



KU 
BIOMASS

Potential of biomass utilization in ACMECS (Laos, Myanmar, Cambodia, Vietnam and Thailand)

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Outlines

- **What is ACMECS**
- **Overview for biomass Utilization in ACMECS**
- **Potential of Biomass for bioenergy in AMECS (Thailand, Vietnam, Myanmar, Cambodia and Laos)**

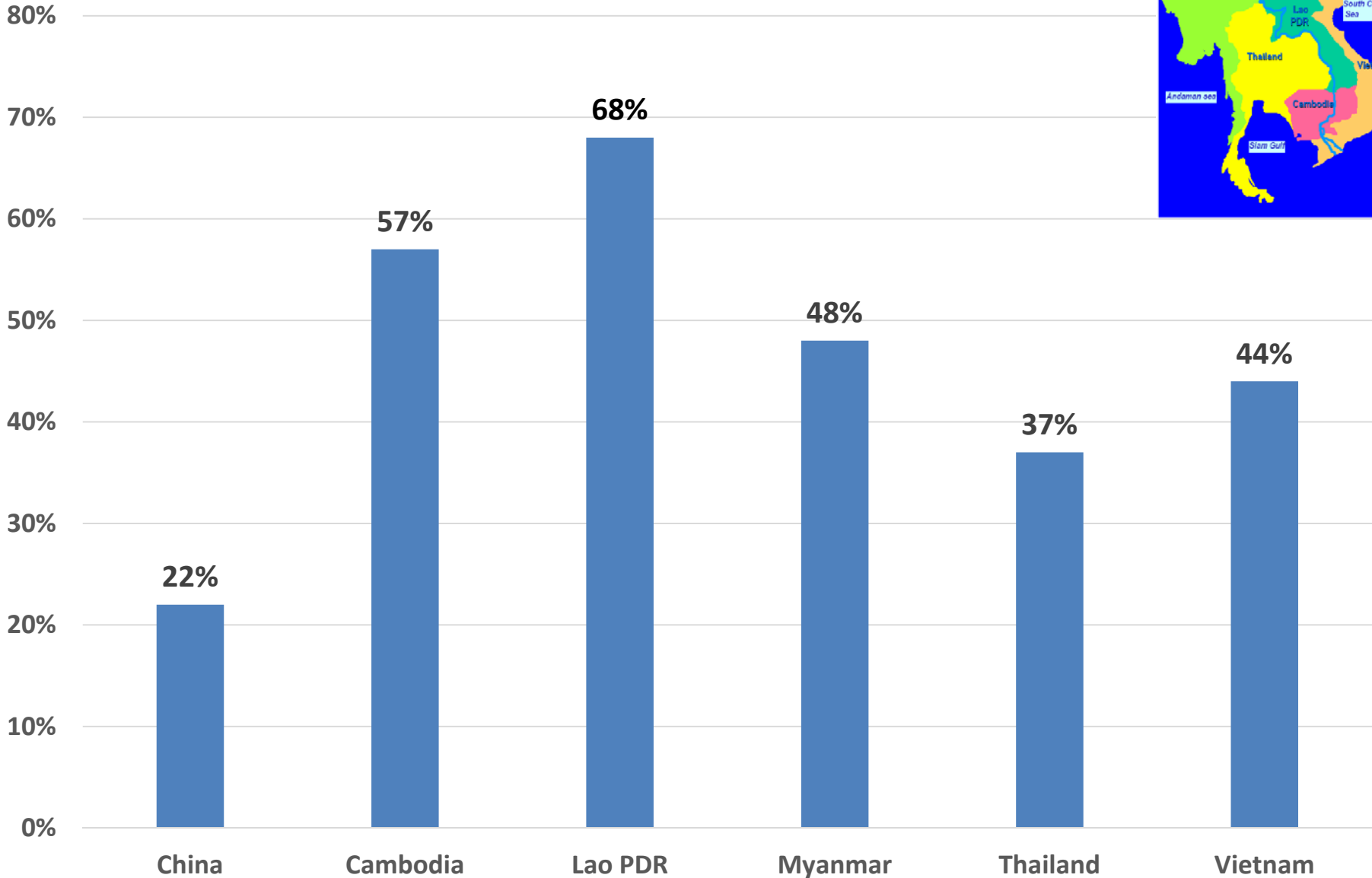


**ACMECS : Ayeyawady
- Chao Phraya - Mekong
Economic Cooperation
Strategy**

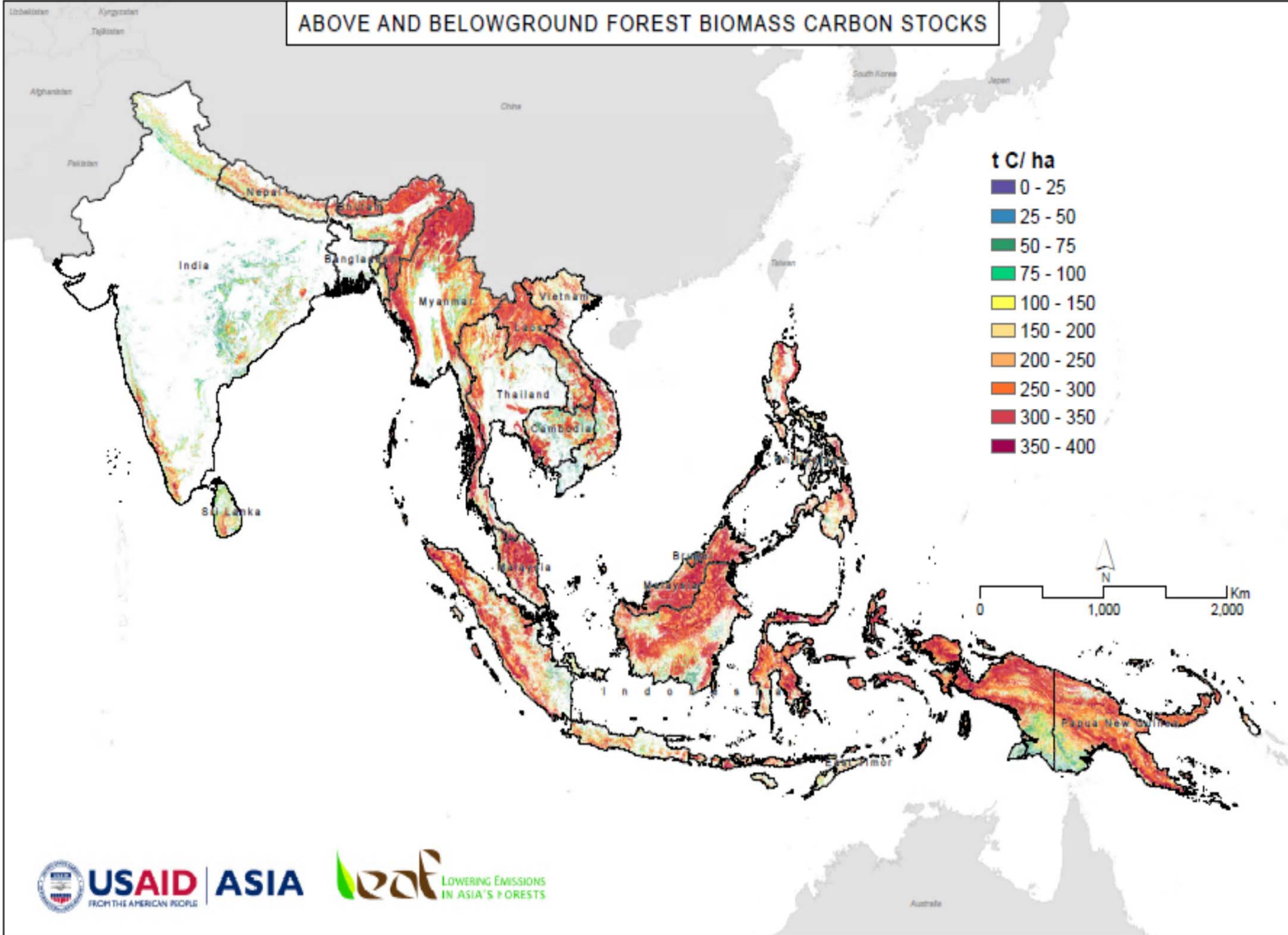


ACMECS : a cooperation framework among Cambodia, Laos, Myanmar, Thailand, and Vietnam to utilize member countries diverse strengths and promote balanced development in the sub region.

Forest cover of ACMECS and neighboring countries (Source: FAO, 2010)



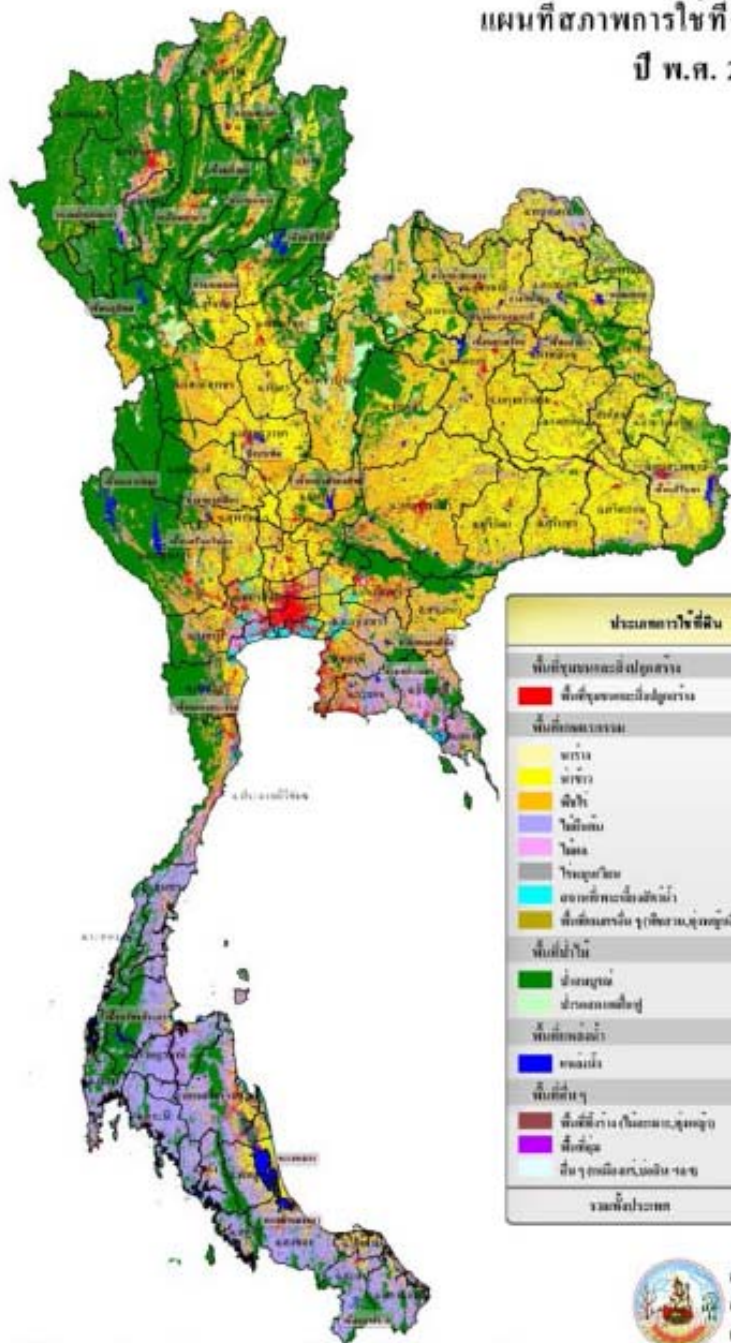
ABOVE AND BELOWGROUND FOREST BIOMASS CARBON STOCKS



