SIIT-TU

LOW CARBON SOCIETY RESEARCH NETWORK 4TH MEETING

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St. Anne's College, Oxford, UK

Regional Co-operation: Asian case study

"Development of Thailand's NAMAs for low-carbon green growth"

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Background

- Developing countries are involved in GHG mitigation by the framework called Nationally Appropriate Mitigation Actions (NAMAs).

- Presently Thailand is categorized in Non Annex-I countries, and Thailand has no commitment to any quantitative objectives under the Kyoto Protocol.

- Thailand is not obligated in GHG mitigation; but to show an intention of being the main supporter for GHG mitigation in the East Asia, Thailand has to be ready for the coming strategies in the proposed NAMAs.

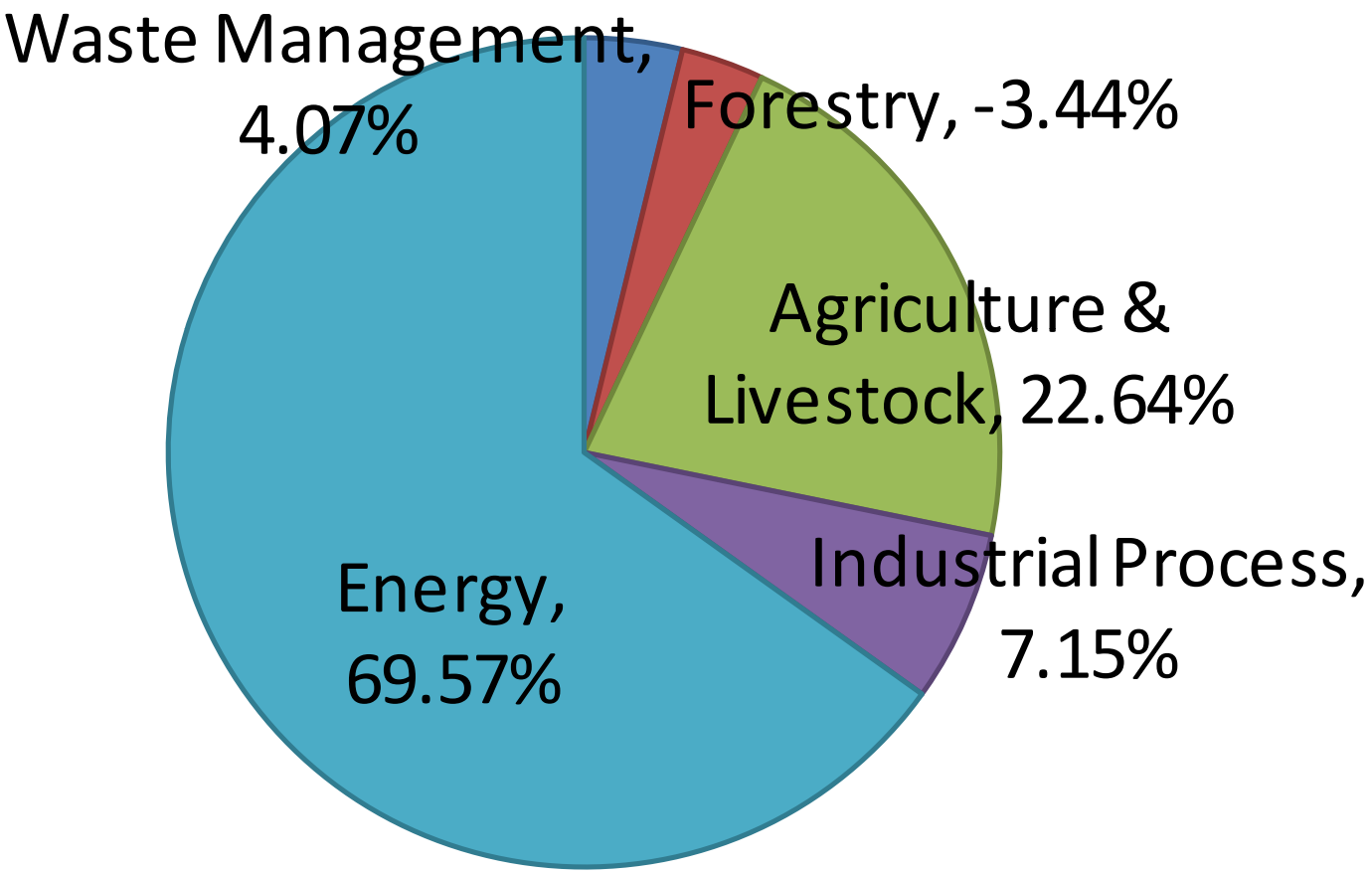
Rationale

- ***"NAMAs aimed at achieving a deviation in emissions relative to 'business-as-usual' emissions in 2020".***

- Low carbon growth/low carbon society concept is complied with the "Self-sufficiency economy" in Thailand.

- GHG reduction level in Thailand's NAMAs must be reasonable and achievable.

Figure 1 Thailand CO_2 emissions by sectors in 2000



Source: Thailand's Second National Communication, (ONEP, 2011)

Table 1 Increasing national energy demand forecast is offset by RE and EE Action Plans in PDP forecast

Year	Actual	PDP Forecast	Mitigation Credit
	kt-CO_2	kt-CO_2	kt-CO_2
2005	192,724	192,945	220
2006	197,241	201,126	3,885
2007	201,640	205,732	4,092
2008	204,547	208,031	3,484
2009	205,794	213,840	8,046
2010	217,713	217,794	81
Total CO_2 reduction (Mt-CO_2)			**19.59**

Note: PDP = power development plan of Ministry of Energy.

Low Carbon Development in Thailand's NAMAs

STEPS to LCG Thailand

1. Development of CO_2 Emissions in the BAU 2020
2. CO_2 counter-measures: Renewable electricity
3. CO_2 CMs: Energy efficiency in buildings
4. CO_2 CMs: Energy efficiency in industries
5. CO_2 CMs: Biofuels in transportation: Ethanol
6. CO_2 CMs: Biofuels in transportation: Biodiesel 1st Gen
7. CO_2 CMs: Biofuels in transportation: Biodiesel 2nd Gen
8. CO_2 CMs: Improving fuel economy
9. CO_2 CMs: New transport system
10. Consensus building: workshops

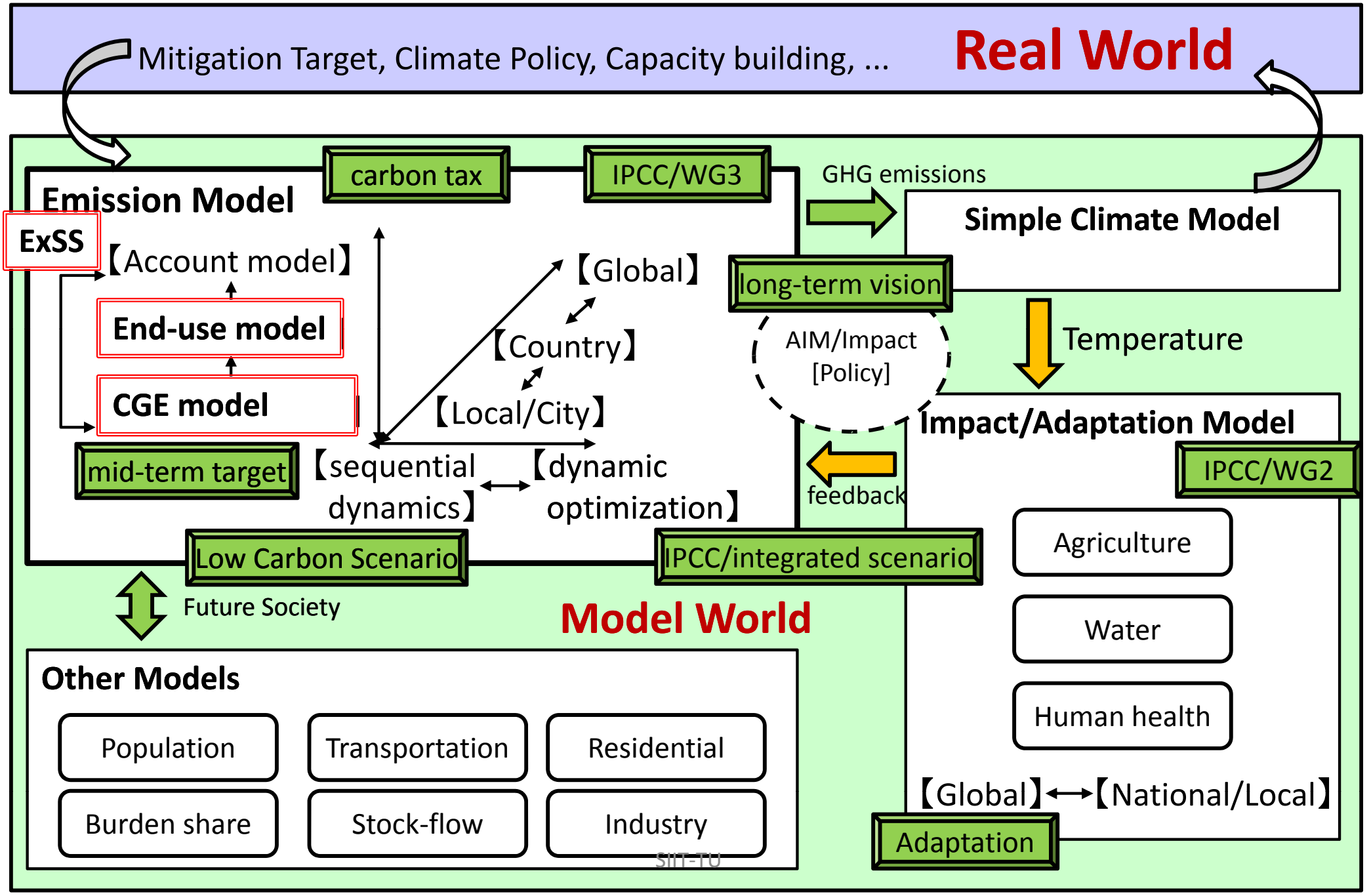
Roadmap to Thailand's NAMAs

Analysis Tools for the BAU and LCG

"**AIM/Enduse**" model.

The Asia-Pacific Integrated Model (AIM) has been developed by National Institute for Environmental Studies (NIES) JAPAN as the first integrated assessment model focusing on Asia which was used to evaluate policy options on sustainable development particularly in the Asia Pacific region.

