

4th ATRANS Symposium, August 26-27, 2011, Bangkok, Thailand
**"Toward Low Carbon Transportation for Sustainable Society:
Bangkok Vision 2030 (250th Anniversary)"**

PROFILE



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CO₂ Mitigation, Renewable Energy, Energy Efficiency

Low-Carbon Society in Thailand's Transport Sector

Summary

The objectives of Thailand's Low-carbon Society (LCS) in the transport sector are i) to propose measures for avoiding global climate change, and precursors to zero carbon society and renewable-energy economy, ii) to discuss the possibility of developing a low-carbon society in Thailand's transport sector, iii) to present co-benefits of CO₂ mitigation, and iv) to create awareness among Thailand's authorities, government, stakeholders, and communities for LCS transportation. Several cost-effective countermeasures (CMs) are proposed for low-carbon transportation in Thailand. Results of LCS scenario analyses by using a snap shot model, called "AIM/ExSS tool", which is developed by the Asia-Pacific Integrated Model (AIM) team of National Institute for Environmental Studies (NIES) Japan and Kyoto University revealed that the GHG emissions in 2030 BAU scenario without 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 CMs in transport sector, GHG emissions can be decrease by 38,581 kt-CO₂, and accounted for 29.5% reduction in the transport sector. However, to increase more CO₂ mitigation, appropriate CMs & advanced technologies are needed under National Appropriate Mitigation Actions (NAMAs). If those policies are planned in early stage, Thailand will be able to serve as a model for LC transportation These research findings hope to contribute to sustainable energy and environmental transportation of Thailand, one of the fast growing economies in Southeast Asia, towards a Thai low carbon society.

Session 3C: Assoc. Prof. Dr. Bundit Limmeechokchai

Presentation entitled: Low Carbon Society in Thailand’s Transport Sector: Vision 2030

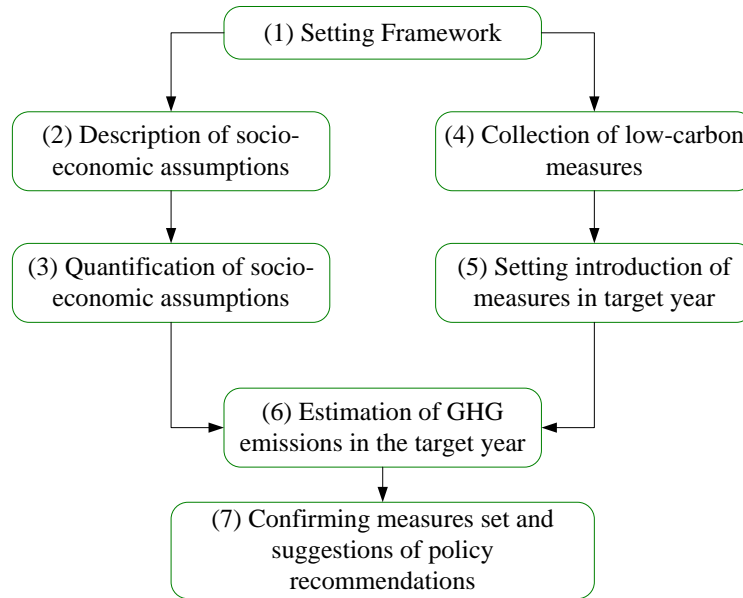


Thailand “Low Carbon Society” Objectives

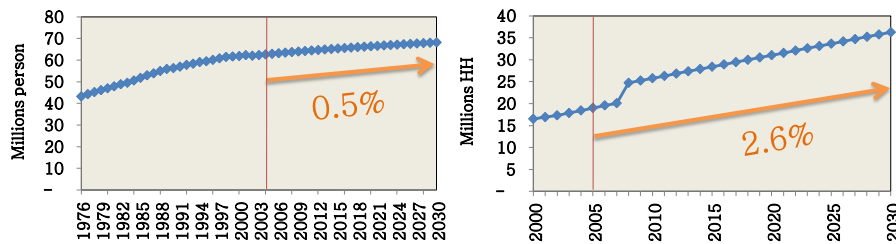
- ❖ To propose measures for avoiding global climate change, and precursors to zero carbon society and renewable-energy economy.
- ❖ To discuss the possibility of developing a low-carbon society in Thailand’s transport sector.
- ❖ To present co-benefits of CO₂ mitigation.
- ❖ To create awareness among Thailand’s authorities, government, stakeholders, and communities for LCS transportation.



