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The Potential of Regional Power Sector Integration

Nam Theun 2 | Generation Case Study

**Submitted to ESMAP by:
Economic Consulting Associates**

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Abbreviations and acronyms

ADB	Asian Development Bank
BOOT	Build, Own, Operate, Transfer
CA	Concession Agreement between GoL and NTPC
EdL	Electricité du Laos
EdFI	Electricité de France International (EdFI)
EGAT	Electricity Generating Authority of Thailand
EGCO	Thai electricity company
EGPC	Electricity Generation Public Company (Laos)
EPC	Engineering, Procurement and Construction contract
ERC	Energy Regulatory Commission (Thailand)
GLIP	Government Letter of Implementation Policy
GMS	Greater Mekong Subregion
GoL	Government of Laos
IFC	International Finance Corporation
IAG	International Advisory Group
IGA	Inter-Government Agreement
IPP	Independent Power Producer
LHSE	Laos Holding State Enterprise
MEA	Metropolitan Electricity Authority (Thailand)
MIGA	Multilateral Investment Guarantee Agency
MOU	Memorandum of Understanding
MRC	Mekong River Commission
NBCA	Nakai Basin Catchment Area
NNT NPA	Nakai Nam Theun 2 National Protection Area
NPA	National Protection Area

NT1	The Nam Theun 1 project
NT2	The Nam Theun 2 project
NTPC	Nam Theun 2 Power Company
PDA	Project Development Agreement
PEA	Provincial Electricity Authority (Thailand)
PFMSP	Financial Management Strengthening Programme
POE	Panel of Experts
PROPARCO	French private investment agency
WBG	World Bank Group
WCD	World Commission on Dams
WMPA	Watershed Management & Protection Authority (Laos)
WUP	Water Utilisation Programme

Preface

This case study is part of an Energy Sector Management Assistance Program (ESMAP) project on Regional Power System Integration (RPSI). The objective of the project is to facilitate and accelerate RPSI projects in developing countries around the world. The project will draw on international experience and theoretical analysis in this area to provide a framework to assess:

- o the economic, financial and environmental benefits that can accrue to regional power trading;
- o the institutional and regulatory arrangements needed to sustain and optimize regional projects; and
- o the ways in which obstacles to integration have been successfully overcome.

The final output of the project will be an umbrella report, *Regional Power Sector Integration – Lessons from Global Case Studies and a Literature Review*. This review will summarize the 12 case studies and literature review undertaken and analyze common themes on barriers to RPSI and solutions to overcome them.

Economic Consulting Associates was contracted to execute the project. In doing so, we are working closely with ESMAP and World Bank staff, as well as government officials, utility, power pool, and regional economic community personnel, and others directly involved in implementing regional power schemes.

This and other 11 Case Studies are prepared as clear, factual presentations of the selected projects. The intent is to provide a direct, easily digestible description of each of the selected projects without imposing an analytic framework or making judgments about the degree of success. Such analysis will be undertaken at the global level, considering the entirety of experiences from the Case Studies, in the aforementioned umbrella report.

All 12 Case Studies follow a uniform structure to facilitate ease of comparison and reference from one Study to the next. Some sections are longer than others, depending on the specifics of the Study. Additionally, there is some cross-referencing within each Study.

1 Executive summary

1.1 Background and motivations for trade

Laos is a low-income Southeast Asian country situated between Vietnam to its east and Thailand to its west. Laos is estimated to have total hydropower development potential of 18,000 MW. The Nam Theun 2 project (NT2) is developing part of this hydroelectric potential for export to Thailand.

Thailand is expecting its electricity energy and peak supply requirements to more than double from current levels by 2020. Demand is expected to grow at 5–6% annually over the period. The country is highly dependent on natural gas to fuel its existing fleet of generators but is facing decline in its domestic gas reserves. Furthermore, there are environmental and planning constraints on the installation of new domestic coal and hydro capacity. Against this background Thailand is seeking to diversify its energy supply options in pursuit of its goals of supply security and environmental sustainability.

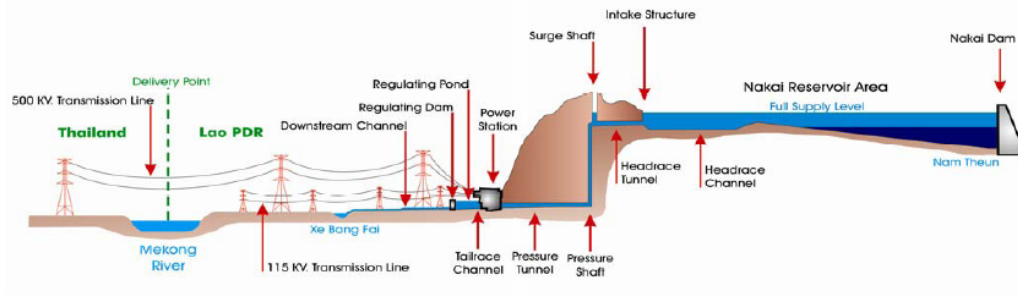
While Laos is also facing rapidly growing electricity demand, it is from a vastly lower base. Also, in contrast to its larger and more developed neighbor, Laos has a very large surplus of potential energy in the form of unexploited hydropower resources. The Lao economy is at an early stage of development and depends on exports of minerals and other natural resources for foreign exchange income. Exports of electricity generated from hydro projects are seen as a significant opportunity for Laos to rapidly increase its export revenues in support of poverty alleviation and economic development programs. The major international development institutions (in particular the World Bank Group and the Asian Development Bank) are supporting Laos in pursuing this opportunity.

Accordingly, since the 1990s Laos has embarked on an ambitious hydropower development and export program. Laos has signed a series of intergovernmental memoranda of understanding with Thailand which serve to underpin the development of trade between the two countries. To date, Nam Theun 2 is the largest project developed under these agreements. Laos is also pursuing electricity trade with Vietnam, its other large neighbor, and is supportive of broader trade initiatives within the region.

1.2 The trade solution

Nam Theun 2 (NT2) is an enclave project in which output from a new build generation facility is almost entirely devoted to export via a dedicated transmission line. NT2 involves the construction of a 1,070 MW hydroelectric storage project with the capacity to deliver an annual average of 5,636 GWh of electricity to Thailand over a new 138 km double circuit 500 kV transmission line. A 115 kV line will also be built to supply a small portion of production to customers in Laos. The technical design of the project is shown schematically in Figure 1.

Figure 1 NT2 Project Schematic



Source: NTPC

The major partners in the trade project are: the single Thai customer (EGAT); a special-purpose entity created to build, own and operate the facility and its public and private-sector shareholders (NTPC); the Government of Laos; the state-owned Lao utility; international aid and development institutions; and international commercial banks. Design and construction is contracted to international and local public and private providers.

The project is financed by a mix of equity and debt (Table 1), with the debt equally split between two syndicates of commercial banks, one in Thailand and one abroad. The participation of these and other private-sector partners is supported by a package of risk mitigation measures provided by the international institutions.

The power purchase agreement (PPA) between the buyer (EGAT) and the seller (the project company) is the main document governing the commercial aspects of the trade. Most of the contracted output is on a take-or-pay basis at prices agreed in advance according to a formula in the PPA.

The Concession Agreement between the Government of Laos and the project company defines the critical governing arrangements and responsibilities for the design, build and operation of the project.

Table 1 Summary of NT2 Financing Structure (US\$ millions)

	Equity	Debt	Total
Project company shareholders	350		
US dollar debt		450	
Thai baht debt		450	
Total base financing	350	900	1,250
% split	28%	72%	
Contingency	100	100	200
Total financing	450	1,000	1,450

Source: ADB/WB project update, March 2006

The projected financial benefits from trade for Laos come at the price of potentially significant environmental and social impacts from large-scale hydro developments. Accordingly, a particularly important aspect of the NT2 project has been a careful focus on mitigating these impacts. The Concession Agreement includes a number of sections governing these issues.

The development and implementation of the environmental and social safeguards are shared between the project company and the government. These include resettlement and livelihood protection plans for people in the affected area, and the management of conservation areas, including the reservoir catchment. Various institutional arrangements have been put in place to support these roles. The international financial institutions, led by the World Bank and the Asian Development Bank, have played a critical role in setting the safeguard standards, supporting their development and implementation, and monitoring progress.

Another defining feature of the project has been building revenue management capacity within the Government of Laos. Under the commitments required by the supporting IFIs, NT2 is both explicitly an electricity trade project and part of the Government of Laos' broader economic development plan. The revenue management support is intended to help ensure that the revenues from the project are put to their intended use. However, the program has been criticized for impinging on the sovereignty of Laos and for being disproportionate given the actual timing of the revenue stream expected from NT2.

1.3 Progress against targets

The NT2 reservoir impoundment has begun and the station is expected to be commissioned by the end of 2009. The project is currently running close to schedule and the expected cost overrun is within the bounds of the planned contingency finance.

2 Context for trade

2.1 Economic and political context

Thailand is considered a lower-middle income country whereas Laos PDR (hereafter Laos¹) is in the low-income group (World Bank classification). Thailand is physically and economically larger and more populous than Laos and leads Laos on all economic development indicators. Correspondingly, Thailand's electricity demand and nominal capacity growth requirements overwhelmingly dominate those of Laos. Table 2 provides a comparison of the key economic statistics for the two countries.

Table 2 Leading Indicators for Lao and Thailand (2007)

	Laos	Thailand
Population (millions)	5.8	63.8
Land area (km ²)	236,800	513,120
GDP (US\$ billions)	4.0	245.8
GNI per capita (PPP)	1,940	7,880
Electricity demand (TWh)	1.3	146.9
GDP growth %	7.1	4.8
Electricity consumption growth forecast % (2006-10)	9	5.4
Inflation	4.1	3.4
Exports (% of GDP) ^a	36	73
Life expectancy at birth (years) ^a	63.8	70.2
Mortality rate under 5 years (per 1,000) ^a	74.6	7.75

Source: *World Development Indicators (World Bank), IEA.*

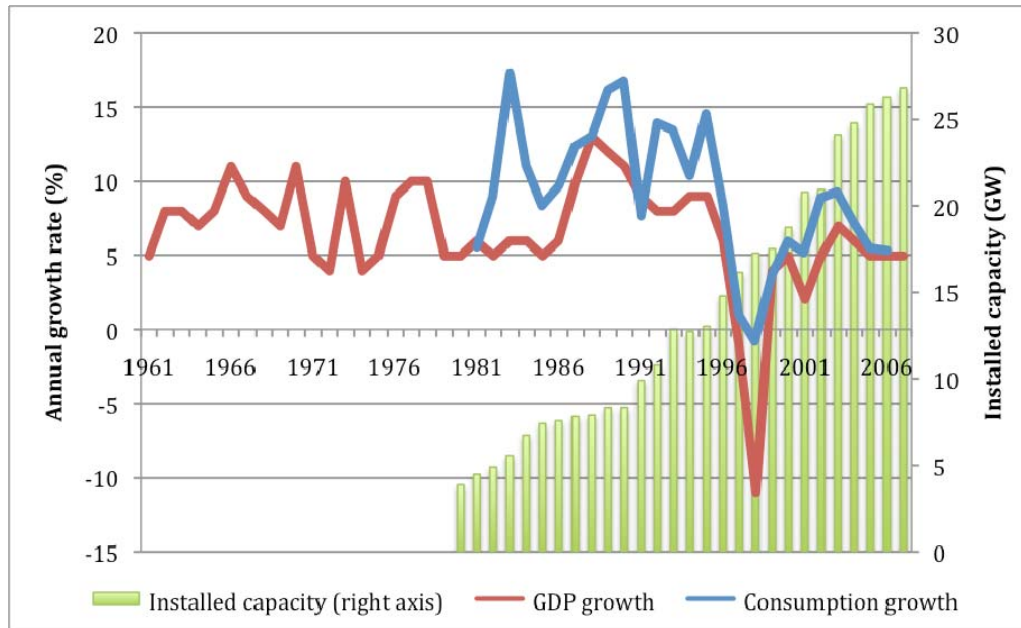
^a2006 data

During the decade to 1997 Thailand's rate of economic growth accelerated to among the highest in the world, averaging 9.5% per annum. This followed strong economic growth since at least the 1960s. The Asian financial crisis threw Thailand's growth into reverse in 1997 and 1998, but growth recovered in 1999, albeit at a lower average rate of slightly under

¹ Throughout the text we use the naming convention of Laos as referring to the country and Lao as referring to the people, language and things of and relating to Laos. We use the Lao word Nam to refer to river, without adding the English word.

