Energy Sector Development in Lao PDR

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Energy Sector

1. Oil and Gas
2. Coal
3. Power Sector/Electricity
4. Others
   - Renewable energy
   - Nuclear energy

BACKGROUND OF LAO PDR

- Area of 236,800 sq km;
- Population of 6.8 million (2009);
- GDP per Capita of USD 900 (2009);
- Mountainous area with major tributaries of the Mekong River covering 35% of total Mekong River basin.
- Relatively high annual rainfall.
- Hydropower potential: 23,000 MW
- Existing installed capacity of 3,205 MW
- The Government has identified both the hydropower and mining sectors as fundamental drivers of progress toward achieving the Millennium Development Goals by 2015 and graduating from the list of least developed economies by 2020

Primary Energy Resources of Lao PDR

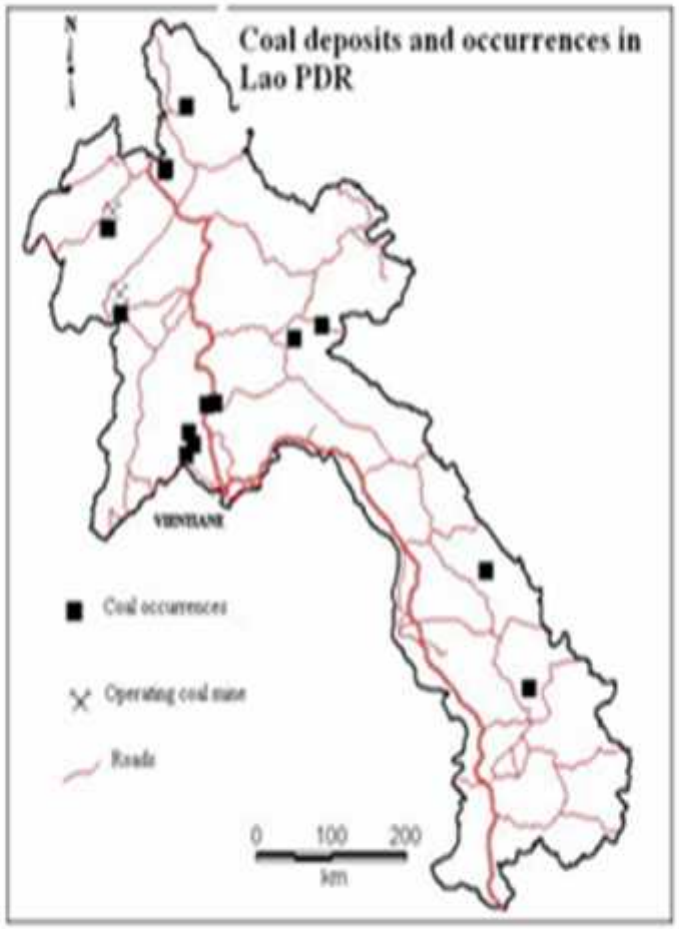
Resource	Reserves	Potential for Use in Power Generation
Oil and Gas	Two exploration concessions in central and southern Lao PDR. Mapping and geophysical investigations are being carried out, including deep hole drill (2,560 m). Results are being evaluated	Possibly in the longer term (10-15 years), if sufficient reserves found
Coal (Lignite)	Major resource located at Hongsa in north-west Lao PDR. About 810 million tons proven reserve, of which over 530 million tons 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 tons. Energy contents 23-35 MJ/kg.	Current annual production of 130,000 tons, 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 (agriculture 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.

Oil and Gas

- 100% imported as in 2008 the total import was 558,426,822 Liter (motor gasoline, diesel, jet fuel, bunker oil, lubricant)
- Annual growth rate 7-8% (Oil consumption)
- Salamander Energy Group has been approved for exploration concessions in central of Lao PDR the Mapping and geophysical investigations are being carried out, including deep hole drill (3,400 m). Results are being evaluated
- Petro Vietnam has been approved for exploration concessions in southern of Lao PDR.

Coal

Figure 8: Map showing coal deposits and occurrences in Lao PDR.



Coal mining activity in the Lao PDR is medium to small scale operation.

19 coal projects:

3 General survey,

8 Exploration,

8 Exploitation

---> conducted by

8 foreign companies

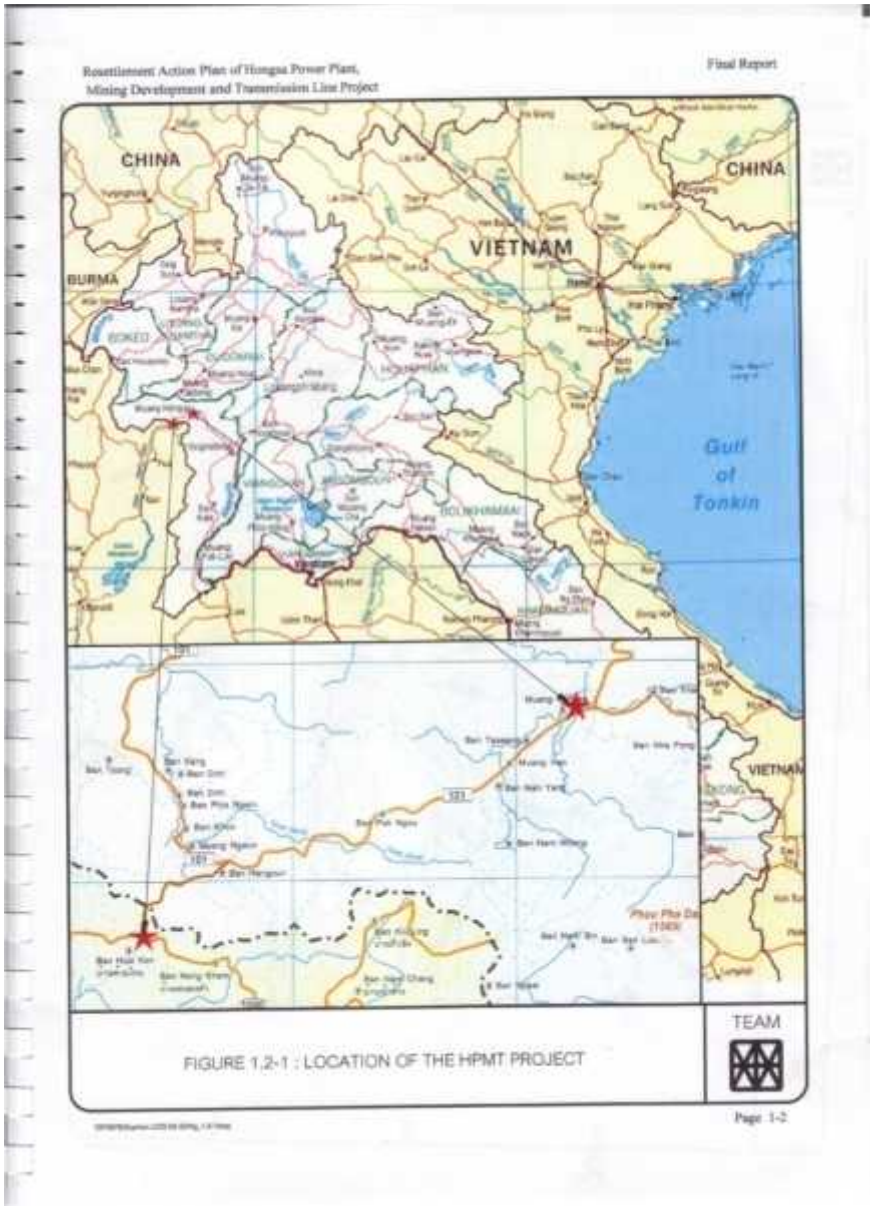
and 5 local companies.