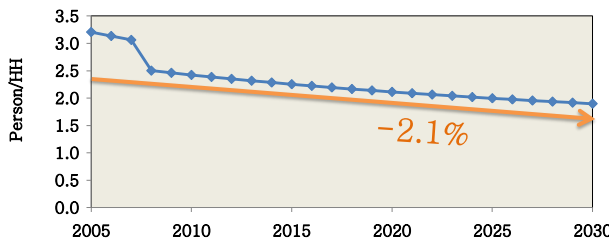
A Procedure to Create a LCS Scenario



Quantitative assumptions



Household size




Estimated socio-economic indicators

	2005		2030
- NESDB	Population	60,991,000	0.49% → 68,815,004
- DOPA	No. of HH	19,016,784	2.6% → 36,265,390
	GDP (mil Baht)	8,016,595	5.5- 5.0% → 30,802,306
- NESDB	Gross output (mil Baht)	18,755,884	
	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

- 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



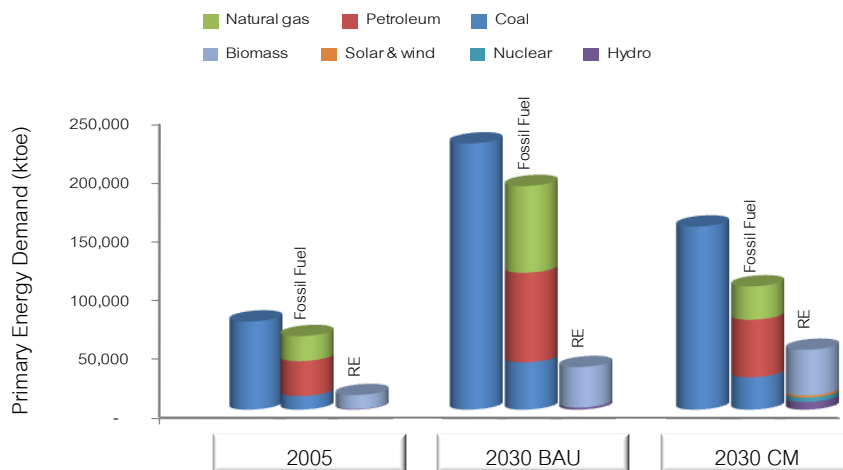
Scenarios & CO₂ Countermeasures

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

CO₂ Mitigation:

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

Total Primary Energy Demand



Remarks: BAU is Business as Usual
CM is Countermeasures



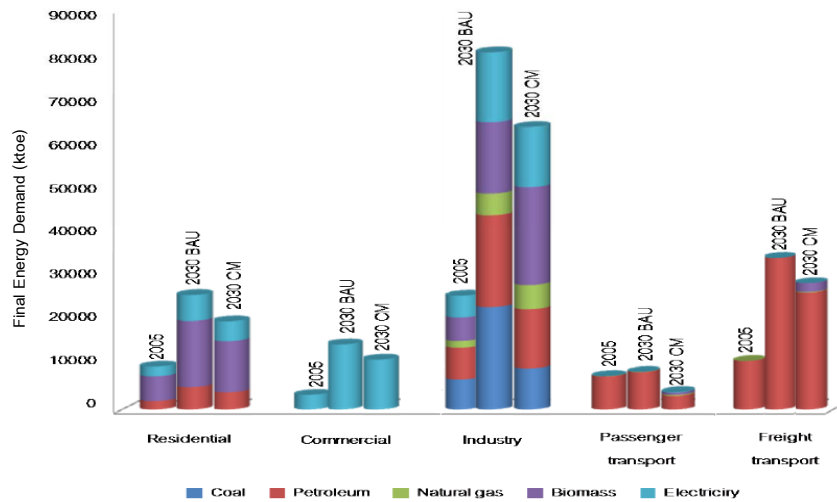
Total Primary Energy Demand (ktoe)

