

## Nam Theun 2: Sustainable Energy for South East Asia



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### ABSTRACT

*The Nam Theun 2 hydroelectric project (the "Project") has been identified by the World Bank as a key project for the economic and social development of the Lao PDR and is being developed by the Government of the Lao PDR alongside a consortium of private sector developers comprising Electricit de France, Electricity Generating Public Company Limited and Italian-Thai Development Public Company Limited of Thailand.*

*In the mid 90s, the Project was nominated by the Governments of Lao PDR and Thailand as a potential supplier of electricity to the Electricity Generating Authority of Thailand ("EGAT") under the 3,000 MW bilateral agreement between the two countries. The Power Purchase Agreement between EGAT and the Project was signed on 8 November 2003 and the electricity from the Project is expected to be fully on line by the end of 2009. Some small quantity of electricity from the Project will be sold into the Lao PDR in the framework of a Power Purchase Agreement with Electricit du Laos (EDL) that was also signed on 8 November 2003.*

*The Project is a 1,070 MW (net capacity) trans-basin scheme benefiting from a 348 m average net head to drive generating units capable of producing on the average 5,936 GWh per year. The Project has a unique geographical location that optimises the topography of the region to allow a high average net head and high generating capacity without the requirement of a high dam. The maximum size of the reservoir is 450 km<sup>2</sup> with an active storage of 3,530 million m<sup>3</sup>, a volume approximately half the average annual flow of the Nam Theun. Given the location, design and anticipated cost, the Project will be one of the cheapest suppliers of long-term, sustainable electricity into Thailand.*

*However, the Project is not simply a very attractive economic asset. It is far more than that. Indeed, its long period of development has been used to accurately prepare all environmental and social safeguards while understanding and integrating the Project in the long-term economical development of the Lao PDR and the region.*

*In respect of the Project's environmental benefits, the Project will support the funding of an environmental protection agency to manage the conservation of the world heritage Nakai-Nam Theun National Biodiversity Conservation Area ("NBCA"), a unique area of pristine primary rainforest that also constitutes the Project watershed. According to the Panel of Environmental and Social Experts "the project will by way of direct funding help to preserve a vast primary forest of great international significance which makes up the catchment, and which is presently at risk."*

*Similar committed efforts have been undertaken by all parties to ensure that any negative social impacts of the Project at the local level are fully mitigated. These efforts have meant that the Project is regarded by many as setting new benchmarks for high standard environmental and social planning, with all parties active encouraging the participation of the local population, officials, and various independent experts in order to fully address and mitigate the negative social and environmental concerns that such parties may have. It is the stated intent of the Project that those*

parties affected by the Project will have their lifestyles enhanced by the benefits derived from the Project.

Furthermore, the Project is at the forefront of the Lao National Poverty Eradication Programme (“NPEP”), with the revenue generated by the Project to be used to alleviate poverty and to foster long awaited economic reforms within the country. In a statement issued by the World Bank following a visit to Vientiane and the Project in May 2003, Shengman Zhang, the World Bank’s Managing Director, said: “We see Nam Theun 2 not as a project per se, but as a vehicle through which to make a considerable progress in the effort of poverty reduction.”

Therefore, the Project is an outstanding example of a public-private cooperation involving the development of a world class, cross border, high standard hydroelectric scheme that will provide sustainable competitive and clean energy to both Thailand and Lao PDR over the long run, that will prove beneficial to the environment, and that will provide improvement in economic and social conditions for the affected people, while serving as a cornerstone for the development of the Lao PDR and its integration in the region as a credible economical partner.

Nam Theun 2 is truly an outstanding example of mutual benefit with its promotion of an enhanced cooperation between Laos and Thailand, and with strong consideration for sustainable development in the Mekong sub region.

## 1. HYDROPOWER IN THE LAO PDR

The Lao PDR is a mountainous and highly forested landlocked country with few options to secure a sustainable and environmentally sound economic and social development. With a population of only 5.4 million, its chance of developing labour intensive industries is limited and the mineralogical resource base is as yet relatively undeveloped and likely to be small in scale.

Historic socio-economic studies by institutions such as the World Bank have shown that the only currently feasible options for economic growth and social development are the export of tropical timber and the development of hydroelectric power projects selling electricity to neighbouring countries.

The large-scale export of tropical hardwood has been rejected as being unsustainable in the long run and severely environmentally degrading. The Government of the Lao People’s Democratic Republic (the “GOL”) has long recognised that the logging industry cannot meet the balanced requirements of economic growth and environmental sustainability and has sought foreign investment to both reverse the trend of unsustainable resource exploitation and to develop sustainable resource management.

By contrast, the development of hydroelectric power facilities represents a highly appropriate method of achieving sustainable social and economic development and one that has seen the support of institutions such as the World Bank and the Asian Development Bank. With neighbouring Thailand needing large amounts of competitive electricity, and identified feasible hydroelectric potential in the Lao PDR exceeding 23,000 MW, the export of hydroelectric power is, at present, seen as the most appropriate alternative for Laos to best achieve its development goals.



### 1.1 The Lao-Thai Relationship on Electricity Supply

In June 1993, the Government of the Lao PDR and the Government of the Kingdom of Thailand signed a Memorandum of Understanding (“MOU”) to support the development of power projects in the Lao PDR through the supply of up to 1,500 MW of electricity to Thailand. In June 1996, the agreement was superseded by a new MOU to increase the scope of supply to 3,000 MW.