RESERVE AND COAL PRODUCTION

- Geological reserve: about 630,901,776 t
- Mineable reserve: about 370,000,000 t
- Coal mining activities in Laos are almost open cast.
- Coal is mainly produced in northern Laos and in Vientiane province.
- In 2009 Coal was exploited about 413,409 tones in which 100,985 t was supplied for domestic consumption.
- The demand for coal for domestic consumption is increasing.

- Coal development in Laos is in the early stage and mostly is small to medium scale activities.
- Coal-fired Hongsa power project is to be the first thermal power plant in Lao PDR.
- Due to the heavy domestic demand all types of coal are preserved for supplying only for domestic consumption.
- Ensure the environmental concerns and sustainable development .

Hongsa Power Project



- **First ever thermal power plant in Laos (? 2015)**
- **To be developed on a BOT basis**
- **Capacity 1,653 MW**

  (3 units of 626 MW each)
- **Consume about 1,923 t/h of lignite of average heating value of approximately 3,000 kcal / kg**

Power Sector

Power Sector

- The hydropower and mining sectors in Lao People's Democratic Republic (PDR) have developed rapidly over the past ten years, and have become the two primary commodities of the country
- The Government Of Lao has set up the national target for the household electrifies (standard usage), which 70% and 90% in 2010 and 2020 respectively

HISTORY OF POWER SECTOR DEVELOPMENT

- Memorandum of Understanding on the power exchange program were signed with the Royal Thai Government in 1993, 1996, 2006 and 2007 under which 1,500 MW is to be supplied to Thailand and subsequently increased to 7,000 MW is agreed;

- In 1998 and 2006 MOUs were signed with the Government of Vietnam for 3000 MW and subsequently increased to 5,000 MW is agreed;

- In 1999 Agreement on Cooperation in Power Sector was signed with Cambodia;
- Power Sector Strategy is being developed and updated from time to time;
- Power sector opened to private foreign direct investments;
- Legal framework has been improved from time to time to meet international financing requirements.

POWER SECTOR POLICY

- Maintain and expand affordable, reliable and sustainable electricity supply to promote economic and social development;
- Promote power exports as well as domestic power supply to earn revenues to meet Government development objectives with particular emphasis on poverty eradication;
- Develop and enhance the legal and regulatory framework to facilitate power sector development by either public, private or public private partnership;
- Gain capacity building through international technical know-how and expertise;
- Ensure accountability and transparency of environmental and social impacts and thereby achieve sustainable development

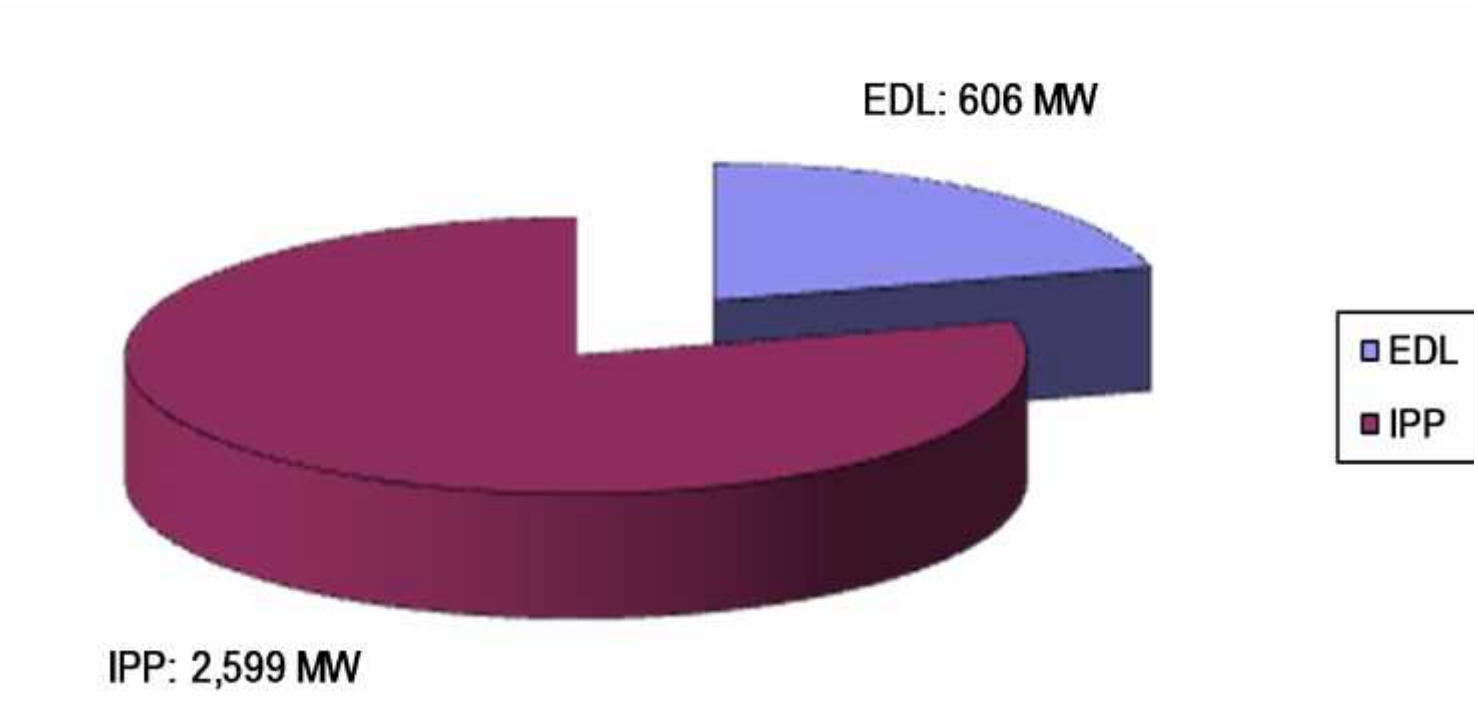
OBJECTIVES OF POWER SECTOR DEVELOPMENT

- Provide a source of foreign exchange to fund economic and social development and alleviate poverty;
- Meet the commitments under intergovernmental MOUs and Agreements with Thailand, Vietnam and others;
- Extend rural electrification to promote better socio-economic development and reach the government target of 70% and 90% by year 2010 and 2020 respectively;
- Integrate power sector and maintain its economic development as a whole with international communities trough its power exchange programs and foreign direct investment.

