



Symposium on Low Carbon Asia Research

Thailand's LCS Scenarios and Actions: The ExSS Modeling Experience

Johor Bahru, Malaysia
July 5, 2011

Sirindhorn International Institute of Technology
Thammasat University, THAILAND

Bundit Limmeechokchai
Pornphimol Winyuchakrit
Artite Pattanapongchai

Asian Institute of Technology
THAILAND

Ram M. Shretha

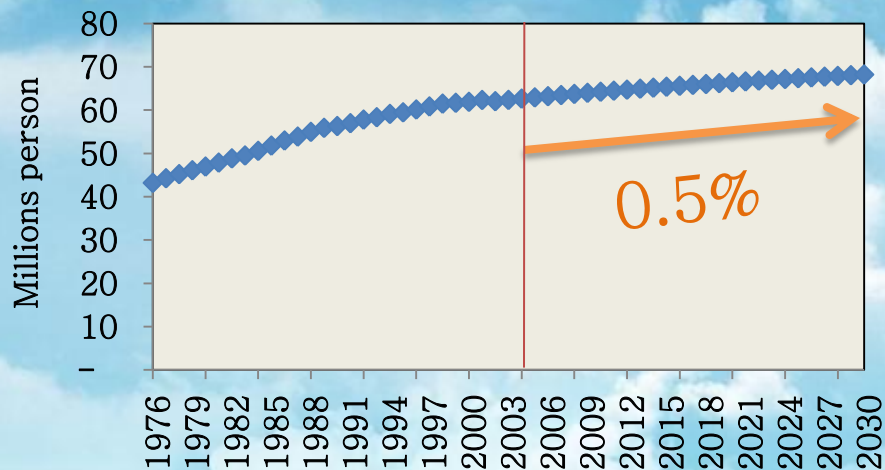
Thailand “LCS” Study Objectives

- ❖ To propose measures for avoiding climate change, and precursors to zero carbon society and renewable-energy economy.
- ❖ To discuss the possibility of developing a low-carbon society in Thailand.
- ❖ To create awareness among Thailand’s authorities, government, stakeholders, and communities for low-carbon Thailand.

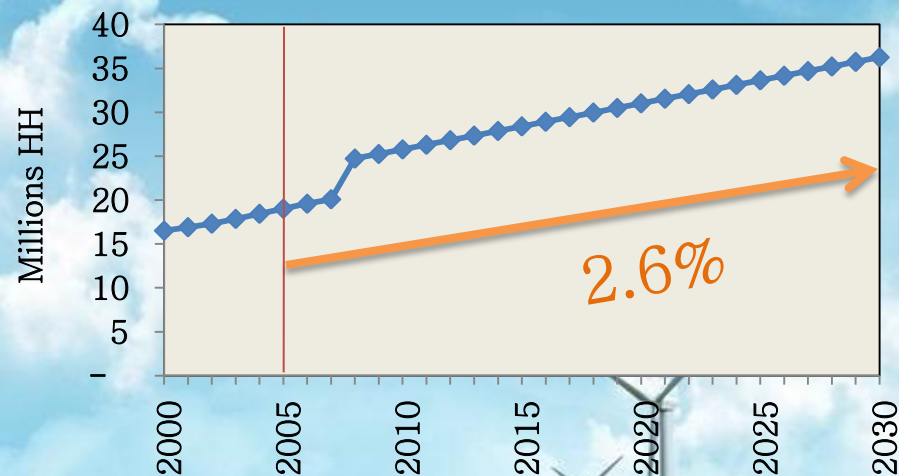


Quantitative assumptions

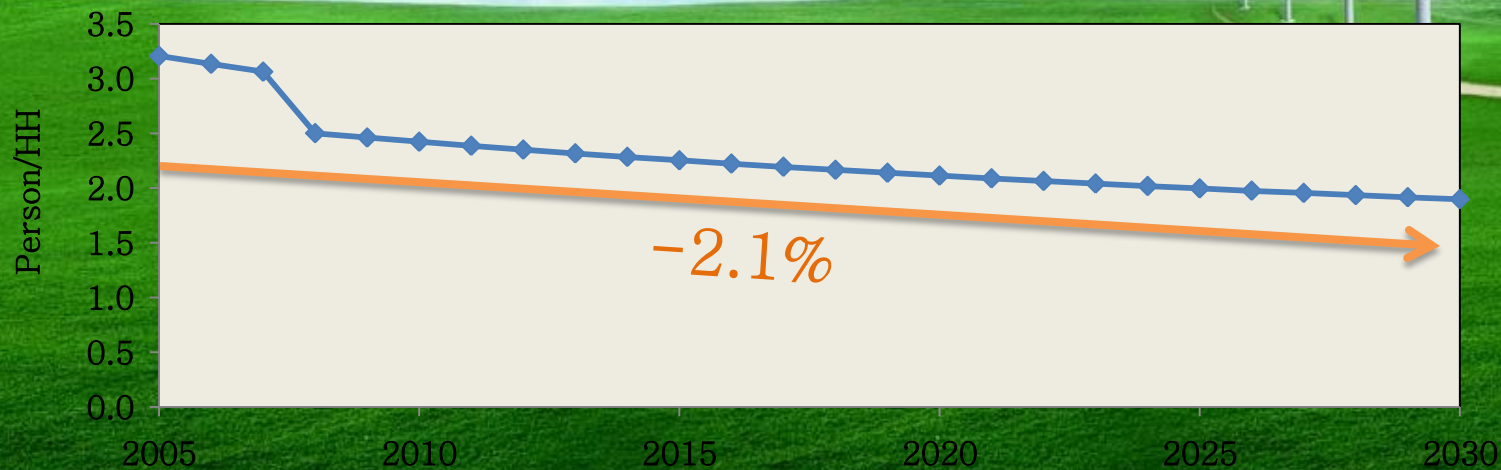
Population



No. of Households



Household size



Estimated socio-economic indicators

	2005		2030
Population	60,991,000	0.49%	68,815,004
No. of HH	19,016,784	2.6 %	36,265,390
GDP (mil Baht)	8,016,595	5.5- 5.0%	30,802,306
Gross output (mil Baht)	18,755,884		
<i>Primary industry (mil Baht)</i>	1,116,621	3.9%	
<i>Secondary industry (mil Baht)</i>	11,453,496	5.1%	
<i>Tertiary industry (mil Baht)</i>	6,185,767	6.4%	
Floor space for commercial (mil m ²)	88		68,456,651
Passenger transport demand (mil p-km)	191,520		2,801,864
Freight transport demand (mil t-km)	188,524		38,008,931
			27,645,856

Remarks: Primary industry → Agriculture, Mining, and Construction 394
 Secondary industry → Textiles, Food & beverage, Chemical, Metallic, Non-metallic, and Others 216,088
 Tertiary industry → Service sector 589,859