Potential of biomass utilization in Thailand



แผนที่สภาพการใช้ที่ดิน ของประเทศไทย
ปี พ.ศ. 2551/52



ประเภทการใช้ที่ดิน	พื้นที่	
	ไร่	ร้อยละ
พื้นที่ชุมชนและเมืองอุตสาหกรรม	15,111,800	4.71
พื้นที่ชุมชนและเมืองอุตสาหกรรม	15,111,800	4.71
พื้นที่เกษตรกรรม	171,585,556	53.51
พรวน	1,340,914	0.42
นาข้าว	38,619,362	24.52
พืชไร่	38,679,371	23.06
ไม้ยืนต้น	32,404,278	19.12
ไร่ถั่ว	12,526,963	7.59
ไร่ถั่วเหลือง	3,607,918	2.12
สวนผลไม้และไม้ผลัดใบ	2,694,372	1.61
พื้นที่เกษตรกรรม (ทุ่งหญ้า, ทุ่งหญ้าเลี้ยงสัตว์)	1,652,382	0.92
พื้นที่ป่าไม้	113,176,136	35.29
ป่าสนภูเขา	182,905,513	32.11
ป่าเบญจพรรณและป่าเต็งรัง	18,086,623	3.18
พื้นที่ชลประทาน	8,812,352	2.75
ชลประทาน	8,812,352	2.75
พื้นที่อื่นๆ	12,817,043	3.74
พื้นที่ป่า (ในเขตเกษตรกรรม)	8,179,624	2.86
พื้นที่อื่นๆ	1,833,783	0.57
พื้นที่ชุมชนและเมืองอุตสาหกรรม	1,803,628	0.31
รวมทั้งประเทศ	320,696,887	100.00



