16th AIM International Workshop

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

National Institute for Environmental Studies (NIES)

Tsukuba, Japan, February 19-21, 2011

Asia Low-Carbon Society: LCS scenario in Thailand

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Thammasat University, THAILAND

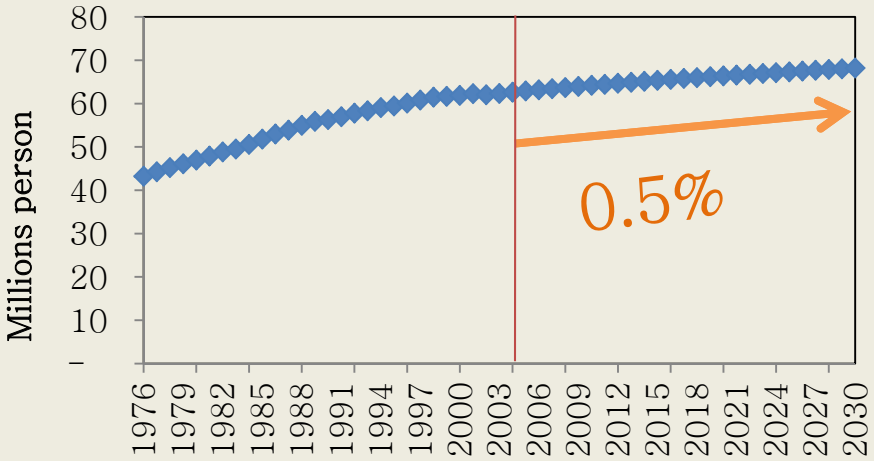
THAILAND "LCS" STUDY OBJECTIVES

- 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.

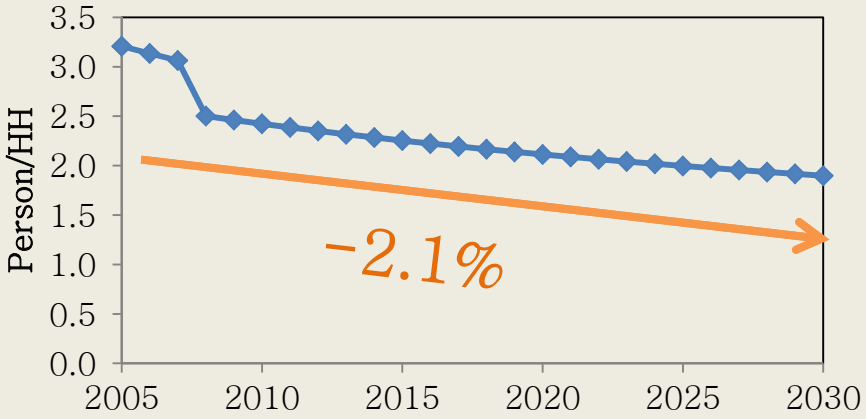


QUANTITATIVE ASSUMPTIONS

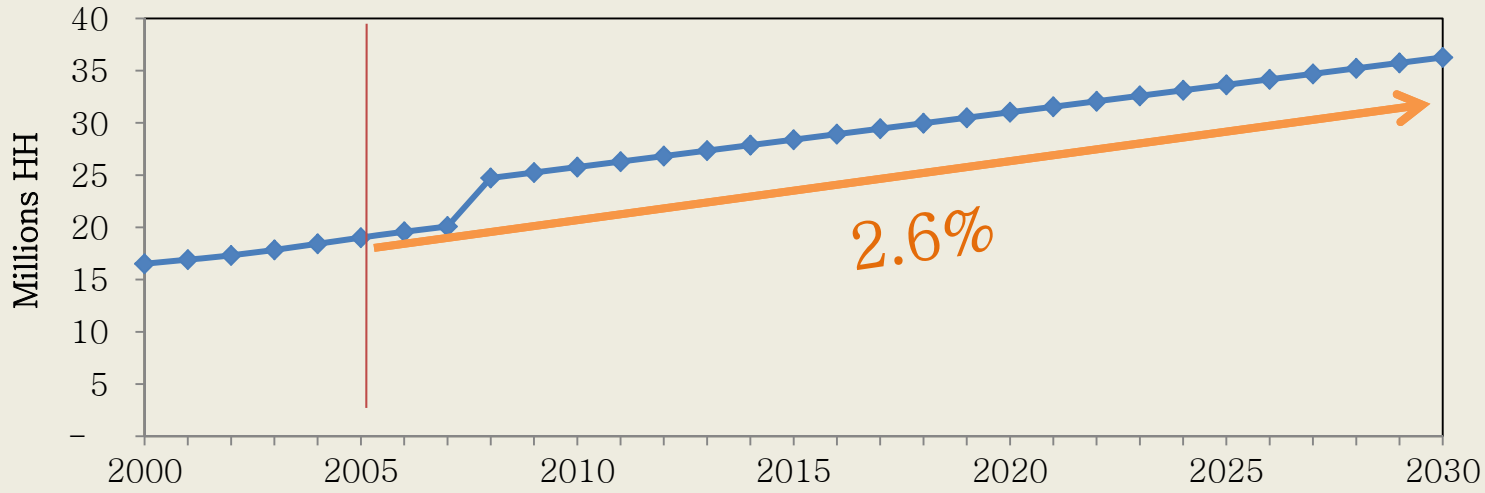
Population



HH size



No. of HH



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		68,456,651
Primary industry (mil Baht)	*1,116,621*	3.9% →	*2,801,864*
Secondary industry (mil Baht)	*11,453,496*	5.1% →	*38,008,931*
Tertiary industry (mil Baht)	*6,185,767*	6.4% →	*27,645,856*
Floor space for commercial (mil m^2)	88		394
Passenger transport demand (mil p-km)	191,520		216,088
Freight transport demand (mil t-km)	188,524		589,859

- NESDB
- DOPA

- NESDB

- TTP
- DCA
- DLT

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

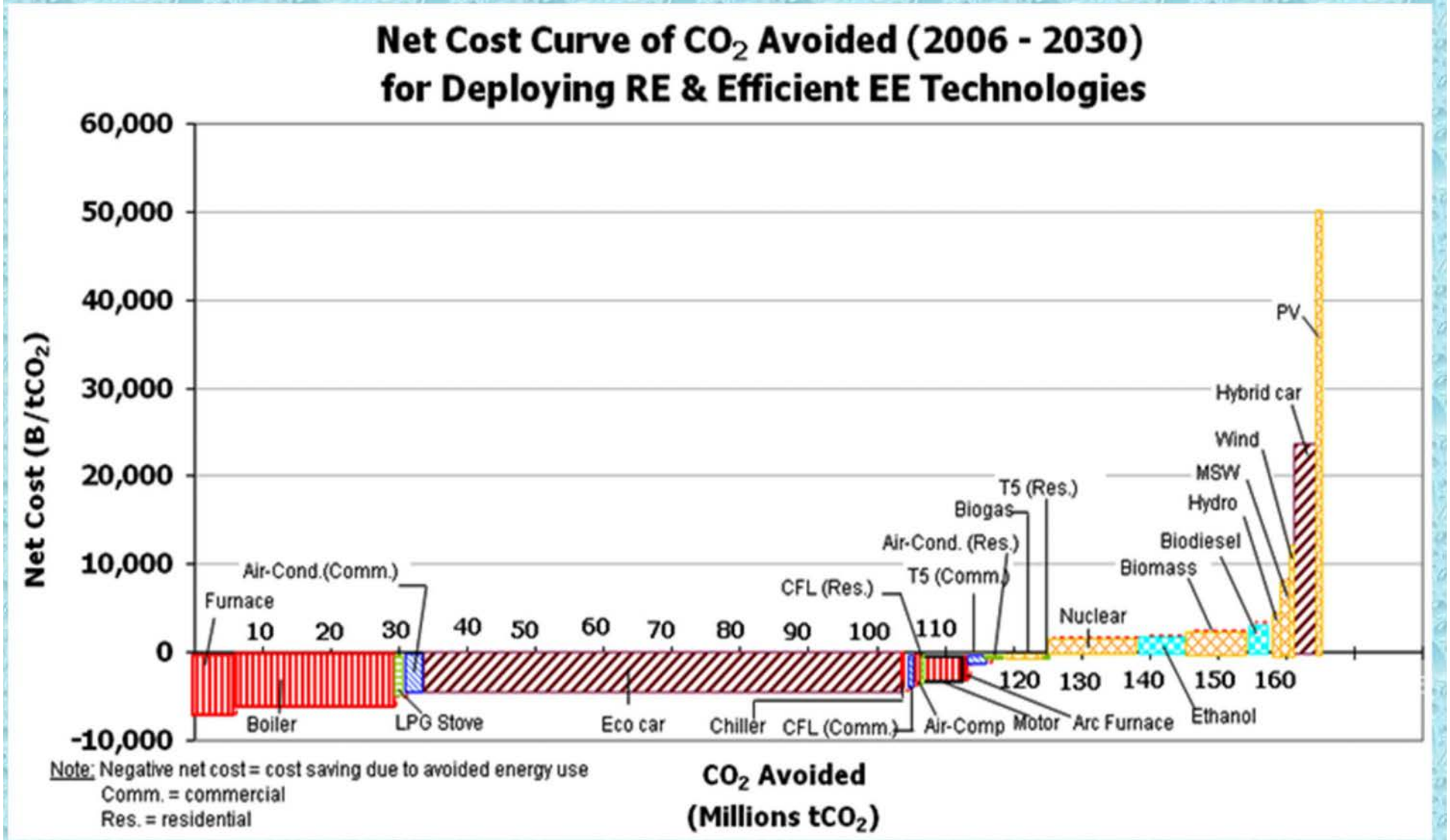
Scenario & CO_2 Countermeasure

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

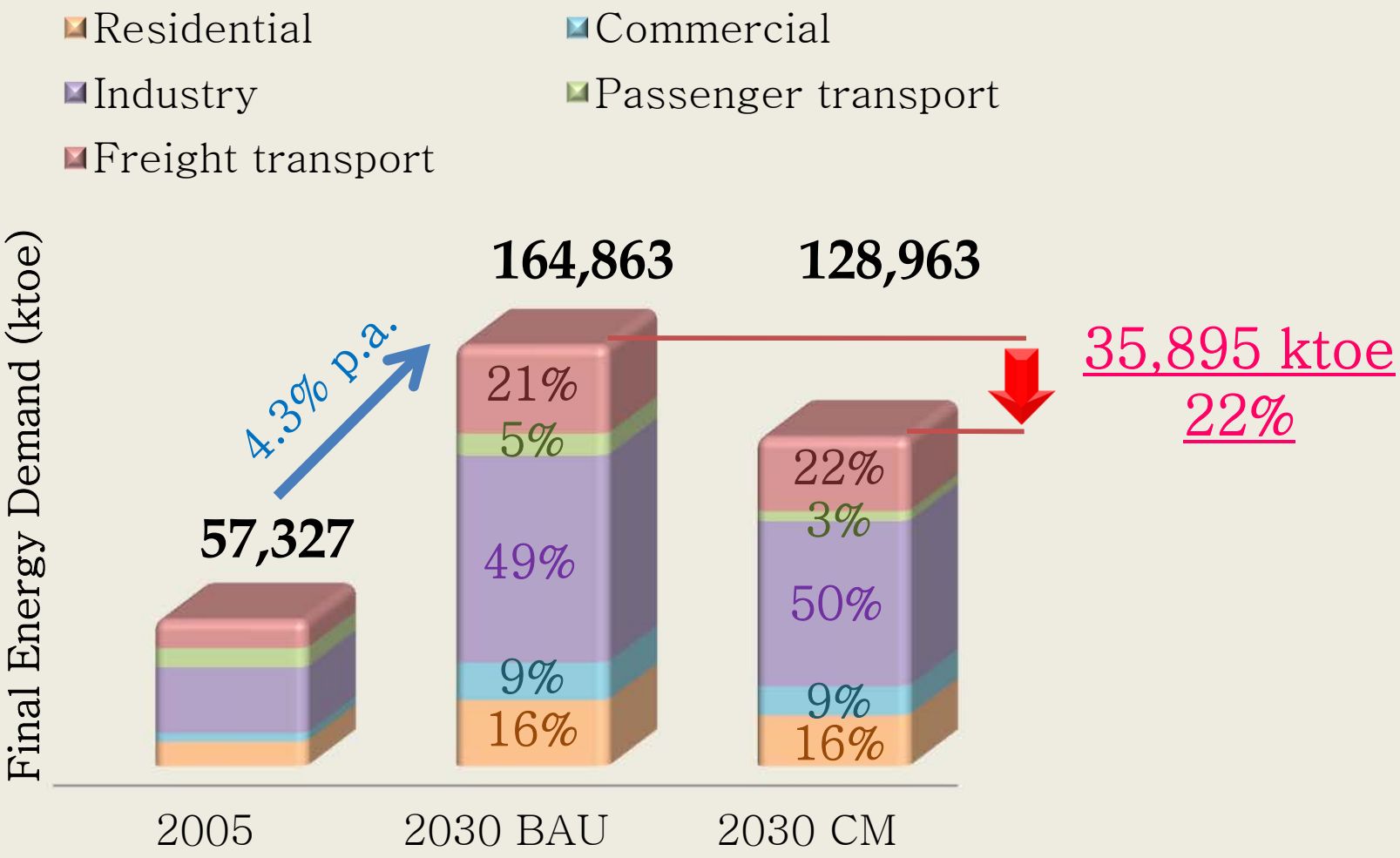
CO_2 Mitigation:
Only cost-effective energy savings of CO_2 mitigation options are considered.

