



Deutsche Gesellschaft für Sonnenenergie e.V.
International Solar Energy Society, German Section

Asia Pro Eco project TH/Asia Pro Eco/05 (101302):
**Diagnostic Study on Renewable energy Potential
and Feasibility in South East Asia**



Final Report
on
Energy Status in Lao PDR

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Summary

Since the late 1980s, the government's economic policy has been to move rapidly from a centralized, planned economy toward an open, liberalized, market-oriented economic system. The foreign exchange markets were also opened and formal exchange controls lifted, and the Lao currency (kip) now floats freely based on supply and demand. Gross Domestic Product (GDP) has been growing annually at 4% to 7% since the crisis and the economy is expected to continue on this trajectory for the next few years .

Real GDP growth over the last few years has been in the range of 5.5 – 6.5 % / year .

GNP in 2002 was US\$ 320 / capita in 2002, and is estimated to have increased to about US\$ 370 / capita in 2004. The Mainly Economic in Laos is from the Agriculture , Forestry, Power Generation, Mining, Small industries and agriculture is 50% of the Gross Domestic Product , while the Industry is 24% and Services 26 % (the National Statistic in 2003) .

Hydropower is the most abundant and cost – effective energy source with a theoretical hydroelectric potential of about 26500 MW but about 80% of population living in the rural areas and their main energy consumption are from fuelwood .

On a domestic level, the Lao power system is still in a low stage of development. Currently only 42% (2003) of households in Lao PDR are electrified but the Government of Lao PDR (GOL) has committed itself to increasing this to 90% by 2020 , 70 % by 2010 and 45% by 2005 .

In Lao PDR, the power sector serves two vital national priorities: as It promotes economic and social advancement by providing a reliable and affordable domestic power supply and It earns foreign exchange from electricity exports

In order to meet the Government 's target about 90% of household to be electrified by 2020 , the government support to develop all power resources with the friendly environmental such as Hydro , Thermal , Renewable , Hybrid System and Cogeneration Energy.

In Lao PDR, the power sector serves two vital national priorities:

1. It promotes economic social advancement by providing a reliable and affordable domestic power supply
2. It earns foreign exchange from electricity exports

Government gives priority to power sector devolopment as ameans of achieving macroeconomic, microeconomic snd social aspirations. The target of the government aims to be electrified 90% of the households by the year 2020, 70% by the 2010 for poverty reduction



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Abbreviations

ADB	Asian Development Bank
ASEAN	Association of South East Asian Nations
BCEL	Banque pour le Commerce Exterieur Lao
BSRP	Banking Sector Reform Programme
BLA	Bilateral Agency
BOO	Build Own Operate
BOOT	Build, operate, own and transfer
BOT	Build, operate, transfer
BTF	Build, transfer, and finance
BTL	Build, Transfer, Lease
COD	Commercial Operation Date
DOE	Department of Electricity (of the Ministry of Industry and Handicraft)
DSCR	Debt Service Coverage Ratio
DSM	Demand Side Management
EBIT	Earnings before Interest and Tax
EBRD	European Bank for Reconstruction and Development
EdL	Electricité du Laos
EGAT	Electricity Generating Authority of Thailand
EIA	Environmental Impact Assessment
ECA	Export Credit Agency
EPF	Electric Power Forum
ESCO	Electricity Supply Company
EVN	Electricity of Vietnam
FIMC	Committee for Investment Management & Foreign Economic Cooperation
FDI	Foreign Direct Investment
FMAC	Financial Management Adjustment Credit
FMCB	Financial Management Capacity Building
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GMS	Greater Mekong Subregion
GOL	Government of Lao PDR
GWh	Gigawatt-hour
HHPC	Houay Ho Power Company
HIPC	Highly Indebted Poor Country
ICB	International Competitive Bidding
IDA	International Development Association
IEE	Initial Environmental Examination



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IFC	International Finance Corporation
IMF	International Monetary Fund
IPP	Independent Power Producer
IRR	Internal Rate of Return
IT	Information Technology
JICA	Japan International Cooperation Agency
JOC	Joint Operating Contract
KfW	Kreditanstalt für Wiederaufbau (German bilateral agency)
kW	kilowatt
LDC	Lesser Developed Countries
LNCE	Lao National Committee for Energy
kWh	Kilowatt hour
LCB	Local Competitive Bidding
MIGA	Multilateral Investment Guarantee Agency
MIH	Ministry of Industry and Handicraft
MOF	Ministry of Finance
MOU	Memorandum of Understanding
MTN	Medium Term Notes
MV	Medium Voltage (22 kV in Lao PDR)
MW	Megawatt
NEM	New Economic Mechanism
NPEP	National Poverty Eradication Programme
NGO	Non-Governmental Organization
NTPC	Nam Theun Power Company
OCO	ADB's Office of Cofinancing Operations
ODA	Official Development Assistance
OPIC	Overseas Private Investment Corporation
O&M	Operation and Maintenance
PRGF	Poverty Reduction and Growth Facility
PPA	Power Purchase Agreement
PPIAF	Public Private Infrastructure Advisory Facility
PPP	Public-Private Partnerships
PRI	Political Risk Insurance
PRG	Political Risk Guarantee (ADB) or Partial Risk Guarantee (World Bank)
PSDP	Power Sector Development Plan
PSFS	Power Sector Financing Strategy ("PSFS Study")
PTD	Power Transmission and Distribution (ADB grid extension project in the north)
RFP	Request for Proposals



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RE	Rural Electrification
RED	Rural Electrification Division, MIH
RMB	Chinese Renminbi
ROO	Rehabilitate Own Operate
ROT	Rehabilitate Operate Transfer
SPC	State Planning Committee
STEA	Science, Technology and Environment Agency
SOE	State Owned Enterprise
SPC	State Planning Committee
SPP	Small Power Producer (developers of small power generation projects)
SPRE	Southern Provinces Rural Electrification
SWER	Single Wire Earth Return
THPC	Theun Hinboun Power Company
TOR	Terms of Reference
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organization

1 ENERGY GENERATION

Lao PDR is endowed with significant indigenous energy resources. Energy use within the country is still dominated by the use of fuel wood, which accounts for about 90% of total energy requirement.

The energy resources range from traditional energy source such as fuel-wood to coal and hydropower is in **Table 1**.

Table 1: Primary Energy Resources in Lao PDR

Resource	Reserves	Potential for Use in Power Generation
Oil and Gas	Three exploration concessions in central and southern Laos. Mapping and geophysical investigations carried out, including one deep drill hole (2,560 m). Results not yet evaluated	Possibly in the longer term (10-15 years), if sufficient reserves found
Coal (Lignite)	Major resource located at Hongsa in north-west Lao PDR. About 810 million tones proven reserve, of which over 530 million tones is deemed economically recoverable. Energy content 8-10 MJ/kg, relatively low sulfur content of 0.7-1.1 %	Sufficient reserves for about 2,000 MW installed capacity
Coal (Bituminous and Anthracite)	Reserves, mainly anthracite, dispersed in various fields throughout Lao PDR. Exploration ongoing Total proven reserve to date about 100 million tones Energy content 23-35 MJ/kg	Current annual production of 130,000 tones, used for local factories or export. Possible longer-term option for around 500 MW installed capacity, depending on results of exploration
Solar	Annual solar radiation received in Lao PDR about 1800 kWh/m ² , possibly less in mountain areas Corresponds to conditions in southern Europe (Italy, Spain)	Photovoltaic modules already used for small-scale (e.g. 100 W) remote applications.
Wind	Mean wind speeds at Luang Prabang and Vientiane around 1 m/s, in mountain areas likely to be somewhat higher	Costs in areas of less than 4 m/s likely to be in upper end of range US\$ 0.05-0.25 per kWh, hence limited potential
Geothermal	No significant known reserves	Limited potential for power generation
Biomass (waste)	Biomass resources dispersed throughout the country	Current share of biomass (mainly wood fuel) in total energy consumption about 88%. Wood-fired cogeneration (heat and power) plants could be economic for self-supply in wood processing facilities
Hydropower	Average annual precipitation about 2,000 mm. Total runoff around 240,000 million m ³ Theoretical hydropower potential of 26,000 MW (excluding mainstream Mekong)	Exploitable hydropower potential, including share of mainstream Mekong, around 23,000 MW

1.1 Hydro Power

Hydropower is the most abundant and cost-effective energy source with a theoretical hydroelectric potential of about 26,500 MW excluding mainstream Mekong. Of this, about 18,000 MW is technically exploitable, with 12,500 MW found in the major Mekong sub-basins and the remainder in minor Mekong or non-Mekong basins. In addition, important lignite and coal deposits have also been discovered. The forest areas which cover over 47 % of total land are a potential source for substantial traditional energy supplies.

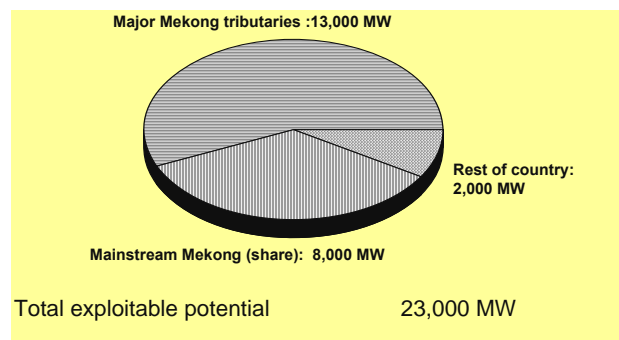


Figure 1: Exploitable Hydropower Potential of Lao PDR

Most of Hydropower Potential site for the big scale in Laos are in the Central and South while the Potential site for the small scale are in the North, List of Hydro Power Potentials sites is in the **Figure 3** and **Table 2**.

Figure 2: Some Hydropower Potential in Laos (for the Medium and Large scale)

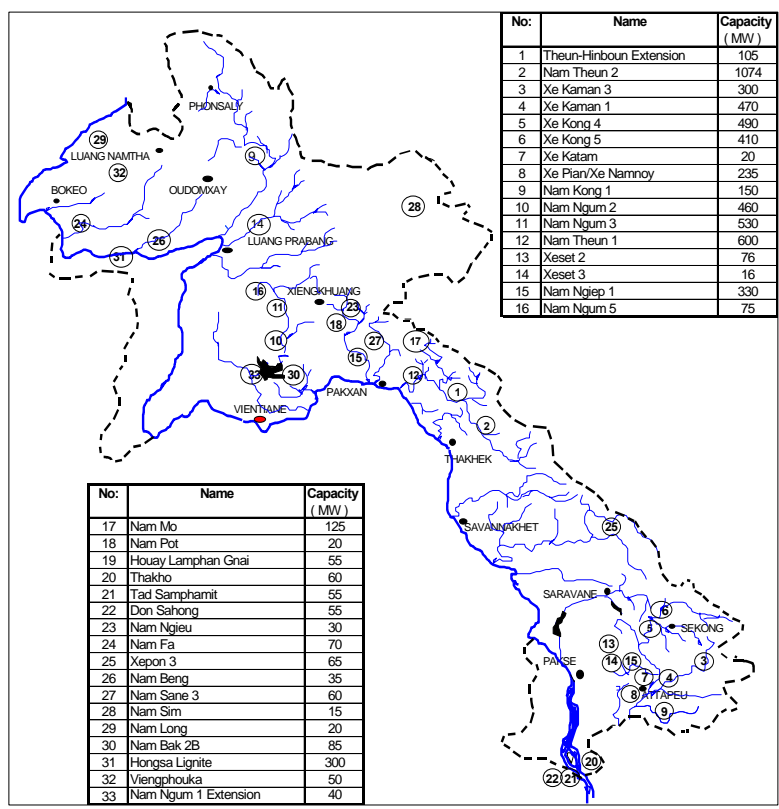


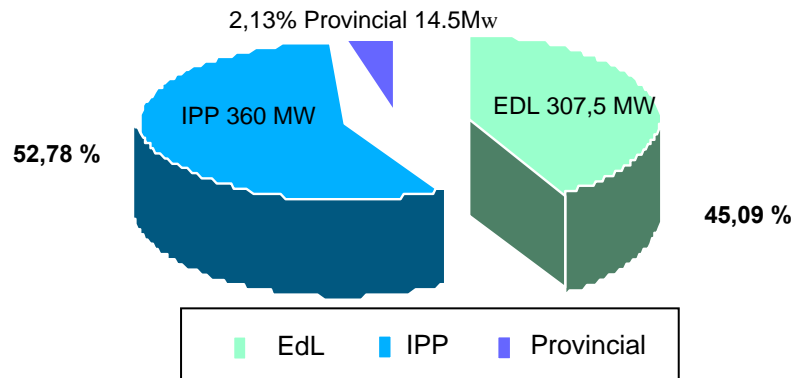
Table 2: List of some Small/Micro- Hydro Power Potential sites in Laos

