PIER
PUEY UNGPHAKORN INSTITUTE FOR ECONOMIC RESEARCH

Thailand Long-term strategies & Net-zero targets

21 JUL 2021

Bundit LIMMEECHOKCHAI

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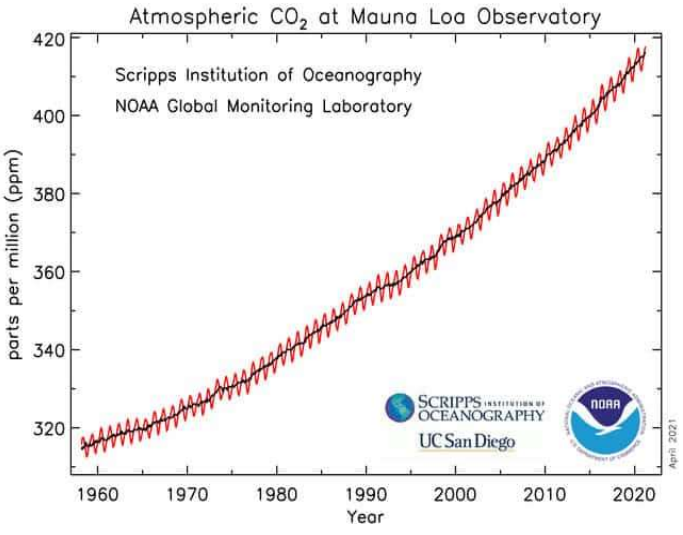
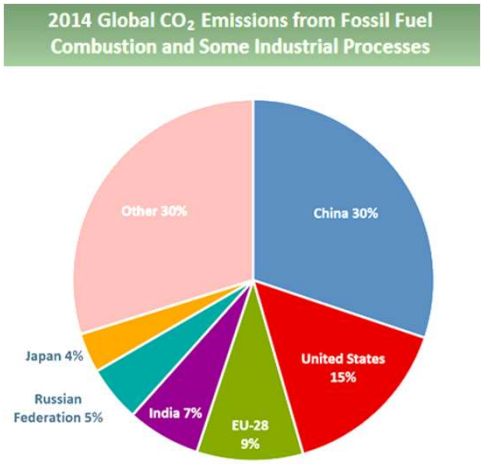
Global GHG Emissions





2

UNITED NATIONS
2015

Paris Agreement

Article 4 → Mitigation

- Peak GHGs →
- Peak year →
- Measures →
- Net Zero →
- Before 2100 →
- Equity& SDG →
- LTS Mitigation →
- UNFCCC Obj. →
- Common but Diff & Capacity →

1. In order to achieve the long-term temperature goal set out in Article 2, Parties aim to reach global peaking of greenhouse gas emissions as soon as possible, recognizing that peaking will take longer for developing country Parties, and to undertake rapid reductions thereafter in accordance with best available science, so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century, on the basis of equity, and in the context of sustainable development and efforts to eradicate poverty.

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19. All Parties should strive to formulate and communicate long-term low greenhouse gas emission development strategies, mindful of Article 2 taking into account their common but differentiated responsibilities and respective capabilities, in the light of different national circumstances.

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The Timing of Countries' Net-Zero Emissions Targets

Already achieved	SURINAME, BHUTAN
2030	URUGUAY
2035	FINLAND
2040	AUSTRIA, ICELAND
2045	SWEDEN
2050	UK, FRANCE, DENMARK, NEW ZEALAND, HUNGARY, EUROPEAN UNION, CHILE, CANADA, SOUTH KOREA, FIJI, SPAIN, USA, JAPAN, SOUTH AFRICA, GERMANY, SWITZERLAND, NORWAY, IRELAND, PORTUGAL, PANAMA, COSTA RICA, SLOVENIA, ANDORRA, MARSHALL ISLANDS, CAMBODIA, MYANMAR, LAOS, THAILAND
2060	CHINA, KAZAKHSTAN

Remark:
- Achieved
- In law
- Proposed legislation
- In policy document
- Target under discussion