The MOU represented the formalisation of the long history of bilateral electricity trades. Thailand began buying electricity from the Lao PDR in 1971 (from the Nam Ngum 150 MW hydroelectric dam) and has continued to purchase electricity uninterrupted, notwithstanding minor disputes between the two countries during the mid-1970s. In the same manner, the GOL has been purchasing low voltage electricity from Thailand to supply its border provinces for many years.



Fig. 1 Lao projects map

Whilst Thailand presents a long-term viable customer for power generated from the Lao PDR, importing 2,806 GWh of power from the Lao PDR in 2002, the current trade represents a fraction of the potential electricity exchanges between the two countries. As of today, only the 214 MW Theun-Hinboun and 126 MW Houay Ho projects (i.e. 340 MW or just over 10% of the agreed capacity) have been constructed under the MOU.

The Nam Theun 2 hydroelectric project (the “Project”), which had been previously identified by the World Bank as a potential key aspect of the economic and social development programme of the Lao PDR, was nominated by the GOL as one of the potential suppliers of generating capacity and electrical energy to the Electricity Generating Authority of Thailand (“EGAT”) under the MOU and was reconfirmed several times as a priority project. Thanks to its strong economic fundamentals and its particular focus on the Lao PDR’s social and economic development, the Project has remained under active development since 1994, and is now being implemented in the framework of Power Purchase Agreements with both EGAT and EDL that were signed on 8 November 2003 in Vientiane.

## 1.2 Strong Project Rationale

The Project is an outstanding example of how the GOL is working with the private sector and multilateral organisations to develop a model of sustainable development with strong economic, social, and environment fundamentals. The Project has long been recognised by independent experts as being the one project amongst all the potential hydroelectric power projects in Laos as having the greatest potential to achieve the country’s development objectives.

With the export of 995 MW of generating capacity and electrical energy to EGAT at a very competitive tariff and the supply of 75 MW of generating capacity and electrical energy to Electricité du Laos (“EDL”), the Project is forecast to generate average annual revenues of USD 80 million to Laos in the form of taxes, royalty charges and dividends over the life of the concession. At the end of the concession, the Project will be transferred to the GOL free of charge with all revenues thereafter accruing to the GOL. The Project will be, by far, the largest single source of foreign exchange income to Laos, and its largest single contributor to the Gross Domestic Product and fiscal revenues.

To optimise the use of these revenues, the World Bank, other multilateral institutions and the GOL are working together to establish and ensure that the Project’s revenues to the GOL will effectively serve the long-term development of the country. The Project is recognized as an essential part of the country’s development framework and the Project’s implementation is likely to be the first real possibility for the Lao PDR to reduce gradually its dependence on Official Development Assistance.

The GOL has agreed with the World Bank to implement a Poverty Reduction Fund that is being initially sourced from International Development Agency (“IDA”) funds, and then from the GOL’s taxes, royalties and dividend revenues once the Project commences operation. Special administrative units are being established to deal with both the implementation of the Project and the effective management and allocation of the financial resources gained from the Project.

In a statement issued by the World Bank following a visit to Vientiane and the Project in May 2003, Shengman Zhang, the World Bank’s Managing Director, said in Vientiane in May 2003: *“We see Nam Theun 2 not as a project per se, but as a vehicle through which to make a considerable progress in the effort of poverty reduction.”*

## 2. TECHNICAL DESCRIPTION AND CONSTRUCTION ASPECTS

The Project is to be built on the Nam Theun River, a tributary of the Mekong. The key features of the Project include:

- a 48m high concrete gravity dam with integrated spillway;
- a 450 km<sup>2</sup> reservoir (at Full Supply Level) and active storage of 3,530 million m<sup>3</sup>;
- a catchment area of 4,013 km<sup>2</sup>;
- an average net head of water of 348 m;
- a powerhouse comprising 4 x 250 MW Francis turbines (for supply of power to EGAT) and 2 x 43 MW Pelton turbines (for supply of power to EDL) generating a total of 6,000 GWh per year;

- a 78 km long double circuit 125 kV transmission line to Thakhek;
- a 138 km long double circuit 500 kV transmission line to the Thai border; and
- a 160 km long double circuit 500 kV transmission line from the Thai border to Roi Et (to be built and funded by EGAT).

The Project’s location is extremely favourable for a large-scale, world-class hydroelectric power facility. The natural geography of the Nakai Plateau and the surrounding area is unique in that it allows a hydroelectric project with a significant head of water without a corresponding requirement for a high dam.

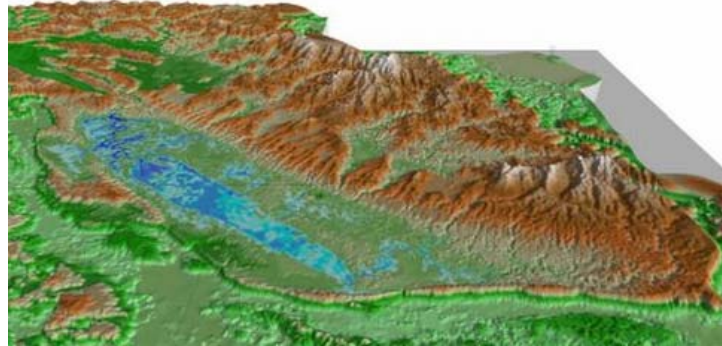


Fig. 2 Nakai Plateau and reservoir simulation

## 2.1 Trans-Basin Scheme

The Project is designed to make optimum use of a unique topographical situation. It is a trans-basin scheme composed of various features located in three provinces of central Laos (primarily in Khammouane province, with some features located in Bolikhamsay and Savannakhet provinces). Bordering the future reservoir and plateau area, the catchment area is mostly covered with pristine primary forest and comprises part of the Nakai-Nam Theun National Biodiversity Conservation Area (“NBCA”). This 4,013 km<sup>2</sup> area of outstanding natural beauty and global importance has been the subject of extensive studies and will be entirely protected thanks to partial funding to be provided by the Project.