ส่วนราชการพัฒนาการใช้ที่ดิน
สำนักสำรวจดินและวางแผนการใช้ที่ดิน
กรมพัฒนาที่ดิน

Land Use of Thailand

Agricultural area 27.02 million ha

■ Paddy Field 11.27 million ha

■ Field Crop (5.02 m ha)

Cassava 1.70 million ha

Sugarcane 1.67 million ha

Maize 1.65 million ha

■ Perennial Crop (4.42 m ha)

Para Rubber 3.31 million ha

Oil Palm 0.60 million ha

Eucalyptus 0.51 million ha

■ Orchard (1.54 m ha)

Mixed Fruit 1.16 million ha

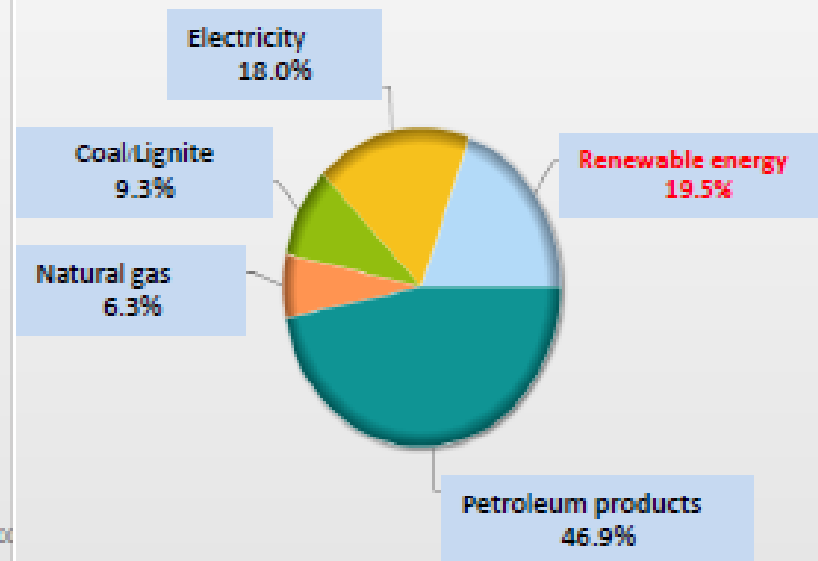
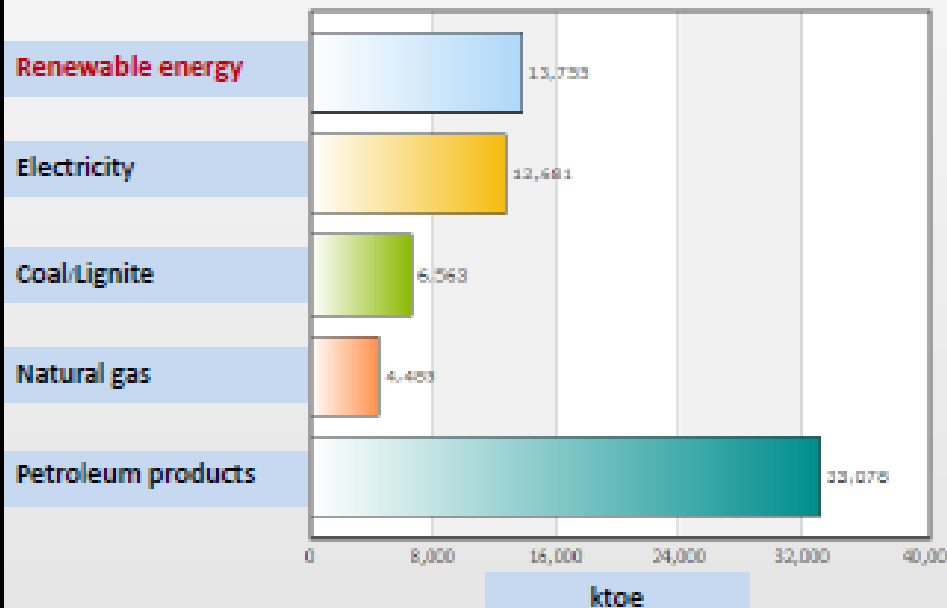
Coconut 0.19 million ha

Longan 0.19 million ha



1. Thailand's Energy situation in 2011

Final Energy Consumption by type 2011



Final Energy Consumption 2011 = 70,562 ktoe

Renewable energy increased 19.5% Growth rate 2.5% from 2010

Commercial RE	Solar, wood, charcoal, paddy husk, baggasse, agricultural waste, garbage & biogas
Traditional RE	wood, charcoal, paddy husk, agricultural waste used in household/industrial household



3. Renewable energy Plan & Policy

Development of low-carbon society

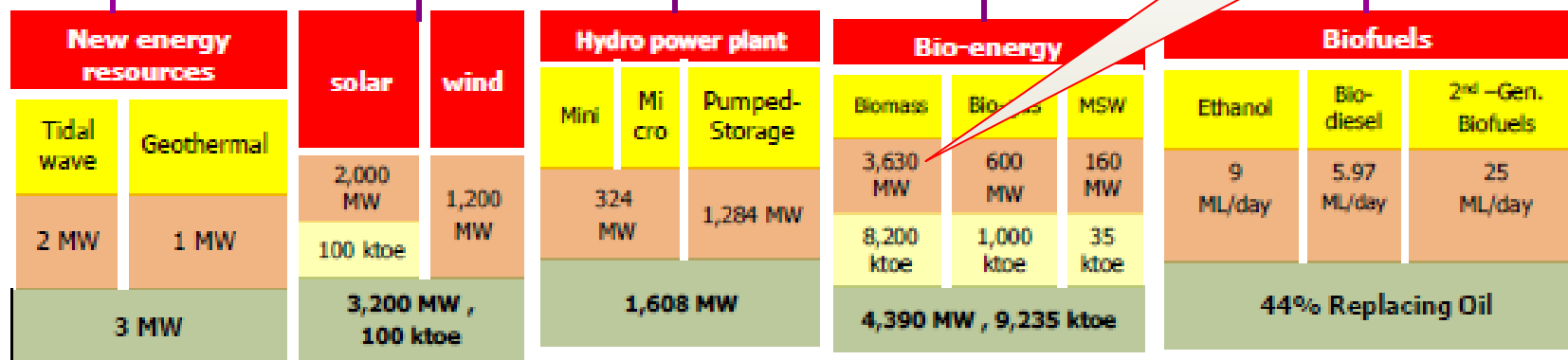
Budget to support Research & Development

Alternative Energy Development Plan (AEDP : 2012-2021)

Support the investment of Private sector and community

Target on using Renewable Energy at **25 %** of Total Energy Consumption By 2021

Increased into 4,800 MW



AEDP Goal	2555	2559	2564
	3,283 MW	4,987 MW	7,633 MW



Eucalyptus

Acacia hybrids

2012/05/16



Agroforestry (Cassava)

