

EAST and Southeast Asia  
Renewable Energy Statistic  
Training Workshop

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# **Renewable Energy Data in Lao PDR**

Institute of Renewable Energy Promotion  
Ministry of Energy and Mines

12-14/12/2016

Bangkok, Thailand

# Outline

1. Introduction
2. Current energy situation and outlook.
3. Power potential in Lao PDR
4. Energy Sector Policy
5. Conclusion

# BASIC FACTS ABOUT LAOS



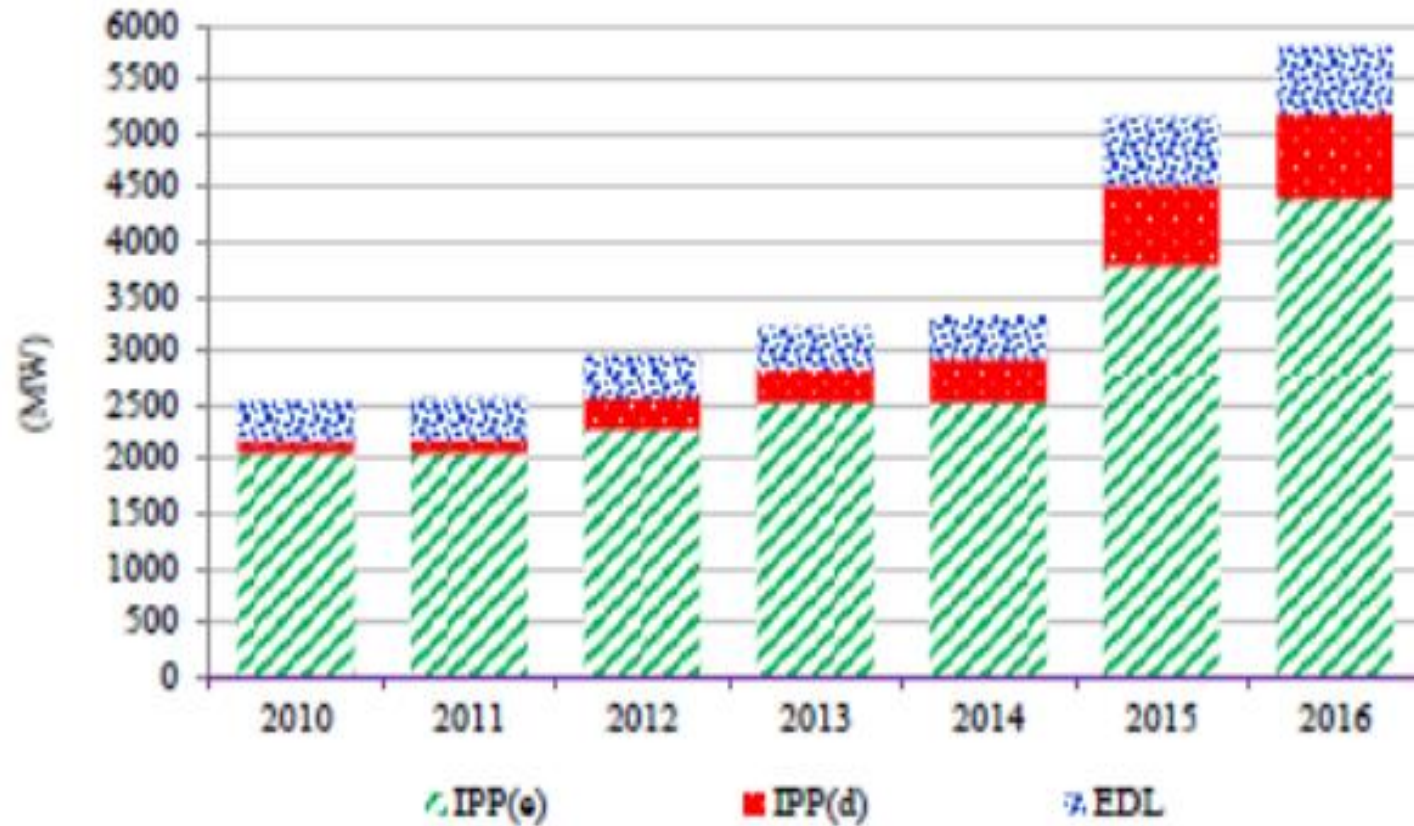
- **Area : 236,800 km<sup>2</sup>**
- **Capital: Vientiane**
- **Population 2015**
  - Total 6.5 millions
  - Density 27 person/km<sup>2</sup>
- **Total Share of GDP 2015**
  - GDP per Capita 1,947 US\$
  - Growth rate of GDP: 7.56%
- **Share of GDP 2015**
  - Agricultural: 21.80%
  - Industry: 32.70%
  - Services: 35.95%
  - Taxes on products and Import duties, net: 9.55%



# 1. Current Energy Situation and Outlook

- Energy Development in Lao PDR has been rapidly increasing in parallel with the domestic demand. Additionally, Lao Government has supported and encouraged private to invest in energy sector. Compare of increasing by the year of 2010, the total install capacity is increased from 2,546.7 MW to 5,806 MW in 2016.

# 1. Current Energy Situation and Outlook



# 1. Current Energy Situation and Outlook

## Energy Supply:

Lao PDR has potential of Hydropower about 28,600 MW with 409 projects

	Project Amount	Install Capacity (MW)	Energy Generation (GWh/year)
Existing Projects	40	6,290	33,590
Under construction Projects and expect to complete construction by 2020	50	5,820	27,502
Expect to complete construction by 2025	35	4,147	20,106
Expect to complete construction by 2030	58	4,434	18,272
MOU signed	246	8,480	30,119
<b><u>Total</u></b>	<b><u>429</u></b>	<b><u>29,171</u></b>	<b><u>129,589</u></b>

Sourced: The 6<sup>th</sup> Report on Hydropower Development Projects in Lao PDR (30 June 2016), by DEPP

# NONE Hydro RE projects

## **WIND: 2000-3000 MW**

- 600 MW (1st phase: 250MW) under negotiation for development in Sekong Prov.
- 3 additional projects under field investigation

## **SOLAR:**

- Only Home Solar System (SHS) (50-100W) (25,000 HH)
- 700 kW grid connected (demonstration project by Japanese grant)
- 500 MW solar farm under study
- 100 MW Solar and Wind Hybrid Project
- 10 MW solar Farm under Construction