OWNERSHIP OF POWER GENERATION

The country's total installed Capacity (2012): 3,205 MW:

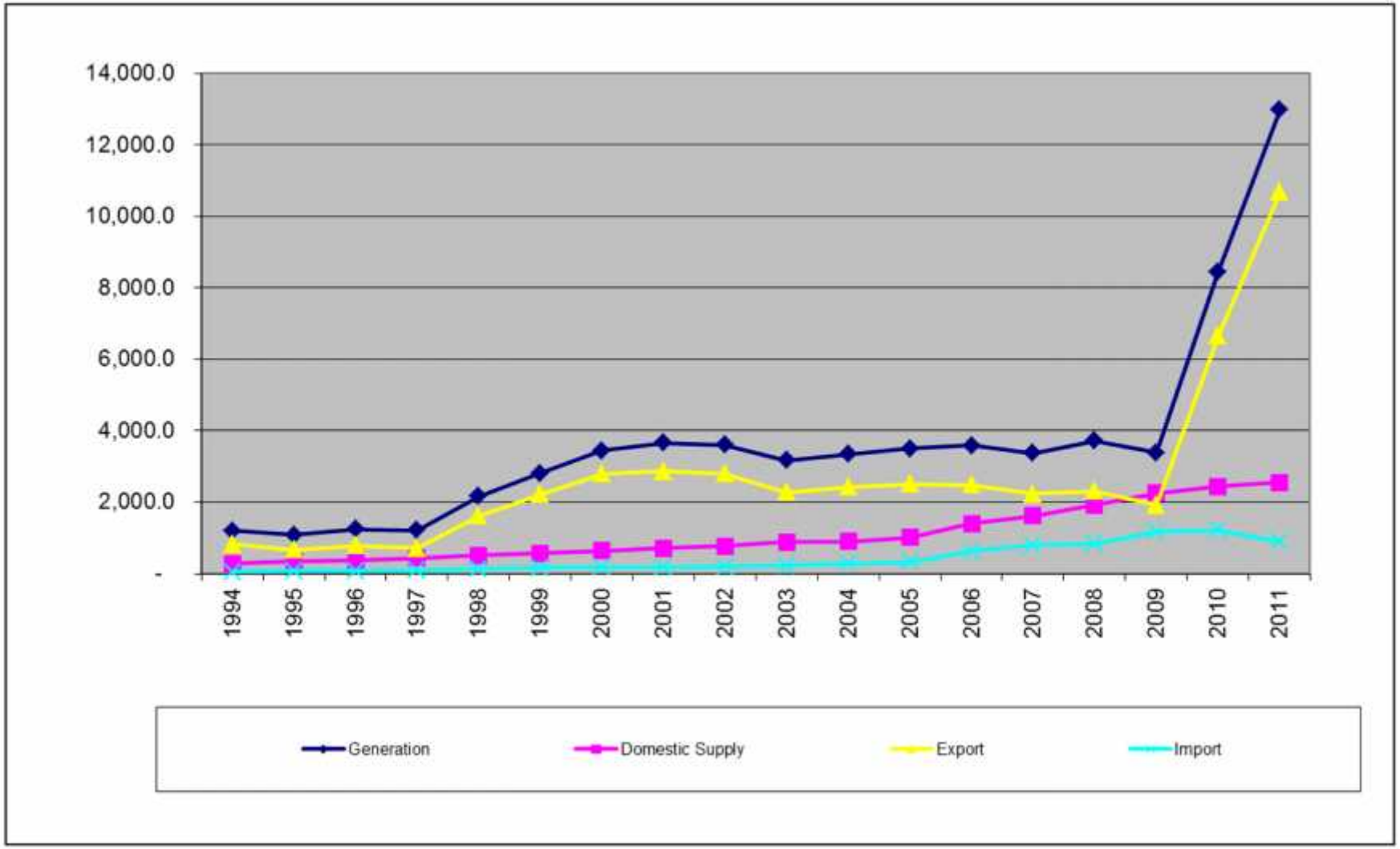
EdL 606 MW, IPP: 2,599 MW



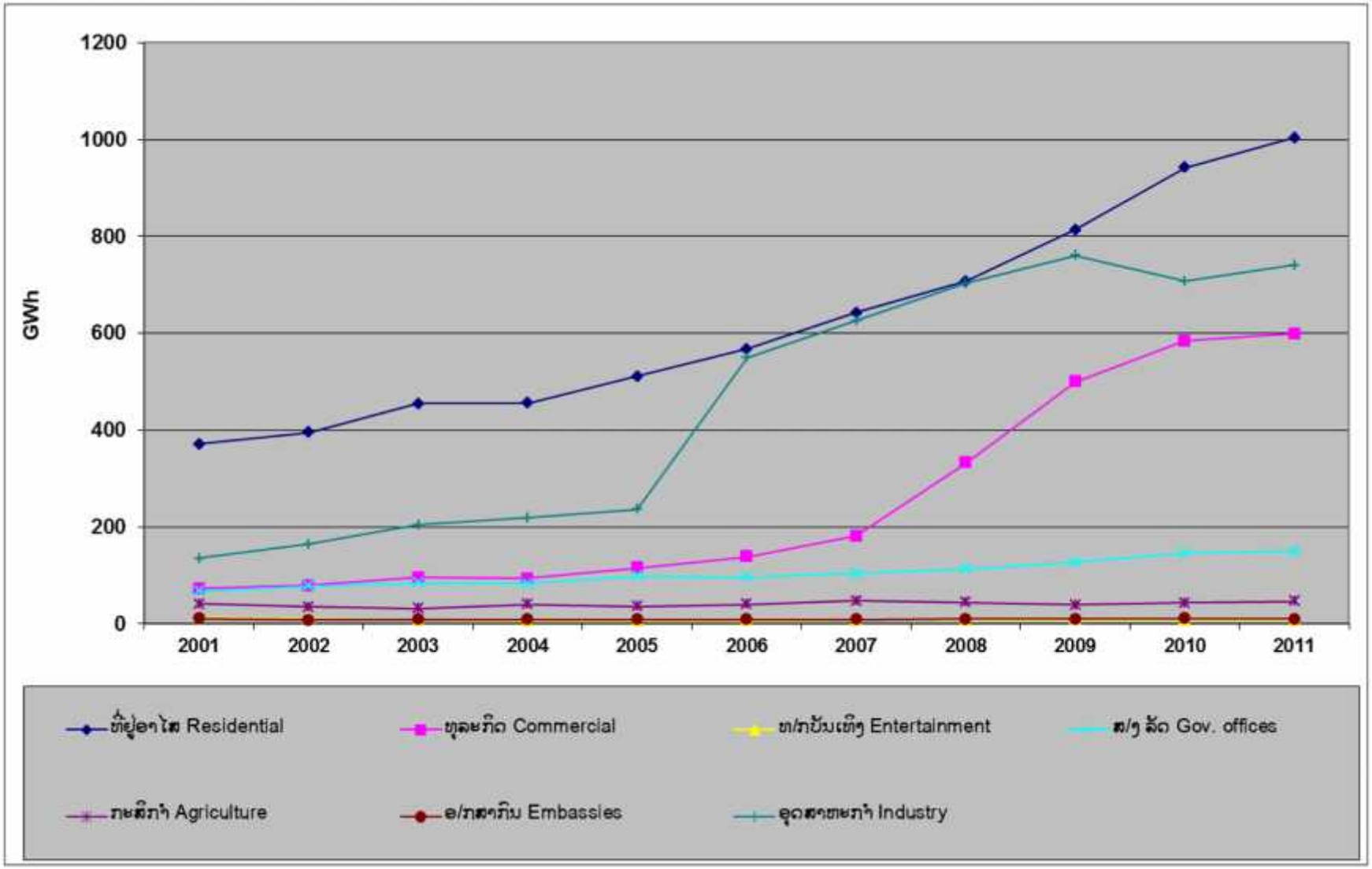
Hydropower Generation

Year	Generation (Gwh)	Domestic supply (Gwh)	Export (Gwh)	Import (Gwh)
2001	3,653.7	710.3	2,871.4	183.8
2002	3,604.1	766.7	2,798.3	200.8
2003	3,178.2	883.7	2,284.6	229.3
2004	3,347.6	902.8	2,424.6	277.6
2005	3,509.4	1,011.1	2,506.0	329.5
2006	3,595.0	1,406.0	2,487.4	631.1
2007	3,373.6	1,615.7	2,230.4	793.4
2008	3,717.0	1,915.7	2,315.4	844.5
2009	3,384.3	2,257.8	1,920.8	1,175.1
2010	8,449.0	2,440.7	6,646.5	1,209.7
2011	12,979.5	2,555.7	10,668.4	904.3

