10th Annual Meeting of International Research Network for Low Carbon Society (LCS-RNet)

17 July 2018
Yokohama, JAPAN

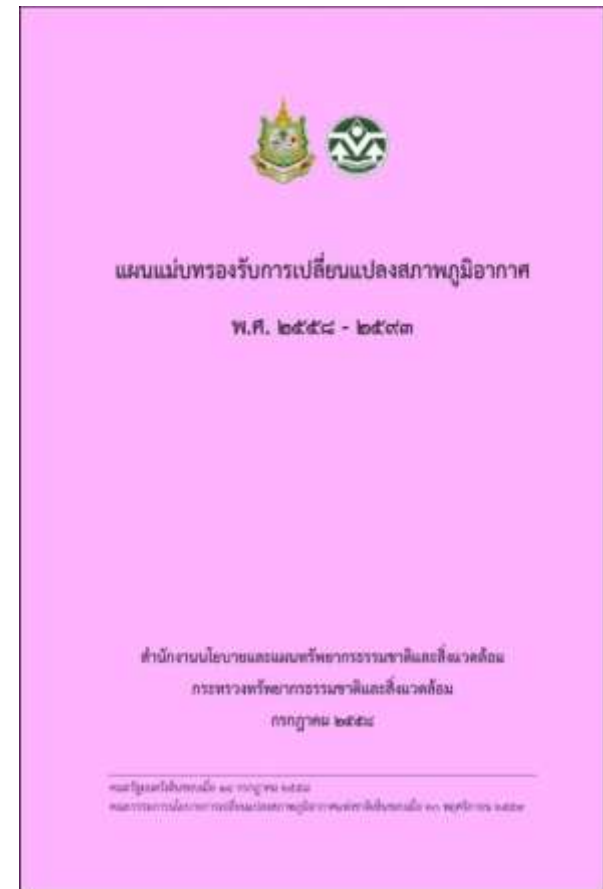# Actions in the Developing World: Decarbonized Thailand

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SELC

Sustainable Energy & Low Carbon

Research Unit

Thailand's Climate Change Master Plan 2050

Approved by Cabinet on

14 July 2015

Thailand CO$_2$ emission targets

Pre-2020 **Post-2020**

2008   2020   2030

Common but differentiated responsibilities

CDM

Thailand submitted NAMAs on 29 December 2014

INDC Pledge

Thailand submitted INDC on 1 October 2015
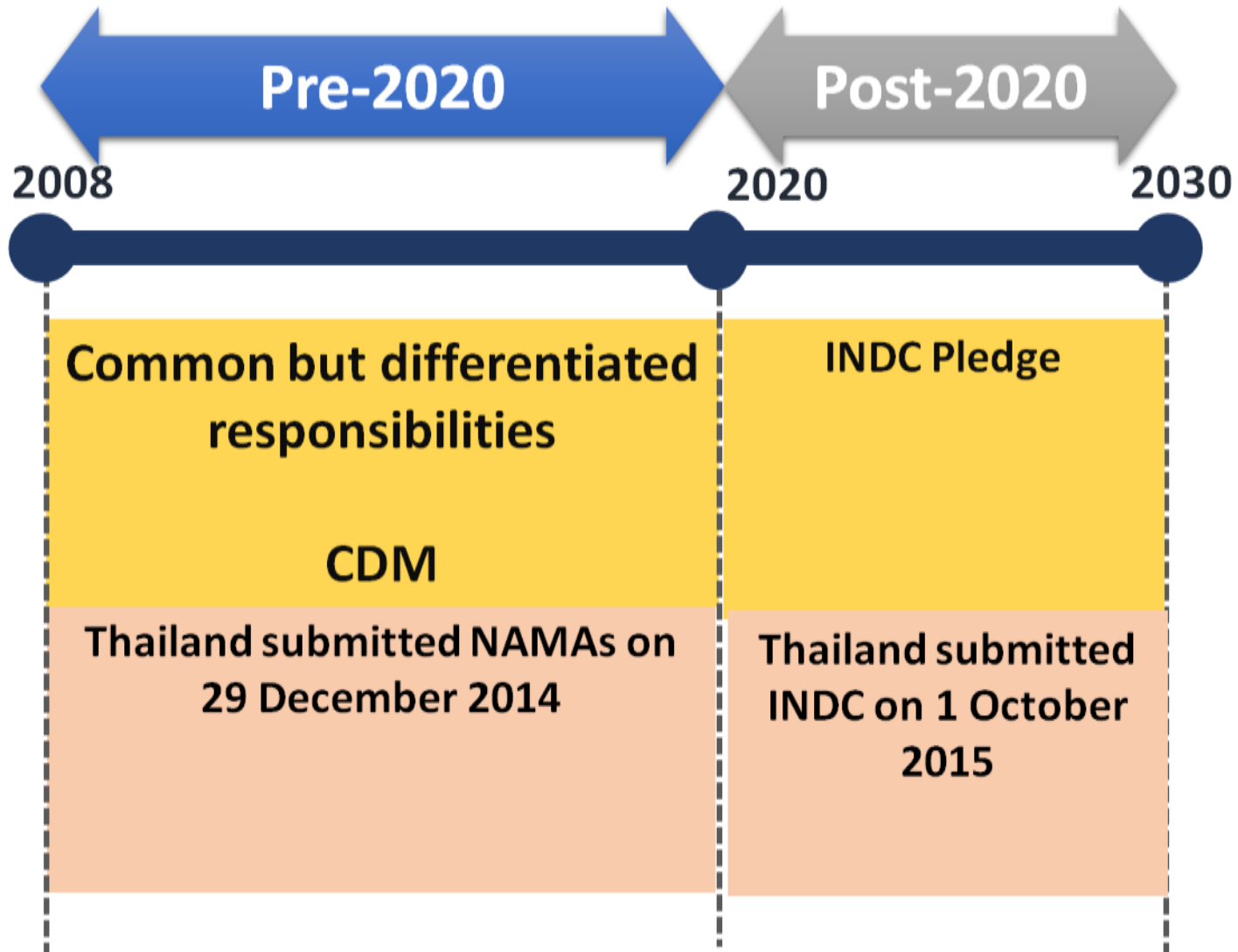
Innovation of Thailand's NDC Roadmap 2030

- PDP 2015
- EEP2015
- AEDP2015
- Smart Grids

+

EEP 2015 Fuel Efficient (Non-electric)

+

AEDP 2015 Biofuel & Heat (Non-electric)

+

Thailand's Transport Infrastructure Development Strategy 2015-2022
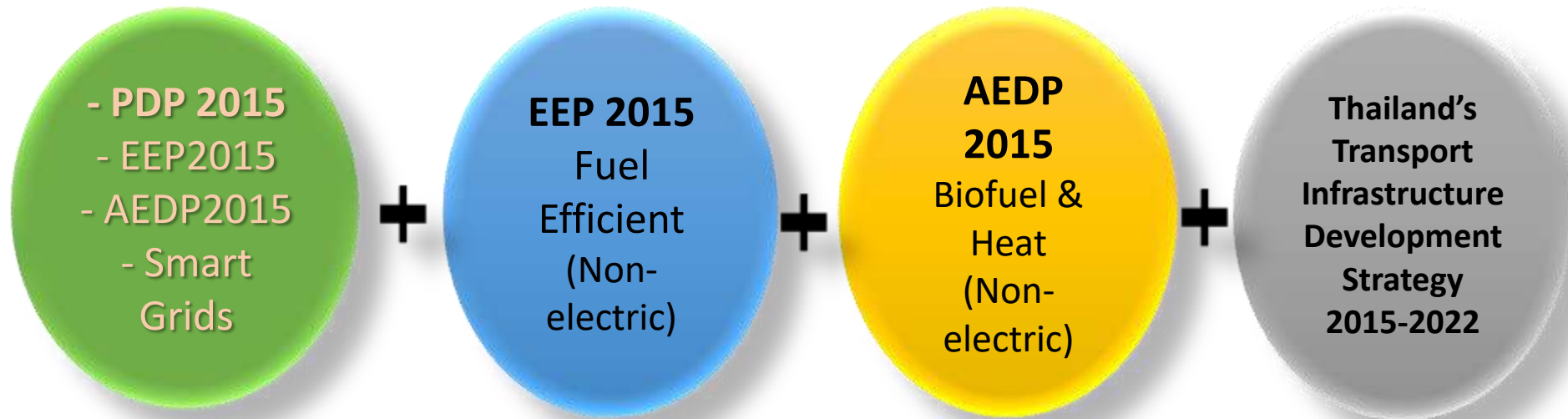
Long-Term Economic Growth (2015-2036)