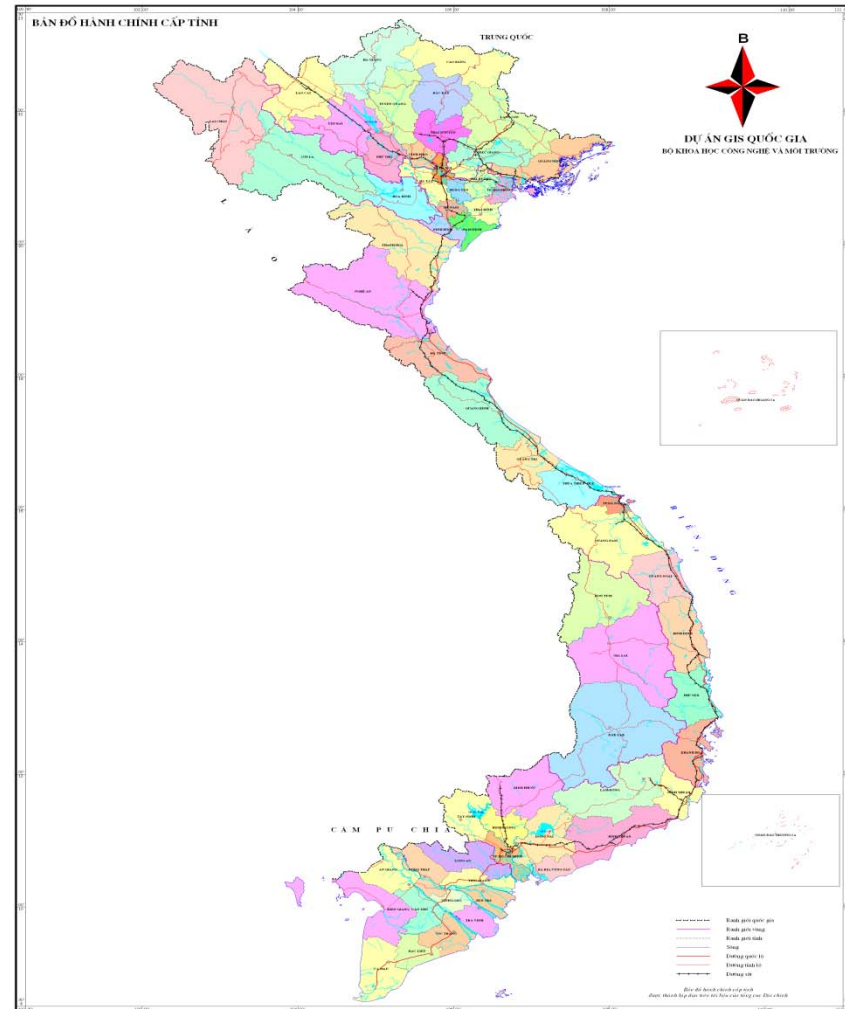


Potential of biomass utilization in Vietnam



The Country

- **Natural area: 33 mil. ha**
- **Population: 90 mil.**
- **Ethnic groups: 54**
- **Forest land: 19 mil.**
- **Forested area: 13.4 mil.**
- **Natural forest: 10.2 mil.**
- **Plantation: 3.2 mil.**
- **25% of total pop. living in or near forests (23 mil.)**



Energy situation in Vietnam

- ❖ Energy consumption increased over 8 % per year and this increase depends on fossil fuels (Institute of Energy 2010)
- ❖ Before 2010 Vietnam exported fuels, but there will be deficit after 2012⁽¹⁾
- ❖ An estimated import could be:
 - 2015: import ~ 6.27 mil. TOE*
 - 2020: import ~ 24.9 mil. TOE
 - 2030: import ~ 62.8 mil. TOE



Vietnam's target to increase the share of renewable energy from 3% in 2010 to 5% in 2020 and 11% in 2050



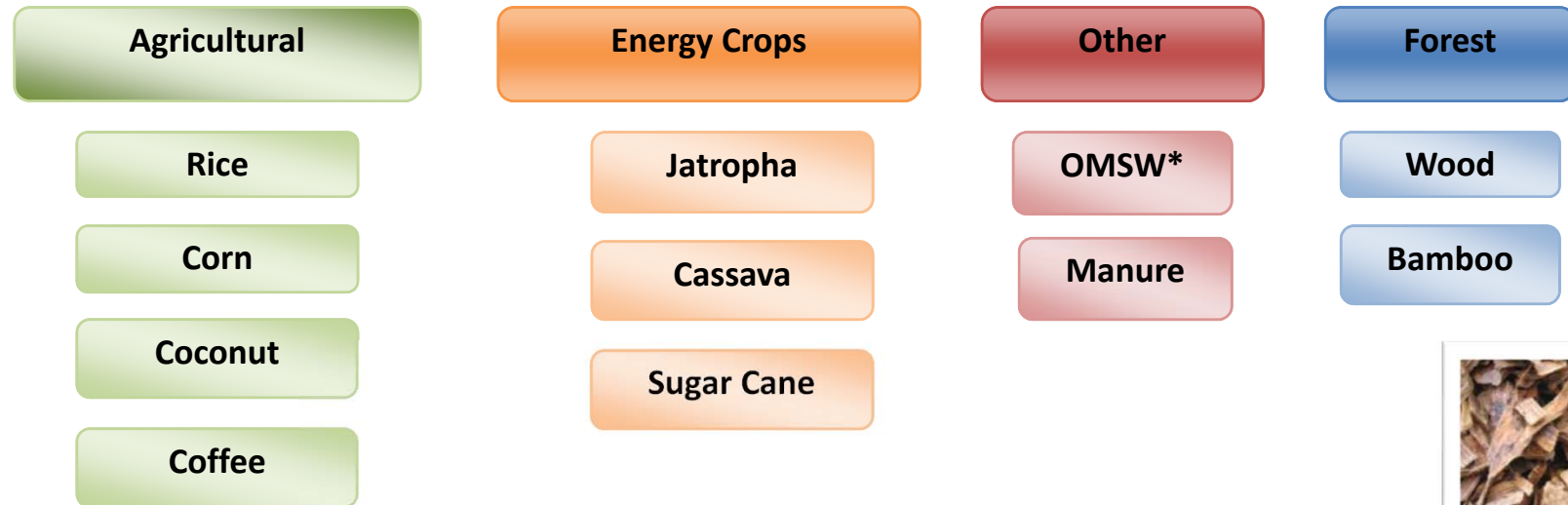
New clean renewable energy sources (e.g wind energy, solar energy and bio-energy) are important.