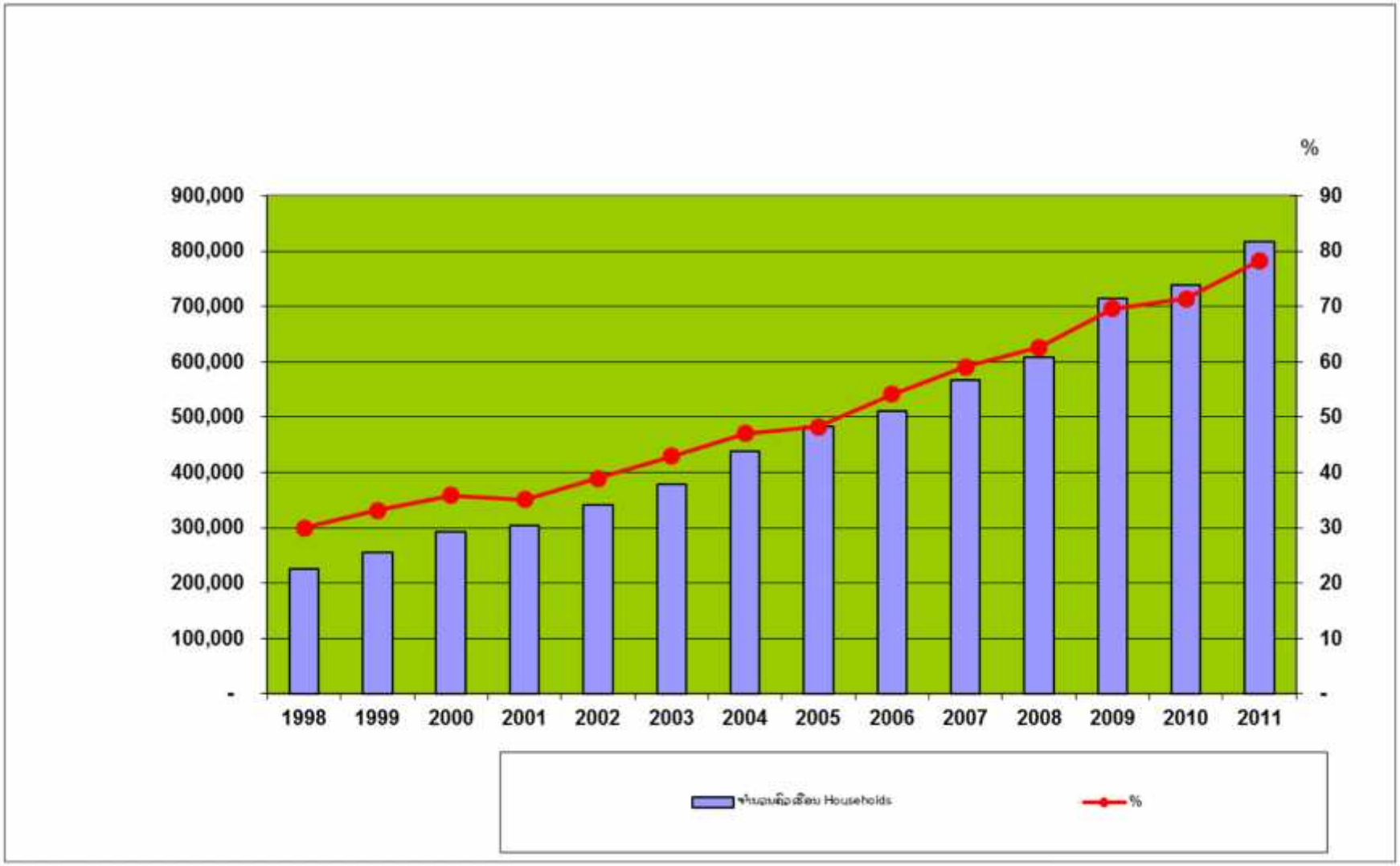
STATISTICS OF ELECTRICITY GENERATION, SUPPLY, IMPORT AND EXPORT



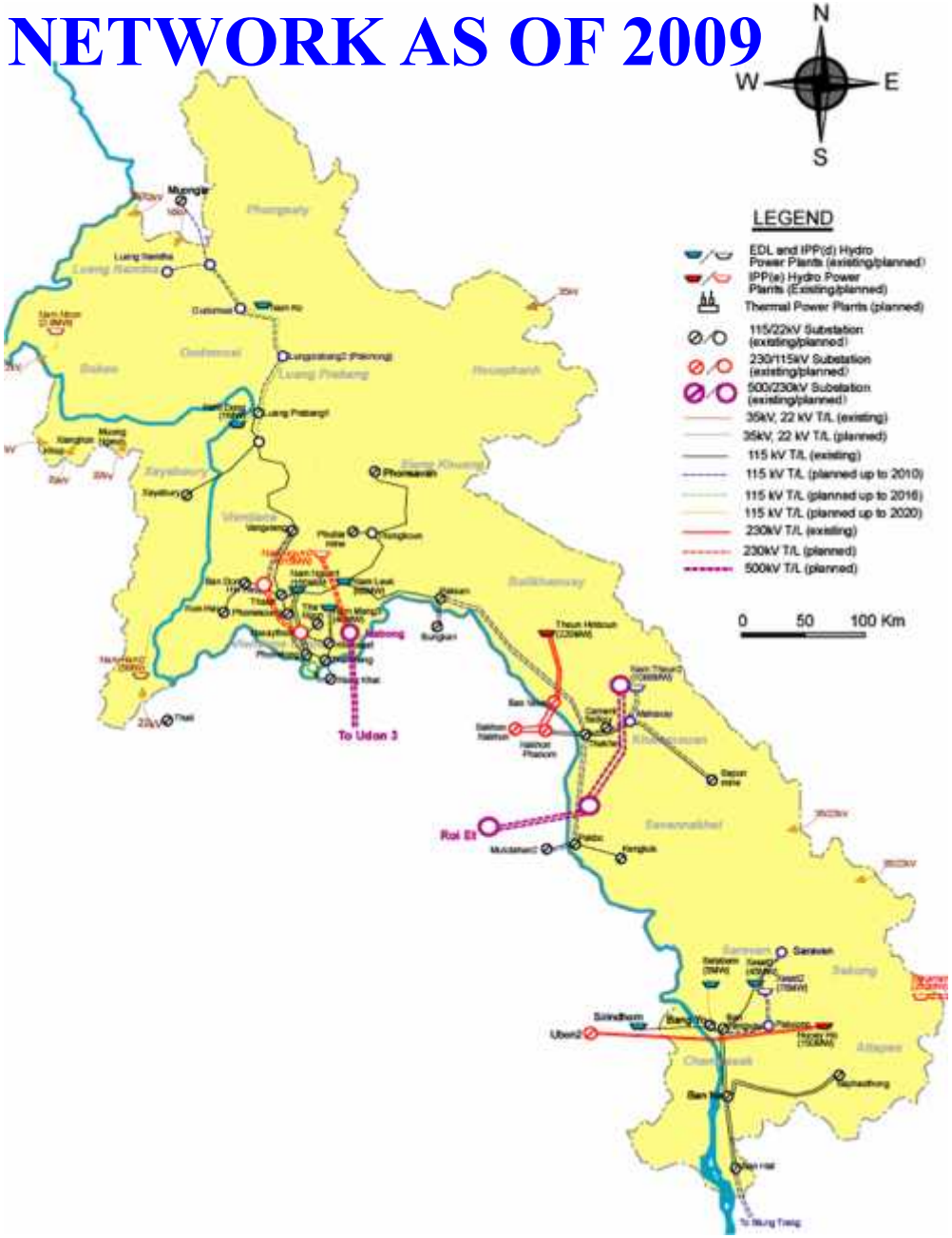
Electricity consumption in all categories from 2001-2011 (Gwh)