Fuel	2005	2030 BAU	2030 CM
Coal	11,608	40,201	27,504
Petroleum	29,677	76,142	48,917
Natural gas	21,190	73,644	28,316
Hydro	515	1,802	6,627
Nuclear	-	-	3,618
Solar & Wind	2	7	1,922
Biomass	11,853	34,369	38,658

Remarks: BAU is Business as Usual
CM is Countermeasures



Sectoral Energy Demand



Remarks: BAU is Business as Usual
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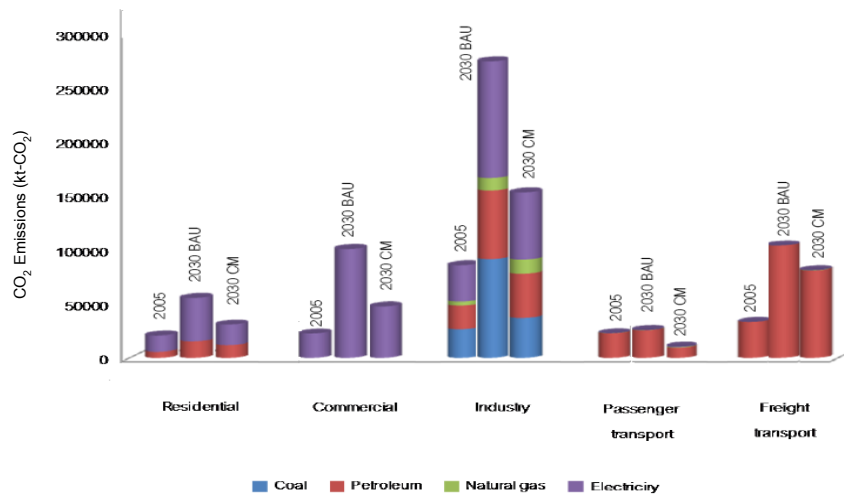


Total Final Energy Demand (ktoe)

	Coal	Petroleum	Natural gas	Biomass	Electricity	Total
2005						
Residential	-	1,897	-	5,621	2,203	9,721
Commercial	-	-	-	-	3,305	3,305
Industry	6,755	7,233	1,520	5,332	4,913	25,753
Passenger transport	-	7,499	44	-	5	7,548
Freight transport	-	10,999	1	-	0	11,000
Total	6,755	27,628	1,565	10,953	10,426	57,327
Share	11.8%	48.2%	2.7%	19.1%	18.2%	100.0%
2030 BAU						
Residential	-	5,071	-	15,026	5,889	25,986
Commercial	-	-	-	-	14,771	14,771
Industry	23,217	21,043	4,917	16,193	15,818	81,189
Passenger transport	-	8,461	49	-	5	8,516
Freight transport	-	34,397	4	-	1	34,402
Total	23,217	68,972	4,971	31,219	36,484	164,863
Share	14.1%	41.8%	3.0%	18.9%	22.1%	100.0%
2030 CM						
Residential	-	3,940	-	11,649	4,532	20,121
Commercial	-	-	-	-	11,391	11,391
Industry	9,353	13,537	5,512	22,506	13,712	64,621
Passenger transport	-	3,128	191	549	111	3,979
Freight transport	-	26,697	117	2,038	5	28,857
Total	9,353	47,301	5,820	36,743	29,751	128,968
Share	7.3%	36.7%	4.5%	28.5%	23.1%	100.0%

Remarks: BAU is Business as Usual
CM is Countermeasures

Sectoral CO₂ Emissions/Reductions



Remarks: BAU is Business as Usual
CM is Countermeasures

LCS Measures: A Sectoral Approach

TRANSPORTATION

- ❑ Fuel economy improvement (FEI) in Transport sector
 - Efficiency improvement by 30% in
 - Full penetration rates 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.