CO_2 mitigation measures in 2030CM must be complied with national constraints.

Thailand's RE & EE Technologies

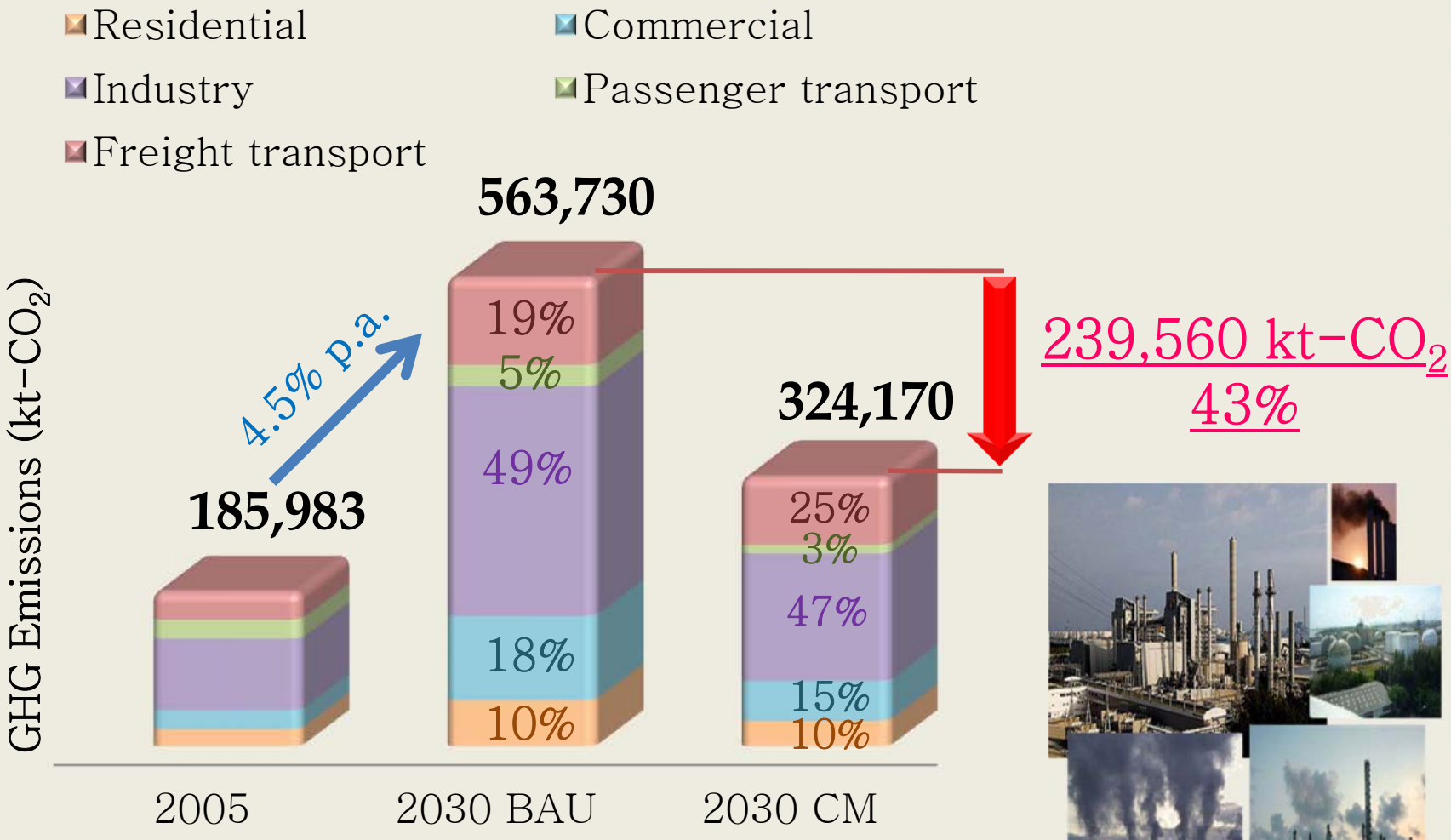


ENERGY DEMAND



Remarks: BAU is Business as Usual
CM is Countermeasure

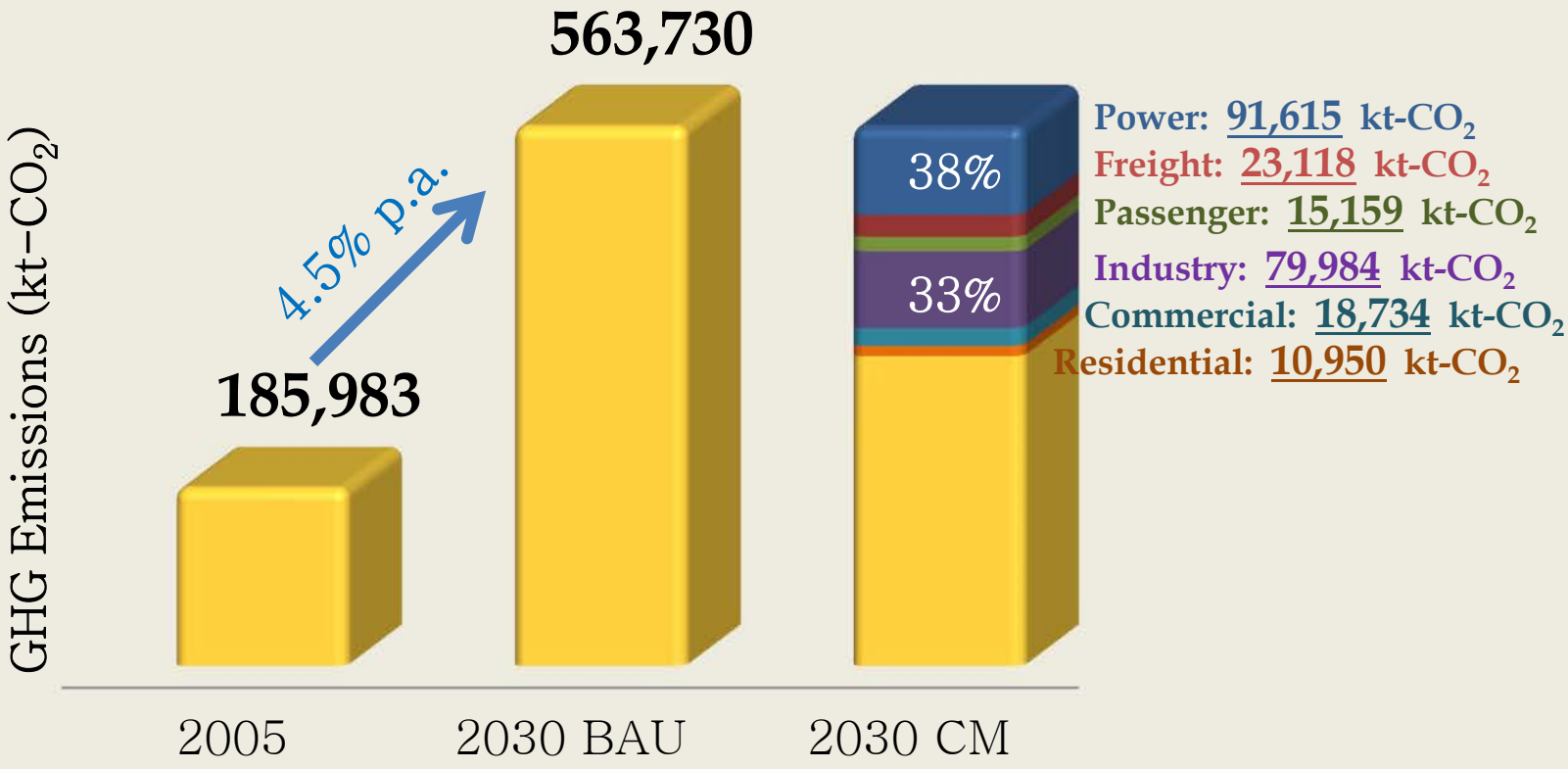
GHG EMISSIONS



239,560 kt-CO_2
43%

Remarks: BAU is Business as Usual
CM is Countermeasure

GHG EMISSIONS/REDUCTIONS



Remarks: BAU is Business as Usual
CM is Countermeasure

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

Ref: Thailand's Power Development Plan, PDP 2010.

MEASURES

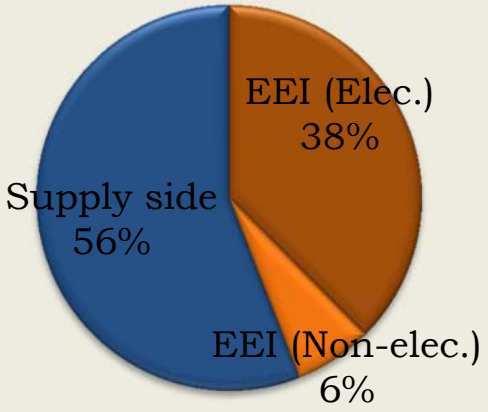
RESIDENTIAL

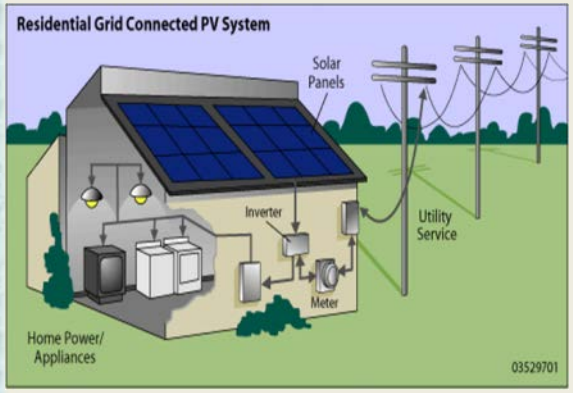
- Energy efficiency improvement in *Households (Electric)*
  - *Efficiency improvement by 30%*
  - *Penetration rates up to 100% in 2030*
- Energy efficiency improvement in *Households (Non-electric)*
  - *Efficiency improvement*
    - *by 30% in wood stove*
    - *by 5% in LPG stove*
  - *Penetration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

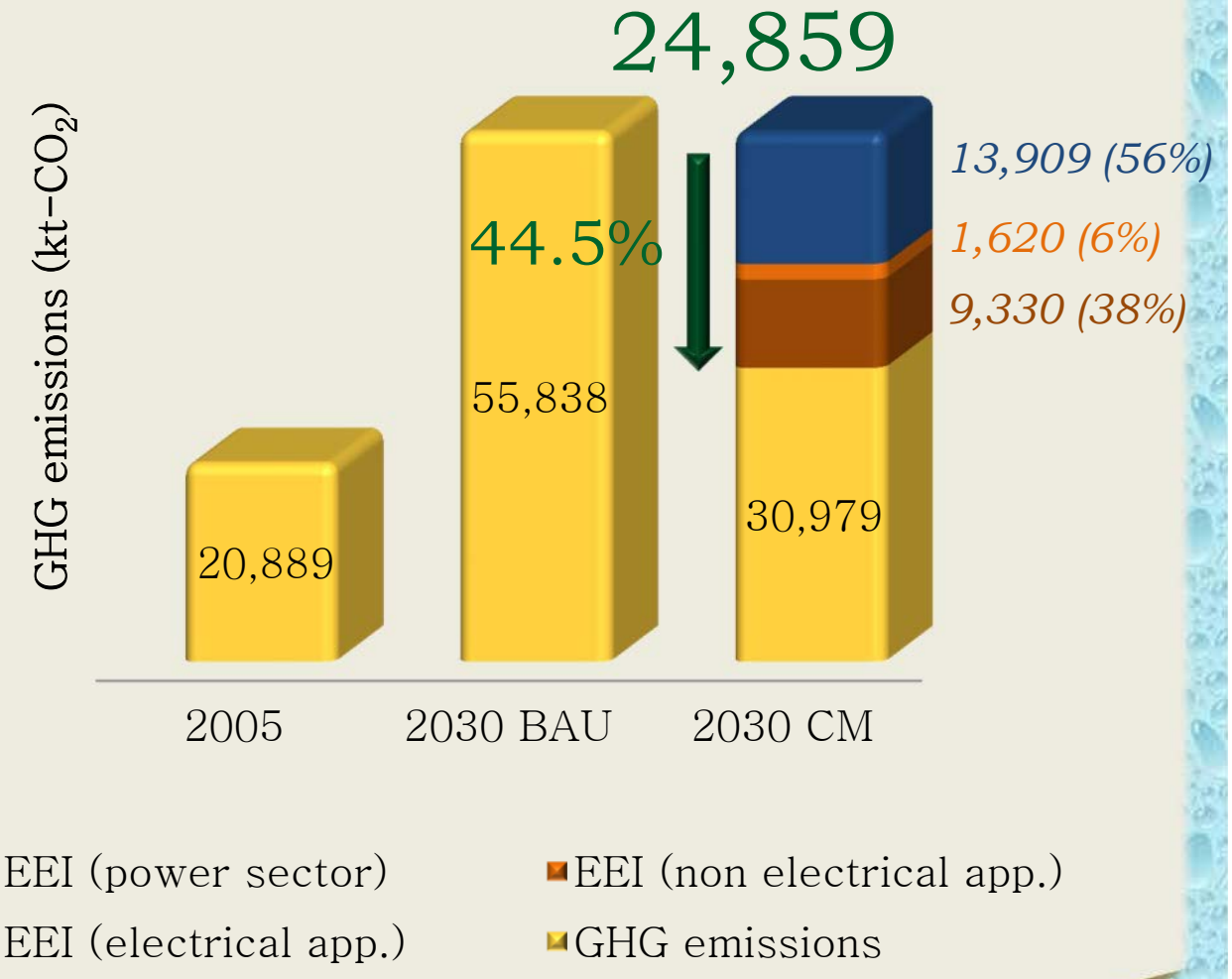
Ref: Thailand Research Fund. 2007. Research Programme on Policy Research for Promoting the Development and Utilization of Renewable Energy and the Improvement of Energy Efficiency in Thailand.