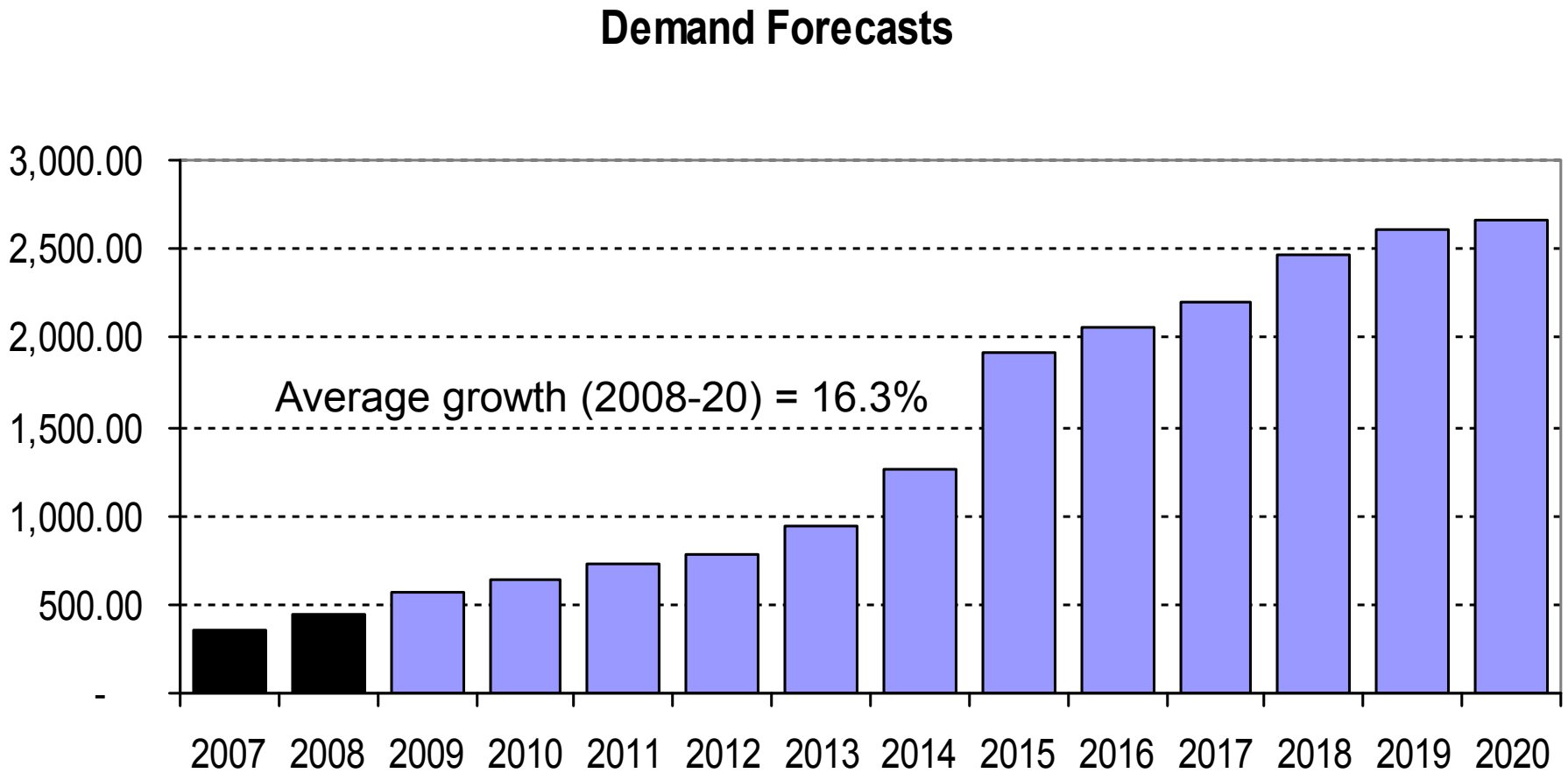
Electrified households



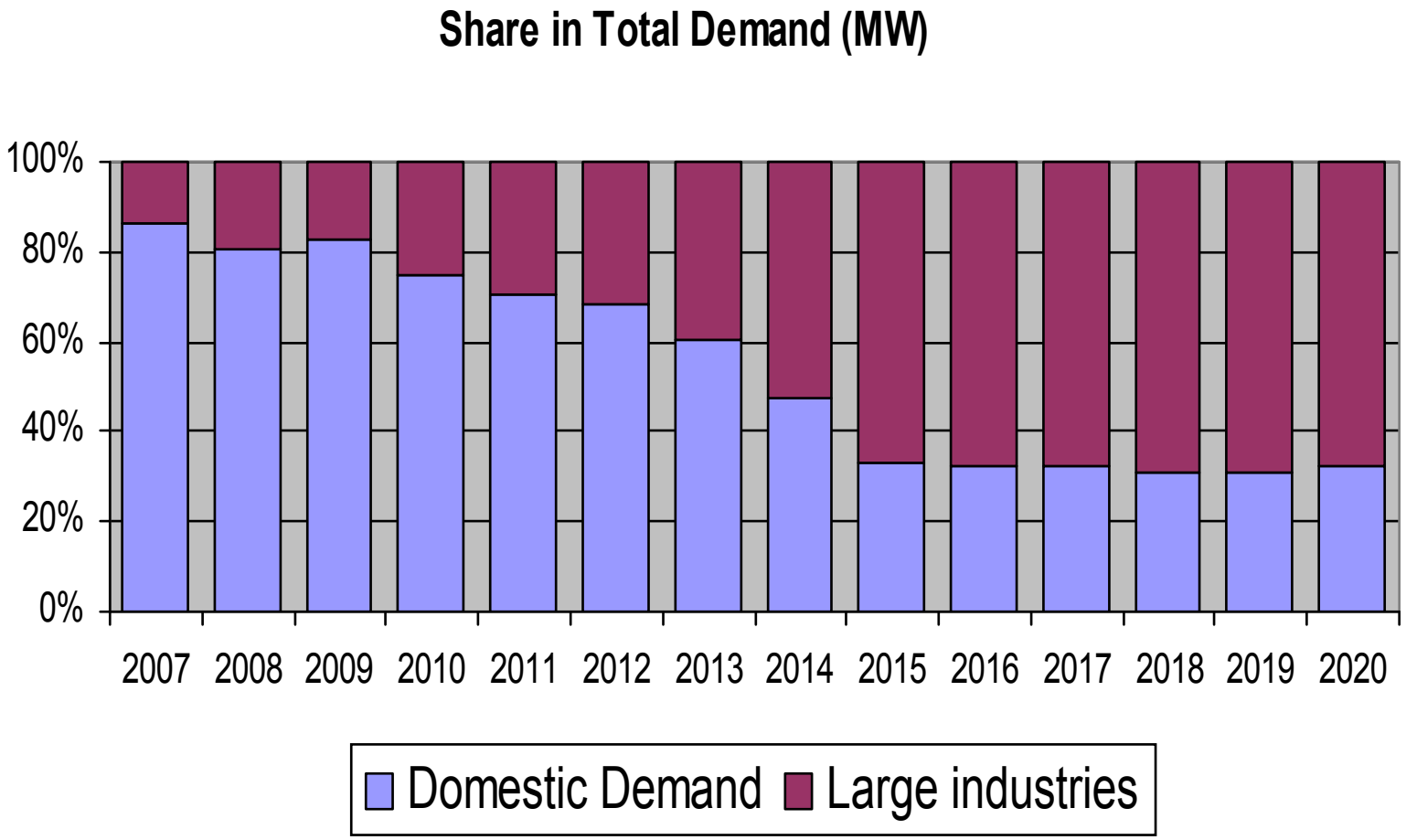
EXISTING NETWORK AS OF 2009



DEMAND FORECASTS



DEMAND FORECASTS (CONT.)



Electricity Tariff in Lao PDR

Month, Year		Lao Kip/kWh	Jan-08	Jan-09	Jan-10	Jan-11
Residential						
0-25 kWh		Lao Kip/kWh	175	201	231	266
26-150kWh		Lao Kip/kWh	290	298	307	316
>150 kWh		Lao Kip/kWh	765	765	765	765
Business	Low Volt.	Lao Kip/kWh	826	826	826	826
	Med. Volt.	Lao Kip/kWh	702	702	702	702
Intertratement		Lao Kip/kWh	1,095	1,095	1,095	1,095
Government	Low Volt.	Lao Kip/kWh	677	667	658	649
	Med. Volt.	Lao Kip/kWh	575	567	559	551
Inter. Organization		Lao Kip/kWh	1,066	1,066	1,066	1,066
Industry	Low Volt.	Lao Kip/kWh	610	601	593	584
	Med. Volt.	Lao Kip/kWh	518	511	504	497
Irrigation	Low Volt.	Lao Kip/kWh	341	359	377	395
	Med. Volt.	Lao Kip/kWh	290	305	320	336