LCS Measures: A Sectoral Approach

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.

LCS Measures: A Sectoral Approach

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.*

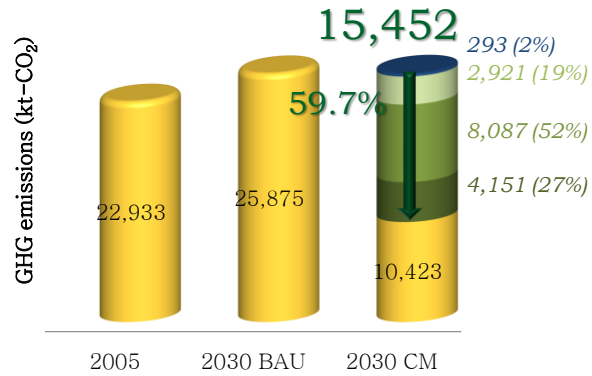
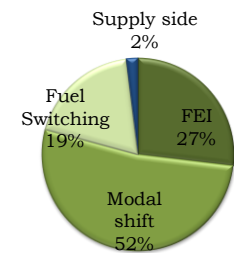
Fuel type	Share in 2030 BAU	Share in 2030 CM
Natural gas	71.4	39.0
Oil	6.6	-
Coal	15.1	23.6
Hydro	4.4	20.5
Nuclear	-	11.2
Renewable energy	2.5	5.7



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

GHG Emissions/Reduction

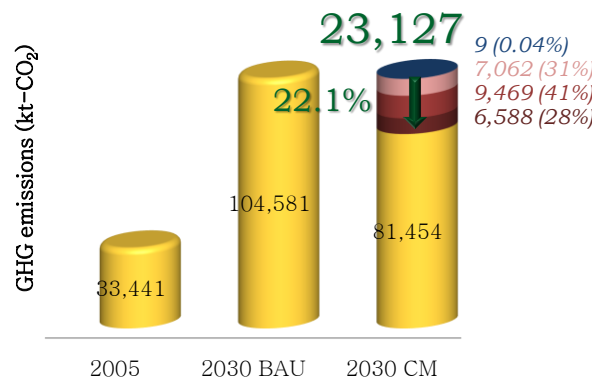
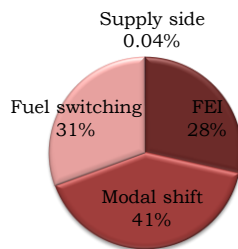
PASSENGER TRANSPORT