* TOE: tonne of oil equivalent

¹ source: Truong Nam Hai. Biomass-Asia Workshop 2005, Tokyo – Tsukuba, Japan

Biomass feedstock

Vietnam has huge resources of biomass with some selected residues for bio-energy ¹



* Organic Municipal Solid Waste

¹ Source: NL Agency's report 2012

Woody biomass feedstock

Source	Area (ha)	Residue s yield	Location	% of resource is residue or waste	theoretical Availability	Current uses of wood residues
Natural forest	10 mil.	5 mil. ton/ year (*)	In whole country	Logging: 40% Sawmilling: 38% solid + 12% sawdust	11 mil. ton residues	Wood chip export, Saw log, boards production, burning in kilns, domestic cooking.
Plantation	3.2 mil.					
Bamboo	~1.4 mil. (150.000 plantation)	10 – 13 tons/ha	Lam Dong and the north	50 – 70%		Floor manufacturing, charcoal, paper and pulp, domestic fuel.

(*) 2 mil. tons from logged timber, 2.5 mil. tons from sawmills, 500,000 tons from scattered trees

Current estimated area of plantations

Species	Total area
<i>Acacia and Eucalypts</i>	1.5 mil ha
<i>Pines</i>	200 - 250,000 ha
<i>Melaleucas</i>	70,000 - 100,000 ha
<i>Casuarinas</i>	60,000 – 80,000 ha
Bamboos & rattan	150 - 200,000 ha
Other NTFP* tree species	50 - 70,000 ha
Others (i.e. <i>Dipterocarps; Teak; Melia</i> and some native species)	100 - 150,000 ha
Scattered planting	200 mil. trees/years



Source: *MARD 2010*

* NTFP: non-timber forest products

Potential of biomass utilization in Myanmar



Forest Resources of Myanmar

Forest Cover of Myanmar (2010)

	Area (,000 ha)	% of total country area
Closed forest	13445	19.87
Open forest	18329	27.09
Total forest	31773	46.96
Other Wooded land	20113	29.73
Others	13869	20.50
Waterbody	1903	2.81
Total	67658	100

Closed Forest

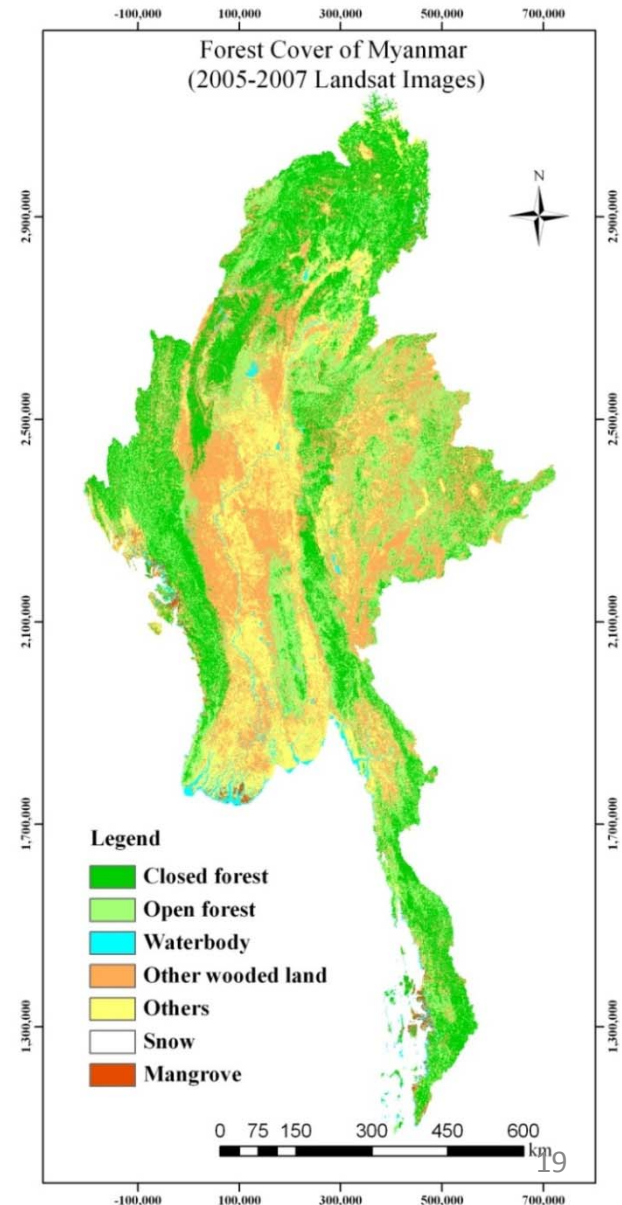
Canopy Coverage

30% and above

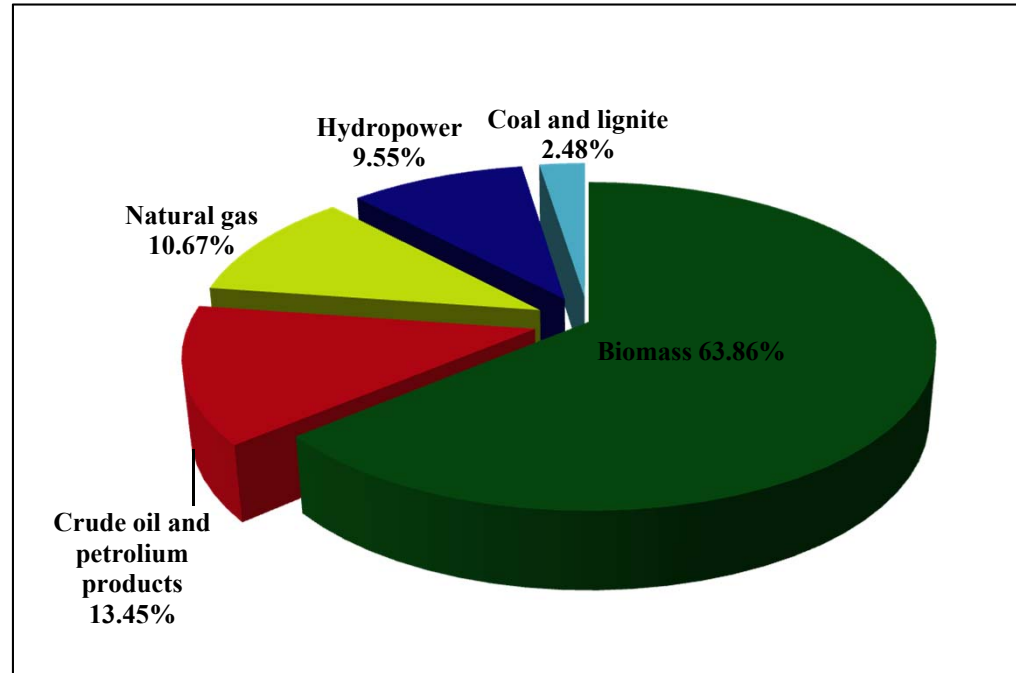
Open Forest

Canopy Coverage

between 10% and 30%



Source of energy in Myanmar



- **About 70% of total population of Myanmar dwell in rural areas.**
- **Current level of wood fuel consumption is about 19.12 million cubic tons per year.**
- **The supply sources are natural forests, plantations, homestead gardens, community forests and tops and lops from timber harvesting.**