Year	2015	2016	2017	2018	2019	2020	2021	2022
GDP	4.0	4.4	4.7	4.3	4.1	4.2	4.2	4.1

Year	2023	2024	2025	2026	2027	2028	2029	2030
GDP	4.0	4.1	4.0	4.0	4.0	3.9	3.8	3.8

Source: PDP2015

GDP PDP2015

historical ← → forecasted
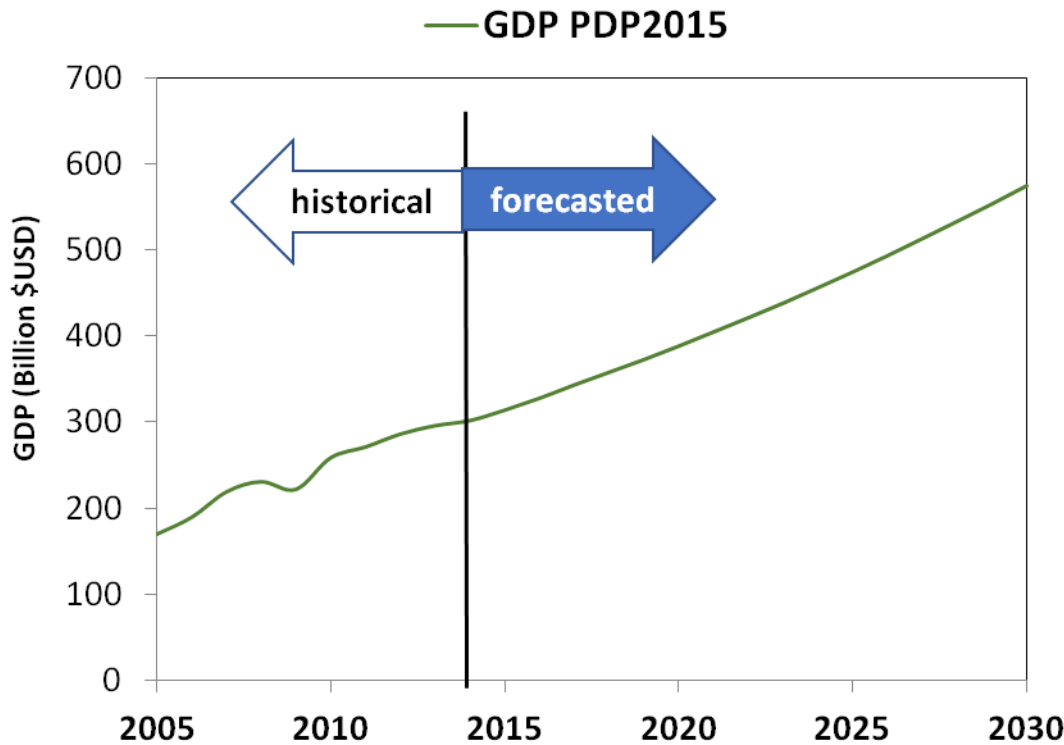
Socio-economic: estimated population
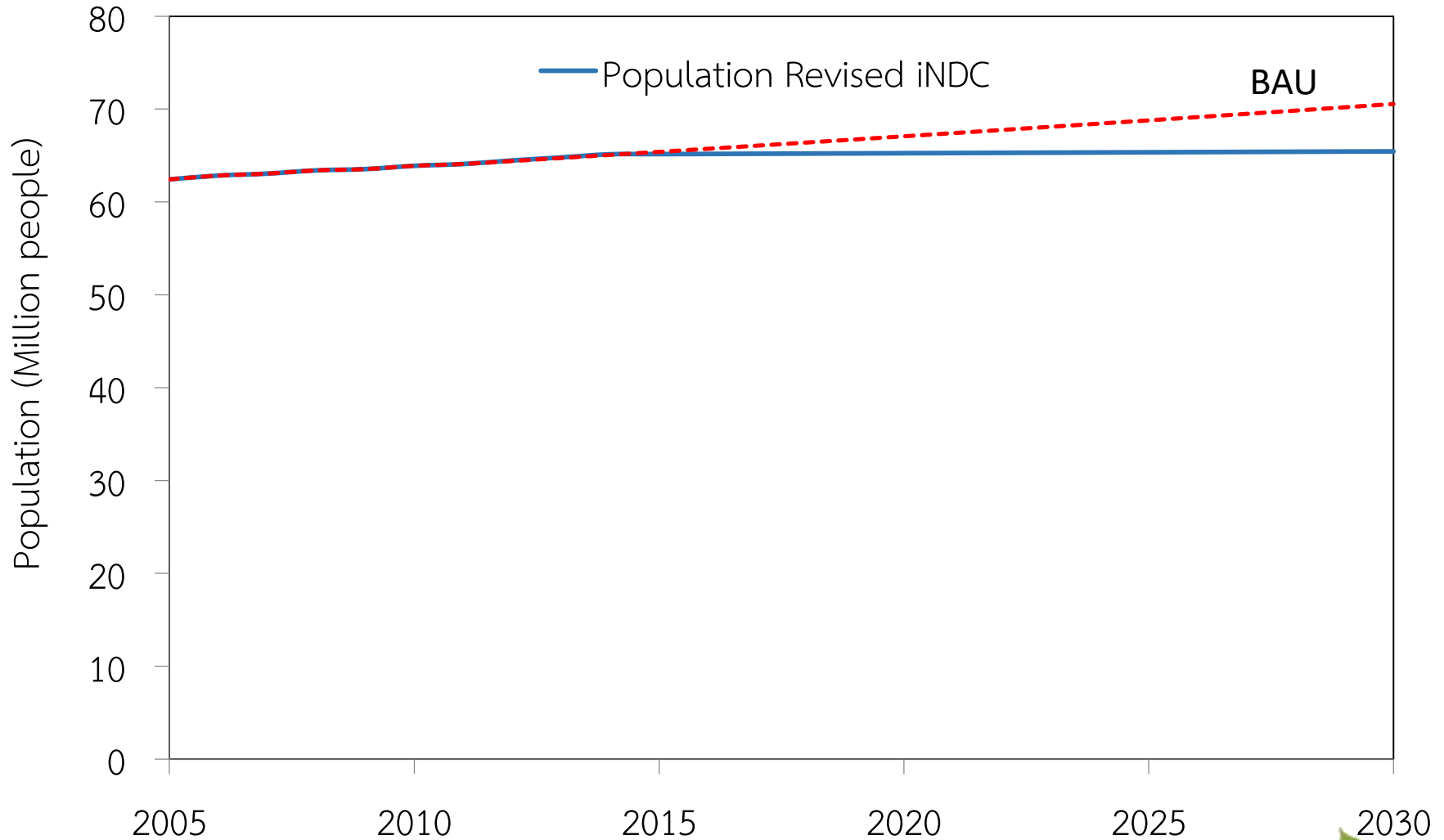
The Estimated Fuel Requirement for The PDP2015

Fuel types	2014	2026		2036	
	(%)	Installed capacity (MW)	(%)	Installed capacity (MW)	(%)
Import	7	6,421	10-15	12,347	15-20
Clean Coal & Lignite	20	6,480	20-25	8,133	20-25
Renewable Energy (include Hydro)	8	15,654	10-20	20,279	15-20
Natural Gas	64	33,362	45-50	26,298	30-40
Nuclear	-		-	2,000	0-5
Diesel and Fuel oil	1	342	-	1,277	-
Total		62,260		70,335	

Source: Thailand Power Development Plan 2015 (English Version)

Alternative Energy Development Plan: AEDP2015

Fuel type	2014 (MW)	2036 (MW)
1 Municipal Solid Waste	65.72	500.00
2 Industrial Waste	-	50.00
3 Biomass	2,451.82	5,570.00
4 Biogas (Waste Water/Waste)	311.50	600.00
5. Small Hydro	142.01	376.00
6 Biogas (Energy Crops)	-	680.00
7 Wind	224.47	3,002.00
8 Solar	1,298.51	6,000.00
9 Large hydro	-	2,906.40
Total Installed Capacity (MW)	**4,494.03**	**19,684.40**
Total Electricity Generation (GWh)	**17,217**	**65,588.07**
Total Electricity Demand (GWh)	174,467	326,119.00
Generated Electricity Ratio by RE (%)	**9.87**	**20.11**

Alternative Energy Development Plan: AEDP2015

Fuel type	2014		2036	
	ML/day	ktoe	ML/day	ktoe
1.Biodiesel	2.89	909.28	14.00	4,404.82
2. Ethanol	3.21	872.88	11.30	2,103.50
3. Pyrolysis	-	-	0.53	170.87
4. Compressed Biogas (ton/day)	-	-	4,800.00	2,023.24
5. Other Renewable Energy	-	-	-	10.00
Total (ktoe)		**1,782.16**		**8,712.43**
Total Bio-fuel in Transport Sector		26,801.00		34,798.00
Bio-fuel Ratio in Transport Sector		**6.65**		**25.04**

Energy Efficiency Plan: EEP2015

- **PDP2015 already included the electricity demand from EEP**

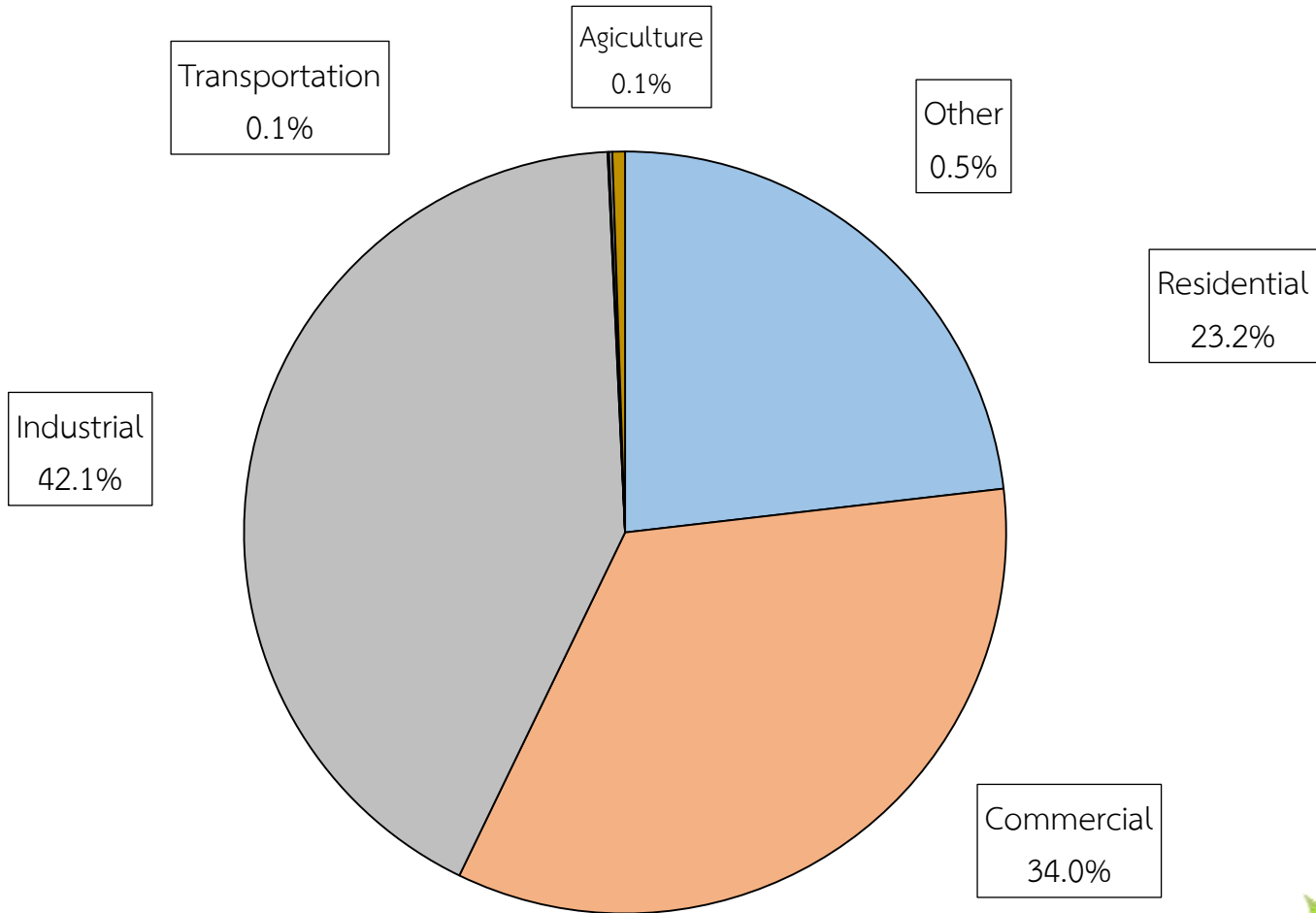- **30% energy intensity reduction in 2030 compared to 2010**
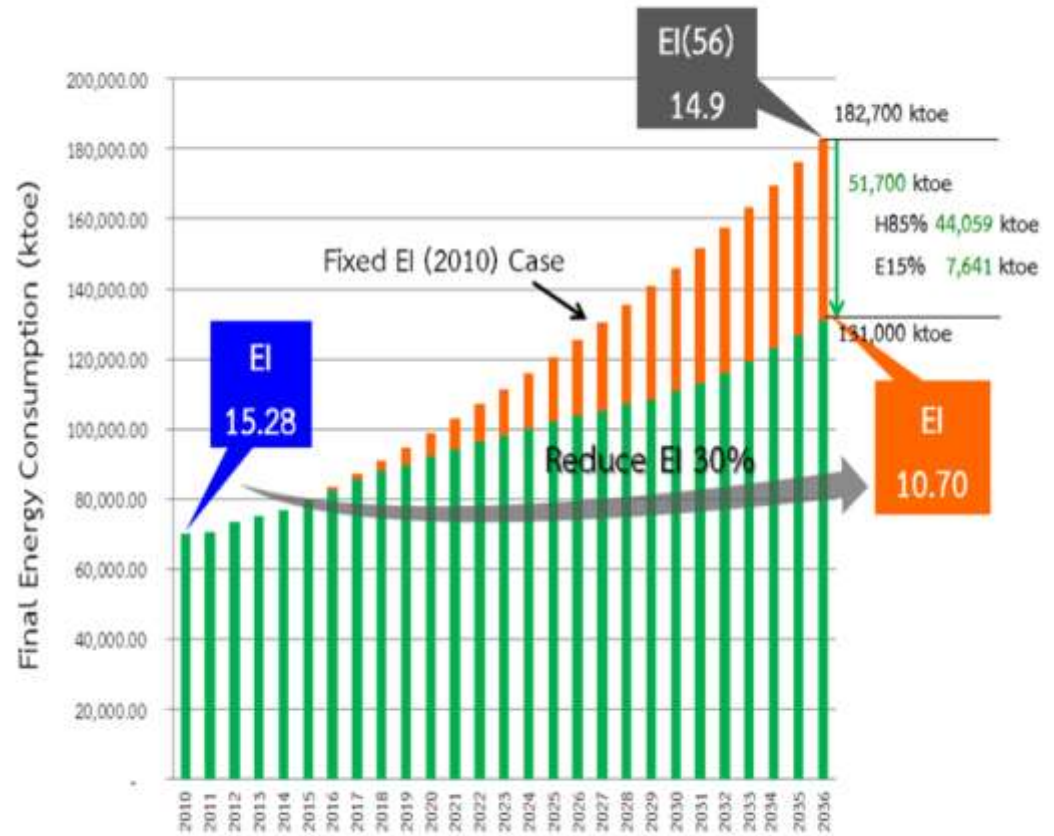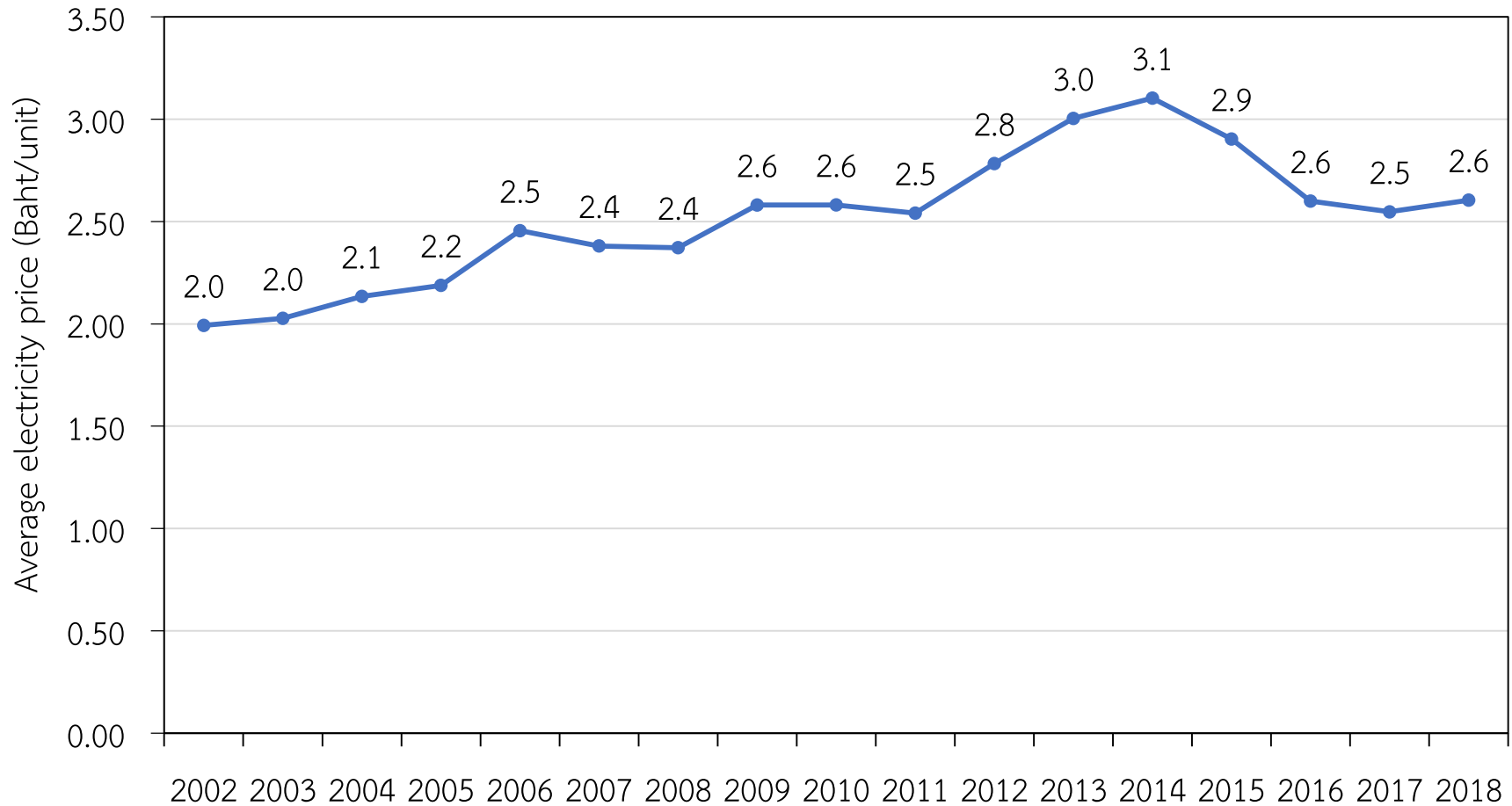