MEASURES

RESIDENTIAL







MEASURES

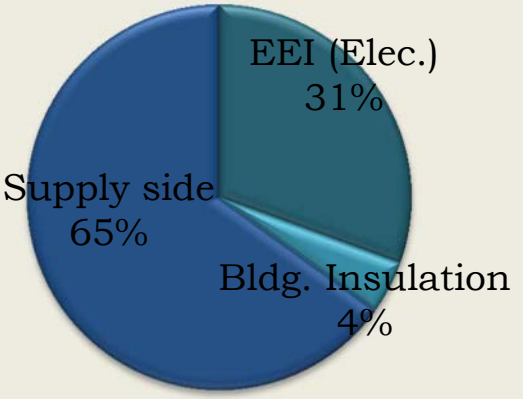
COMMERCIAL

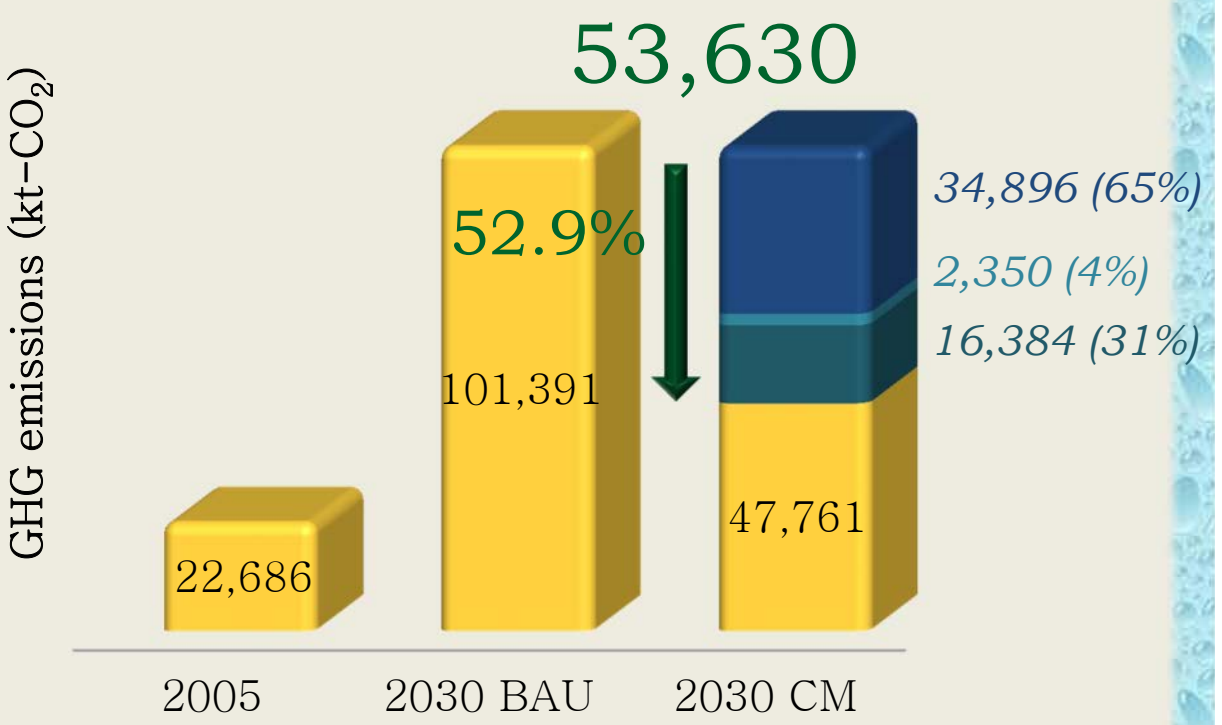
- Energy efficiency improvement in *Buildings*
  - *Efficiency improvement by 30%*
  - *Penetration rates up to 100% in 2030*
- Energy efficiency improvement in *Buildings (Building Codes)*
  - *Building insulation*
  - *Building envelope*
  - *Penetration rates up to 100% in 2030*

Ref: Thailand Research Fund. 2007. Research Programme on Policy Research for Promoting the Development and Utilization of Renewable Energy and the Improvement of Energy Efficiency in Thailand.

MEASURES

COMMERCIAL





MEASURES

INDUSTRY

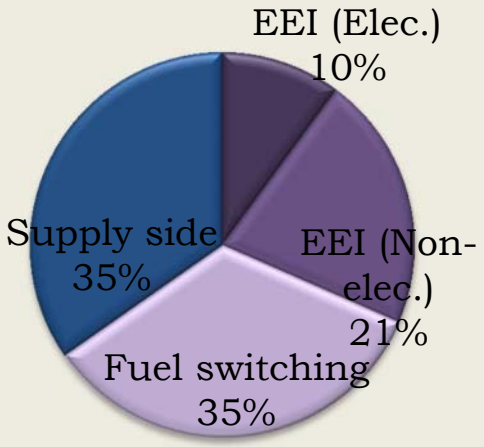
- Energy efficiency improvement in *Industry (Electric)*
  - *Efficiency improvement*

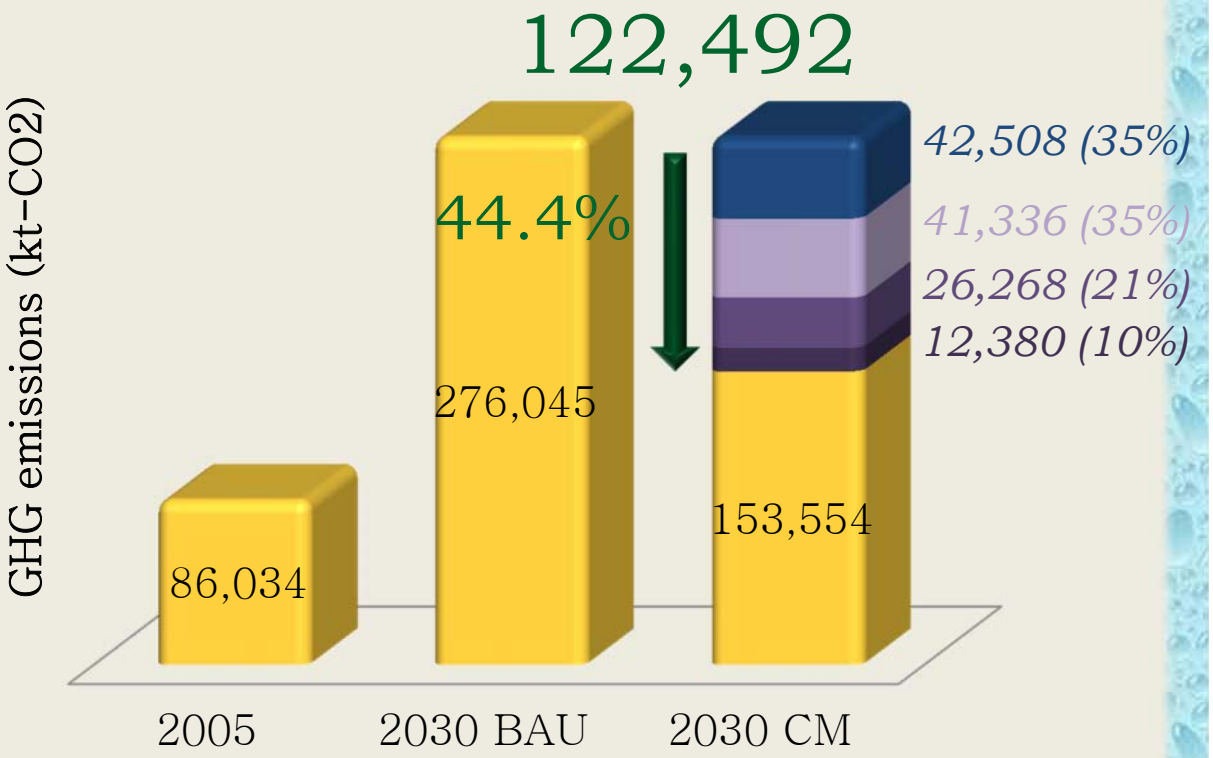
System	Motor	Others	Lighting
EEI	10%	20%	30%

  - *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





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*

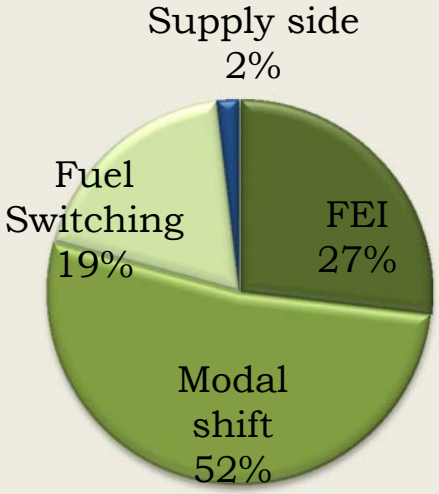
		SV	LV	Bus	Motor bike	Bike	Walk	Train	Plane	Ship
Passenger	2005	24.3	6.7	42.3	14.6	0.8	10.7	0.2	0.4	-
	2030	15.0	5.0	20.0	10.0	12.8	25.0	12.0	0.2	-
Freight	2005	2.2	80.8					2.3	0.02	14.8
	2030	2.2	58.2	-	-	-	-	24.9	0.02	14.8

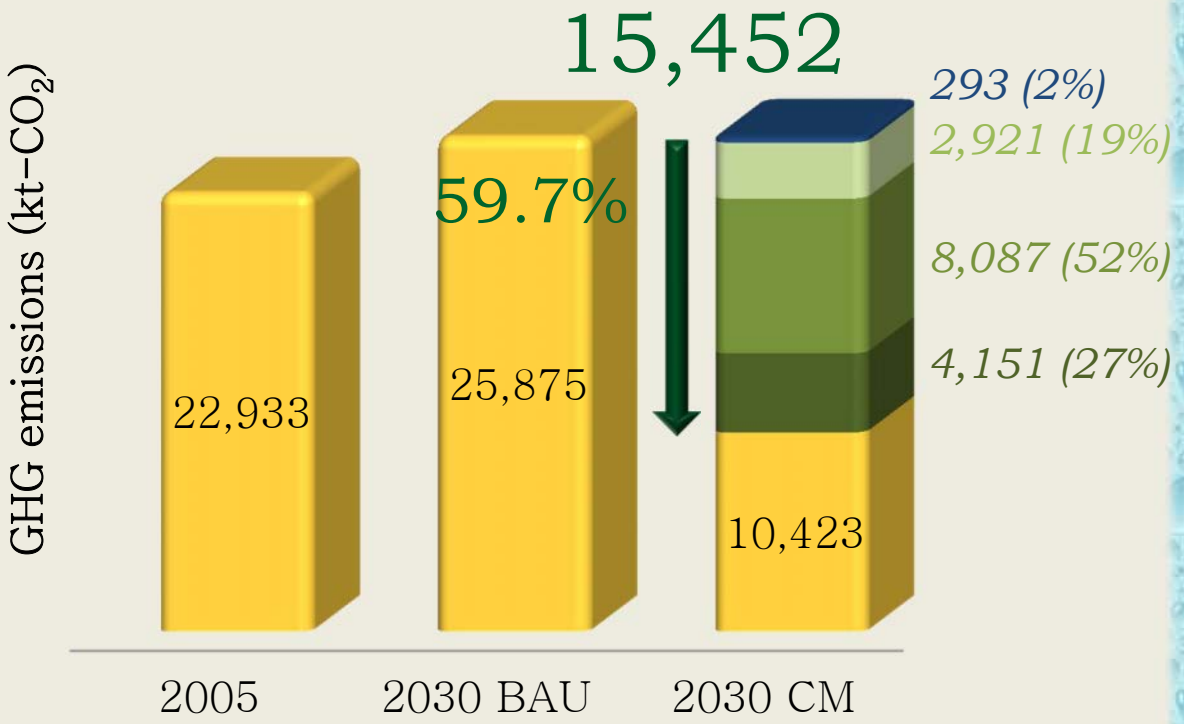
Ref: Pongthanaisawan, J. 2007. Road transport energy demand analysis and energy saving potentials in Thailand. Asian Journal of Energy and Environment