Structure of AIM model (NIES, Japan)



Key concept of AIM/Enduse Modeling (NIES, Japan)

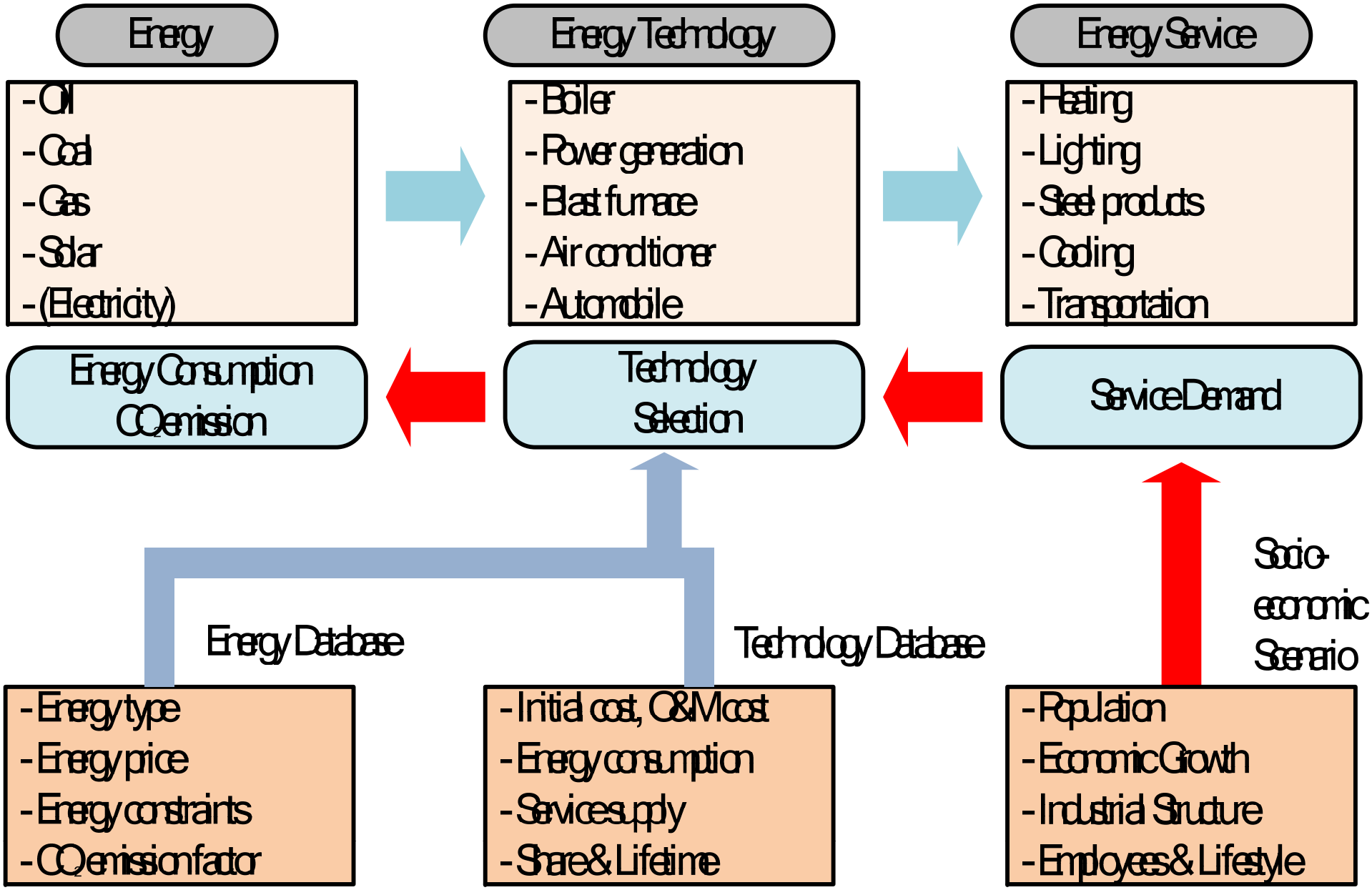


Figure 2 Socio-economic assumption: Forecast of population and GDP

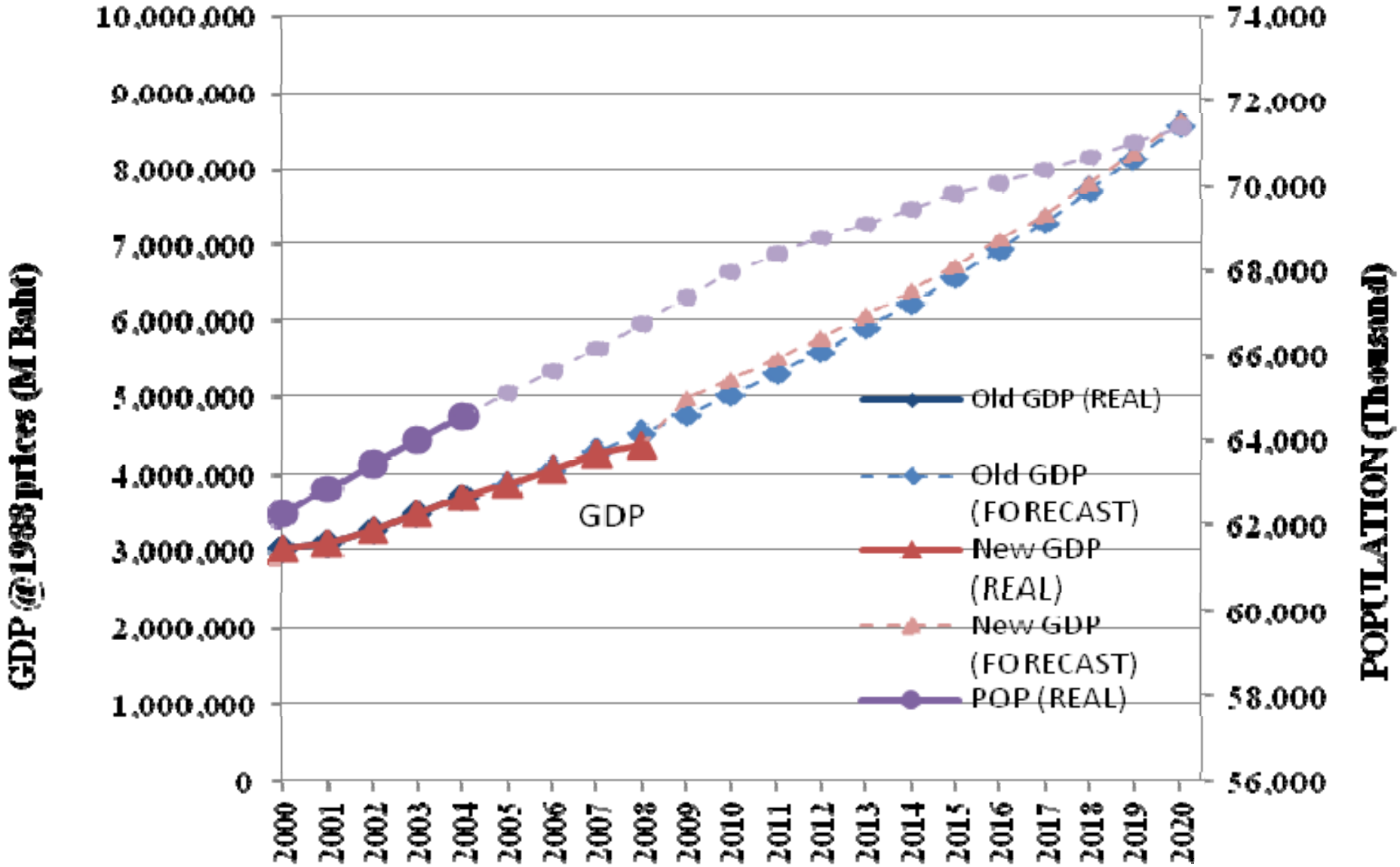


Figure 3 CO_2 Emissions in the BAU 2020

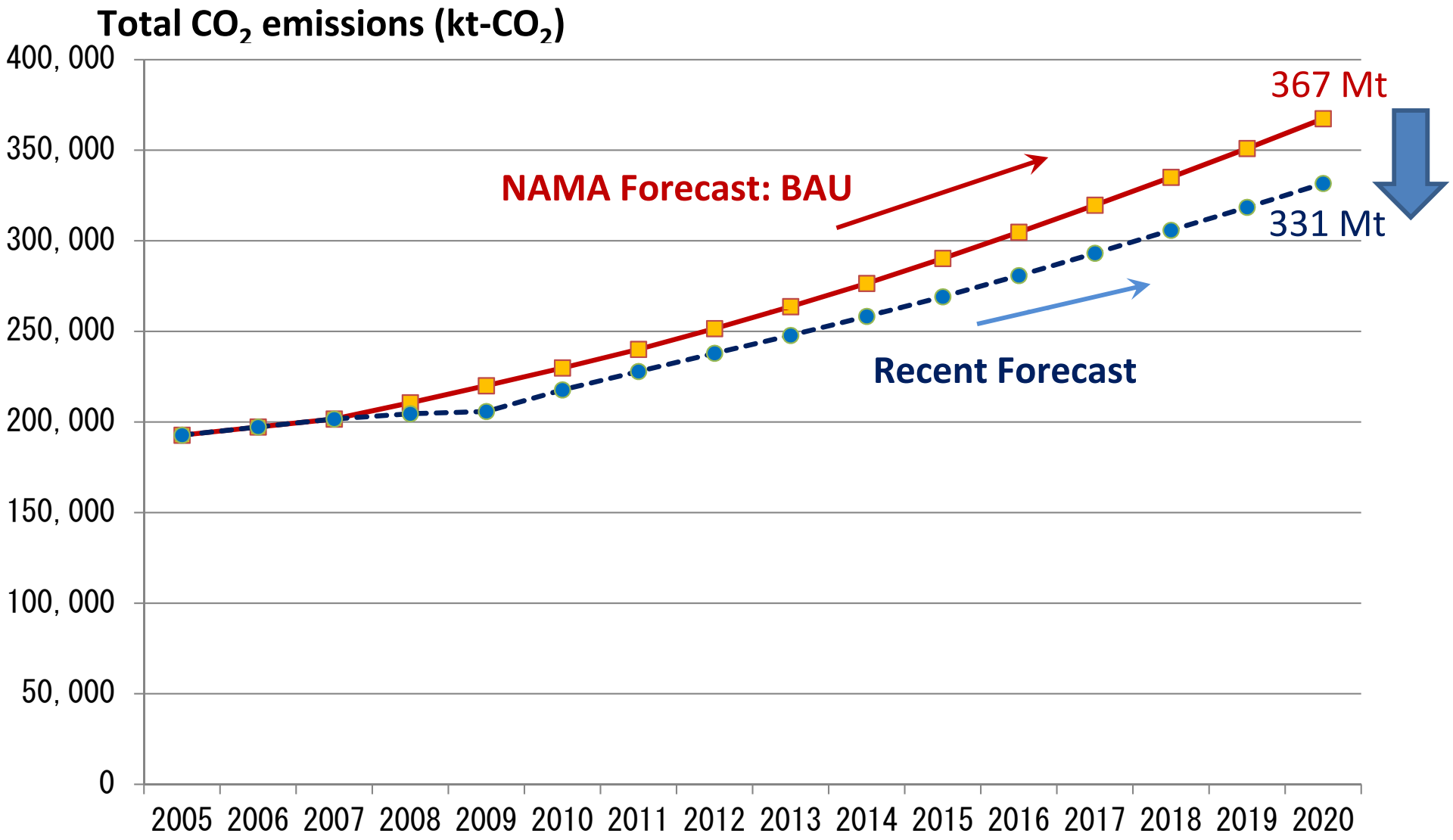
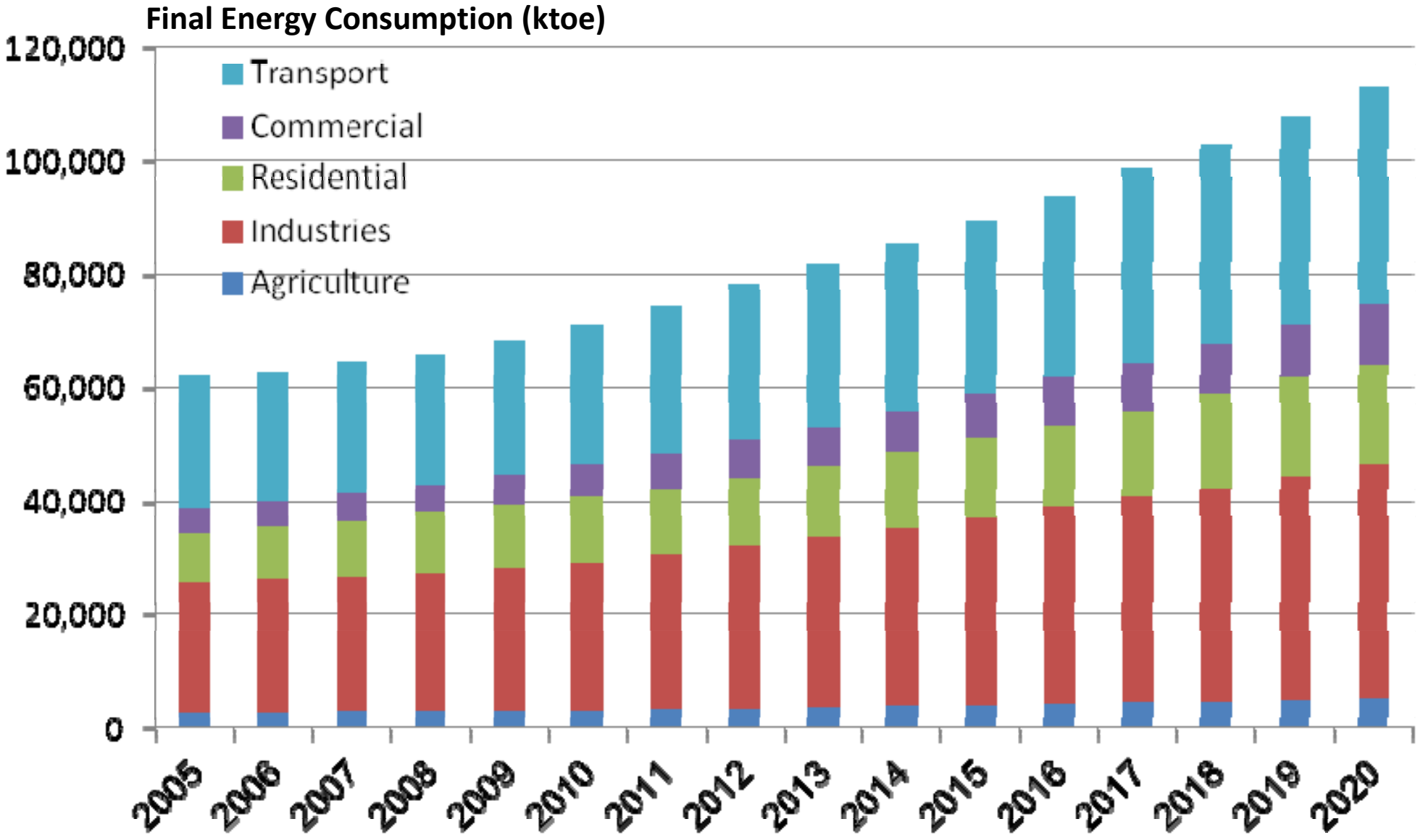