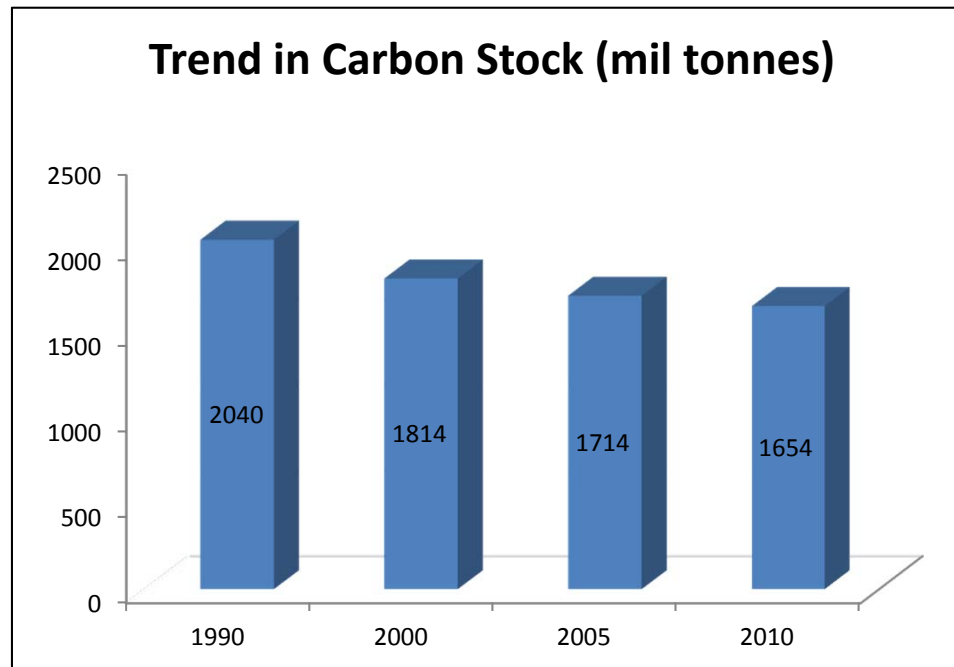
Availability of energy resources in Myanmar

Crude oil (Offshore & On-shore) (Proven + Probable)	648.59 MMBBL
Natural gas (Offshore & Onshore) (Proven + Probable)	122.5391 TSCF
Hydro power	108, 000 MW
Coal	711 Million Metric Tons
Biomass	<ol style="list-style-type: none"> 1. 46.96% of total land area covered with forest . 2. Potential available annual yield of wood-fuel 19.12 million cubic ton
Wind	365.1 TWH per year
Solar power	51973.8 TWH per year

Source: Ministry of Energy, 2008

Potential biomass from Forests

- **Growing Stock in Natural forests of Myanmar – 1430 mil m³ (45 m³/ha)**
- **17.8% of total volume is commercial growing stock (volume of commercial tree species).**
- **Estimated forest carbon stock declining**



Estimated rice husk production and usage

		No. of rice mill	Capacity (ton/24hrs)	Estimated paddy production ('000 ton/year)	Estimated Husk volume ('000 ton/year)	Rice husk for power plant ('000 ton/year)
Large scale rice mills	State	68	5,113	1,637	307	32
	Private	1,158	26,626	8,002	1,600	320
	Total	1,226	31,738	9,539	1,907	352
Small scale rice mill		10,469	41,341	12,424	2,485	-
Total		11,695	73,079	21,963	4,392	352

Source: Myanmar Rice Millers' Association, 2009

Area and production of Ethanol producible crops (2008-2009)

Crops	Growing Area (1000 ha)	Production (1000 MT)	Potential Ethanol Supply (mil. Gallons)
Sugarcane	308	17157	309
Cassava	22	296	30
Sorghum	210	207	2
Maize	347	1159	81
Potato	37	553	n.a
Sweet Potato	7	45	n.a

Source- Ministry of Agriculture and Irrigation, Myanmar

Area and production of Biodiesel producible crops (2008-2009)

Crops	Growing Area (1000 ha)	Production (1000 MT)	Potential Ethanol Supply (mil. Gallons)
Oil Palm	105	261*	52**
Niger	145	83	30
Rape seed	87	71	22
Sunflower	857	773	218
Sesame	1552	833	334
Groundnut	813	1243	358
Soybean	165	243	29
Coconut	53	350 _{Copra}	350 _{Copra}
Jatropha	2722	6	3

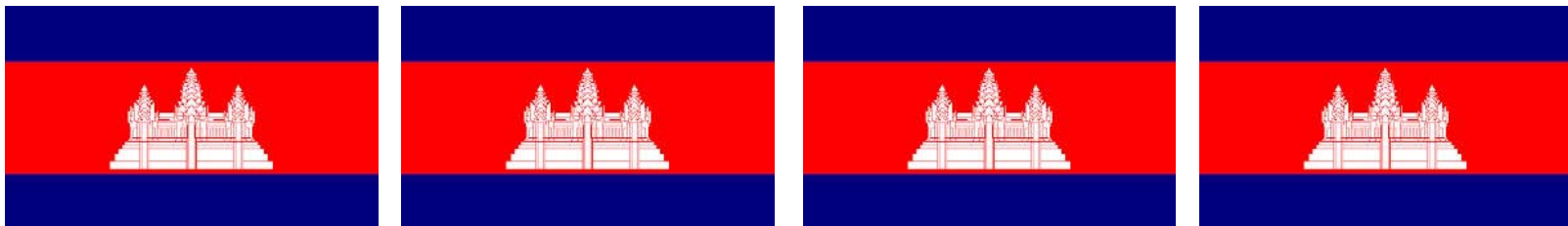
* Fresh Fruit Punch ** crude oil

Source- Ministry of Agriculture and Irrigation, Myanmar

Potential of biomass utilization in Cambodia



- Biomass resources, particularly residues from forests, wood processing, agricultural crops and agro-processing, are under utilized in several ways and to encourage alternative sources of income in rural areas. These resources are renewable, environmentally friendly in energy production, and sustainable in terms of supply.
- In Cambodia, the use of wood-derived fuel represents 80% of total energy consumed and similar high percentages are common for many countries in Asia.