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

MEASURES

PASSENGER TRANSPORT





E20 20% Ethanol

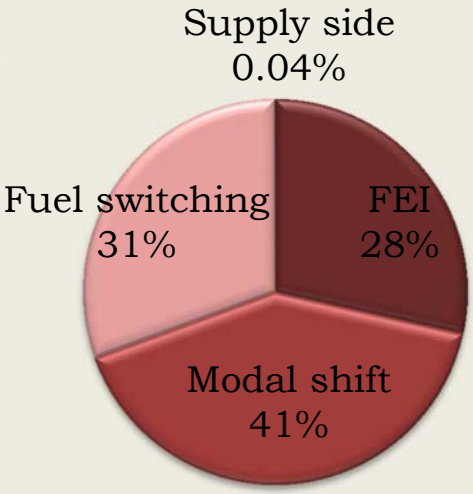
E85 ethanol FLEX-FUEL

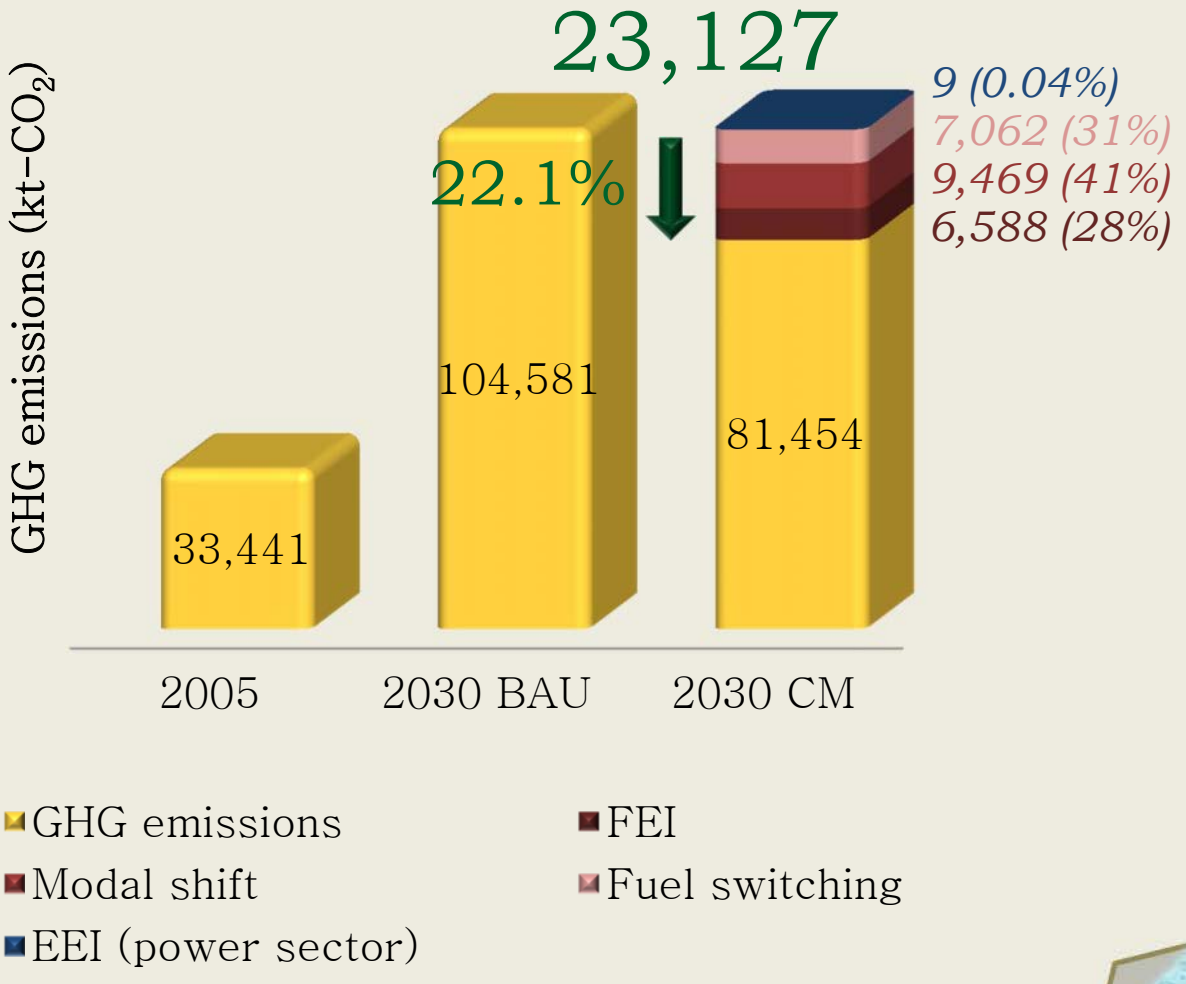
เพาเวอร์ B5

CNG

MEASURES

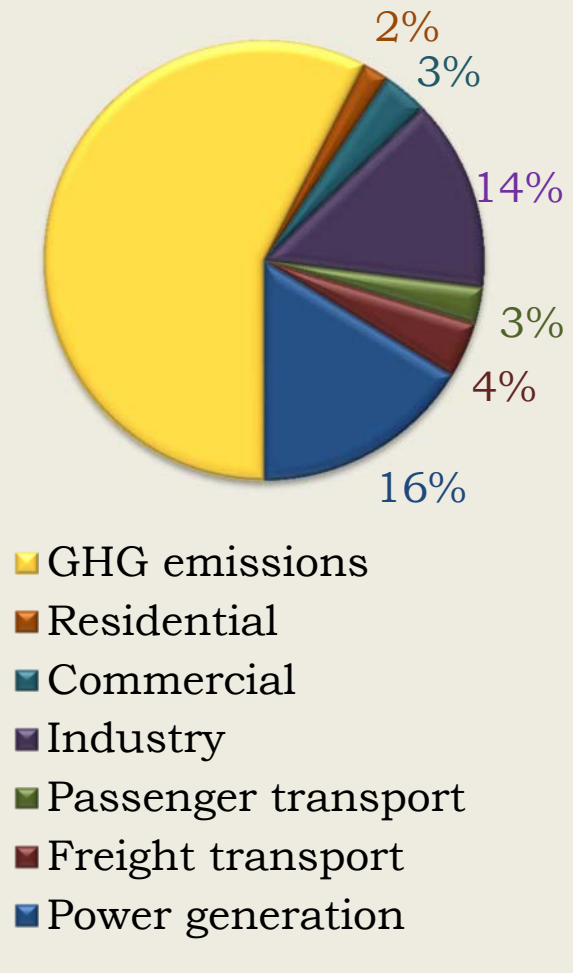
FREIGHT TRANSPORT



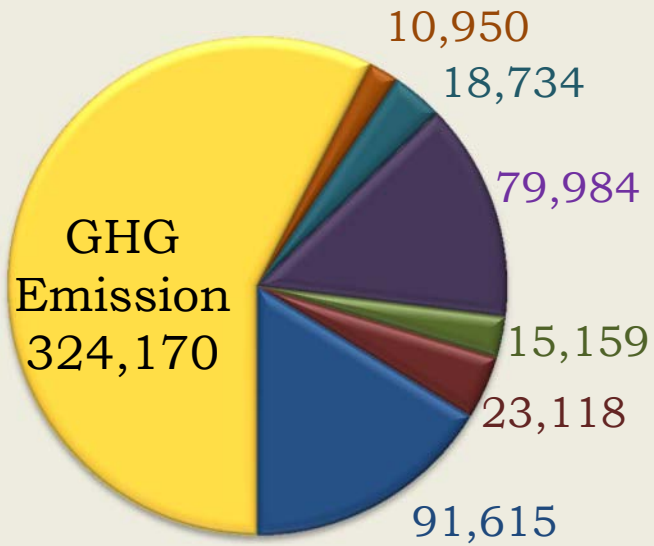


GHG EMISSIONS/REDUCTION

TOTAL



GHG REDUCTION: 239,560 kt–CO_2



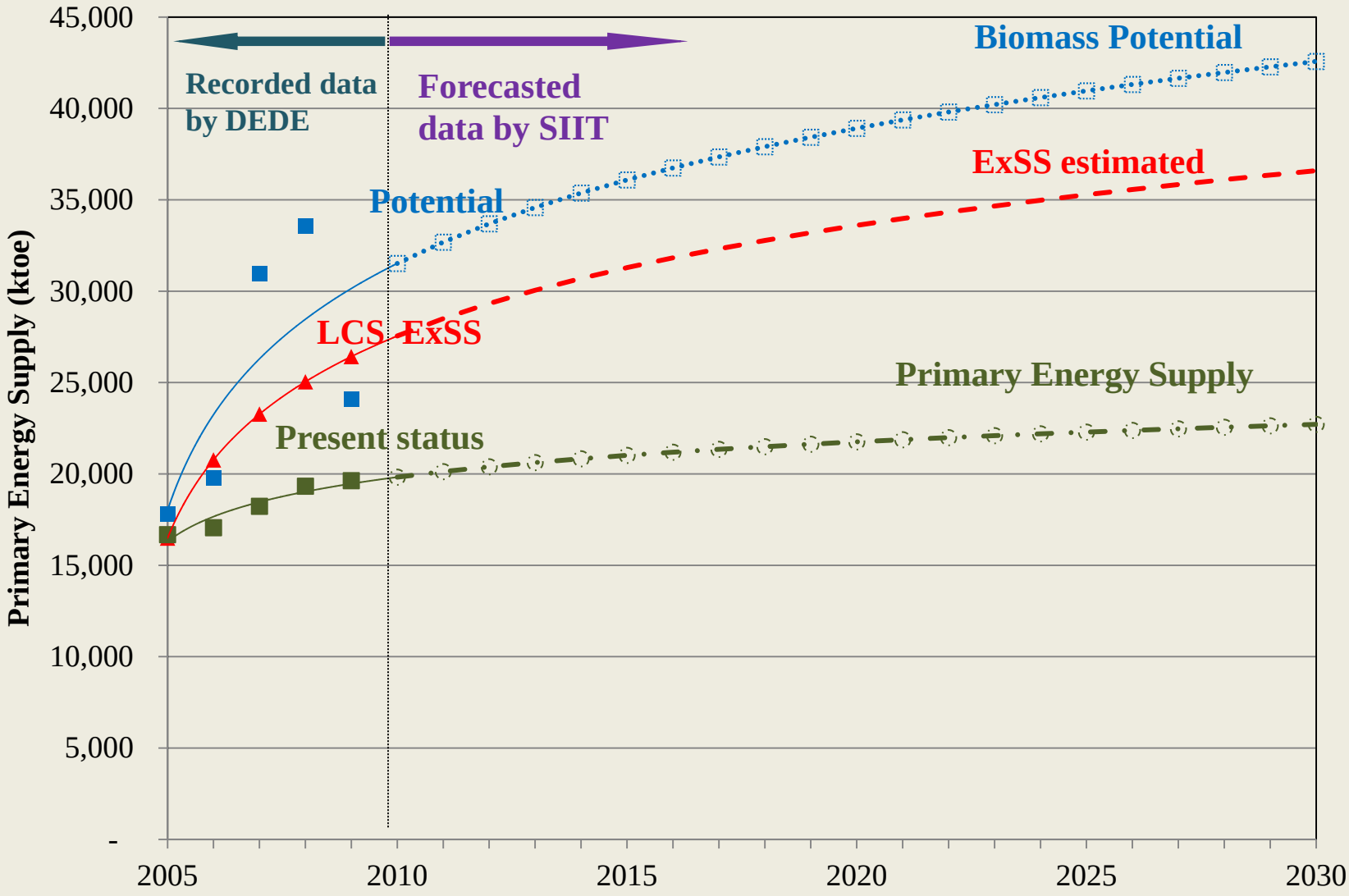
Unit: kt-CO_2

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-CO_2
Total GHG emissions in the 2030 CM scenario	324,170 kt-CO_2

Biomass potential & consistency



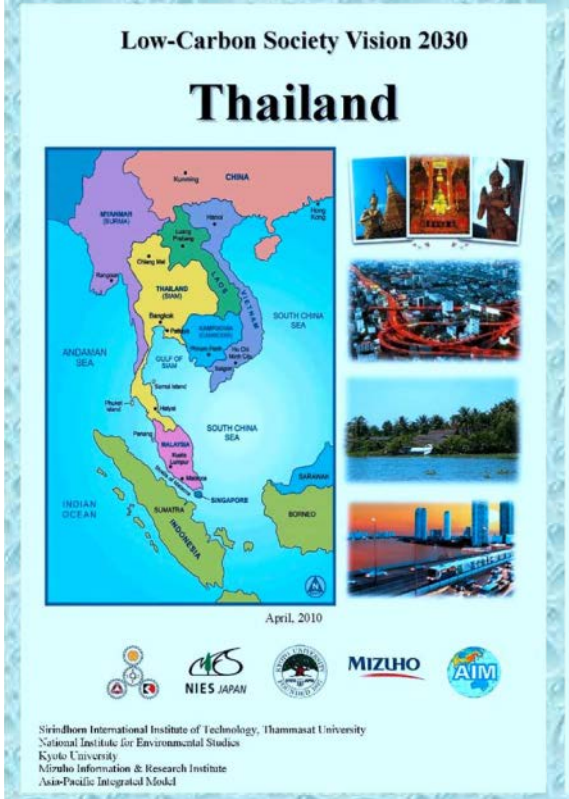
RENEWABLE POTENTIALS (MOEN, TH)