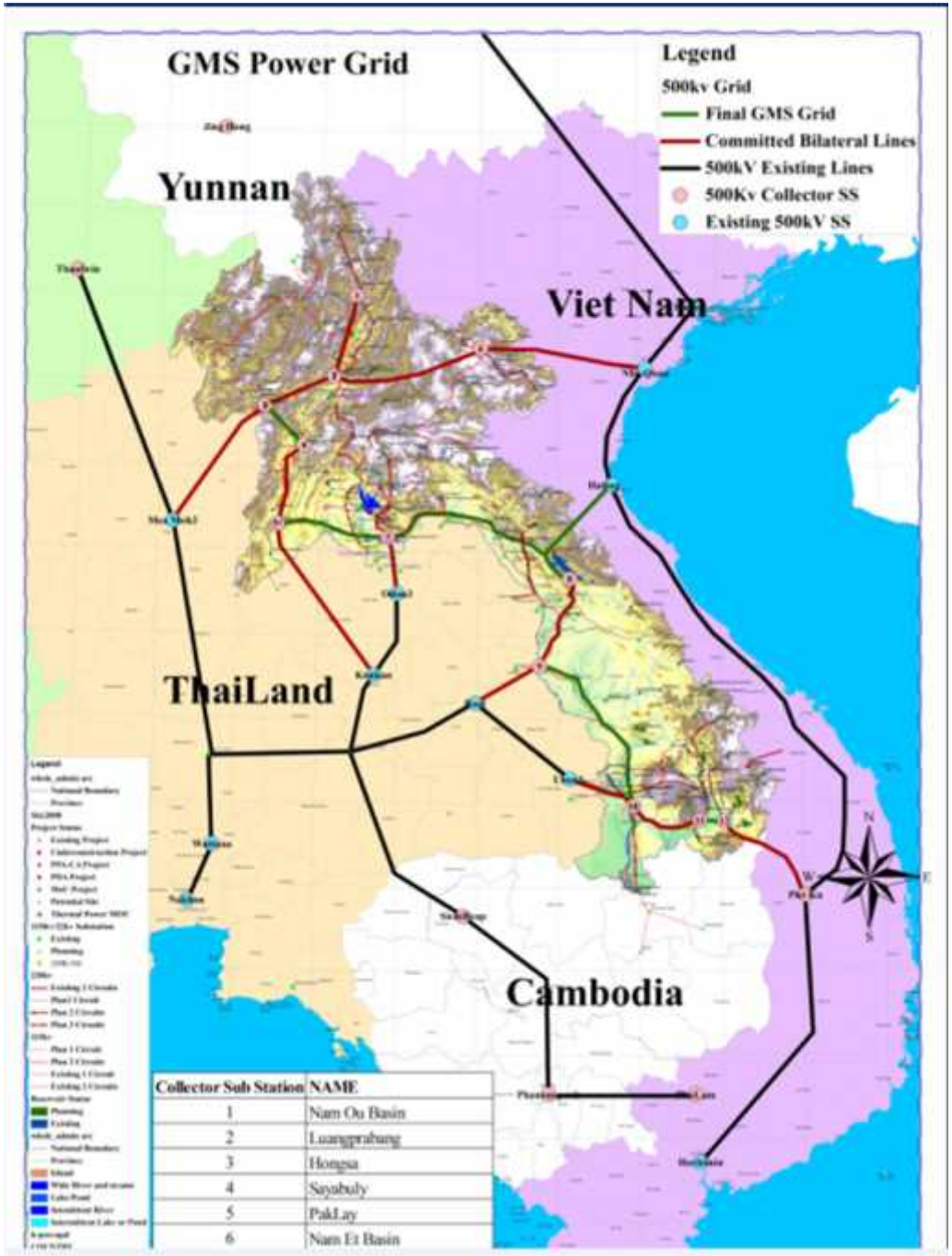
Exchange Rate 1$=8450 Kip

Potential Export to Thailand

		MW	GWh			
1	Nam Theun 2	1088	5936	Under testing	Yes	Dec-09
2	Nam Ngum 2	615	1976	under construction	Yes	2010
3	Nam Bak 1	80	240	FS Completed	No	
4	Theun Hinboun Exp	220	1395	under construction	Yes	2012
5	Nam Ngum 3	460	2077	FS Completed	No	??
6	Nam Theun 1	523	1840	FS Completed	No	??
7	Nam Ngiep 1	268	1327	FS Completed	No	??
8	Hongsa Lignite	1800	12200	under construction	Yes	2014
9	Nam Ou	1143	4977	FS on going	No	??
10	Donsahong (Mainstream)	240	2375	FS Completed	No	??
11	Sepian Xenamnoi	390	1748	FS Completed	No	??
12	Sekong 4	300	1901	FS Completed	No	??
13	Sekong 5	330	1200	FS Completed	No	??
14	Nam Kong 1	75	469	FS Completed	No	??
15	Xayabouly (Mainstream)	1260	5602	FS Completed	No	??
16	Pak Beng (Mainstream)	1012	4722	FS Completed	No	??
17	Pak Lay (Mainstream)	1002	4369	FS on going	No	??
18	Sanakham (Mainstream)	692	3202	FS on going	No	??
19	Lat sua (Mainstream)	686	2750	FS Completed	No	??
		12184	60306			

Potential Export to Vietnam