Final Energy Consumption Target by EE

Electricity consumption by economic sectors
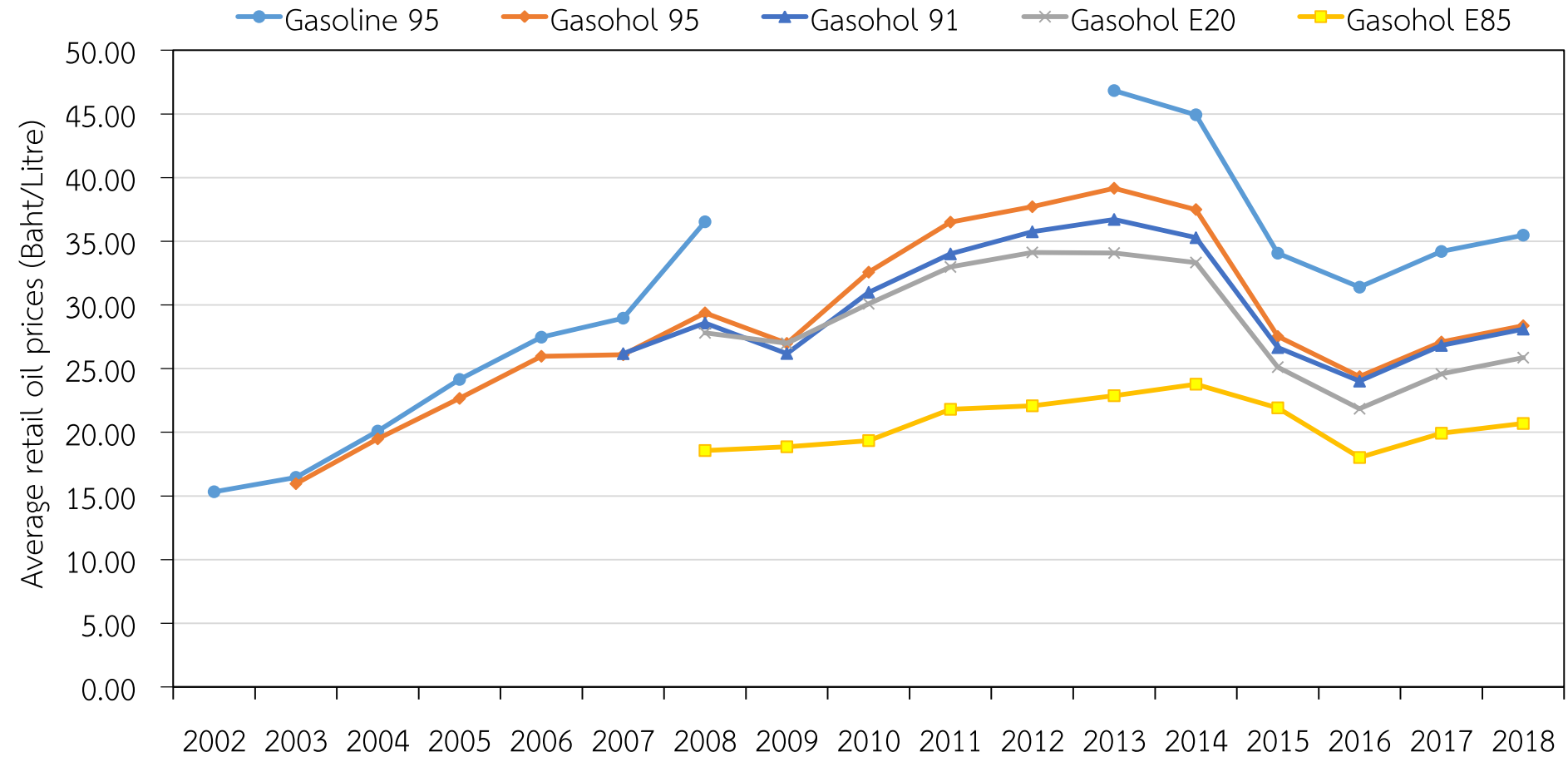
190,504 GWh in 2016

Average electricity price (Including Ft)

Average electricity price (Baht/unit)

2002: 2.0
2003: 2.0
2004: 2.1
2005: 2.2
2006: 2.5
2007: 2.4
2008: 2.4
2009: 2.6
2010: 2.6
2011: 2.5
2012: 2.8
2013: 3.0
2014: 3.1
2015: 2.9
2016: 2.6
2017: 2.5
2018: 2.6

Note: 1 USD = 33 Baht

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Average retail oil prices

Modeling tool: AIM/Enduse

Energy	Energy Technology	Energy Service
• Coal • Oil • Gas • Renewables • Electricity	• Blast furnace • Power generation • Air conditioner • Fluorescent • Automobile	• Crude steel production • Electricity demand • Demand for heating and cooling • Lighting • Passenger, freight transport

Flow of real world →

← **Flow of simulation**

Energy Consumption CO_2 emission	←	Technology Selection	←	Energy Service Demand

Energy Database

• Energy type
• Energy price
• Energy constrains
• CO_2 emission factor

Technology Database

• Technology cost
(Initial cost, running cost)
• Energy consumption
• Service supply
• Diffusion rate
• Lifetime

Socio-economic scenarios

• Population growth
• Economic growth
• Industrial structure
• Employment
• Lifestyle

Source: AIM (NIES, 2018)