Energy type	Potential	Existing		2008-2011			2023-2030		
Electricity	**MW**	**MW**	**GWh**	**MW**	**GWh**	**ktoe**	**MW**	**GWh**	**ktoe**
Solar	50,000	38.6	46	55	66	6	600	720	67.2
Wind	1,600	5.13	10	115	231	13	960	1,934	106.8
Small hydro	700	67	293	165	722	43	390	1,708	102
Biomass	4,400	1,644	11,521	2,800	19,622	1,463	4,400	30,835	2,319
Biogas	190	79.6	573	60	432	27	144	1,036	64.8
Waste	400	5.6	44.8	78	624	35	192	1,536	86.4
Total	**57,290**	**1,840**	**12,487.8**	**3,273**	**21,697**	**1,587**	**6,686**	**37,769**	**2,746**
Thermal	**ktoe**	**ktoe**				**ktoe**			**ktoe**
Solar	154	0.5				5			45.6
Biomass	7,400	3,071				3,660			7,400
Biogas	600	201				470			600
Waste		1.09				15			42
Total	**8,154**	**3,273**				**4,150**			**8,088**
Bioenergy	**ML/day**	**ML/day**		**ML/day**		**ktoe**	**ML/day**		**ktoe**
Ethanol	3.00	1.24		3.00		805	10.8		2,936
Biodiesel	4.20	1.56		3.00		950	5.40		1,698
Total	**7.20**	**2.80**		**6.00**		**1755**	**16.20**		**4,634**
Required energy (ktoe)		66,248				70,300			112,868
Required renewable energy		4,237				7,492			15,468
RE share (%)		6.4%				10.6%			13.7%
NGV (M.cu./Day)		147		393.0		3,469	800		7,064
Alternative energy used (ktoe)						10,961			22,532
AE share (%)						16.6%			19.96%

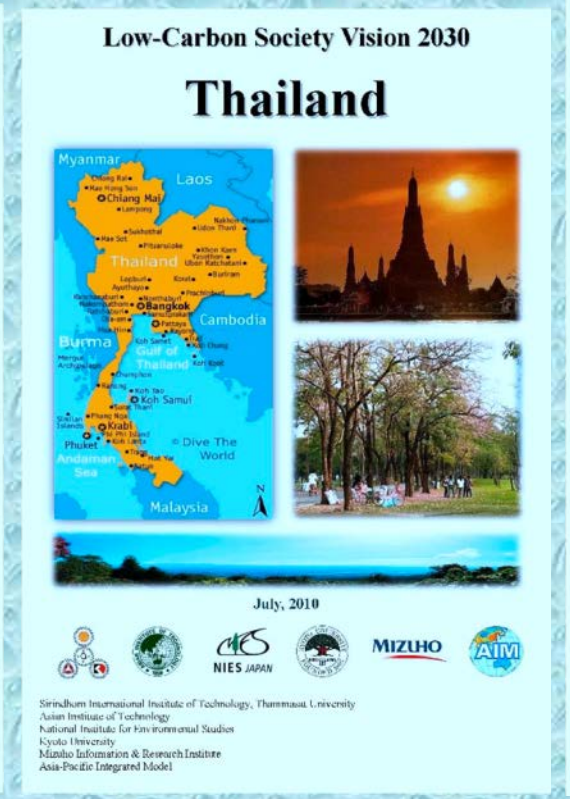
Conclusions on Thailand's LCS Scenario

- The GHG emissions in 2030 BAU scenario without mitigation measures will increase to 563,730 kt-CO_2.
- By adopting CMs in all sectors, GHG emissions can be decreased to 324,170 kt-CO_2 or by 42.5%.
- If those policies are planned in early stage, Thailand will be able to serve as a model for LCS.
- However, to increase more CO_2 mitigation, more CMs & leapfrogging technologies are needed under national appropriate mechanism.

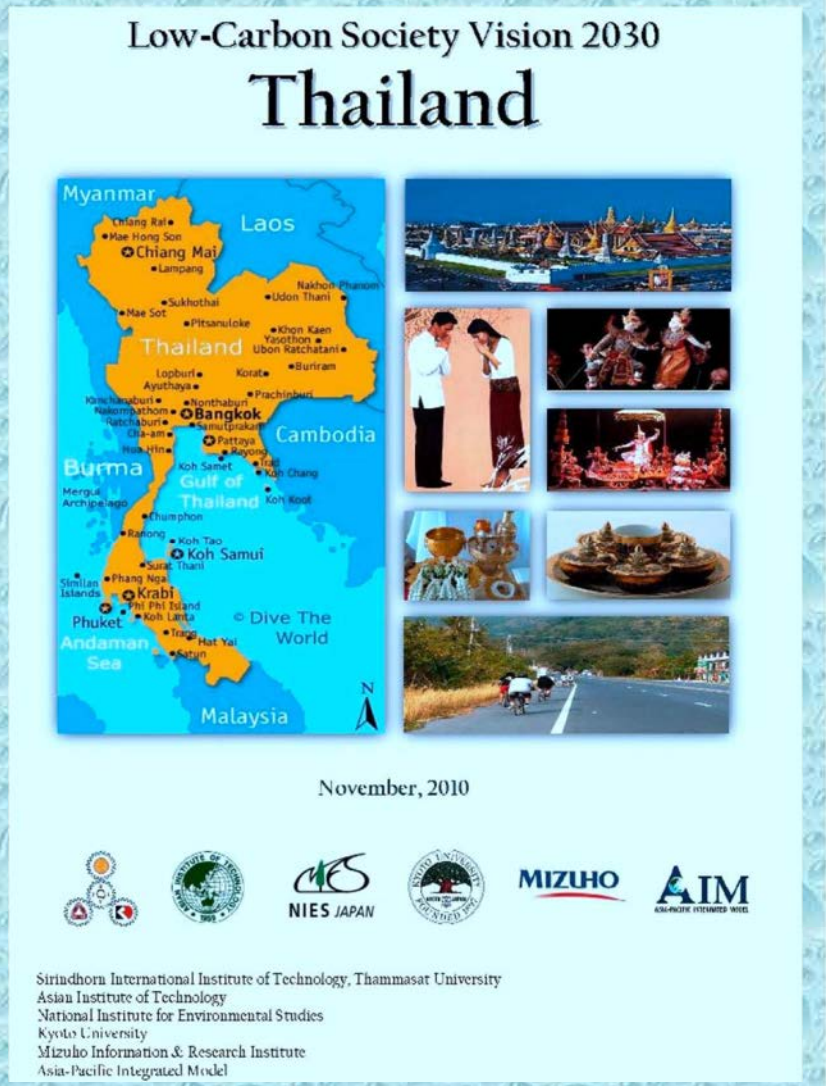
1st Thailand's LCS Scenario 2030 Brochure



1st Draft, Apr 2010



2nd Draft, July 2010



FINAL Thailand LCS
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).**
2. **Climate change focal point of Thailand: ONEP.**
3. **Bangkok Metropolitan Administration (BMA).**
4. **Energy Planning and Policy Office (EPPO), MOEN.**
5. **Department of Alternetive Energy Development and Efficiency (DEDE), MOEN.**
6. **Research Institutes & Universities.**
7. **NGOs.**
8. **Privates/Business.**

Note: TGO & MOEN are looking towards 2030, instead of 2022.

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.

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

TGO provided one session on LCS Scenario: Methodology, cases of Japan & Thailand

CTC2010
21 August 2010

MOU between NIES and SIIT-TU
Low-Carbon Scenario Development in Thailand

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 Kitti

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

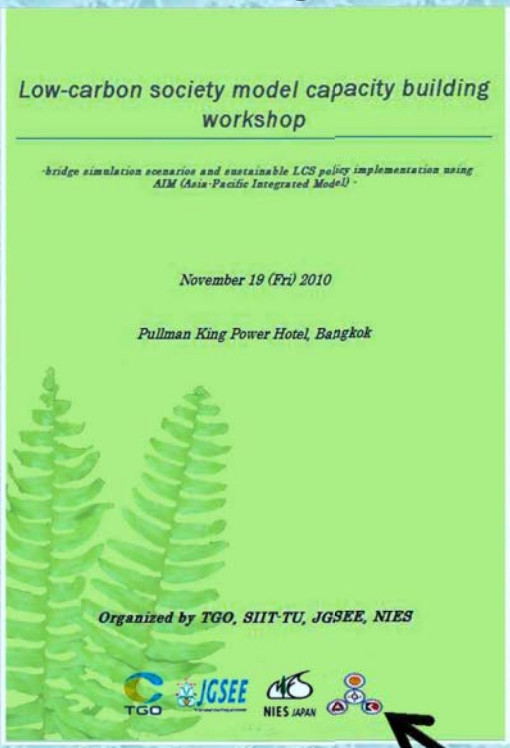
Bridge simulation & LCS Policy
Closing Remarks

Dr Kainuma Dr Sirin (KMUTT)

Thailand's Low-Carbon Society Model Capacity Building Workshop

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

Proceeding of LCS



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.)

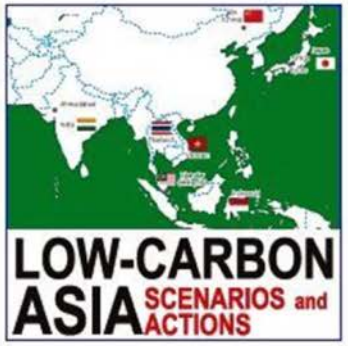
3) Communicate between policymakers, business, researchers to discuss how to develop feasible LCS scenarios and policy options

Workshop Proceedings

All presentations and discussions are summarized in a proceedings.

Download the Proceedings (PDF:17MB)

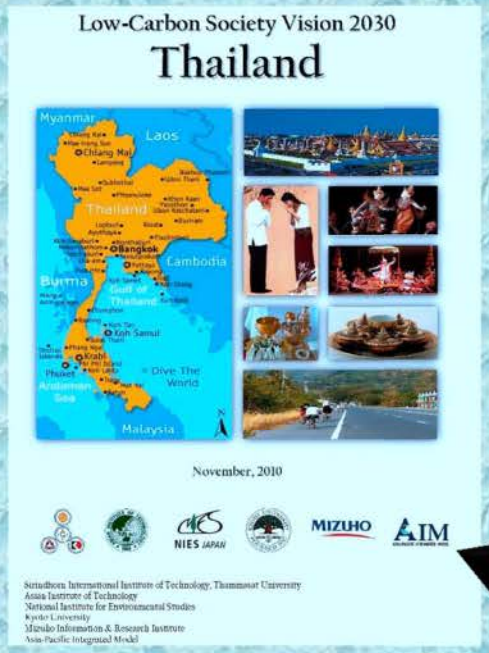
Click to see original photo (1.5MB)