Figure 4 Sectoral Energy Consumption in the BAU 2020



Potential of CO_2 Mitigation: Thailand's NAMAs

Roadmap to Low-Carbon Growth

Renewable Electricity Generation

Table 2.1 Adders for RE power in AEDP 25% (2012 updated)

Renewable Energy	Adder price (Baht/kWh)*	20% target (2011)	25% new target 2012-2021
1.Biomass	0.3-0.5	3,700 MW →	**3,630 MW**
2.Biogas	0.3-0.5	120 MW →	**600 MW**
3. Waste	2.5-3.5	160 MW →	**160 MW**
4. Wind	3.5-4.5	800 MW →	**1200 MW**
5. Hydropower	0.8-1.5	324 MW →	**1,608 MW**
6. Solar	6.5	500 MW →	**2,000 MW**
7.Others	-	-	**3 MW**
Total Capacity		5,604 MW →	**9,201 MW**

Source :
Alternative Energy Development Plan (AEDP) 2012.
Department of Alternative Energy Development and Efficiency (DEDE, 2012).

Table 2.2 Electricity production from AEDP 25% (2012 updated)

Renewable Energy	Current capacity (MW) 2011	Accumulated capacity in 2021 (MW)	Electricity Generation (GWh/yr) in 2021
1.Biomass	1,751.86	3,630	14,008
2.Biogas	138	600	1,050
3. Waste	13.45	160	518
4. Wind	7.28	1200	1,283
5. Small-hydropower	86.39	1,608	5,604
6. Solar	75.48	2,000	2,484
7.Others (geothermal, wave energy)	0.350	3	10
Total	**2,072.81**	**9,201**	24,957

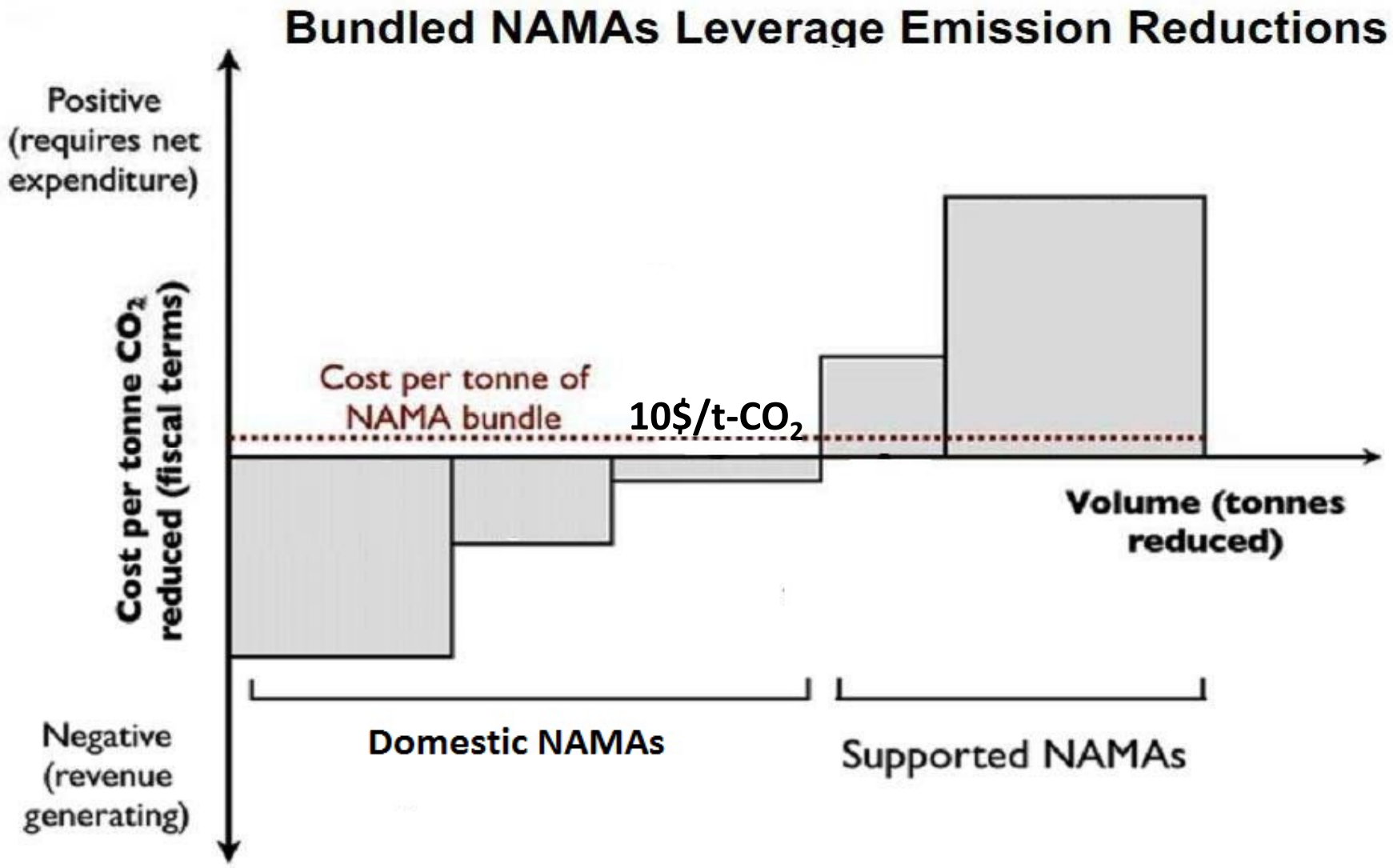
Source :
Alternative Energy Development Plan (AEDP) 2012.
Department of Alternative Energy Development and Efficiency (DEDE, 2012).

Criterion to NAMAs
(Domestic vs. Internationally supported)

1. Marginal Abatement Costs

Domestic vs. Internationally Supported NAMAs

===> Abatement Cost ($/t-$CO_2$) <===



Potential of Thailand's NAMAs: MAC
RE Power (by AIM/Enduse)

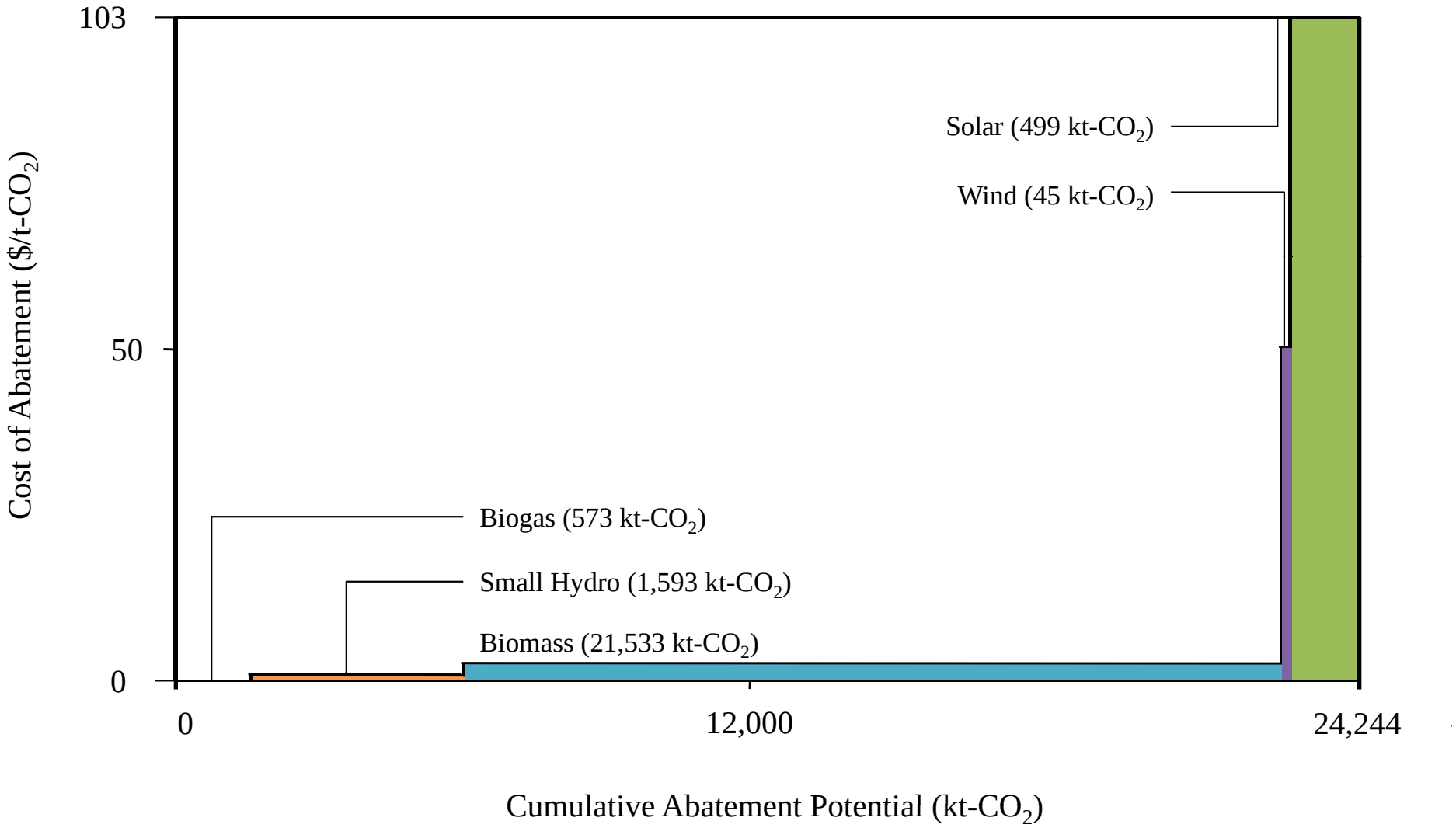


Table 3 Potential of CO_2 Mitigation in 2020
Renewable Power Generation (by AIM/Enduse)