Thailand's GHG mitigation: NAMA 2020 and NDC 2030

Thailand's GHG Mitigation
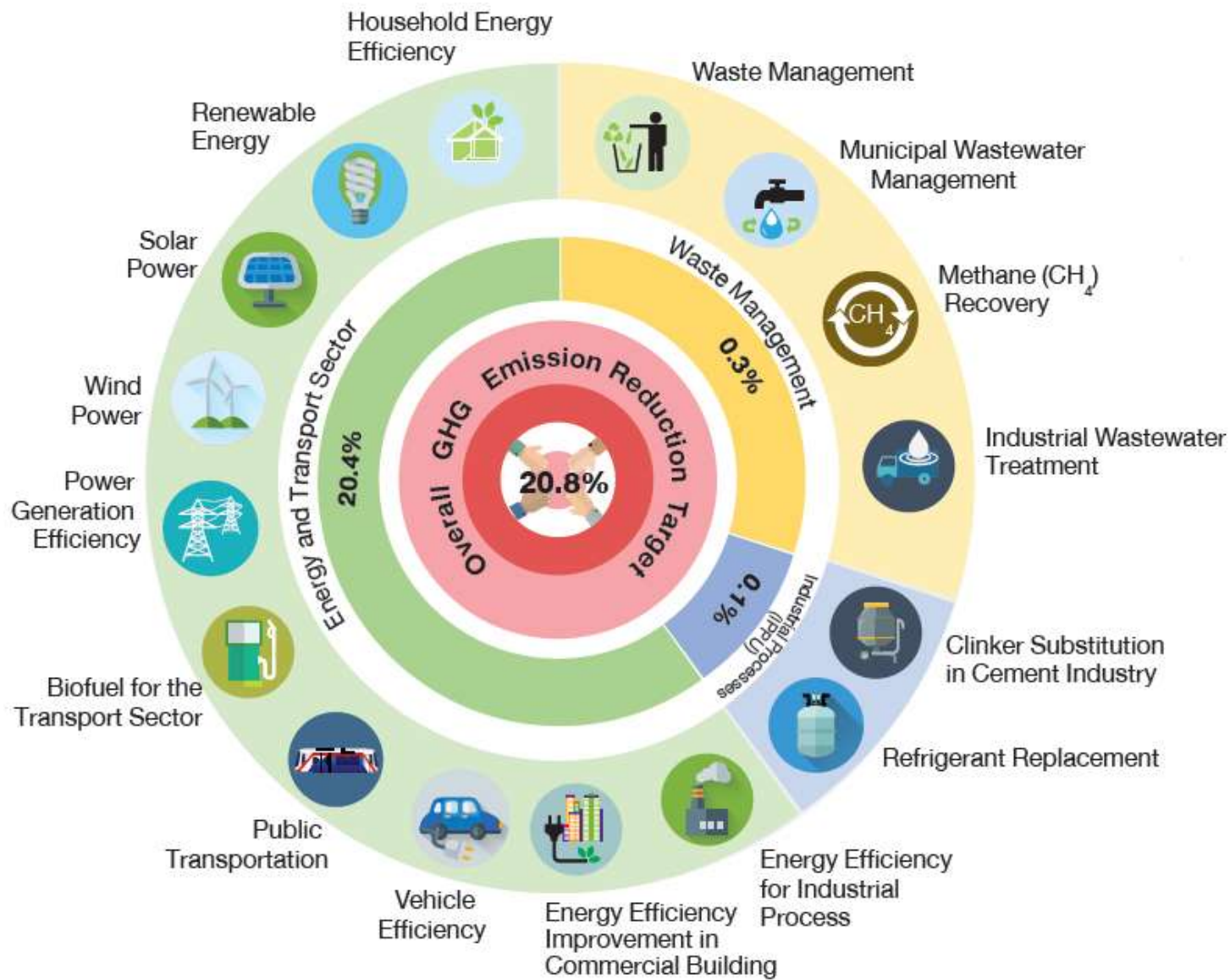
Source: Thailand's third national communication
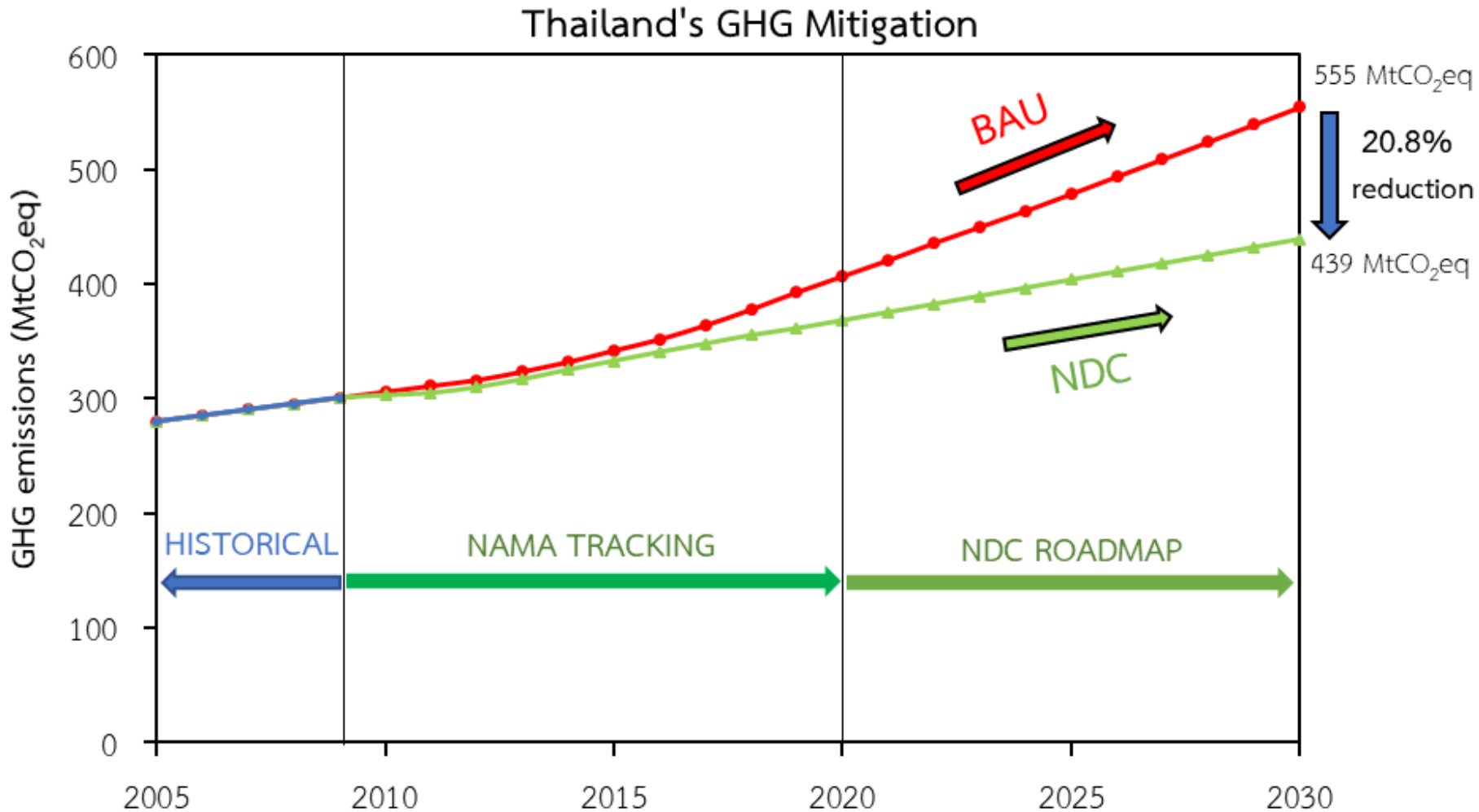
GHG reduction target in NDC 2030

Legend: BaU emissions | 20% GHG reduction | Waste | IPPU | Residential | Commercial | Transport | Industry | Power

Y-axis: GHG emissions (Mt-CO_2eq)

2030BaU: 555
2030INDC: 439.4

GHG mitigation (arrow on chart)

GHG mitigation
- Power 24 Mt-CO_2eq
- Industry 43 Mt-CO_2eq
- Transport 41 Mt-CO_2eq
- Residential 4 Mt-CO_2eq
- Commercial 1 Mt-CO_2eq
- IPPU 0.6 Mt-CO_2eq
- Waste 2 Mt-CO_2eq

Total GHG mitigation
115.6 Mt-CO_2eq
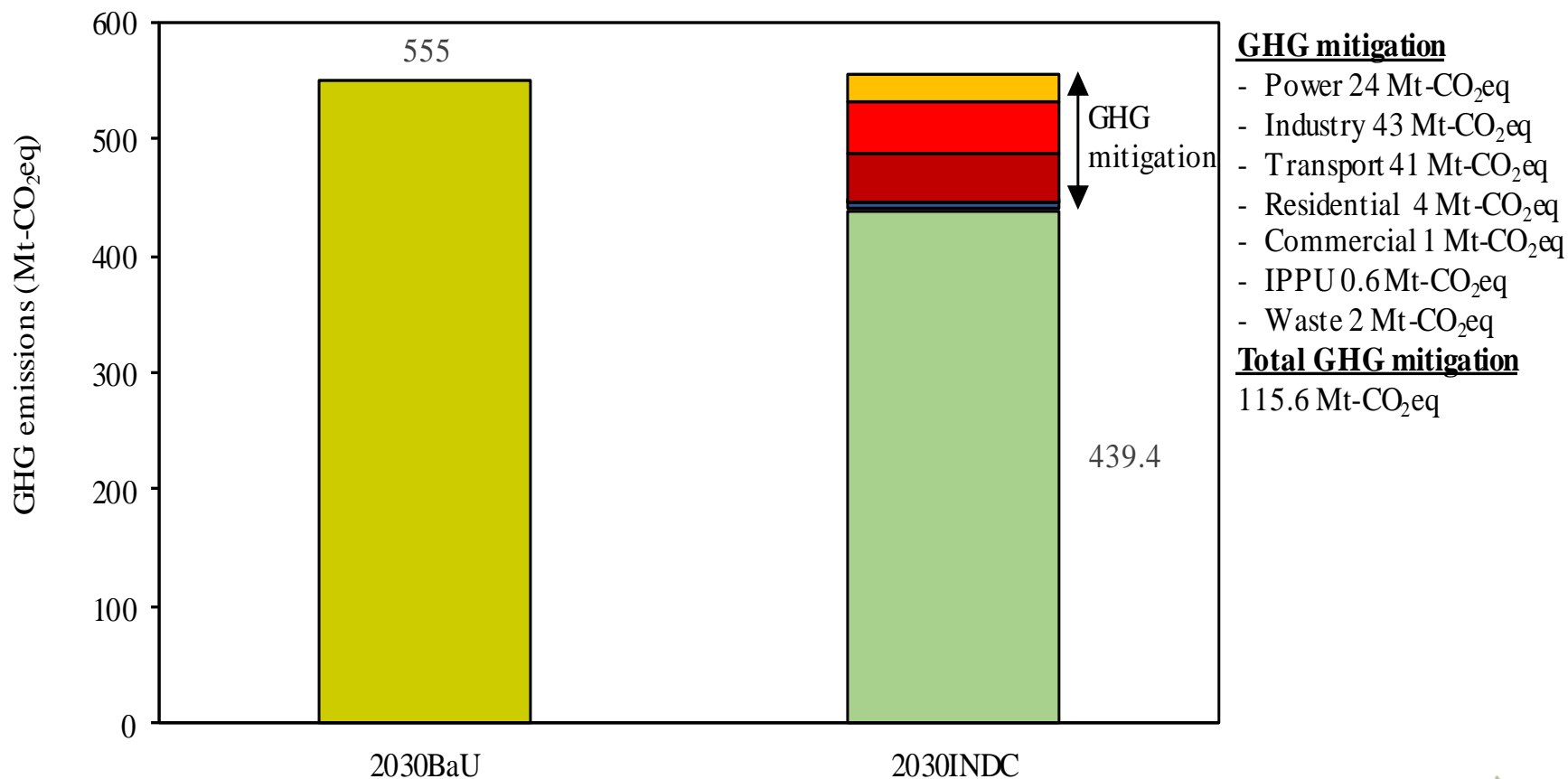
Thailand NDC's Roadmap 2030: ALL SECTORS

CMs in Energy sector and Transport Sector

Unit: $Mt\text{-}CO_2e$

Measure	2020	2025	2030	
Electricity generation sector	14.62	20.71	24.00	4.3%
1. Energy efficiency improvement	2.87	5.84	6.00	
2. Implementation and deployment of renewable energy (e.g. biomass, ground-mounted solar farm, wind, MSW, hydropower)	11.75	14.87	18.00	
Residential sector	1.63	2.82	4.00	0.7%
3. Energy efficiency improvement (e.g. lighting and cooling system etc.)	1.19	2.06	2.79	
4. Renewable energy and alternative energy deployment	0.44	0.76	1.21	
Commercial sector	0.19	0.56	1.00	0.2%
5. Energy efficiency improvement (e.g. heating system and cooling system etc.)	0.19	0.56	1.00	
Manufacturing industrial sector	13.82	27.92	43.00	7.4%
6. Energy efficiency improvement (e.g. heating system, cooling system etc.)	2.38	8.27	11.00	
7. Renewable energy and alternative energy deployment (e.g. solar rooftop)	11.45	19.65	32.00	
Transport sector	9.37	23.83	41.00	7.8%
8. Energy efficiency improvement (e.g. engines efficiency improvement)	7.08	18.02	31.00	
9. Biofuel used in vehicles	2.28	5.81	10.00	
20.4% Total	39.63	75.83	113.00	