No.	Name of Projects	Estimated capacity, kW	Province	Location	Remark
1.	Nam Tha 3	1,200	Luangnamtha	North	Under construction (will complete at the end of 2004)
2.	Nam Fa	750	Luangnamtha	North	
3.	Nam Long	7,000	Luangnamtha	North	
4.	Houay Khouang	250	Luangphabang	North	
5.	Nam Pa	70	Luangphabang	North	
6.	Nam Gnon	460	Bokeo	North	Signed MOU Aug 2005
7.	Nam Khieo	100	Bokeo	North	
8.	Nam Ngao	3,000	Oudomxay	North	
9.	Nam Pak	2000	Ouomsay	North	
10.	Nam Sim	7,800	Houaphan	North	Signed MOU Feb 2003
11.	Nam Hao	5,000	Houaphan	North	Signed MOU Aug 2004
12.	Nam Noua	2,000	Houaphan	North	
13.	Nam Peun 2	300	Houaphan	North	
14.	Nam Kouan	200	Houaphan	North	
15.	Nam Ham 2	2,000	Xayabouly	Central	Signed MOU Aug 2005
16.	Nam Ken	1,200	Xayabouly	Central	
17.	Nam Lay	1,200	Xayabouly	Central	
18.	Nam Pot	2,000	Xiengkhouang	Central	
19.	Nam Ngan	400	Xienkhouang	Central	
20.	Nam Phe	800	Phonsaly	North	
21.	Nam Boun 2	1,500	Phonsaly	North	
22.	Nam Kai	500	Phonsaly	North	
23.	Nam Pok	2,600	Phonsaly	North	
24.	Nam Nga	200	Phonsaly	North	
25.	Nam Ou 1/1	500	Phonsaly	North	
26.	Nam Yang	200	Bolykhamstay	Central	
27.	Tadsiengleu	800	Khammoun	Central	

28.	Tadsaland	3,200	Savannakheth	Central	
29.	Tadnamuang	150	Bokeo	North	
30.	Total	41,080			

The total installed Capacity from hydro power generation plants existing in Lao PDR is 682,043 MW of which 672,75 MW (98,64 %) are from hydropower plants and the remaining 9,29 MW (1,36%) are Diesel generation and other sources. From the total produced by Hydropower plants, 307,5 MW (45.09%) are owned by EDL, another 360 MW (52,78%) are from IPP plants and the remaining 14,52 MW (2,13%) belong to the provincial authorities and communities as show in the figure below

Figure 3: Installed Capacity in year 2005



Nam Ngum I (1971), Nam Leuk (2000) and Nam Mang 3 (2005) Hydro power stations has supplied energy for domestic demand in Vientiane areas and in some part of Thailand since it was commissioning in 1991 and 2 provinces (Thakhek and Savannakhet) in the centre part are supplied by power imported from Thailand's grid and then Luangprabang areas, supplied by Nam Dong hydro power after 1970 and from 1994 a 115 KV transmission line connected the region with Nam Ngum station. Since 1998-99, large scale of hydropower plants (Theun-Hinboun: 210 MW and Houay Ho: 150 MW) were completed under IPP (Independent power producer) form. It has exported their energy to Thailand. The existing power plants for export purpose, including IPP plants are in Attachment 1 below

1.2 Others Energy Resources

1.2.1 Coal in Laos:

Coal mine is one of most important energy resources in Laos and there are many coal mines in Laos one of the most popular is Hongsa Lignite in Sayabuly province (North) which is for the future Thermal Power Plant to have the installed capacity between 300 and 1400 MW, supply to the Lao National Grid and to Thailand by the high voltage transmission line 500 kV. Viengphouka lignite deposit in Luangnamtha province is also one of the potential thermal power plants with installed capacity 50 MW and there other potential deposits in the North, Central and South of Laos.

Lao PDR Coal Industry is still young. The first mine, a small anthracite mine at Bo Chanh in Northwest of Vientiane province is operated by the State Mining Enterprise for coal in 1985 mainly for domestic production and principally for the cement industry. The Bo Chanh deposit has reserves estimated at 5 million tones. In 1989, the operation was transferred to the Lao Cement Company. The coal mining operation has provided with the objective only to supply the production of Lao cement of the company. The second mine, a small lignite mine at Viengphoukha in Louangnamtha province was opened in 1995 by the Thai private company.

1.2.2 Biomass in Laos

The forest are already a vital economic resources for Lao PDR , there provide essential contribution to the consumption and income of rural poor people and conserve biodiversity, soil and water values. The rural people 80% of the Lao population rely heavily on the forest for food, fuel, medicines, houses and shelter. Energy use within the country is still dominated by the use of fuel wood, which accounts for about 88 % of total energy requirement.

There is little experience of biomass systems in Lao PDR , although wood –fired cogeneration (heat & power) plants could be economic for self –supply in wood ,sugar processing facilities. In the rural areas, rice is generally widely distributed, now in the rural areas, the rice husk are using as a component of animal feed, and when the rice husk is burned the remaining ash is used as a component of fertilizer .

The high potential for the Biomass in Laos are waste wood, sugarcane bagasse and rice husk.Forest cover (in percentage) in Laos PDR is higher than in neighbouring countries as Vietnam, Thailand, China, but lower than in Cambodia and Myanmar. **Table 3** gives the forest cover areas of ASEAN countries.

Table 3: Forest Cover of ASEAN Countries year 2000

Country	Land (1000ha)	Population (million)	Rural (%)	Forest Land (1000ha)	Cover (%)	Wood Volume (m ³ /ha)
Lao PDR	23.680	5,2	80	11.160	47	30
Cambodia	17.650	11	77	9.330	52	40
Vietnam	32.550	79	80	9.810	30	38
Thailand	51.080	61	78	12.840	25	17
Myanmar	65.750	45	73	34.410	52	33
Malaysia	32.850	22	43	19.290	58	119
Indonesia	181.150	209	61	104.980	58	79
Singapore	61	3,5	0	2	3	119
Philippines	29,10	74,5	42	5.790	19	66
Brunei D.	527	0,3	28	442	83	119
Total	435.108	510,5		208.054		

Source: State of the World's Forests 2001, FAO.

SIDA supported a reconnaissance survey of Lao forest in 1988-89 and the National Forest Inventory (NFI) in 1991-99 using 1988-89 SPOT satellite imagery, to provide detailed information on the quantity and quality of forest resources. Forest Type and Forest Land Use Maps have been completed for the whole country.

Preliminary results of National Forest Inventory indicate that forest cover 11 million ha, or 47% of Lao Land. Forests are distributed with the great concentration in the Central and Southern Regions, particularly in five Provinces: Borikhamxay, Khammuane, Savannakhet, Champasak and Attapeu, witch account for 42% of National Forest. **see Table 4.**

Table 4: Land Area, Forest Land and Production Forest

Provinces	Land Area (1000 ha)	Forest Land (1000 ha)	Forest cover (%)	Production Forest		
				N. Zone	Area (1000 ha)	Stock (1000 m ³)
Northern region	9.693	3.571	36	28	969	18.773
Phongsaly	1.627	667	41	2	65	977
Luangnamtha	933	512	57	1	13	900
Oudomxay	1.537	415	27	3	54	559
Bokeo	620	304	49	7	98	6.790
Luangprabang	1.687	371	22	1	3	59
Houaphang	1.650	594	36	5	306	2.998
Xayabury	1.639	688	42	9	430	6.490
Central region	9.587	4.984	51	49	1.301	51.201
Vientiane M.	392	125	32	2	56	871
Xiengkhuang	1.588	746	47	4	223	2.840
Vientiane	1.593	637	40	8	123	4.396
Borikhamxay	1.486	966	65	8	269	8.616
Khammuane	1.632	963	59	6	196	15.546
Savannakhet	2.177	1.198	55	13	332	12.130
Xaysomboun	710	349	49	8	102	6.802
Southern region	4.409	2.612	58	14	217	7.919

Saravane	1.069	577	54	4	73	3.144
Sekong	766	414	54	3	45	1.320
Champasack	1.542	940	61	3	53	1.759
Attapeu	1.032	681	66	4	46	1.696
Total:	23.689	11.167	47	91	2.487	77.893

Sources: Department of Forestry, MAF, 1995, 1996

There are other estimates of forest cover in Lao PDR. GTZ and Mekong River Commission (MRC) supported the Forest Cover Mapping Project, an assessment of forest cover and forest land-use based upon 1992-93 and 1996-97 LANDSAT photos. GTZ/MRC classified 9.6 million ha or 40,6% of the national land, as forest cover in 1993, and 9,4 million ha or 39,7% in 1997.

There are about 2,5 million ha officially designated as Production Forests. Of the Production Forest Area, 696.000 hectares (39%) are in the Northern Region, 1,3 million hectares (52%) in Central Region, and 217.000 hectares (9%) in the Southern Region.

The potential production forest volume was estimated of 77,8 million cubic meters (31 m³/ha).

Criteria for designation are not published and the official Production Forest is not mapped. Production Forest designation seems to be largely administrative and not technical or economic.

Forest comprise a wide variety of commercial tree species suitable for production of swan, timber, plywood, parquet and furniture. The commercial forest areas at 1,3 Mha whereas the potential commercial forest area is estimate at 2,5 Mha. Data on land resource availability and use in the country are showed in **Table 5**. This data provide the preliminary indication of the current use of land resources in the country and aggregate changed in 1982, but is dominated by a forest perspective.

Table 5: Land Used Statistic

No :	Land used group /land use and vegetable type	Area %	(' 1000 ha)
1.	Current forest	47.162	11167.9
2.	Dry dipterocarp	5.095	1206.5
3.	Lower dry evergreen	0.361	85.5
4.	Upper dry evergreen	4.480	1061.0
5.	Lower mixed deciduous	3.657	866
6.	Upper mixed deciduous	31.457	7448.9
7.	Gallery forest	0.369	87.5
8.	Coniferous	0.559	132.3
9.	Mixed coniferous Broad-leaved	1.184	280.5
10.	Potential Forest	37.791	8949.0
11.	Bamboo	6.469	1531.9
12.	Unstocked	2.642	625.6
13.	Ray	6.099	1444.4
14.	Other wooded areas	3.854	912.5
15.	Savannah/open wood land	2.245	531.7
16.	Heath Scrub forest	3.587	849.5
17.	Permanent Agriculture land	3.334	789.4
18.	Rice paddy	0.075	17.8
19.	Agriculture plantation	0.179	42.3
20.	Other agriculture land	5.361	1269.5
21.	Other non forest land	0.49	116.1
22.	Barren lands /rock	3.474	822.8
23.	Grass land	0.356	84.2
24.	Urban areas	0.149	35.4
25.	Swamps	0.891	210.9
	Total	100	23680.0

Sources: the First National Communication on Climate Change , October 2000

1.3 Biogas in Laos



Biogas obtained by anaerobic fermentation of cow dung and other organic matters can be used as an energy source for cooking, lighting and other purposes. Biogas technology was introduced in Lao PDR in 1983 through the assistance of FAO. Initially, there family-size biogas units were set up by the Ministry of Agriculture and Forestry with the cooperation of FAO. Since 1983, STEA has been involved in the development of pilot biogas plants. At present 50 biogas plants with capacity ranging from 6 to 16 m³ each have been installed in the country so far. According to estimates, the potential of biogas from recoverable animal wastes in Lao PDR is some 189 ktoe/year. (Bhattacharya et al., 1997)

Biogas energy resource from the anaerobic fermentation of animals in Laos are low possibility but from the waste bagasse especially in Vientiane Municipality is the high potential because of the waste in Vientiane Municipality is about 130 Ton /day.

1.4 Wind in Laos

According to the Wind Energy Resource Atlas of South Asia prepared by the world Bank Asia Alternative Energy Programme (STAE, 2001), good to excellent wind resource areas for large-scale wind generation are found in central Laos. Also, good to excellent wind resource for village power generation and water pumping using small turbines are predicted for south- central Laos. However, a detailed assessment of wind energy potential in Lao PDR has yet to be carried out (LNCE, 2002).

1.5 PV Solar in Laos

Lao PDR is located in the tropical zone and has an average daily solar radiation level of 4,5 to 4,7 kilowatt-hour per square meter (kWh/m²). Solar photovoltaic (PV) systems were first introduction in Lao PDR during the 1980s .These earliest PV project were using for the telecommunication system , now a day the PV solar are widely using more in the whole country for telecommunication ,Solar Home System , Battery Charging station , medicine and Hybrid System (Between Micro Hydro Power and PV Solar) .

2 TRANSMISSION LINE AND SUBSTATION FACILITIES

2.1 Transmission line

Based on the particular characteristics of the Lao PDR and the existing power grids as well as to facilitate the process of conducting electricity demand forecast, the whole country has been divided into 4 regions (according to EDL Power Development Plan PDP 2004-2013).

- A. Central 1: Vientiane Prefecture, Vientiane province, Xaysomboun special Zone and the provinces of Luangprabang, Sayabury, Xieng Khouang and Borikhamxay
- B. Central 2: The provinces of Khammouane and Savannkhet
- C. Northern: The provinces of Phongsaly, Oudomxay, LuangNamtha, Bokeo and Hua Phan
- D. Southern: Champasak, Saravane, Attapeu and Sekong

The four transmission voltage systems in operation for domestic power supply in the four regions are not interconnected, and function separately, the four main 115 kV Transmission lines systems are: Vientiane'115 kV transmission line System, Thakhek'115 kV transmission line system, Savannakhet'115 kV transmission line system and Saravane'115 kV transmission line system.

2.1.1 Vientiane '115 kV transmission line system

Vientiane region is provided by 3 major hydropower plants: Nam Ngum 1 with 155 MW, Nam Leuk: 60 MW, and Nam Mang 3: 40 MW of which plays the important role in this system and it is the largest system of the four regions. At the present time the system supplies energy for Vientiane/Paksan, Vang vieng/Luangprabang and it is planned to link up Nam Ngum substation to the provinces of Oudomxay, Luang Namtha, Phongsaly and Saysomboun/ Xieng Khouang areas, by building new substations for each location.