- NESDB
- DOPA

- NESDB

- TTP
- DCA
- DLT

Scenarios & CO₂ Countermeasures

- Energy demand in 2030 BAU scenario
- Energy demand in 2030 CM scenario

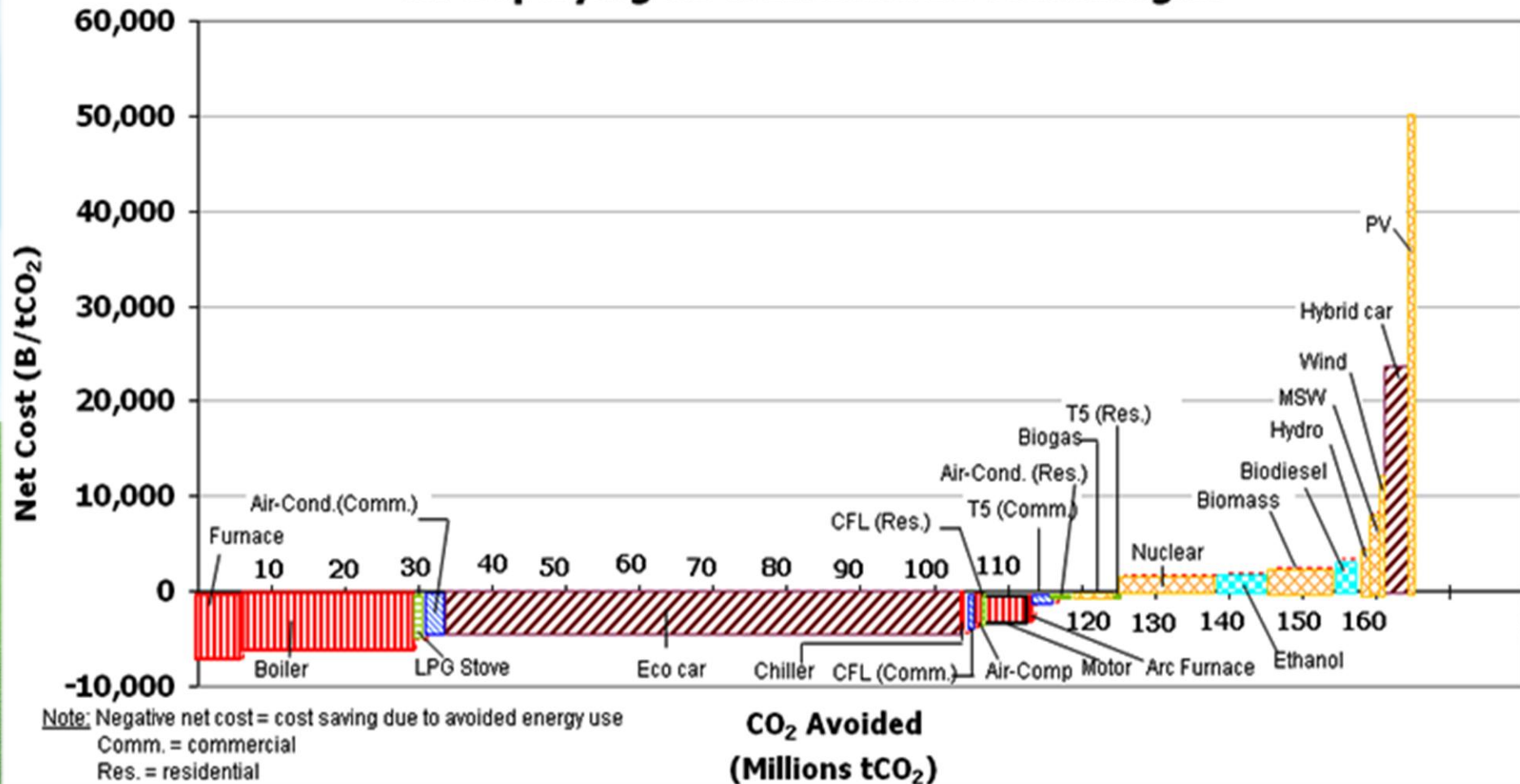
CO₂ Mitigation:

- ❖ Only cost-effective energy savings of CO₂ mitigation options are considered.
- ❖ CO₂ mitigation measures in 2030CM must be complied with national constraints.



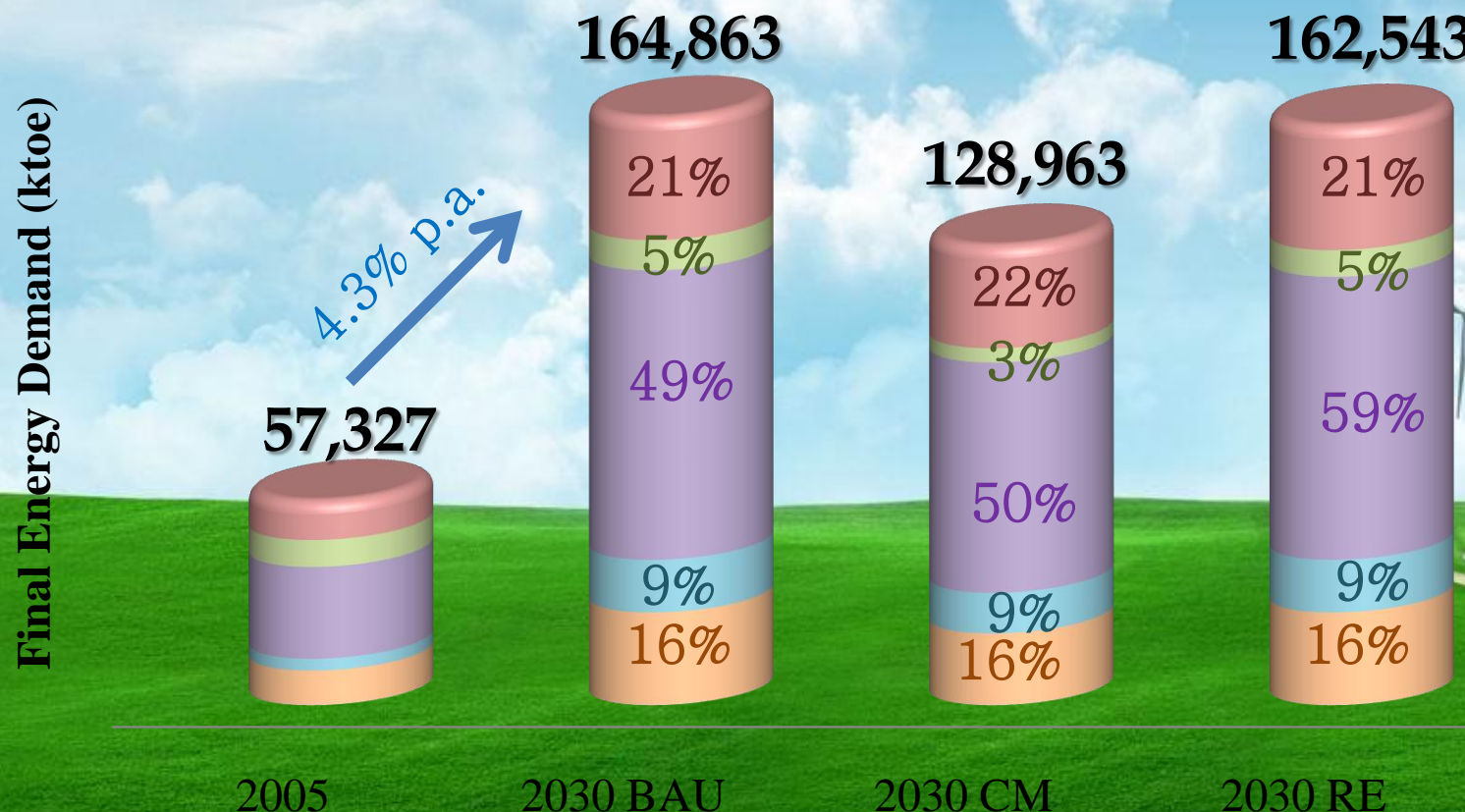
Thailand's EE & RET: Abatement Cost Curves

**Net Cost Curve of CO₂ Avoided (2006 - 2030)
for Deploying RE & Efficient EE Technologies**



Energy demand

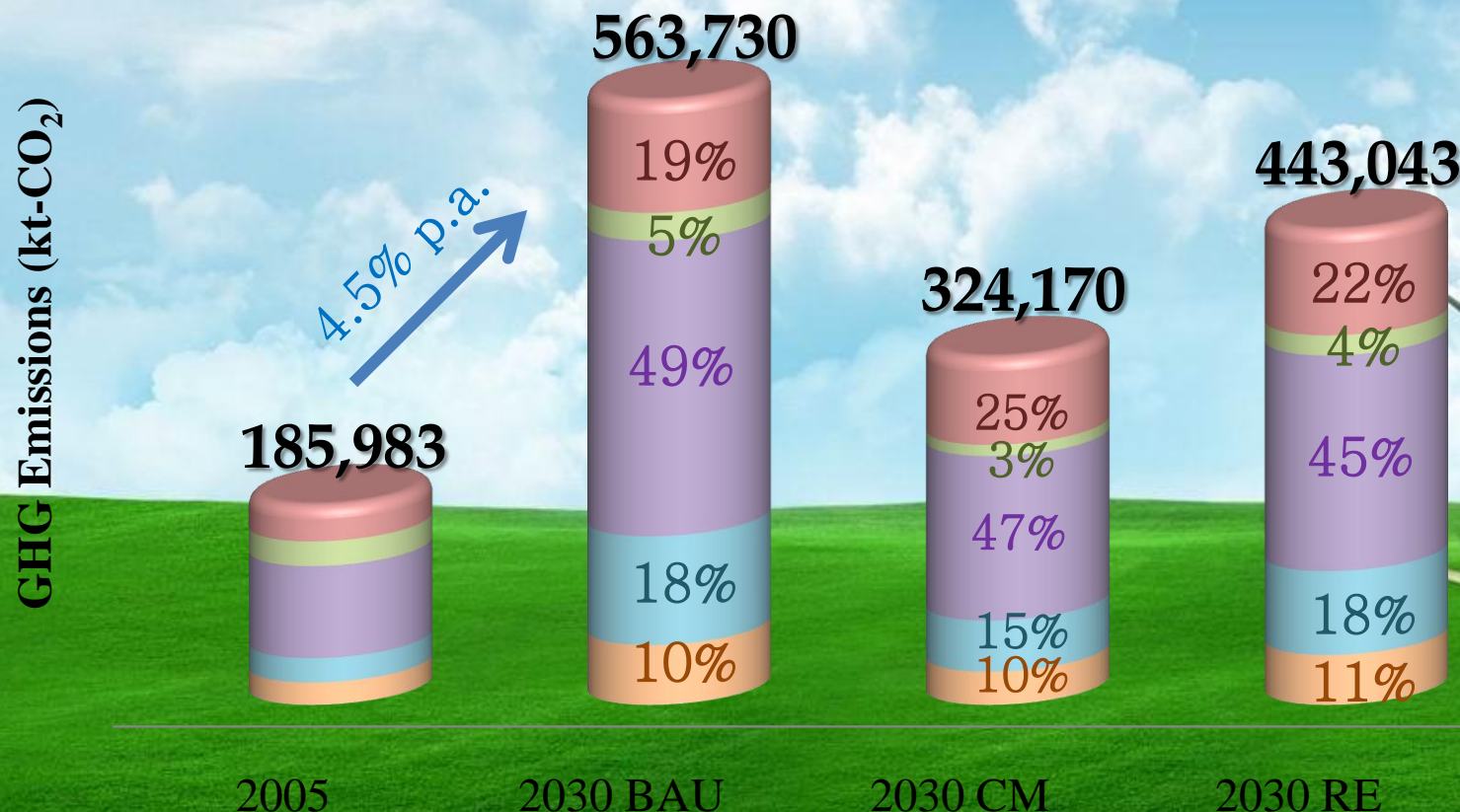
■ Residential ■ Commercial ■ Industry ■ Passenger transport ■ Freight transport