5% until 2007. Electricity consumption has been growing at a correspondingly high rate (Figure 2).

Figure 2 Thailand Installed Capacity and Growth of GDP and Electricity Use



Source: World Development Indicators (World Bank), EIA; electricity data available for period 1980-2006

2.1.1 The electricity sector in Laos' national development

The Lao economy is highly dependent for foreign exchange earnings on the extractive and natural resource industries. The Lao electricity sector is the country's third-biggest export earner after copper and gold.

Although Lao domestic electricity demand is growing, it is from a low base, and the country's production potential from hydropower will remain in excess of its own requirements. The combination of regional demand growth with Laos' supply potential and central location suggest that expanded electricity exports can be a driver for Laos' GDP growth and development.

As such, the Government of Laos (GoL) recognizes the electricity sector as an important means of increasing quality of life and development opportunities for Laos. Electricity has been designated as a prime sector in Laos' long-term National Development Plan. Opportunities for the sector to contribute to the country's economic development operate through two channels:

- o directly through the provision of a modern energy sector, and
- o indirectly as an important foreign exchange source that can fund poverty reduction programs and development policies.

The GoL's objectives for the electricity sector include:²

- o Generate export revenues for use in poverty alleviation.
- o Electrify rural communities to support their social and economic development (greater than 90% electrification target by 2020).
- o Explore and benefit from cross-border electricity trade in the region.
- o Integrate the power sector with regional communities.
- o Meet obligations in power export agreements with neighboring countries.

There is currently 2,311 MW of new hydro capacity in eight new plants under construction in Laos:³

- o Three plants totalling 220 MW would be dedicated to serving the Lao market.
- o One plant would sell all its output to Thailand (615 MW Nam Ngum 2).
- o The remainder would be split between Lao / Thailand (3 plants) or Lao / Vietnam (1 plant).

All but one of these projects was a public-private partnership, and in most of them the Government of Laos (through Electricité du Laos, EdL) had only a minority stake.

A further 7,200 MW of capacity is in the planning phase following the signing of Project Development Agreements (PDA). Pre-feasibility studies are also underway for more than 40 other projects.

The scale and structure of in-progress and planned electricity projects illustrate the position of the Lao political leadership in favor of developing the sector for export and its openness to both foreign capital and a large private-sector involvement. These features reflect the government's strategy of export-led growth, and recognize the realities of the country's fiscal position and constraints on domestically sourced capital funding and expertise in

² Ministry of Energy and Mines

³ Powering Progress,

http://www.poweringprogress.org//download//Electric_Power_Plants_in_Laos_as_of_January_2009.pdf

project planning and implementation. GoL favors the development of increased electricity trade in the region.

2.1.2 Political environment and attitude toward imports in Thailand

Thailand is heavily reliant on imported energy. Its national energy policy goals include achieving supply diversity, and in particular reducing its dependence on natural gas imports, which would otherwise increase in the context of declining indigenous gas reserves. Thailand also has environmental protection regulations that limit its options in developing new domestically based hydro and coal-fired power generation.

Each of these factors argues in favour of Thailand contracting with its energy-endowed neighbors for new electricity supply sources.⁴ However, this is mitigated by a preference among some groups in Thailand for self-reliance in energy production, which is seen as enhancing national security of supply.

Thailand's willingness to enter long-term contracts for electricity from Laos is influenced by several factors, including favorable cost, Lao government guarantees, a history of reliable supply, and the involvement of IFIs and private-sector parties. Economically, it is not in Laos' interests to interrupt supply of lucrative exports. Additionally, Thailand is significantly stronger than Laos both economically and politically, suggesting that reliance on Laos presents a diminished strategic threat.

Notwithstanding these mitigating factors, Thailand's current and planned exposure to Lao imports remains relatively small. Existing imports from Laos are barely 1% of Thailand's overall capacity. Even at the full level envisaged in the Thai-Lao MOU, Thailand would not be relying on Laos for more than 10% of its capacity availability.

2.1.3 Policy, legislative and regulatory framework for electricity

Laos

The Lao electricity sector is overseen by the Ministry of Energy and Mines (MEM), within the Prime Minister's Office. MEM's responsibilities include planning, regulation, and environmental and social management. It is also the line ministry for Electricité du Laos (EdL).

EdL is the state-owned utility that owns and operates the transmission and distribution networks and is the government's implementing agency for new-build power projects. Historically EdL also dominated generation asset ownership, but this position has been eroded by increasing outside participation in the hydro development program.

The Law on Electricity was promulgated in 1997. This, with other legislation such as the Law on the Promotion of Foreign Investment (2004), establishes an environment for investment in electricity projects by the state or private investors under concessions granted by GoL. The GoL's policy is to encourage investment in the sector.

⁴ In addition to the hydro resources in Laos, Myanmar is recognized as having large hydro potential and has natural gas reserves. Cambodia is also believed to have considerable gas reserves.

The Law on Electricity requires concession applicants to carry out a number of studies, including feasibility studies (covering technical, social and economic aspects) and environmental impact assessments. The law also covers technical standards and government approval of electricity prices.

The Law on the Promotion of Foreign Investment allows private investors to take a majority share (over the state) of up to 100% in power projects and grants rights to repatriate profits. Laos' electricity sector policy also grants investors recourse to international arbitration. The Department of Domestic and Foreign Investment, also under the Prime Minister's Office, acts as a one-stop shop for foreign and domestic investors in Laos.

The government's shareholdings in new IPPs is through either EdL or a holding company (LHSE) operated by the Ministry of Finance.

Thailand

Energy sector policy in Thailand is developed and overseen by the Energy Policy and Planning Office (EPPO) under the Ministry of Energy. EPPO was created in October 2002, replacing the National Energy Policy Office.

The electricity sector is governed by the Energy Industry Act 2007. The act established the Energy Regulatory Commission (ERC), which oversees the regulation of the sector. ERC has assumed responsibility for setting end-user tariffs.

The Thai generation sector is dominated by the Electricity Generating Authority of Thailand (EGAT). Plans to partly privatize it met with controversy and resistance and have been put on hold. The company remains a state-owned enterprise. The retention of a large share of national generation capacity in EGAT is seen as necessary for the long-term stability and security of supply.⁵ EGAT was corporatized in June 2005.

Plans to introduce a competitive power pool in 2000 were abandoned. EGAT remains the dominant provider of wholesale electricity and is designated as the single buyer for output from private producers through long-term PPAs with IPP investors. Since 1992, Thailand has progressively sought to attract private investment in generators selling their output to EGAT. More recently the policy environment has shifted to include encouragement of small power producers (SPPs), with a focus on renewable sources and cogeneration.

The distribution and retail activities are shared between two state-owned utilities: one serving metropolitan Bangkok and two neighboring districts (Metropolitan Electricity Authority, MEA) and one serving the remainder of the country, including isolated rural areas (Provincial Electricity Authority, PEA). These distributors are supplied by EGAT. The quantity of energy supplied by PEA is around twice that of MEA (see Figure 12 in annex A3).

⁵ Thailand's Energy Policy, October 2008 <http://www.eppo.go.th/doc/policy-wannarat-E.html>

2.2 Supply options

Laos supply situation

The Mekong River flows through the length of Laos, forming its border with Myanmar and much of its border with Thailand. Laos is a mountainous country with relatively high rainfall coming in two monsoons (eastern from the Gulf of Tonkin and southwestern from the Gulf of Thailand). The combination of mountainous terrain and high rainfall provides Laos with several large tributaries of the Mekong.

Excluding the mainstream Mekong, Laos is estimated to have 18,000 MW of exploitable hydropower potential. Figure 3 shows the path of the Mekong through Laos and the location of several large existing and under-construction hydro plants.

Figure 3 Location of Laos Hydro Projects



Source: Lao National Committee for Energy

As of January 2009 there was 667.5 MW of installed hydropower capacity in operation (a list is provided in Table 9, Annex A22). Installation of new capacity has accelerated since the 1990s with the implementation of an expanded investment program. In addition, there is a small diesel capacity (around 10–15 MW) and some small-scale off-grid generation.

The Lao electricity network is split into separated grids. Some energy is wheeled through the Thai grid in order to transfer it within Laos. The 2004 Master Plan envisages the sequenced interconnection of the isolated grids to form a unified national network.

EdL has power purchase agreements with EGAT and PEA in Thailand, Electricity of Vietnam, and Chinese producers. Since the beginning of exports to Thailand from the Nam Ngum 1 plant in 1971, Laos has historically been a net exporter of electricity. This trend reversed in 2007 as the result of increased domestic demand and static domestic capacity during a below-average rainfall year.

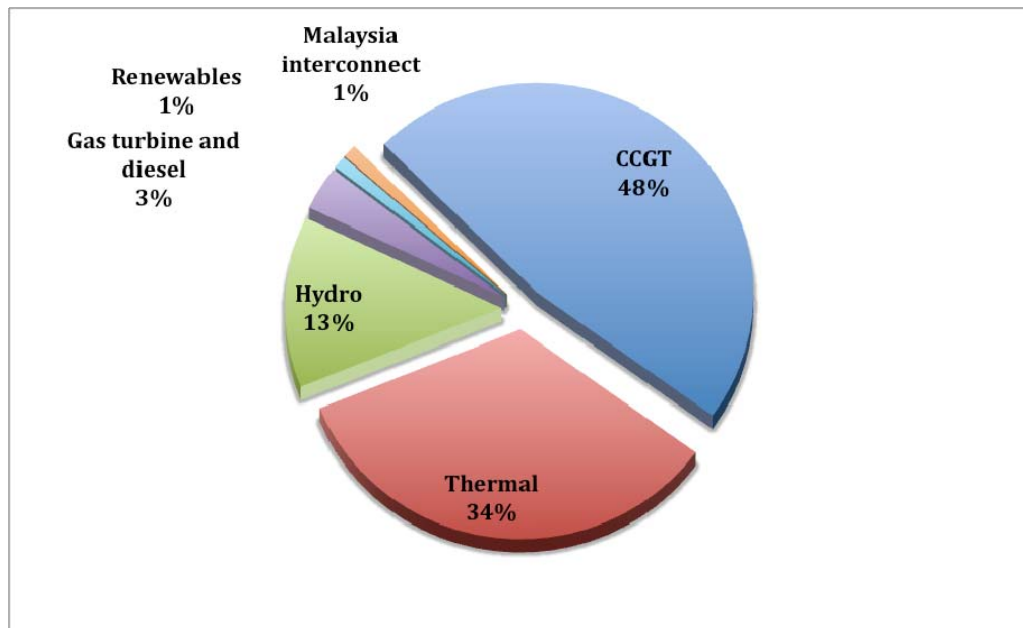
Thai supply situation

Installed capacity in Thailand in 2007 was 28.5 GW, of which EGAT accounted for 55.4% with 15.8 GW installed (see Table 6, Annex A2). The remaining 45% was split between private independent power producers (10 GW, 35% of the total), small power producers (2 GW, 7.3% of the total) and imports from Laos and Malaysia (640 MW, 2.3% of the total).

At the 2007 demand peak Thailand had a reserve margin of 20.4%. This was down from 25% in 2006, partly as a result of a higher peak load due to particularly high summer temperatures.

Thailand's fuel mix is dominated by thermal capacity, which makes up over 80% of the total (Figure 4). Natural gas is the primary fuel, and almost 50% of the country's installed capacity is in CCGT plants. Table 7 (Annex A2) shows the fuel mix with actual generation shares for the first seven months of 2007.