NAMAs	CO_2 Counter measure	MAC ($/t-$CO_2$)	Potential of CO_2 mitigation in 2020 (kt-CO_2)
Domestic NAMAs	Biogas	0.02	51.7
	Small Hydro	0.69	237.0
	Biomass	2.67	2,340.0
Supported NAMAs	Wind	51.88	4.1
	Solar	102.81	41.5
			Total 2,674

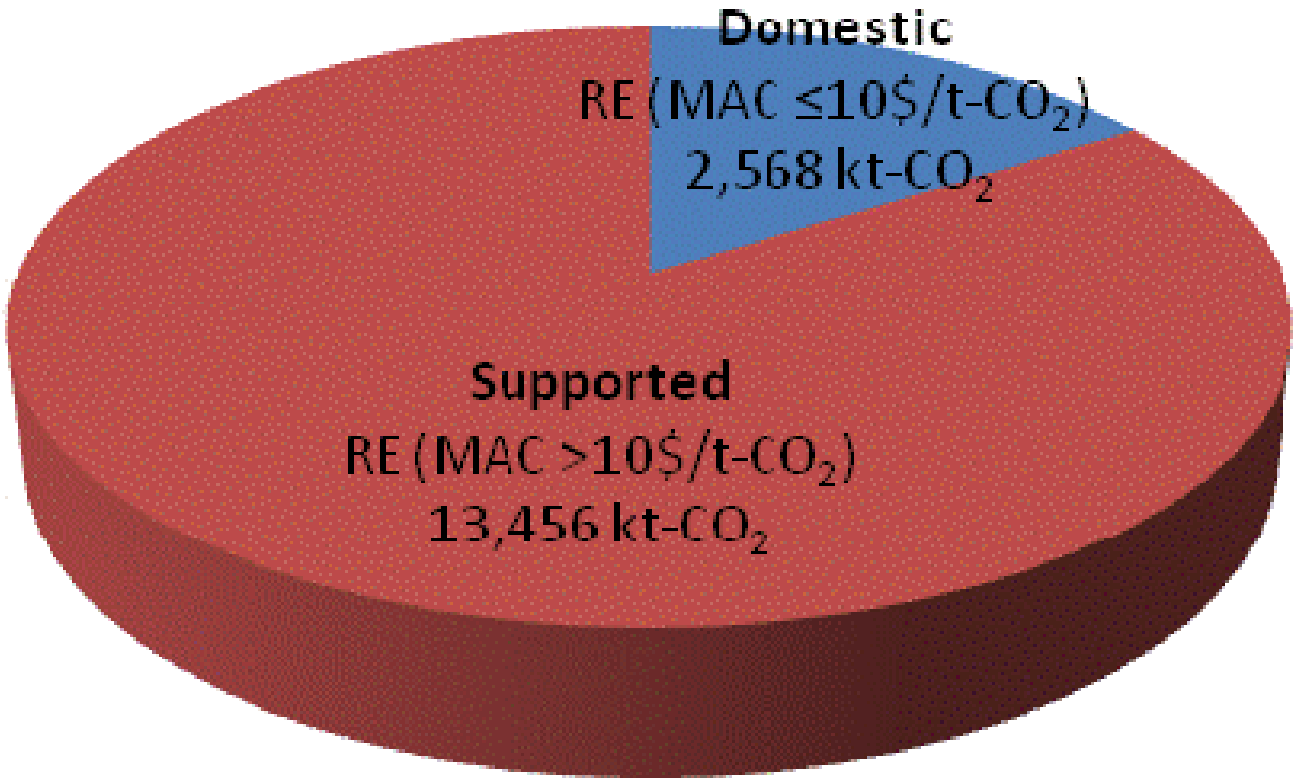
Table 4 Identified CO_2 Mitigation in 2020
Waste to Energy (by AIM/Enduse)

NAMAs	CO_2 Counter measure	MAC ($/t-$CO_2$)	Potential of CO_2 mitigation in 2020 (kt-CO_2)
Internationally Supported NAMAs	Local Landfill	32.8	42.6
	Incinerator	140.6	6.3
	Biogas Digester	164.7	11.6
	Controlled Landfill	395.3	0.3
			Total 60.8

Table 5 CO_2 emissions in the cases of AEDP 2012 vs. MAC

	Energy ($kt\text{-}CO_2$)	AEDP (RE) ($kt\text{-}CO_2$)	RE-MAC ($kt\text{-}CO_2$)
2010	217,713	6,409	1,163
2011	227,879	6,409	1,287
2012	237,936	7,467	1,410
2013	247,776	8,513	1,533
2014	258,296	9,475	1,657
2015	269,105	10,451	1,780
2016	280,812	11,420	1,959
2017	293,148	12,401	2,138
2018	305,813	13,525	2,317
2019	318,496	14,643	2,495
2020	331,663	16,024	2,568

Figure 5 Potential of CO_2 Mitigation in 2020
AEDP 2012 - RE power



Note: AEDP = Alternative Energy Development Plan of DEDE.

Table 6 Potential of CO_2 Mitigation in 2020
AEDP 2012 - RE power

NAMAs	CO_2 Countermeasures	CO_2 reduction in 2020 ($kt\text{-}CO_2$)
Domestic NAMAs	RE Power (MAC < 10 $/t-$CO_2$)	2,568
	Sub-total	*2.6 Mt-CO_2*
Internationally supported NAMAs	RE Power (MAC > 10 $/t-$CO_2$)	13,456
	Sub-total	*13.5 Mt-CO_2*
Total Domestic and Supported NAMAs		**16.0 Mt-CO_2**

Potential of CO_2 Mitigation

Energy Efficiency Improvement in Buildings

Criterion: Building Codes (Designated Buildings)

Figure 6 Shares of electricity consumption of large buildings in MEA & PEA (2007)

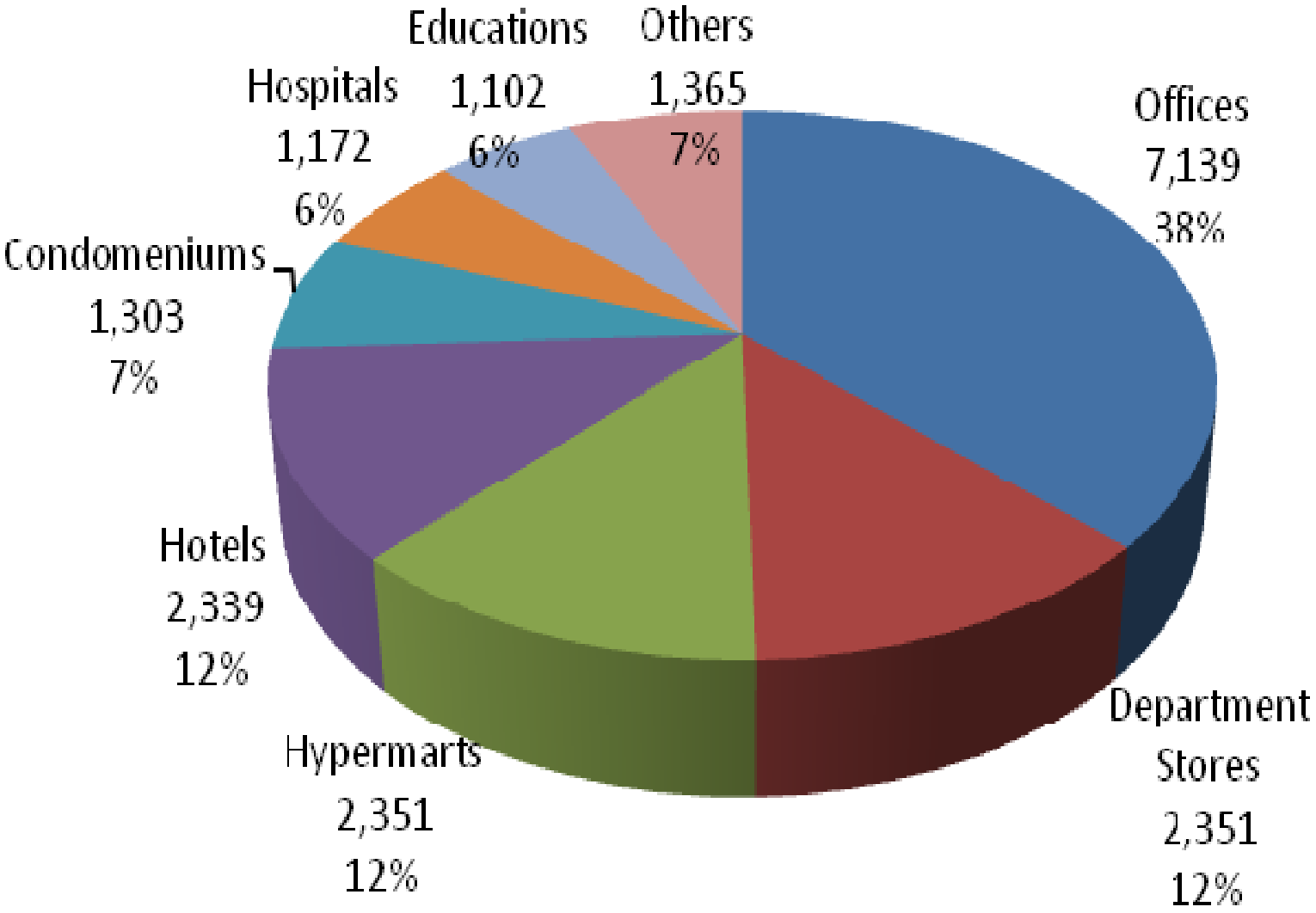


Figure 6 Total electricity use (GWh) in the building sector (DEDE, 2005-2009)