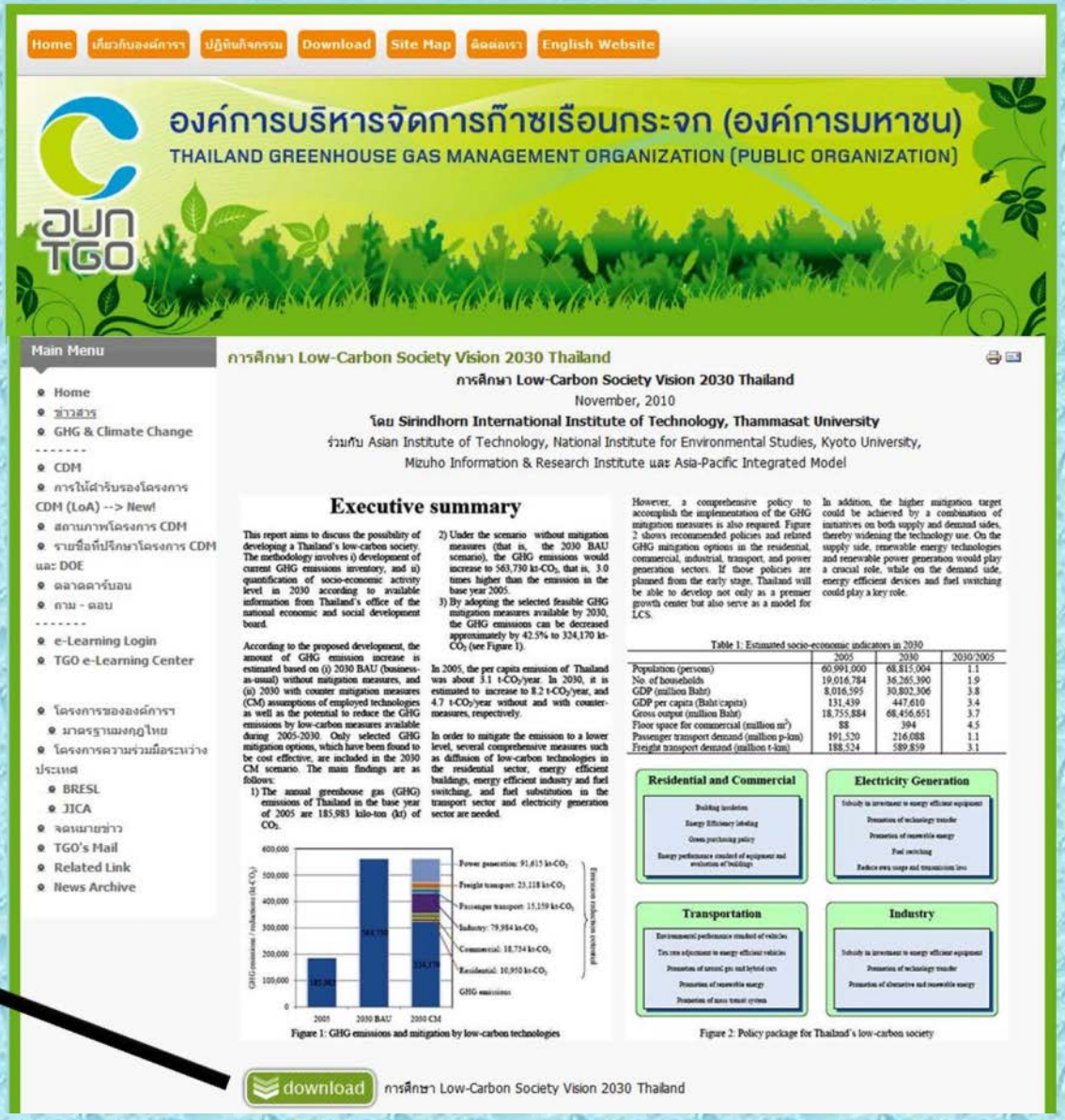


AIM
ASIA-PACIFIC INTEGRATED MODEL

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



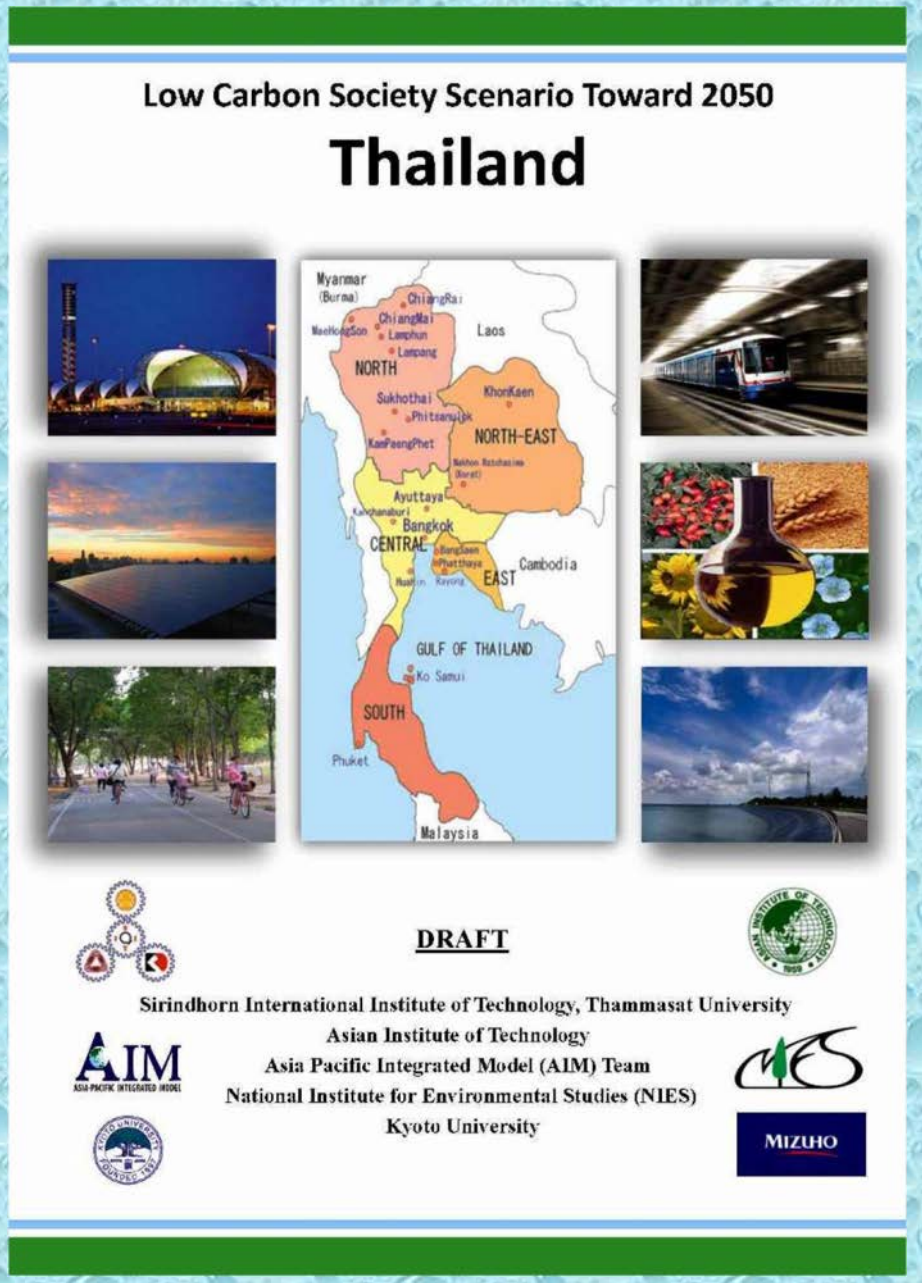


2nd Thailand's Low-Carbon Society Scenario

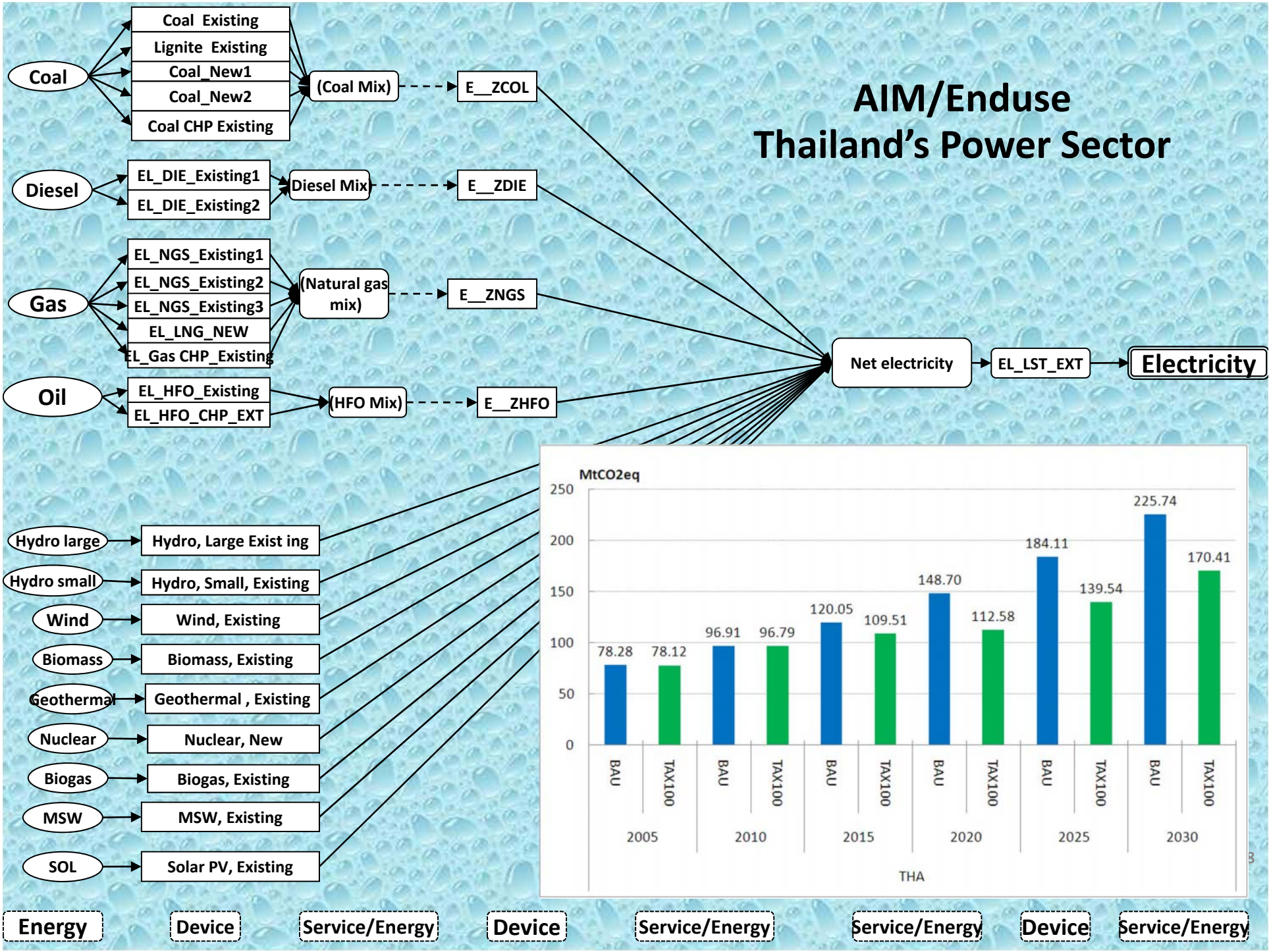
- Improved analysis of 2030CM to 2050CM scenario using ExSS tool.

- 2nd LCS 2050CM Scenario brochure using AIM/EndUse for the power sector with carbon tax.

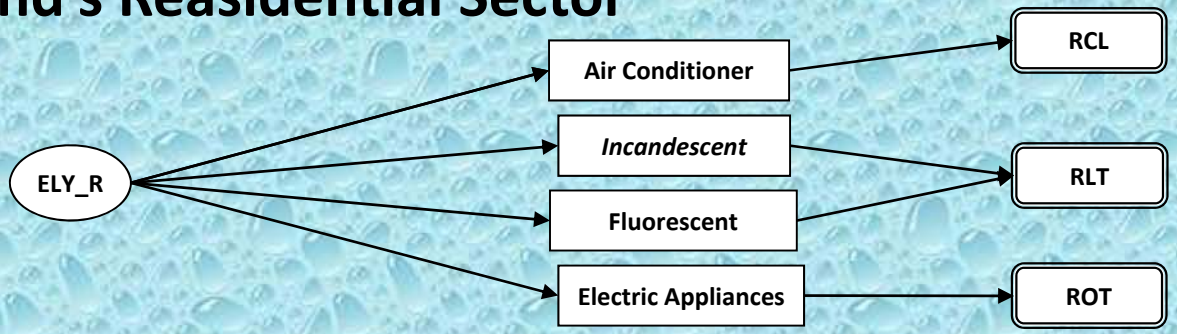
- AIM/CGE for 2050 CM Scenario.



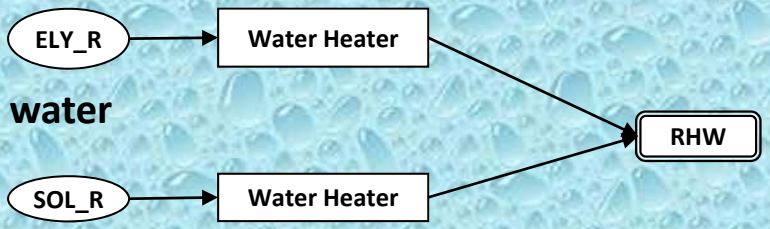
AIM/Enduse
Thailand's Power Sector



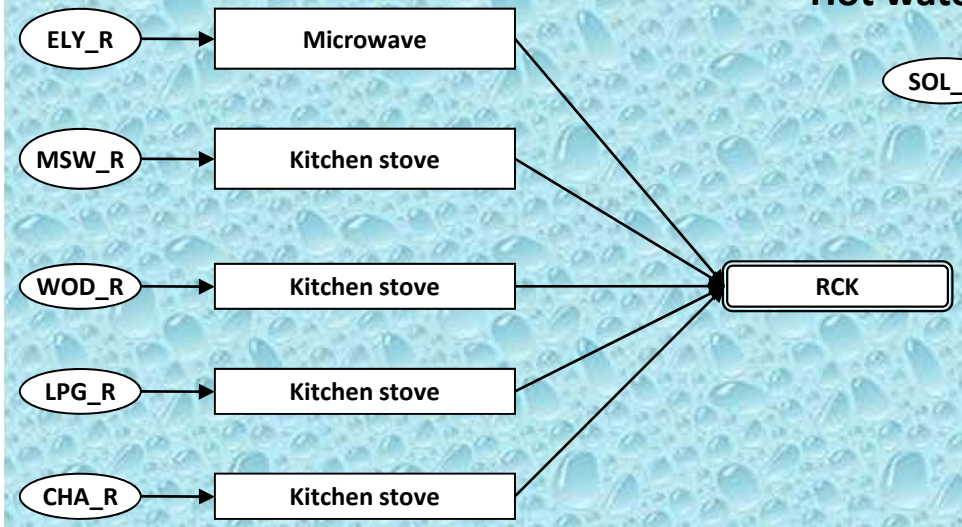
AIM/Enduse
Thailand's Reasidential Sector



