

# Thailand Experience in Alternative Transport Fuels: Successes and R&D Challenges

By

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For

Asia Pacific Economic Cooperation (APEC)

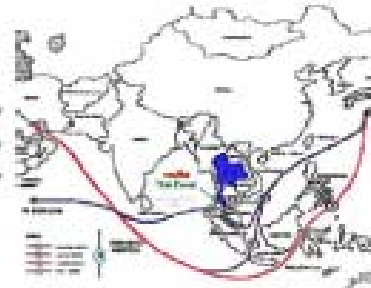
New and Renewable Energy Technologies

Twenty-Fourth Meeting

17-19 May 2005

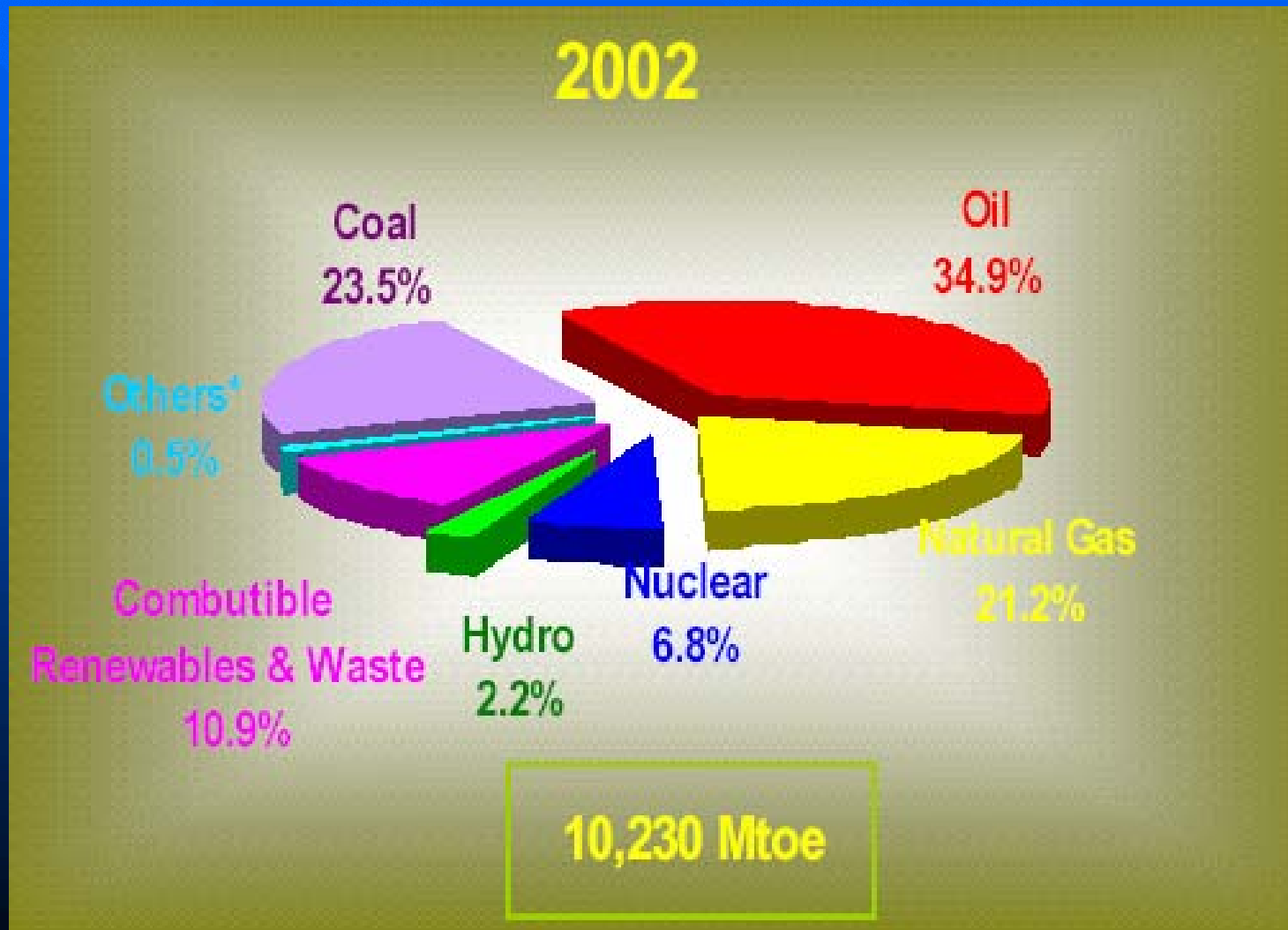
Honolulu, Hawaii, USA

# General Information of Thailand



<b>Area</b>	:	<b>513,115</b>	<b>km<sup>2</sup></b>
<b>Population</b>	:	<b>63,540</b>	<b>thousand</b>
<b>Number of Provinces</b>	:	<b>76</b>	
<b>Number of Households</b>	:	<b>18,342,607</b>	
<b>Average Size of Households</b>	:	<b>3.5</b>	<b>persons</b>
<b>GDP (1988 Prices)<sup>a</sup></b>	:	<b>3,676</b>	<b>10<sup>3</sup> Baht</b>
<b>GDP Growth<sup>a</sup></b>	:	<b>6.2</b>	<b>%</b>
<b>GDP per capita</b>	:	<b>57,855</b>	<b>Baht/capita</b>