# None Hydro RE projects

## **Biomass: 1000-2500 MW**

- 39 MW in operation
- 20 MW is under Construction

## **Biogas:**

10000 kg/day to replace the LPG import

Livestock Farms



# 1. Current Energy Situation and Outlook

## Energy Demand:

No.	ລາຍລະອຽດ (Descriptions)	Units	ປະຈຸບັນ (Actual)		ຄາດຄະເນ (Forecast)				Growth Rate (%)		
			2014	2015	2016	2020	2025	2030	2015-2020	2015-2025	2015-2030
1	ຄວາມຕ້ອງການ ພະລັງງານໄຟຟ້າ (ບໍ່ລວມຕົກເຮັບໃນລະບົບ) Energy Demand (Excluding system losses)	(GWh)	4,321	4,665	6,131	13,253	22,407	30,680	23.2%	17.0%	13.4%
2	ພະລັງງານຕົກເຮັບໃນລະບົບ System Losses	(GWh) (%)	502 10.4%	547 10.5%	658 9.7%	1,125 7.8%	1,649 6.9%	2,243 6.8%			
3	ຄວາມຕ້ອງການ ພະລັງງານໄຟຟ້າ (ລວມຕົກເຮັບໃນລະບົບ) Energy Demand (Including system losses)	(GWh)	4,823	5,213	6,789	14,378	24,057	32,923	22.5%	16.5%	10.7%
4	ຄວາມຕ້ອງການ ກຳລັງໄຟຟ້າສູງສຸດ Peak Load	(MW)	960	1,056	1,349	2,723	4,395	5,892	20.9%	15.3%	12.1%
5	Load Factor	(%)	57.3%	56.3%	57.5%	60.3%	62.5%	63.8%			
* ສະເລ່ຍເພີ່ມຂຶ້ນ ຕໍ່ປີ (Average Growth per Annum)									2015-2020	2015-2025	2015-2030
* ຄວາມຕ້ອງການ ພະລັງງານໄຟຟ້າ ບໍ່ລວມຕົກເຮັບໃນລະບົບ (Energy Demand Excluding System Losses), GWh)									1,717	1,774	1,734
* ຄວາມຕ້ອງການ ພະລັງງານໄຟຟ້າ ລວມຕົກເຮັບໃນລະບົບ (Energy Demand Including System Losses), GWh)									1,833	1,884	1,847
* ຄວາມຕ້ອງການ ກຳລັງໄຟຟ້າສູງສຸດ (Peak Load), MW)									333	334	322

Sourced: Demand forecast 2016-2030 Report (February 2016), by EDL

# Energy demand in Lao PDR

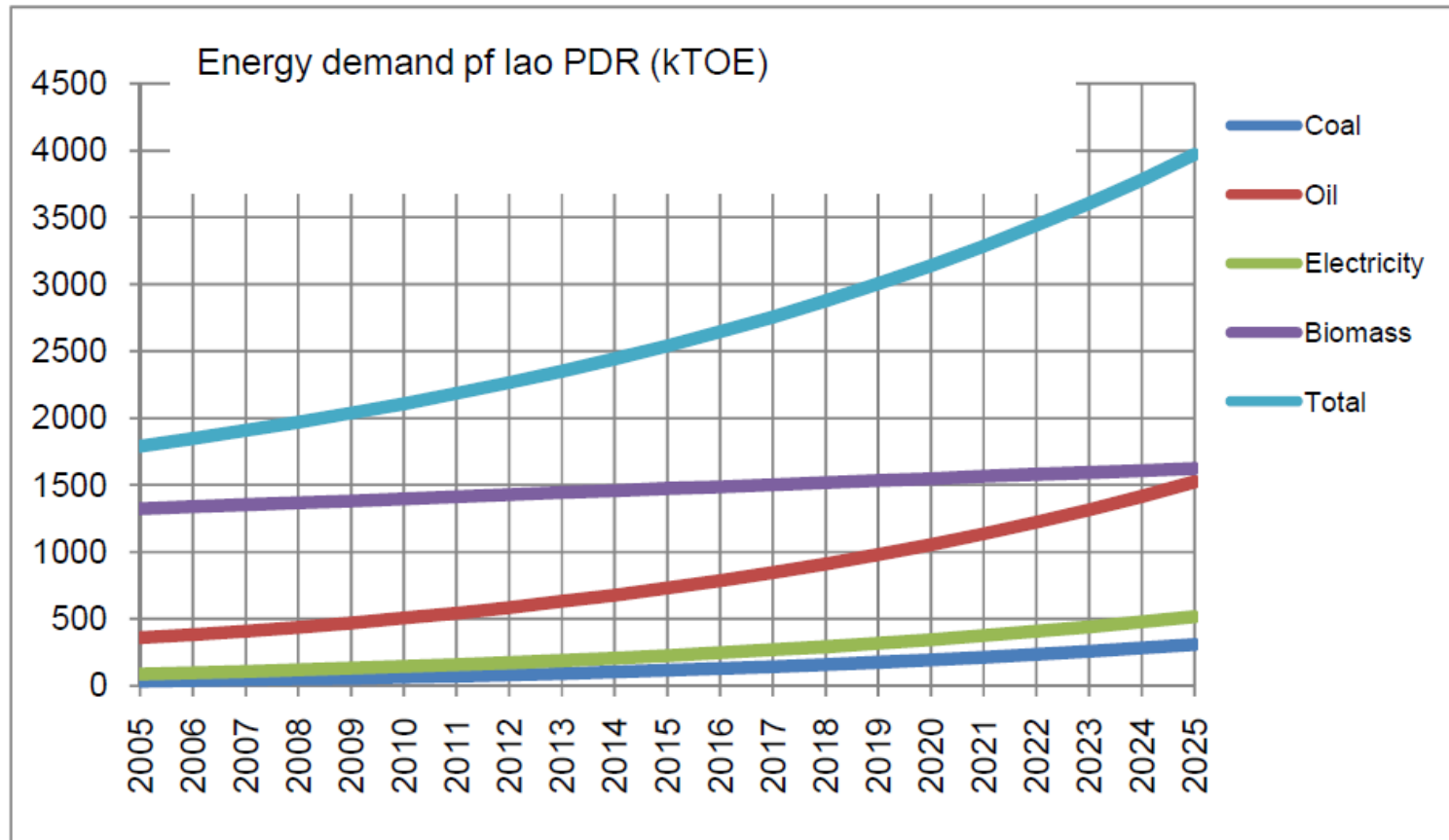
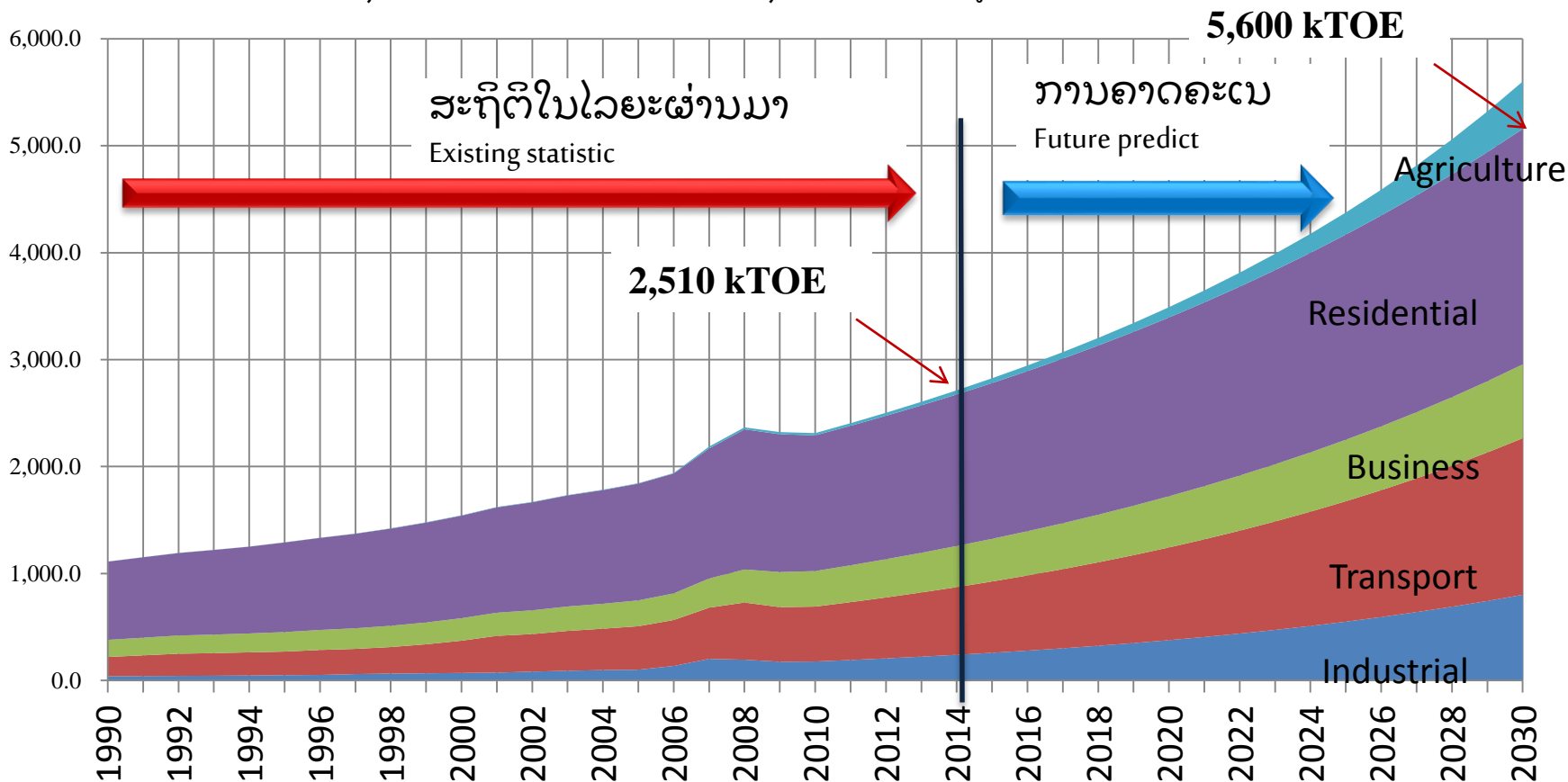