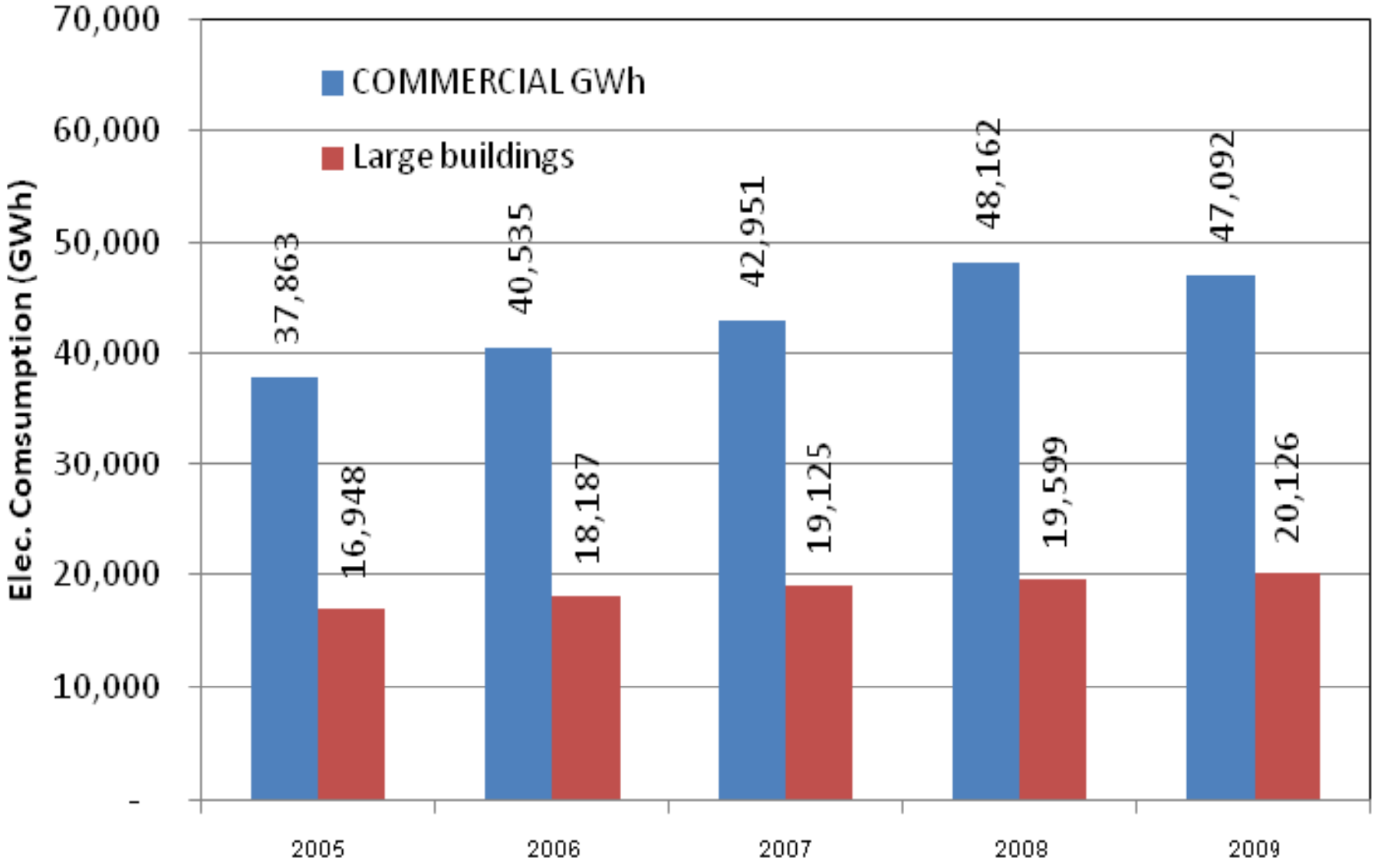


Figure 7 Potentials of savings in building codes, HEPS, and ZEB scenarios in large buildings (EPPO, 2011)

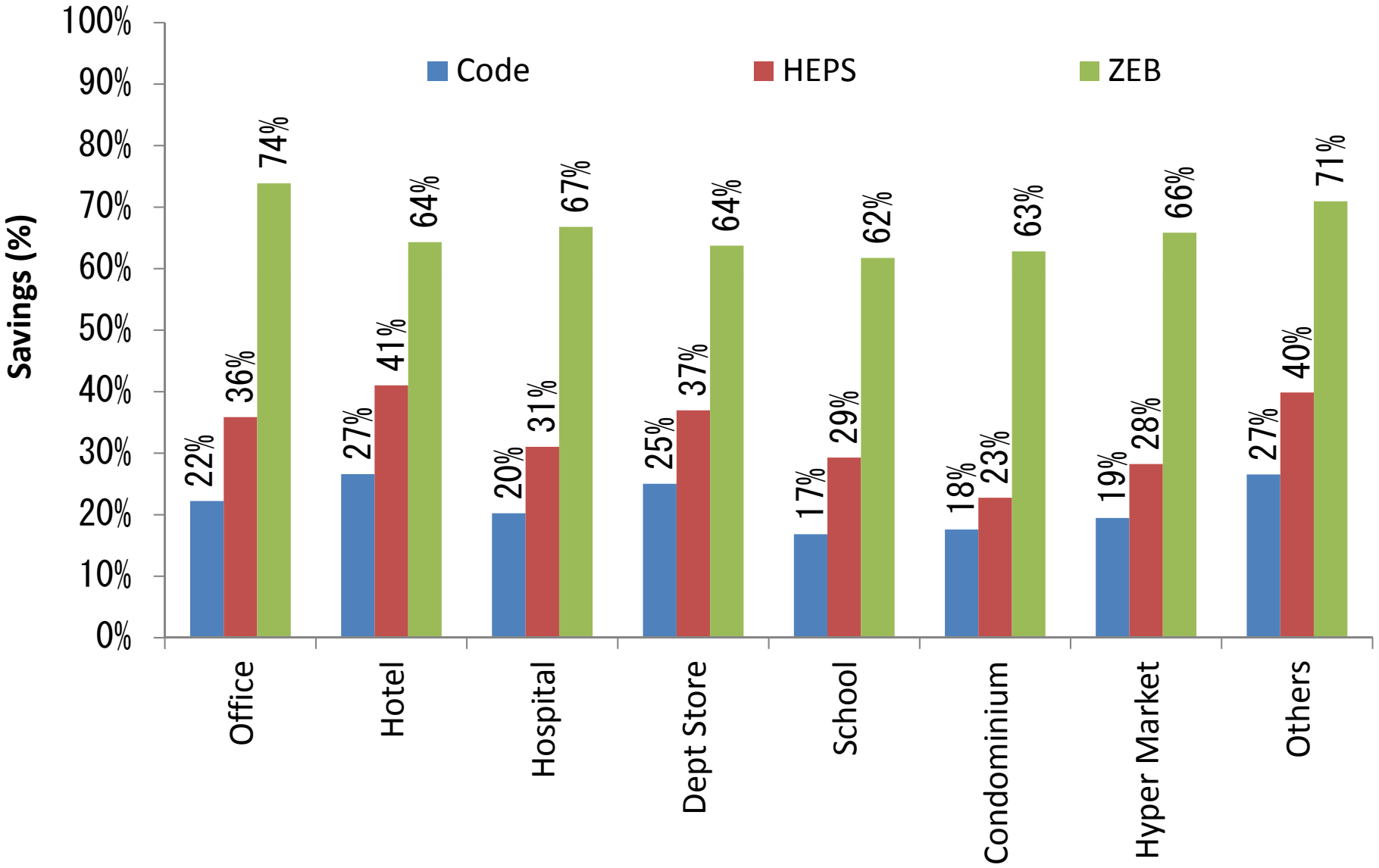
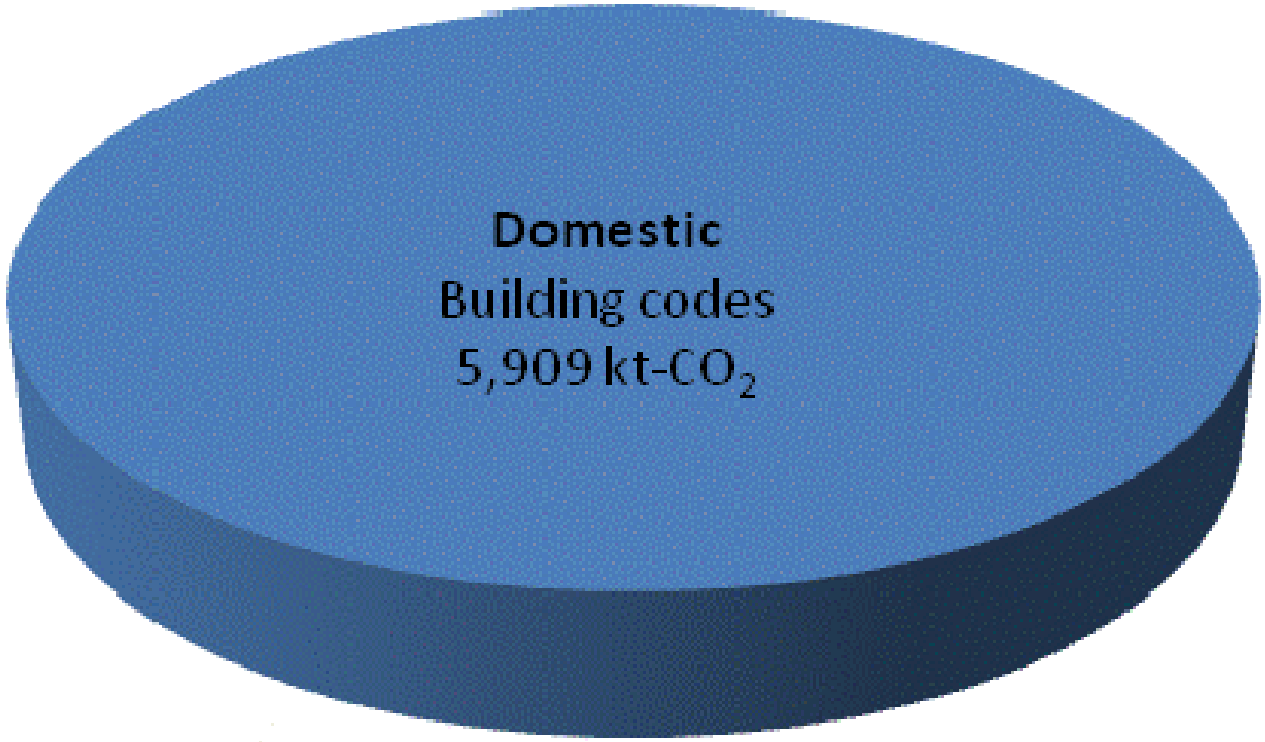


Figure 8 Potentials of CO_2 Mitigation in 2020
Building Codes



Potential of CO_2 Mitigation

Energy Efficiency Improvement in Industries

Criterion: Designated Factories

Table 7 Potential of CO_2 Mitigation in 2020
Energy efficiency improvement in large industries

NAMAs	CO_2 Counter measure	MAC ($/t-$CO_2$)	Potential of CO_2 mitigation in 2020 (kt-CO_2)
Domestic NAMAs	Lighting system	0.04	700
	Cooling system	0.11	833
	Motor	2.47	714
	Industrial furnace	10.33	2,515
Inter. Supported NAMAs	kiln	20.39	1,747
	Industrial boilers	37.73	7,996
			Total 14,505

Figure 9 Potentials of CO_2 Mitigation in 2020
Energy efficiency improvement in large buildings & factories