## 2.2 Project Features

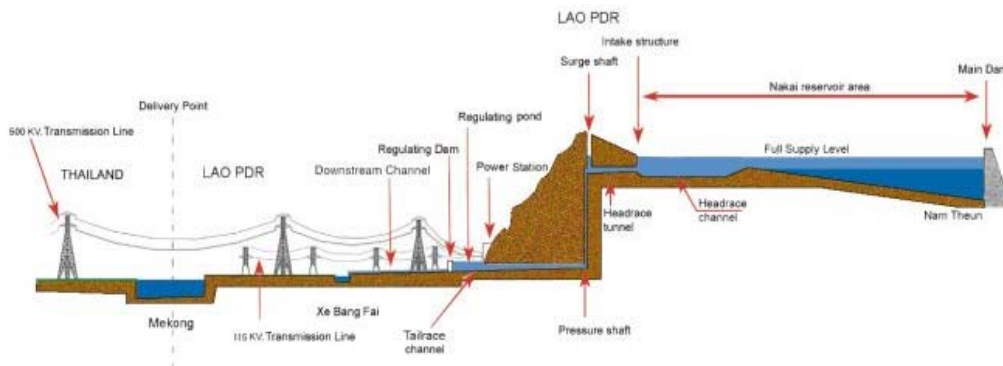


Fig. 3 Project schematic

### 2.2.1 Dam and Reservoir

The Project reservoir will be formed by the construction of a 48 m high gravity dam with a crest length of 325 m across the Nam Theun, plus 13 small earthwork saddle dams along the west bank of the reservoir. A spillway and stilling basin have been specially designed for the purpose of reservoir level control.

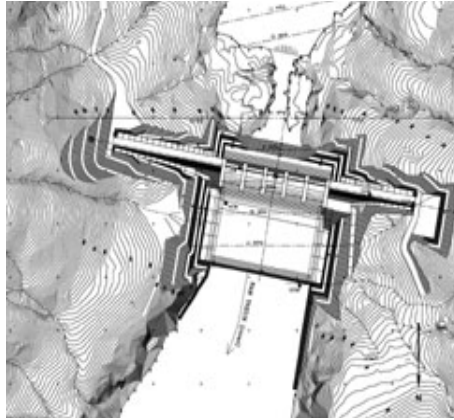


Fig. 4 Dam drawing



Fig. 5 Dam site

The Sponsors and independent consultants have extensively reviewed the underlying geology of the construction and reservoir sites. The basic geological structure of the Project areas is favourable to the undertaking of major civil works and proper completion and impounding of the reservoir.

### 2.2.2 Waterways

A 4 km long headrace channel will be excavated in the reservoir floor to direct the stored water to the intake structure. 3 km of headrace tunnel, pressure shaft and pressure tunnel will transport water from the intake structure to the power station. Turbined water will be stored and the flow regulated thanks to an artificial pond before being finally released into the Xe Bang Fai River through a 27 km downstream channel.

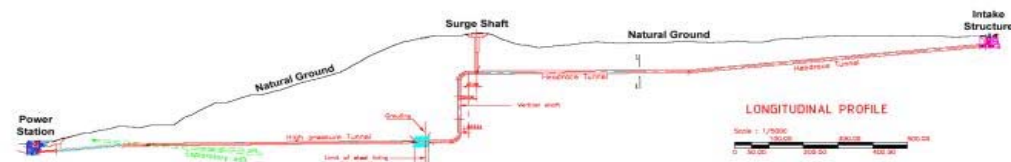


Fig. 6 Underground Works

### 2.2.3 Power House & Electricity Dispatch

The power station will be located at the foot of the escarpment of the Nakai Plateau in the Nam Kathang Valley. To fit with the EGAT requirement for intermediate peaking power, the Project has been designed with four 250 MW (nominal rating) units with Francis turbines operating at a minimum of 16

hours per day to provide EGAT with up to 995 MW or 5,636 GWh of electricity per year. In addition, two 43 MW (nominal rating) units with Pelton turbines will provide EDL with up to 75 MW or 300 GWh of electricity per year, as well as power station internal needs.

#### **2.2.4 Transmission Lines**

Both the seller (NTPC) and the main buyer (EGAT) are to build transmission lines on his own side of the Lao-Thai border for delivery at the border. Accordingly, electricity generated at the power station for EGAT will be delivered to the border near Savannakhet via a 138 km double circuit 500 kV transmission line to be constructed by the Project. EGAT will construct a 160 km 500 kV line from the border to the nearest substation at Roi Et. The electricity delivered at the power station for EDL will be transmitted to Thakhek via a 70 km long 115 kV transmission line to be constructed by the Project. EDL will also offtake up to 15 MW of energy from the power station switchyard via 22 kV lines to the resettlement villages.

#### **2.3 Safety Consideration**

To warrant that the Project is being developed and will be constructed according to the highest safety standards, a Dam Safety Review Panel of independent experts has been formed and provided with the role and authority to scrutinize and ensure that the Project implement the requirement of the World Bank's Dam Safety Policy relating to safety issues in respect of the design, construction, commissioning and operation and maintenance of the Project and downstream areas. The Dam Safety Review Panel comprises eminent technical experts in all aspects of dam design, hydrology, and engineering technology.

