Principles of Electricity Development
Laos should pursue three key principles in the development of its electricity sector: maximize economic efficiency, ensure that government acts as a regulator not an investor, and ensure the protection of property rights of both citizens and investors to lower long-term costs.

Economic Efficiency
One key to success of the Laos electricity sector is economic efficiency. According to Maurice Strong, sustainable development depends on economic efficiency.

> "Economic efficiency is what sustainable development is all about. When you have got economic efficiency you reduce your use of materials and energy, you reduce the amount of waste produced in a given operation. So sustainable development, I would submit, as we are trying to practise it at Ontario Hydro, simply means [a] greater degree of efficiency in our economic decision making and management practices."

Economic efficiency requires that social and environmental costs be reflected in decisions and appropriately mitigated or compensated. Development which occurs without imposing uncompensated costs is most likely to be sustainable.

The Laos electricity sector must be both profitable and capable of meeting the growing service needs of electricity consumers. The ongoing worldwide trend toward competition in the electricity sector is a reflection of the need to enhance the efficiency of the electricity sector. Private sector investors should be encouraged to participate in electricity development using their own skills and their own capital. Public capital should not be risked in the electricity sector, as it is in the case of the Theun-Hinboun project.

To maximize efficiency, prices for electricity should be determined as much as possible by the independent actions and choices of producers and consumers. Electricity markets, for both domestic and export markets, are very well suited for open competition. Methods for creating these competitive markets are well developed in the many jurisdictions, both in developed and developing economies. Leading examples include Norway, New Zealand, Australia, U.K. and Argentina.

Some jurisdictions, including some parts of Canada, United States and Thailand have adopted a slow approach to liberalization. Under this approach, utilities competitively procure electricity through contracts with non-utility suppliers. This model of development leaves the utility as a monopsonist, buying electricity on behalf of it customers. Although this method has often proved to be a significant improvement over more vertically integrated utility practices, the benefits are limited by the lack of participation in the decision process by consumers. Direct customer responsibility for electricity purchases has enhanced the efficiency of the electricity sector where it has been tried.

Regulation
Some aspects of the electricity sector must remain regulated. Environmental performance, long-distance transmission service, and local distribution service are examples of aspects of the electricity sector that must be closely scrutinized by independent government regulation. Regulation cannot be effective when it suffers from conflicting or competing interests by various government bureaucracies. Therefore, in the interest of strong regulation, governments should not be an investor in the electricity sector.

Private sector electricity enterprises can be regulated in a number of ways. In Canada, private hydropower development is regulated by government through site licences, specific operating codes, and general environmental protection statutes. Violations of operating codes and environmental laws can be prosecuted in the courts. Private electricity transmission and local distribution enterprises also have their rates regulated. They are subject to renewable franchise agreements, and are required to operate according to specified service arrangements.

Privatization offers additional opportunities for regulation. Asset sales agreements can specify operating constraints and requirements. Specific penalties for failure to meet these conditions can be agreed to in advance with the purchaser.

EdL: From Producer to Regulator
The limited but highly valuable technical and managerial capabilities available to the Laos government, through the staff of EdL and other government agencies, should be applied to the task of regulating private electricity producers and protecting the public interest. If the electricity production and distribution functions of EdL were privatized, investors would become responsible for electricity system operations. Key staff members of EdL, now committed to running the system, could instead be deployed to regulation.

Regulation can be used as an effective measure to ensure that the objectives of the Lao government are achieved. Measures to protect electricity consumers and also riparian, forest and land users can be imposed on electricity providers. Terms of access to the power grid can be specified. Service quality requirements can be established. In return for complying with regulated requirements, regulated companies gain predictability in their business and investment plans, which improves the availability of investment capital.

Property Rights
To minimize long-term costs and to ensure the most rapid possible development of worthwhile projects, the government should take strong steps to protect the property rights of citizens and electricity sector investors.

Citizens should have their rights to their water, land and forest resources protected by law so that electricity developers are obliged to make fair deals for the private resources they consume. If electricity developers are allowed to take land from people without their consent or to damage fisheries without the users' consent, expansion in the electricity sector could reduce the general welfare of Laotians. On the other hand, if investors feel that their capital is exposed to capricious regulation, weak legal methods of enforcing contracts, or even the threat of confiscation, they will be disinclined to invest. Enforcement of strong property rights will ensure that all costs are properly and fairly internalized. Enforcement of strong property rights will also ensure that electricity supplies will be adequate and the costs of providing electricity will not exceed the benefits to individual Laotians, their communities, and the nation as a whole.

Nautilus Institute
608 San Miguel Ave., Berkeley, CA 94707-1535 | Phone: (510) 423-0372 | Email: nautilus@nautilus.org