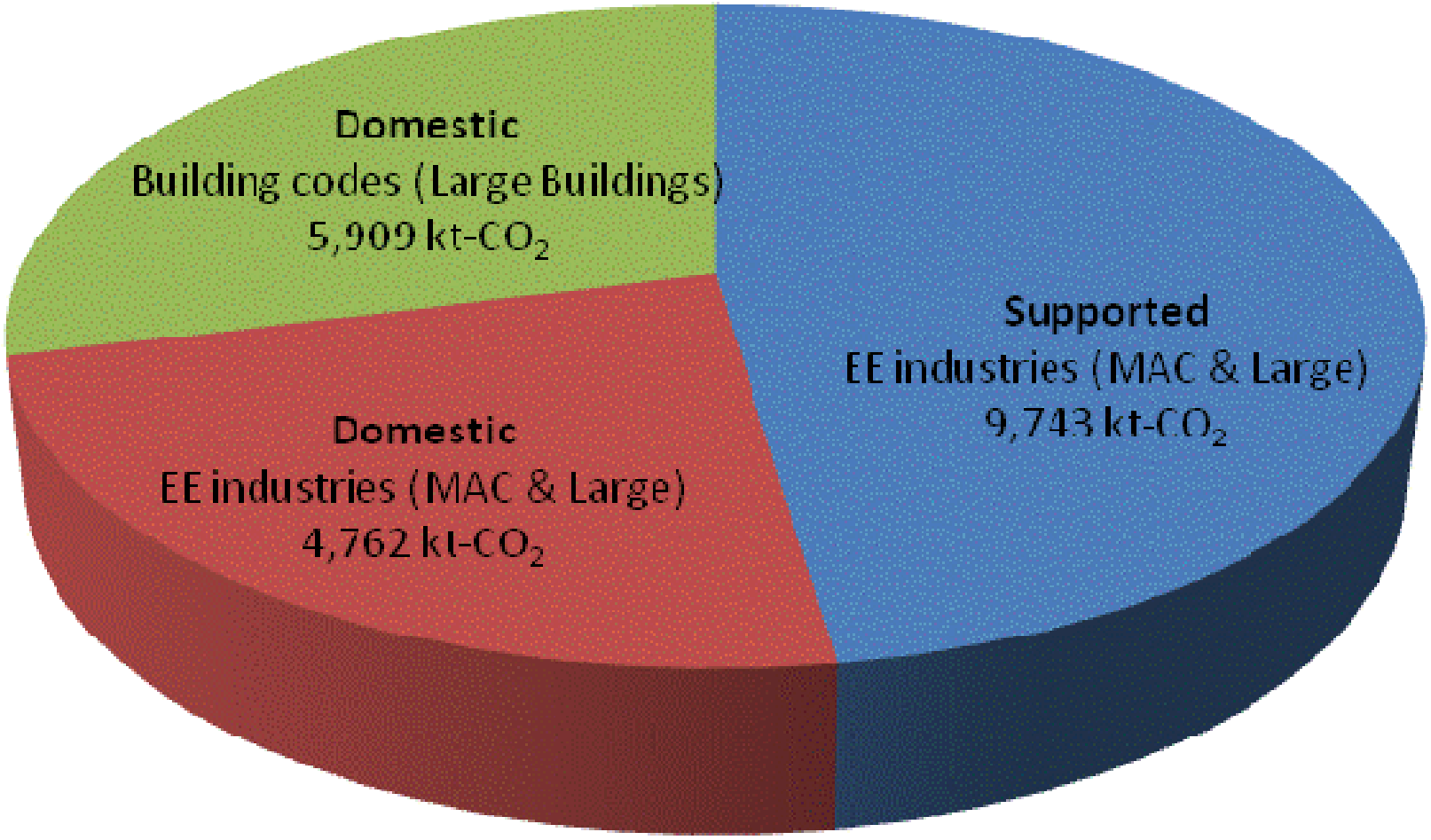


Table 8 Potential of CO_2 Mitigation in 2020
Large Buildings and Industries

NAMAs	CO_2 Countermeasures	CO_2 reduction in 2020 ($kt\text{-}CO_2$)
Domestic NAMAs	EE Industries (MAC & Large)	4,762
	Building Codes (Large)	5,909
	Sub-total	*10.7 Mt-CO_2*
Supported NAMAs	EE Industries (MAC & Large)	9,743
	Sub-total	*9.7 Mt-CO_2*
Total Domestic and Supported NAMAs		**20.4 Mt-CO_2**

Economics of CO_2 CMs: *RE Power Generation in Thailand*

Renewable Energy	CO_2 CM	IRR (without Adders)	IRR (with Adders)
Domestic NAMAs	**Biogas**	9 %	14%
	Small Hydro	5 %	12%
	Biomass	4 %	11%
Internationally Supported NAMAs	**Wind**	2 %	11 %
	Solar	NA	9%

Economics of CO_2 CMs: *Energy Efficiency in Industries in Thailand*

EE in Industries	CO_2 CM	Payback Period
Domestic NAMAs	**EE Lighting**	3.5 years
	EE Cooling	3.0 years
	EE Motors	3.0 years

Potential of CO_2 Mitigation

Fuel Substitution in Transportation

Figure 10 Targets of bio-fuels in 2020

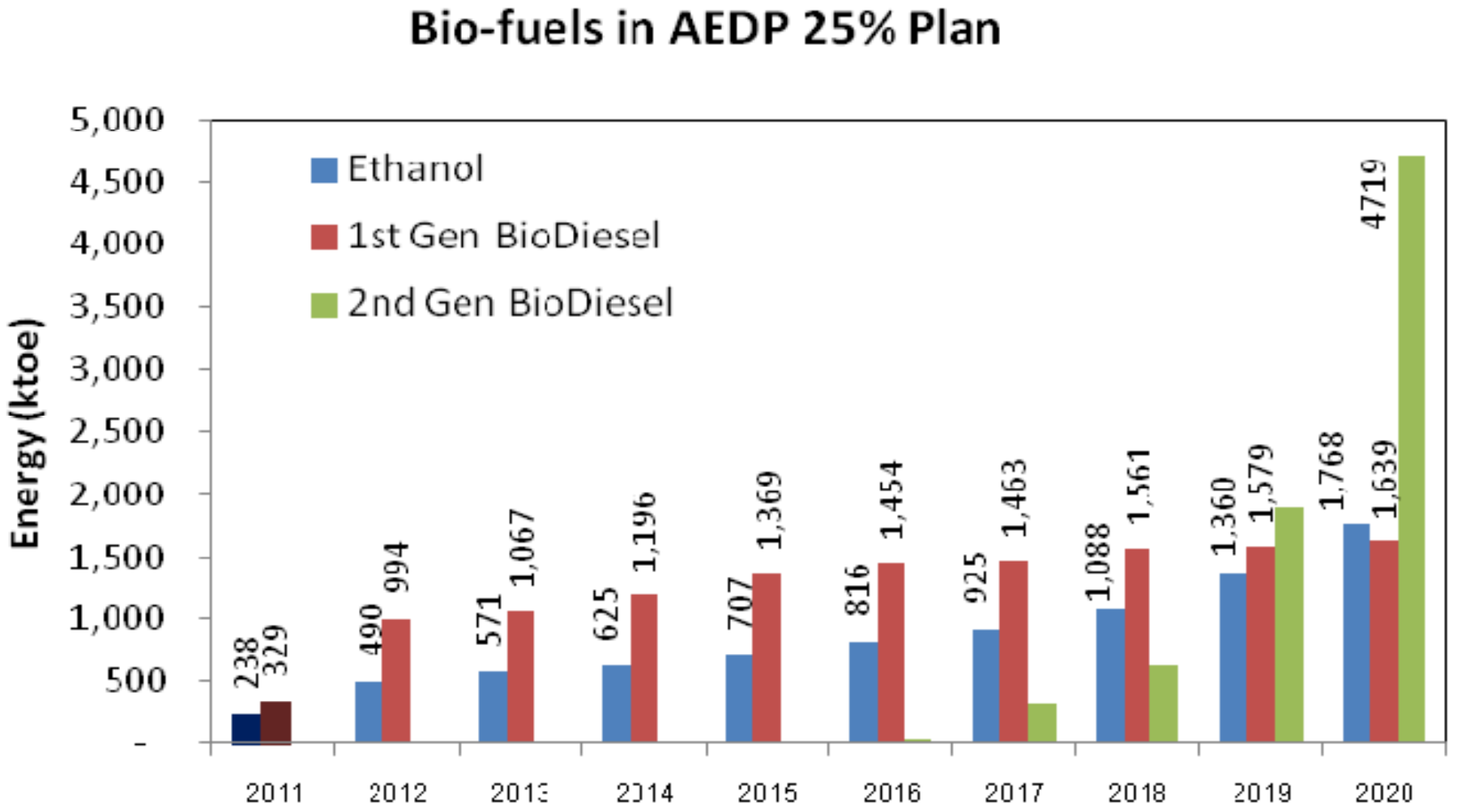


Figure 11 CO_2 mitigation by Ethanol in 2020

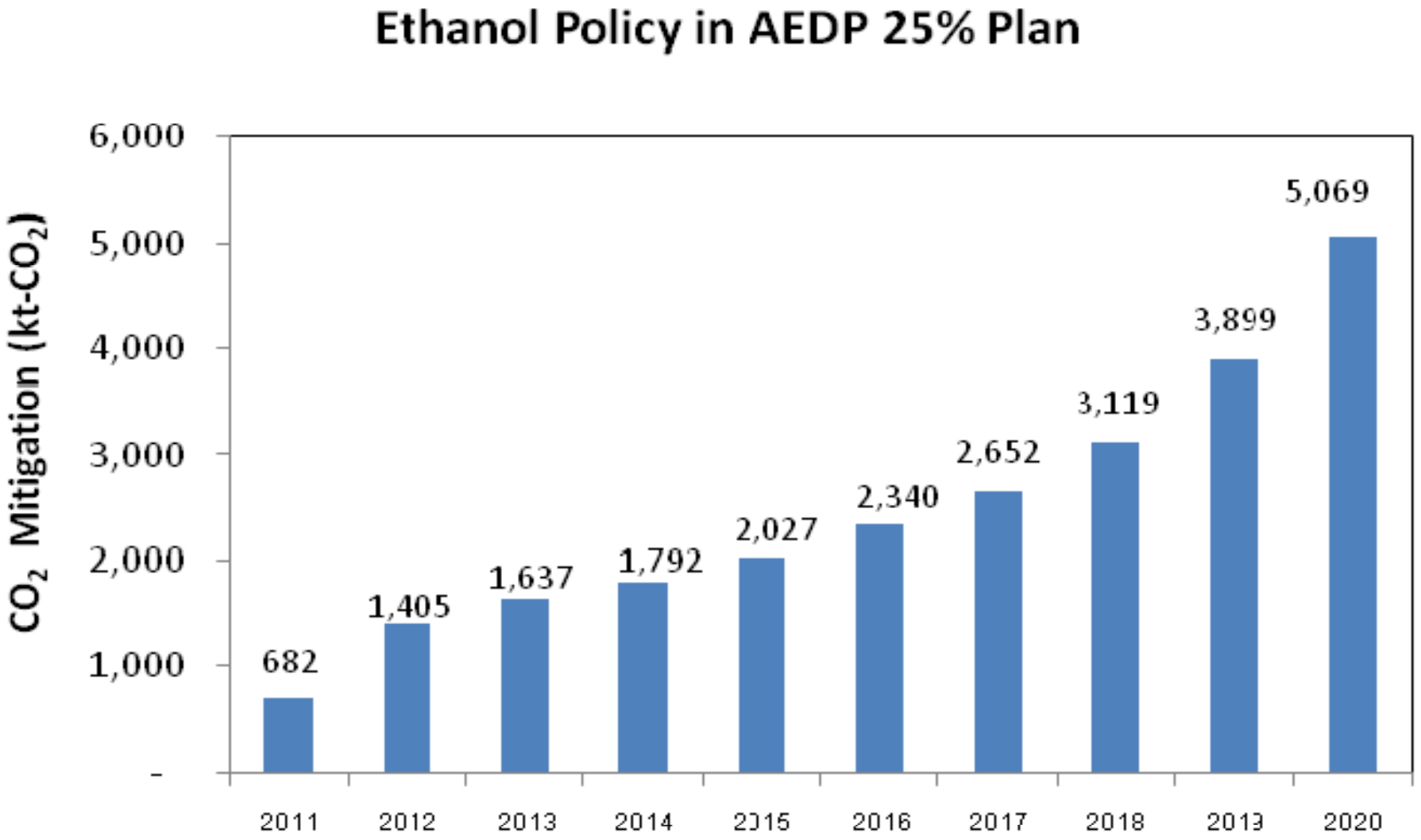


Figure 12 CO_2 mitigation due to biodiesel policy in AEDP (Biodiesel 1st & 2nd Generation)