<b>GDP per household</b>	:	<b>200,413</b>	<b>Baht/household</b>
<b>Export</b>	:	<b>3,922</b>	<b>10<sup>3</sup> Baht</b>
<b>Import</b>	:	<b>3,840</b>	<b>10<sup>3</sup> Baht</b>
<b>Currency</b>	:	<b>1 USD = 40.37</b>	<b>Baht</b>

# World Primary Energy Supply



# Domestic Production of Primary Energy

(Physical unit)

## Domestic Production

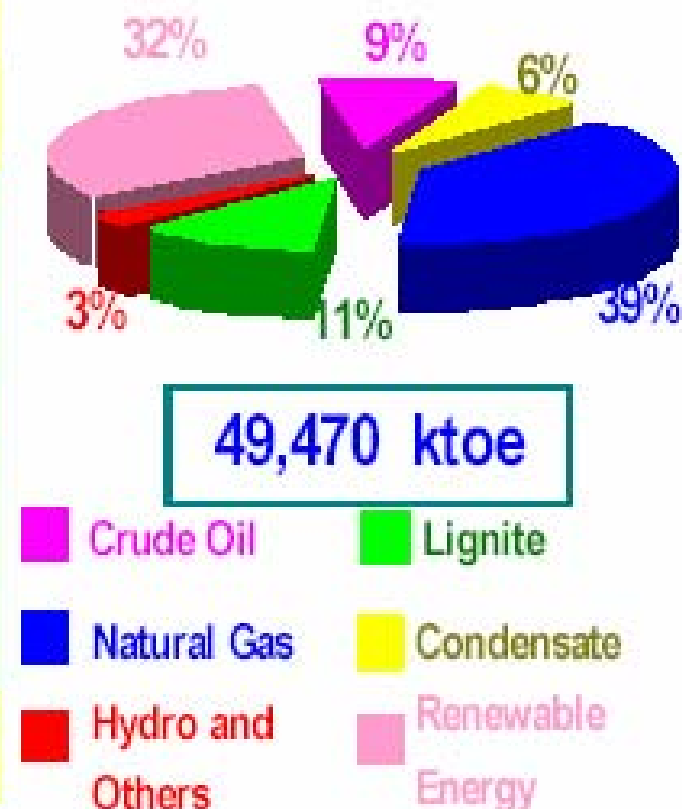
of Primary Energy

### Commercial Energy

	2003	2004 <sup>e</sup>
Crude Oil (mil. litres)	5,561	4,937
Condensate (mil. litres)	3,682	3,978
Natural Gas (MMscf)	765,510	791,724
Lignite(10 <sup>3</sup> ton)	18,843	20,163
Hydro and Others*(Gwh)	7,301	6,003
Renewable Energy(10 <sup>3</sup> ton)	49,258	53,285

Shares of Domestic Production  
of Primary Energy

2004<sup>e</sup>

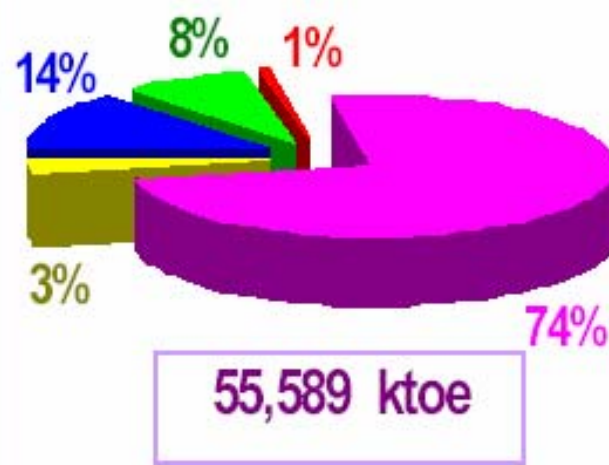


# Energy Imports

(Physical unit)