18

CMs in Waste sector

Unit: Mt–CO_2e

Measure	2020	2025	2030	
Municipal Solid Waste (MSW) management	0.36	0.79	1.30	0.2 %
10. MSW reduction				
Waste water management	0.20	0.43	0.70	0.1%
11. Collect methane gas from industrial waste water to increase biogas capacity				
12. Other Industrial waste water management				
13. Domestic waste water management				
0.3% Total	0.56	1.22	2.00	

EE

NDC Roadmap in Transport

Energy Efficiency Measures

RE
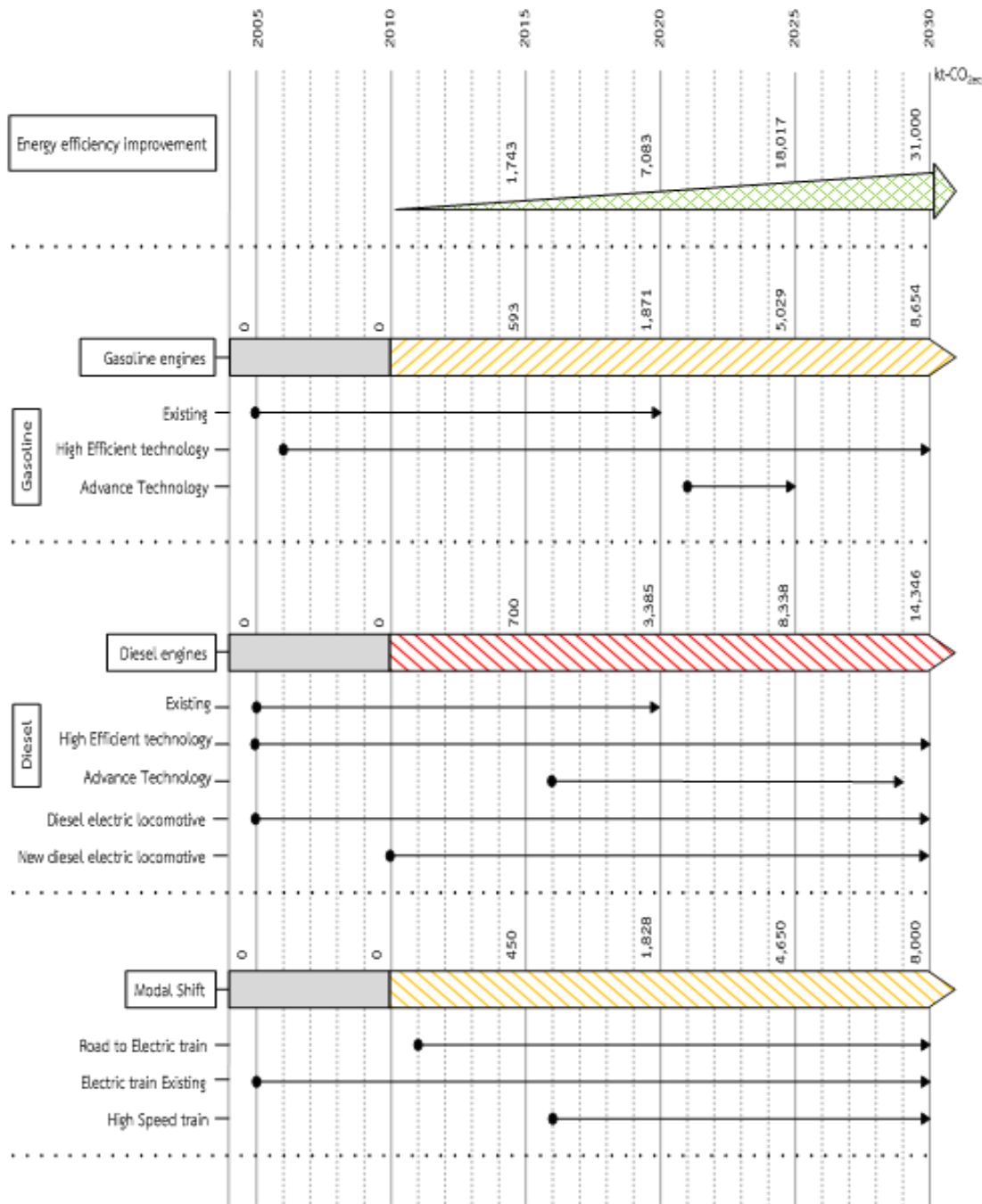
NDC Roadmap in Transport

Bio-fuel Measures
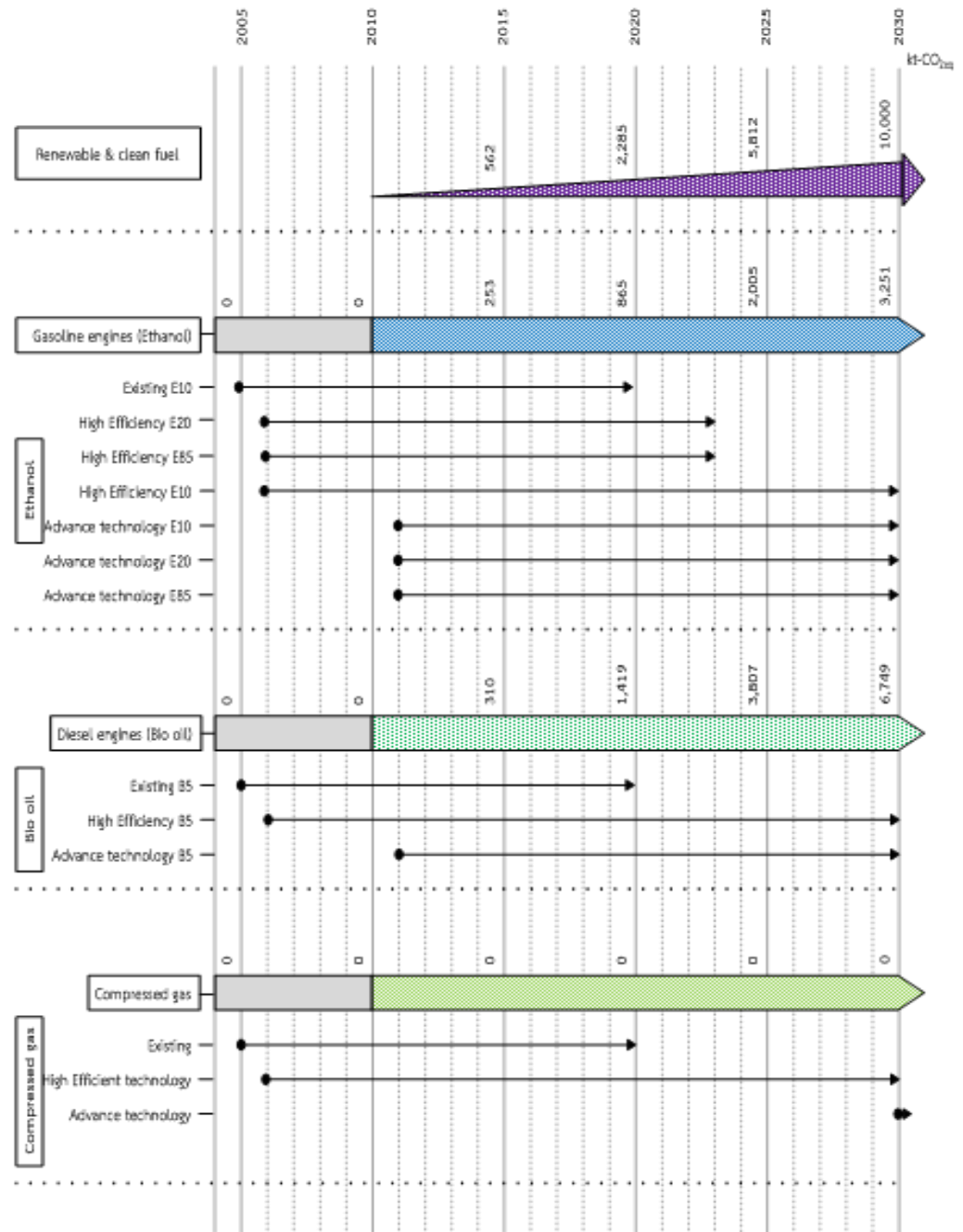
Trends of GHG emissions/removals: 2000-2013