Actually, at Nam Ngum 1 there are 3 circuits of 115 kV transmission lines in operation, one line, set up for export purpose is connected Phone tong substation to Egat power station in Thailand, the second circuit is set up in Thakhek and Savannakhet in order to import power back from Thailand through Nakhonephanom and Mukdahan, the third new reinforced circuit is connected Tha Lat station (Nam Ngum 1) to Luangprabang substation, extended over 212 km via Vang Vieng substation in order to supply the Northern region.

2.1.2 Thakhek' 115 transmission line system

Actually, the 115/22 kV Substation is in operation in Thakhek in replacement of the former 22 kV submersible line, in order to import power from Nakhone Phanom substation in Thailand,.

2.1.3 Savannakhet'115 transmission line system

Due to the insufficiency of domestic power supply, the Savannakhet'115 transmission line system is set up in order to import power from Thailand, by connecting the 115/22 kV Pak Bo substation to the Egat' system in Mukdahan through the 115 transmission line across the Mekong river, to feed Savannakhet city then extended to Keng Kok district, 50 km further.

2.1.4 Saravane ' 115 kV transmission line system

This system is fed by 2 hydropower plants, Xeset (45 MW) and Selabam (5 MW) and another 2MW from IPP plant of Houay Ho, it is set up in order to supply power for rural areas of Saravane and Champassak provinces and the city of Pakse. In the near future Attapeu province and Siphandone area (Khong District) will be supplied by this system, actually the construction of 115 kV grid and substation are ongoing).

Besides the domestic supply, the surplus of energy from the 2 Plants (Xe set 1 & Selabam) was exported to Thailand, as Xe set 1 is conceived as a run-of river type, and during the dry season, the station couldn't run in full capacity due to lack of water and to feed the system it is necessary to import back the energy from Thailand through a 115 kV transmission line.

The systems described up above are operated by EDL to provide mostly energy for local consumers of which the surplus is exported particularly to Thailand.

Existing 115/22 kV Substations feeding the four systems are summarized in Table 6.

Table 6: Existing 115/22 KV Substations (December 2005)

No	Substation	Supply Area	Capacity	Total Capacity
1	Luangprabang	Central 1	2 x 12,5 MVA	25 MVA
2	Vang Vieng	Central 1	2 x 16 MVA	37 MVA
3	Phonesoung	Central 1	1 x 10 MVA	10 MVA
4	Nam Ngum 1	Central 1	1 x 7,5 MVA	7,5 MVA
5	Nam Leuk	Central 1	1 x 5 MVA	5 MVA
6	Tha Ngon	Central 1	1 x 22 MVA	22 MVA
7	Phone Tong	Central 1	3 x 30 MVA	90 MVA
8	Thanaleng	Central 1	1 x 22+ 1x10	32 MVA
9	Paksan	Central 1	MVA	5 MVA
10	Xayabury	Central 1	1 x 5 MVA	16 MVA
11	Phonesavan	Central 1	1 x 16 MVA	16 MVA
12	Ban Done	Central 1	1 x 16 MVA	16 MVA
13	Nong Hai	Central 1	1 x 16 MVA	16 MVA
14	Thakhek	Central 2	1 x 16 MVA	20 MVA
15	Pak Bo	Central 2	1 x 10 MVA	20 MVA
16	Xepon mine	Central 2	1 x 10 MVA	20 MVA
17	Ban yo	Southern	1 x 10 MVA	32 MVA
18	Xe set 1	Southern	2x8+1x16 MVA	5 MVA
19	Ban Jiangxai	Southern	1 x 5 MVA	10 MVA
20	Ban Hat	Southern	1 x 10 MVA	10 MVA
	Total			414,5 MVA

Note: In addition to the twenty 115/22 KV Substations there 2 T-off 115/115 KV Sustations:

- a. Thalat-T-off Station 115/115 KV
- b. Nakhounnoy T-off Station 115/115 KV

Besides the four 115KV Transmission systems used for domestic supply, two 230 KV double circuit lines are in operation to export power from IPP plants (Theun Hinboun, Houay Ho) toward Thailand, it was built and operated by IPP exclusively for export purpose and are not connected to the EDL power grid.

2.2 Distribution Facilities

EDL's distribution systems are principally the 22 kV medium voltage (MV) systems. Feeders are extended to urban and rural areas from 22buses of 115/22 kV substations or from diesel and small hydropower plants of the provincial authorities through overhead lines or underground cables.

The low voltage (LV) distribution systems is 380/220 V, 3 phases, 4 wires and used to supply power to customers in general. Following is a summary of the HV, Medium and Low voltage throughout the distribution lines of the whole country as December 2003.

Table 7: Transmission Lines: 230 KV, 115 KV, 22KV, 0,4 KV and Transformers (Year 2005)

No	Province	Existing Transmission Lines							Transformers		
		High Voltage			Medium Voltage				Low voltage	Quantity	Capa city
		230KV	115KV	Total	35KV	25KV	22KV	Total	0,40KV	Unit	KVA
	Km	Km		Km	Km	Km		Km			
1	Vientiane Prefecture		291.00	291.00			1.270.38	1.270.83	18749.11	1.470	470.310
2	Phongsaly			0.00			58.24	58.24	45.30	29	3.765
3	Luangnamtha			0.00	0.80		147.46	148.26	151.56	93	6.440
4	Oudomxay			0.00			142.71	142.71	103.79	104	2.512
5	Bokeo			0.00			140.46	140.46	120.05	104	9.060
6	Luangprabang		146.00	146.00		169.86	354.16	524.02	220.03	296	68.208
7	Hua Phan			0.00	170.25		27.50	197.50	158.74	132	9.568
8	Sayabury		74.60	74.60			457.61	457.61	357.90	211	23.680
9	Xiengkhouang		181.00	181.00			54.78	54.78	159.67	60	5.220
10	Vientiane	219.50	219.50			27.03	818.63	845.66	1.032.38	553	77.185
11	Borikhamxay		85.00	85.00			670.49	670.49	537.55	387	55.996
12	Khammouane	86		86.00			1.217.49	1.217.49	756.19	749	143.166
13	Savannakhet		1.12	1.12			1.442.52	1.442.52	1.198.37	957	194.865
14	Saravane			0.00			594.42	594.42	532.22	310	33.020
15	Sekong			0.00			130.52	130.52	106.51	54	5.205
16	Champasak		114.48	114.48			665.73	765.73	1.143.30	598	90.645
17	Attopeu	160		160.00			130.36	130.36	70.90	65	10.410
18	Special zone			0.00			38.00	38.00	48.00	45	2.970
	Total	246.00	1.112.70	1.358.70	171.05	196.91	8.361.91	8.729.85	8.591.57	6.487.00	1.212.225.00

Source of Information : DOE, MIH

1. Length of transmission line 230 KV : 246 Km - circuit
2. " " 115 KV : 115 Km - circuit
3. " " 35 KV : 171 Km - circuit
4. " " 25 KV : 197 Km - circuit
5. " " 22 KV : 8362 Km-circuit
6. " " 0,4 KV : 8592 Km-circuit
7. Transformers : 1212 MVA

2.3 International Connecting Lines

The Lao PDR is linked up Thailand, Vietnam and China by interconnections lines in order to export and import of energy with neighbor countries. In 1971, the Connection of electricity from Nam Ngum 1 power plant to neighbor country (to EGAT grid in Thailand) was made by two circuits of 115 kV transmission line, one in double circuit and the other in single circuit, it transmit energy from power station via the Phontong Substation and overhead the Mekong crossing at Thanaleng to the Thai grid. another one in the southern region is connected Xeset 1 hydro power plant to the Thai grid by single circuit of 115 kV. These connections are operated by EDL.

Besides, 22 kV systems are operated by EDL branch offices in order to import energy from the provincial electricity authority of Thailand at Houaysai in Bokeo province, Kene Thao in Sayabury province and the 35 kV systems for the import of power from Vietnam at Samneua, Huaphanh province, at Dansavan, Savannakhet province (35/22 kV), and at Sanamsai in Sekong province, and the import of energy from China made by a 35/22 kV system at Muong Sing, Luangnamtha province.

In addition to those lines, two lines from Theun-Hinboun & Houay Ho power station plants were set up in order to export power to Thailand are operated by the IPP. (See Table 8 below)

Table 8: Transmission lines

No	Location		Voltage (KV)	Circuit		Conductor (mm ²)
	Lao PDR	Thailand/Vietnam/China		designed	Installed	
1	Theun Hinboun	Nakhonphanom (EGAT)	230	2	2	664
2	Houay Ho	Oubolrathani (EGAT)	230	2	2	664
3	Phonetong SS	Oudon 1-2 (EGAT)	115	2	2	240
4	Thanaleng SS	Nong Kai (EGAT)	115	1	1	95
5	Paksan SS	Bung Khan (EGAT)	155	2	1	240
6	Thakhek SS	Nakhonphanom (EGAT)	115	2	2	169
7	Pak BO SS	Mukdahan (EGAT)	115	2	1	240
8	Ban yo SS	Surindhorn P/S (EGAT)	115	1	1	240
9	Sam Neua SS	Pahang (EVN)	35/22	1	1	150
10	Bo Keo	Xieng Khong (PEA)	22	1	1	N.A
11	Ken Thao SS	Thali (PEA)	22	1	1	N.A
12	Hongsa	Pakmone (PEA)	22	1	1	N.A
13	Borikhamxai SS (Laksao)	Vietnam (EVN)	22	1	1	N.A
14	Dansavan(SVK)	Vietnam (EVN)	22	1	1	N.A
15	Sanamxai (sekong)	Vietnam (EVN)	22	1	1	N.A
16	Muong Sing (Luangnamtha)	China	22	1	1	N.A

Notes: EGAT: Electricity Generating Authority of Thailand
PEA : Provincial Electricity Authority (Thailand)
EVN : Electricity of Vietnam

3 ENERGY CONSUMPTION

3.1 Past Energy Consumption Record

The total energy demand for the whole country in 2004 is about 903 GWh, the forecast for the period 2004- 2005 is 1026 GWh while the total energy consumption including energy lost is about 18.69 %.

An average growth rate of energy demand for the whole country is 13% between 1999-2003, and for the period last 3 years (2003 - 2005) the average growth is 13,8%.

During the past five years between 1993 and 2003, demand in energy in the Southern region has dramatically increased at the rate of 18% especially in agriculture sector (irrigation pumps).

The demand of energy in Central 1 region in 2003 covers 71% of the total demand follow by Central 2 region with 16%, while 11% is covers by the Southern region and 2% is for the Northern region.

The Lao PDR Power sector is still in low level with only 45% (2005) of the population having access to electricity, and the power energy consumption is 177 kWh per capita in 2005.

Table 9: Summary of record of Energy consumption & Peak load (EDL)

Description	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Energy Consumption in GWH	264.7	279.4	337.5	379.5	433.1	513.2	565.5	626.3	710.3	766.7	883.7	902.8	1025.8



Peak Load in MW	66	73.4	85.0	95.4	109.0	126.2	147.4	172.1	191.7	204.7	232.3		
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3.2 Past record of Peak load

In 1995 the peak load for the whole country was 85 MW it has increased since to 232.3 MW in 2003. The annual average growth rate of peak load was 12 % during the period between 1999-2003 and 13% for the nine last years 1995-2003. The peak load occurs in two periods in a day. The first occurs in the day time between 11:00 AM to 15:00 PM for supplying mainly industrial and commercial loads in the metropolitan areas, the second peak load occurs between 18:00 PM to 20:00 PM during the night time for residential load.

3.3 Electricity Demand forecast For the whole country

The reference point for preparation of the demand forecast is the government's goal to increase the electrification ratio from the current level of 45% of households electrified in 2005 to 70% by the year of 2010 and 90% in year 2020.

Electricity demand forecast is conducted in each province (18 provinces) by taking into account the estimated growth rate of energy consumption and peak local load associated with EDL and Government's policy on electrification and other relevant factors mentioned above.

The Table 10 shows Electricity forecast for the whole country where average growth rate of energy demand and peak load is estimated at 21%, while peak load is at 19% for the period of 2003 to 2005.

For the period 2010 to 2020 Energy demand is estimated at 6% to 11% while peak load is at 6% to 9%. The summary of Electricity demand forecast is shown in Table 10.

Table 10: Summary of Electricity Demand forecast

No	Items	Unit	2005	2010	2015	2020
1	Energy Consumption	GWh	1,524.0	2,608.7	3,650.7	4,854.7
2	Average growth rate	%	13.9	11	6	6
3	Peak Load	MW	232.3	510.7	694.6	923.6
4	Average growth rate	%	13.5	19	6	6
5	Load Factor	%	54.1	60.0	60.0	60.0

It is noted that past Energy consumption in Lao PDR is still low compared to that in other ASEAN Countries. Referring to the electrification statistics by MIH, in July 2004 the electrification ratio for the villages is about 33,17% while the electrification ratio for households is about 41,2%.