Energy Imports	2003	2004 <sup>e</sup>
<b>Commercial Energy</b>		
Crude Oil (mil. litres)	45,025	48,076
Petroleum Products (mil. litres)	998	1,860
Natural Gas (MMscf)	285,125	309,585
Coal & Its Products (10 <sup>3</sup> ton)	7,107	7,482
Electricity(Gwh)	2,479	3,324

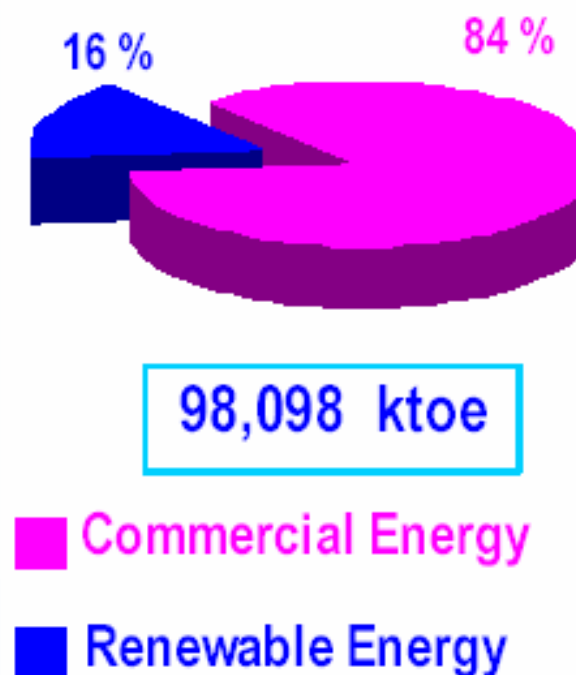
## Shares of Energy Imports 2004<sup>e</sup>



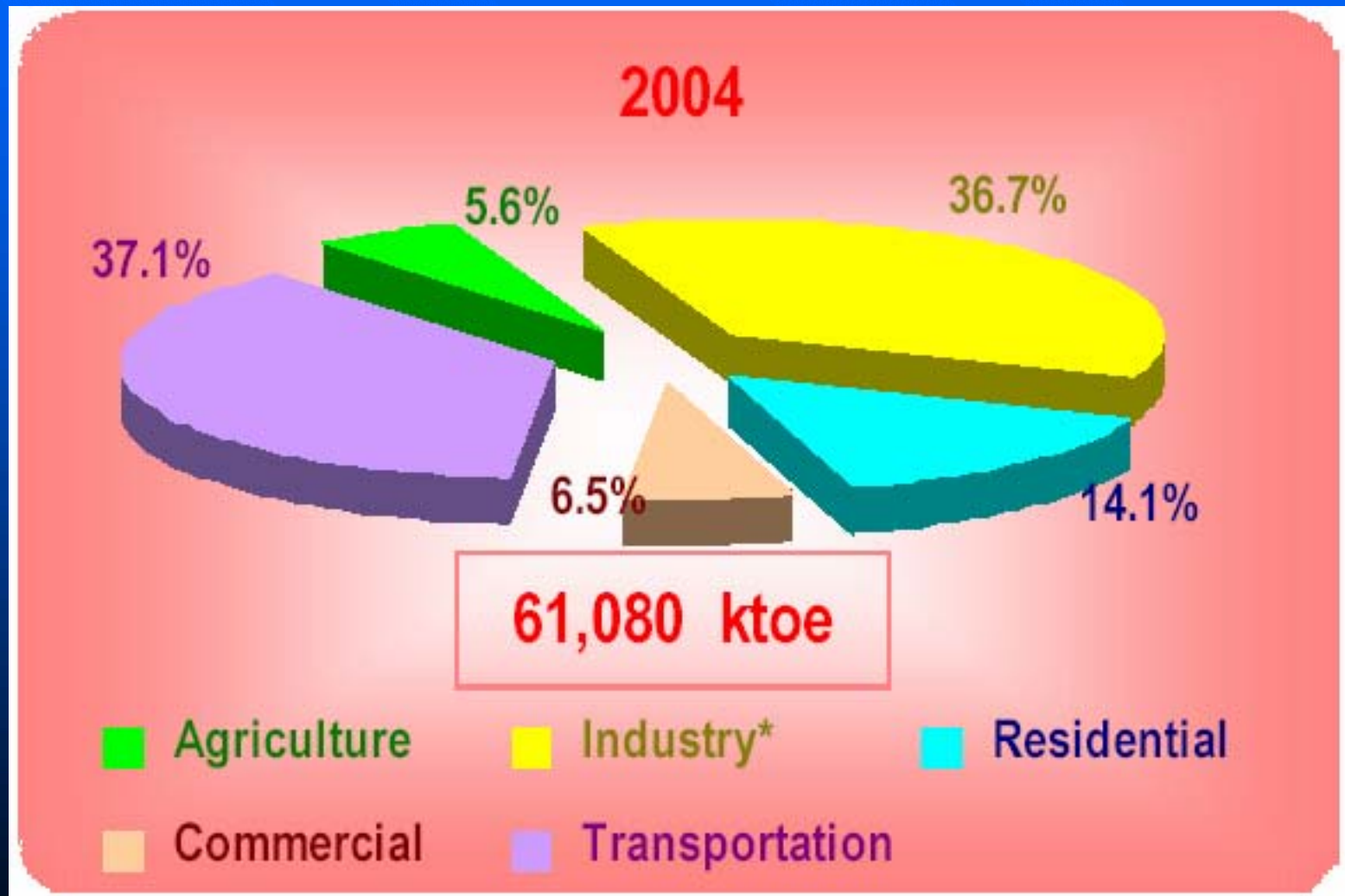
## Primary Energy (Physical unit)