Source: Thailand's Second BUR
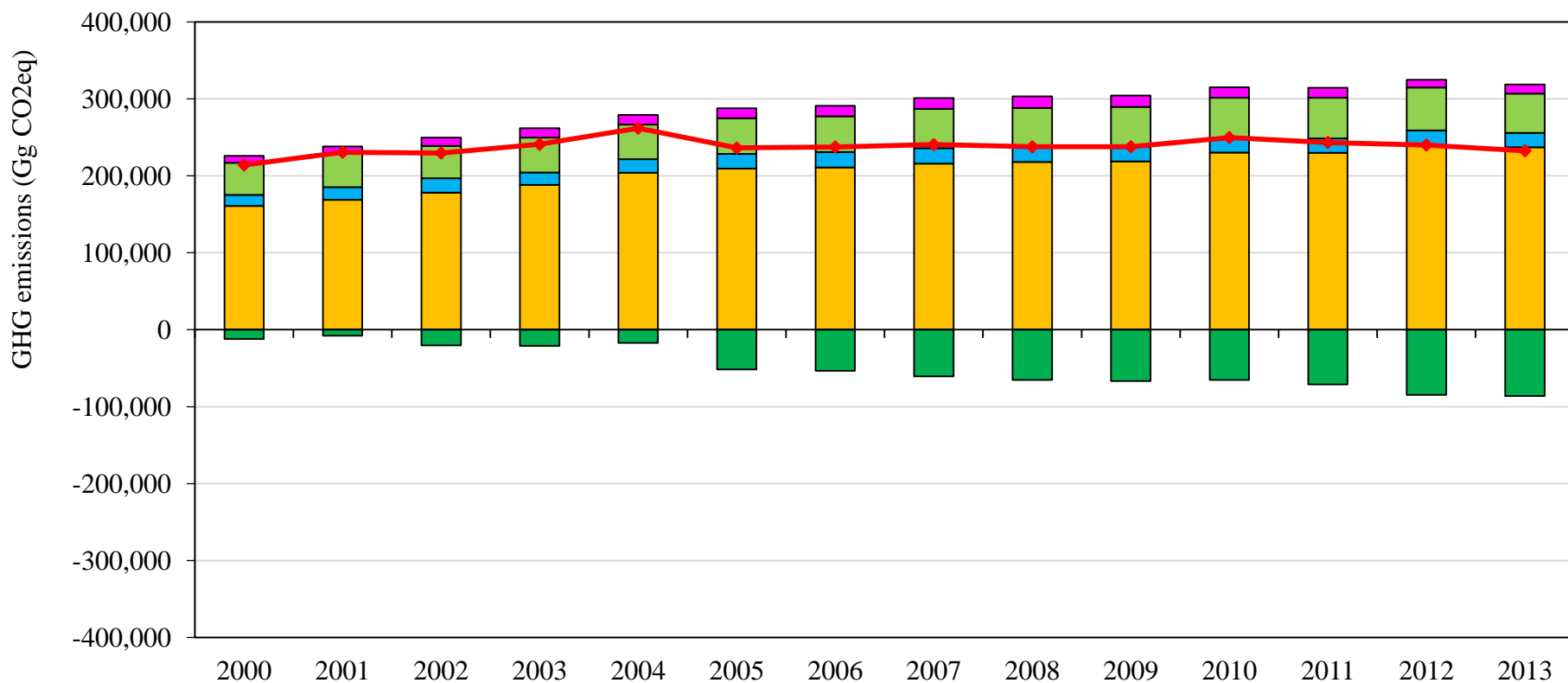
Trends of national GHG emissions vs Total final energy consumption: 2000-2013
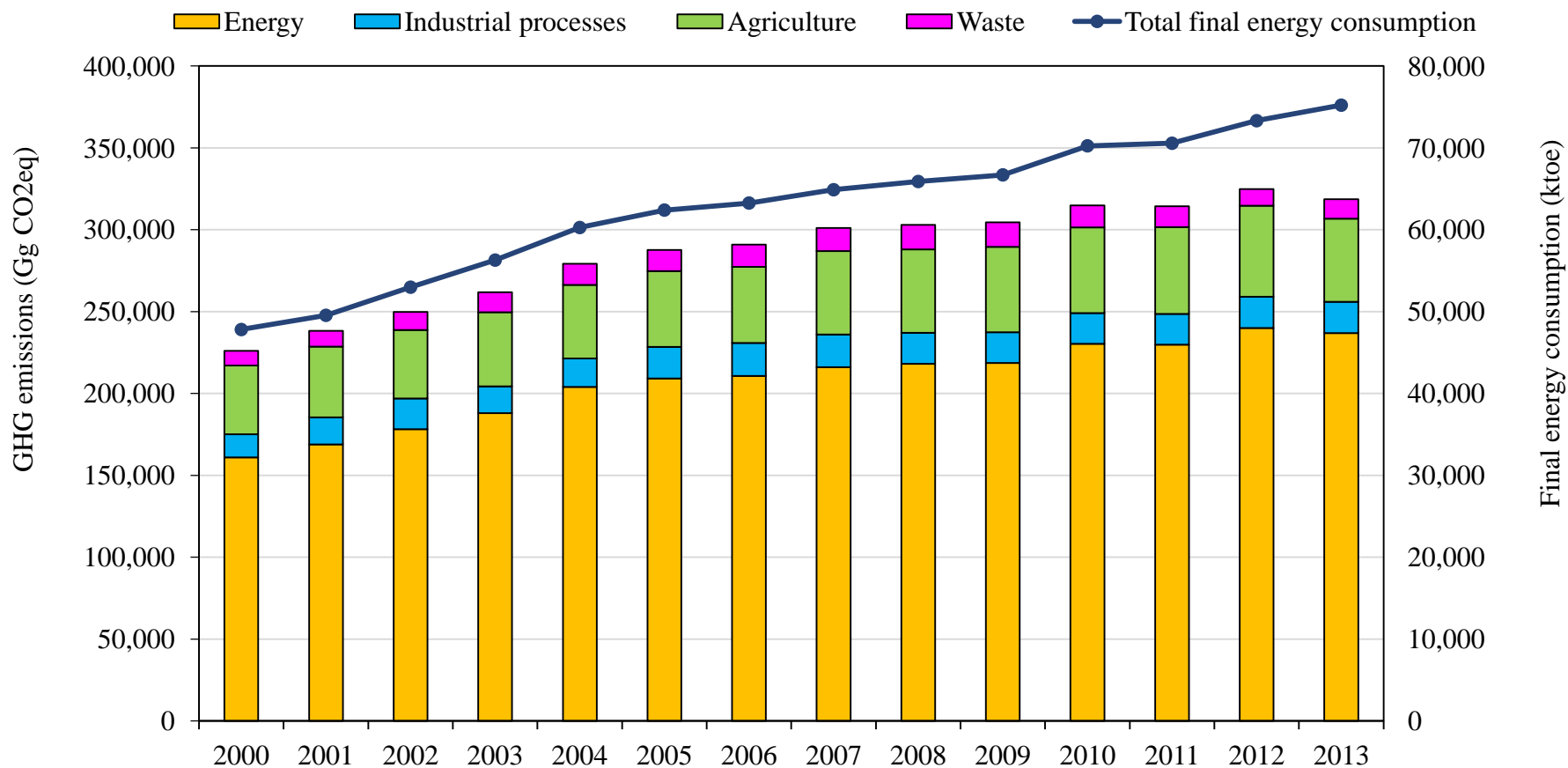
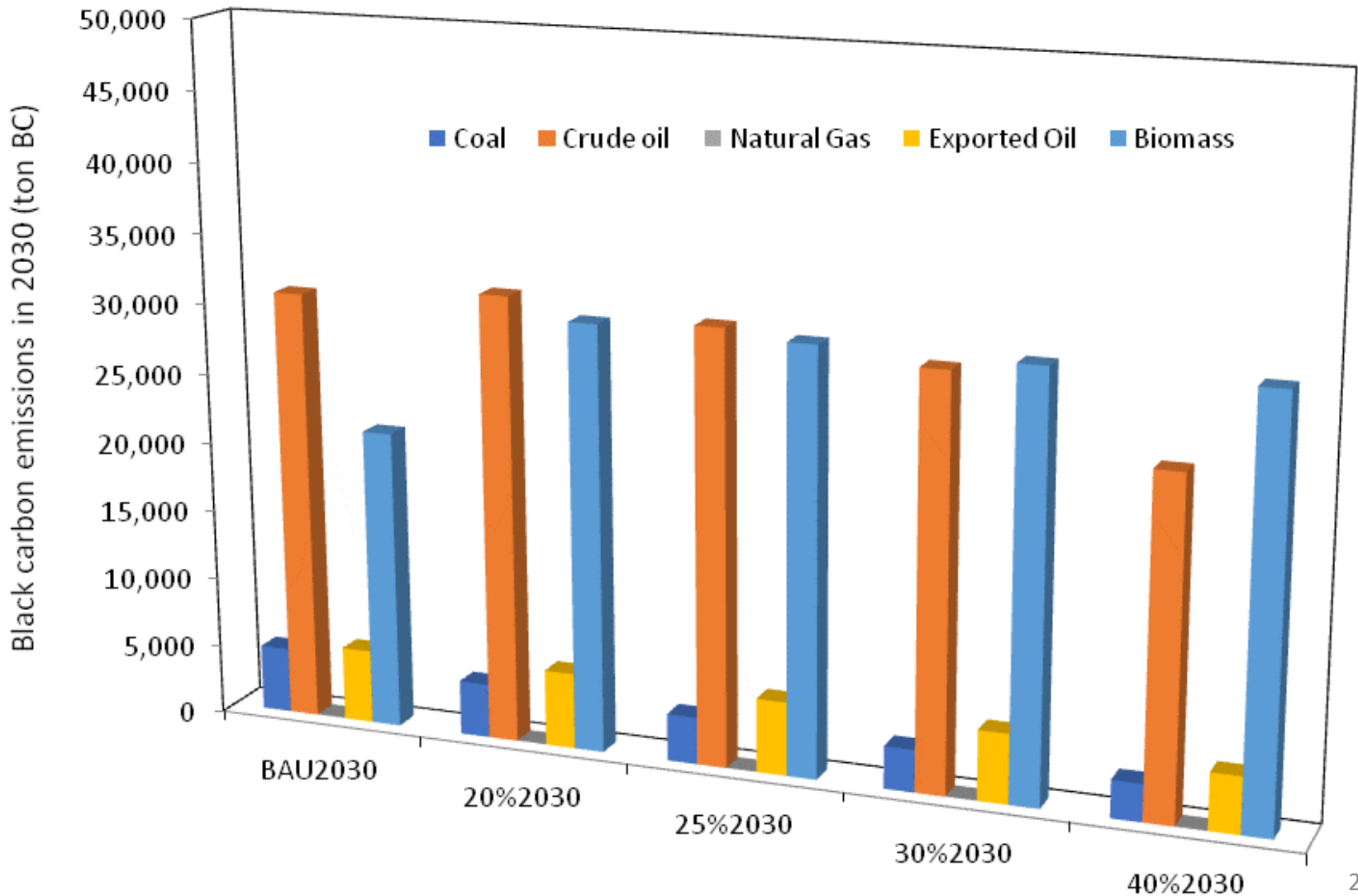# Trends of GHG emissions in Public Electricity and Heat Production (1A1a)

Source: Thailand's Second BUR
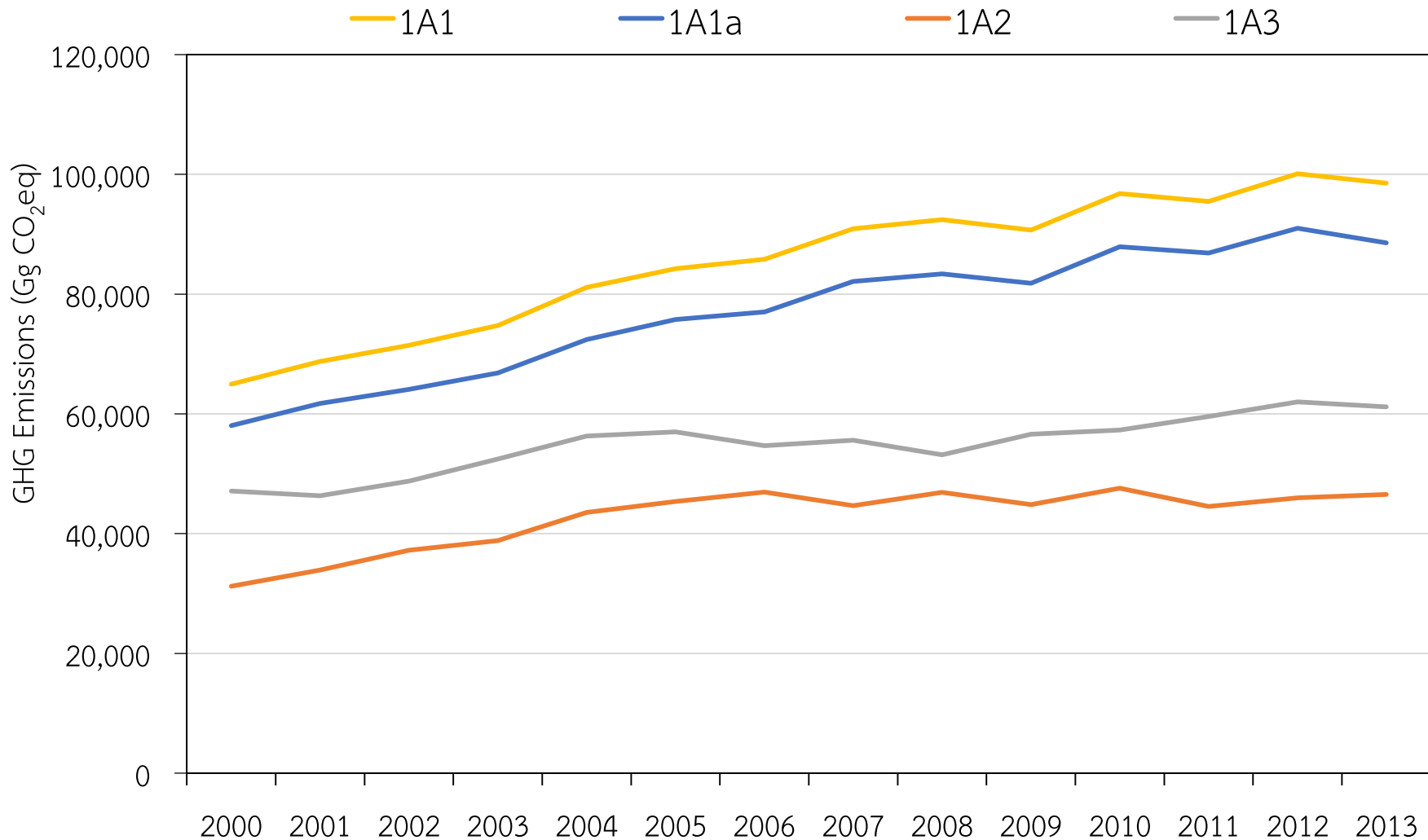
Actions besides NDC Roadmap in Thailand