Figure 4 Thailand Installed Capacity by Fuel



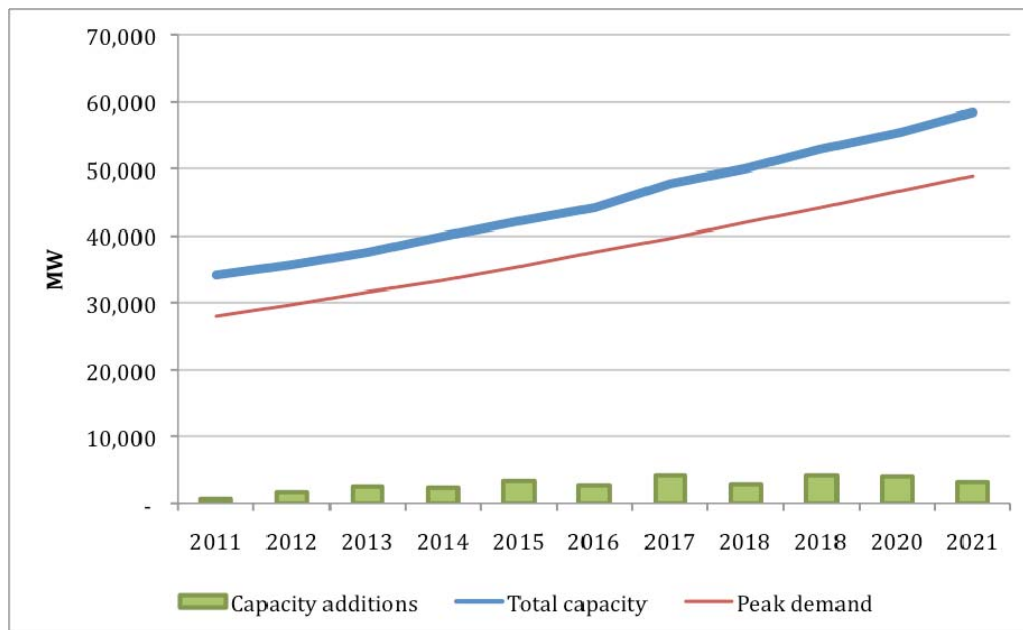
Source: EGAT

EGAT's Power Development Plan for the period 2007–2021 (PDP 2007) includes the following capacity forecasts:

- o Average annual additions to available capacity close to 2.5 GW over the period 2011–2015, rising to 3.5 GW on average per year for the period 2016–2021.
- o Total available capacity (domestic installed plus imports) growing to 42 GW by 2015, and to 58 GW by 2021. Reserve margin maintained at around 16% (minimum reserve is specified at 15%).

The base-case PDP forecast is illustrated in Figure 5 (see Annex A2 for underlying data table).

Figure 5 Thailand Capacity and Peak Demand Forecast, 2011–2021



Source: Energy Policy and Planning Office, Thailand.

A major focus of Thai energy policy planning relates to fuel supply to the country's large fleet of gas-fired generators. Thailand's indigenous natural gas reserves are in decline. At the end of 2007 the country had 330 billion cubic meters of reserves and a reserves-to-production ratio of 12.7,⁶ implying exhaustion by 2020 at prevailing rates of production.⁷ New supplies are expected to come through imports from neighbors and LNG.

PDP 2007 foresees an increase in the importance of imported energy in the overall generation mix. Also included are plans for EGAT to build four 1,000 MW nuclear power plants, with the stated aim of diversifying the country's energy supplies and reducing greenhouse gas emissions.

⁶ BP Statistical Review of World Energy, 2008

⁷ In practice, the production path to exhaustion is likely to be more gradual to allow optimal field management and for replacements to become operational.

Highlights of the evolution of the generation mix in the PDP (recommended plan) include:

- o Gas is expected to peak at 75% of generation in 2012 and 2013.
- o Gas then declines in the mix to 70% in 2015 but is still 65% by 2021.
- o The decline is met by imported energy, which is forecast to reach 8% in 2013 and 9% in 2020, including imported coal and nuclear.
- o Nuclear is planned for introduction in 2020, quickly reaching 9% of the total by the following year. Imported coal is 12% in 2015 and gradually declines to 10% by 2021.

EGAT's PPA for NT2 anticipates that by 2010 supply from NT2 will represent 3% of the Thai electricity system total annual energy demand.

The PDP includes two new 500 kV transmission lines to receive energy imported from the Nam Ngum 2 (615 MW), Nam Ngum 3 (440 MW) and Nam Theun 1 (523 MW) plants in Laos.⁸ Commissioning of the lines is planned for 2010 (Nam Ngum 2) and 2012.

2.3 Demand

Laos

Lao electricity consumption in 2007 was 1.34 TWh against generation of 1.64 TWh.⁹ Total energy demand is growing at 8–10% per annum. Wood fuel remains the primary energy source, supplying around 90% of total energy consumption. At the beginning of 2008 around 60% of households had access to electricity supply. Around half of all electricity is consumed in the capital city, Vientiane.

The 2004 Power System Development Plan for Laos forecasts domestic electricity consumption to grow to 2.69 TWh by 2015 and 4.66 TWh by 2020. This is an increase of 5–6% annually over the 2010–2020 period (see Table 12, Annex A3).

Thailand

Thailand's total electricity demand for 2007 was 146.9 TWh, an increase of 3.4% over the previous year. The demand growth rate had slowed from previous years with slowing economic activity.

The industrial sector accounts for the largest portion of demand (44% of total in 2006), followed by the commercial (25%) and residential (21%) sectors (Figure 6). The country's electricity demand typically peaks with air-conditioning load in April. Peak demand in 2007 was 22.5 GW.

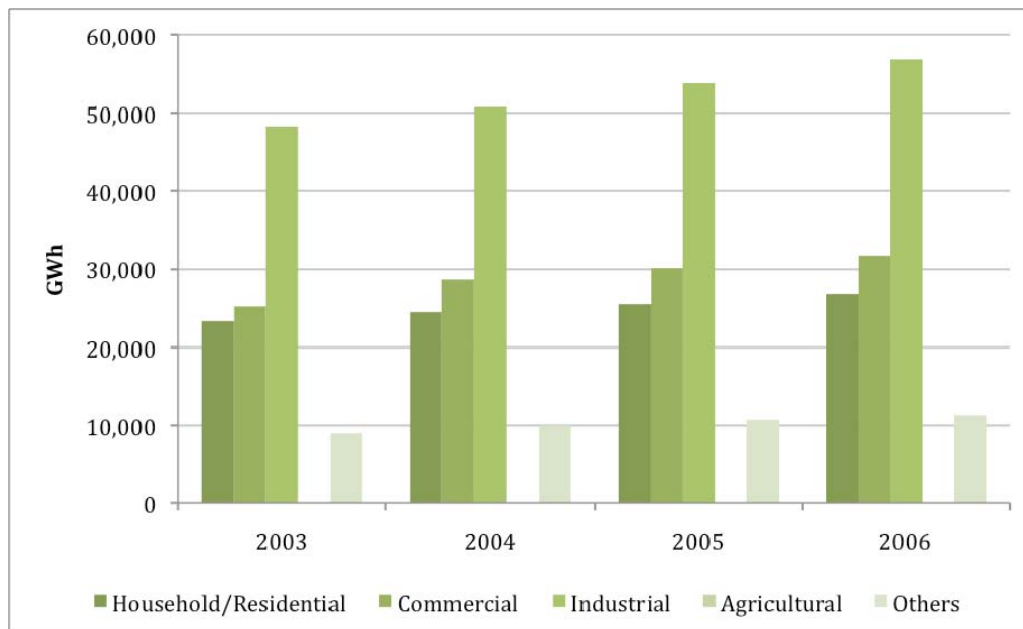
⁸ NT1 is a separate project from NT2 located on the Nam Kading river. NT1 is also an export project with EGAT as the customer.

⁹ Energy Information Administration

The northeast region, which can be served by imports from Laos, has been facing supply shortages.

The 2007 PDP forecasts electricity demand growth of approximately 5.5% per year to 2010, rising to 6% in the period to 2015, and falling back to 5.5% by 2021 (see Table 11 in Annex A3). These growth rates were revised slightly downward from the 2004 PDP. The World Bank's economic analysis of the NT2 project used an earlier estimate of 6.17% demand growth per year for 2003–2016.

Figure 6 Thai Electricity Demand by Sector, 2003–2006



Source: Energy Policy and Planning Office, Thailand

2.4 Tariffs

Laos

The Law on Electricity notes a distinction between different tariff customer categories in Laos. Commercial and agricultural users and isolated rural users are specifically mentioned in the law.

The EdL tariff schedule (see Table 13, Annex A3) shows that low-consumption residential users (0–25 kWh and 26–150 kWh) and irrigation (agricultural users) are charged the lowest electricity tariffs.¹⁰ These tariffs are most likely below cost and are cross-subsidized by the much higher tariffs charged to high-use residential customers, industry, commercial and other users.

¹⁰ EdL Annual Report 2007

Thailand

All electricity is generated or purchased by the single buyer, EGAT, except for a few small distribution-connected generators. Wholesale tariffs are set at intervals based on an analysis of long-run marginal costs rescaled according to a financial revenue requirements analysis to arrive at base tariffs.

Between reviews, transmission and distribution costs are adjusted according to a CPI-X formula. An adjustment factor, the F_t , is applied every four months to reflect EGAT's changing power purchase and generation costs, including those due to changing fuel prices and exchange rates. The setting of the F_t is not transparent, and it is frequently used as a means of achieving other objectives (e.g., during 2008 the F_t adjustment did not match the full increase in power purchase costs resulting from higher fuel prices, with the F_t during 2009 being held above cost-reflective levels to compensate). Until recently, tariff setting was the responsibility of the National Energy Policy Council on a proposal by the Energy Planning and Policy Office. The new regulator, ERC, has assumed responsibility for tariff setting and is currently preparing for its first review of tariffs.

At the retail level a uniform tariff policy is in place. A subsidy system is used to balance allowed costs against the tariff revenues. Transfers are made from the revenue surplus MEA (and EGAT if necessary) to the revenue deficit PEA. Thus, the tariff policy results in cross-subsidization of users in rural areas by industrial and commercial users in the primary city.

3 History of the scheme

3.1 Overview

The NT2 project has undergone a long period of evolution and development. Given the size of the project in the context of the Lao domestic electricity sector, a full-scale NT2 was always envisaged as an export project. The Thai wholesale electricity supplier, EGAT, was naturally a key player in the project's origination. Table 3 gives a chronology of events.

Thailand entered the 1990s as a large and fast-growing energy demand center for the region. The rapid economic growth rates were reflected in forecasts of future electricity demand made at the time. Consequently, Thailand began to formally establish relationships with its neighbors to develop the potential for electricity imports. The first intergovernmental agreement for imports from Laos was signed in 1993.

The potential of the Nakai Basin for hydro development was recognized in the 1970s. A pre-feasibility study for a major hydro development, considering the NT2, Nam Ngum 2, and Nam Ngum 3 project options was carried out in 1987. This established NT2 as a potential development driver for Laos. Serious consideration of its development did not begin until the early 1990s as EGAT emerged as a serious buyer.

Feasibility studies were done in 1989 and 1992 and further economic, social and environmental studies were carried out over the following decade. A Study of Alternatives was completed in 1998, in the wake of the Asian financial crisis. Updates in 2000 and 2004 supported NT2 and reaffirmed the Thai market as a viable destination.

The Nam Theun 2 Electricity Consortium (NTEC), which was formed by a group of developers, signed an agreement with GoL in 1993 to develop the project. In 1994, GoL asked the World Bank to become involved in the project, and in 1995 NTEC approached the World Bank with a request for assistance with risk mitigation. This was considered essential to the bankability of the project. When Electricité de France International joined the consortium, NTEC was renamed NTPC, which then took over the project development.

The Concession Agreement was signed in 2002, and PPAs with EGAT and EdL were agreed in 2003 conditional on project completion. Finalization of the financing agreements was reached in June 2005 following approval of financing and risk mitigation support by the World Bank and Asian Development Bank.

Construction and safeguard implementation began in May 2005, soon after financial closure. Preliminary site preparation work had been ongoing since the middle of 2004. Resettlement of all the villages out of the flood-affected area was completed in early 2008 and, following this, the reservoir impoundment began in April.