### **3. SOCIAL AND ENVIRONMENTAL TRADEOFFS**

The Project has been designed to meet and often exceed the applicable World Bank guidelines on environmental and social issues.

At the national level, the GOL has committed to both the World Bank and the IMF that its policy is to implement a development framework aimed at poverty reduction and environmental protection. This policy is viewed by the international donor community as a unique opportunity for the Lao PDR to considerably improve the livelihood of its population, both at local and national levels, in a manner that is environmentally sustainable.

The Project has also been designed to secure the long-term protection of the Nakai-Nam Theun NBCA, a unique world heritage area in term of its existing biodiversity that comprises the entire Project watershed. The GOL has long recognised that it does not have adequate personnel or monetary resources to prevent the potential future degradation of the forest and wildlife resources in the Project area from uncontrolled human activity and sees the Project's implementation as one way to obtain these resources and implement an environmental protection plan. It is evident that without the Project's revenue and environmental mitigation plans, the existing level of degradation of the forest areas of the Nakai-Nam Theun NBCA may continue indefinitely. According to the Panel of Environmental and Social Experts "*the project will by way of direct funding help to preserve a vast primary forest of great international significance which makes up the catchment, and which is presently at risk.*"

In general, the Project is widely seen as a model of sustainable development focussing on the country's development and its social and economic benefits to the people.

### 3.1 Expert Studies

The potential environmental, social, and economical impacts of the Project have been the subject of many years of comprehensive assessment, study and evaluation by the Sponsors, the GOL, domestic and international non-governmental organisations (“NGOs”), independent consultants and the World Bank. These studies commenced in the early 1970s when the Nam Theun was first identified as having significant hydropower development potential. Following Laos’ invitation to the World Bank to become involved in the Project in 1994, the Project’s environmental and social assessment and study requirements were determined to be, at an absolute minimum, those required by the World Bank.

The development of the environmental and social mitigation measures have been the result of comprehensive study and dialogue amongst various national and international institutions in order to ensure that the views of all stakeholders are considered, that all appropriate remedial measures have been undertaken and that the Project will be undertaken in compliance of World Bank Guidelines.

The experts that have been involved with the preparation of the environmental and social management plan for the Project, include:

- SEATEC International for the *Environmental Assessment and Management Plan* (“EAMP”);
- Acres International and Norplan for the original *Resettlement Action Plan* (“RAP”);
- Norplan for the *Ethnic Minorities Development Plan* for the Project Area (“EMDP”);
- Norplan for the *Social Development Plan* (“SDP”), which encompasses both the revised RAP and the EMDP;
- Independent experts for the GOL’s *Social and Environmental Management Framework and Operational Plan* (“SEMFOP”). This plan also contains information from the preliminary *biodiversity area management plan* prepared by the New York based NGO Wildlife Conservation Society (“WCS”), as well as from the *Environmental and Social Management Plan* (“ESMP”) - the original study prepared by International Union for the Conservation of Nature (“IUCN”) for the watershed and Nakai-Nam Theun NBCA;
- Lahmeyer International in association with Worley International for the *Study of Alternatives*, which identified and justified the Project as the most viable option for the GOL to undertake; and
- Louis Berger International for the *Economic Impact Study* of the Project on the GOL and on the GOL’s ability to use the revenue from the Project in an appropriate and cost effective manner.

The studies that have been undertaken and developed by the Sponsors and all the works of contractors and sub-contractors of the Project will be governed by the applicable environmental and social protection policies of the World Bank and the ADB.

In order to ensure that the Project is developed and operated in accordance with all applicable standards, three internationally recognized and fully independent panels have been established. These have closely monitored the Project’s development to date, and will continue to scrutinize the entire development and implementation of the Project. They are:

- the Panel of Environmental and Social Experts, commissioned by the GOL in conjunction with the World Bank;
- the International Advisory Group, responsible for advising the World Bank in its handling of the social and environmental issues on the Project; and
- the Dam Safety Panel of Experts, appointed by the GOL in conjunction with the World Bank.

The World Bank and many NGOs consider the work that has been undertaken by all parties for the Project as a model in these fields. A representative of the Panel of Environmental and Social Experts commented: “*The Panel believes the NT2 Project has the potential to have unique and truly globally significant environment benefits... We see the NT2 Project as a national development project that has the potential to pioneer new approaches to the integration of development and conservation*”



*activities and for poverty alleviation, providing a model, not just for Lao PDR but also for other countries throughout the developing world.”*

The Concession Agreement contractually defines, incorporates and costs all the relevant environmental and social obligations, including appropriate compensation principles and payments, that have been identified in the expert studies and that are to be strictly followed by the Project Company and the GOL.

These environmental and social obligations represent a significant amount of the total Project cost with the Project undertaking and funding additional ongoing environmental and social responsibilities throughout the Concession Period.

### 3.2 Watershed Protection

It is recognized that the Project will act as a natural barrier for the pristine forest of the Nakai-Nam Theun National Biodiversity Conservation Area (“NBCA”), which is in itself very valuable to the Project for being its watershed, ensuring continuous supply of water to the Project in the long run. Indeed, this world class primary forest area recognized to be of outstanding significance in terms of its biodiversity would have already been seriously degraded if the Project had not been under development for the past decade. By providing significant funding over the life of the Concession Agreement, NTPC and the GOL are committed to protect and conserve this 4,000 km<sup>2</sup> of forest and wildlife in the Project watershed and NBCA.