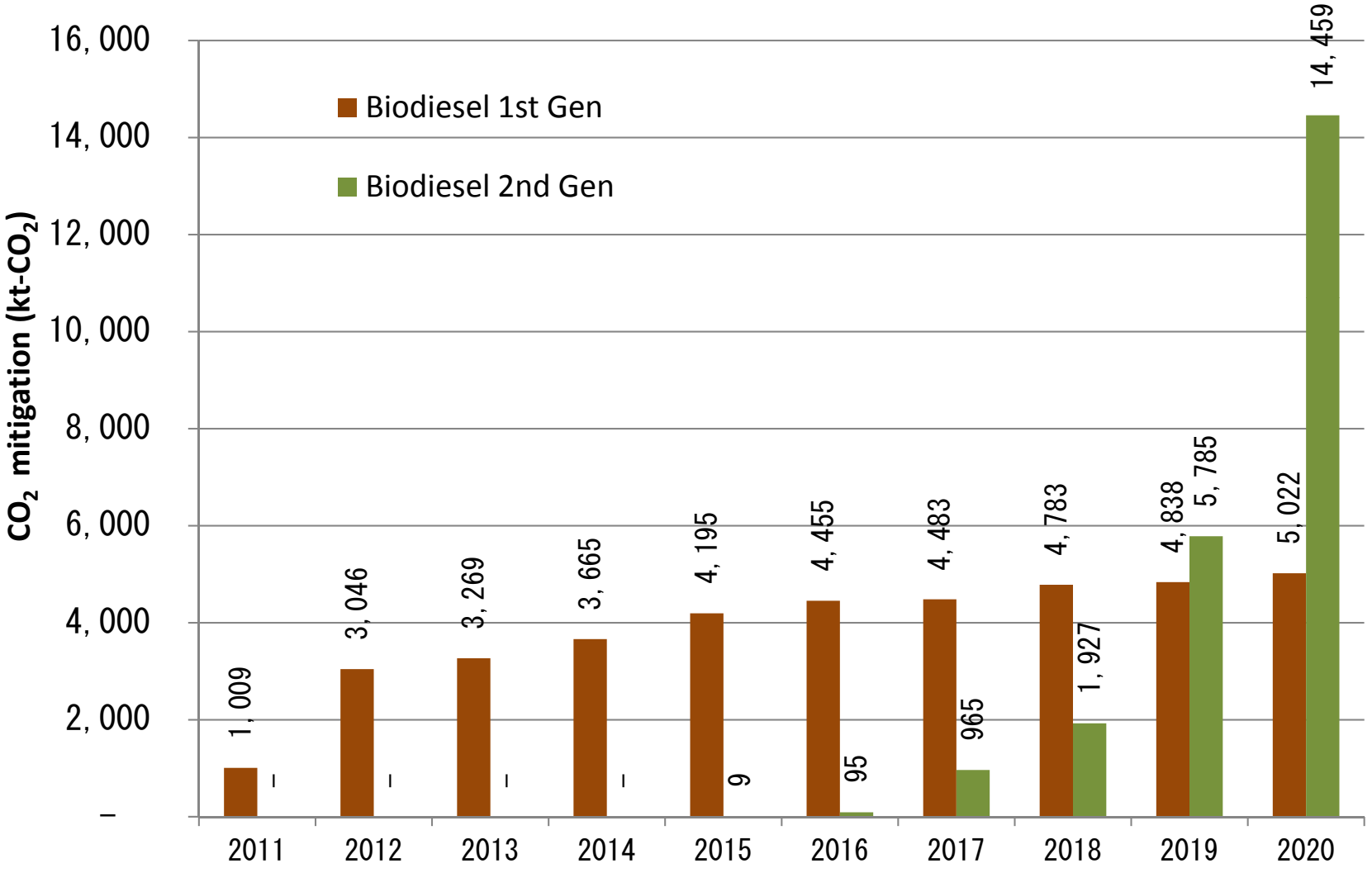


Figure 13 Potentials of CO_2 Mitigation in 2020
Transport Sector

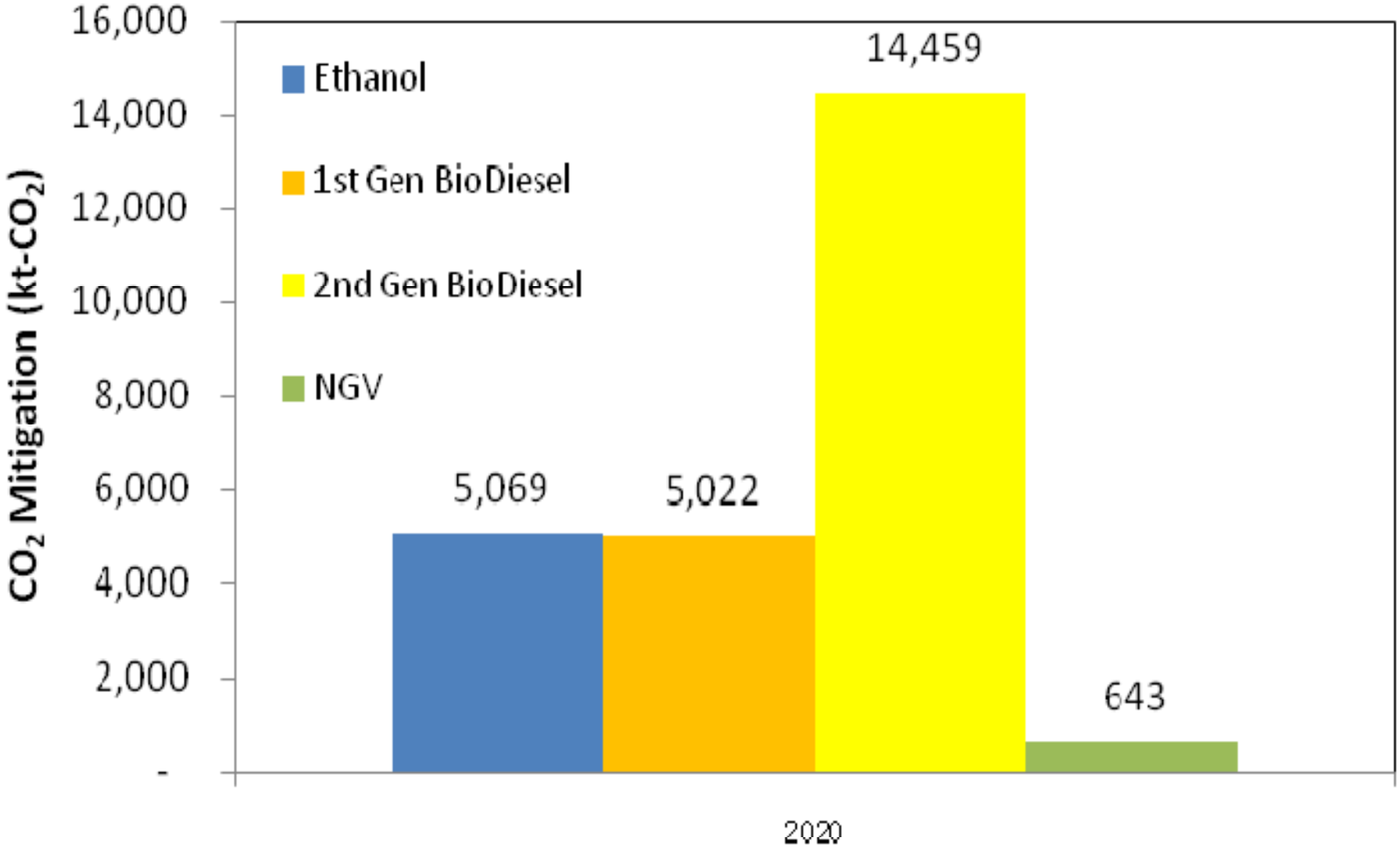


Figure 14 Potentials of CO_2 reduction in 2020
Transport Sector

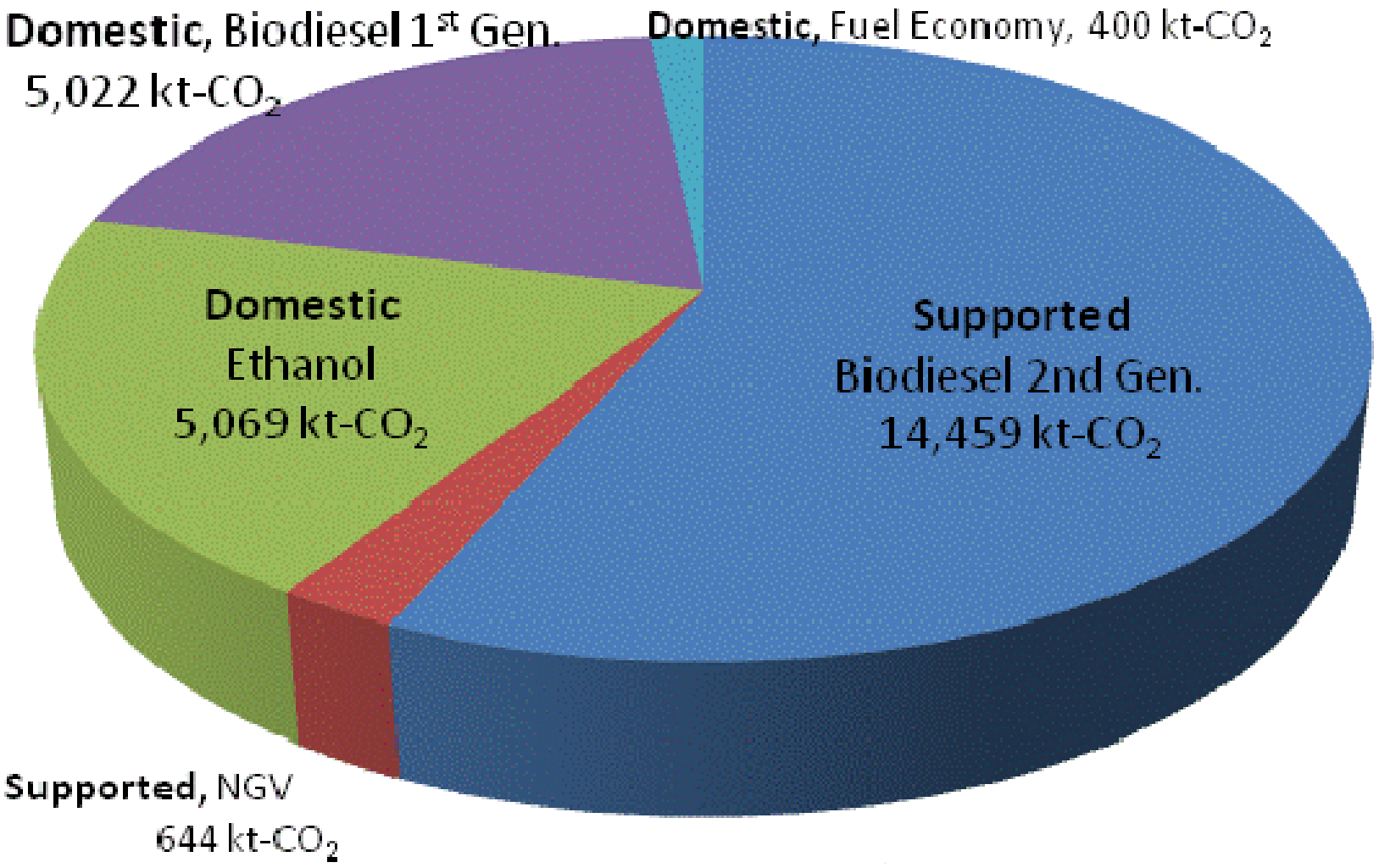


Table 9 Potential of CO_2 mitigation in 2020
Transport sector

NAMAs	CO_2 Countermeasures	CO_2 reduction in 2020 ($kt\text{-}CO_2$)
Domestic NAMAs	Transport/Ethanol (AEDP)	5,069
	Transport/Biodiesel 1st Gen	5,022
	Improving Fuel Economy	400
	Sub-total	*10.5 Mt-CO_2*
Internationally supported NAMAs	Transport/Biodiesel 2nd Gen	14,459
	Transport/NGV	644
	Sub-total	*15.1 Mt-CO_2*
Total Domestic and Supported NAMAs		**25.6 Mt-CO_2**