Figure 1.6 Estimate of energy demand in Lao PDR by 2025 (MEM)

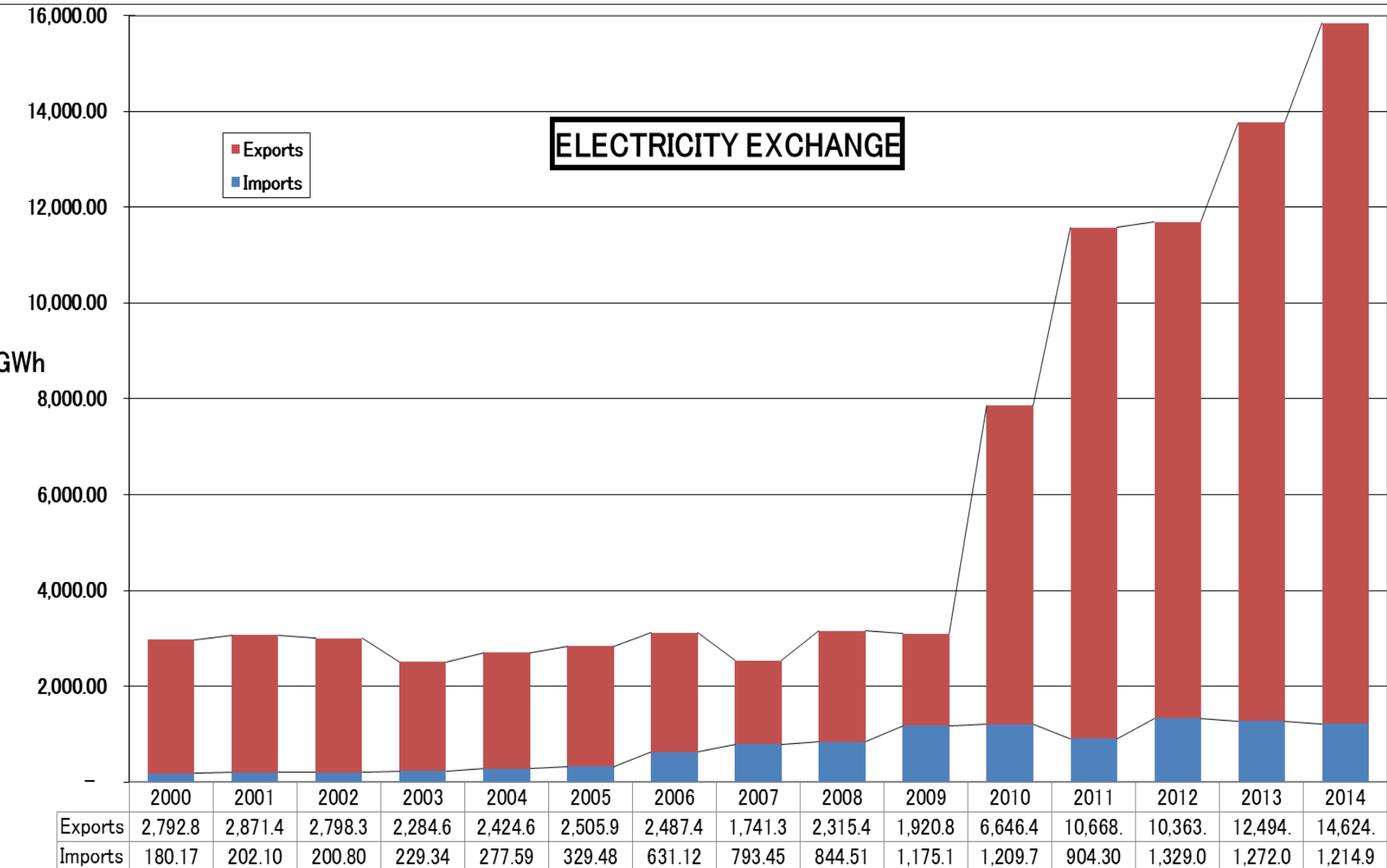
# Trend of Total Energy Demand

ທ່າອ່ຽງໃນຄວາມຕ້ອງການຊົມໃຊ້ພະລັງງານສໍາເລັດຮູບ, kTOE

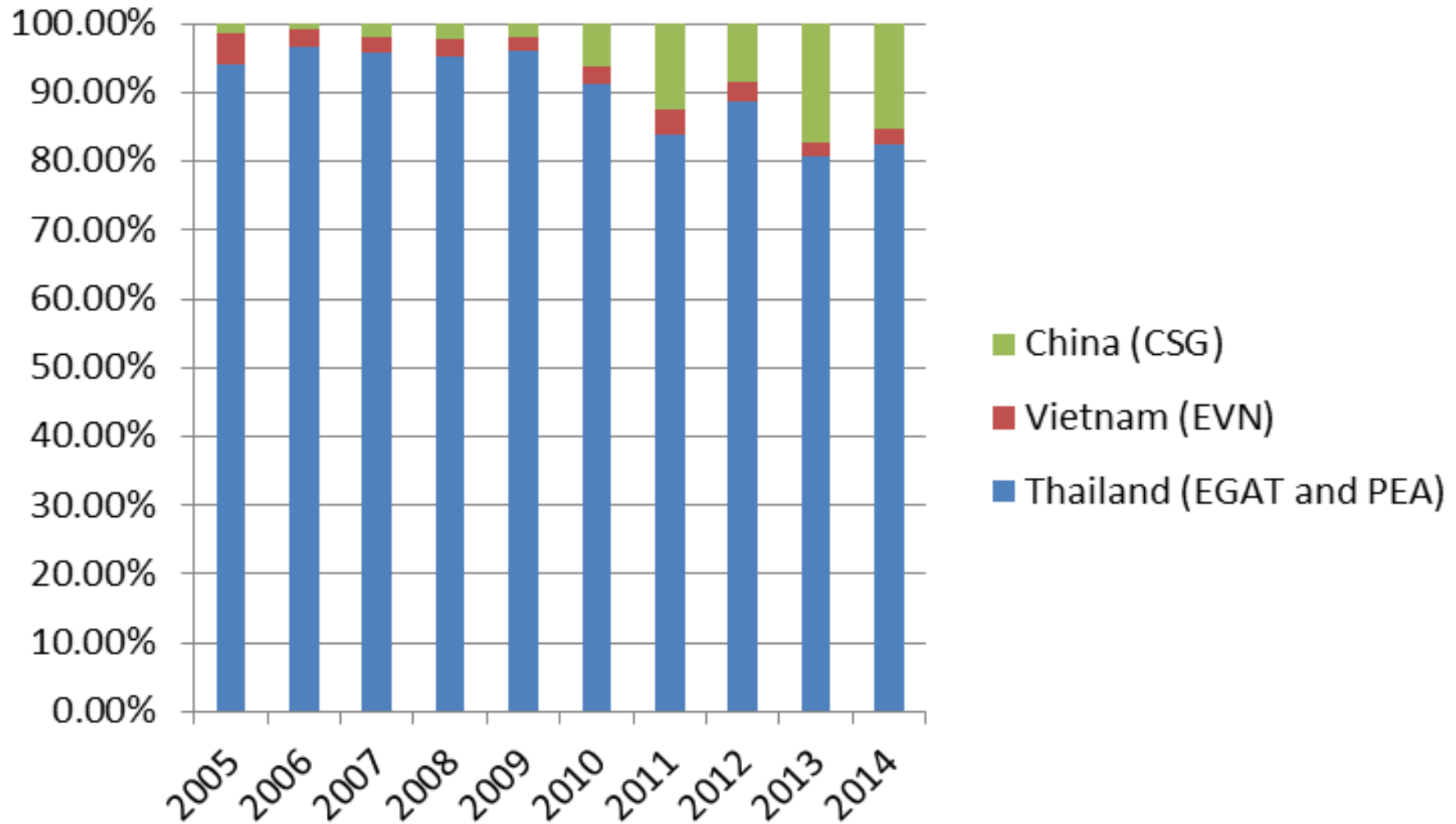
■ ອຸດສາຫະກຳ  