Accordingly, not only will NTPC secure its water source, but also it will financially contribute to the protection of the biodiversity in the watershed and that of some surrounding non-watershed corridors. With serious attention of the GOL, the World Bank, and the developers, there will be no more logging in this area, as long as the Project exists. The Project will directly contribute funding of USD 1.0 million per year in each of the 25 years after the beginning of commercial operations in order to support the action of and provide technical management to the Watershed Management Protection Authority (“WMPA”), a special purpose GOL entity established under the Prime Minister’s Office responsible for the management of the conservation in the Project watershed. An additional USD 6.5 million will be contributed during the construction phase.

### 3.3 Public Consultation and Participation

A high level of public consultation and disclosure has been a priority for the GOL and the Sponsors to ensure that all affected people are fully informed of the Project and that the views of the

affected population on the consequences of the Project are taken into consideration. Where relevant, the design of the Project has been amended to reflect any valid concerns.

In addition, extensive socio-economic surveys have been performed during the past eight years on both the population on the Nakai Plateau and those living along the Xe Bang Fai River. Over 200 consultations and workshops have been conducted for the affected people in order for them to actually participate to the Project's preparatory work, and later for them to be fully involved in the implementation process.



#### **3.4 Management of Resettlement Activities on the Nakai Plateau**

The Nakai Plateau, through which the Nam Theun River flows, is composed of agricultural land, heavily degraded forest, and both permanent and seasonal wetlands. With most stakeholders considering that the Project would go ahead sooner, logging inside the future reservoir boundaries had been authorized by the GOL in 1995. However, it was later confirmed that some illegal logging activities was going on outside the authorized limits, which triggered the decision by the GOL to ban all logging activities on the Nakai Plateau in early 2000.

The construction of the Project will require the resettlement of around 1,000 households, or approximately 5,700 people on the Nakai Plateau. The resettlement of these villagers onto the shores of the new reservoir will represent a considerable improvement in their livelihoods. Indeed, villagers have been hoping for relocation and better life to be created thanks to the Project since the beginning of its development. It is beyond the current financial capacity of the GOL to help improving these population's livelihoods without the funding assistance from the Project. Also, NTPC has already spent substantial amounts in building a pilot village to show to the villagers what kind of life they can expect. Moreover, NTPC is legally committed with the GOL through a very detailed Concession Agreement that was prepared in accordance with the GOL policy on poverty reduction and ethnic minorities' development and with World Bank guidelines.

Work on the pilot resettlement village began in early 2002, and the construction of the 29 houses, an irrigation dam and distribution system, and electricity supply is now almost complete. The families of the pilot village are now progressively enjoying a new livelihood based on organized land ownership, permanent farms and real community development. Ultimately, the entire 5,700 villagers will be re-established in similar locally designed villages, and provided with electricity, water supply, schools and kindergartens, clinics and other community infrastructures. Each village will have an irrigation system, and villagers will be fully supported in their choice of a range of livelihood options including irrigated agriculture, commercial forestry, reservoir fisheries and livestock husbandry. All resettlement villages will not be of any lower standard than the current pilot one.



### 3.5 Project Impacts on Downstream Areas

From the power plant to the water release in the Xe Bang Fai River, the routing of the 27 km downstream channel has been designed to avoid, to the greatest extent possible, the existing paddy fields in the Gnommalat Plain.

While having the positive effect of improving navigation and irrigation of the river, the increased flows in the Xe Bang Fai basin will result in the river adjusting its morphological equilibrium. Aeration structures and processes are incorporated within the design of the regulating pond and downstream channel to maintain the quality of the water entering the Xe Bang Fai River.

As part of the Concession Agreement, the Project will provide compensation for any negative livelihood impacts resulting from damage that may occur to riverbank gardens and land losses due to bank erosion caused by the increased water flows. Furthermore, there is a commitment to stop releases from the power station into the Xe Bang Fai River during peak flood periods to avoid increased downstream flooding. Also, it is recognised by the Project that the existing conditions in downstream fisheries may undergo some changes mainly due to the change of water flow. The 7,100 families in 89 villages, or about 40,000 persons, who live along relevant lower sections of the Xe Bang Fai River and nearby tributaries that could be potentially negatively impacted by the Project's water releases are being consulted about these issues, and a comprehensive mitigation plan will be implemented in coordination with the local authorities.



### 3.6 Summary of the main Project Benefits to the Lao PDR and the Region

- The Project will have many direct benefits for the population of the Lao PDR, including improved living standards for the local population, the opportunity for improvement of road, electricity and irrigation infrastructures at provincial level, and the implementation of employment and training opportunities at local, provincial and national levels. On a wider national scale, the successful implementation of the Project will allow a considerable improvement in respect of the Lao PDR's poverty reduction programme.
- By supplying Thailand with electricity at a very competitive tariff, the Project will help to develop the greater Mekong sub-region, through enhanced interregional trade.
- The Project is anticipated to be a major asset for the global environment. Funding from the Project will permit the long term protection of a 4,000 km<sup>2</sup> unique biodiversity and primary forest heritage that would otherwise not be protected. In addition, it has been calculated that the electricity generated from the Project over its life will save considerable amount of greenhouse gasemissions when compared to an equivalent sized gas-fired combined cycle plant.

## 4. PARTNERS AND CONTRACTUAL STRUCTURE

Following the nomination of the Project by the GOL, the Nam Theun 2 Electricity Consortium ("NTEC") was established in 1994 to develop the Project in accordance with World Bank requirements, Lao PDR laws and other appropriate guidelines. NTEC is an unincorporated joint venture between Electricité de France ("EDF") of France, Electricity Generating Public Company Limited ("EGCO") of Thailand, and Italian-Thai Development Public Company Limited ("ITD") of Thailand (together, the "Sponsors").