No	Name of Project	Install Capacity MW	Energy GWh	Status of the project	Tariff	COD
1	Xekaman 1	290	1096	under construction	No	2012
2	Xekaman 2A	64	241	FS on going	No	??
3	Xekaman 2B	100	380	FS on going	No	??
4	Xekaman 3	250	982	under construction	Yes	2010
5	Xekaman 4A	96	375	FS on going	No	??
6	Xekaman 4B	74	301	FS on going	No	??
7	Sekong 3Up.	145	598	FS on going	No	??
8	Sekong 3dow.	90	375	FS on going	No	??
9	Nam Ngum 4	220	813	FS Completed	No	??
10	Nam Sam 1	94	323	FS Completed	No	??
11	Nam Sam 3	196	635	FS Completed	No	??
12	Nam Mo2	105	496	FS Completed	No	??
13	Nam Mo1	66	280	FS on going	No	??
14	Nam Ma-1,2,3	175	820	FS on going	No	??
15	Luangprabang (Mekong)	1288	5602	FS on going	No	??
16	Dak E Mule	105	506	FS on going	No	??
17	Nam Kong 2	75	310	FS on going	No	??
18	Nam Kong 3	30	126	FS on going	No	??
		3463	14259			



GMS Power Grid

1. Nabong (Laos) - Oudon (Thailand)

2. Ban Sok (Laos) – Pleiku (Vietnam)

3. Ban Sok (Laos) - Oubon (Thailand)

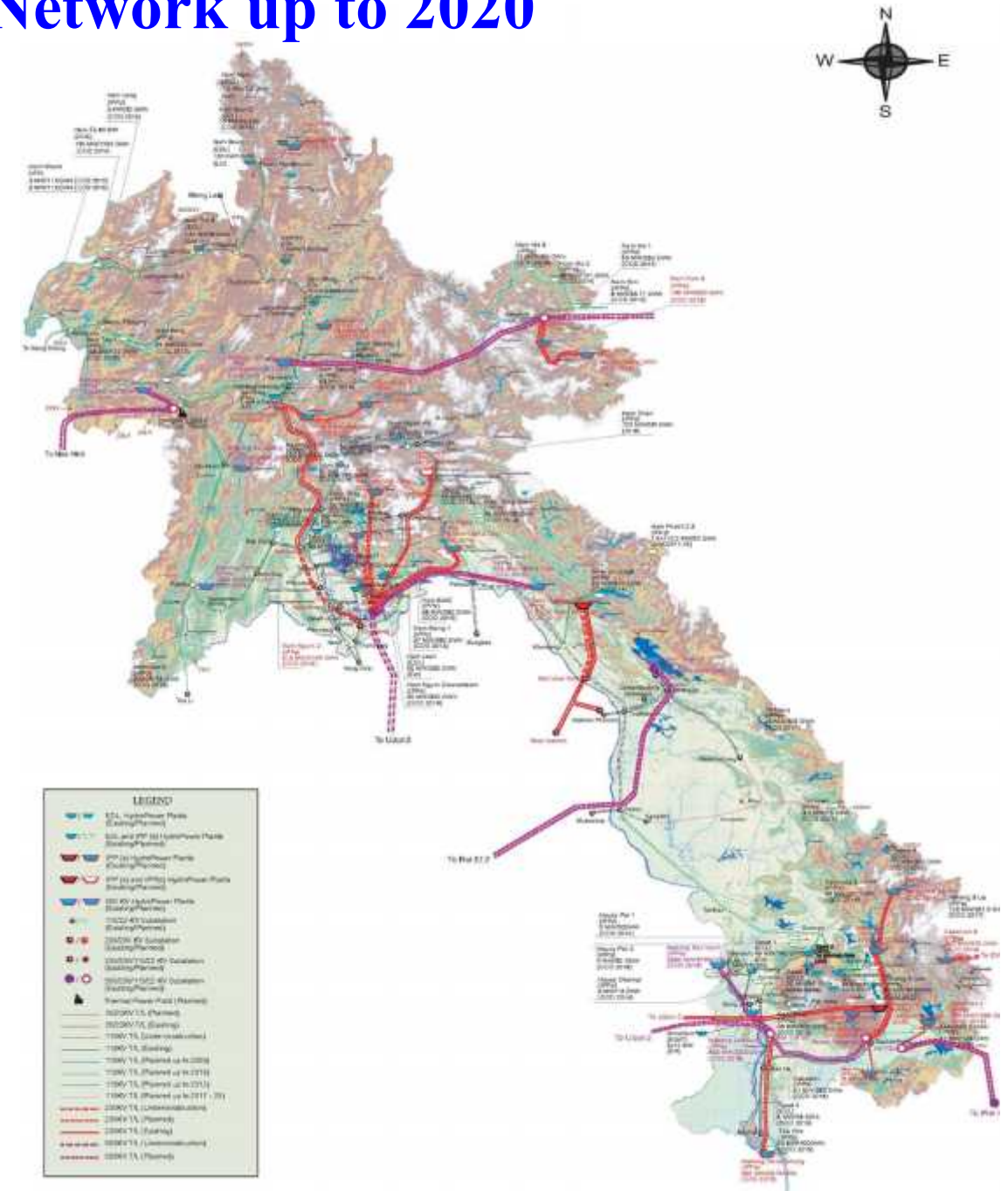
4. Hongsa (Laos) - Thailand
5. Nam Ou (Laos) - Thailand