Actions besides NDC Roadmap in Thailand

AIM/CGE Analyses:
Co-benefits of GHG mitigation targets
Black Carbon in 2030

AIM Training Workshop in Thailand

AIM/Enduse Training Workshop at SIIT-TU, Thailand
11 June 2018 (Beginning level for Policy Makers)

AIM Training Workshop in Thailand

AIM/Enduse Training Workshop at SIIT-TU, Thailand
12-15 June 2018 (Advanced Users)

Updates on Nepal's Enduse Model

1. Revision of Power sector
2. Revision of Brick sector

Further modification required in Nepal's Enduse Model

1. Addition of CCS in cement industry
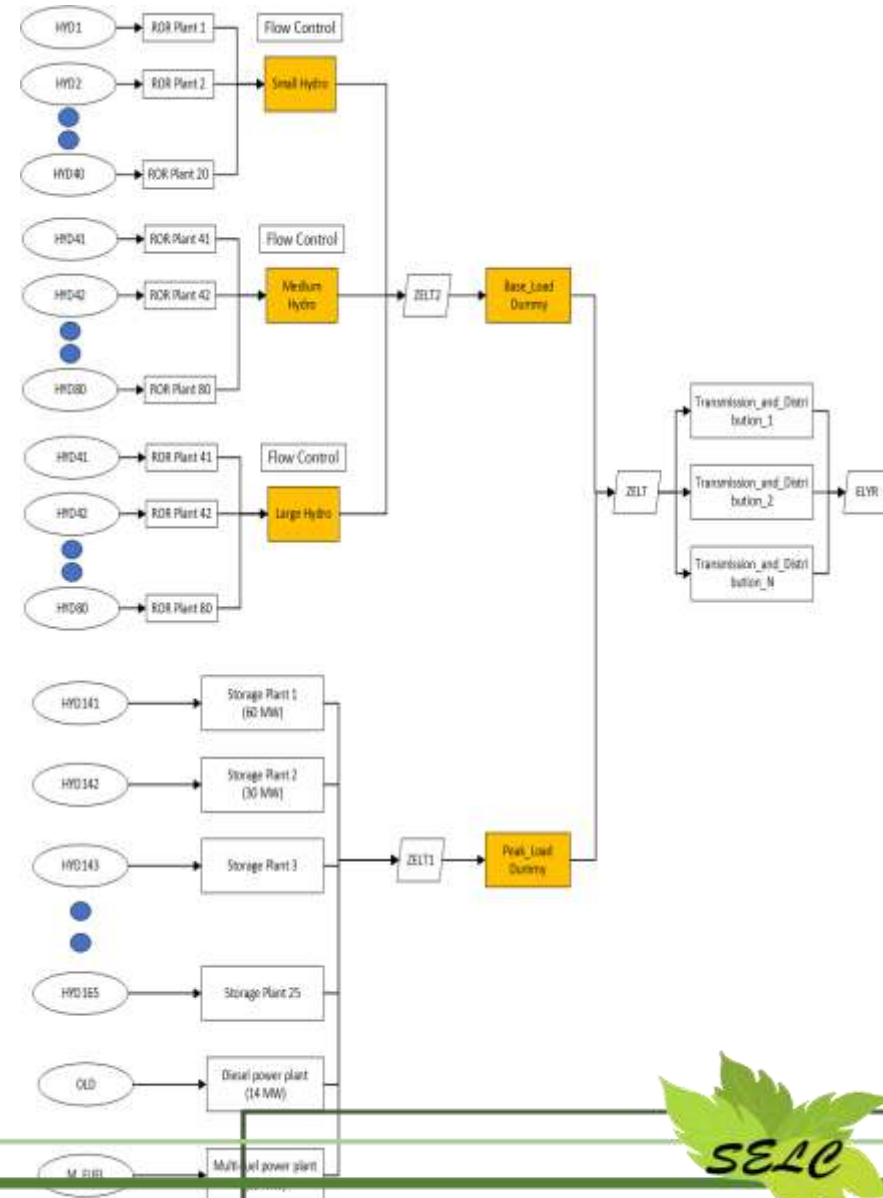2. Addition of Bioenergy with CCS (BECC) in power sector

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Changes in Power Sector: Nepal

Previous flow diagram
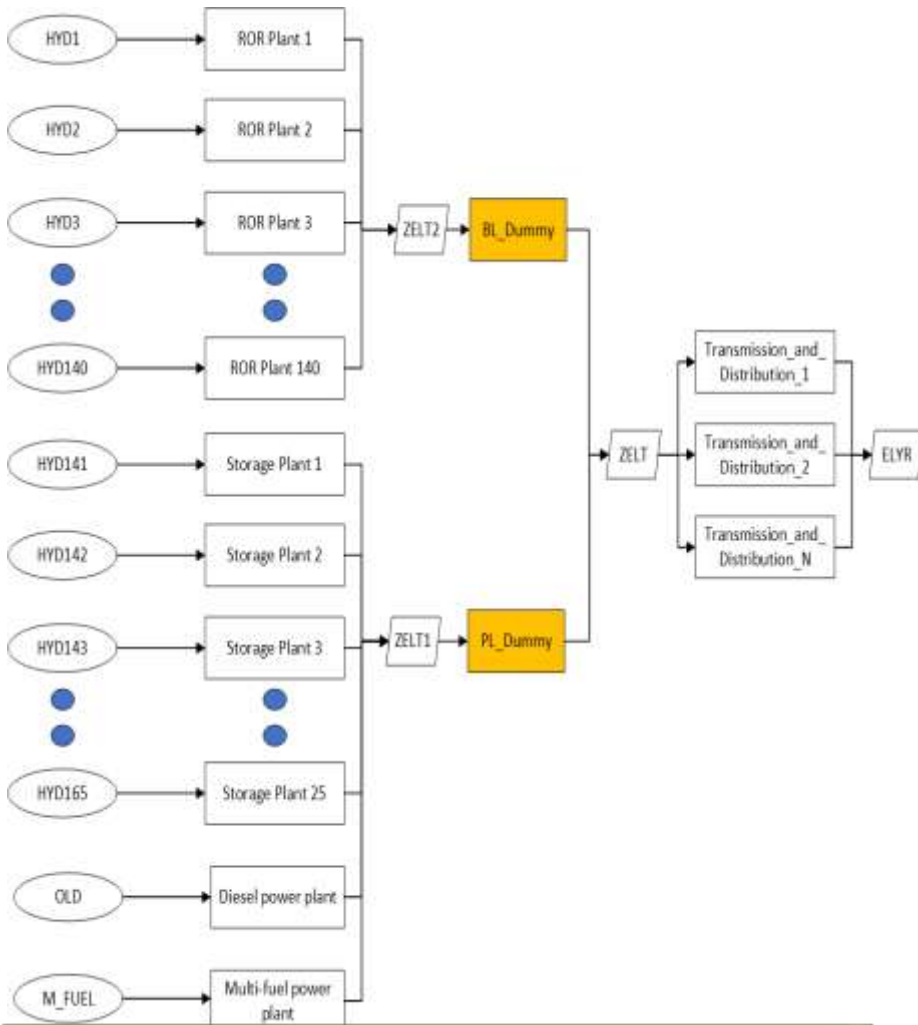
Revised flow

Current Situation of Thailand AIM/Enduse

- Thai AIM/Enduse model was already integrated in both the supply side and the demand sides

- The CCS technology was already introduced in the power sector

- The EV was already adopted in the current model version

- The 1.5 degree climate goal was already provided

- Energy efficiency policies was already adopted

Thailand Power Sector
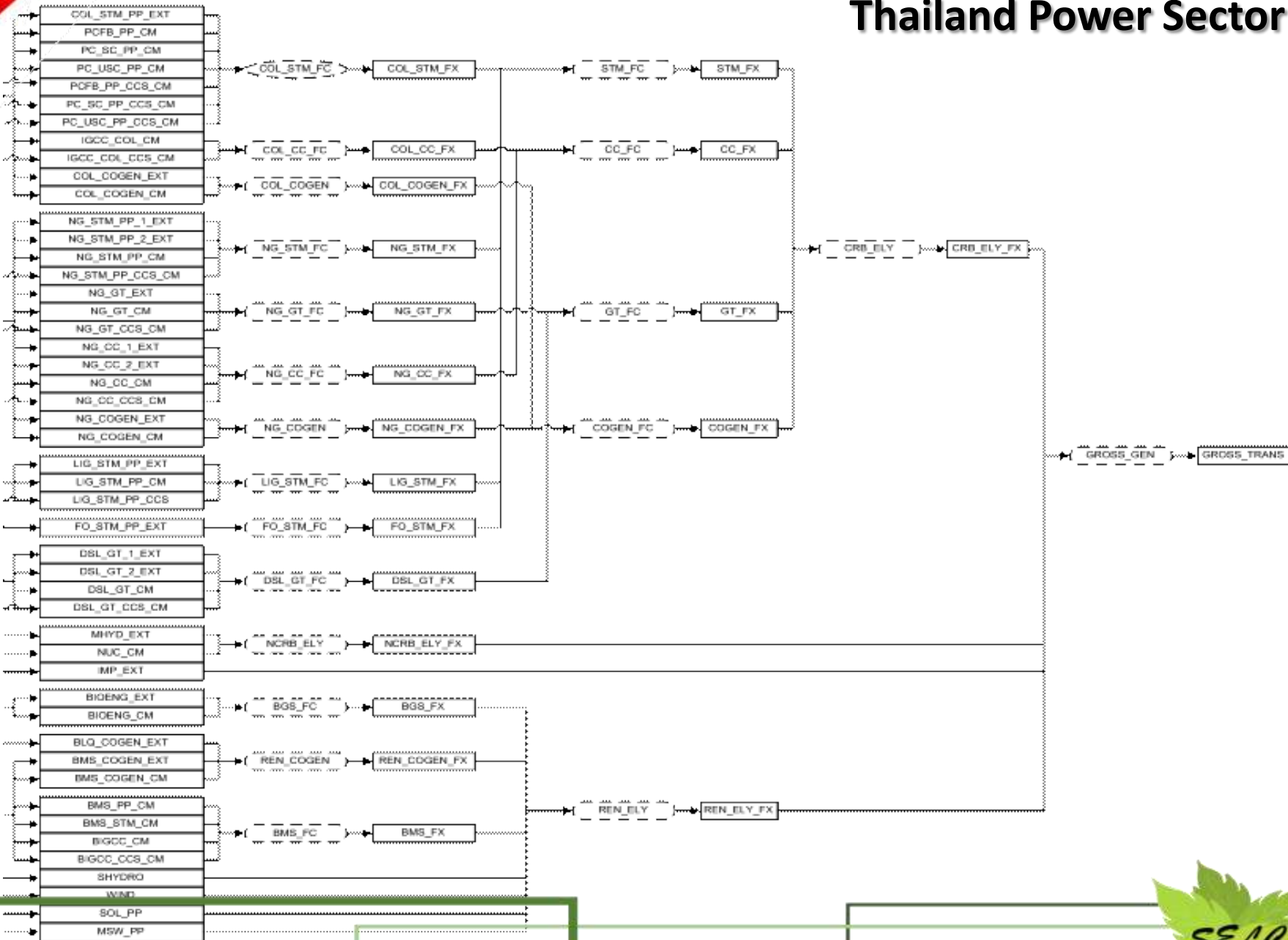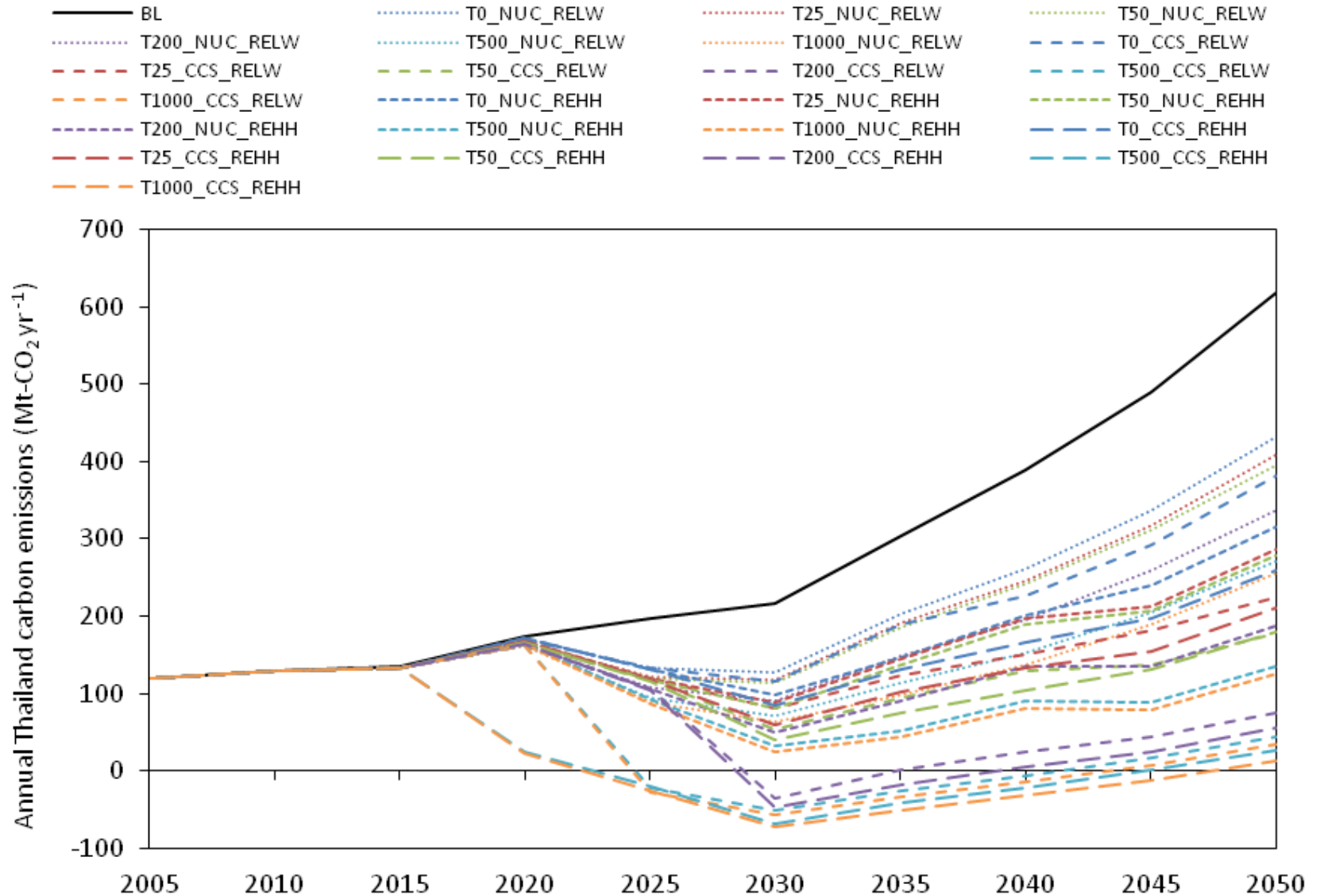
1.5 Degree Study: Thailand