The estimation of load Growth in the GMS countries

The following Table summarizes the estimated electricity load growth in the GMS countries, as obtained from recent projections in the **Table 11**:

Table 11: The estimation of load Growth in the GMS countries

Country	Peak Demand, MW			Energy, GWh/a		
	2000	2005	2010	2000	2005	2010
Thailand (EGAT PDP)	15,254	20,818	28,912	97,858	132,228	184,213
Vietnam	4,487	7,802	11,653	24,763	44,766	68,731
Yunnan, China	3,371	4,715	6,362	21,857	30,569	41,241
Burma	1,125	1,628	2,124	6,905	9,627	12,094
Lao PDR (Base Case)	169	368	543	871	1839	3503.7
Cambodia	150	304	477	678	1,200	1,900

Figure 4: Existing and Plan for Hydropower , Thermal and Transmission in Laos





4 POWER EXPORT/IMPORT

Electricity energy in Lao PDR are generating from the main power resource as hydropower plants, but from diesel generators and other resources. Of these hydropower plants are the cost effective and plentiful energy resource, so the government has accelerated to promote this sector, and recently the total of installed capacity has reached 682.02 MW (see Attachment 1) of which 667.5 MW is origin hydropower, the remaining 9.11 MW is from Diesel generators, 7.73 MW is from small-scale hydropower and 0.178 MW is from Solar power (2005)

Lao PDR has a low per capita consumption in Asia it is about 177kWH/year and only 45% of the households have access to electricity about 429.386 users (December 2005), some cities and villages are serviced with electricity generated from diesel generators for only 2 or 3hours per day during evening time, and some parts of the country are still in the dark, therefore people use extensively fuel wood as a source of primary energy.

The gross power generation of the whole country for the period 1998 to 2004 is tabulated in Table 10, and the total energy generated in the whole country, including IPP' s plants, is 3.347 GWH in 2004. EDL plants provided 1,416.4 GWH mainly from hydropower stations of which 80% are from Nam Ngum and Nam Leuk stations (central 1). Nam Mang 3 is commissioning in 2005.

For the surplus of energy, EDL exported to Thailand, from Nam Ngum 115 KV system and Xeset 115 KV system (southern region).

But also EDL has to import electricity mostly from Thailand (EGAT, PEA) and partly from Vietnam and China and purchased from IPP plants.

It is noted that the Xeset system is needed to import energy in the dry season due to shortage of water inflow. In 2004, EDL has exported 507,1 GWh and imported 277,6 GWh and the details are summarized in Table12.

Table 12: Generation, Import, Export and Consumption of Energy for the period 1998-2005

Year	Generation (GWH)			Growth %	Export (GWH)	Import (GWH)	Consumption (GWH)	Growth %
	EDL	IPP	Total					
1998	947.7	1208.8	2156.6	76,95%	1,613.4	142.3	513.2	18,3%
1999	1,168.7	1637.5	2806.2	30,1%	2,792.8	172.2	565.5	10,19%
2000	1,337.0	2101.3	3438.3	22,53%	2,871.4	180.2	626.3	10,75%
2001	1,553.6	2100.0	3653.6	6,26%	2,7987.3	183.8	710.3	13,41%
2002	1,570.2	2033.9	3604.1	- 1,36%	2,77	200.8	766.7	7,94%
2003	1,316.9	1861.3	3178.2	-11,82%	2,284.6	229.3	883.7	15,26%
2004	1,416.4	193` 1.2	3347.6	0,53%	2,424.6	277.6	902.7	2,10%
2005	1,524.0						1.025.8	13,61%

Note: The information of the year 2005 is not certain

Actually, all hydropower stations owned by EDL are capable to generate 1.514 GWH/year, besides Two IPP plants, Theun-Hinboun 210 MW commissioning in 1998 and Houay Ho 150 MW (1999) both plants can generate 2.237 GWH of which 95% of the energy is being sold to Thailand and the remaining 5% supplied local areas surrounding the project site. It is noted that Houay Ho station has set up a 2 MW generator to supply especially Attapeu province.

Off-grid electrification is one of the alternative for those communities located too far from existing distribution circuit or transmission network to be economically non feasible.

Since 1985, PV Solar are started using in the telecommunication sector in rural and isolated areas. And from 1998-2000, the pilot project of JICA (Japan International Cooperation Agency) has been implemented

in Laos, besides, the World Bank has also supported rural electrification projects by providing 3350 PV Solar home systems (1998 to 2004) and will continue to support the off-grid electrification program in Laos.

PV Solar are implemented by STEA (Science, Technology, Environment Agency) for demonstration in some villages. Micro-hydropower (especially Pico-300 W) plants in the rural and isolated Northern regions, because it constituted the most important and affordable power resources for local people.

Diesel generators are also very popular in the rural areas, because it is easy to use, but the main issue is the cost of fuel and transportation are quite expensive and not worthwhile for 2 or 3 hours per night.

5 COST STRUCTURE OF THE ENERGY FACTOR

5.1 Energy Consumption by consumer types

A Past Records of energy consumption register from period 1991 to 2003 are shown in Table 9, it covers the 18 provinces of the Lao PDR and classified according to categories of consumer and divided up from seven sectors: Industry, Agriculture, Entertainment, Government office, residential and Embassies. And the share of the total energy consumption by sector is show in Table 13.

Table 13: Shares in % of Energy Consumption by category of consumers (Units in %)

Year	Residential	Business	Entertainment	Govern. Office	Agriculture	Embassy	Industry	Total in %
1991	49%	21%	-	14%	4%	4%	9%	100%
1992	47%	23%	-	11%	5%	4%	10%	100%
1993	51%	17%	-	13%	4%	3%	12%	100%
1994	52%	14%	-	12%	3%	3%	16%	100%
1995	50%	12%	-	13%	4%	2%	19%	100%
1996	51%	11%	-	12%	4%	2%	21%	100%
1997	50%	9%	2%	11%	4%	2%	21%	100%
1998	49%	10%	2%	11%	6%	2%	21%	100%
1999	50%	10%	2%	10%	6%	1%	20%	100%
2000	51%	11%	2%	9%	5%	1%	21%	100%
2001	53%	10%	2%	9%	6%	2%	19%	100%
2002	52%	10%	1%	10%	5%	1%	21%	100%
2003	51%	10%	1%	10%	5%	1%	22%	100%
2004								

Table 14: Domestic Electricity Consumption by various Sectors Unit: In KW

Year	Residential	Business	Entertainment	Government Office	Agriculture	Embassy	Industry	Total



**Asia Pro Eco project TH/Asia Pro Eco/05 (101302):
Diagnostic Study on Renewable energy Potential
and Feasibility in South East Asia**



Deutsche Gesellschaft für Sonnenenergie e.V.
International Solar Energy Society, German Section

1990	77,629,211	35,289,207		22,312,473	5,875,674	9,193,332	14,276,194	164,576,091
1991	107,281,905	45,445,590		30,789,955	8,681,566	8,420,276	20,047,077	220,666,369
1992	119,540,561	58,338,460		28,481,219	11,988,891	9,008,589	25,379,770	252,737,490
1993	135,263,558	45,749,294		33,690,582	10,426,711	7,549,357	32,108,894	264,788,396
1994	144,975,182	39,029,617		34,788,168	7,701,524	7,527,782	45,419,405	279,441,678
1995	170,190,786	38,833,339		42,919,778	13,589,860	7,458,563	64,479,985	337,472,311
1996	192,638,819	40,703,798		44,716,515	13,441,015	8,079,996	79,961,280	379,541,423
1997	218,286,703	40,094,203	9,701,282	49,623,547	16,969,721	8,098,174	91,086,827	433,860,457
1998	252,218,101	50,110,610	10,685,471	54,444,110	29,631,919	8,583,996	107,598,300	513,272,507
1999	258,053,226	58,553,120	11,068,706	54,464,514	33,905,540	7,712,277	114,789,455	565,546,838
2000	324,693,846	67,804,500	11,838,193	59,802,343	33,413,405	7,480,376	134,852,919	639,858,582
2001	371,410,713	72,441,414	12,707,319	67,210,227	40,750,934	10,928,830	134,880,705	710,330,142
2002	394,557,831	78,142,296	10,223,482	77,484,072	34,799,916	7,560,312	163,970,932	766,738,823
2003	454,978,322	94,976,309	7,503,390	83,910,978	31,751,549	8,210,237	203,416,998	853,738,983
2004								

- The following table indicates that the share of residential energy consumption is 51% in 2003 which is the largest amongst the seven categories and remained constant during the last 10 years,
- The share of industrial energy consumption has increased from 9% in 1991 to 22% in 2003; it is likely that industrial consumption will increase further its share in the coming years.
- Business (commercial & service sector) which aggregates enterprises, entertainment, and government offices, shares 27% of the total energy consumption which is nearly the same figure as the industrial sector.

Table 15: Number of Energy consumers by types

No	Category	1996	1997	1998	1999	2000	2001	2002	2003
1	Residential	125.080	151.785	183.660	209.783	231.419	254.445	266.443	
2	Business	3.373	7010	7446	8439	9127	9442	10.019	
3	Entertainment	-	149	125	100	132	142	146	
4	GOL. office	3328	3558	3856	4145	4581	4962	5099	
5	Agriculture	144	282	420	580	637	708	736	
6	Embassy	422	393	339	299	261	241	242	
7	Industry	1737	2131	2484	2971	3491	3875	4010	
	Total	134.084	156.308	198.330	226.317	249.648	273.75	295.415	355.651

It notes that from 1996 to 2003 the number of residential customers receiving energy from EDL's grid has been increased with the average annual growth rate of about 12%, this means that electrification program has progressed with a relatively higher pace during the last five years.

5.2 Electricity Tariff

As a policy the Government with regard to electricity tariff is to keep intentionally domestic tariffs as low as possible (below economic cost) in order to encourage the socio-economic development, thus the profit of EDL is pending on the export of electricity. However, EDL decided to raise the tariff by the guidance of the World Bank and the present economic situation.

The tariff adjustment was applied from May 2002 to April 2005 and to be increased by 2.3% per month except category 2 (Diplomatic and International organizations). The details are shown in the Table 16.

Table 16: The EDL' s Tariff of Domestic Electricity charges for year 2004. (Unit: Kip/ KWH)

Year	Unit	Price-up	Calendar Year 2004										
			1	2	3	4	5	6	7	8	9	10	11
1. Residence													
0 - 50 kWh	Kip	2.3%/Month	101	103	106	108	110	113	116	118	121	124	127
51- 200 kWh	Kip	2.3%/Month	236	242	247	253	259	265	271	277	284	290	297
201- kWh	Kip	2.3%/Month	682	698	714	731	747	765	782	800	818	837	857
2. Embassy, Foreigner													
	US Cent		9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9
3. Business													
	Kip	2.3%/Month	737	754	772	790	802	826	845	865	885	905	926
4. Entertainment Business													
	Kip	2.3%/Month	977	999	1022	1046	1070	1095	1120	1146	1172	1199	1226
5. Government Admi.													
	Kip	2.3%/Month	630	645	660	675	690	706	722	739	756	773	791
6. Irrigation													
	Kip	2.3%/Month	263	269	275	282	288	295	302	309	316	323	330
7. Industry													
	Kip	2.3%/Month	567	580	594	607	621	636	650	665	680	696	712

Note : 1. The exchange rate Kip/USD has suffered significant inflation from 2000-2004

2000: 7911 kips = 1 USD
2001: 8948 kips = 1 USD
2002: 10.171 kips = 1 USD
2003: 10.625 kips = 1 USD
2004: 10.800 kips = 1 USD

2. The application of the 2, 3% rate increased per month has suspended since June 2004, the main reason is customers could not afford to follow this type of tariff adjustment.

The new Electricity tariff is show in Table 17 below. In reference to the notice from the MIH No 302/MIH, dated 24/06/2005 with regard to the adjustment of domestic electricity price.