The Nam Theun 2 Power Company Limited ("NTPC" or the "Company") is a limited liability company that was incorporated under Lao PDR law on August 28, 2002 to undertake the Project. It is owned by EDF International ("EDFI") – a wholly owned subsidiary of Electricité de France ("EDF"), EGCO, ITD, and Electricité du Laos ("EDL") of the Lao PDR (together the "Shareholders").

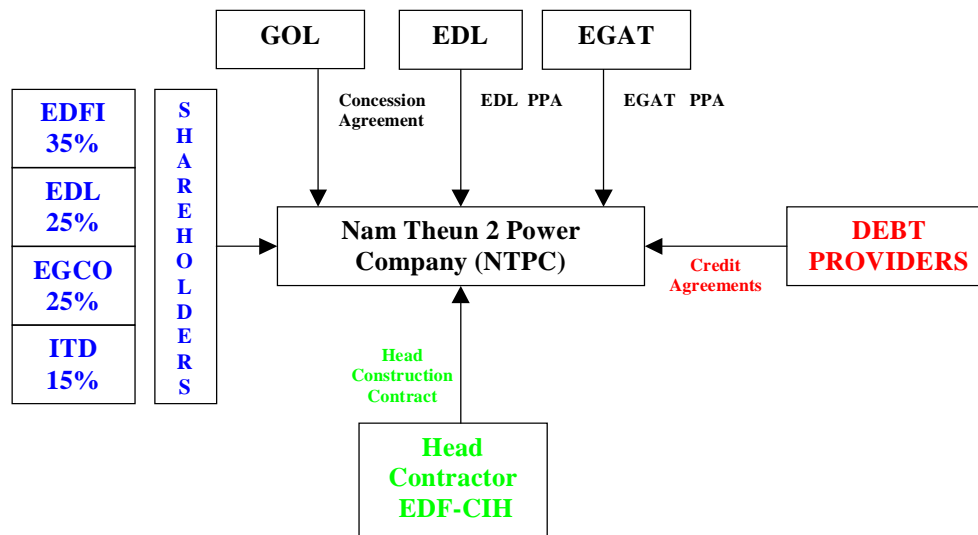


Fig. 7 Contractual structure

### **Electricité de France and EDF International (EDFI)**

Role in Project:

- Project Sponsor (EDF)
- Project Shareholder (EDFI)
- Head Contractor (EDF, acting through EDF-CIH)
- Technical Services and Personnel Management provider (EDF)

EDF is a public law entity owned by the French Government. The EDF group ranks as one of the largest enterprises in France and is one of the largest electric utility entities in the world with a total generating capacity of 101,255 MW including 20,655 MW of hydroelectric capacity. Outside of France, EDF, through EDFI, has shareholdings in approximately 44,828 MW of additional generating capacity (including plants under construction). EDF has participated in the construction of more than 600 hydroelectric schemes in France and elsewhere through the provision of hydroelectric and hydraulic expertise. EDF-CIH, the responsible division within EDF, is a world leader in undertaking hydroelectric related work, including the design, construction and testing / commissioning of projects.

### **Electricity Generating Public Company Limited (EGCO)**

Role in Project:

- Project Sponsor and Shareholder
- Technical Services and Personnel Management provider (acting through its subsidiary ESCO)

EGCO was established on 12 May 1992 in accordance with the Government of Thailand's privatisation policy for the energy sector in order to reduce the public sector's financial burden and to enhance the efficiency of the country's electricity generating operation. EGCO's establishment as the first independent power producer in Thailand was undertaken with the aim to acquire some of the assets of EGAT and to supply generating capacity and electrical energy to EGAT under long-term power purchase agreements. In addition, as a second line of business, EGCO has sought out possible investment opportunities and developments in both Thailand and neighbouring countries. EGCO is among the largest publicly listed energy companies in Thailand. It is a leading operator of independent generating capacity within Thailand with over 2,000 MW of generating capacity.

### **Italian-Thai Development Public Company Limited (ITD)**

Role in Project:

- Project Sponsor and Shareholder
- Principal Sub-Contractor under the Head Construction Contract

ITD is the largest publicly listed infrastructure construction company in Thailand. ITD's experience in constructing large-scale dams and hydroelectric power projects in South-East Asia is unparalleled with experience in the construction of earthfill, rockfill and concrete dams and tunnel construction. ITD has constructed seven major dams since 1970, including the Khao Laem Dam and hydroelectric project at Kanchanaburi which included a 1,000 m long, 127 m high concrete faced rock-fill dam.

## Electricité du Laos (EDL)

### Role in Project:

- Project Shareholder
- Offtaker
- Technical Services and Personnel Management provider

EDL is a statutory body established in 1959 to have responsibility for the generation, transmission and distribution of electricity within the Lao PDR. EDL is under the jurisdiction of the Department of Energy, which, in turn, is under the jurisdiction of the Ministry of Industry and Handicrafts. EDL was originally responsible for the distribution and supply of electricity in the Vientiane region, but has expanded to cover the entire national grid. EDL owns and operates the generation, transmission and distribution assets in the Lao PDR and manages the cross-border electricity sales involving its own plants and assets. EDL is a key shareholder in the two existing Lao PDR independent projects that currently sell electrical energy to EGAT, namely Theun Hinboun and Houay Ho.