Remarks: BAU is Business as Usual
CM is Countermeasures
RE is Renewable energy scenario

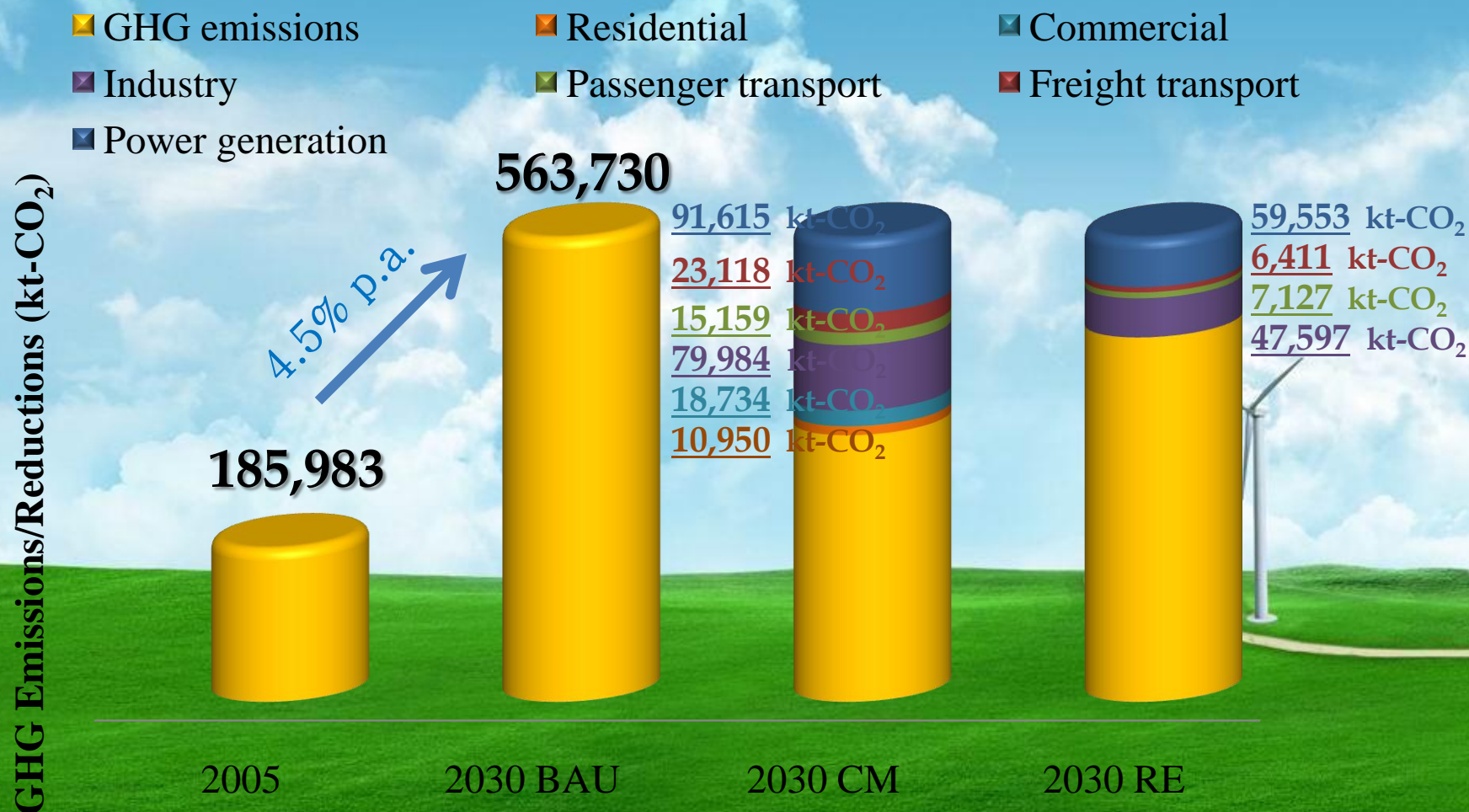
GHG emissions

▣ Residential ▣ Commercial ▣ Industry ▣ Passenger transport ▣ Freight transport



Remarks: BAU is Business as Usual
CM is Countermeasures
RE is Renewable energy scenario

GHG Emissions/Reductions



Remarks: BAU is Business as Usual
 CM is Countermeasure
 RE is Renewable energy scenario

Measures

POWER GENERATION

- ❑ Efficiency improvement in the Power generation sector
 - T&D loss will improve to be 5%.
 - Technology transfer: New power plant technology will be added such as IGCC and CCGT → Eff. Improve to be 48% and 56%.
 - Fuel switching: Increasing share of RE and NE in PDP 2010.

Fuel type	Share in 2030 BAU	Share in 2030 CM
Natural gas	71.4	39.0
Oil	6.6	–
Coal	15.1	23.6
Hydro	4.4	20.5
Nuclear	–	11.2
Renewable energy	2.5	5.7



Measures



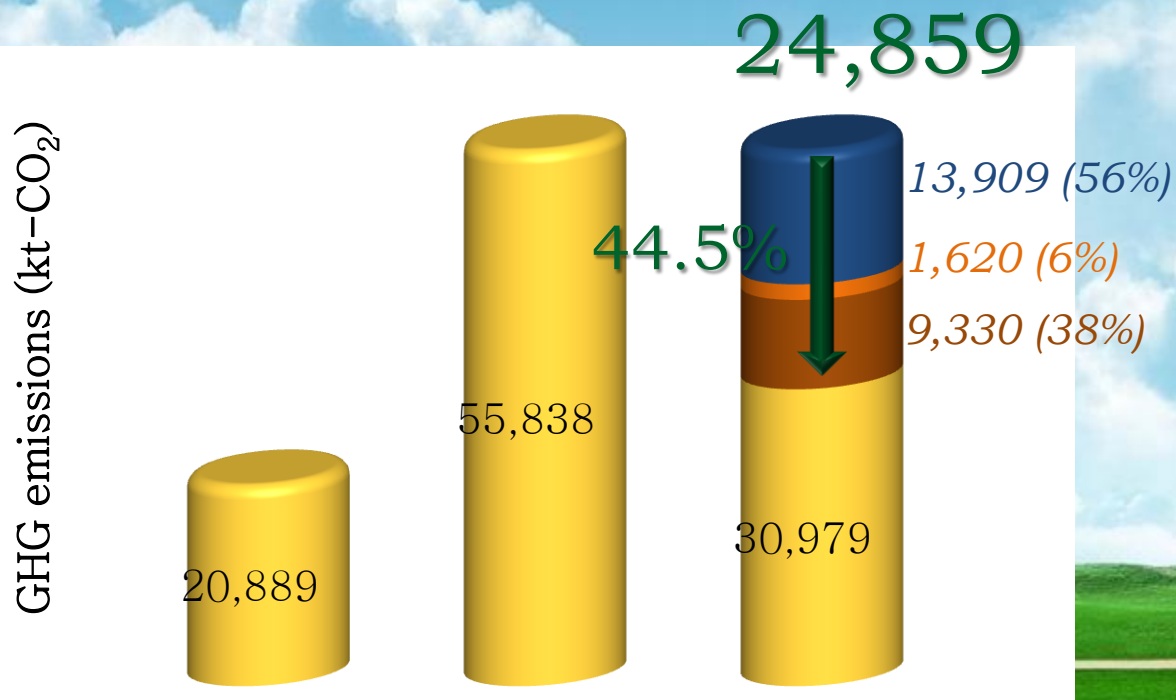
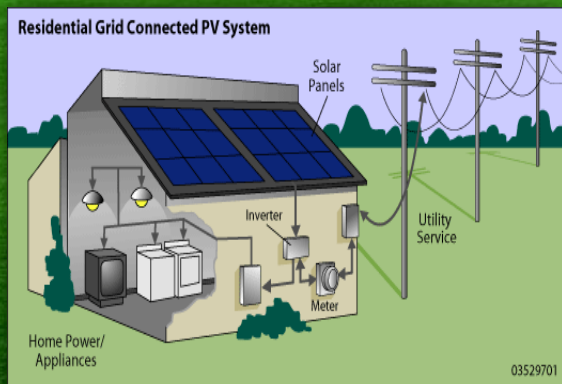
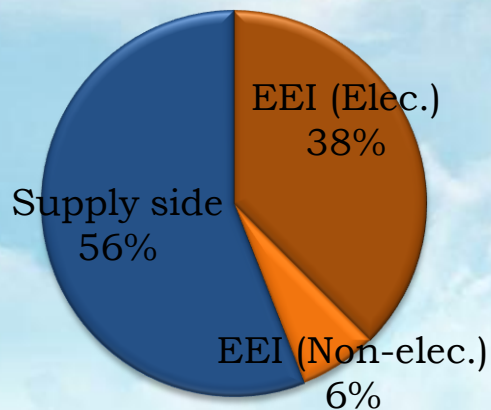
RESIDENTIAL