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

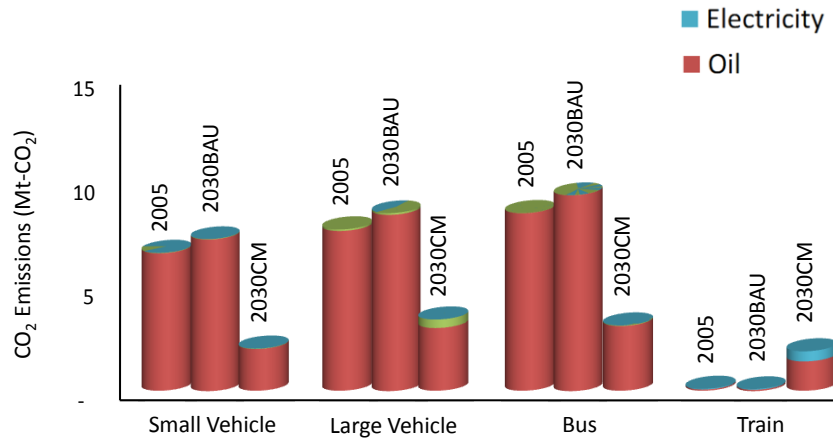
GHG Emissions/Reduction

FREIGHT TRANSPORT



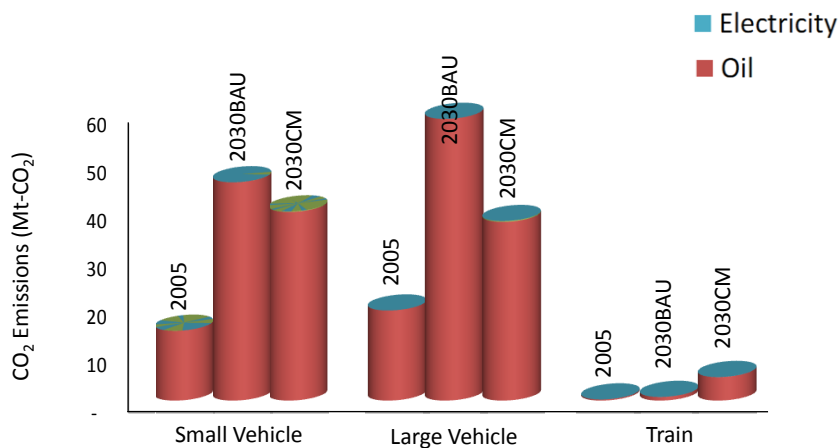
- GHG emissions
- FEI
- Modal shift
- Fuel switching
- EEI (power sector)

CO₂ Decomposition (Passenger Transport)



Remarks: BAU is Business as Usual
CM is Countermeasures

CO₂ Decomposition (Freight Transport)



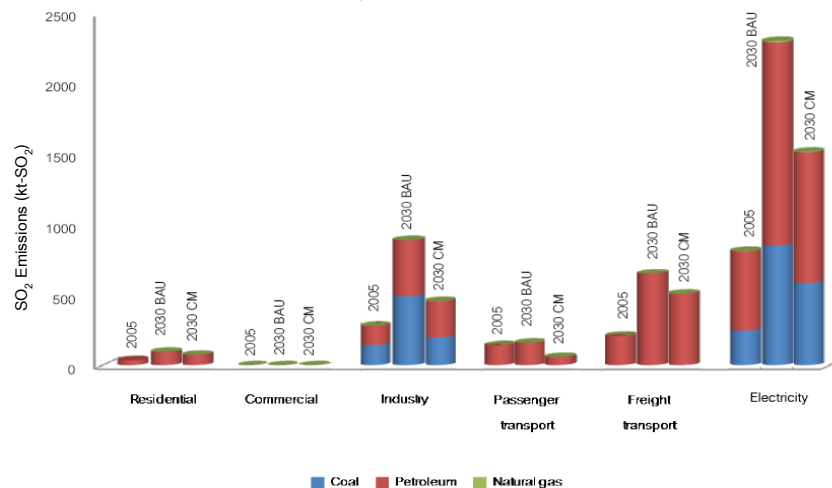
Remarks: BAU is Business as Usual
CM is Countermeasures

CO₂ Emissions/Reductions (kt-CO₂)