Table 3 Chronology of Developments in the NT2 Project

Year	Event
1970s	Hydropower potential of Nakai Basin recognized
1987	Pre-feasibility study carried out
1992	Feasibility study conducted
1993	Thai and Lao governments sign MOU on hydropower development for export of 1,500 MW to Thailand
1995	NTEC approaches World Bank for assistance with project risk mitigation
1996	Thai-Lao MOU updated with target increased to 3,000 MW
1997	Asian financial crisis impacts heavily on the Thai economy, delaying NT2 development POE and IAG established to advise the GoL and World Bank on environmental and social safeguards
1998	Study of Alternatives completed
2000	Laos Hydropower Development Strategy Study
2002	NTPC incorporated in Laos Concession Agreement signed with NTPC
2003	PPAs signed with EGAT and EdL First village resettlement carried out as a pilot
2004	Environmental and social safeguards documents finalized Laos PDR Power Sector Development Strategy completed
2005	World Bank Group (WBG) Board approves grants and risk guarantees to NT2 Asian Development Bank Board approves a loan to the Government of Laos to finance NT2 and signs a related project agreement with NTPC GoL agrees to the Government Letter of Implementation Policy (GLIP) with ADB and WBG specifying social, environmental and revenue management commitments. Construction begins Financial closure achieved
2006	Full resettlement of villages in the reservoir-affected area begins
2007	Latest update to the Thai-Lao MOU sets a target of 7,000 MW of exports to Thailand by 2015
2008	Resettlement of all villages in the affected area completed Impoundment of the NT2 reservoir begins
2009	December target date for commissioning

As of July 2008, the project civil works were 93% complete and progress overall was assessed as 87% complete. Construction was expected to be completed in time for the December 2009 commercial operations date. Cost overruns were expected to be small and within the contingency finance planned for the project.¹¹

3.2 Project concept and objectives

The project has been explicitly framed as a development opportunity for Laos. The support of major IFIs, in particular the World Bank and the Asian Development Bank (ADB), that enabled the private-sector financing for the project was conditional on developmental, environmental and social safeguards (see section 3.6). Among the IFI roles in the project are capacity support and monitoring of these safeguards.

One of the key IFI conditions is the revenue management capacity building program. At the request of the funding IFIs the Government of Laos is implementing the Public Financial Management Strengthening Program (PFMSP). This includes reforms of GoL revenue systems and spending operations.

Within the PFMSP the GoL has committed to revenue management arrangements designed to enhance the transparency and accountability of the use of funds flowing from NT2. The NT2 revenue management plan is designed to ensure NT2 revenues are directed to specified developmental and environmental programs, including education, health and rural roads projects. This will be monitored by the World Bank and ADB (see section 4.4 for further detail of PFMSP).

For Thailand, electricity imports from Laos enable the Thai electricity sector to diversify its supply sources while avoiding the planning restrictions on new domestic projects:

- o Although there are potential hydroelectric development sites within Thailand, domestic objections to new large hydro projects on environmental and social grounds create barriers to their development.
- o While the country has coal reserves and can import coal for electricity production there are also planning restrictions, primarily on environmental grounds, on new-build coal-fired generation.
- o Finally, Thailand's domestic natural gas reserves are limited and in decline, and although there are alternative natural gas supply options in the region there are associated security of supply issues, particularly given its already high dependence on this fuel. Nearly half of Thailand's installed generating capacity is fuelled by natural gas.

Thailand is also in a strong position to negotiate a favorable price for purchases from Laos.

NT2 is part of the long-term power development plans for both Laos and Thailand.

¹¹ Annual NT2 Update report to the World Bank and ADB, July 2008.

The project was developed within the framework of intergovernmental agreements to develop trade. The design, construction and associated safeguard implementation have been managed by the project company, NTPC, and its subcontractors. International development institutions have also played an important role in assisting the preparation and implementation.

3.3 Feasibility studies

A pre-feasibility study was conducted in 1987 with the World Bank as executing agency for UNDP funding.

The feasibility stage, which extended over several years, saw technical, economic, financial, social, and environmental studies carried out. Feasibility studies were carried out in 1989 and with World Bank funding in 1992.

Following this, economic and technical viability studies and environmental and social impact assessments were conducted over the course of more than a decade. The project generated extensive public debate, which extended the study period.

A Study of Alternatives was completed for GoL in 1998. This was updated in the 2000 Hydropower Development Strategy Study and in the 2004 Power Sector Development Strategy. These found NT2 to be the most attractive option from among 19 potential export projects considered.¹² The analyses of alternatives adjudged the Thai market big enough to accommodate supply from NT2 under a moderate growth scenario.

Economic appraisal

An economic impact study was carried out in 1997. A World Bank benefit-cost analysis found that at capacity utilization rates above 30%, NT2 was the least-cost investment option for Thailand (the plant is expected to operate with a capacity utilization of around 60%).¹³ The analysis also found NT2 to be least-cost for Laos. However, the economic studies of the project have attracted criticism from observers outside of the World Bank.

Environmental and social impact reports

The first set of environmental and social safeguards reports was prepared in 1997. A population and assets census and a sample socioeconomic survey were carried out by GoL with NTPC assistance in 1998. The population survey was updated in 2003. The Concession Agreement requires NTPC to repeat these studies for the resettlement area prior to resettlement.

The 1998 Study of Alternatives also considered several possible NT2 configuration options based on various alternatives for reservoir size and downstream flow patterns on the Xe Bang Fai. A 2005 Riparian Release Study considered options for flow patterns on the Nam Theun.

¹² The 2004 PSDP ranked NT2 first among shortlisted projects on an adjusted weighted generation cost basis.

¹³ Project Economic Analysis, March 14 2005

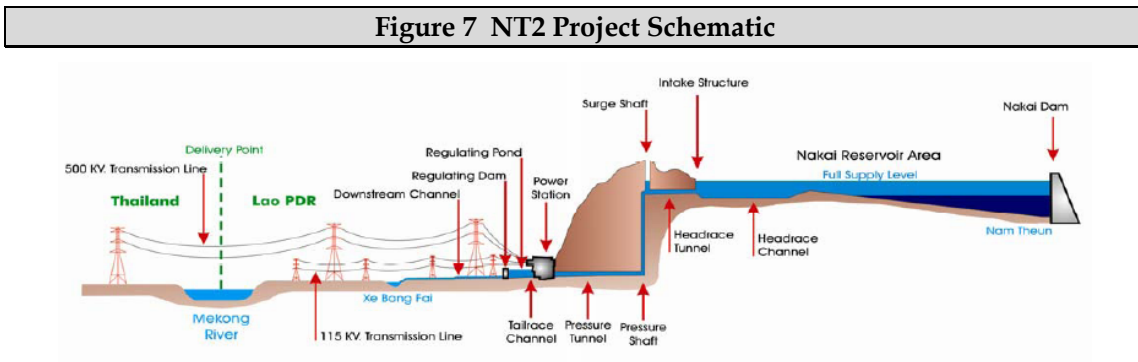
3.4 Assets built or planned resulting from the scheme itself

The project involves:

- o construction of a 1,070 MW hydroelectric storage project with the capacity to provide an annual average of 5,636 GWh of electricity to Thailand and around 300 GWh to Laos.
- o construction of a 138 km double circuit 500 kV transmission line to deliver the energy to the Thai border, and a 28 km 115 kV line to deliver to the Lao grid. EGAT is responsible for the connecting transmission in Thailand.

The construction phase began in June 2005, and the facility is planned to be in operation in late 2009.

The project will capture water from the Nam Theun river (a tributary of the Mekong) at a site in central Laos and flood the Nakai Plateau to create the 450 km² storage lake. The reservoir will cover 40% of the Plateau's area. The water will be released down a 350 m natural drop to the powerhouse, and from there diverted through a 27 km channel to another Mekong tributary, the Xe Bang Fai river. The technical design of the project is shown schematically in Figure 7.



Source: NTPC

The Lao and Thai systems are not synchronized. As a result, an important part of the technical design has been the segregation of the turbines (penstocks) and switchyards for the parts of the plant that will serve Laos and Thailand, respectively.

3.5 Interconnections and electricity trade

3.5.1 Laos–Thailand trade

Laos borders Thailand's Northern and Northeastern transmission regions.¹⁴ All existing imports from Laos enter the Northeastern Thai grid with which there are five existing

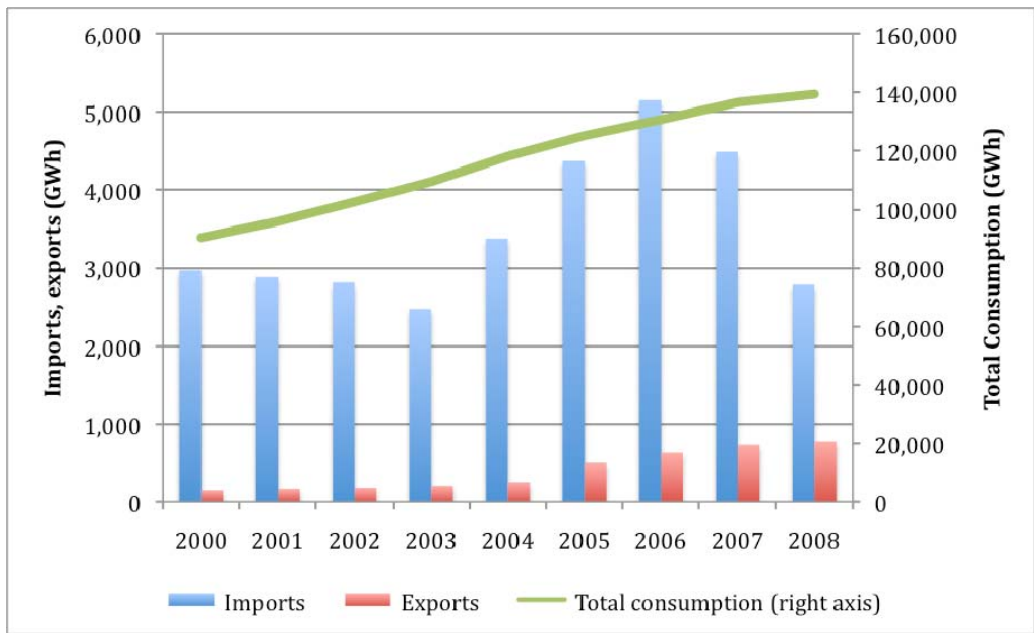
¹⁴ The Thai transmission system is divided into four regions plus metropolitan Bangkok.

interconnections (see Figure 11, Annex A2). In addition, two new lines are under construction to interconnect with Laos, and there are plans to build four more.

Thailand’s Southern region is interconnected with Malaysia by a 300 MW HVDC line commissioned in 2001, which serves demand in the southern provinces.

In total, Thailand currently has 640 MW of capacity available from Laos and Malaysia. Total energy imports and exports have been growing (Figure 8). Thailand exports energy to Laos both to make up for existing capacity shortage in that country and as re-export of Laos energy routed through Thailand in order to transfer between the separated Laos grids.

Figure 8 Thailand Electricity Imports and Exports, 2007



Source: Energy Policy and Planning Office (EPPO) based on EGAT data

The Lao and Thai governments have a memorandum of understanding under which there are several ongoing projects to develop Laos’ hydropower potential for export to Thailand.

In addition to NT2, Laos has implemented three other hydro projects to serve Thailand as an export market under PPAs. These are much smaller in scale, with the largest being the 210 MW Theun-Hinboun IPP that was put into operation in 1998. These projects served as test cases for the development of hydropower in Laos and for the technical and economic arrangements for export to Thailand.

3.5.2 Regional trade initiatives

The countries in the Southeast Asian region are linked by existing electricity interconnections of varying capacities. Laos is currently interconnected with Thailand, Vietnam, China and Cambodia. The Thai grid is interconnected with Malaysia in its south, Laos to its northeast, and Cambodia to its east.¹⁵

In addition to the existing and expanding Laos-Thailand trade, bilateral arrangements are expected in the coming four to five years between Laos and Vietnam and Cambodia and Vietnam. Thailand has signed MOUs with the governments of Myanmar and Cambodia. The Myanmar MOU signed in 1997 commits Thailand to contract up to 1,500 MW of capacity from Myanmar by 2010.

Electricity demand in the immediate region around Laos is dominated by Thailand and Vietnam. Laos' central location makes it a potential transit country between these two demand centers as well as an origination point for energy flowing to them.

Two major power network integration and trading initiatives are underway in the region:

- o The **Greater Mekong Subregion (GMS) initiative** aims to develop a regional market for electricity among the six Mekong River riparian countries¹⁶ (see separate case study on the GMS).
- o The countries in the ASEAN regional grouping are party to an initiative to create an **ASEAN Power Grid**, under the auspices of the GMS project. This would create a system of interconnected national grids forming an open ring from Vietnam and China, west through Laos, Cambodia and Thailand, arching south through Malaysia with an interconnection to Indonesia and then north up to the Philippines.