### 4.1 Robust Contractual Framework

The Company has entered into the following agreements, summarised below:

- the *Sponsors Agreement* between EDF, EGCO, ITD and the GOL, under which the Sponsors agreed to develop the Project;
- the *Shareholders Agreement* between EDFI, EGCO, ITD and the GOL (acting through EDL), under which the Shareholders agree to implement the Project;
- the *Concession Agreement* (or “CA”) with the GOL, under which the GOL grants the Company a concession to develop, own, finance, construct, operate the Project and transfer it to the GOL at the end of the concession period. The CA is for a period of 25 years from the date of Commercial Operations under the EGAT PPA and includes provisions detailing the rights and obligations of both the GOL and the Company, including the performance obligations of the GOL and the Company, GOL and Company Events of Default, Force Majeure Events and Termination;
- the *EGAT Power Purchase Agreement* (or “EGAT PPA”), under which the Company shall make available generating capacity of up to 995 MW and electrical energy of 5,636 GWh per year to EGAT to be purchased at an agreed tariff on a take-or-pay basis. The EGAT PPA is for a period of 25 years from the date of Commercial Operations and includes provisions detailing the rights and obligations of both EGAT and the Company, including the performance obligations of EGAT and the Company, EGAT and Company Events of Default, Force Majeure Events and Termination;
- the *EDL Power Purchase Agreement* (or “EDL PPA”), under which the Company shall make available generating capacity of up to 75 MW and electrical energy of 200 GWh per year to EDL to be purchased at an agreed tariff on a take-or-pay basis. The EDL PPA will be for a period of 25 years from the date of Commercial Operations under the EGAT PPA and will include provisions detailing the rights and obligations of both EDL and the Company, including the performance obligations of EDL and the Company, EDL and Company Events of Default, Force Majeure Events and Termination;

In addition, the Company has entered into negotiations in respect of the following Project agreements, summarised below:

- the *Head Construction Contract* (or “HCC”) with EDF, acting through its hydraulic engineering division the Centre d’Ingenierie Hydraulique (“EDF-CIH”), under which the Head Contractor (“HC”) shall construct the Project on a date certain, fixed price turnkey basis. The HCC includes provisions detailing the rights and obligations of both the HC and the Company, including the

- performance obligations of the HC and the Company, the HC and Company Events of Default, liquidated damages for performance and delay and Termination; and
- the *Technical Services and Personnel Management Services Contracts* under which EDF, EDL and EGCO (or their respective subsidiaries) will provide technical services and staffing to the Company to ensure that the Project is operated, repaired and maintained in accordance with all applicable laws and regulations, the CA, the EGAT PPA and the EDL PPA.

## 4.2 Commercial Aspects

Under the proposed financial and contractual structure, the Project's electrical energy will be sold under long-term "Take-or-Pay" Power Purchase Agreements with both EGAT and EDL supplying intermediate peaking electricity at different tariff categories according to the time of the day it is supplied. The Project's cashflow stability is predicated upon

- the prudent design, construction, operation and maintenance of the Project;
- the contractual mechanisms and protection within the EGAT PPA, which represents approximately 96% of the forecast revenue of the Project; and
- the hydrological regime of the Nam Theun River.

### 4.2.1 Proven Hydrological Record

Fifty years of hydrological records and direct flow measurements have been studied extensively. Such statistics provided the Sponsors with sufficient comfort to design and develop the scheme, and negotiate a long term Power Purchase Agreement with EGAT. The flows of the Nam Theun River have been measured, either directly or indirectly, since 1950 and average 7.5 billion m<sup>3</sup> per annum. The reservoir capacity is 3.9 billion m<sup>3</sup> and, based on the long-term average, could be filled easily in the wet season.

In 49 of the 50 years since records began, the water flows of the Nam Theun River were greater than the reservoir's total capacity. In every year since records began the water flows of the Nam Theun River would have filled the reservoir's "live capacity" (i.e. the water volume that can be used for generating purposes).

### 4.2.2 Stable Project Economics

As the ability of the Company to supply energy to EGAT depends on, inter alia, hydrological conditions, the PPA has been negotiated to establish a mechanism that stabilises the Company's cash flow by dampening the effects of hydrological variation.

### 4.2.3 Reliable offtaker

EGAT is a state-owned juristic entity established in 1969 under the EGAT Act, B.E. 2511 responsible for the generation and transmission of electrical energy in Thailand. EGAT is the largest electrical generator in Thailand, accounting for over 56% of generating capacity. Whilst the obligations of EGAT are not explicitly guaranteed by the Government of Thailand, the EGAT Act provides for financial support from the Government of Thailand in the event that EGAT is unable to meet its debt obligations. Standard & Poor's recently raised its long-term local and foreign currency ratings on EGAT to A- and BBB from BBB+ and BBB- respectively. EGAT has historically honoured in full all of its commitments to take or pay for electrical energy for the other hydroelectric power projects in Lao PDR as well as the commissioned Thai IPPs.

Given the increased demand for power in Thailand, the Project is regarded as a critical development to maintain Thailand's reserve margin at the appropriate required level thanks to the long-term provision of competitive and high quality electricity supply having a high degree of flexibility and reliability.

### 4.3 Project Cost and Financing

The Project's total base cost exceeds US\$ 1 billion and will be financed by a combination of equity by the Shareholders (28%) and international loans (72%). NTPC has requested support from the World Bank and the Asian Development Bank in the form of partial risk guarantees and other involvement in the Project financing activities. Several international and Thai financiers are expected to participate, including the European Investment Bank, the Agence Française de Développement, Export Credit Agencies and commercial banks.