Electricity du Laos informed to all of electricity users that from the month (7/2005) of July 2005, their will make an adjustment of electricity rate of which the details are as follow:

Table 17: Electricity tariff

Category of Customer	From 06/2004 To 06/2005	From 07/2005 To 12/2005	2006	2007
Residential users of low Voltage power				
From 0 - 25 KWh	113	115	132	152
From 26 - 150 KWh	265	265	273	281
> 150	765	765	765	765
Non Residential users of low Voltage power				
Irrigation	295	295	310	325
State' Office & Building	706	706	696	686
Industry	636	636	627	6187
Business in general	826	826	826	826
Embassies & International organizations	1,066	1,066	1,066	1,066
Entertainment	1,095	1,095	1,095	1,095
Non Residential users of middle Voltage power (22 KV)				
Irrigation	266	251	263	276
Industry	572	541	533	526
State' Office & Building	653	600	592	583
Business in general	743	702	702	702

Remark: we would like to inform our customers that the rate shows in this table is in Lao

Currency, KIP/KWh. Exchange rate: \$ 1 USD = 10,860 Kips in year 2005

A. Export Tariffs (the 115KW Transmission lines system) generated by Nam Ngum 1, Xeset 1, Nam Leuk and Nam Mang 3.

1. Peak rate (at 18:00h – 21:30h) = \$ 0, 0277USD/KWH



2. Off Peak rate (at 21h – 18: 00h) = \$ 0, 0259 USD/KWH

B. Import Tariffs

1. At 115 KW from EGAT (Vientiane / Xe set)TOD rate
 - Peak rate (at 18:00h - 21:30h) = \$ 0,0320 USD/KWH
 - Off Peak rate (21:30h – 18:00h) = \$ 0,0302 USD/KWH
2. At 22KV from EGAT (Khammouane) TOD rate
 - Peak rate (at 18:00h – 21:30h) = \$ 0,035 USD/KWH
 - Off Peak (at 21:30h – 18:00h) = \$ 0,033 USD/KWH
3. At 22KV from PEA (Houaysai/Bokeo-Kenthao, Muong Ngeun) TOU rate
 - Peak rate (at 18:00h – 21:30h) = \$ 0, 0800 USD/KWH Monday-Friday
 - Off Peak rate (21:30h – 18:00h) = \$ 0, 0325 USD/KWH Monday-Friday
 - Off Peak rate (0.00h – 24:00h) = \$ 0, 0325 USD/KWH (Saturday, Sunday and Holi-
days)
4. At 35 KW from EVN (Samneu Houaphanh, Sepone Savannakhet, Sanuei/Sekong)
 - 0,0600 USD/KWH Flate Rate
5. At 35 KW from China (Muonh Sing/Muong Namtha)
 - 0,0600 USD/KWH Flate Rate

5.3 Electricity Trade with Neighboring Countries

Electricity trading between Lao PDR and its neighbors is carried out at several levels:

- (i) There are committed exports to neighboring countries under project-specific PPAs that set out strict conditions governing delivery of capacity and energy and the penalties that apply in the event of breach. At present, PPAs have been signed only with EGAT (Theun Hinboun, Houay Ho and Nam Theun 2), although negotiations are in progress with Vietnam in respect of two other proposals (Nam Mo and Xe Kaman 3).
- (ii) Under a blanket PPA between EdL and EGAT, EdL can freely export surplus energy without committing to the quantity or timing of either. Electricity exports from Lao PDR began in 1971 with the commissioning of Nam Ngum 1 and in the period since, the trade has provided a significant source of foreign exchange although it is tapering off as local demand absorbs surplus energy and periodic tariff negotiations erode price.
- (iii) As outlined in the previous section, there is opportunistic power trading for least-cost supply to border areas. EdL's PPA with EGAT also allows it to import capacity and energy at the PEA tariff for a large customer and several important border towns have been supplied in this way. Similar arrangements are in place allowing localized MV imports from China and Vietnam to supply towns near those borders.

While electricity trading has been an important feature of the sector's development to date, its role in the future development is potentially profound. Given the country's location between populous and rapidly developing neighbors, the development of the Lao power system is likely to take on an increasingly regional dimension.

6 HYDROPOWER DEVELOPMENT PLANTS FOR THE DOMESTIC , EXPORT AND TRANSMISSION SYSTEM IN LAOS

The followings table is showed the development of Hydro Power Plants for the domestic, Export and Transmission System in Laos as in the Table 18, 19, 20, 21and 22.

Table 18: Hydro Power Development Plants Project up to 2013 for the domestic

No	Project	Installed Capacity (MW)	Annual Energy Output (GW h pa)	Estimated Investment M US\$	Comm year
1	Nam Ngum upgrading (Unit 1&2)	5	-	1.1	2004 (completed)
2	Nam Mang 3	40	147	56.6	2005
3	Xeset 2	76	309	135.5	2006
4	Nam Sim	7.8	34.1	-	2008
5	Theun Hinboun (Extension)	110	785.3	-	2007
6	Nam Beng	20	66.6	-	2008
7	Nam Theun 2	75	275	-	2009
8	Nam Ngiep	16	200	-	2010
9	Nam Chia	116	563	-	2011
10	Houay Lamphan Gnai	60	354	120	2013
11	Total	525.8	2,734		

Table 19: Hydro Power Development Plants Project After 2013 for the domestic

No	Project	Installed	Energy Out	Estimated	Comm	Location
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		Capacity (MW)	put (GWh)	Cost MUS\$	year	
1	Xekatom	60	270	120	2014	South
2	Nam Ngum 5	100	430	128	2016	Central 1
3	Xepon 3	75	301	138	2016	Central 2
4	Sexet 3	20	85	25.4	2017	South
5	Nam Kong3	25	142	86	2018	South
6	Nam Lik	100	374	159	2018	Central 1
7	NamLong	11	53	25	2019	North
8	Nam Ngum 4 A	55	250	115	2019	Central 1
9	Thakho	36	215	68.4	2020	Central 1
	Total	482	2120	864.8		

Table 20: Power Development Plants from for Export from Lao PDR

No	Project	Installed Capacity (MW)	Energy Out put (GWh)	Comm year	Estmated Investment MUS\$	Export to
01	Nam Theun 2	1088	5173	2009	1080	Thailand
02	NamMo	105	581	2008	123	Vietnam
03	Xekaman3	218	1349	2008	343	Vietnam
04	NamNgum3	460	1851	After 2010	688	Thailand
05	NamNgum2	615	2109	After 2010	596	Thailand
06	Hongsa Lignite	1400	8293	After 2010	1647	Thailand
07	TheunHinboun Phase II	210		2010		
08	Xekaman1	468	1-925	2010	504	Vietnam / Thailand
09	Xepian XenamNoy	390	1995	2010	656	Vietnam / Thailand
10	Nam Ngiep 1	240	1429	2010	439	Vietnam / Thailand
11	Xekong4	440	1746	2011-16	678	Vietnam
12	Xekong 5	253	1183	2012 -17	458	Vietnam
13	Nam Theun1	400	1897	2015-19	526	Thailand
14	NamKong 1	240	802	2016 -20	250	Vietnam /Cambodia
	Total	6527	26305		8327	

Table 21: 500 KV Transmission plan

No	Projects	Distant Km	Voltage KV	Circuit	Project cost (M US\$)	Comm year
1	Nam Thuen 2 to Savannaketh	120	500	2	73.32	2009
2	Nabong to border Lao- Thai	30	500	2	66.33	2010
3	PaAm to border Lao-Vietnam	60	500	2	83.66	2010
4	Hongsa Lignite to border Lao- Thai	75	500	2	45.83	2010
5	Na Bong to NamTheun 2	282	500	2	172.30	After 2010
6	NamTheun 2 to border Lao- Vietnam	90	500	2	54.99	After 2010
7	South to Svannakheth	300	500	2	183.30	After 2010
8	ChiangHung (China) to Laos to Thailand	1015	500	Just only in Laos 200 km		After 2010
Total		957			679.73	

Remark : The Project cost including Substation 230/500 KV

Table 22: EdL 115 kV Transmission Development

From	To	km	kV	Conductor	No of Circuits
Planned:					
Nam Mang 3	Thanaleng	51	115	240	2
Khoksaad	Naxaythong	18	115	240	1
Mahaxay	Sepone mine	150	115	240	1
Thakhek	Nam Theun 2	68	115	240	2
Ban Jiangxai (Pakse)	Ban Hat (Thakho)	123	115	240	2
Xeset 1 & 2	Paksong	39	115	240	2
Pakxan	Thakhek	180	115	400	4
Thakhek	Pakbo	93	115	240	2
Nam Ngum 1	Thalat	5	115	240	1
Hin Heup	Vang Vieng	46	115	240	1
Luang Prabang	Oudomxai	173	115	240	2
Oudomxai	Luangnamtha	79	115	240	1
Namo	Boun Neua	96	115	240	1
Ban Hat (Thakho)	Cambodian border	30	115	240	1
Ban Na	Attapeu	123	115	240	2
Nam Lik	Ban Don	6	115	240	2
Ban Don	Thalat (add a cct)	48	115	240	1
Xepon P/S	Saravan	98	115	240	1
Xepon town	Xepon P/S	78	115	240	2
Xepon town	Xepon mine	36	115	240	1



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Xepon town	Kengkok	140	115	240	2
Xayabury	Paklay / Nonhai	223	115	240	1
Viengphouka	Luangnamtha	56	115	240	2
Viengphouka	Houayxai	95	115	240	1
Xeset 1	Saravan	32	115	240	1
Pakbo	Kengkok (add a cct)	50	115	240	1
Hongsa	Xayaburi	64	115	240	1
Nam Leuk	Pakxan (add a cct)	85	115	240	1
Ban Jiangxai (Pakse)	Xeset 1	76	115	240	2
H. Lamphan Gnai	Sekong / Saravan	76	115	240	2
Kengkok	Ban Jiangxai (Pakse)	180	115	240	2
Phoukhoun	Phonsavan	100	115	240	1
Phonsavan	Sam Neua	152	115	240	1
Nam Ngum 5	Phoukhoun	26	115	240	2
Vangvieng	Phoukhoun	72	115	240	2
Phoukhoun	Luang Prabang	75	115	240	2
Thalat	Vangvieng	64	115	240	1

Reference

1. Basic Statistic of Lao PDR 1975 – 2000 , National Statistic Center , Vientiane May 2000
2. Statistical Year Book 2001 of Lao PDR , National Statistic Center , Vientiane May 2002
3. Statistical Year Book 2002 of Lao PDR , National Statistic Center , Vientiane May 2003
4. Statistical Year Book 2003 of Lao PDR , National Statistic Center , Vientiane May 2004
5. Statistics of Electricity Consumption in 2002 , MIH , DOE
6. Economic and Monetary Statistics , Economic Research Department , Bank of Lao PDR , September 2002
7. Foreign and Report 2000-2001 , Committee for Planning and Cooperation , Vientiane May 2002
8. A comprehensive framework to foster economic initiative in Lao PDR , draft report on wood processing industry component 9 Output 2.1 , UNIDO , Viena 2002
9. The National Poverty Eradication Programme (NPEP) , A comprehensive Approach to Growth and Development , Eight Round Table Meeting , September 2003
10. Presentation Report at the First AFCO Coucil Meeting in Jakata , May 15 , 2000 Mr Manomay VILAYHONG , Senior Officer in Mineral Policy , Ministry of Industry and Handicraft
11. The First National Communication on Climate Change , October 2000 , Vientiane Lao PDR
12. Report on Activities of Technology Research Institute 1999-2004 , Vientiane May 2004 .
13. A Summary of Activities and Achievements in Lao PDR , Renewable Energy Technology in Asia , Aregional Research and Dissemination Programme Phase II , SIDA , December 2002 .



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Diagnostic Study on Renewable energy Potential
and Feasibility in South East Asia

ASIA PRO ECO



EUROPEAID
CO-OPERATION OFFICE

Deutsche Gesellschaft für Sonnenenergie e.V.
International Solar Energy Society, German Section

14. Inception Report of Master Plan Study on Small Hydro Power in Northern Laos , February 2004 , By Nippon Koei Co ., LTD .
15. Annual Report 2002 , Electricity Du Laos
16. Power System Development Plan for LAO PDR , Draft Final Report March 2004 , MIH , DOE
17. Power Development Plan (PDP 2004 -13) , Electricity Du Laos , March 2004
18. Inception Report of Rural Electrification Framework Study , Ministry of Industry and Handicraft April 2004
19. Inception Report of Power Sector Financing Strategy Study , May 2004 , MIH , DOE
20. Draft final report of Rural Electrification Frameworks Study , June 2004

Attachment 1: Statistics of Existing Power generation Plants year 2005

No	Production	Locations		Installed Capacity In KW	Turbine or Generator / Unit	Year of Commissioning	Remark
		District	Province				
1	2	3	4	5	6	7	8
I. Big-scale Hydropower Plants							
1	Nam Ngum 1	Keo oudom	Vientiane	30.000	2 x 15 MW	1971	EDL
				80.000	2 x 40 MW	1978	
				40.000	1 x 40 MW	1984	
				5.000		2004	
2	Xe set	Lao ngam	Saravane	6.000	2 x 3 MW	1991	EDL
				39.000	3 x 13 MW	1991	
3	Se labam (medium)	Sanasomboun	Champasak	2.000	3 x 668 kW	1970	EDL
				3.000	1 x 3 MW	1994	
4	Theun-Hinboun	Hinboun	Khammouane	210.000	2 x 105 MW	April,1998	IPP
5	Houay Ho	Samakxay	Attopeu	150.000	2 x 75 MW	April,1999	IPP
6	Nam Leuk	Long xan	Special Zone	60.000	1 x 60 MW	April,2000	EDL
7	Nam Mang 3	Phou Khao Kuai	Vientiane	40.000	2x 20 MW	2005	EDL
TOTAL				665.000			

II. Small-Scale Hydropower Plants

1	Nam Phao	Kham Keut	Borikhamxay	1.600	1 x 1,600 kW	1995	Provincial (Broken)
2	Nam Ko	Xay	Oudomxay	1.500	3 x 500 kW	1996	EDL
3	Houay Kasene	Pak beng	Oudomxay	155	1 x 100 kW 1 x 55 kW	2003	
4	Nam Dong	Luangprabang	Luang prabang	1.000	3 x 336 kW	1970	
5	Nam Pa	Luangprabang	Luangprabang	16	1 x 16 kW	1998	
6	Nam Mong	Nam Bak	Luangprbang	70	1x70 kW	9 /3/2000	
7	Nam Boun 1	Boun Neua	Phongsaly	110	2 x 55 kW	1996	
8	Nam Koun	Boun Neua	Phongsaly	5	1 x 5 kW	1996	Broken
9	Nam Kha	Boun Neua	Phongsaly	5	1 x 5 kW	1996	Broken
10	Nam ngai	Phongsalyó	Phongsaly	1.200	2 x 600 kW	2002	
11	Nam Lue	Luang Namtha	Luang Namtha	46	1 x 46.2 kW	1994	Broken
12	Houay Khi bouane	Long	Luang Namtha	50	1 x 50 kW	1998	Broken
13	Nam Boung	Na Lai	Luang Namtha	30	1 X 30 kW	1999	