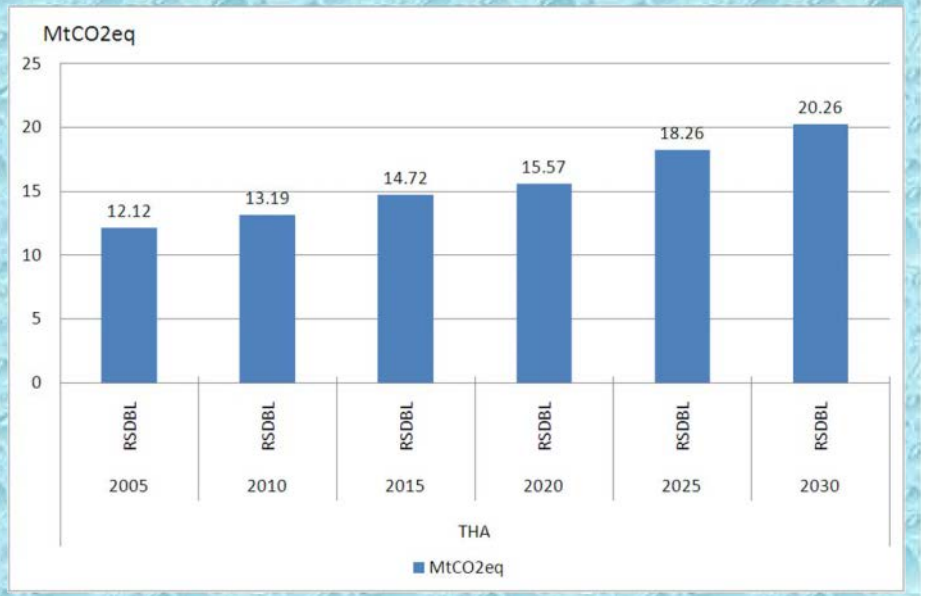
Cooling, lighting, Electric appliances



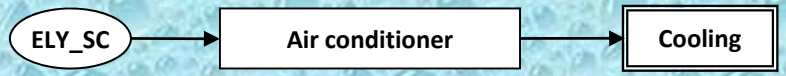
Hot water



Cooking

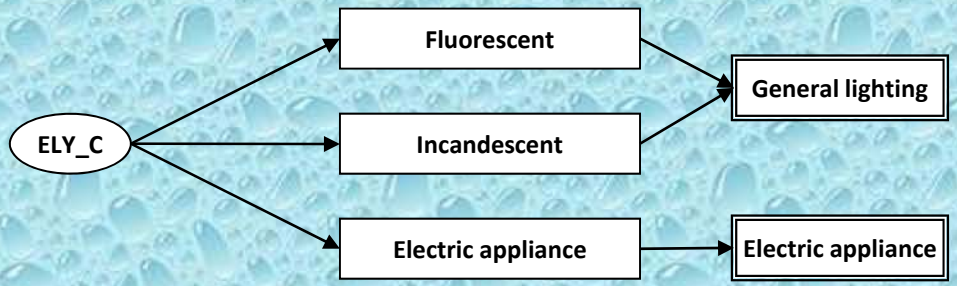


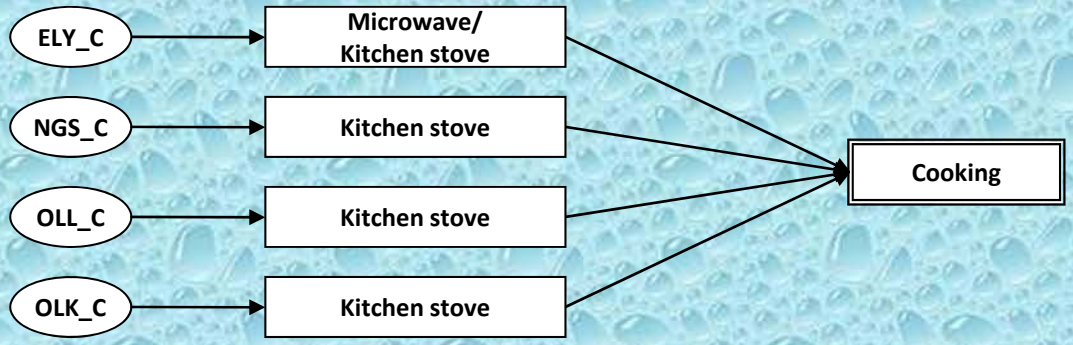
AIM/Enduse
Thailand's Commercial Sector



Cooling system

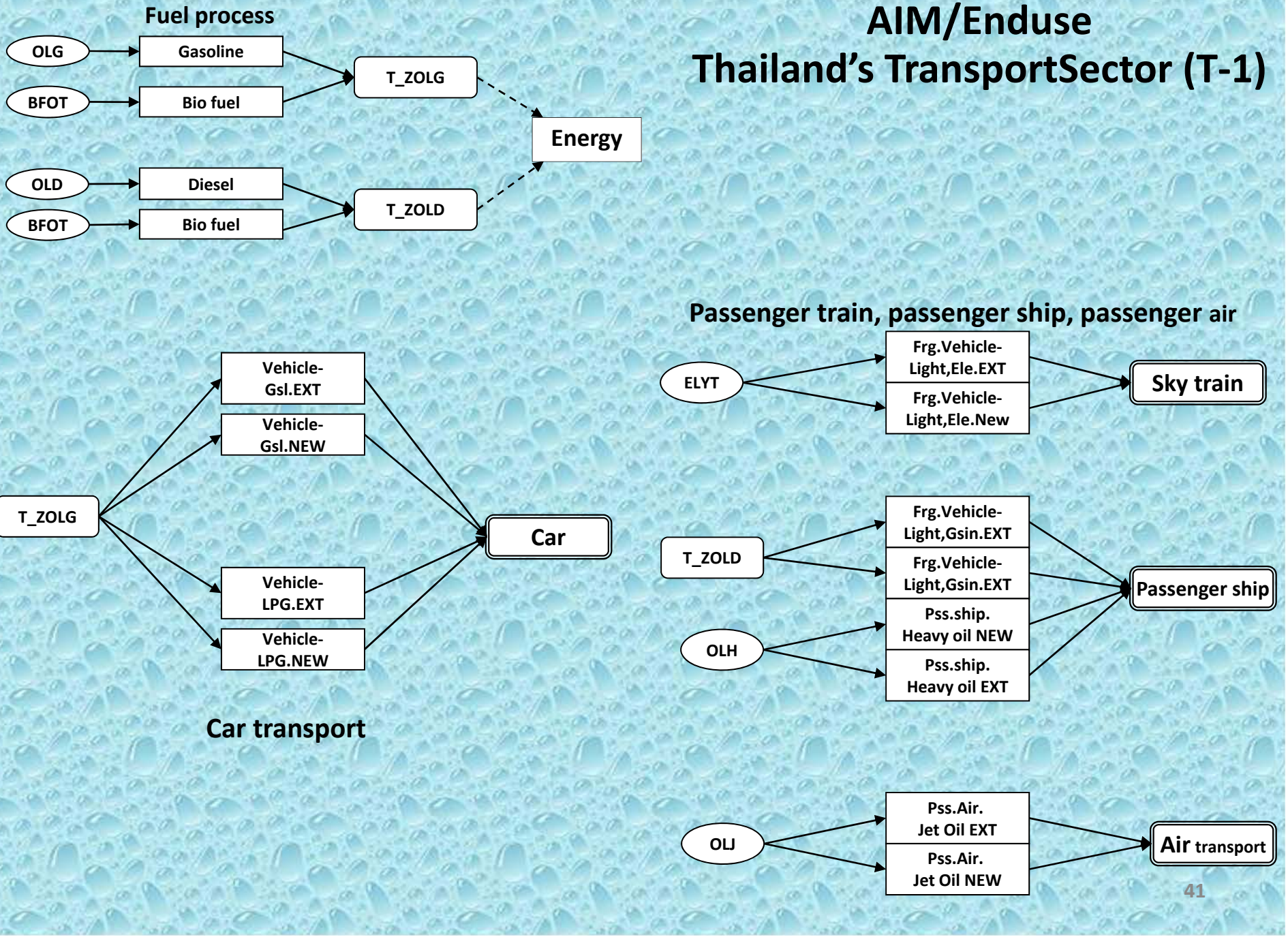
General lighting and electric appliance



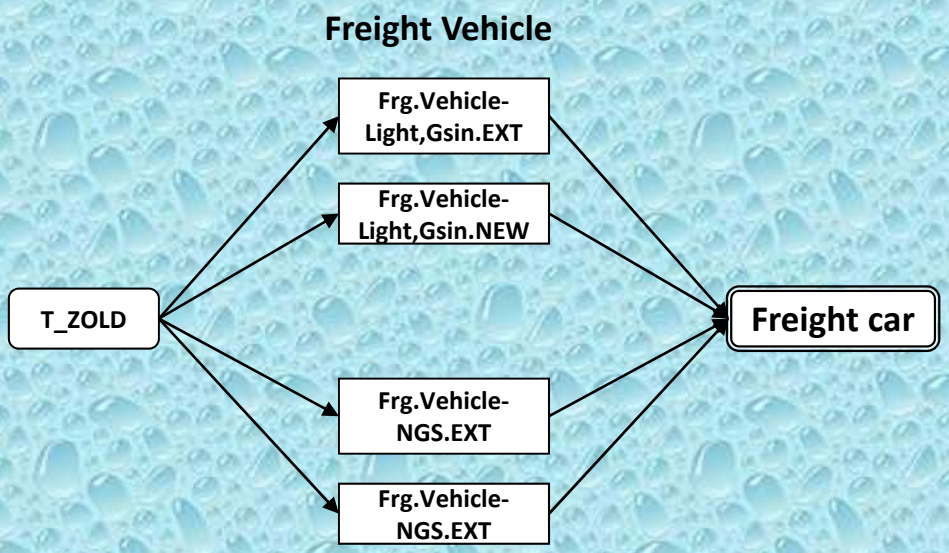


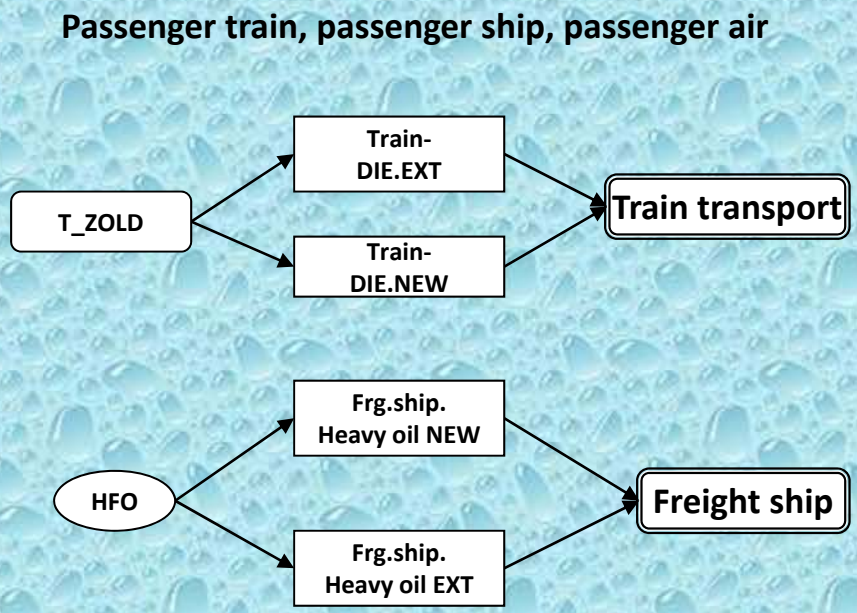
Cooking

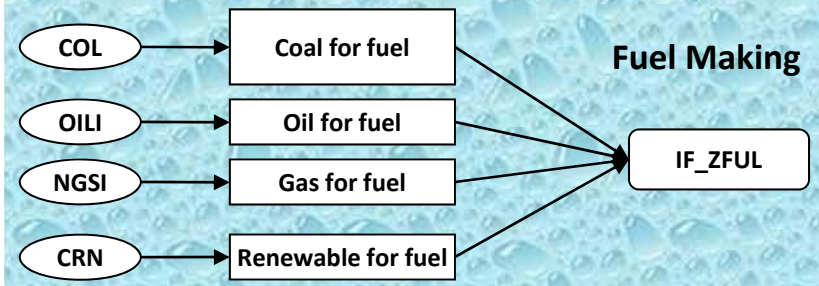
AIM/Enduse
Thailand's TransportSector (T-1)