The ASEAN Interconnection Master Plan Study (AIMS) was completed in 2003. AIMS identified 11 potential interconnection projects in the region, including strengthening existing interconnections.

There is currently no regional transmission operator. Rather, the regional network is a collection of national networks with interchange arrangements between national system operators and their cross-border counterparts.

3.6 Environmental and social issues

The attention given to environmental and social issues and the safeguards that have been developed are among the defining features of the NT2 project.

The project attracted interest and scrutiny from academics, NGOs and individuals around the world. Several international advocacy NGOs (such as the International Rivers Network,

¹⁵ Cambodia has ambitions similar to those of Laos in becoming an exporter and a link in the regional electricity trading network.

¹⁶ Cambodia, China, Laos PDR, Myanmar, Thailand and Vietnam

Environmental Defence and Probe International) lodged strong objections to the project on environmental and social grounds.

The international publicity given to these concerns led to renewed focus on environmental and social safeguards, particularly among the international public institutions. A number of safeguards requirements were incorporated into the agreements between the IFIs and GoL. These were in turn put into the Concession Agreement (Schedule 4), making it the crucial document governing the responsibilities of NTPC in relation to the environmental and social safeguards.

The project affects three geographic areas: the watershed, the Nakai plateau, and the downstream areas. There are a number of environmental and social impacts on these areas, including:

- o the creation of a large storage reservoir as well as major civil works in relation to the dam and river diversion
- o 6,200 indigenous people in 1,265 households living in the Nakai Basin have been displaced by the creation of the reservoir.¹⁷
- o Changes to water flow will also affect communities downstream of the powerhouse and the dam (these affect separate rivers). In 2001, approximately 40,600 people in 7,096 households lived in the downstream Xe Bang Fai area and a further 3,300 people were reliant on the river for seasonal fishing.¹⁸
- o The transmission corridor to the border involves forest clearance and new roads into forested areas.
- o The Mekong River, which is fed by the two rivers directly affected by the project, flows through Cambodia and Vietnam after leaving Laos, potentially raising issues of international riparian rights.

Under the CA, NTPC is responsible for managing the environmental and social impacts of the project in accordance with standards agreed with GoL based on the World Bank Safeguard Policies. The environmental and social plans developed to monitor, plan for and mitigate these impacts include:

- o **Environmental Assessment and Management Plan (EAMP)**—prepared by NTPC, details the environmental impacts of the project.
- o **Social Development Plan (SDP)**—prepared by NTPC, considers the impacts identified in the EAMP and presents income development plans and a compensation plan for people affected by the project. The SDP incorporates the Resettlement Action Plan (RAP) and Ethnic Minorities Development Plan.

¹⁷ Annual Update on NT2, July 2008, ADB

¹⁸ SESIA, 2004, p13

- o **Social and Environmental Management Framework and Operational Plan (SEMFOP)**—prepared by GoL, presents a conservation plan for the watershed and conservation area.

The environmental and social responsibilities of NTPC are described in its overarching Project Implementation Plan (PIP). GoL has responsibility for SEMFOP.

Some of the required environmental and social measures are limited by cost as specified in the CA, and others are limited by an agreed scope. The CA also includes provision for unanticipated (at the time of signing) project impacts, which the company is required to cover up to a specified limit. NTPC's environmental and social obligations are to be secured by letters of credit.

Two panels of experts were created in 1997 in response to the environmental and social concerns raised over the project:

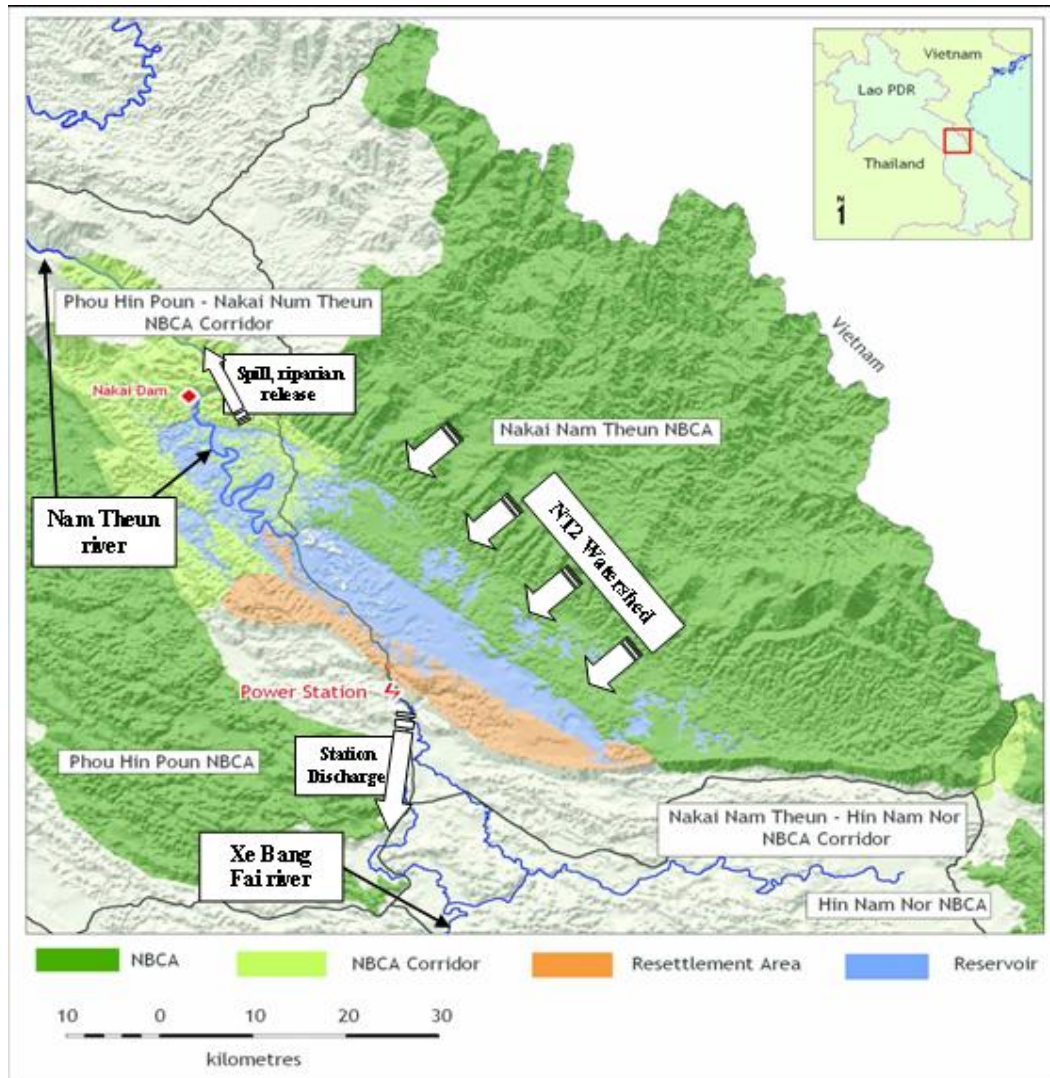
- o The **International Environmental and Social Panel of Experts (POE)**—To advise the GoL, the CA provides for the POE to conduct independent reviews of the environmental and social mitigation measures and their implementation.
- o The **International Advisory Group (IAG)**—Advising the President and senior management of the World Bank, the IAG reports on environmental and social issues as well as arrangements for revenue management in relation to the project. IAG's mandate includes suggesting how the Bank can overcome identified problems.

The analysis and reports produced by these groups played an important role in establishing safeguards as required by the World Bank's board.

3.6.1 Environmental impact mitigation

The Concession Agreement separately covers environmental safeguards for the watershed area and areas outside the watershed.

The Nakai Nam Theun National Protection Area (NNT NPA) covers 88% of the NT2 reservoir watershed in the mountains to the northeast of the Nakai Plateau. This relatively sparsely populated area is considered of global significance for its biodiversity. Two further National Protection areas are situated near the reservoir. The transmission lines skirt around these. The project zone, including the surrounding conservation areas, is shown in Figure 9.

Figure 9 Protection Areas in the NT2 Project Zone


Source: SEMFOP-1 presentation, 2004 and ECA Graphics; NBCA = Nakaï Basin Conservation Area (NNT NPA)

Each of the three NPAs contains species that are rare or threatened as a result of deforestation and encroachment by human settlement and agriculture. The Lao government has not had the institutional capacity or resources to limit this process.

The Watershed Management Protection Authority (WMPA) is charged with overseeing the environmental protection of the watershed area in accordance with SEMFOP. The WMPA was created by Lao Prime Ministerial Decree in 2001 and is under the Prime Minister's Office. WMPA is responsible for implementing the SEMFOP and other operating plans for the watershed area.

The objectives of the WMPA include conservation of the watershed's biodiversity, protection from poor land stewardship, such as over-logging, which could result in greater sedimentation into the NT2 reservoir, and poverty reduction for the people living in the watershed area.

The CA (Schedule 4, Part 3) commits NTPC to providing funding to WMPA during the construction phase and in each year of the operating phase of the concession. The operating phase payments are US\$1M per year, escalated for inflation. NTPC has a member on the WMPA board, and the CA establishes certain protections on the accountability of WMPA.

The head contractor and NTPC are both required by the CA (Schedule 4, Part 2) to prepare environmental monitoring and management plans for the construction and operation phases, respectively. GoL established an Environmental Management Unit (EMU) to oversee the responsibilities of NTPC in relation to the areas outside the watershed. NTPC is required to provide some funding to the EMU. For its part, NTPC is required to establish an Environmental Management Office to implement and monitor its obligations. Independent monitoring is also required by the CA.

Other environmental assessment and protection studies carried out for the project include wildlife surveys, fish and aquatic habitat surveys, and elephant studies.

The EAMP has been criticized as being based on inadequate data. Opponents of the project argue that the alteration of the natural river flow will cause a breakdown in the aquatic food chain along the Nam Theun and Xe Bang Fai to the Mekong, and that the environmental and social implications of this have not been sufficiently prepared for.

3.6.2 Social impact mitigation

Fifteen villages had to be resettled as a result of the reservoir impoundment. A 20,800-hectare area along the southern edge of the reservoir was selected as the resettlement zone. The first village was resettled in 2003 to a pilot village, which provided experience that could be applied to the remaining 14 villages. Resettlement of the remaining villages began in 2006 and was completed in early 2008. This was a precondition for the spillway gate closure that would begin the water impoundment.

A Resettlement Policy is included as an annex to the CA.

The CA obliges NTPC to develop and fund the mitigation, compensation and resettlement process.¹⁹ A major component of this process is the restoration of livelihoods for the people affected by the project. This includes cash or in-kind compensation for permanent loss of land, housing and other fixed and productive assets. The CA explicitly requires consultation and input from the affected persons.

Household income targets are specified for resettled households and villages with a floor set at the Lao national rural poverty level. Under the Concession Agreement, resettled villagers are expected to experience a doubling of their incomes within five years of relocation. Household incomes will be at least US\$800 (2002 dollars) per person after five years and village incomes will be at least US\$1,200 per person by the end of the resettlement period specified in the CA.

¹⁹ Schedule 4 of the CA sets out Social Components of NTPC's responsibilities (Watershed area is covered in Part 3, Downstream Areas are covered in Part 4, and other areas are in Part 1).

A Livelihood Program was developed around five pillars: agriculture, livestock, fishery, forestry and other forms of employment. A range of initiatives is in place under each of these headings to support resettler livelihoods. These include:

- o Resettlers are allotted land and given training in agriculture techniques.
- o The SDP includes an agriculture and livestock development plan for the resettlers. Livestock numbers are being reduced to fit the reduced grazing area.
- o The resettlers were granted exclusive rights to the reservoir fisheries for a period of 10 years by Prime Minister's Decree (February 2008). The SDP contains reservoir fisheries predictions, and a Reservoir Fisheries Plan has been developed.
- o A Village Forestry Association (VFA), created in 2006, is responsible for managing logging in local forests and for developing a handicraft industry. This is intended to create an alternative income stream for villagers and foster a stake in the sustainable use of forest resources. A forestry development plan is included in the SDP.