Primary Energy Supply,	2003	2004 <sup>e</sup>
<b>Commercial Energy</b>		
Crude Oil (mil.litres)	49,576	52,612
Condensate & NGL (mil.litres)	3,345	3,921
Natural Gas(Bcf)	1,051	1,101
Coal & Its Products (10 <sup>3</sup> ton)	25,071	27,137
Petroleum Products (mil. litres)	-5,832	-6,242
Electricity(Gwh)	9,484	9,074
<b>Renewable Energy(10<sup>3</sup>ton)</b>		
	49,278	53,305

## Shares of Primary Energy Supply 2004<sup>e</sup>



# Final Energy Consumption



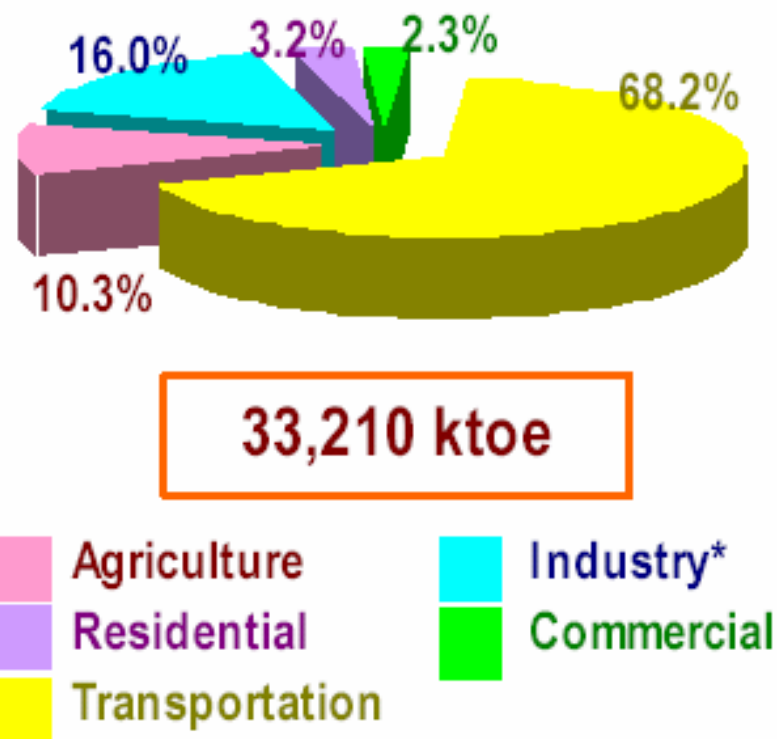


# Petroleum Products Consumption by Economic Sector

(Physical unit)

Petroleum		
Products	2003	2004 <sup>e</sup>
(million litres)		
Total	37,229	40,479
Agriculture	3,827	4,001
Industry*	5,135	6,060
Residential	1,657	1,687
Commercial	1,135	1,201
Transportation	25,475	27,530