 ■ ຂົນສົ່ງ  
 ■ ທຸລະກິດ  
 ■ ທີ່ຢູ່ອາໄສ  
 ■ ກະສິກຳ



# Electricity Exchange and Trade 2000-2014



# Major Electricity Trade Partners



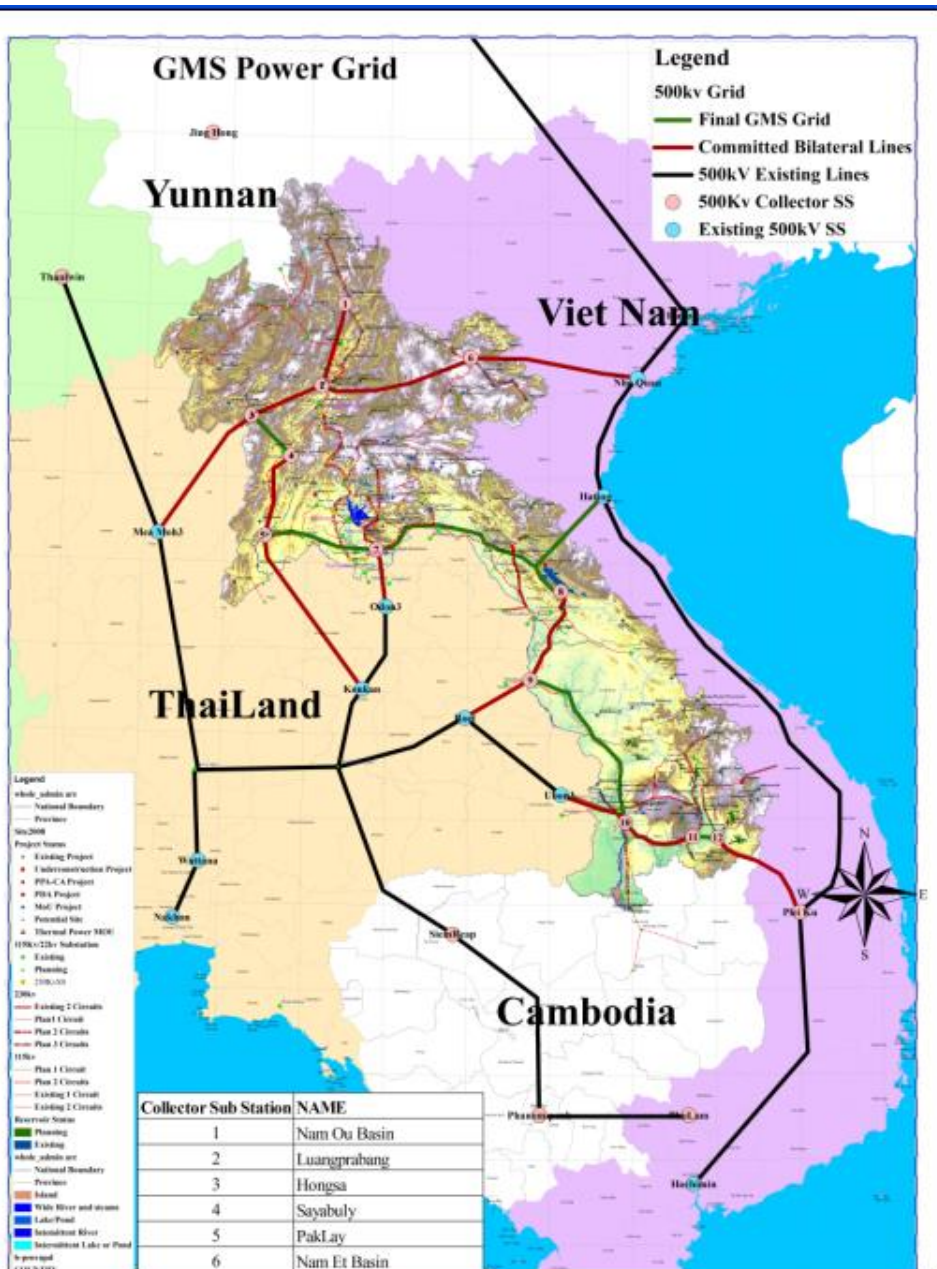
# Grid to Grid memoranda on Power Export by 2020