- ❑ Energy efficiency improvement in Households (Electric)
 - *Efficiency improvement by 30%*
 - *Penetration rates up to 100% in 2030*
- ❑ Energy efficiency improvement in Households (Non-electric)
 - *Efficiency improvement*
 - *by 30% in wood stove*
 - *by 5% in LPG stove*
 - *Penetration rates up to 100% in 2030*



Measures

RESIDENTIAL



■ GHG emissions

■ EEI (electrical app.)

■ EEI (non electrical app.)

■ EEI (power sector)

Measures

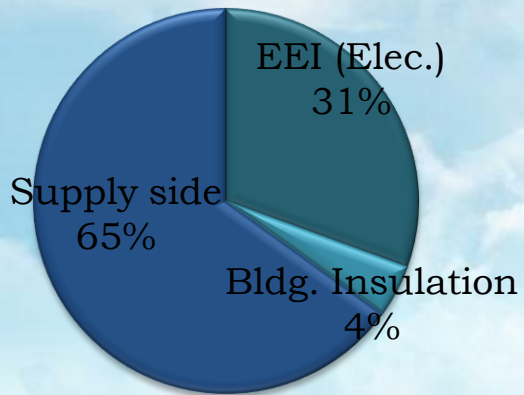
COMMERCIAL

- ❑ Energy efficiency improvement in Buildings
 - *Efficiency improvement by 30%*
 - *Penetration rates up to 100% in 2030*
- ❑ Energy efficiency improvement in Buildings (Building Codes)
 - *Building insulation*
 - *Building envelope*
 - *Penetration rates up to 100% in 2030*

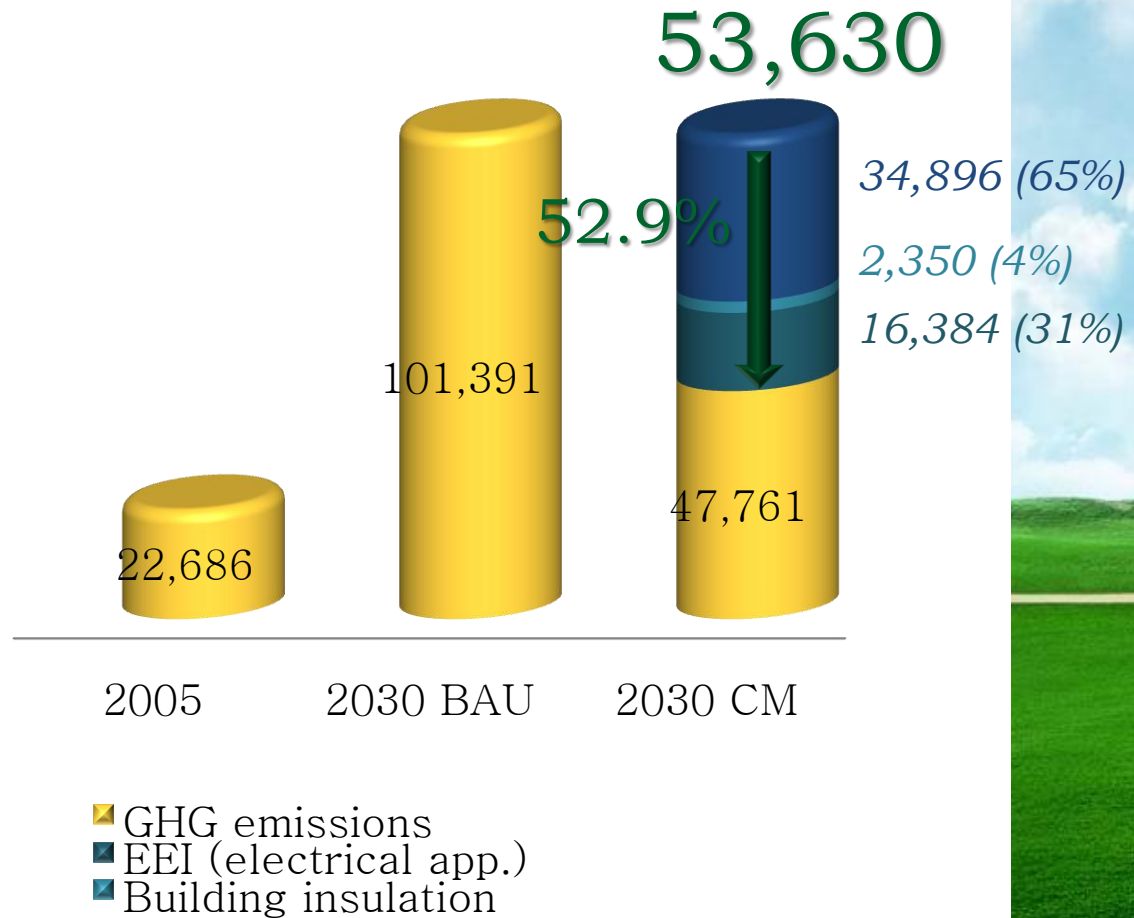


Measures

COMMERCIAL



GHG emissions (kt-CO₂)



Measures

INDUSTRY

❑ Energy efficiency improvement in Industry (Electric)

▪ *Efficiency improvement*

System	Motor	Others	Lighting
EEI	10%	20%	30%

▪ *Penetration rates up to 100% in 2030*

❑ Energy efficiency improvement in Industry (Non-electric)