	Coal	Petroleum	Natural gas	Biomass	Electricity	Total
2005						
Residential	-	5,767	-	-	15,122	20,889
Commercial	-	-	-	-	22,686	22,686
Industry	26,750	21,988	3,572	-	33,724	86,034
Passenger transport	-	22,798	103	-	33	22,933
Freight transport	-	33,436	3	-	2	33,441
Total	26,750	83,989	3,678	-	71,566	185,983
Share	14.4%	45.2%	2.0%	0.0%	38.5%	100.0%
2030 BAU						
Residential	-	15,416	-	-	40,423	55,838
Commercial	-	-	-	-	101,391	101,391
Industry	91,940	63,972	11,555	-	108,578	276,045
Passenger transport	-	25,722	116	-	37	25,875
Freight transport	-	104,566	10	-	5	104,581
Total	91,940	209,676	11,681	-	250,433	563,730
Share	16.3%	37.2%	2.1%	0.0%	44.4%	100.0%
2030 CM						
Residential	-	11,976	-	-	19,003	30,979
Commercial	-	-	-	-	47,761	47,761
Industry	37,039	41,152	12,953	-	62,410	153,554
Passenger transport	-	9,509	449	-	465	10,423
Freight transport	-	81,158	275	-	21	81,454
Total	37,039	143,795	13,676	-	129,660	324,170
Share	11.4%	44.4%	4.2%	0.0%	40.0%	100.0%

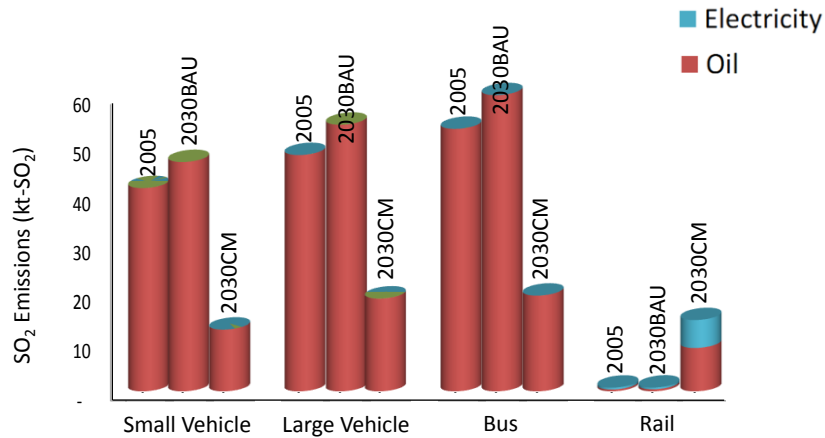
Remarks: BAU is Business as Usual
CM is Countermeasure

Sectoral SO₂ Emissions/Reduction



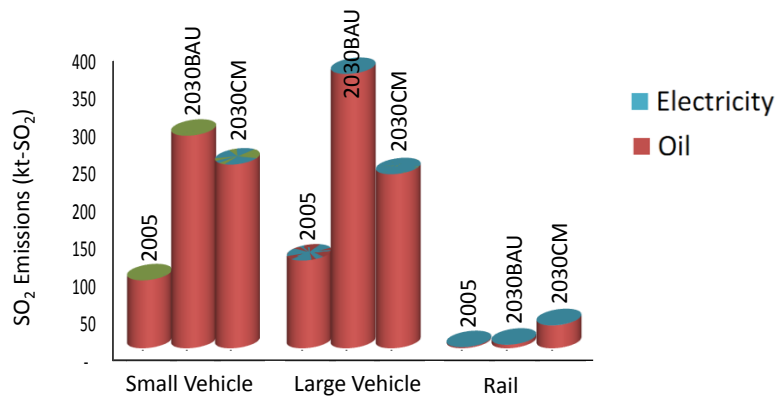
Remarks: BAU is Business as Usual
CM is Countermeasures