Export to	MW
Thailand	7,000 MW expanded with 2000 MW
Vietnam	3,000 MW
Cambodia	2,000 MW, initial
Myanmar	3,000 MW, to be initialed
China (Yunan Province)	12,000 MW, being discussed

# Future Transmission System and other pipelines

## GMS Power Grid

1. Nabong (Laos) - Oudon (Thailand)
2. Hatsan (Laos) – Pleiku (Vietnam)
3. Hongsa (Laos) - Thailand
4. Nam Ou (Laos) - Thailand
5. Luangphabang (Laos) - Nho Quan or Than Hoa Vietnam
6. Xayabouli (Laos) – Khon Ken (Thailand)
7. Pakbeng (Laos)-Thailand



# Livestock waste (Example)

Livestock	2010 Production (million heads)	Daily Manure Production Factor (kg/animal)	Substrate Quantity (kg/day)	Dry Matter Factor (%)	Total Dry Matter Available (kg/day)	Mean Biogas Yield Factor (m <sup>3</sup> /kg dry matter)	Daily Biogas Production (m <sup>3</sup> /day)
Buffalo	1.183	8.00	9,464,000	16	1,514,240	0.250	378,560
Cattle	1.475	8.00	11,800,000	16	1,888,000	0.250	472,000
Pigs	2.752	2.00	5,504,000	17	935,680	4.200	3,929,856
Chicken	24.078	0.08	1,926,240	25	481,560	0.575	276,897
<b>Total</b>							<b>5,057,313</b>

kg = kilogram, Lao PDR = Lao People's Democratic Republic, m<sup>3</sup> = cubic meter.

Source: Renewable energy developments and potential in the Greater Mekong Sub region



# Agriculture waste (Example)

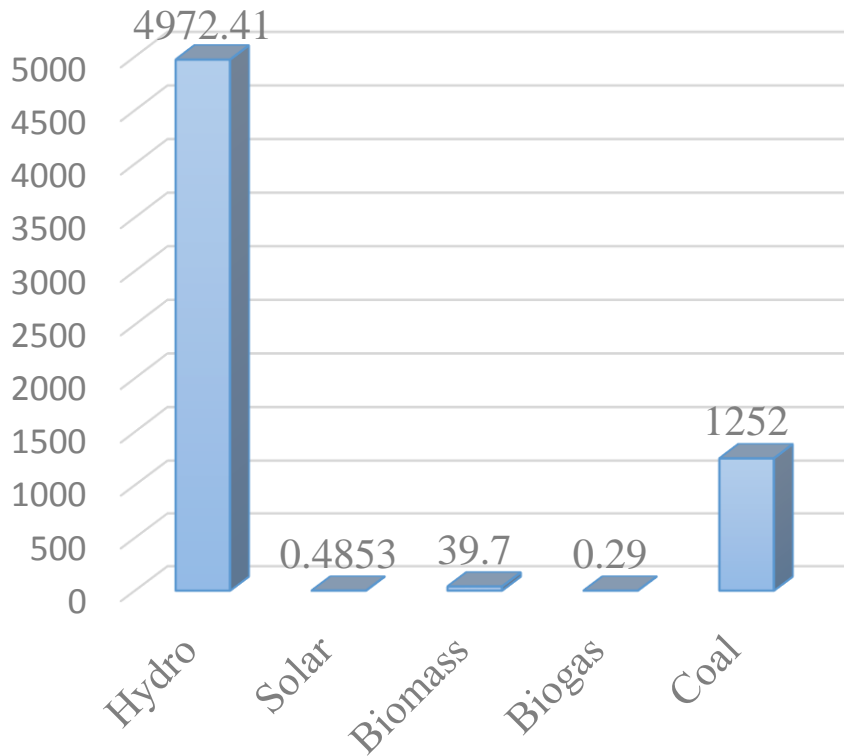
Biomass Residue	Total Yearly Biomass Production (10 <sup>3</sup> tons)	Total Theoretical Energy Potential (10 <sup>6</sup> GJ)	Total Theoretical Energy Potential (GWh)
Rice husks	767	9.86	2,740
Rice straw	1,013	6.12	1,700
Maize or corn cobs	255	3.66	1,017
Cassava stalks	64	0.44	123
Sugarcane tops and trash	247	1.66	462
Sugarcane bagasse	205	1.32	366

GJ = gigajoule, GWh = gigawatt-hour, Lao PDR = Lao People's Democratic Republic.