6. Luangphabang (Laos) - Nho Quan or Than Hoa Vietnam

7. Xayabouli (Laos) – Khon Ken (Thailand)

8. Pakbeng (Laos)-Thailand

National Network up to 2020



Others

- Renewable energy
- Nuclear

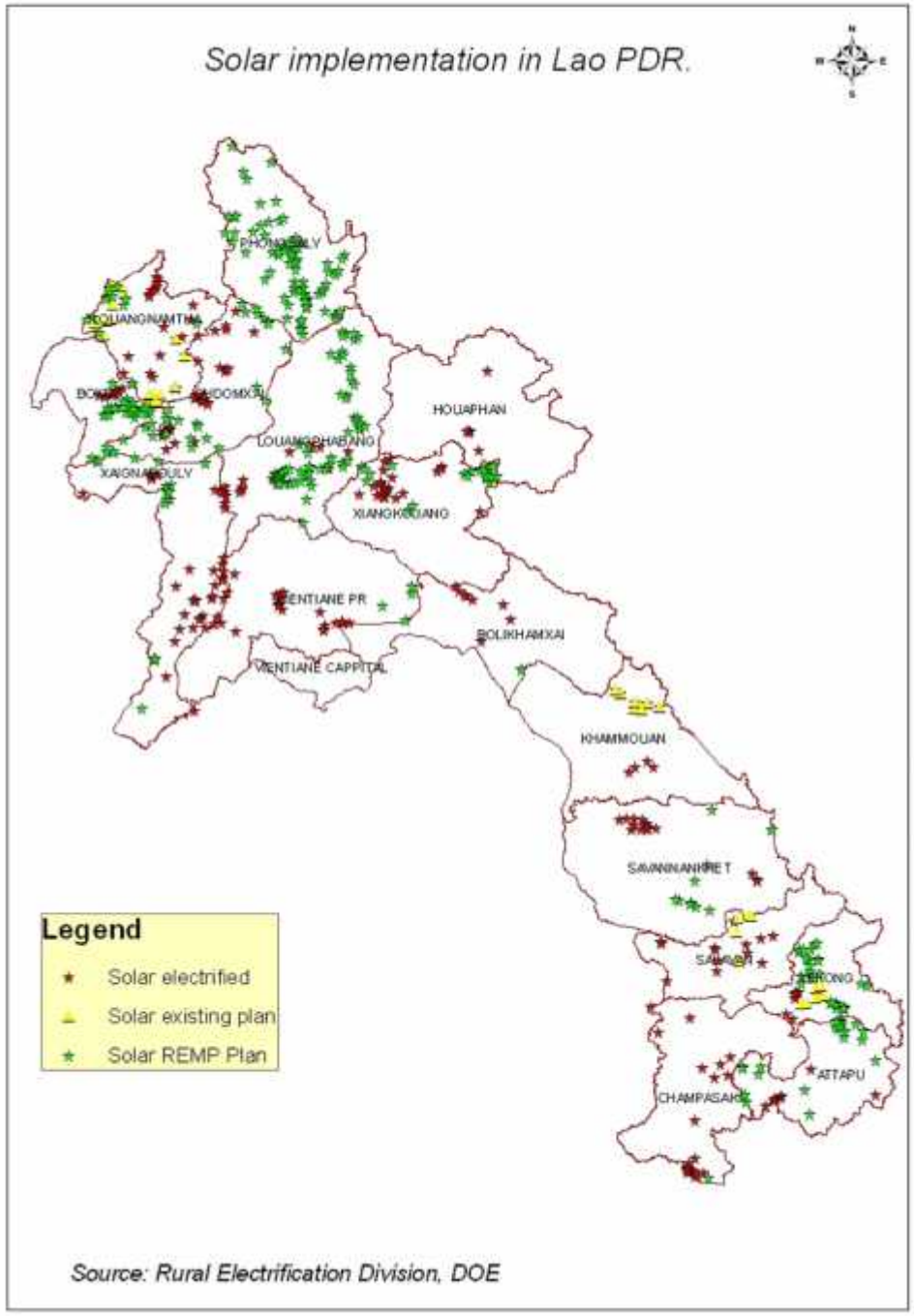
Renewable energy

- Currently Lao PDR is drafting the strategy policy for renewable energy
- Policies on the promotion and development of renewable energy in Laos have emphasized hydropower and should be focusing more on producing feedstock for bio fuel which has potential in the country
- The Goals of 2025 state that production of renewable energy should reach 30% of the total energy in the country, for use in production, agriculture, forestry, processing and industry. The specific goal for bio fuel is set at 10%, especially to replacing imported fossil fuel

- The government defines priorities for development as follows:
  - Promote sustainable renewable energy development as important part for ensuring the supply of energy in the social and economic development
  - Facilitate financial aspects such as tax exemption and incentive for investors
  - Prepare and improve law, regulations related to facilitation of renewable energy development

Rural Electrification (Solar)

Year	Number of operational system (watts)
1999	257
2000	392
2001	392
2002	1,207
2003	3,531
2004	5,107
2005	6,357
2006	6,183
2007	9,431
2008	8,728
2009	13,339


Solar implementation in Lao PDR.
HOUAPHAN
LOUANGPHABANG
XIANGKHOUANG
VIENTIANE PR
BOLIKHAMXAI
VIENTIANE CAPPITAL
KHAMMOUAN
SAVANNAKHET
ATTAPU
CHAMPASAK
Legend
Solar electrified
Solar existing plan
Solar REMP Plan
Source: Rural Electrification Division, DOE

Nuclear energy

- Government of Lao PDR is fully support the nuclear energy in the developmental, safety and environmental friendly aspect for electricity generation

Thank You

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