SO₂ Decomposition: Passenger Transport



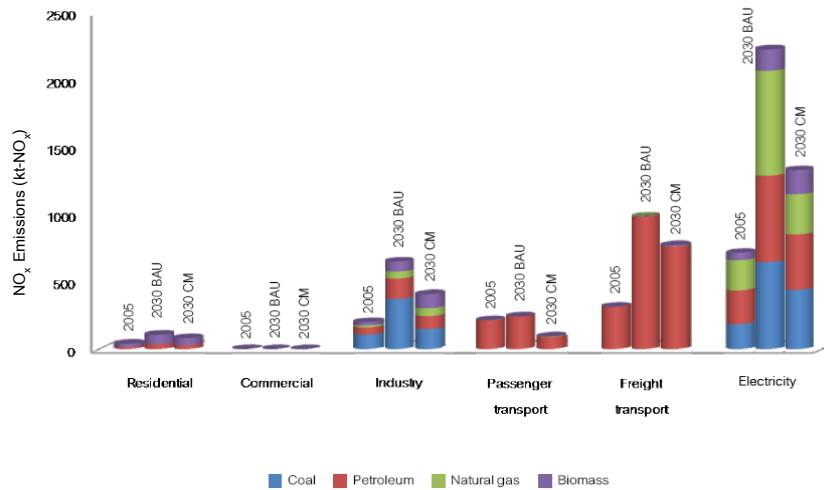
Remarks: BAU is Business as Usual
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SO₂ Decomposition: Freight Transport



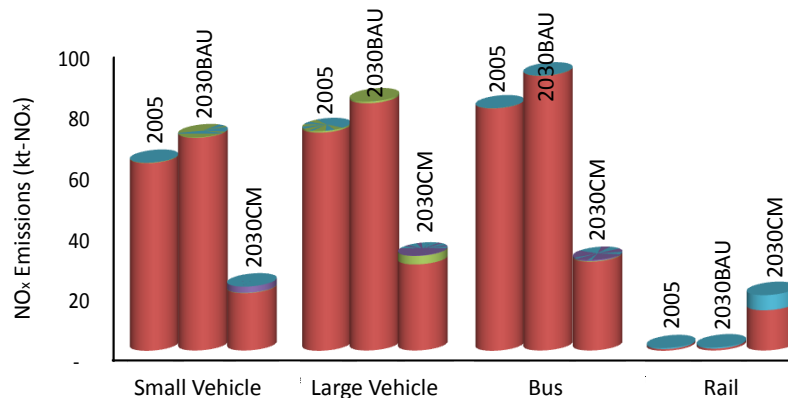
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Sectoral NO_x Emissions/Reduction



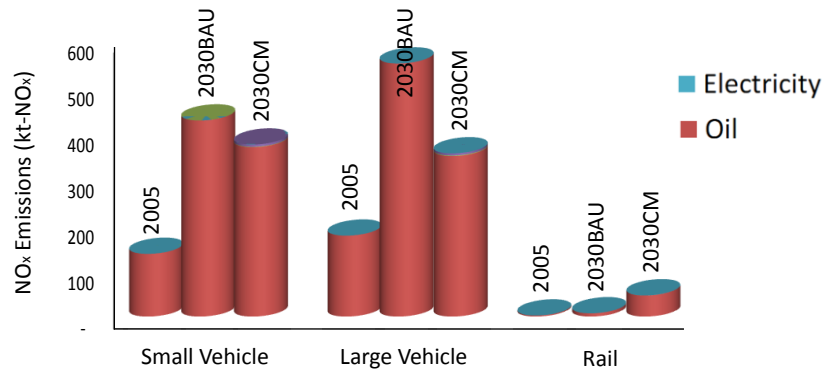
Remarks: BAU is Business as Usual
CM is Countermeasures

NO_x Decomposition: Passenger Transport



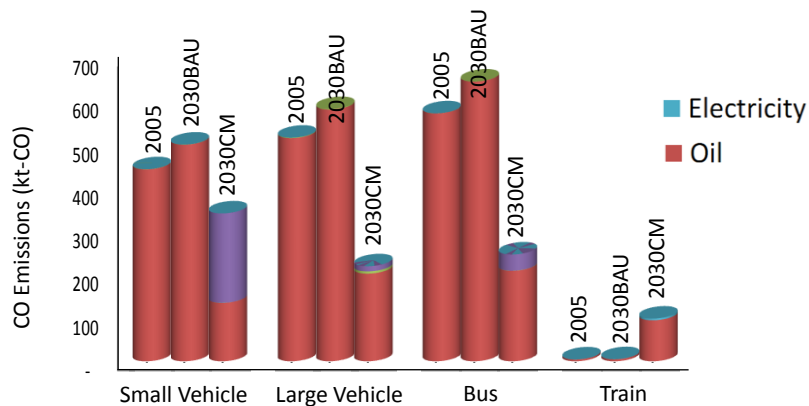
Remarks: BAU is Business as Usual
CM is Countermeasures