14	Nam Pouné 1	Vieng xay	Houa Phanh	96	2 x 48 kW	1994	Broken
15	Nam Pouné 2	Vieng xay	Houa Phanh	48	1 x 48 kW	1994	Broken
16	Nam Khouey	Vieng xay	Houa Phanh	12	1 x 12 kW	1994	Broken
17	Houay Mene	Sam Neua	Houa Phanh	24	1 x 24 kW	1994	Broken
18	Nam hang	Sam Neua	Houa Phanh	6	1 x 6 kW	1994	Broken
19	Nam Xan	Sam Tai	Houa Phanh	110	2 x 55 kW	1995	
20	Nam Peun	Hua muong	Houa Phanh	40	1 x 40 kW	1986	
21	Nam Aid	Vieng Thong	Houa Phanh	80	1 x 80 kW	1988	
22	Nam Long	Xieng Kho	Houa Phanh	20	1 x 20 kW	1989	
23	Kheuane Sop Long	Xieng Kho	Houa Phanh	24	1 x 24 kW	1989	Broken
24	Nam Xaat	Vieng Thong	Houa Phanh	250	2 x 125 kW	1999	
25	Nam La	Sam tai	Houa Phanh	100	2 x 50.2 kW	2002	
26	Nam Ham	Boten	Xayabury	180	2 x 90 kW	1992	Broken
27	Kheuane Ban sop Ma	Kham	Xieng Khouang	55	1 x 55 kW	1995	
28	Nam Tiane	Kham		75	1 x 75 kW	1995	
29	Kheuane Ban Tan - 1	Khoune	Xieng Khouang	5	1 x 5 kW	1994	Broken
30	Kheuane Ban Tan --2	Khoune	Xieng Khouang	8	1 x 8 kW	1995	Broken
31	Kheuane Ban poun	Khoune	Xieng Khouang	5	1 x 5 kW	1995	Broken
32	Kheuane Ban nong	Pha xay	Xieng Khouang	40	1 x 40 kW	1995	Broken
33	Nam Kaa--1	Pha xay	Xieng Khouang	12	1 x 12 kW	1987	
34	Nam Kaa-2	Pha xay	Xieng Khouang	81	1 x 81 kW	1995	
35	Nam Kaa-3	Pha xay	Xieng Khouang	5	1 x 5 kW	1995	Broken
36	Kheuane Ho kang	Pha xay	Xieng Khouang	24	1 x 24 kW	1986	Broken
37	Nam Chat	Mork	Xieng Khouang	100	1 x 100 kW	1992	Broken
38	Houay Saloy	Nong	Savannakhet	104	1 x 75 kW	1996	
39	Houay Champi	Paksong	Champasak	40	1 x 40 kW	1985	Broken
40	Houay samong	Sanamxay	Attopeu	226	2 x 113 kW	January 2004	
41	Nam Pkouné	Phoum	Special Zone	200	1 x 200 kW	1999	Broken
	Total			7,757			

III. DIESEL

1	Diesel	May	Phongsaly	300	2 x 150 kW	1993	
2	Diesel	Khoua	Phongsaly	120	1 x 120 kW	1997	
3	Diesel	Nam ha	Luang Namtha	155	1 x 155 kW	1997	Broken
4	Diesel	Sing	Luang Namtha	120	1 x 120 kW	1997	Stop operation
5	Diesel	Vieng phoukha	Luang Namtha	120	1 x 120 kW	1997	
6	Diesel	Long	Luang Namtha	155	1 x 155 kW	1997	
7	Diesel	Xay	Oudomxay	200	1 x 200 kW	1993	Stop operation
8	Diesel	Houn	Oudomxay	50	1 x 50 kW	1993	
9	Diesel	Na Mo	Oudomxay	50	1 x 50 kW	1994	
10	Diesel	Houay sai	Bo Keo	244	1 X 244 kW	1993	Stop operation
11	Diesel	Pha Oudom	Bo Keo	54	1 X 54 kW	1993	Stop operation
12	Diesel	Pak Tha	Bo Keo	15	1 x 15 kW	1993	Stop operation
13	Diesel	Thon Pheung	Bo Keo	20	1 x 20 kW	1993	Stop operation
14	Diesel	Thon Pheung	Bo Keo	120	1 x 120 kW	1997	Stop operation
15	Diesel	Meung	Bo Keo	45	1 x 45 kW	1993	Stop operation
16	Diesel	Luangprabang	Luangprabang	240	1 x 240 kW	1960	Stop operation
17	Diesel	Luangprabang	Luangprabang	636	2 x 318 kW	1991	Stop operation
18	Diesel	Luangprabang	Luangprabang	250	1 x 250 kW	1992	Stop operation
19	Diesel	Luangprabang	Luangprabang	100	1 x 100 kW	1992	Stop operation
20	Diesel	Luangprabang	Luangprabang	160	1 x 160 kW	1992	Stop operation
21	Diesel	Naan	Luangprabang	155	1 x 155 kW	1997	Stop operation
22	Diesel	Nam Bak	Luangprabang	120	1 x 120 kW	1997	Stop operation
23	Diesel	Ngoy	Luangprabang	155	1 x 155 kW	1997	Stop operation
24	Diesel	Vieng Kham	Luangprabang	120	1 x 120 kW	1997	
25	Diesel	xayabury	Xayabury	400	1 x 400 kW	1993	Stop operation
26	Diesel	Kop	Xayabury	50	1 x 50 kW	1993	Stop operation
27	Diesel	Kong sa	Xayabury	70	1 x 70 kW	1993	Stop operation
28	Diesel	Hong sa	Xayabury	155	1 x155 kW	1997	Stop operation
29	Diesel	Ngeun	Xayabury	50	1 x 50 kW	1994	Stop operation
30	Diesel	Xieng hone	Xayabury	50	1 x 50 kW	1994	Stop operation
31	Diesel	Phiang	Xayabury	200	1 x 200 kW	1989	Stop operation
32	Diesel	Paklay	Xayabury	250	1 x 250 kW	1994	Stop operation
33	Diesel	Paklay	Xayabury	155	1 x 155 kW	1997	Stop operation
34	Diesel	Pek	Xieng Khouang	600	2 x 300 kW	1995	Stop operation
35	Diesel	Phou kout	Xieng	35	1 x 35 kW	1995	

			Khouang				
36	Diesel	Phouang	Vientiane	155	1 x 155 kW	1997	Stop operation
37	Diesel	Sanakham	Vientiane	350	1 x 350 kW	1994	Stop operation
38	Diesel	Kanthabouly	Savannakhet	1,000	4 x 250 kW	1970	Stop operation
39	Diesel	Saravane	Saravane	400	2 x 200 kW	1985	Stop operation
40	Diesel	Ta oy	Saravane	120	1 x 120 kW	1997	Stop operation
41	Diesel	Samoy	Saravane	30	1 x 30 kW	1998	Stop operation
42	Diesel	La mam	Sekong	400	2 x 200 kW	1995	Stop operation
43	Diesel	Pakse	Champasak	240	1 x 240 kW	1970	Stop operation
44	Diesel	Sanamxay	Attopeu	244	1 x 244 kW	1994	Stop operation
45	Diesel	Sanamxay	Attopeu	120	1 x 120 kW	1997	Stop operation
46	Diesel	Xaysomboun	Special Zone	75	1 x 75 kW	1995	Stop operation
47	Diesel	Xaysomboun	Special Zone	155	1 x 155 kW	1997	Stop operation
	Total			9,108			

IV. Existing Solar PV System up to year 2002

Locations of Solar PV System Implementations				Installed Capacity in Watt	Number of Unit	Responsible of Project Implementation	
No	Commune	District	Province				
1	Done xayoudom	Keo Oudom	Vientiane	11,855		MIH+JICA	
2	Houay Poug	Keo Oudom	Vientiane	2,200		MIH+JICA	
3	May	Keo Oudom	Vientiane	4,950		MIH+JICA	
4	Nong Pene	Phone Hong	Vientiane	2,915		MIH+JICA	
5	Pak soun	Pakading	Borikhamxay	3,000		MIH+JICA	
6	Na May	Pakading	Borikhamxay	2,000		MIH+JICA	
7	Muong Office	Sa Moy	Saravane	84		MIH	
8	Muong Office	Toum Lane	Saravane	84		MIH	
9	Muong Office	Ka Lum	Sekong	84		MIH	
10	Muong Office	La mam	Sekong	84		MIH	
11	Ban tang Kham	Hin Heup	Vientiane	1,100		MIH	
12	Ban Na Khom	Hin Heup	Vientiane	1,925		MIH	
13	Ban Na Xaat	Hin Heup	Vientiane	1,925		MIH	
14	Ban Na Phong	Hin Heup	Vientiane	1,650		MIH	
15	Ban Na Luong	Hin Heup	Vientiane	880		MIH	

16	Ban Pha Bong	Hin Heup	Vientiane	1,265		MIH	
17	Ban Na anh	Hin Heup	Vientiane	1,100		MIH	
18	Ban Na Tai	Hin Heup	Vientiane	1,760		MIH	
19	Pha Koup	Vang Vieng	Vientiane	750		OffCEGrid	
20	Phon savang	Pheuang	Vientiane	340		OffCEGrid	
21	Na seng	Pheuang	Vientiane	1,780		OffCEGrid	
22	Nong Pet	Pheuang	Vientiane	350		OffCEGrid	
23	Na MaiĒ	Pheuang	Vientiane	320		OffCEGrid	
24	Na Toui	Pheuang	Vientiane	250		OffCEGrid	
25	Pak Keua		Vientiane	290		OffCEGrid	
26	Si Set		Vientiane	370		OffCEGrid	
27	Na Bone	Pheuang	Vientiane	120		OffCEGrid	
28	Hua Nam Bak		Oudomxay	700		OffCEGrid	
29	Phon Kham		Oudomxay	300		OffCEGrid	
30	Souane Ya	Long	Luang Namtha	830		OffCEGrid	
31	Houa Dam	Long	Luang Namtha	280		OffCEGrid	
32	Houa Houm	Long	Luang Namtha	210		OffCEGrid	
33	Na Laan	Long	Luang Namtha	630		OffCEGrid	
34	Nam Sing	Vieng Neua	Luang Namtha	370		OffCEGrid	
35	Nam Long	Vieng Neua	Luang Namtha	210		OffCEGrid	
36	Pak Nga	Vieng Kham	Luangprabang	350		EDL	
37	Sae	Vieng Kham	Luangprabang	300		EDL	
38	Tang Huay Kok	Keng Kok	Savannakhet	1,500		STEА	
39	Done Na xay	Hat sayfong	Vientiane Prefec.	200		STEА	
40	Phon Ngam	Song Khone	Savannakhet	1,500		STEА	
41	Ka sir	Luangprabang	Luangprabang	1,600		NGO	
42	Nam Ha	Namtha	Luang Namtha	2,400		MCTPC	
43	Done moune ngai	Namtha	Luang Namtha	2,100		MCTPC	
44	Done	Namtha	Luang Namtha	2,100		MCTPC	
45	Nam Pik	Namtha	Luang Namtha	2,100		MCTPC	
46	Zay	Xay	Oudomxay	2,400		MCTPC	
47	Phou Pha Pheung	Xay	Oudomxay	2,100		MCTPC	
48	Xong tia	Luangprabang	Luangprabang	2,100		MCTPC	
49	Phou sa	Luangprabang	Luangprabang	2,100		MCTPC	
50	Phou Xieng Noy	Luangprabang	Luangprabang	6,300		MCTPC	

51	Kiaokathiam	Luangprabang	Luangprabang	6,300		MCTPC	
52	Phou Nam Kok Hou	Luangprabang	Luangprabang	2,100		MCTPC	
53	Pak Khone	Luangprabang	Luangprabang	2,100		MCTPC	
54	Xayabury	Xayabury	Xayabury	2,400		MCTPC	
55	Phou Soung	Khoun	Xieng Khouang	2,100		MCTPC	
56	Phou Hene	Phon Savan	Xieng Khouang	2,100		MCTPC	
57	Phon Savan	Phon Savan	Xieng Khouang	2,400		MCTPC	
58	Pha keng Kiane	Ka si	Vientiane	2,100		MCTPC	
59	Pha Tang	Vang Vieng	Vientiane	2,100		MCTPC	
60	Vang Vieng	Vang Vieng	Vientiane	3,000		MCTPC	
61	Phou Houat	Vang Vieng	Vientiane	2,100		MCTPC	
62	Phou Khao Nang	Tourakhom	Vientiane	4,600		MCTPC	
63	Phon Hong	Phon Hong	Vientiane	2,400		MCTPC	
64	Na xay	Pak ngum	Vientiane Prefec.	2,400		MCTPC	
65	Pak Chouao	Pakading	Borikhamxay	2,100		MCTPC	
66	Hong Na my	Pakading	Borikhamxay	2,100		MCTPC	
67	Na Lieng	Hin Boun	Khammouane	2,100		MCTPC	
68	Hin Boun	Hin Boun	Khammouane	2,100		MCTPC	
69	Na Deng	Outhoumthone	Savannakhet	2,100		MCTPC	
70	Seno	Outhoumthone	Savannakhet	2,100		MCTPC	
71	Km. 35	Kanthabouli	Savannakhet	2,100		MCTPC	
72	None Sa nga	Song Khone	Savannakhet	2,100		MCTPC	
73	Km. 90	Khong Sedone	Saravane	2,100		MCTPC	
74	Na Pong	Khongsedone	Saravane	4,200		MCTPC	
75	Done Kho		Champasak	2,750		OFF GRID	
76	Done Khor		Champasak	680		OFF GRID	
77	Houay Lu si	Pakse	Champasak	2,100		MCTPC	
78	Pa Hang	Pakse	Champasak	2,100		MCTPC	
79	Muong Khong	Muong Khong	Champasak	2,400		MCTPC	
80	Thong Kam	Saravane	Saravane	2,100		MCTPC	
81	Saravane	Saravane	Saravane	2,400		MCTPC	
82	Muang Keo	Houay sai	Bo Keo	1,200		MCTPC	
83	Nam Phet	Houay sai	Bo Keo	600		MCTPC	
84	Nam phair ngai	Houay sai	Bo Keo	600		MCTPC	
85	Nam Sing	Vieng phou Kha	Luang Namtha	600		MCTPC	