The SDP also includes compensation measures for people living in the downstream areas depending on the impact of the project on their assets, livelihoods and lifestyles.

A 22 kV substation is to be built at the power station to enable delivery of electricity to the resettlement area.

The CA requires a number of institutions to be created to manage the resettlement process. These include:

- o Within NTPC, a Resettlement Office (RO) to carry out the company's obligations
- o Within GoL, a Resettlement Committee to oversee the policy development, and a Resettlement Management Unit to jointly plan and coordinate the process with the RO.

Resettlement working groups were also formed as well as village-level representation. A grievance process is described in the CA for dissatisfied project-affected people.

Monitoring by both NTPC and GoL and by independent monitors was required to gauge progress against the resettlement plan and livelihood targets. This is to continue until the resettlement objectives have been met. The CA commits NTPC to carry out population and socioeconomic studies prior to resettlement to act as the monitoring baseline, and ongoing surveys following resettlement. The POE and IAG are also involved in the monitoring process.

3.6.3 Water management

The Concession Agreement grants NTPC exclusive water rights over the Nam Theun, Xe Bang Fai and other rivers. GoL commits not to make changes that would affect NTPC's operation of the hydro scheme and its ability to generate electricity from it. NTPC is required to make minimum water releases into the Nam Theun to support other riparian

uses and to accommodate water use for irrigation in the project design. The agreement also allows for future changes in the water release regime into the Nam Theun to enable downstream parties to generate electricity and for NTPC to charge for water released for this purpose.

The watershed is to be monitored by the WMPA within GoL. WMPA will be supported by technical advice from NTPC.

At the regional level the Mekong River Commission (MRC) provides a forum for agreement on riparian issues among the four lower-Mekong countries (Thailand, Vietnam, Laos and Cambodia). China and Myanmar are not MRC members but participate on a nonbinding basis.

The MRC was established by the 1995 Agreement on Cooperation for the Sustainable Development of the Mekong River Basin.²⁰ The agreement includes the Water Utilisation Programme (WUP), which establishes riparian water use procedures. The WUP was implemented in 2007 after a six-year development period.

3.6.4 CO₂ emissions

NT2 is expected to result in a net greenhouse gas emissions reduction. The avoided CO₂ emissions resulting from NT2 are estimated against the baseline of an equivalent-output CCGT plant located in Thailand over the lifetime of the project. A report prepared for the World Bank in 2005 estimated the avoided emissions at 2 million tonnes of CO₂ annually, implying 200 million tonnes saved over a project life of 100 years.²¹

The savings are offset by reservoir emissions that occur as a result of degrading organic material submerged by the inundation. A previous study estimated total emissions from the NT2 reservoir of 30 million tonnes of CO₂ equivalent over a 100-year period. However, the release profile of the reservoir is not uniform, with greater releases expected to occur during the early years.

²⁰ The four countries have been party to regional cooperation organizations of various forms (and with some interruptions to membership) since the establishment of the Mekong Committee in 1957.

²¹ "Economic Analysis of Environmental and Social Impacts of the Nam Theun 2 Hydroelectricity Power Project"

4 Institutional arrangements

4.1 Overall coordination and governance

Laos and Thailand have had arrangements in place for electricity trade since transfers were first made from Laos to Thailand in 1971. This trade has included small cross-border trade (some Lao customers near the border are supplied by low-voltage connections from Thailand) and larger-scale sales under PPAs from dedicated new-build plant. Accordingly, technical and commercial arrangements were in place prior to NT2 to support both these levels of trade.

The Laos-Thailand export projects have all been developed as enclave projects, supported by the following governance framework:

- o Since 1993 the key high-level agreements underpinning Lao-Thai trade have been the MOUs on power development between the two governments.
- o Each individual project is then governed by specific contractual arrangements between utilities (PPAs), concession agreements, and financing arrangements.

Together, these agreements constitute the trade framework between Laos and Thailand (see Section 5 for more details of the contractual framework).

The project-by-project basis for the trading arrangements and agreements has continued for projects developed since NT2. Perhaps a key change that has arisen from the NT2 experience has been an increased focus on environmental and social safeguards in the development of hydro projects in Laos.

4.2 Role of national governments and regional institutions

The NT2 project is being developed in the context of bilateral cooperation between governments and utilities of the two countries. Regional institutions have had a limited part in the project. Rather, the role of IFIs was crucial in determining the project's fate.

IFIs provided equity and debt finance and assisted with securing the financial risk mitigation measures that enabled the private-sector participation. The involvement of the IFIs themselves was contingent to a large extent on the incorporation of satisfactory environmental and social risk and impact mitigation into the scheme.

4.3 Regulatory agencies

NT2 is an enclave project with a direct transmission link from the power station to the receiving country's electricity system. As such, the regulation of the physical aspects of the power trade is set in the PPA in accordance with the Thai grid code. The contracting parties

monitor compliance with the PPA. General regulatory compliance is monitored by the Thai regulatory authority. Tariff aspects are also determined in the PPA.

There is no regional energy sector regulator.

4.4 Role of outside agencies

A number of IFIs and bilateral aid agencies have been involved in the project. These include the World Bank Group (IDA, MIGA), the Asian Development Bank, Agence Française de Développement and PROPARCO, European Investment Bank, Nordic Investment Bank, and export credit agencies of Thailand, France, Norway and Sweden. These institutions have provided financial guarantees, grants (see Section 5.2.2), loans (including equity loans to GoL for its share in NTPC) and export credits.

IFIs are also providing technical assistance to the GoL in relation to:

- o revenue and expenditure management
- o environmental and social impact management
- o broader development and poverty reduction programs

Laos is one of the least developed countries in East Asia, and there was concern among the IFIs that it would not have the required institutional capacity to manage the revenues from the project transparently and accountably.

The IFIs have been instrumental in establishing and supporting the Public Financial Management Strengthening Program (PFMSP) in the Lao government. The PFMSP aims to improve financial management and accountability across the public sector in Laos. It includes tax and customs reform, capacity building for government audit agencies, improving financial management in some state-owned enterprises, and monitoring state-owned commercial banks.

As part of the PFMSP the GoL is receiving capacity building assistance to better enable it to direct the revenues from the NT2 project through its public spending program. Importantly, this assistance recognizes the need to begin building capacity before the revenue stream begins.

The GoL committed to the programme in a Government Letter of Implementation Policy (GLIP) sent to the presidents of the World Bank and the ADB in 2005. A revised PFMSP was approved by GoL in March 2008. The program is not without its critics, who point out that the commitments impose restrictions and controls by outside parties on a sovereign government. Furthermore, the scope of the revenue management requirements are not necessarily well matched with the revenue stream generated by NT2 itself. Payments in the early years are weighted toward servicing debt rather than providing revenue to GoL.

The PFMSP is receiving financial support from a number of donor sources, including the international aid agencies of Australia, Sweden, Switzerland and the European Union. This funding is being coordinated through a multi-donor trust fund created for the purpose in June 2008.

The World Bank is supporting the GoL in the creation of a Poverty Reduction Fund that will be used to channel revenue from the project to priority programs. The Fund is initially supported by World Bank (IDA) funds until payments to the project begin.

IFIs' involvement has been ongoing through the project monitoring mechanisms. These include monitoring the resettlement program and associated social development plan implementation, monitoring implementation of the environmental safeguards, and following progress with the physical construction.

A further condition for World Bank support of the NT2 project was that the Government of Laos prepare an environmental and social management policy.

5 Contractual, financing and pricing arrangements

5.1 Contracts

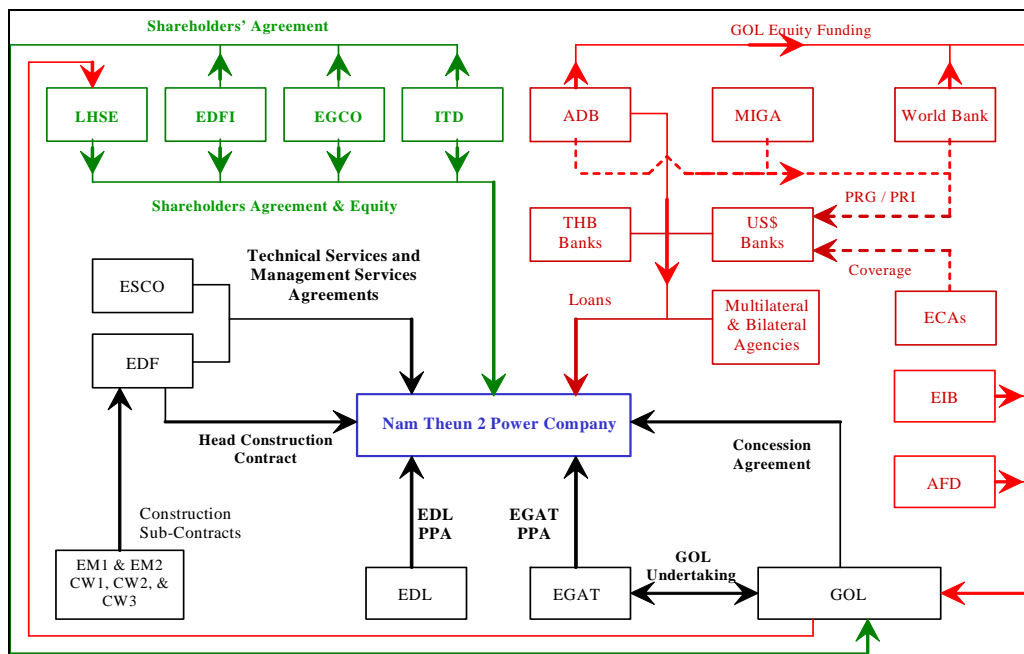
The key legal and contractual agreements supporting the project are:

- o MOUs between the governments of Laos and Thailand
- o Concession Agreement between the GoL and the project company
- o PPAs between the project company and both of the offtakers
- o Risk guarantees from international institutions
- o Financing agreements between the project company and the financiers
- o Head construction contract issued by the project company

In addition there is a Sponsors' Agreement among the partners in NTPC and the GoL, and the Shareholders' Agreement among the four owners of NTPC. There are also agreements between the GoL and the IFIs and bilateral institutions, relating in particular to environmental and social safeguard standards.

The contractual and financing relationships supporting the project are summarized in Figure 10. Each of the key agreements is then summarized in turn.

Figure 10 NT2 Contractual and Financial Relations



Source: World Bank

Thai-Lao governmental agreements

Electricity exports from Laos to Thailand are supported at the highest level by a series of memoranda of understanding between the two governments. These agreements have successively increased the volume of capacity to be developed for export to Thailand:

- o The 1993 Memorandum of Understanding (MOU) formalized the electricity trade relationship between the two countries and set a target for development of 1,500 MW of hydropower.
- o In 1996 the governments updated the MOU with an increased development target of 3,000 MW.
- o The latest MOU, signed in December 2007, further increases planned development to 7,000 MW by 2015.

NT2 is the single most significant project to be pursued to date under the MOUs.

The 1993 and 1996 MOUs had been signed in the context of rapid economic growth in Thailand and associated forecasts of accelerating electricity demand. These forecasts were revised downward following the 1997 Asian financial crisis. This is partly reflected in the 11-year period between the second and third revisions to the target for imports from Laos.

Concession Agreement

The project is structured on a Build, Own, Operate, Transfer (BOOT) basis according to a Concession Agreement between a special-purpose vehicle created for the project, the Nam Theun 2 Power Company Ltd, and GoL.²² The agreement grants a 25-year concession to NTPC after which the project assets, which include the dam and power generation facilities and transmission lines to the EGAT delivery point, are to be transferred to GoL. The concession period begins with the commencement of sales under the PPA.

As discussed previously, the CA specifies the responsibilities of NTPC in relation to mitigating the environmental and social impacts of the project. It also grants NTPC water rights to the rivers associated with the project for the period of the concession.

While the CA is between GoL and NTPC, it makes explicit reference to the other project agreements, in particular the EGAT PPA, and references EGAT's rights as a stakeholder in the agreement.

The CA is governed by Lao law.²³ It includes provisions for dispute resolution (see below).