Net CO_2 emissions = CO_2 Sources – CO_2 Sinks
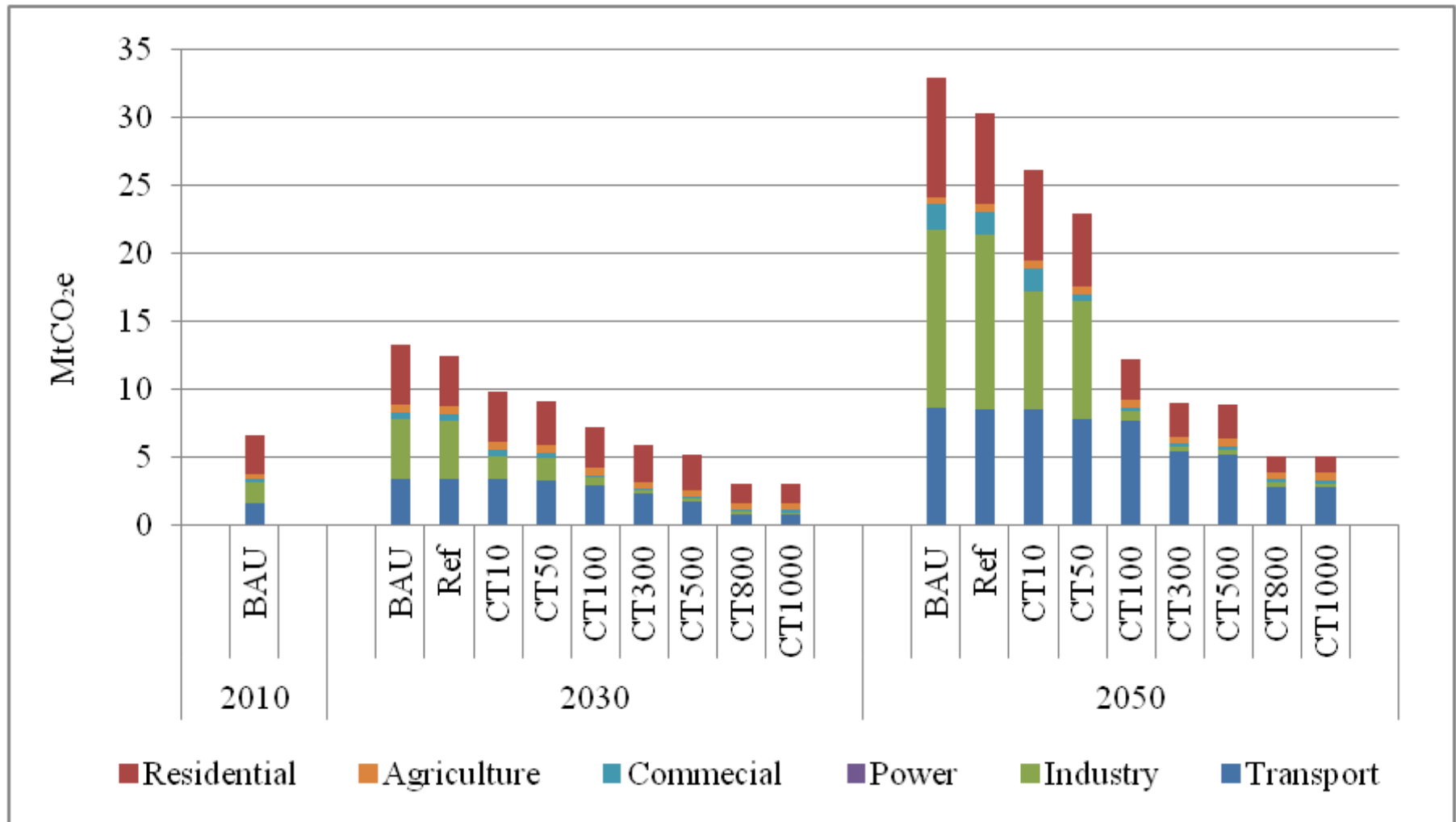
Time frame: 2010 – 2050

Modeling tool: AIM/Enduse

CM: Ctax, RE, Bio-fuels, EE, Adv Technologies, CCS

1.5 Degree Study: Thailand

1.5 Degree Study: Nepal

AIM Training Workshop in Thailand

CGE Training Workshop at SIIT-TU, Thailand
26 June 2018 (Beginning level for Policy Makers)

Participants: Bhutan, Thailand: ONEP & CITC, SIIT-TU, JICA-Thailand

AIM Training Workshop in Thailand

CGE Training Workshop at SIIT-TU, Thailand
26 June 2018 (Policy Dialogue: Climate Policy Assessment)

AIM Training Workshop in Thailand

CGE Training Workshop at SIIT-TU, Thailand
27 June-5 July 2018 (Advanced Users)

AIM Training Workshop in Thailand
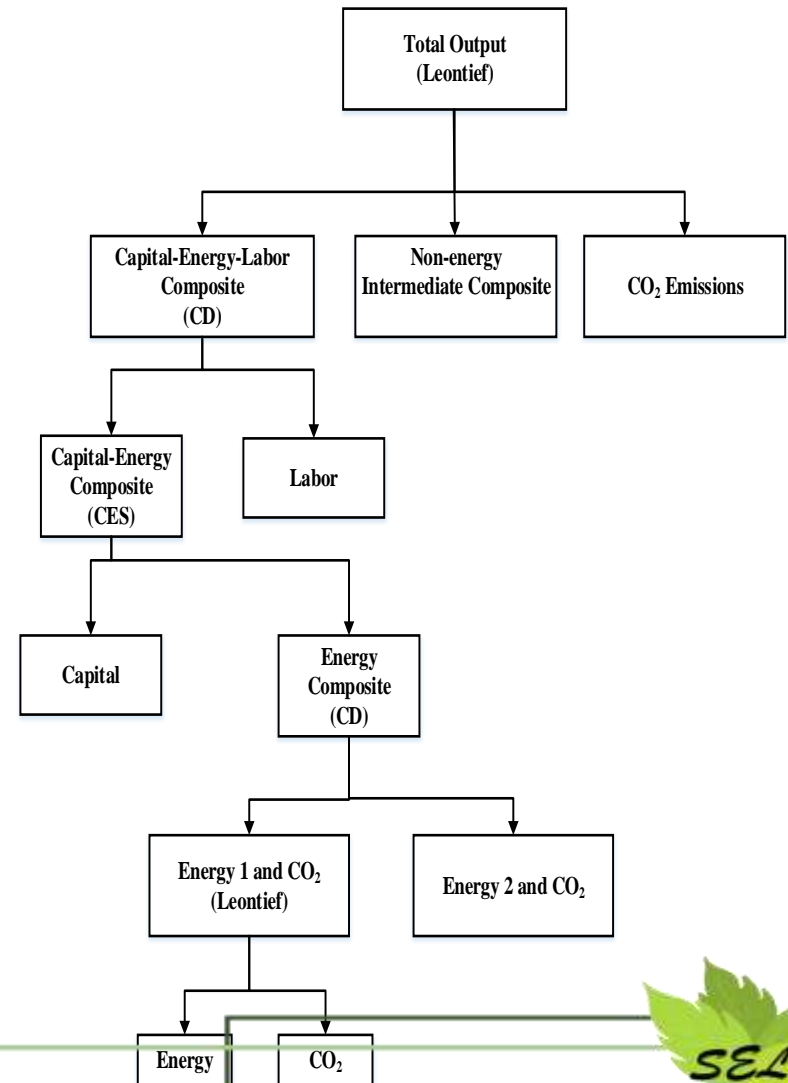
CGE Training Workshop at SIIT-TU, Thailand
27 June-5 July 2018 (Advanced Users)

Present Status of Thai and Nepal CGE Models

Nested Production Structure

- Development of both Thai and Nepal CGE models – Base case

- Assessment of macro-economic implications of imposing NDC targets of GHG emission reductions by 20-25% by 2030 in case of Thailand

Acts for Earth

IPPU

0.6 $MtCO_2e$

Energy & Transport

113 Mt CO_2e

Waste

2 $MtCO_2e$

THANK YOU

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