86	Houay Kham	Namtha	Luang Namtha	600		MCTPC	
87	Nong heng	Xay	Oudomxay	450		MCTPC	
88	Nam Pik	Xay	Oudomxay	600		MCTPC	
89	Km. 50	La	Oudomxay	600		MCTPC	
90	Phongsaly	Phongsaly	Phongsaly	600		MCTPC	
91	Aat ya kao	Boun tai	Phongsaly	600		MCTPC	
92	Phoxaytai	Kua	Phongsaly	600		MCTPC	
93	Phoxay tai	Kua	Phongsaly	600		MCTPC	
94	Km. 10	Luangprabang	Luangprabang	600		MCTPC	
95	Nam Ok Hou	Xieng ngeun	Luangprabang	600		MCTPC	
96	Keokathiam	Phou koune	Luangprabang	600		MCTPC	
97	Sene si	Phou koune	Luangprabang	600		MCTPC	
98	Simuong	Xayabouli	xayabury	600		MCTPC	
99	Pang khone		xayabury	600		MCTPC	
100	Vieng Thong	Pek	Xieng Khouang	600		MCTPC	
101	Xone	Pek	Xieng Khouang	600		MCTPC	
102	Ngot lieng	Kham	Xieng Khouang	600		MCTPC	
103	Na sala	Sam Neua	Hua Phanh	600		MCTPC	
104	Na Pheng	Tourakhom	Vientiane	600		MCTPC	
105	Namone	Vang Vieng	Vientiane	600		MCTPC	
106	Ngot Cheng	Sang Thong	Vientiane Prefect.	750		MCTPC	
107	Phia Lat	Sang Thong	Vientiane Prefect	450		MCTPC	
108	Nong Kok	Kham Keut	Borikhamxay	600		MCTPC	
109	Phakatat	Kham Keut	Borikhamxay	600		MCTPC	
110	Hin Boun	Hin Boun	Khammouane	900		MCTPC	
111	Na ry	Hin Boun	Khammouane	600		MCTPC	
112	Hin Boun	Hin Boun	Khammouane	600		MCTPC	
113	Na Kai mai	Nakai	Khammouane	600		MCTPC	
114	Km. 35	Champhone	Savannakhet	750		MCTPC	
115	Khiat ngong	Pathoumthone	Champasak	600		MCTPC	
116	Sou Xoum ma	Soukoum ma	Champasak	600		MCTPC	
117	Houay Ho	Paksong	Champasak	600		MCTPC	
118	Na pong	Khong sedone	Saravane	600		MCTPC	
119	Thong Kham	Lao ngam	Saravane	600		MCTPC	
120	Chanh To	Sanamxay	Attpeu	600		MCTPC	

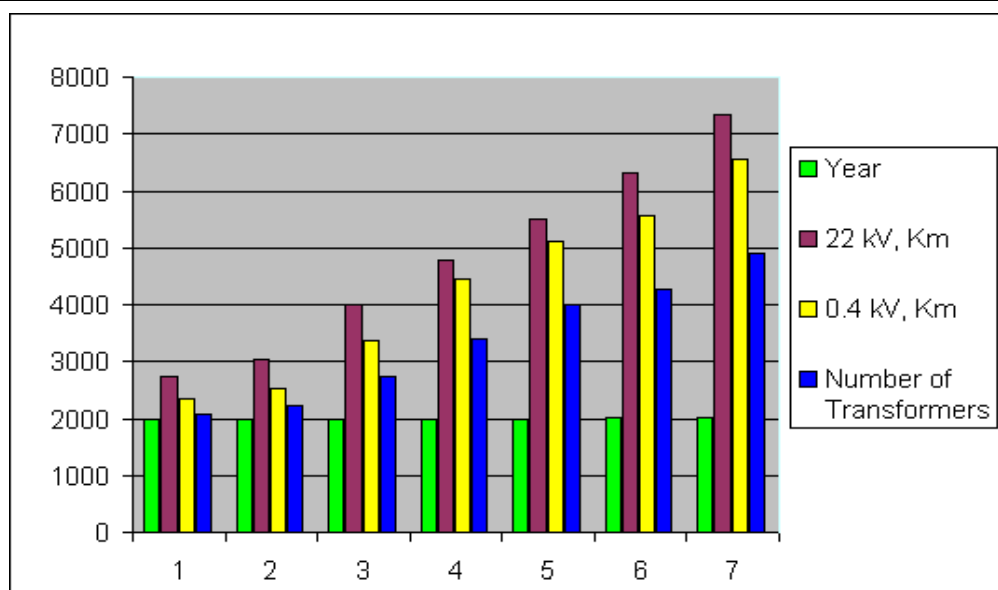
121	Mit samphanh	Sanamxay	Attpeu	450		MCTPC	
122	Toy	Saysettha	Attpeu	750		MCTPC	
123	None mixay	La mam	Sekong	600		MCTPC	
	Total			178.041 W		0,178 MW	%
1)	Installed Capacity from big scale Hydropower Plants			665 MW		97.50%	
2)	Installed Capacity from small scale Hydropower Plants			7,757 MW		1.14%	
3)	Installed Capacity from Diesel generation			9,108 MW		1.34%	
4)	Installed Capacity from Solar PV			0,178 MW		0.02%	
	Grand Total (in KW)			682,043 MW		100%	

Remark:

- MIH+JICA -CE Ministry Industry & Handicrafts, Depart. of Electricity, Japan International cooperation Agency
- STEA CE- Science Technology Environment Agency
- MCTPC CE- Ministry of construction Transport Post Communication (to cover demand from Post and Telecommunication)
- EDL CE- Electricite du Laos
- NGO CE- Non Governmental organization

Attachment 2: The Statistic of the Growing of Midum voltage line, low voltage line and Transformer all country 1996 - 2005

Year	Length of Transmission line		Number of Transformers
Year	22 kV, Km	0.4 kV, Km	Unit
1996	2,748.6	2,347.9	2,073
1997	3,039.8	2,526.9	2,215
1998	4,013.0	3,353.8	2,724
1999	4,770.0	4,448.0	3,406
2000	5,516.5	5,110.5	4,013
2001	6,315.8	5,569.4	4,256
2002	7,338.0	6,549.5	4,889
2005	8,361.91	8,591.57	6,487



Attachment 3: Statistic of Electricity Production, Domestic Sale, Import & Export of Power of EDL, Theun Hinboun & Houay Ho (Unit in KWh) (1962-2005)

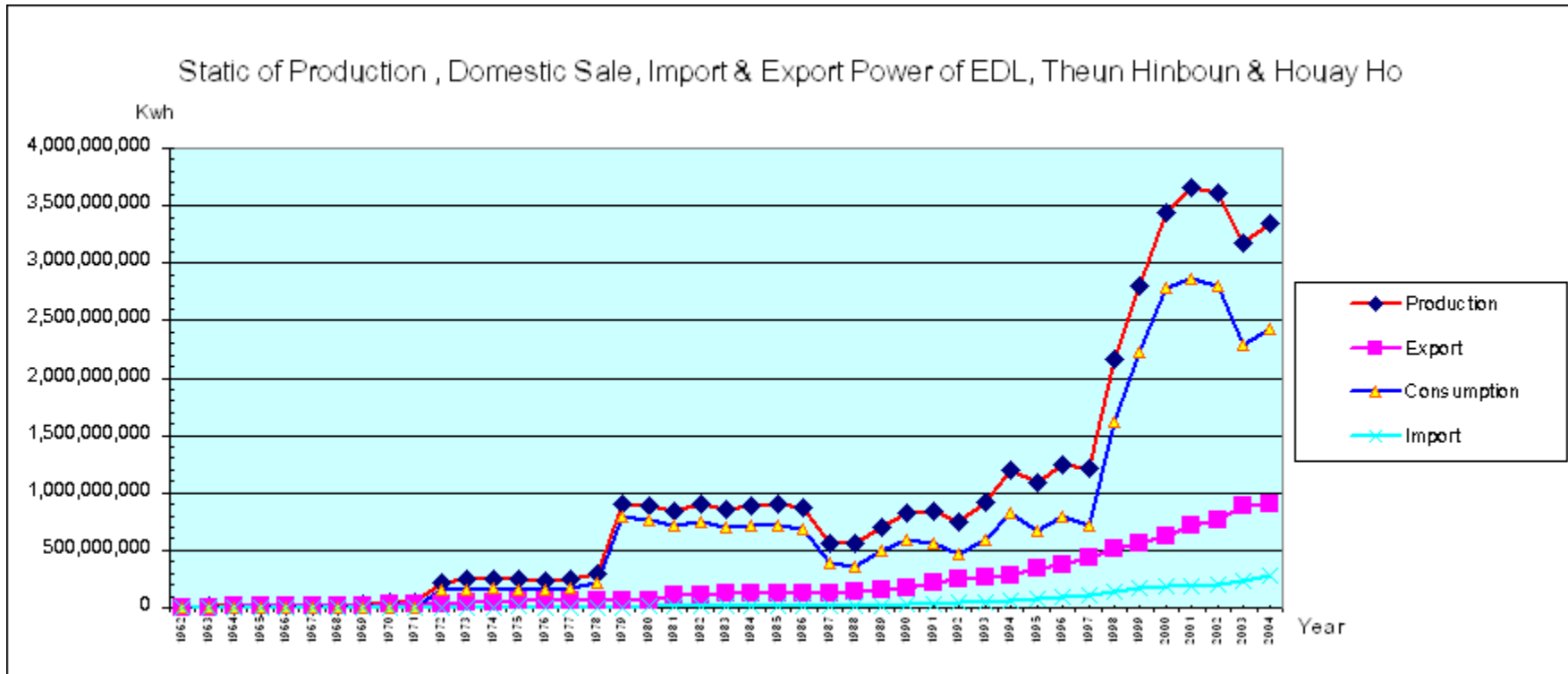
Years	Total Energy generation				Electricite du Laos EDL				Theun Hinboun Power Company				Houay Ho Power Company			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	Generation	Domes sale	Export	Import	Generation	Domes.Sale	Export	Import	Generation	Domes	Export	Import	Generation	Do.Sale	Export	Import
1962	7,146,947	5,843,684		00	7,146,947	5,843,684										
1963	7,929,601	5,959,360		00	7,929,601	5,959,360										
1964	10,517,740	8,508,271		00	10,517,740	8,508,271										
1965	12,365,706	8,980,007		00	12,365,706	8,980,007										
1966	16,817,967	12,810,150		00	16,817,967	12,810,150										
1967	19,707,824	16,985,798		00	19,707,824	16,985,798										
1968	22,860,836	17,337,959		00	22,860,836	17,337,959										
1969	31,336,722	21,808,312		00	31,336,722	21,808,312										
1970	42,918,387	25,304,733		00	42,918,387	25,304,733										
1971	51,906,622	28,835,814	4,071,700	0	51,906,622	28,835,814	4,071,700									
1972	216,568,459	37,481,097	151,974,200	0	216,568,459	37,481,097	151,974,200									
1973	244,080,744	53,076,306	159,981,800	1,554,000	244,080,744	53,076,306	159,981,800	1,554,000								
1974	253,912,478	49,787,481	165,662,000	2,236,538	253,912,478	49,787,481	165,662,000	2,236,538								
1975	241,343,500	60,662,478	155,289,801	8,433,443	241,343,500	60,662,478	155,289,801	8,433,443								
1976	232,762,740	63,567,000	156,617,600	6,744,050	232,762,740	63,567,000	156,617,600	6,744,050								
1977	256,140,300	64,926,000	176,722,000	6,271,745	256,140,300	64,926,000	176,722,000	6,271,745								
1978	298,435,100	63,668,803	222,510,033	6,232,464	298,435,100	63,668,803	222,510,033	6,232,464								
1979	898,064,100	65,373,343	787,968,903	6,852,066	898,064,100	65,373,343	787,968,903	6,852,066								
1980	886,196,100	64,593,000	766,405,400	7,828,152	886,196,100	64,593,000	766,405,400	7,828,152								
1981	845,897,700	105,118,000	708,703,800	8,387,581	845,897,700	105,118,000	708,703,800	8,387,581								
1982	910,451,200	107,373,000	749,762,200	10,658,385	910,451,200	107,373,000	749,762,200	10,658,385								
1983	863,377,600	124,008,965	694,416,900	13,371,806	863,377,600	124,008,965	694,416,900	13,371,806								