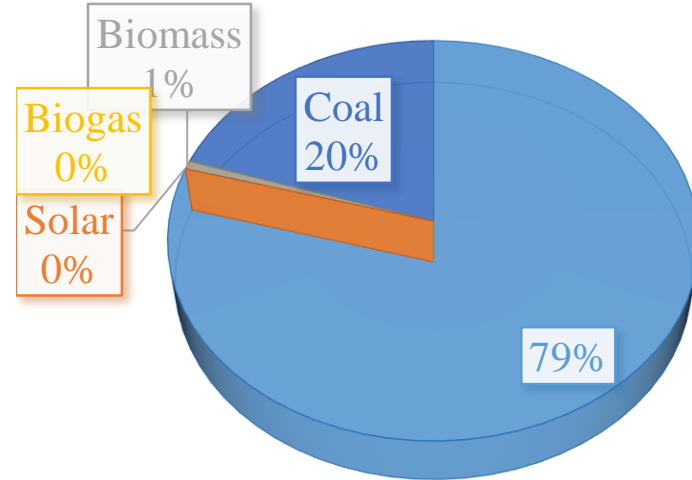
Source: Renewable energy developments and potential in the Greater Mekong Sub region

# Power Generation Share

Power Generation Share (MW)



POWER GENERATION SHARE [%]



- Total Install Capacity 6,264.9 MW [November 2016]

## 2. Power potential in Lao PDR

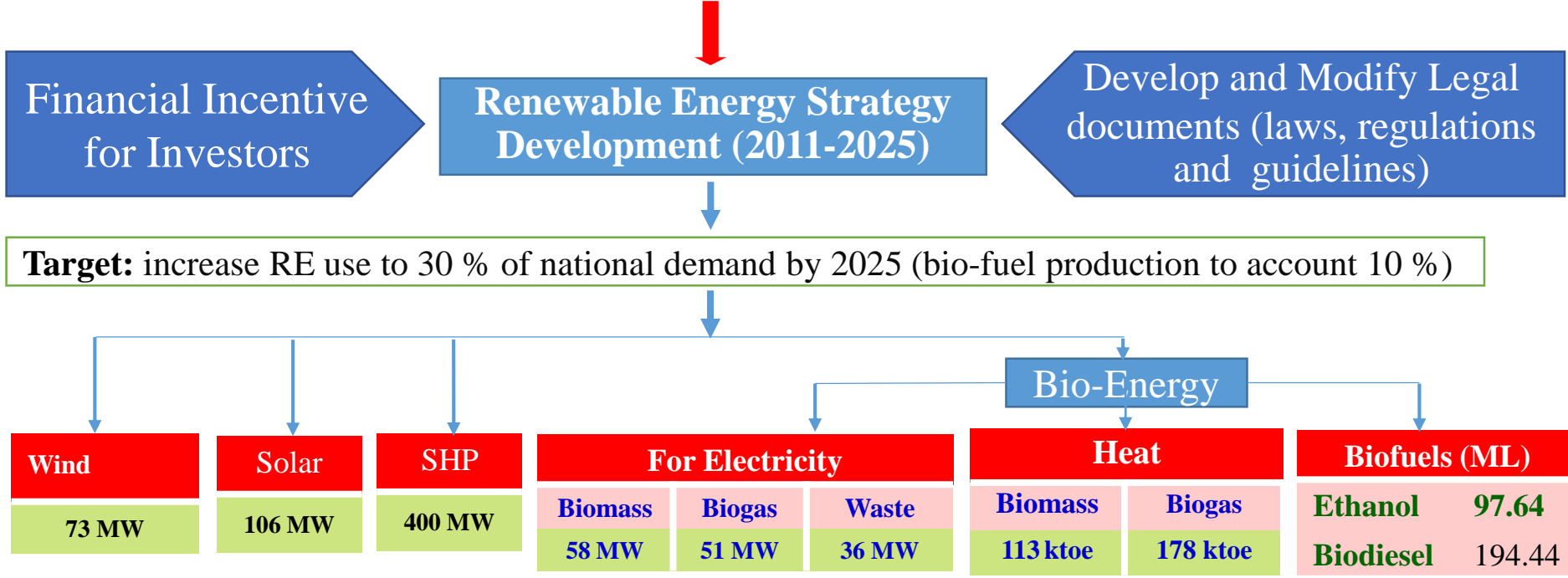
- HYDRO POWER POTENTIAL OF ABOUT 26,000 MW.
  - Small Hydro Power  $\leq 15$  MW: 2,000 MW
- Wind  $\sim 182,000$  MW, very good 2,000-3,000 MW
  - 600 MW (phase 1: 250MW) under negotiation for development in Sekong Prov.
- Solar: irradiation 3.6-5.5 kWh/m<sup>2</sup> (1800-2000hrs/y)
- Biomass  $> 938$  MW
- Biogas  $> 313$  MW

### 3. Energy Sector Policy

- Increase electrification ratio to 98% by 2025 and Make modern energy more affordable and accessible for every Lao citizen even in the remote areas;
- Promote energy efficiency and conservation by Reduce 10% of energy consumption in 2030
- Increase Energy export to boost national socio-economic development;
- Reserve coal for domestic use and power generation;
- Increase power export to 12,000 MW by 2020, 7,000 MW to Thailand and 5,000 MW to Viet Nam.
- Increase a share of other renewable energy to 30% in the total energy mix by 2025;

# POLICY AND STRATEGY

**Objective:** Ensure energy security, sustain socio-economic development, and enhance environmental and social sustainability



- Establish Renewable Energy Fund
- Financial Mechanism:
  - Import duty free on production machinery, equipment and raw materials
  - Import duty free on chemical materials necessary for biofuels production within 7 years
  - Profit tax is divided in to 3 categories: 20%, 15% and 10%. Profit tax exemption is possible for a certain period depending on activities, investment areas and size investment
- Subsidies on unit product price depending on energy type and times period

## Support Mechanism

# Renewable Energy Strategy Development (2011-2025)

- Develop legal documents
- Study & development models
- Market assessment and energy source studies

2011-2015

2016-2020

- Promote the RE energy technology industry,
- Formulate a clear framework for a midterm program (increased competition)
- Support the full development of RE
- Increased competition and reduced dependency

2021-2025

- Promote new, economically viable, RE technologies
- Encourage full competition based on equality.

# GOL Target on RE Sector

No	RE TYPE	Potential	Existing	Target 2010-2015		Target 2016-2020		Target 2021- 2025	
		MW	MW	MW	Ktoe	MW	Ktoe	MW	Ktoe
<b>A</b>	<b>Electricity</b>			<b>140</b>		<b>243</b>		<b>728</b>	<b>416</b>
1	Small Hydropower	2,000	12	80	51	134	85	400	256
2	Solar	511	1	22	14	36	23	33	21
3	Wind	>40		6	4	12	8	73	47
4	Biomass	938		13	8	24	16	58	37
5	Biogas	313		10	6	19	12	51	33
6	Municipal Solid Waste	216		9	6	17	11	36	23
7	Geothermal	56							
<b>B</b>	<b>Biofuels</b>	<b>ML</b>	<b>ML</b>	<b>ML</b>		<b>ML</b>		<b>ML</b>	
1	Ethanol	600		10	7	106	178	150	279
2	Biodiesel	1,200	0.01	15	13	205	239	300	383
<b>C</b>	<b>Thermal Energy</b>	<b>Ktoe</b>	<b>Ktoe</b>						
1	Biomass	227			23		29		113
2	Biogas	444			22		44		178
3	Solar	218			17		22		109