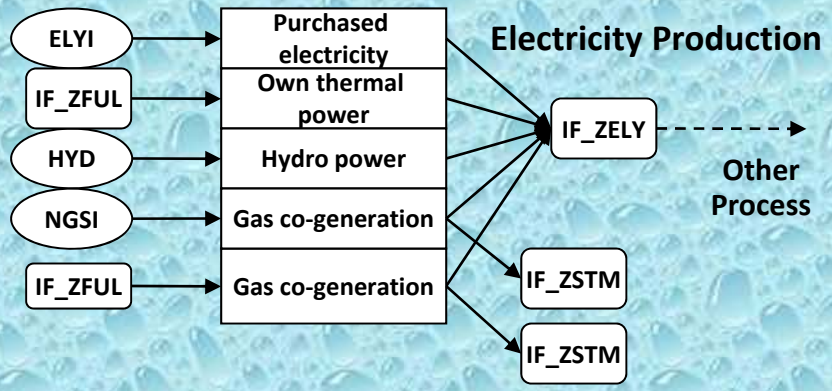


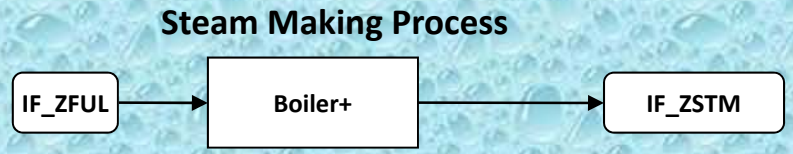
AIM/Enduse
Thailand's Transport Sector (T-2)

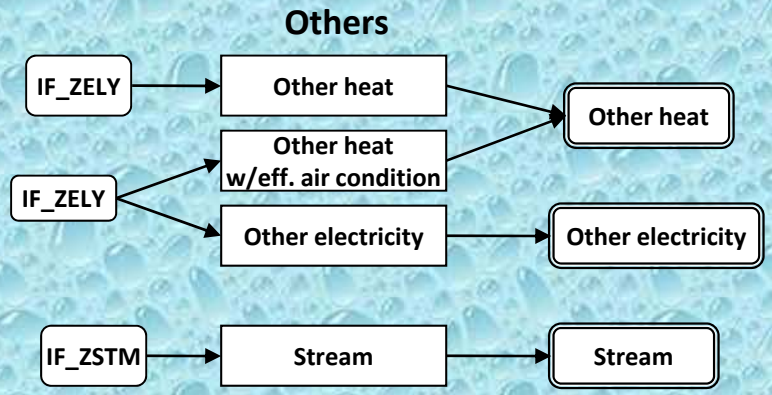


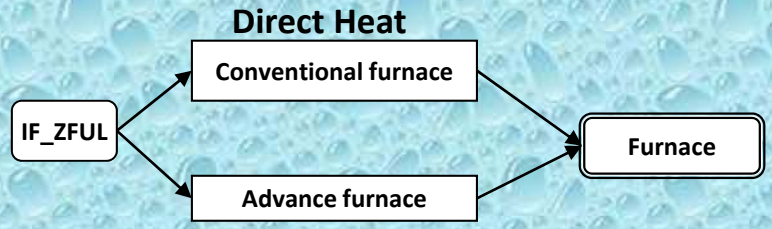


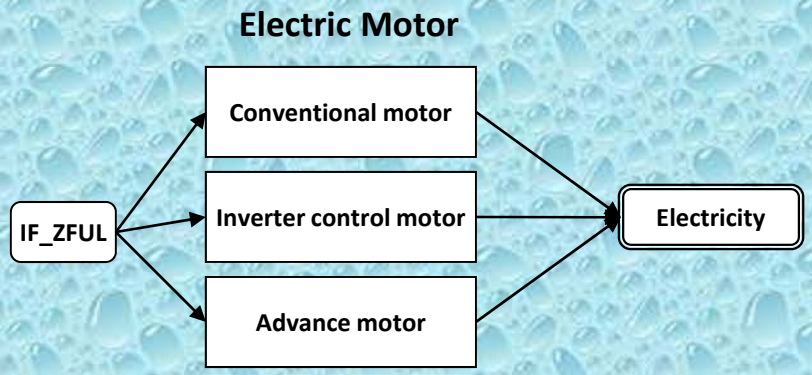




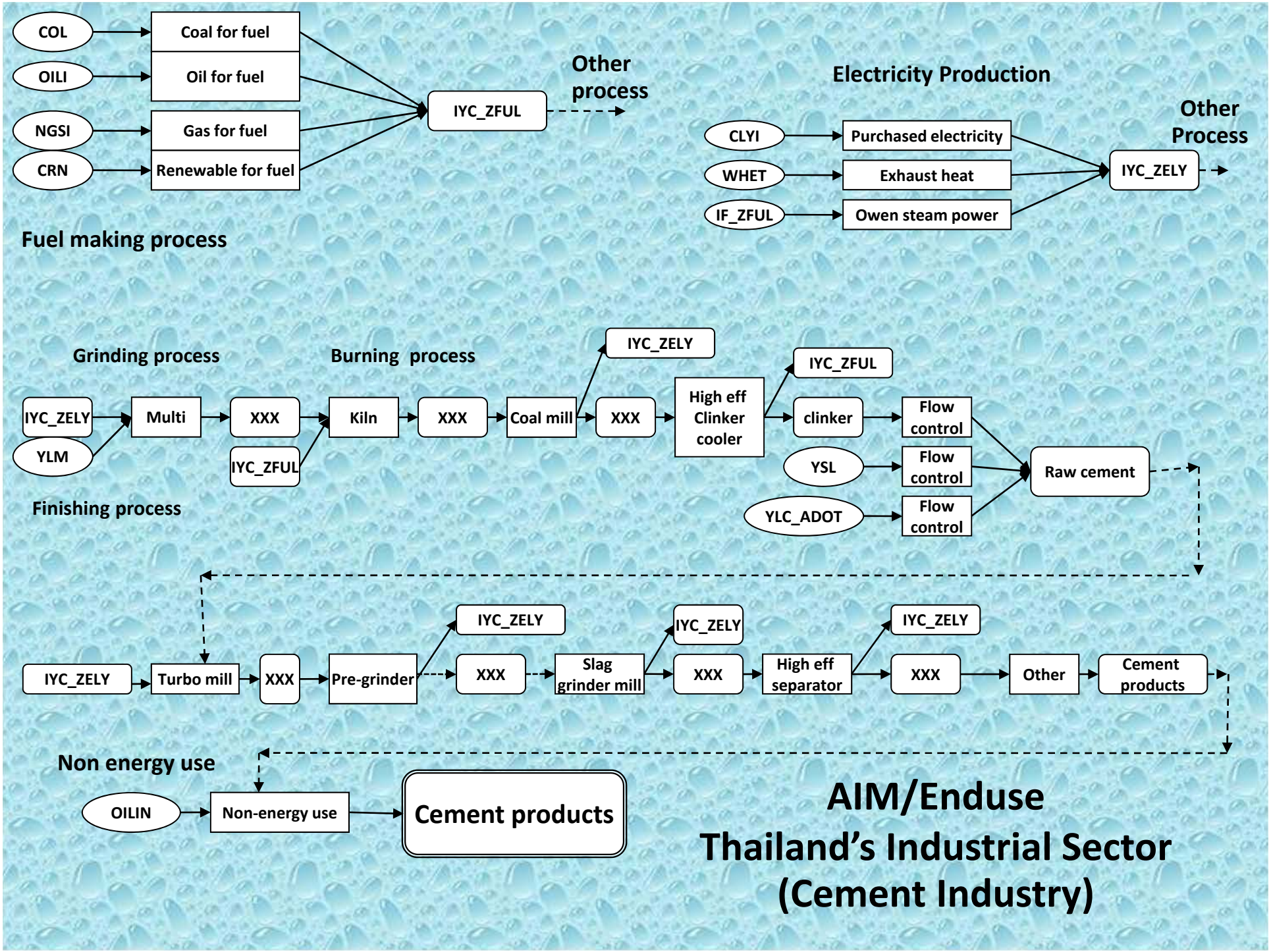




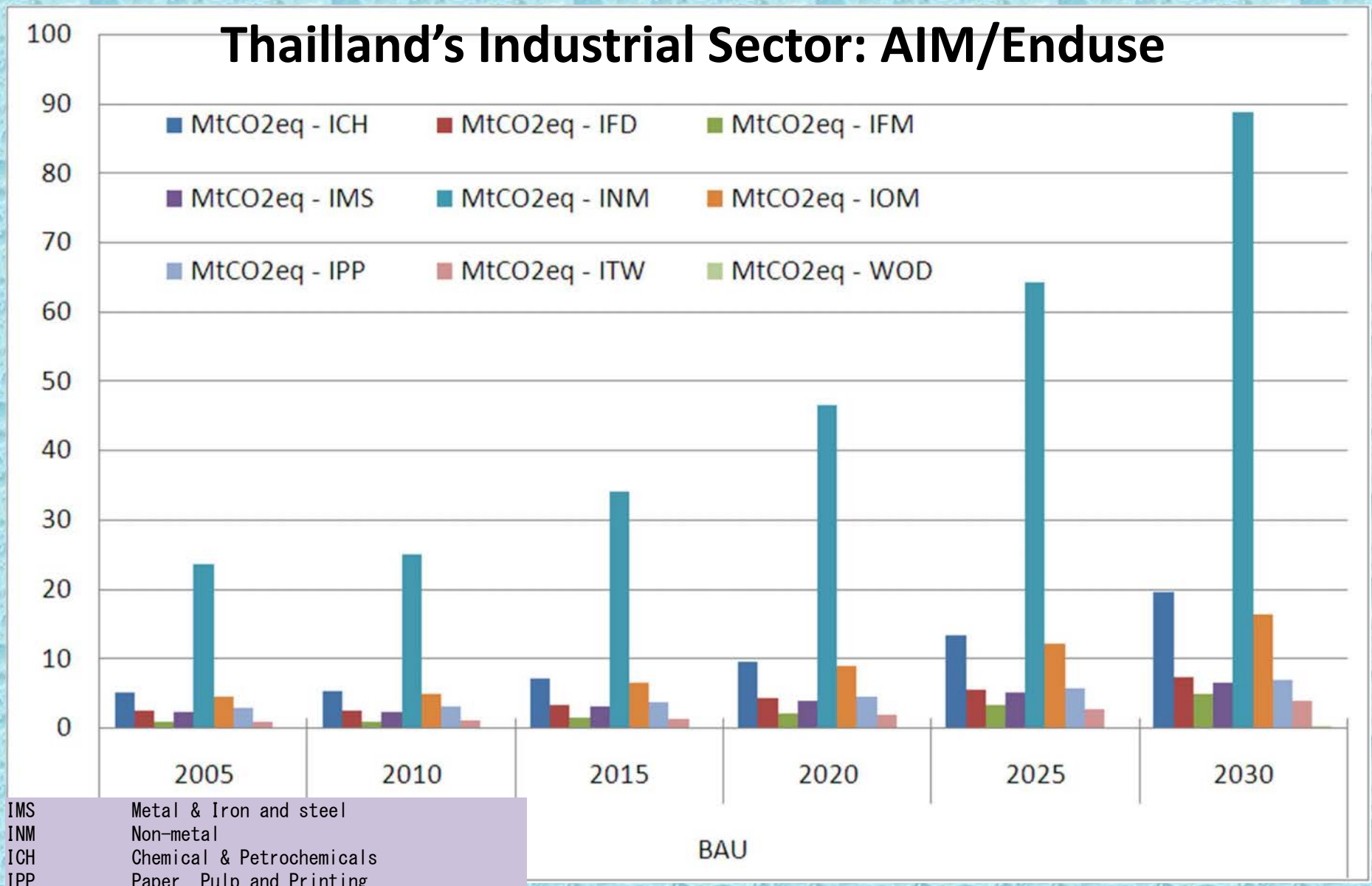




AIM/Enduse
Thailand's Industrial Sector
(Food Industry)


COL
OILI
NGSI
CRN
Coal for fuel
Oil for fuel
Gas for fuel
Renewable for fuel
IYC_ZFUL
Other process
Fuel making process
Electricity Production
CLYI
WHET
IF_ZFUL
Purchased electricity
Exhaust heat
Owen steam power
IYC_ZELY
Other Process
Grinding process
Burning process
Finishing process
IYC_ZELY
YLM
Multi
XXX
IYC_ZFUL
Kiln
XXX
Coal mill
IYC_ZELY
XXX
High eff Clinker cooler
IYC_ZFUL
clinker
YSL
YLC_ADOT
Flow control
Flow control
Flow control
Raw cement
IYC_ZELY
Turbo mill
XXX
Pre-grinder
IYC_ZELY
XXX
Slag grinder mill
IYC_ZELY
XXX
High eff separator
IYC_ZELY
XXX
Other
Cement products
Non energy use
OILIN
Non-energy use
Cement products
AIM/Enduse
Thailand's Industrial Sector
(Cement Industry)

Thailand's Industrial Sector: AIM/Enduse



IMS	Metal & Iron and steel
INM	Non-metal
ICH	Chemical & Petrochemicals
IPP	Paper, Pulp and Printing
IFD	Food Product, Beverage and Tobacco
ITW	Textiles, Wearing Apparel and Leather
IFM	Frabricated metals & Machinery
IOM	Other Manufacturing
WOD	Wood and wood product

S-6, MOEJ

どうもありがとう

THANK YOU