Transmission and operation

The PPA specifies the delivery point at the center of the Mekong River at a location on the border between the two countries. EGAT is required to build, and will own, a 166 km double

²² A Summary and selected Sections and Schedules of the Agreement are available from http://www.namtheun2.com/Concession_Agreement.htm

²³ English law is to be used in the case of any particular issue where Lao law is found to be silent on the issue in question or wholly inadequate.

circuit 500 kV transmission line from Roi Et in Thailand to the border to meet the transmission line being built from the powerhouse by NTPC.

The PPA states that the power station will be operated automatically by EGAT by remote dispatch control, subject to certain operating restrictions such as NTPC's water management obligations. NTPC uses its energy declarations to carry out its water management responsibilities.

The Thai Grid Code governs access rights to the Thai network for imports.

Head construction contract

The Head Construction Contract is between NTPC and the lead construction contractor, Electricité de France International (EdFI). It is a turnkey contract for engineering, procurement, construction (EPC) and management of the project. EdFI will subcontract many of the project roles. Through the Head Construction Contract NTPC passes many of the development and construction phase project risks to EdFI.

5.1.1 Dispute resolution

The arrangements for dispute resolution between GoL and NTPC are set out in the Concession Agreement. This provides three avenues:

- o The Consultation and Dispute Committee
- o An expert
- o Arbitration in Singapore according to the UNCITRAL arbitration rules

For disputes between EGAT and NTPC, the PPA also stipulates three avenues for resolution:

- o In the first instance, a standing committee of two representatives from each party will consider billing and payment disputes, while an attempt should be made to resolve other disputes through direct negotiation.
- o If the matter remains unresolved, it is referred to a panel of three experts, whose decision is final and binding.
- o If, however, the referral of the dispute to experts is not required or is not agreed to by the parties, or if the experts fail to determine the dispute within the required time period, the dispute will be referred to arbitration in Singapore under the UNCITRAL arbitration rules.

5.2 Ownership and financing

5.2.1 Project partners and ownership

The key participants in the project implementation (the project design, construction and operation) are:

- o NTPC – the special-purpose company created to execute the project
- o Government of Laos (GoL)
- o EGAT – the key customer for the power station output
- o Head contractor – EdFI, which is contracted by NTPC to oversee the design and construction of the project

The IFIs have also had an important role in the project design and facilitating financing, and will provide further technical support assistance related to the project. A group of banks are involved in the financing.

The legal structure for the project is established on the foundation of the Thai-Lao MOU.

Nam Theun 2 Power Company (NTPC)

NTPC is incorporated in Laos under Lao law as a foreign investment company. It is a joint venture between a mix of four public and private-sector partners:

- o **35% Electricité de France International (EdFI)** – The parent company of EdFI, Electricité de France (EdF), remains 85% owned by the government of France.
- o **25% Lao Holding State Enterprise (LHSE)** – A publicly owned investment vehicle created by the Government of Laos in 2005 to represent its investment in the project. It is overseen by the Ministry of Finance.
- o **25% Electricity Generating Public Company (EGCO) of Thailand** – EGCO is 25% owned by EGAT, which is in the hands of the Thai state.
- o **15% Italian-Thai Development Public Company Ltd (ITD)** – A Thailand-based construction and civil engineering firm. It is a publicly traded company listed on the Stock Exchange of Thailand.

Three governments together ultimately own around 61% of NTPC.

5.2.2 Financing structure

The total project base investment is US\$1.25 billion with a further US\$200 million contingency funding. Finance is 28% equity and 72% international loans from a mixture of the private and public sector investors, IFIs, bilateral agencies, commercial banks and export credit agencies.

Crucially for the viability of the large private-sector participation in the project, the World Bank Group, Asian Development Bank and export-credit agencies are providing debt guarantees of around US\$185 million to cover commercial lenders' political and financial risk.

The project's financing structure is summarized in Table 4.

Table 4 Summary of NT2 Financing Structure (US\$ millions)			
	Equity	Debt	Total
NTPC shareholders	350		
US dollar debt		450	
Thai baht debt		450	
Total base financing	350	900	1,250
% split	28%	72%	
Contingency	100	100	200
Total financing	450	1,000	1,450

Source: ADB/WB project update, March 2006

In addition there is US\$130 million of bonding facilities.

Equity financing

Equity financing in the project is US\$350 million. The partners in NTPC each make an equity contribution to the project in proportion to their shareholding. Public-sector investors directly account for 60% of NTPC equity through the inclusion of the Lao government-owned LHSE and the French government-owned EdFI, and slightly more indirectly through ownership of the private-sector partners (i.e., EGCO).

The LHSE equity component is US\$87.5 million. The GoL's equity contribution through LHSE is being funded by grants and loans to GoL from several of the IFIs and Agence Française de Développement (Afd).

Debt financing

The project's US\$900 million of base senior debt financing is denominated equally in US dollars and Thai baht. The US dollar financing participants include:

- o A syndicate of nine international commercial banks
- o Asian Development Bank (US\$50 million private-sector loan to NTPC, and US\$20 million public sector loan to the GoL to assist its equity contribution to

NTPC), the European Investment Bank (EIB) (US\$55 million loan to NTPC) and the Nordic Investment Bank²⁴

- o Two French bilateral agencies (Afd and PROPARCO), and the Export-Import Bank of Thailand

The baht-denominated component is financed by a further syndicate of seven Thai commercial banks (some of which are owned by the Thai state).

Commercial debt maturity is 16.5 years on the US dollar component and 15 years on the baht component. The IFI equity loans to GoL are extended on concessionary terms.

Risk guarantees

The large private-sector commercial lending component is enabled in part by the protection of political risk guarantees and insurance from the IFIs, bilateral institutions and by the export credit agencies.²⁵ The main IFI contributions to political risk coverage are:

- o The World Bank Group is providing partial risk guarantees (US\$42 million) and MIGA guarantees (US\$91 million) to cover the commercial lenders.
- o The Asian Development Bank is providing a political risk guarantee to commercial lenders to NTPC (US\$50 million).

The MIGA guarantee is provided to cover all of the political risks within MIGA's ambit.²⁶ The guarantee applies mostly (US\$86 million) to the US dollar commercial bank debt provided by Fortis Bank of Belgium (which is acting as agent to other banks), with a small component to cover EdFI against currency transfer restriction in Laos.

The GoL provides a counter-guarantee to the ADB partial risk guarantee.

Additionally, the EGAT PPA requires NTPC to provide several forms of financial security guaranteeing its obligations to EGAT. These are in the form of bank guarantees, cash deposits and a mortgage over NTPC's physical assets. The security guarantees were due at the time NTPC was able to drawdown its debt financing.

Revenue off-shoring

The Concession Agreement allows NTPC to open US dollar and baht bank accounts in any one or more of England, Singapore, and Thailand, as well as kip, dollar and baht accounts in Laos. The international accounts may be used for deposit of all equity and revenues related to the project and for payment of project costs and disbursements.

²⁴ The World Bank is also providing a grant to cover social and environmental impact management.

²⁵ The participating export credit agencies are those of France, Sweden and Norway.

²⁶ These are risk of currency convertibility and transfer restriction, expropriation, war and civil disturbance, and breach of contract.

5.3 Pricing arrangements

Power Purchase Agreements and tariffs

The two offtakers from the project are the state-owned utilities in each country: the Electricity Generating Authority of Thailand (EGAT) and Electricité du Laos (EdL).

In 2003, EGAT and EdL each entered into a PPA between themselves and NTPC. The EGAT PPP, accounting for 95% of NT2's design capacity (995 MW), is the core demand driving agreement for the project. The remaining 5% (75 MW) is for delivery to EdL under a separate PPA.

The contracted energy and associated tariffs in the EGAT PPA are categorized according to three types:

- o Primary Energy (PE), of 4,406 GWh/year on average; delivery between 6:00 a.m. and 10:00 p.m. Monday through Saturday. The tariff and payment are set half in Thai baht and half in US dollars.
- o Secondary Energy 1 (SE1), of 948 GWh/year on average; delivery at any other time. The tariff is set half in Thai baht and half in US dollars, while payment is all in baht.
- o Secondary Energy 2 (SE2), of 282 GWh/year on average. Both tariff and payment are in baht.

The first two categories are subject to take-or-pay (TOP) conditions with annual tariff escalation. SE2 is reserve or excess energy taken in addition to the TOP quantities. It has a fixed tariff and is not TOP and would account for around 5% of the contracted volume.

The per kWh tariffs are formed of US dollar and Thai baht components. Using the starting exchange rate of 40 baht to the US dollar, the currency split in the tariffs is 51% US dollars and 49% baht. This closely matches the currency split in the project's debt financing.

The tariff for PE and SE1 escalate at a rate of 1.4% per year until the end of the concession in 2034. The SE2 tariff is constant in all years of the concession. The tariffs under the EGAT PPA are summarized in Table 5.

Table 5 Tariffs in the Nam Theun 2 EGAT PPA

	2009 (tariff year 1)			Annual Escalation	2034 (tariff year 26)		
	USc/ kWh	Baht/ kWh	Total USc/kWh		USc/ kWh	Baht/ kWh	Total USc/kWh
PE	2.118	0.805	2.118	1.4%	2.948	1.120	2.948
SE1	0.975	0.370	0.974	1.4%	1.358	0.516	1.358
SE2	-	0.570	1.500	-	-	0.570	1.500

Source: ADB loan document and NTPC. The concession period is 25 years. The 2009 tariff year contains only one month, while 2034 contains 11 months.

The total tariff is based on current (July 2009) USD:THB exchange rate of 1:34 and is indicative only.

Energy sold under the EdL PPA is all PE escalated at the same annual rate as for EGAT of 1.4%. In summary, the EdL tariff structure is:

- o 1.765 USc/kWh and 0.698 baht/kWh in 2009 (Indicative total 1.801 USc/kWh)
- o 2.457 USc/kWh and 0.961 baht/kWh in 2034 (Indicative total 2.493 USc/kWh)

Most (95%) of the average annual total available energy contracted to EGAT is on a take-or-pay basis. While EGAT is contractually required to pay NTPC for the full amount of TOP energy that NTPC declares available in any month, it is not required to dispatch the full declared amount. If it dispatches less, EGAT is able to receive an equivalent amount of energy at a later date to make up the dispatch shortfall.²⁷ EGAT may also dispatch more when there is sufficient water available.

The EGAT PPA is governed by English law. Dispute resolution under the PPA is discussed in Section 5.1.1.

²⁷ The shortfall amount that EGAT may claim is subject to limits to protect NTPC from being forced to spill valuable water in order to retain the water related to the dispatch shortfall.

6 Future plans

The Nam Theun 2 project's physical components and contractual and institutional arrangements were for the most part planned in advance. As a result of this and the bilateral and precontracted nature of the trade, the project is not subject to ongoing evolution.

The challenges that remain to realizing the full objectives of the project are to continue the implementation of the environmental and social safeguards and to convert the revenues from the project into development results for Laos.

In the broader context of realizing its trade potential, Laos is continuing to develop its hydropower sector for export to Thailand and Vietnam, as the list of under-construction projects in Table 10 (Annex A2) indicates. Among these, of direct significance to the NT2 project is the Nam Theun 1 plant, which is on a related river system.

A 27-year concession to construct and operate the planned US\$700 million, 523 MW NT1 plant was awarded to a public-private consortium in September 2006. As with NT2, the primary customer of NT1 will be EGAT under a PPA. NT1 will be located downstream from NT2 and the Theun Hinboun hydro project.

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World Bank NT2: www.worldbank.org/laont2

A1 Economics and demographic environment

Average incomes of the people living in the Nam Theun 2 reservoir area before the project were low even by Lao standards, falling below the national poverty line. Agricultural productivity in the poor and degraded soils of the Nakai Basin was particularly low. There was also a relatively lower level of education and little access to modern infrastructure services.

Population densities in the region affected by the project are at their lowest in the eastern highlands in the catchment area above the NT2 reservoir. Densities increase progressively as one moves in the direction of the Mekong toward the more productive soils of the western lowlands.