▪ *Efficiency improvement by 30%*

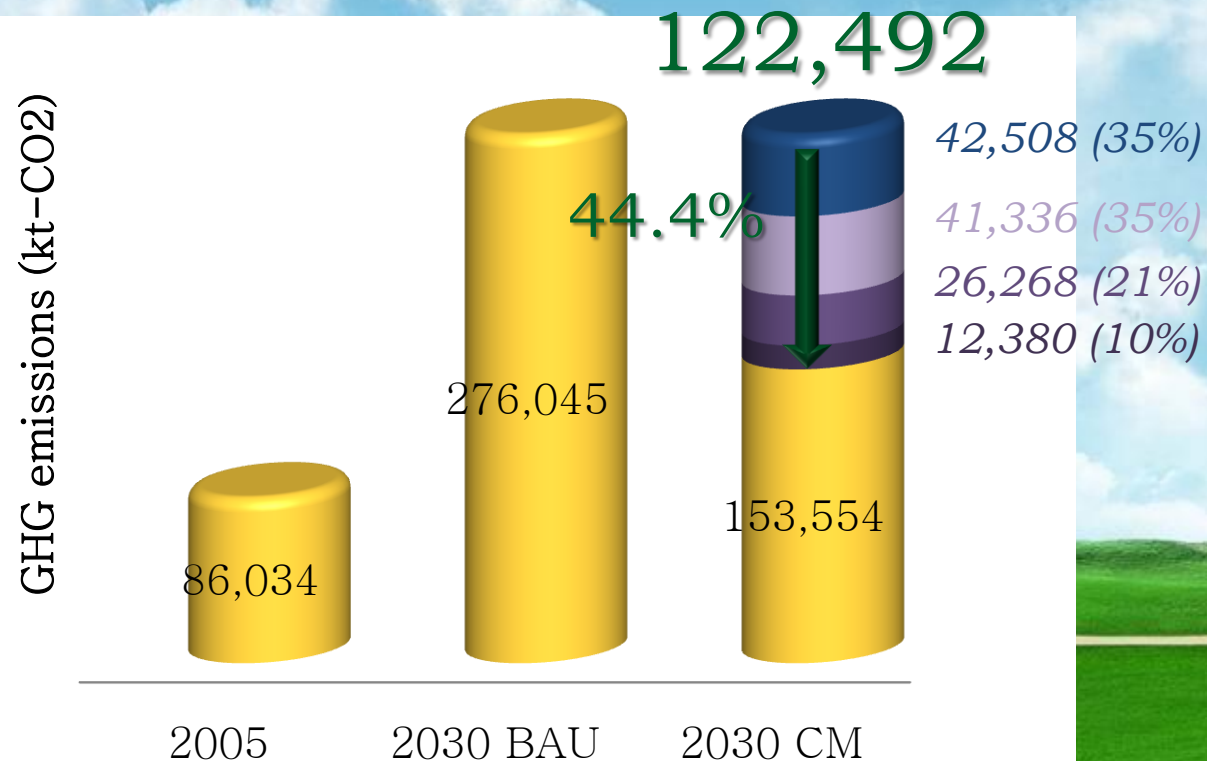
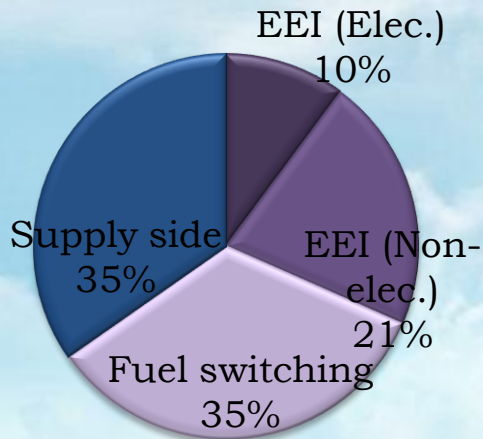
❑ Fuel switching in Industry

▪ *Reduce the penetration level in coal and oil by 50%*

▪ *Replace the penetration level remaining in biomass and LPG.*

Measures

INDUSTRY



- GHG emissions
- EEI (electrical app.)
- EEI (non electrical app.)
- Fuel switching
- EEI (power sector)

Measures

TRANSPORTATION

- ❑ Fuel economy improvement (FEI) in Transport sector
 - *Efficiency improvement by 30% in*
 - *Penetration rates up to 100% in 2030*
- ❑ Travel demand management (TDM) in Transport sector
 - *Efficiency improvement by 7.38%*
 - *Using (eco-driving, bus priority, and non-motorized transport)*

Ref: Pongthanaisawan, J. 2007. Road transport energy demand analysis and energy saving potentials in Thailand, Asian Journal of Energy and Environment

Kuwattanachai, N. 2009. Hybrid and Electric cars. TRF Newsletter.

Measures

TRANSPORTATION

❑ Fuel switching in Transport sector

- CNG engines will increase by 20% in 2030
- Hybrid engines can save energy consumption by 30%

❑ Modal shift in Transport sector



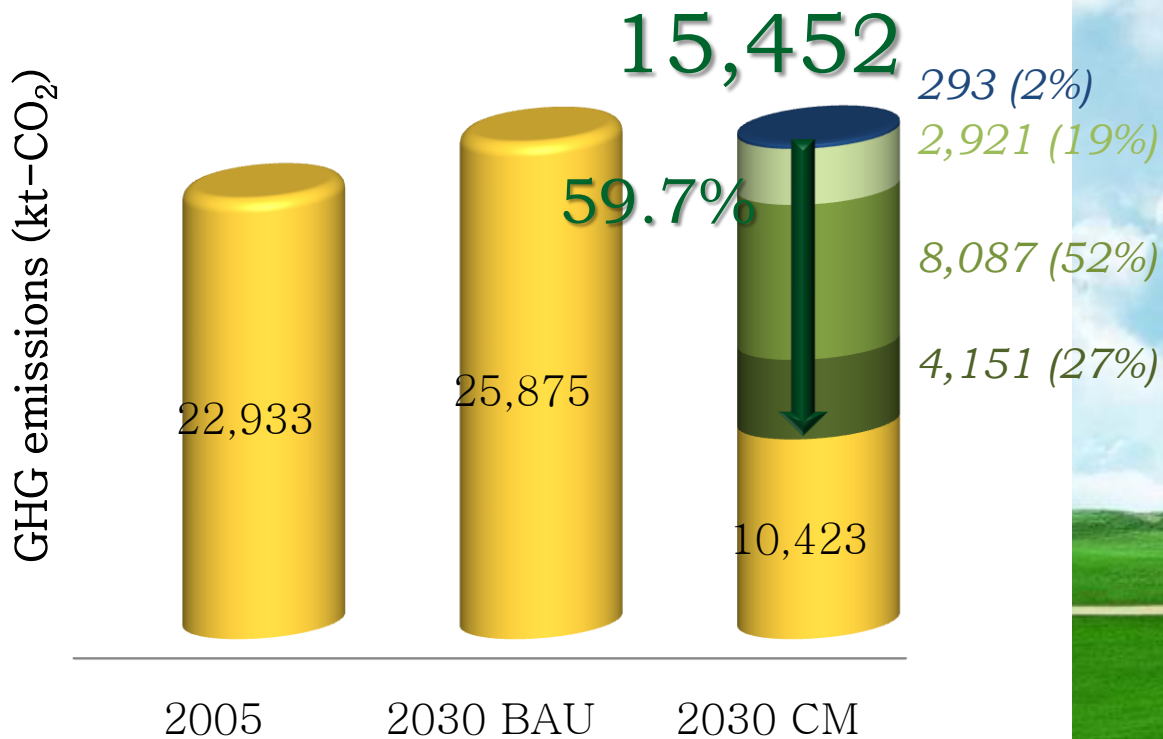
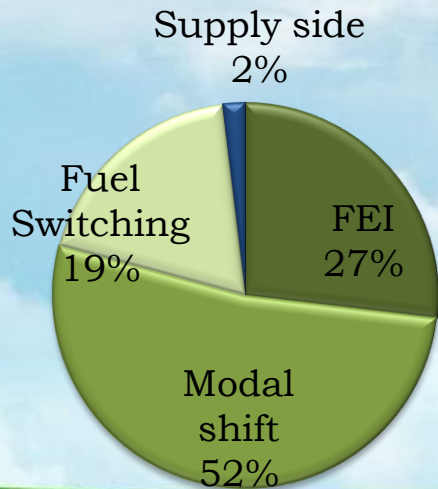
		SV	LV	Bus	Motor bike	Bike	Walk	Train	Plane	Ship
Passenger	2005	24.3	6.7	42.3	14.6	0.8	10.7	0.2	0.4	–
	2030	15.0	5.0	20.0	10.0	12.8	25.0	12.0	0.2	–
Freight	2005	2.2	80.8					2.3	0.02	14.8
	2030	2.2	58.2	–	–	–	–	24.9	0.02	14.8

Ref: Pongthanaisawan, J. 2007. Road transport energy demand analysis and energy saving potentials in Thailand. Asian Journal of Energy and Environment

Kuwattanachai, N. 2009. Hybrid and Electric cars. TRF Newsletter.