Shares of Petroleum Products Consumption by Economic Sector 2004<sup>e</sup>





## Candidates after dry out of conventional OIL

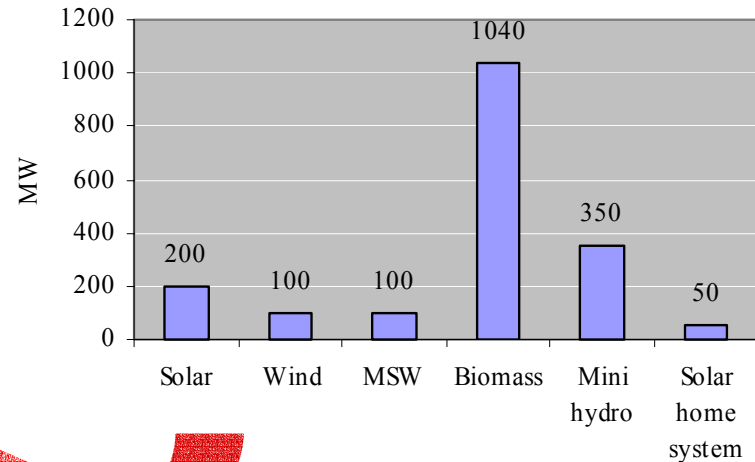
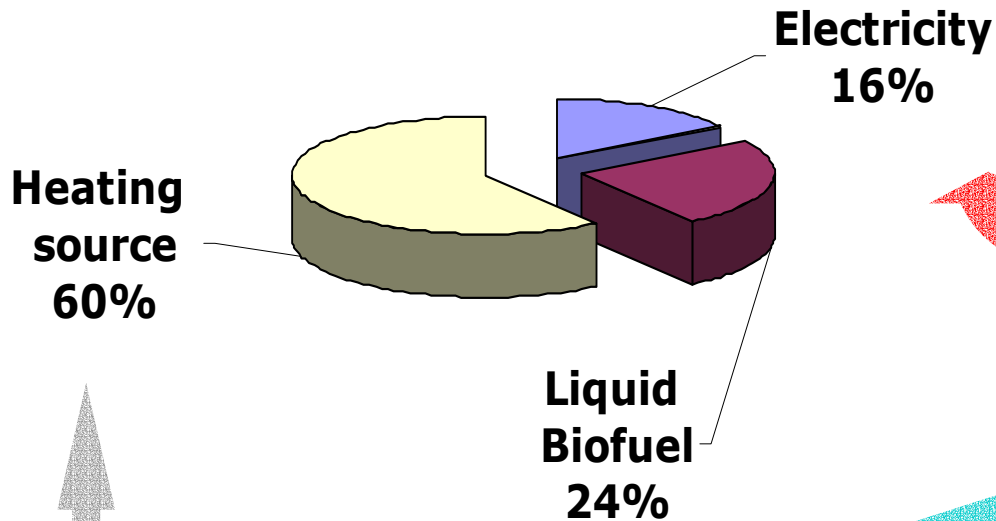
(Blue : Automobile Fuels)

- 1. Unconventional Oil** (tar sand)  
Gasoline, Diesel fuel  
New category hydrocarbon fuel
  - Resources may be abundant
  - CO<sub>2</sub>reduction is needed
  - Fuel quality change
- 2. Alternative Fossil Fuels** (NG, Coal)  
CNG, **Synthetic Fuels**  
(FTD, Methanol, DME, Hydrogen)
  - Resources may be abundant
  - CO<sub>2</sub>reduction is needed
  - Tremendous investment to fuel production facilities
- 3. Biomass** (Crops, Vegetable oil)  
Ethanol, ETBE, Vegetable oil  
**Bio-synthetic fuel**(BTL, Hydrogen)
  - Cost will become competitive
  - **Excellent in terms of CO<sub>2</sub>**
- 4. Renewable** (Wind, Photo cell)
- 5. Nuclear**  
Hydrogen, Electricity
  - Electricity cost will become competitive.
  - Hydrolysis efficiency is poor
  - Excellent in terms of CO<sub>2</sub>