# CURRENT STATUS OF SOLAR DEVELOPMENT

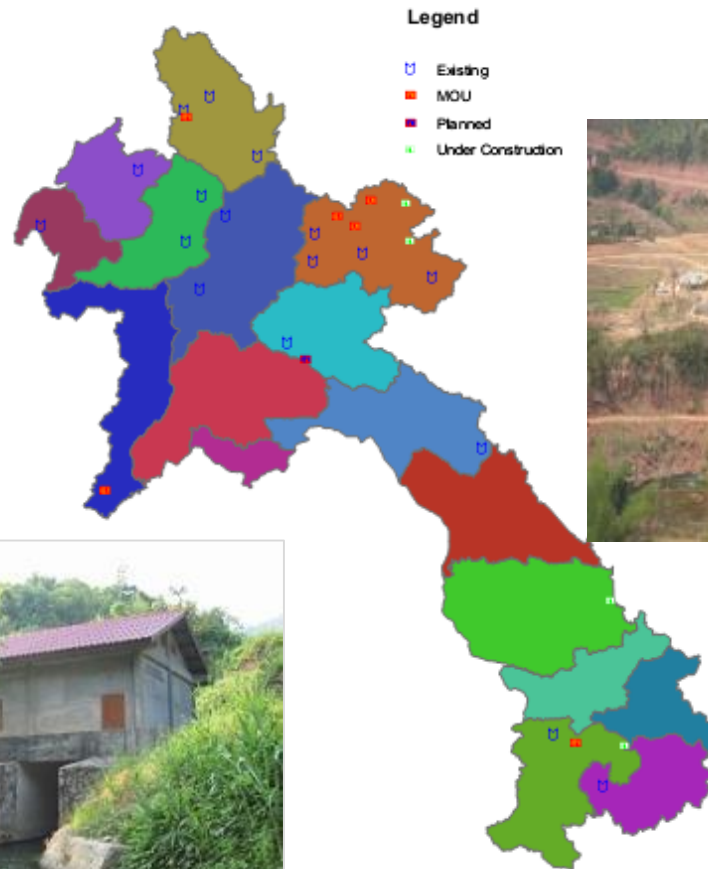
Type of System	Unit	Ins Cap (kW)	Supporter	Remark
SHS	16,570	459.57	JICA, WB	End of 2013
BCS	3	8	JICA	
Hybrid	1	100/70	NEDO	(Solar for Pump + MH)
Hybrid	1	110/40	NEDO	(MH + Solar for Pump)
Hybrid	1	36/60/1.5	Private	(MH/Gen-set/Solar)
Stand alone	1	6.5	EEP/FONDEM	Luang Prabang Prov
Hybrid	1	4.8/5	FONDEM	Solar + Diesel
Solar roof	1	236	JICA	Wattay Airport
Solar roof	1	150	JICA	EDL' Building (UC)
Solar crop dryers	2		ACMEC/ University	For community and university
Telecom		155	Telecom	57 station



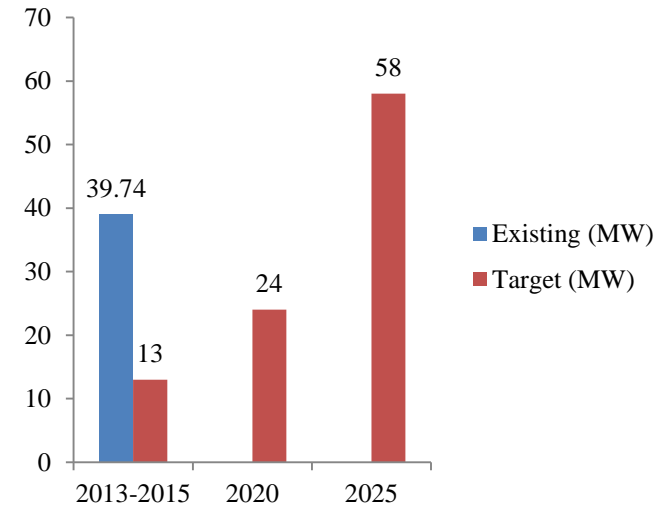
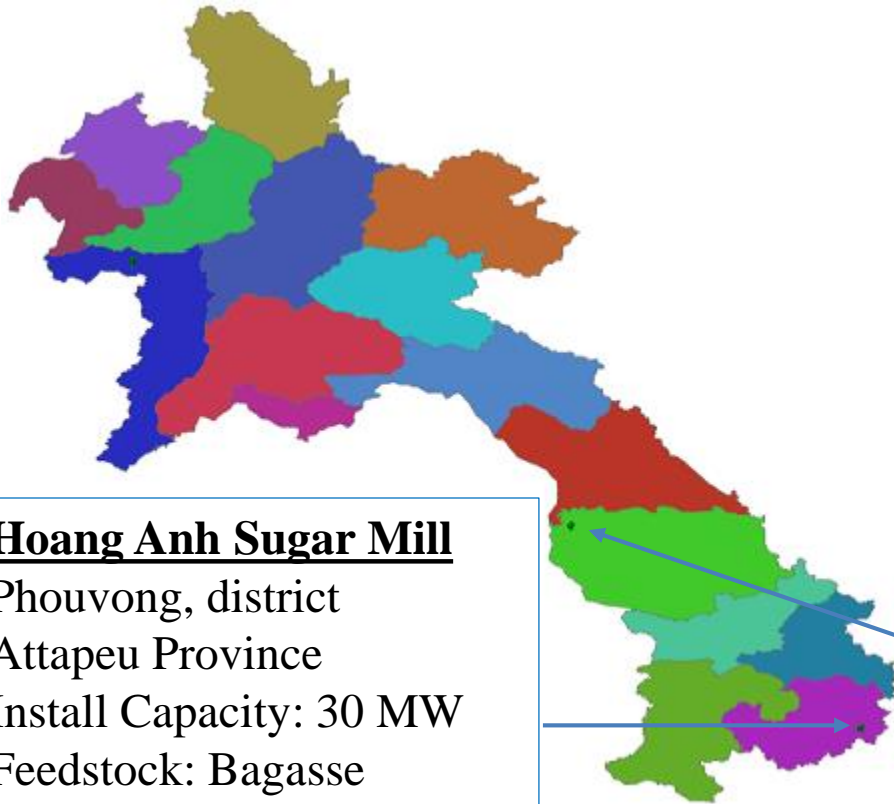


# CURRENT STATUS OF SHP DEVELOPMENT

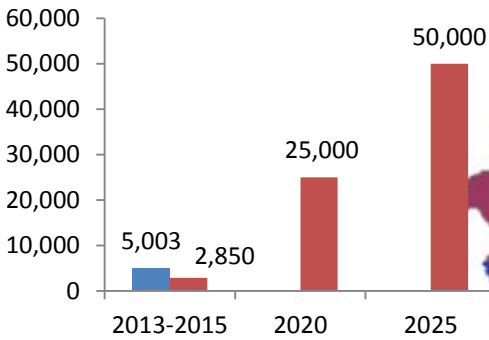
- Potential: 2,000 MW (Less than 15 MW)
- Existing Projects: 23 projects, 76 MW,
- Under Construction: 18 projects, 166 MW
- Under study: 142 projects, 1263 MW