Measures

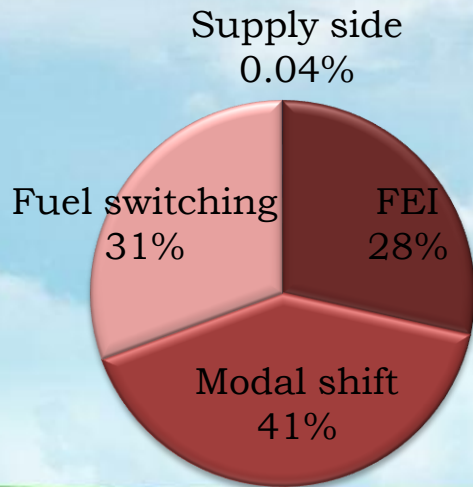
PASSENGER_TRANSPORT



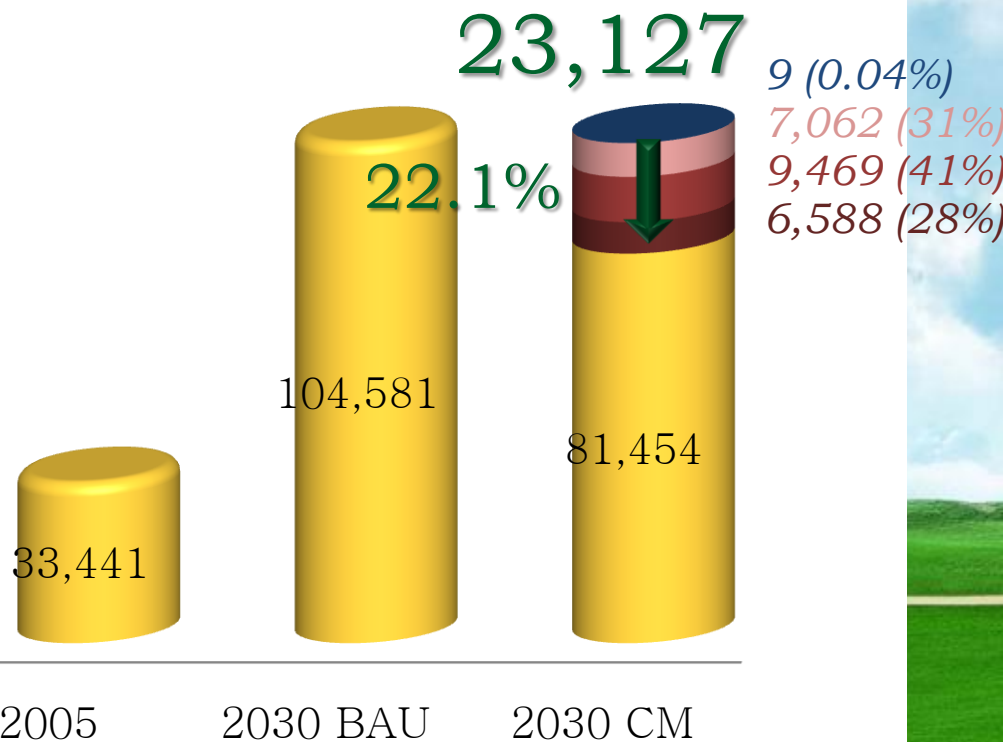
- GHG emissions
- Modal shift
- EEI (power sector)
- FEI
- Fuel switching

Measures

FREIGHT TRANSPORT



GHG emissions (kt-CO₂)



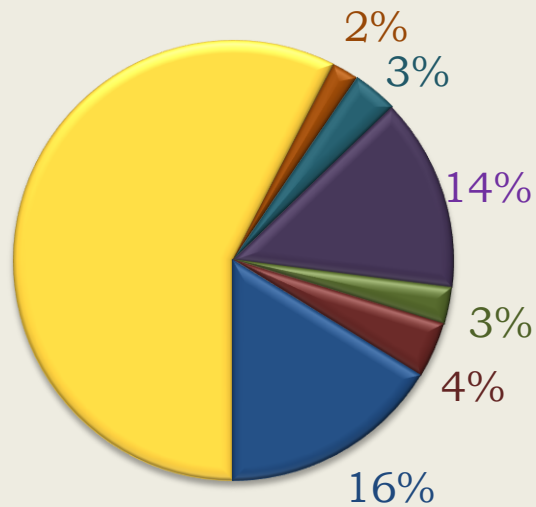
- GHG emissions
- Modal shift
- EEI (power sector)

- FEI
- Fuel switching



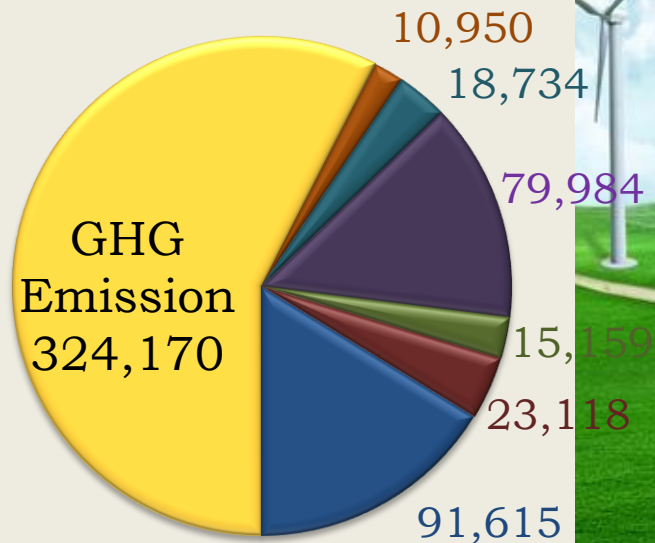
GHG emissions/reduction

TOTAL



- GHG emissions
- Residential
- Commercial
- Industry
- Passenger transport
- Freight transport
- Power generation

**GHG REDUCTION:
239,560 kt-CO₂**

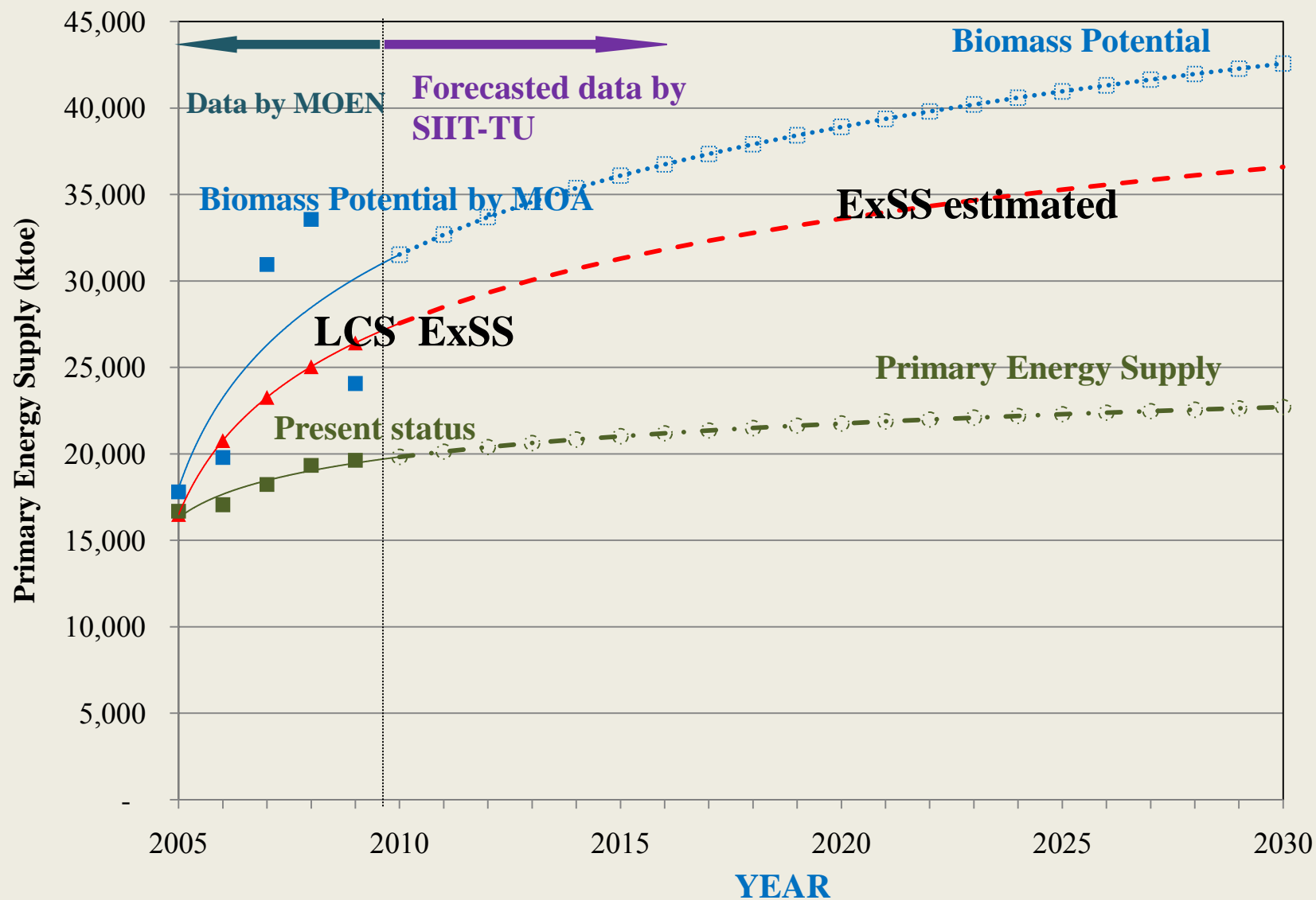


Unit: kt-CO₂

Summary of GHG mitigation measures

Action	GHG Reduction (kt-CO ₂)	(%)
1. Energy efficiency improvement (EEI) in households	10,950	4.6%
- EEI in electric devices	9,330	3.9%
- EEI in non-electric devices	1,620	0.7%
2. Energy efficiency improvement in buildings	16,384	6.8%
3. Building codes	2,350	1.0%
4. Energy efficiency improvement in industries	38,648	16.1%
- EEI in electric devices	12,380	5.1%
- EEI in non-electric devices	26,268	11.0%
5. Fuel switching in industry	41,336	17.3%
6. Fuel economy improvement in transportation	10,739	4.5%
- Passenger transport	4,151	1.7%
- Freight transport	6,588	2.8%
7. Fuel switching in transportation	9,983	4.2%
- Passenger transport	2,921	1.2%
- Freight transport	7,062	3.0%
8. Modal shift in transportation	17,556	7.3%
- Passenger transport	8,087	3.3%
- Freight transport	9,469	4.0%
9. Efficiency improvement and fuel switching in the power sector	91,614	38.2%
Total GHG mitigation in 2030	239,560	100.0%
Total GHG emissions in the 2030 BAU scenario	563,730 kt-CO₂	
Total GHG emissions in the 2030 CM scenario	324,170 kt-CO₂	