1984	890,975,700	127,466,238	709,716,277	16,632,804	890,975,700	127,466,238	709,716,277	16,632,804									
1985	906,620,300	130,385,347	716,277,200	18,600,000	906,620,300	130,385,347	716,277,200	18,600,000									
1986	867,305,000	128,151,280	683,588,000	17,196,270	867,305,000	128,151,280	683,588,000	17,196,270									
1987	566,606,800	125,533,604	387,250,600	17,997,097	566,606,800	125,533,604	387,250,600	17,997,097									
1988	552,647,000	139,100,930	363,607,900	19,803,050	552,647,000	139,100,930	363,607,900	19,803,050									
1989	698,017,300	149,196,361	490,542,900	23,086,340	698,017,300	149,196,361	490,542,900	23,086,340									
1990	820,557,700	164,576,173	595,192,720	27,732,920	820,557,700	164,576,173	595,192,720	27,732,920									
1991	834,611,344	220,666,369	562,586,813	34,900,178	834,611,344	220,666,369	562,586,813	34,900,178									
1992	751,624,306	252,737,490	459,818,078	41,269,742	751,624,306	252,737,490	459,818,078	41,269,742									
1993	919,637,170	264,788,396	595,786,249	47,724,262	919,637,170	264,788,396	595,786,249	47,724,262									
1994	1,198,316,967	279,441,678	829,250,624	57,440,282	1,198,316,967	279,441,678	829,250,624	57,440,282									
1995	1,084,985,378	337,472,311	675,546,863	76,832,692	1,084,985,378	337,472,311	675,546,863	76,832,692									
1996	1,247,836,792	379,541,423	792,430,900	87,560,771	1,247,836,792	379,541,423	792,430,900	87,560,771									
1997	1,218,744,232	433,865,857	710,211,695	101,584,810	1,218,744,232	433,865,857	710,211,695	101,584,810									
1998	2,156,619,542	513,272,507	1,613,448,685	142,283,840	947,777,356	513,272,507	405,197,069	142,283,840	1,208,842,186	590,570	1,208,251,616	0					
1999	2,806,272,537	565,546,838	2,228,816,655	172,197,130	1,168,703,500	565,546,838	598,140,993	172,197,130	1,439,557,237	791,943	1,438,765,294	0	198,011,800	452,600	191,910,368	0	
2000	3,438,381,570	626,346,000	2,792,838,789	180,167,000	1,337,043,000	626,346,000	694,187,000	180,167,000	1,483,788,149	749,081	1,483,039,068	0	617,550,421	1,937,700	615,612,721	0	
2001	3,653,660,230	710,330,142	2,871,413,817	183,802,549	1,553,648,951	710,330,142	796,379,635	182,497,035	1,507,498,700	729,500	1,485,260,283	1,305,514	592,512,579	2,740,958	589,773,899	0	
2002	3,604,109,207	766,738,823	2,798,343,351	200,797,000	1,570,201,000	766,738,823	771,434,000	200,797,000	1,454,594,941	1,010,653	1,453,584,288		579,313,266	4,363,800	573,325,063	0	
2003	3,178,201,652	883,738,983	2,284,638,513	229,343,554	1,316,902,213	883,738,983	434,656,874	229,343,554	1,432,080,000	3,812,425	1,426,930,000		429,219,439	6,167,800	423,051,639		
2004	3,347,625,644	902,762,784	2,424,685,423	277,588,003	1,416,458,798	902,762,784	507,054,590	277,588,003	1,527,713,746	6,362,913	1,521,350,833		403,453,100	7,173,100	396,280,000		
2005					1,524,000,000	1,025,820,000	520,460,000	261,030,000									

Source of Information: - EDL

- o Nam ngum 1 (1971)

- Theun-Hinboun Power Company (1998)
- Houay Ho Power Company (1999)
- The information of the year 2005 is not certain



Attachment 4: The Status of IPP projects

Item	Project	Capacity (MW)	Original Project Sponsor	Type of Agreement	Signing Date	Current Project Sponsor	Status
1	Theun-Hinboun	210	THPC	CA	13-Oct-94	THPC	Operating phase
2	Houay Ho	150	Daewoo	CA	23-Sep-93	Tractabel	Operating phase
3	Hongsa Lignite	720	Thai Lao Lignite	CA	22-Jun-94	Thai Lao Lignite	Initialed PPA lapsed
4	Nam Ngum 3	440	GMS Power	PDA	15-Nov-97	GMS Power	MOU superseded by PDA
5	Nam Ngum 2	615	Shlapak	CA	17-Mar-98	Shlapak	MOU superseded by CA
6	Nam Mo	105	Mahawong	PDA	18-Nov-99	Mahawong/Harza	MOU superseded by PDA
7	Nam Theun 2	980	NTEC	CA	16-Nov-98	NTEC	EGAT PPA negotiated
8	Xe Kaman 3	300	Viet-Lao PDR	MOU	25-Jul-03	Viet-Lao PDR	Feasibility study in progress
9	Xe Kong 5	250	Sondel S.P.A	MOU	10-Apr-00		Inactive (MOU expired)
10	Nam Tha 1	265	SPB	MOU	07-Oct-95		Inactive
11	Xe Pian-Xe Namnoy	390	Dong Ah	CA	17-Aug-94	K & L	MOU re-assigned
12	Xe Kaman 1	468	ANSCAN	CA	15-Nov-97		In process of cancellation
13	Nam Theun 3	237	Heard Energy	PDA	01-Aug-94		In process of cancellation
14	Nam Theun 1	540	SUSCO	MOU	25-Mar-94		In process of cancellation
15	Nam Ou 8	600	Pacific Rim Energy	MOU	11-Nov-94		Inactive
16	Donesahong	30	EP (Malaysia)	MOU	23-Aug-01	EP (Malaysia)	MOU extended for 6 months
17	Nam Ngum 5	90	Melkyma	MOU	10-Sep-96		Intention to cancel notified
18	Xe Kong 4	528	Modular	MOU	21-Jan-94		Intention to cancel notified
19	Nam Pha		Statecorp Holding P/L	MOU	29-Aug-02	Statecorp Holding P/L	Survey for feasibility study
20	Nam Bak(Cha) 2B	120	Engineering Con.C	MOU	17-Oct-02	Engineering Con.C	Survey planned
21	Nam Beng	25-50	International Blaster	MOU	16-Dec-02	International Blaster	Survey for feasibility study
22	Nam Ngew	20	Hongkham Construction	MOU	29-Nov-02	Hongkham Construction	Survey for feasibility study
23	Nam Sim A	9.3	Energy Development	MOU	15-Feb-03	Energy Development	Feasibility study in progress
24	Nam Ngiep 1	440	Nippon Koei	MOU	09-May-03	Nippon Koei	Active

Attachment 5: Attachment 9 On-Grid Electric Tariff of Lao PDR (Effective from May 2002 to April 2005)

No. 375/EDL, 26 April 2002 (Unit: Kip or USCent/kWh)

Year		Price-up	Calendar Year 2002											
Month	Unit	Rate	1	2	3	4	5	6	7	8	9	10	11	12
1. Residence														
0 - 50 kWh	Kip	2.3%/Month					64	65	67	69	70	72	73	75
51- 200 kWh	Kip	2.3%/Month					150	153	157	161	164	168	172	176
201- kWh	Kip	2.3%/Month					433	443	453	464	474	485	496	508
2. Embassy, Foreigner	US Cent						9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9
3. Business	Kip	2.3%/Month					468	479	490	501	513	524	536	549
4. Entertainment Business	Kip	2.3%/Month					620	634	649	664	679	695	711	727
5. Government Admi.	Kip	2.3%/Month					400	409	419	428	438	448	458	469
6. Irrigation	Kip	2.3%/Month					167	171	175	179	183	187	191	196
7. Industry	Kip	2.3%/Month					360	368	377	385	394	403	413	422

Year		Price-up	Calendar Year 2003											
Month	Unit	Rate	1	2	3	4	5	6	7	8	9	10	11	12
1. Residence														
0 - 50 kWh	Kip	2.3%/Month	77	79	80	82	84	86	88	90	92	94	96	99
51- 200 kWh	Kip	2.3%/Month	180	184	188	193	197	202	206	211	216	221	226	231
201- kWh	Kip	2.3%/Month	519	531	544	556	569	582	595	609	623	637	652	667
2. Embassy, Foreigner	US Cent		9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9
3. Business	Kip	2.3%/Month	561	574	587	601	615	629	643	658	673	689	705	721
4. Entertainment Business	Kip	2.3%/Month	744	761	778	796	815	833	852	872	892	913	934	945
5. Government Admi.	Kip	2.3%/Month	480	491	502	514	525	538	550	563	576	589	602	616
6. Irrigation	Kip	2.3%/Month	200	205	210	214	219	224	230	235	240	246	251	257
7. Industry	Kip	2.3%/Month	412	442	452	462	473	484	495	506	515	530	542	535

Year		Price-up	Calendar Year 2004											
Month	Unit	Rate	1	2	3	4	5	6	7	8	9	10	11	12
1. Residence														
0 - 50 kWh	Kip	2.3%/Month	101	103	106	108	110	113	116	118	121	124	127	130
51- 200 kWh	Kip	2.3%/Month	236	242	247	253	259	265	271	277	284	290	297	304
201- kWh	Kip	2.3%/Month	682	698	714	731	747	765	782	800	818	837	857	876
2. Embassy, Foreigner	US Cent		9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9
3. Business	Kip	2.3%/Month	737	754	772	790	802	826	845	865	885	905	926	947
4. Entertainment Business	Kip	2.3%/Month	977	999	1022	1046	1070	1095	1120	1146	1172	1199	1226	1245
5. Government Admi.	Kip	2.3%/Month	630	645	660	675	690	706	722	739	756	773	791	809
6. Irrigation	Kip	2.3%/Month	263	269	275	282	288	295	302	309	316	323	330	332
7. Industry	Kip	2.3%/Month	567	580	594	607	621	636	650	665	680	696	712	729

Year		Price-up	Calendar Year 2005											
Month	Unit	Rate	1	2	3	4	5	6	7	8	9	10	11	12
1. Residence														
0 - 50 kWh	Kip	2.3%/Month	132	236	139	142								
51- 200 kWh	Kip	2.3%/Month	311	312	325	332								
201- kWh	Kip	2.3%/Month	896	917	938	960								
2. Embassy, Foreigner	US Cent		9.9	9.9	9.9	9.9								
3. Business	Kip	2.3%/Month	969	991	1014	1037								
4. Entertainment Business	Kip	2.3%/Month	1284	1313	1343	1374								
5. Government Admi.	Kip	2.3%/Month	828	847	867	887								
6. Irrigation	Kip	2.3%/Month	346	354	362	370								
7. Industry	Kip	2.3%/Month	745	762	780	798								

Note:

1. Above figure is not including 5 % of Government Tax.
2. According to Declare of MIH No. 152/MIH, Date 23/04/2002 Approve Electric Tariff

Attachment 6: The New Electric Tariff 2005-2006-2007

Notice of the Ministry of Industry and Handicrafts on Domestic

Power rate adjustment (June the 24th 2005)

- In reference to the notice from the MIH No 302/MIH, dated 24/06/2005 with regard to the adjustment of domestic electricity price.

Electricity du Laos would like to inform to all of electricity users that from the month (7/2005) of July 2005, we will make an adjustment of electricity rate of which the details are as follow:

Category of Customer	From 06/2004 To 06/2005	From 07/2005 To 12/2005	2006	2007
Residential users of low Voltage power				
From 0 - 25 KWh	113	115	132	152
From 26 - 150 KWh	265	265	273	281
> 150	765	765	765	765
Non Residential users of low Voltage power				
Irrigation	295	295	310	325
State' Office & Building	706	706	696	686
Industry	636	636	627	6187
Business in general	826	826	826	826
Embassies & International organizations	1,066	1,066	1,066	1,066
Entertainment	1,095	1,095	1,095	1,095
Non Residential users of middle Voltage power (22 K v)				
Irrigation	266	251	263	276
Industry	572	541	533	526
State' Office & Building	653	600	592	583
Business in general	743	702	702	702

Remark: we would like to inform our customers that the rate shows in this table is in Lao currency, KIP/KWh.

Exchange rate : \$ 1 USD = 10,860 Kips in year 2005

EDL Managing Director : Viraphonh VIRAVONG

Attachment 7: Electricity Tariff Analysis

ELECTRICITY TARIFF ANALYSIS
Comparative Study on Importing Tariff

	Import from PEA Bokeo, Boten	Import from- EVN - Xam- neua	Purchased from THPC Borikhamxay	Purchased from HHPC Borik- hamxay	Import from EGAT Savannakhet	Purchased from NT2 Thakhek	Import from EGAT Sepon mining
1.Demand Charge	3.281	-	-	-	-	-	-
2. Energy Charge(US cent\KWH)							
Peak	6.651	6.00			3.5	-	-
Off- peak	2.940	6.00	-	-	3.30	-	-
Average	4.458	6.00	4.26	3.78	3.39	3.6	5.96
3. Power Factor Charge (US\$)	78.975	-	-	-	-	-	-
4. FT Adjustment Charge (US\$\KWH)	0.009506	-	-	-	-	-	-
5. Service Charge (US\$)	5.631	-	-	-	-	-	-
6. Discount amount for the investor							
7. Adjustment(Increase\ Decrease							
8. Income Compensation Charge (US\$\KWH)	0.03601	-	-	-	-	-	-
9.Value Added Tax							
AVERAGE Import Tariff (US cent\KWH	6.690	6.00	4.26	3.76	3.39	3.60	5.96