Table 10 Potential of CO_2 Mitigation in Thailand NAMAs

NAMAs	CO_2 Countermeasures	CO_2 reduction in 2020 (kt-CO_2)
Domestic NAMAs	RE Power (MAC < 10$/t-$CO_2$)	2,568
	EE Large Industries (MAC < 10$/t-$CO_2$)	4,762
	Building Codes (Large buildings)	5,909
	Transport/Ethanol (AEDP 2012)	5,069
	Transport/Biodiesel 1st Gen (AEDP 2012)	5,022
	Improving Fuel Economy	400
	Sub-total	*24.0 Mt-CO_2*
Internationally Supported NAMAs	RE Power (MAC > 10$/t-$CO_2$ plus AEDP)	13,456
	EE Large Industries (MAC > 10$/t-$CO_2$)	9,743
	Transport/Biodiesel 2nd Gen (AEDP 2012)	14,459
	Transport/NGV	644
	Sub-total	*38.0 Mt-CO_2*
Total Domestic and Supported NAMAs		**62.0 Mt-CO_2**
Total emissions in 2005		**192,724 kt-CO_2**
Total emissions in BAU2020		**367,436 kt-CO_2**

Figure 15 Potential of CO_2 Mitigation in Thailand NAMAs

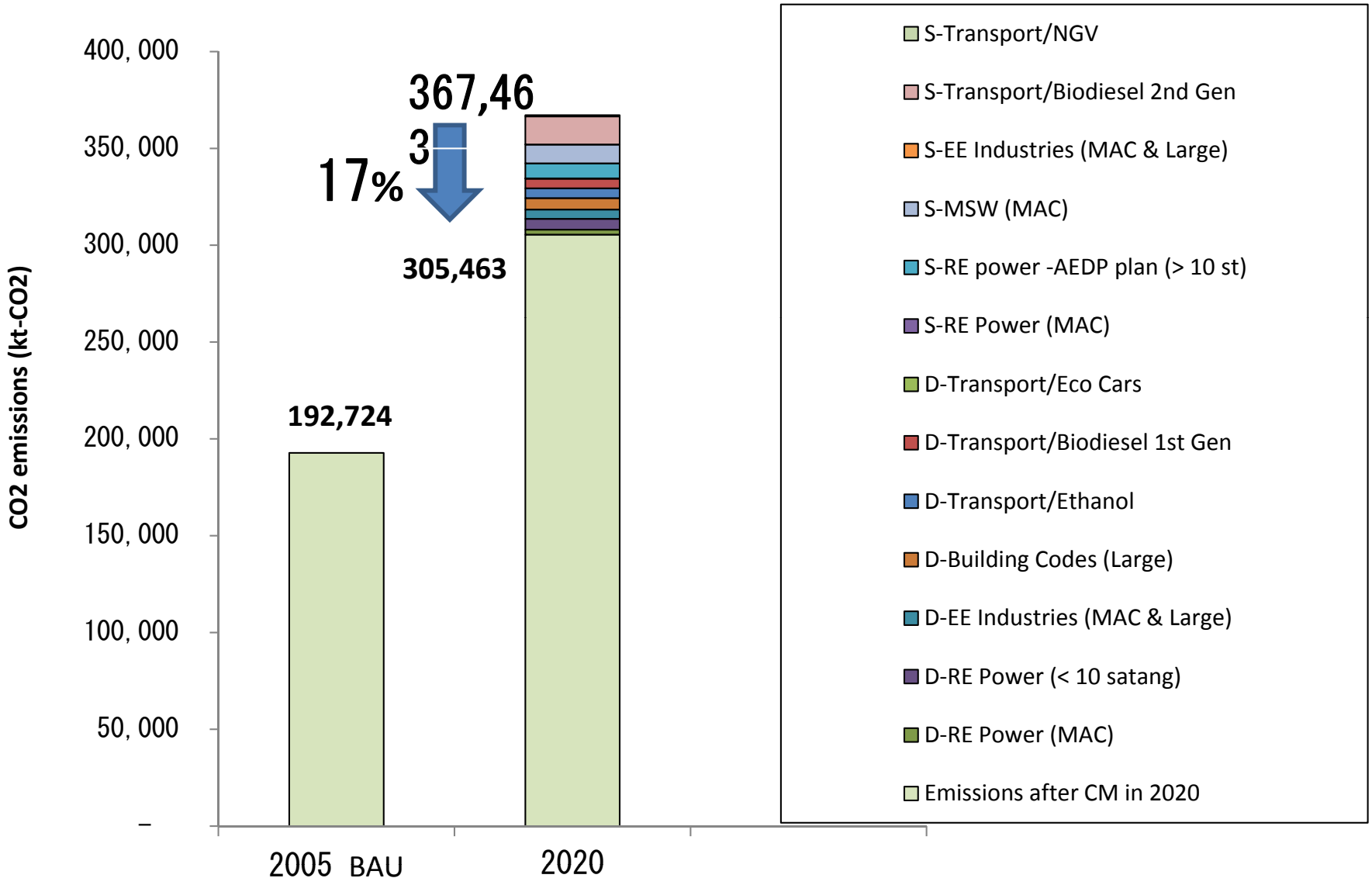


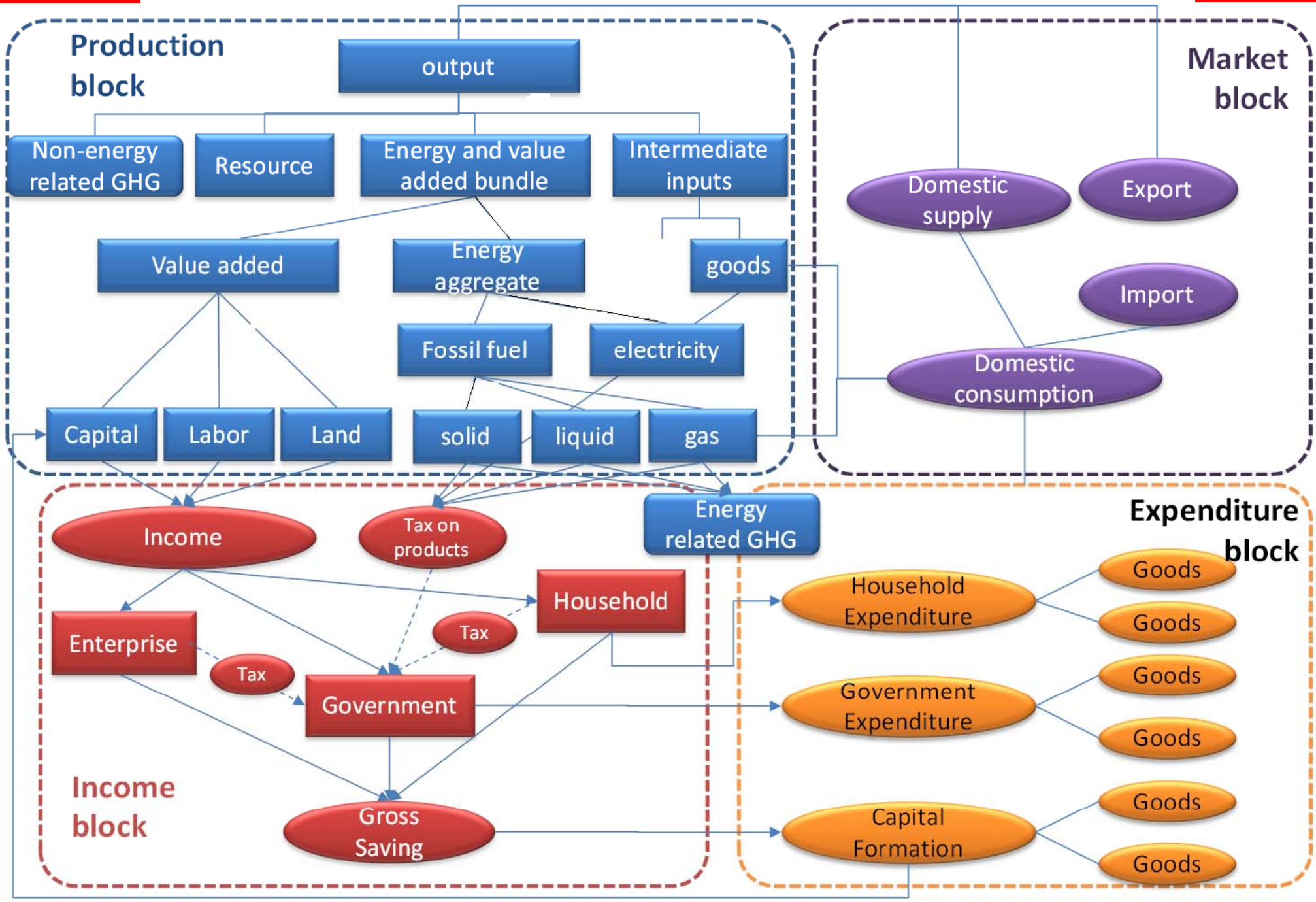
Table 11 Co-benefits of Low Carbon Growth in Thailand NAMAs

Energy Security of LCG in Thailand NAMAs

Year	DoPED*	Energy Intensity (toe/1000 USD)	CO_2 Intensity (t-CO_2/USD)
2005	68.82	0.280	0.696
2020 BAU	69.24	0.274	0.564
2020 NAMA	74.18	0.233	0.468

* DoPED: Diversification of primary energy demand

AIM/CGE model for Thailand



"Thailand will endeavor to lower CO_2 emissions by 17% in 2020 compared to the BAU"

CO_2 Counter-measures for low-carbon green growth

- *Renewable electricity: Biomass, biogas, hydro, Waste-to-energy, Solar, Wind etc.*
- *Energy Efficiency Improvement in Industries, Building Codes.*
- *Bio-Fuels, Improving Fuel Economy & NGV in Transportation & New transport system.*

SIIT-TU

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