# THAILAND

## Target of new renewable energy in 2011

8% of total energy consumption  
or 6,540 ktoe



Manufacturing/  
Agriculture

3,910  
ktoe

**Biomass and biogas:**

MSW, industrial waste  
water and manure

Transportation

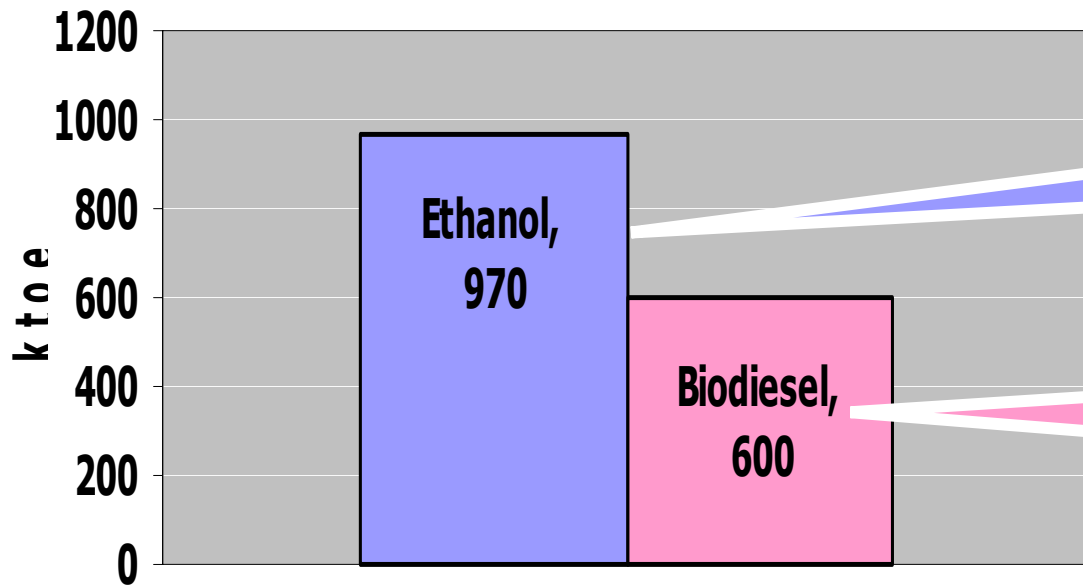
1,060  
ktoe

1,570  
ktoe

# THAILAND: Target of new renewable energy in 2011



**1,570 ktoe as Liquid Biofuel  
for Transportation and Agriculture**



- 1 M. Litres/D in 2006
- 3 M. Litres/D in 2011

- 172 M. Litres in 2006
- 720 M. Litres in 2011

# Ethanol Utilization for Transport

- 7% blend in gasoline (95 RON) and priced at 7% lower than 95 RON gasoline
- Higher than 7% blend causes
  - excessive fuel vapor pressure and leads to vapor lock problem in some car models
  - moisture absorption being a potential problem
  - Detectable drive-ability deterioration
- 10% blend in diesel was tried without success

# Policy on Bio-diesel

- Encouraging the use of 10% blend in diesel from 2006 in most part of the country
- Mandating the 10% blend in diesel from 2012
- The use of bio-diesel in 2012
  - decreases the diesel consumption by 3,100 Mliters/year
  - alleviate the CO<sub>2</sub> emission by 6.8 Mt/year

# Policy on Natural Gas Utilization in Transport Sector

Year	Policy
2005	New route buses and garbage collecting trucks that operate in Bangkok must use natural gas
2006	Route buses over 8 years old must be modified to use natural gas
2008	Only natural gas buses are allowed into Bangkok area



# Light Duty CNG Vehicles Projection

Type	2005	2006	2007	2008	2009
Taxi	4450	8550	26250	45450	64650
Private	200	800	3200	17652	43655
Gov.	0	1100	3200	3800	4400
3-W	0	2500	4000	5500	7000
Total	4650	12950	36650	72402	119705



# Heavy Duty CNG Vehicles Projection

Type	2005	2006	2007	2008	2009
Bus	82	1182	3482	5782	7782
Tractor	0	100	1600	5600	10100
Truck	0	130	1580	3580	6580
Garbage Truck	0	300	800	1300	2300
Light truck	0	400	6900	18900	35900
Total	82	2112	14362	35162	62900

# CNG Refueling Stations

Area	2005	2006	2007	2008	2009
Bangkok	28	47	75	95	120
Outside	3	10	25	45	60
Total	31	57	100	140	180

# CNG cylinder in the car trunk



# Engine converted to use CNG





# Master shut-off valve and refilling receptacle



# Ongoing CNG Pilot Projects

- 1 CNG locomotive (Diesel Dual Fuel)
- 2 CNG fishing boats (Diesel Dual Fuel)
- 5 CNG trucks and tractors (Diesel Dual Fuel and CNG dedicated)



Thank You