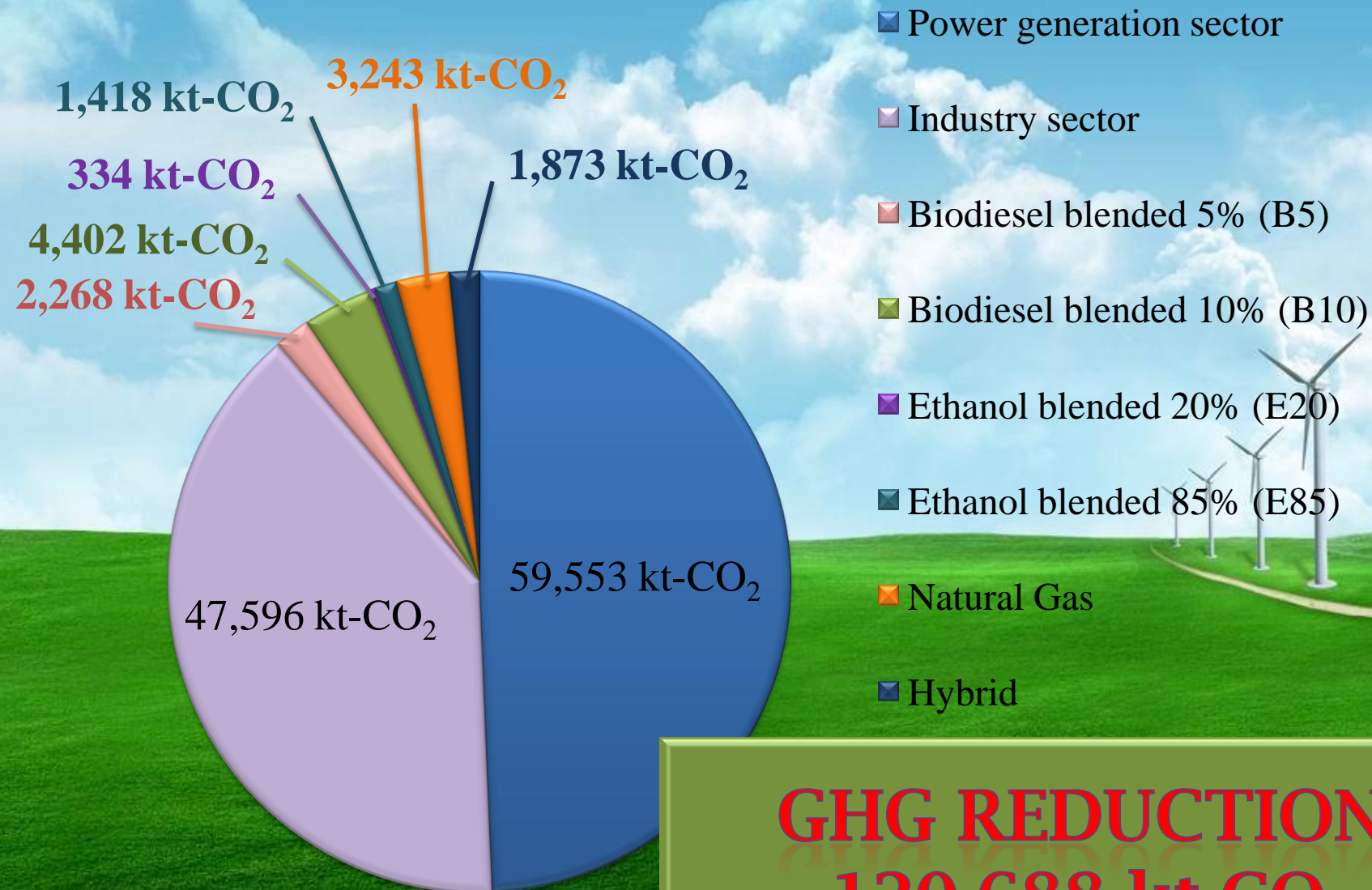
Biomass potential & consistency



Renewable Promotion (MOEN): Feed-in-Tariffs

Sources	Target Installed Capacity (MW)		
	2008-2011	2012-2016	2017-2022
Solar	55	95	500
Wind	115	375	800
Municipal Solid Waste (MSW)	78	130	160
Biomass	2,600	3,220	3,700
Hydro	165	281	324
Biogas	60	90	120
<u>Financial Support (MBaht)</u>	<u>3,273</u>	<u>4,191</u>	<u>5,504</u>

GHG emissions by fuel types



GHG REDUCTION:
120,688 kt-CO₂

Conclusions on Thailand's LCS Scenarios & Actions

- The GHG emissions in 2030 BAU scenario w/o mitigation measures will increase to 563,730 kt-CO₂.
- By adopting CMs in all sectors, GHG emissions can be decreased to 324,170 kt-CO₂ or by 42.5%.
- By adopting RET, GHG emissions can be decrease to 443,043 kt-CO₂ or by 21.4%
- If those policies are planned in early stage, Thailand will be able to serve as a model for LCS.



Conclusions on Thailand's LCS Scenarios & Actions

- However, to increase more CO₂ mitigation, more CMs & advanced technologies are needed under National Appropriate Mitigation Actions (NAMAs).
- In 2011, specific CMs have been developed under Thailand's NAMAs by using AIM/EndUse.



1st Thailand's LCS Scenario 2030 Brochure

Low-Carbon Society Vision 2030

Thailand



April, 2010



Sirindhorn International Institute of Technology, Thammasat University
Asian Institute of Technology
National Institute for Environmental Studies
Kyoto University
Mizuho Information & Research Institute
Asia-Pacific Integrated Model

1st Draft, Apr 2010

Low-Carbon Society Vision 2030

Thailand



July, 2010

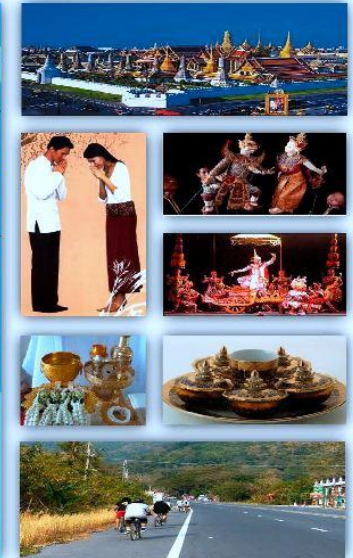


Sirindhorn International Institute of Technology, Thammasat University
Asian Institute of Technology
National Institute for Environmental Studies
Kyoto University
Mizuho Information & Research Institute
Asia-Pacific Integrated Model

2nd Draft, July 2010

Low-Carbon Society Vision 2030

Thailand



November, 2010




Sirindhorn International Institute of Technology, Thammasat University
Asian Institute of Technology
National Institute for Environmental Studies
Kyoto University
Mizuho Information & Research Institute
Asia-Pacific Integrated Model

FINAL Thailand LCS Brochure
November 2010

1st Thailand's LCS Scenario 2030 Brochure

The 3 versions of Thailand's LCS brochures had been distributed and disseminated in Thailand.

- 1. Thailand Greenhouse gas management Organization (TGO), MONRE.**
 - 2. Climate Change Focal Point: ONEP, MONRE.**
 - 3. Bangkok Metropolitan Administration (BMA).**
 - 4. Energy Planning and Policy Office (EPPO), MOEN.**
 - 5. Department of Alternative Energy Development and Efficiency (DEDE), MOEN.**
 - 6. Research Institutes & Universities.**
 - 7. NGOs.**
 - 8. Privates/Business.**
- 

1st Thailand's LCS Scenario 2030 Brochure

The 2nd version of Thailand's LCS brochures had been distributed and disseminated during CTC2010 conference, organized by TGO during 19-21 August 2010.