A2 Electricity supply

Table 6 Thailand Generating Capacity by Ownership, 2007

	Installed Capacity (MW)	% of Total Capacity
EGAT	15,793	55.4%
IPPs	10,018	35.1%
SPPs	2,079	7.3%
Import availability	640	2.2%
Total	28,530	

Source: EGAT Annual Report 2007

Table 7 Thailand Generating Capacity by Fuel, 2007

	Installed Capacity (MW)	% of Total Capacity	Actual Generation Share, Jan - July 2007
CCGT	13,540	47.5%	66.2%
Thermal (lignite, imported coal, heavy oil)	9,667	33.9%	23.5%
Hydro (includes Laos imports)	3,764	13.2%	7.2%
Gas turbine and diesel	972	3.4%	0.02%
Renewables	279	1.0%	1.7%
Malaysia interconnect	300	1.1%	1.6%
Total	28,522		

Source: EGAT

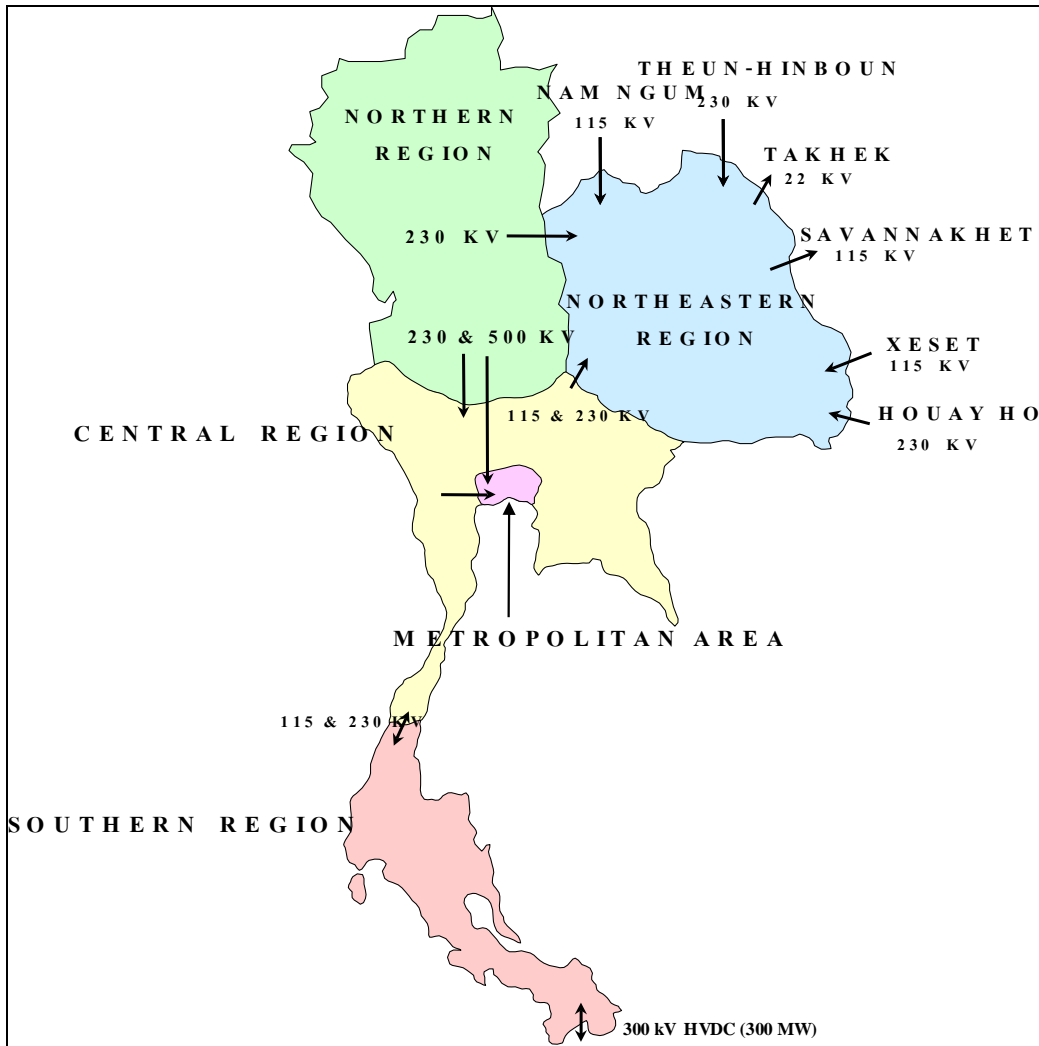
Note: Discrepancy between Table 6 and Table 7 totals reflects discrepancy in source.

Table 8 Thailand PDP 2007 Capacity Forecast (Base Case), 2011-2021

Year	Total Capacity (MW)	Peak Demand (MW)	Capacity Additions (MW)
2011	34,102	27,996	597
2012	35,702	29,625	1,600
2013	37,645	31,384	2,563
2014	39,945	33,216	2,300
2015	42,150	35,251	3,380
2016	44,191	37,382	2,790
2017	47,883	39,560	4,200
2018	49,952	41,795	2,810
2019	52,893	44,082	4,230
2020	55,335	46,481	4,050
2021	58,405	48,958	3,270
Total			31,790

Source: Energy Policy and Planning Office, Thailand

Figure 11 Thailand Transmission Regions and Interconnections



Source: EGAT, 2003

Table 9 Laos Installed Hydropower Capacity

	Installed Capacity (MW)	Operational since	Target Market
Selebam	5	1970	Laos
Nam Dong	1	1970	Laos
Nam Ngum 1 ^a	155	1971	Laos/Thailand
Xeset 1	45	1990	Laos/Thailand
Nam Phao ^b	1.6	1995	Laos
Nam Ko	1.5	1996	Laos
Theun-Hinboun IPP	210	1998	Laos/Thailand
Houay Ho IPP	150	1999	Thailand
Nam Leuk	60	2000	Laos/Thailand
Nam Mang 3	40	2004	Laos/Thailand
Total	669.1		

Source: www.poweringprogress.org, data current as of January 2009

^a Capacity expanded since 1971

^b Out of service since 2002; all plants are owned by EdL except IPPs (part-EdL ownership) and Nam Phao (owned by a provincial authority)

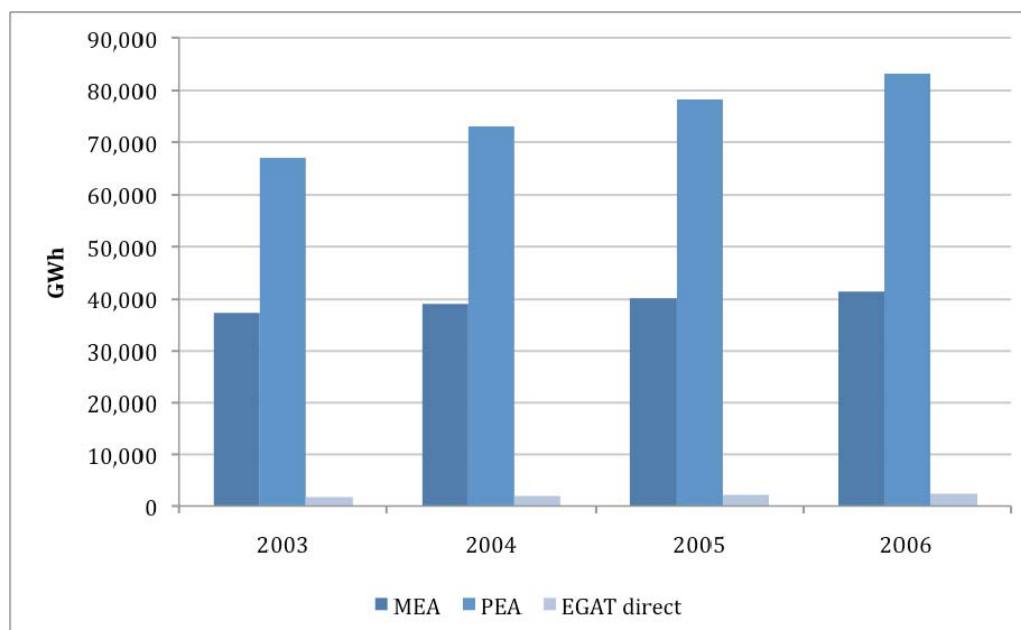
Table 10 Laos Hydropower Plants Under Construction

	Installed Capacity (MW)	Commission Target	Target Market
Nam Nhone	2.4	2009	Laos
Nam Theun 2 (IPP)	1,088	2009	Laos / Thailand
Se Xet 2	76	2009	Laos / Thailand
Nam Lik 1, 2 (IPP)	100	2010	Laos
Xekaman 3 (IPP)	250	2010	Laos / Vietnam
Nam Ngum 5 (IPP)	120	2011	Laos
Theun-Hinboun expansion (IPP)	60	2012	Laos / Thailand
Nam Ngum 2 (IPP)	615	2013	Thailand
Total	2,311.4		

Source: www.poweringprogress.org, data current as of January 2009

A3 Electricity demand

Figure 12 Thailand Electricity Demand by Service Area, 2003–2006



Source: Energy Policy and Planning Office, Thailand

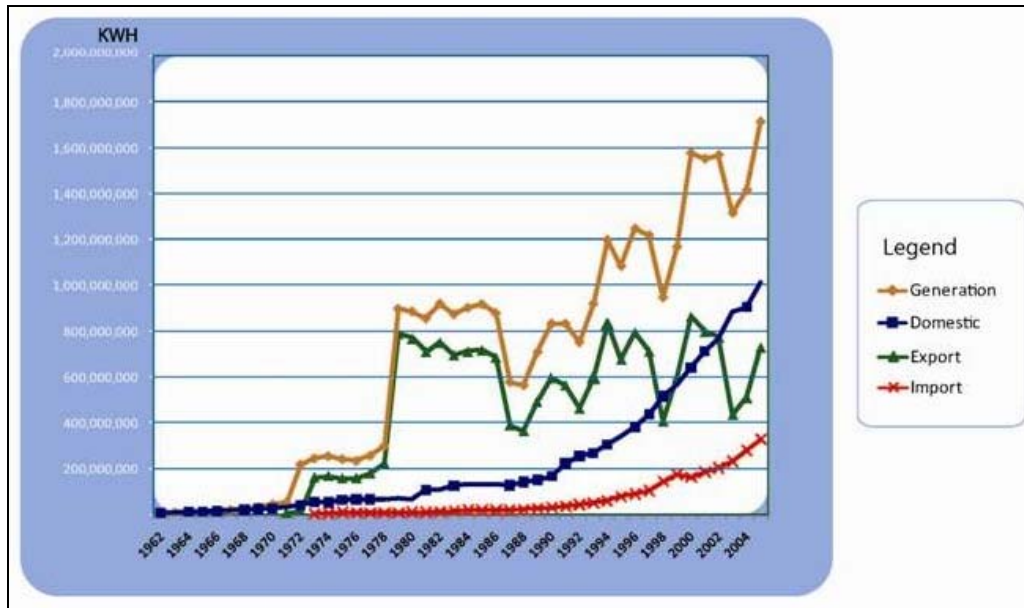
Table 11 Thailand Demand Forecast

	2003 actual	2006 actual	2010	2015	2021
Demand (GWh)	118,374	141,948	177,285	234,375	325,697
% growth rate ^a	6.4%	5.2%	5.6%	6.1%	5.3%
Peak load (MW)	18,121	21,064	26,635	35,251	46,481
% growth rate ^a	8.6%	2.6%	5.6%	6.1%	5.3%

Source: EGAT PDP, 2007

^aOn previous year

Figure 13 Laos Electricity Generation and Trade, 1962–2005



Source: www.poweringprogress.org

Table 12 Laos Demand Forecast

	2002 actual	2005	2010	2015	2020
Demand (GWh)	969	1,839	2,776	3,717	4,834
% growth rate ^a		24%	9%	6%	5%
Peak load (MW)	205	368	543	728	949
% growth rate ^a		22%	8%	6%	5%

Source: Power System Development Plan for Lao PDR, 2004

^a Average annual growth over five years

Table 13 Laos Retail Electricity Tariffs, 2007

	Customer Category	Kip / kWh
Residential	0-25 kWh	154
	26-150 kWh	284
	> 150 kWh	773
Nonresidential	Irrigation	247
	Government office	694
	Industry	625
	General business	835
	Embassies / International organizations	1,077
	Entertainment	1,106
Transmission connected	Irrigation	210
	Industry	531
	Government office	590
	General business	709

Source: EdL Annual Report 2007; tariffs as per notice 046/EDL (15 Jan 2007)