Current Situation of Forest Cover in Cambodia

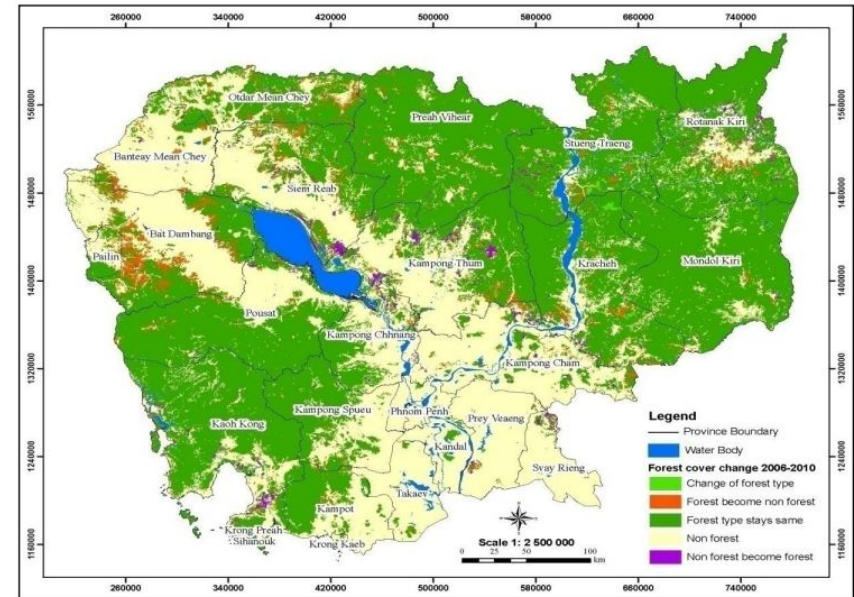
Forest Cover in 2010

- Evergreen Forest : 3,499,185 ha (19.27%)
- Semi-Evergreen Forest : 1,274,789 ha (7.02%)
- Deciduous Forest: 4,481,214 ha (24.68%)
- Other Forest : 1,108,600 ha (6.1%)

The forest land of Cambodia is 10,363,789 ha,
(57.07%) of the total land area.

-Non Forest : 7,796,885 ha (42.93%)

TOTAL AREA: 18,160,674 (100%)



Current situation of biomass/wood energy Utilization and Technology

- 80% of national energy consumption (MIME 2001)
- Biomass power generation is very limited (200 kW)

Biomass source for electricity generation

- Agricultural Waste
 - Rice husk –One million ton /year ; 60-100 MW capacity
 - Cashew nuts shell, sugarcane baggasse, cassava stems etc.
- Old Rubber Trees
 - 40,000 ha plantation, 25-30 year replanting cycle, 180 t/ha
250,000 t/year; 20-50 MW capacity
- Forest Resource
 - Plantation, tree farming

Biomass source for wood energy

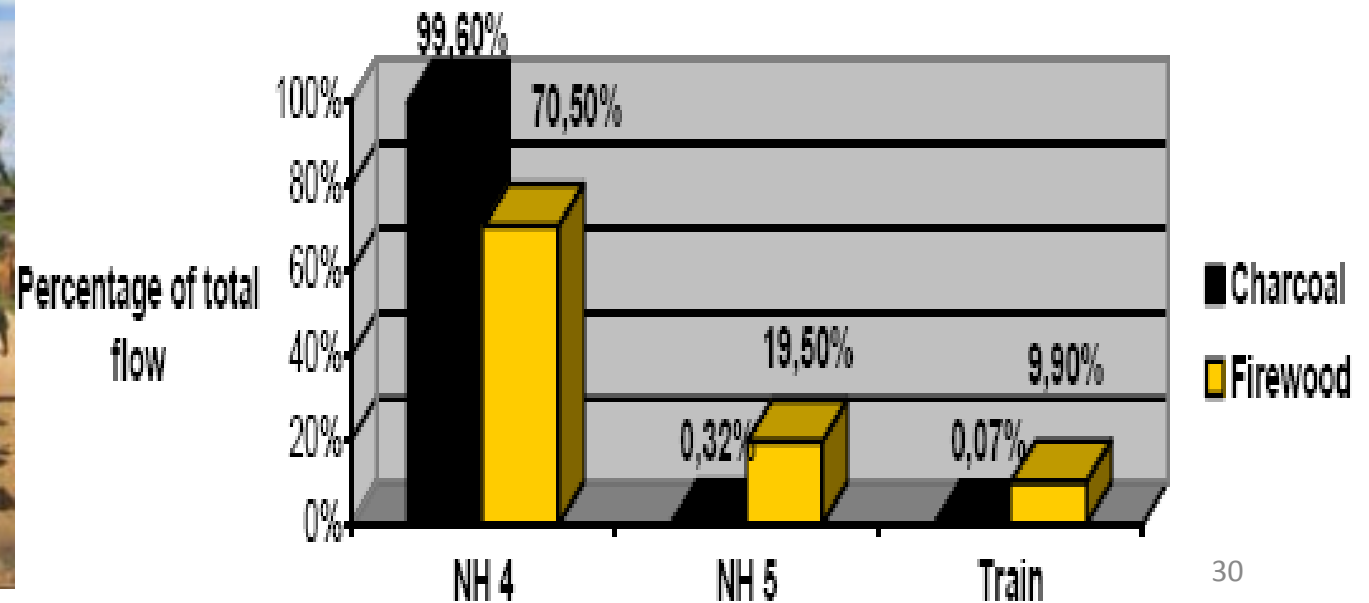
Wood/charcoal flows:

The sources of charcoal and firewood transport to Phnom Penh city are:

National road No4 : Aural Wildlife Sanctuary, Kirirom National Park and Koh Kong Province

National road No5-6 : flooded forest around Toule sap Lake and Upland forest.

Wood energy is consumed by households, approximately 7,000,000m³ of fuel wood is estimated to be collected annually (FAO,2001)



Potential of biomass/wood energy utilization

- Wood and wood charcoal account for approximately 80% of the total energy consumption in Cambodia. 80% in urban and 94% in rural areas use for cooking. Wood is used in huge quantity mainly in brick industry, garment factory, Sugar palm production and restaurants (Duraismy, 2010).
- In Cambodia 22% of the total population has access to electricity (60% in urban and 10% in rural areas). Phnom Penh, with 10% of the country's population, use more than 85% of the total electricity in the country.

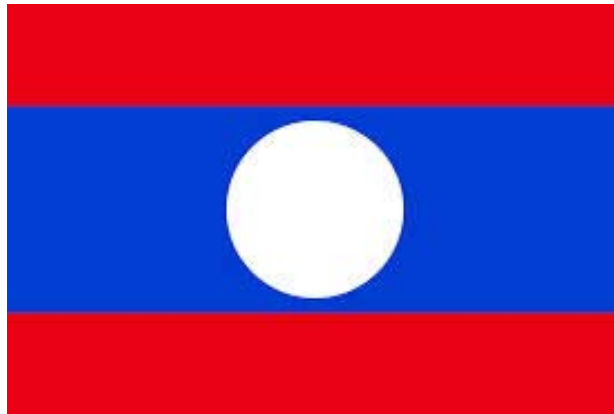
Potential of biomass/wood energy utilization

- For non-electricity areas, mostly batteries or Kerosene or solar lanterns are use for lighting in rural areas. The middle group's households also use high capacity diesel engine (3-5 KW), consuming large amount of diesel (Duraisamy, 2010).
- Biomass fuels are mostly used in the household sector, primarily by the rural and urban in small towns. These people usually end up paying more for their household energy.