CLIMATE THAILAND CONFERENCE 2 0 1 0

"National Risks and Opportunities in Global Climate Change"

THAILAND GREENHOUSE GAS MANAGEMENT ORGANIZATION (PUBLIC ORGANIZATION)

Ministry of Natural Resources and Environment, The Royal Thai Government

Thailand's LCS scenario development was presented in CTC2010. In addition, 2 papers on Thailand LCS were also presented.

Asia LCS scenarios and actions: How to achieve sustainable low-carbon society

Dissemination & ExSS Workshop in Thailand Low-carbon society model capacity building workshop

Bridge simulation scenarios and sustainable LCS policy implementation using
AIM (Asia-Pacific Integrated Model)

Organized by TGO, SIIT-TU, JGSEE, NIES

November 19, 2010. Pullman King Power Hotel, Bangkok



Low-Carbon Society Model Capacity Building Workshop

Objective:

1. To introduce LCS scenario.
2. To operate LCS model. (ExSS tool)
3. To communicate among policy makers, researchers, and business on feasible LCS development.



Prof. Matsuoka



Prof. Ram Shrestha



TGO NIES Kyoto NIES



TGO TGO SIIT-TU



NIES TGO SIIT-TU



TGO Board, Dr Kittu



TGO Local Authority



AIT iGES

Low-Carbon Society Model Capacity Building Workshop



LCS methodology



LCS Thailand, SIIT & AIT



Prof. Ho (MTU)



Mr. Boyd (IRDA)



Dr Savitri (KMUTT)



LCS India, Prof. Aashish



Chair, TGO Board



Dr Kainuma Dr Komi



ExSS Training



ExSS Training



ExSS Training



ExSS Training

Low-Carbon Society Model Capacity Building Workshop



ExSS Training



ExSS Training



**Prof Nishioka (iGES & NIES)
Bridge simulation & LCS Policy**

**Bridge simulation & LCS Policy
Closing Remarks**



Thailand's Low-Carbon Society Model Capacity Building Workshop

<http://2050.nies.go.jp/sympo/101119/>

Proceeding of LCS Workshop

Low-carbon society model capacity building workshop

*-bridge simulation scenarios and sustainable LCS policy implementation using
AIM (Asia-Pacific Integrated Model) -*

November 19 (Fri) 2010

Pullman King Power Hotel, Bangkok

Organized by TGO, SIIT-TU, JGSEE, NIES



Low-Carbon Society Scenarios towards 2050

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Low-Carbon Society Model Capacity Building Workshop

- Bridge Simulation Scenarios and Sustainable LCS Policy
Implementation using AIM (Asia-Pacific Integrated Model) -

Time	9:00-16:30, November 19 (Fri.), 2010
Venue	Pullman King Power Hotel, Bangkok, Thailand.
Language	English-Thai Simultaneous translation is available.
Organizer	TGO, SIIT-TU, JGSEE and NIES

Objectives

- 1) Introduce LCS scenario making process to stakeholders for better understanding how to use simulation studies for policy formulation and implementation
- 2) Learn to operate LCS simulation model (simple version) and assess the CO2 reduction possibilities effected by change of driving forces (population, GDP etc.) and countermeasures (energy savings in buildings and industries, modal shift in transportation etc.)
- 3) Communicate between policymakers, business, researchers to discuss how to develop feasible LCS scenarios and policy options

Workshop Proceedings

All presentations and discussions are summarized in a proceedings.

[Download the Proceedings](#) (PDF:17MB)



[Click to see original photo \(1.5MB\)](#)




**LOW-CARBON
ASIA** SCENARIOS and
ACTIONS



Thailand's LCS Brochure in the TGO Homepage is available at
http://www.tgo.or.th/index.php?option=com_content&task=view&id=441&Itemid=2

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องค์การบริหารจัดการก๊าซเรือนกระจก (องค์การมหาชน)
THAILAND GREENHOUSE GAS MANAGEMENT ORGANIZATION (PUBLIC ORGANIZATION)

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การศึกษา Low-Carbon Society Vision 2030 Thailand
การศึกษา Low-Carbon Society Vision 2030 Thailand
November, 2010
โดย Sirindhorn International Institute of Technology, Thammasat University
ร่วมกับ Asian Institute of Technology, National Institute for Environmental Studies, Kyoto University, Mizuho Information & Research Institute และ Asia-Pacific Integrated Model

Executive summary

This report aims to discuss the possibility of developing a Thailand's low-carbon society. The methodology involves i) development of current GHG emissions inventory, and ii) quantification of socio-economic activity level in 2030 according to available information from Thailand's office of the national economic and social development board.

According to the proposed development, the amount of GHG emission increase is estimated based on (i) 2030 BAU (business-as-usual) without mitigation measures, and (ii) 2030 with counter mitigation measures (CM) assumptions of employed technologies as well as the potential to reduce the GHG emissions by low-carbon measures available during 2005-2030. Only selected GHG mitigation options, which have been found to be cost effective, are included in the 2030 CM scenario. The main findings are as follows:

- The annual greenhouse gas (GHG) emissions of Thailand in the base year of 2005 are 183,983 kilo-ton (kt) of CO₂.
- Under the scenario without mitigation measures (that is, the 2030 BAU scenario), the GHG emissions would increase to 563,730 kt-CO₂, that is, 3.0 times higher than the emission in the base year 2005.
- By adopting the selected feasible GHG mitigation measures available by 2030, the GHG emissions can be decreased approximately by 42.5% to 324,170 kt-CO₂ (see Figure 1).

In 2005, the per capita emission of Thailand was about 3.1 t-CO₂/year. In 2030, it is estimated to increase to 8.2 t-CO₂/year, and 4.7 t-CO₂/year without and with counter-measures, respectively.

In order to mitigate the emission to a lower level, several comprehensive measures such as diffusion of low-carbon technologies in the residential sector, energy efficient buildings, energy efficient industry and fuel switching, and fuel substitution in the transport sector and electricity generation sector are needed.

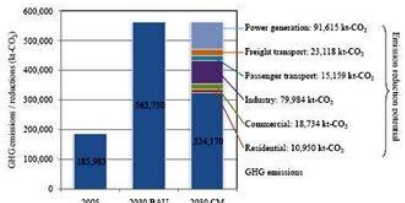


Figure 1: GHG emissions and mitigation by low-carbon technologies

However, a comprehensive policy to accomplish the implementation of the GHG mitigation measures is also required. Figure 2 shows recommended policies and related GHG mitigation options in the residential, commercial, industrial, transport, and power generation sectors. If those policies are planned from the early stage, Thailand will be able to develop not only as a premier growth center but also serve as a model for LCS.

In addition, the higher mitigation target could be achieved by a combination of initiatives on both supply and demand sides, thereby widening the technology use. On the supply side, renewable energy technologies and renewable power generation would play a crucial role, while on the demand side, energy efficient devices and fuel switching could play a key role.

Table 1: Estimated socio-economic indicators in 2030

	2005	2030	2030/2005
Population (persons)	60,991,000	68,815,004	1.1
No. of households	19,016,784	36,265,390	1.9
GDP (million Baht)	8,016,595	30,802,306	3.8
GDP per capita (Baht/capita)	131,439	447,610	3.4
Gross output (million Baht)	18,755,884	68,456,651	3.7
Floor space for commercial (million m ²)	88	394	4.5
Passenger transport demand (million p-km)	191,520	216,088	1.1
Freight transport demand (million t-km)	188,524	589,859	3.1

Residential and Commercial

- Building insulation
- Energy Efficiency labeling
- Green purchasing policy
- Energy performance standard of equipment and evaluation of buildings

Electricity Generation

- Subsidy to investment to energy efficient equipment
- Promotion of technology transfer
- Promotion of renewable energy
- Fuel switching
- Reduce own usage and transmission loss

Transportation

- Environmental performance standard of vehicles
- Tax rate adjustment to energy efficient vehicles
- Promotion of natural gas and hybrid cars
- Promotion of renewable energy
- Promotion of mass transit system

Industry

- Subsidy to investment to energy efficient equipment
- Promotion of technology transfer
- Promotion of alternative and renewable energy

Figure 2: Policy package for Thailand's low-carbon society



การศึกษา Low-Carbon Society Vision 2030 Thailand

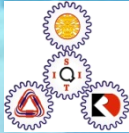
Low-Carbon Society Vision 2030 Thailand



November, 2010



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National Institute for Environmental Studies
Kyoto University
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Asia-Pacific Integrated Model



Terima kasih
THANK YOU

ขอบคุณครับ

S-6, MOEJ