NO_x Decomposition: Freight Transport



Remarks: BAU is Business as Usual
CM is Countermeasures

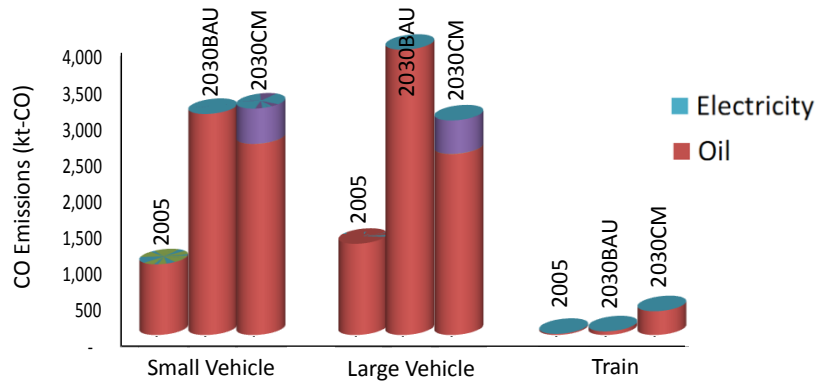
CO Decomposition : Passenger Transport



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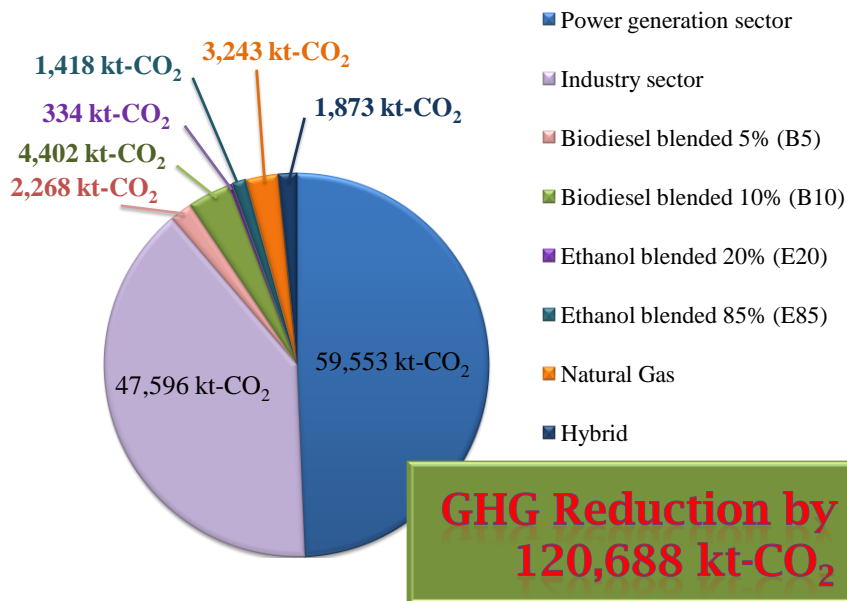
CO Decomposition: Freight Transport



Remarks: BAU is Business as Usual
CM is Countermeasures



GHG Mitigation by fuel types



Conclusions on Thailand's LCS Transportation

- 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 CMs in transport sector, GHG emissions can be decrease by 38,581 kt-CO₂ or by 29.5%.
- If those policies are planned in early stage, Thailand will be able to serve as a model for LC transportation.

- However, to increase more CO₂ mitigation, appropriate CMs & advanced technologies are needed under National Appropriate Mitigation Actions (NAMAs)

THANK YOU
ขอบคุณครับ