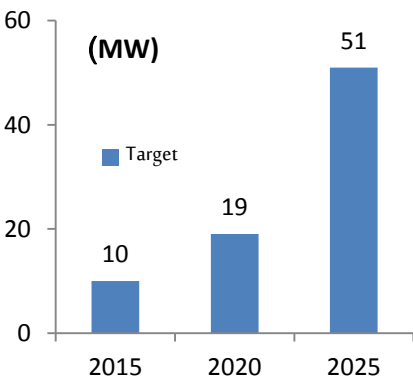
# CURRENT STATUS OF BIOMASS DEVELOPMENT



# BIOGAS DEVELOPMENT

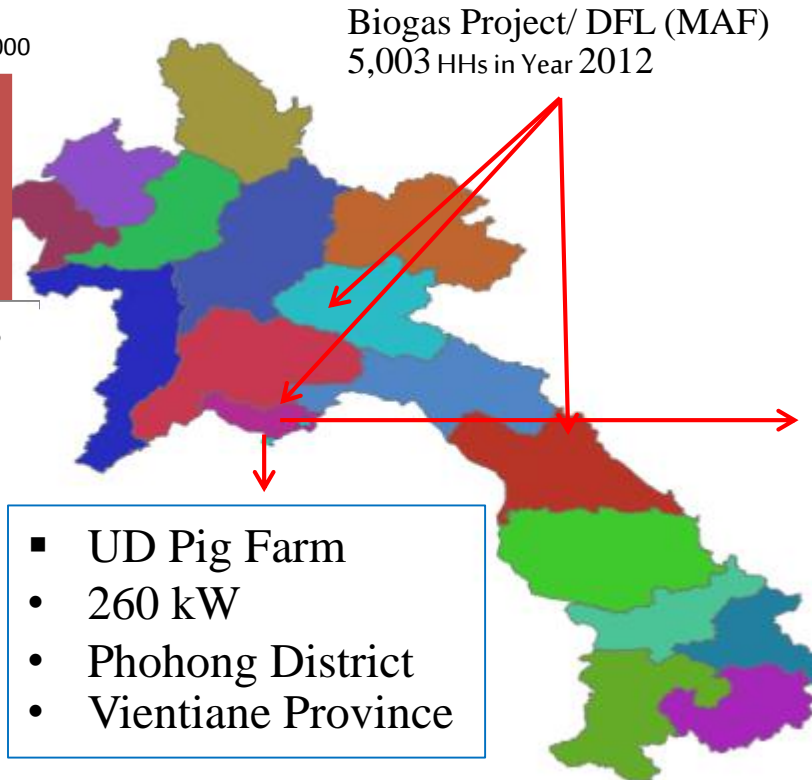


■ Existing Household with biogas  
■ Target household for biogas utilization



(MW)

■ Target



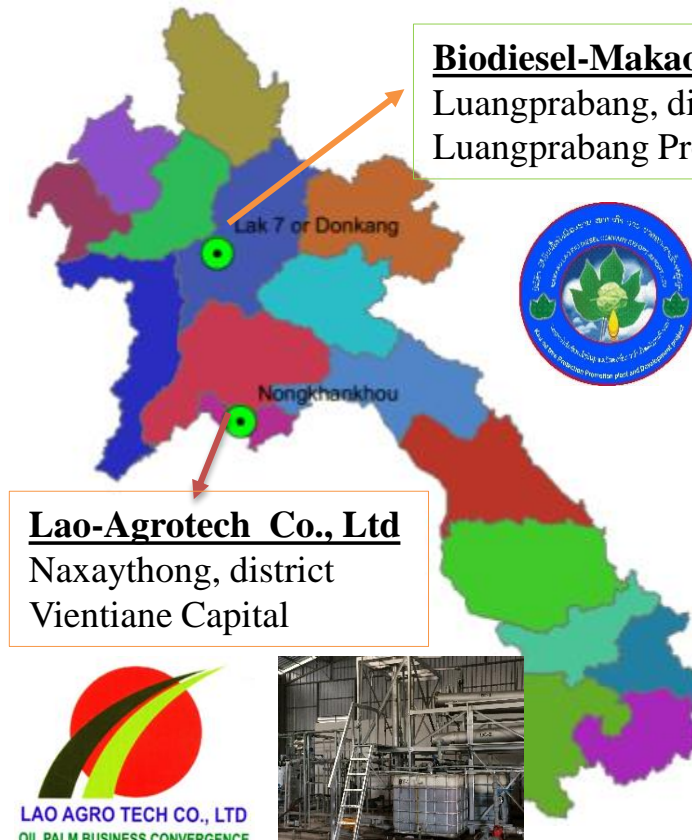
Biogas Project/ DFL (MAF)  
5,003 HHs in Year 2012

- UD Pig Farm
- 260 kW
- Phohong District
- Vientiane Province

- Pig Farm Viravong.
- 30 kW
- Viengkam District
- Vientiane

# BIOFUEL DEVELOPMENT

Plantation-Area	Harvest-Area
<b>Palm oil</b>	
300+800 ha	60 ha (2016)
FFB	173,640 kg
CPO	33,000 L
B100	20,000 L
Biodiesel Plant: 20,000 L/day	
<b>Extraction Plant:</b> 20 tons/day	
<b>Vernicia Montana</b>	
12,350	3,000 ha
Fruit collection	75,000 kg
B100	18,000 L
Biodiesel Plant: 1,000 L/day	
<b>Extraction Plant:</b> 2 tons/day	
In 2017 new Plant 2 units; Each unit 15 t/day	
B100	18,000 L



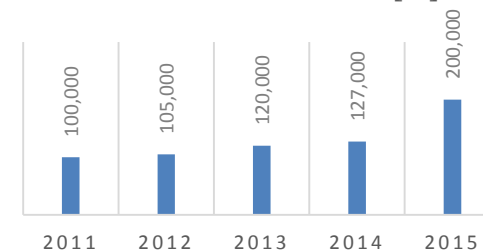
**Biodiesel-Makao Oil Lao Co., Ltd**  
Luangprabang, district  
Luangprabang Province



**Bio ethanol: June 2014**

The GOL signed MOU with 2 local private company to conduct feasibility study of bio ethanol production from cassava (each 200,000 L/day)

**CURRENT STATUTE  
BIO-DIESEL  
PRODUCTION B100 [L]**





# CHALLENGE

- Lack of information on resources available and sustainability, in particular with regard to biomass
- Geographic location, no access road (cannot access during raining season)
- Limited budget for collecting RE data.
- Lack of appropriate mechanism to promote RE statistics.



## Conclusion

- Capacity building among technical level and community level about RE statistic
- Knowledge and Information sharing
- Capacity building and promotion regional cooperation to develop tools, database development.

*Khop Jai Laiy Laiy !*

Thank you