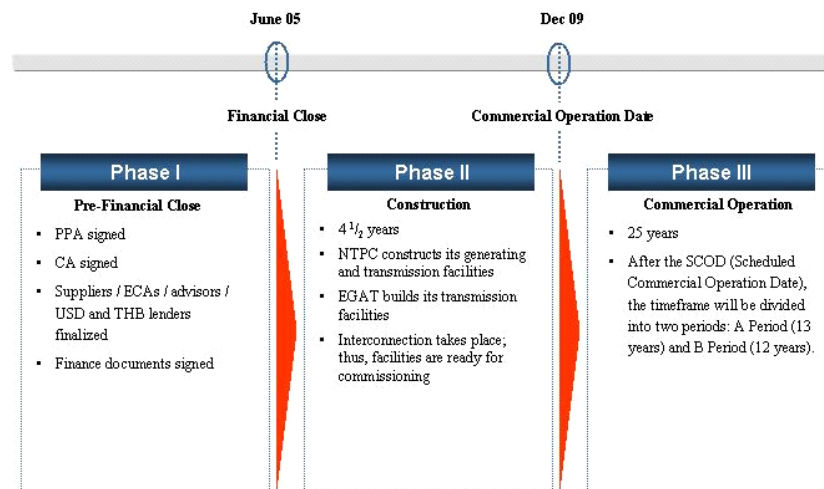


Fig. 8 Tentative Project Schedule

## 5. REFERENCES

- [1] World Bank Independent Advisory Group (IAG) reports. Report #1 – August 1997, Report #2 – December 1998, and Report #3 – April 2001.
- [2] Independent Environment and Social Panel of Experts (POE) Reports. Report #1 – February 1997, Report #2 – July 1997, Report #3 – January 1998, Report #4 – January 1999, Report #5 – January 2001, Interim Report – April 2002, and Report #6 – March 2003.



6. APPENDIX

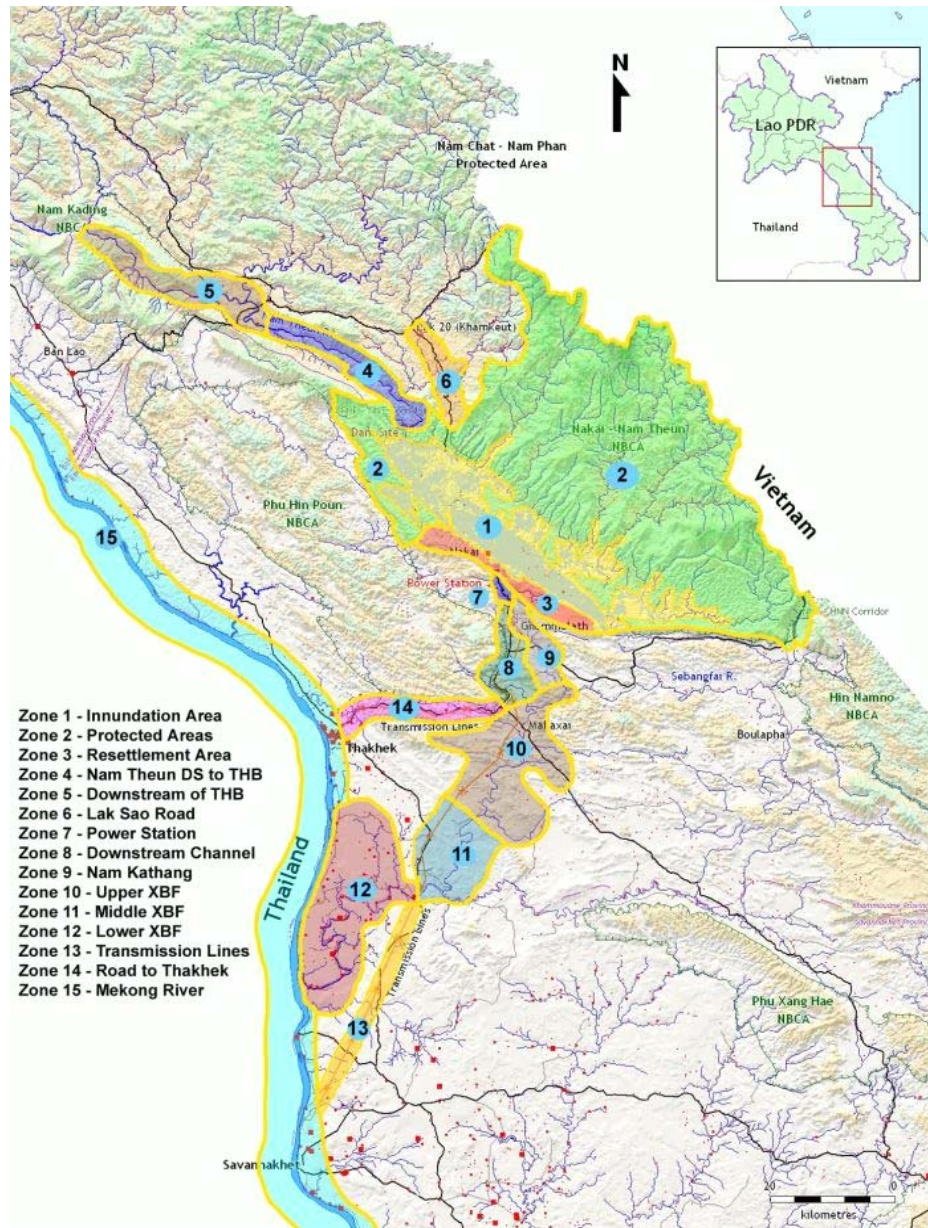


Fig. 9 Project Map