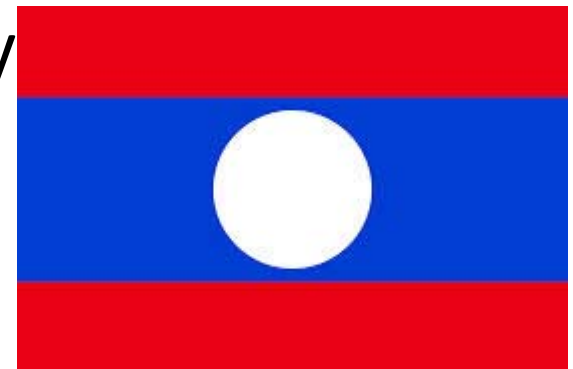
Planted forest in degradation areas



Potential of biomass utilization in Laos



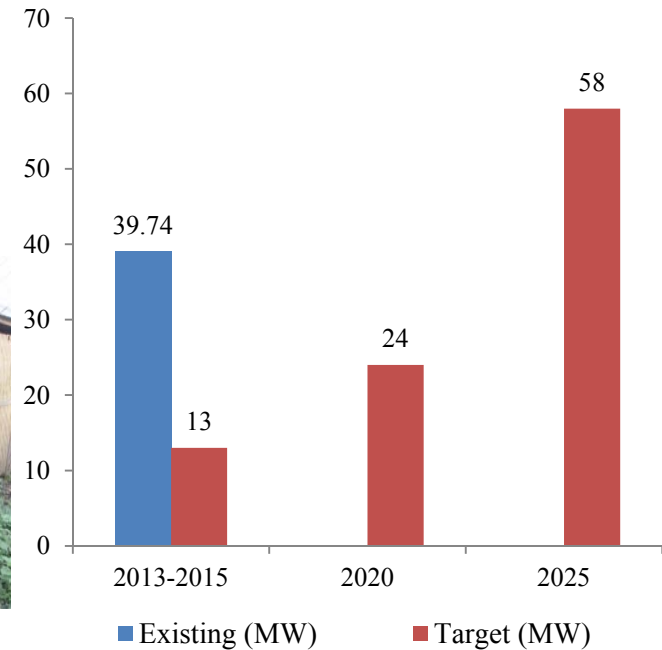
- The forest cover **68 %** of the country (FAO, 2010)
- About **80 %** of Lao population are living in the rural areas and they rely heavily on the forest for fuel wood, medicines, houses and shelter. Wood energy is widely used throughout the country.
- The forests are already a vital economic resource for Lao PDR, they provide an essential contribution to the consumption and income of rural poor people and conserve biodiversity, soil and water values. Energy use within the country is still dominated by the use of fuel wood, which accounts for about **88 %** of total energy requirement.



Biomass Development

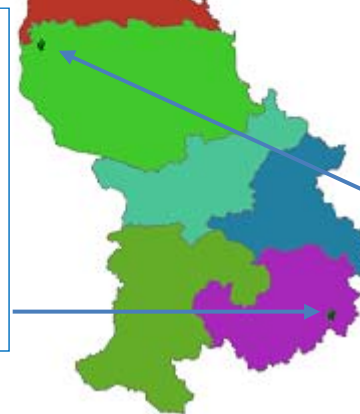


Energy Self Sufficiency Village
 Pangbong Village
 Ngeun District
 Xayabury Province
 Install Capacity: 40 kW
 Feedstock: Corn



Hoang Anh Sugar Mill

Phouvong, district
 Attapeu Province
 Install Capacity: 30 MW
 Feedstock: Bagasse



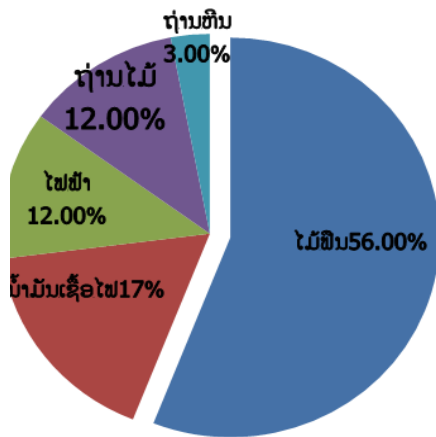
Mit Lao Sugar Mill

Xaibury, district
 Savannakhet Province
 Install Capacity: 9.7 MW
 Feedstock: Bagasse



Fuel Wood Energy

- About 50%-80% of hh are Using fuel wood for cooking, and other relates activities



Case study of wood biomass

Item	2007	2010 (est.)	Ref.
Total population consumption of wood biomass for energy	4.684 million	5.040 million	Ingsay et al., 2008 (cover 8 provinces in Laos)
Total small industry consumption wood for bioenergy (503 unit)	279,644 - 330,716 m ³ /year		
Wood charcoal factory (47 unit)	38,100 m ³ /year		
Agar wood factory (53 unit)	37,179 m ³ /year		
Wood charcoal Consumption Raw wood materials	866,421 persons 17,949 t/year 119,660 m ³		

Case study of wood biomass

Item	Basic data	Ref.
Forest area	16,142 Mha	Suzuki et al., 2009
Biomass stock	3,301 Mt	Suzuki et al., 2009
Biomass stock by area	204 t/ha	Suzuki et al., 2009
Growing stock	957 Mm ³	Suzuki et al., 2009
Growing stock by area	59 m ³ /ha	Suzuki et al., 2009
Sawn wood	130 Km ³	Suzuki et al., 2009
Plywood	24 Km ³	Suzuki et al., 2009
Wood fuel	5,944 Km ³	Suzuki et al., 2009
Wood charcoal	20 Kt	Suzuki et al., 2009
Energy consumption	1.41 Mtoe	FAO, 2008
Energy consumption per capita	0.27 toe/capita	FAO, 2008

Case study of wood biomass

Item	Basic data	Ref.
Main produce volume (MPV)	130 Km ³	FAO, 2008
Residue production ratio (RPR)	40%	Yoshida et al., 2007
Residue volume (RV)	87 Km ³	Yoshida et al., 2007
Low heating volume (LHV)	8.4 GJ/m ³	IEA, 2007
Energy potential (EP)	0.02 Mtoe	IEA, 2007
Formula for Estimating the biomass energy potential		
$RV = MPV \times RPR / (100 - RPR)$ $EP = RV \times LHV$		

Case study of wood biomass

Item	Basic data	Residue	LHV (Mj/kg)	PE (MGj)	Ref.
Rice residue biomass energy	2.66 Mt				FAO
Rice husk residue (RPR)	0.25	0.67	12.85	8.56	Asia Pro Eco Project , 2006;
Rice straw residue (RPR)	0.25	0.88	14.00	12.31	Sajjakulnu kit et al., 2005