Updated 19/3/2021
https://eciu.net/netzerotracker

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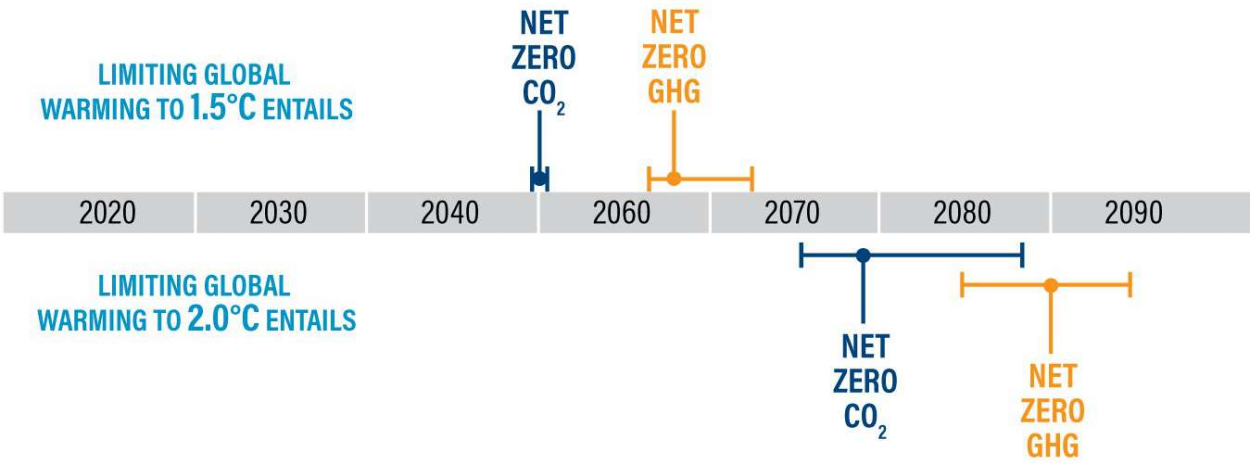
Suggested Global Timeline to Reach Net-zero Emissions



Source: IPCC & WRI

5

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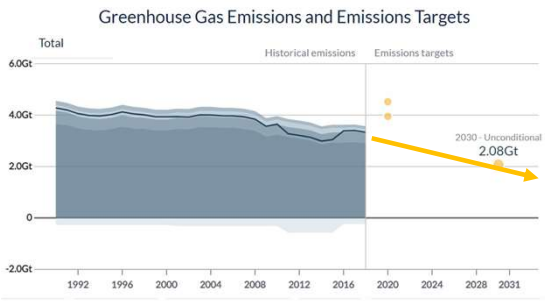
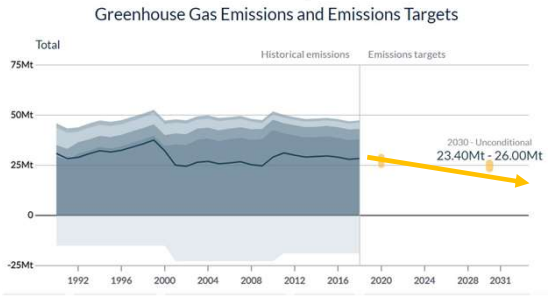
GHG emissions & Targets

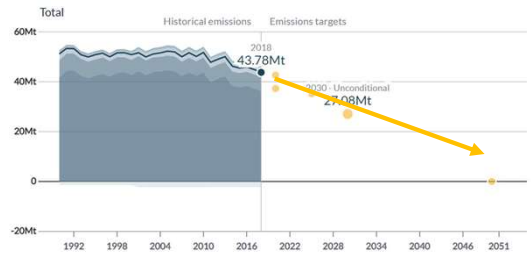
EU



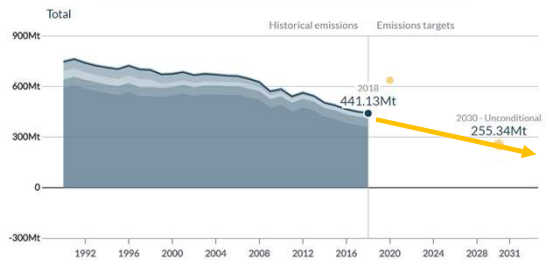
Norway



Switzerland



UK



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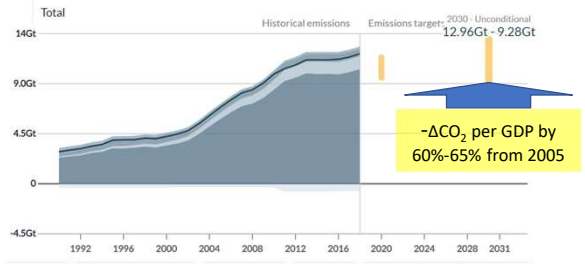
GHG emissions & Targets

CHINA

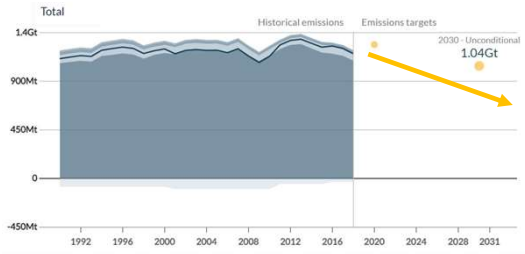
Greenhouse Gas Emissions and Emissions Targets



-ΔCO_2 per GDP by 60%-65% from 2005

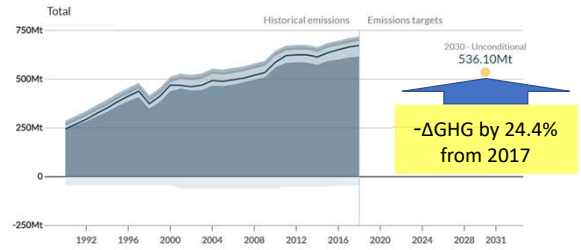
JAPAN

Greenhouse Gas Emissions and Emissions Targets



KOREA

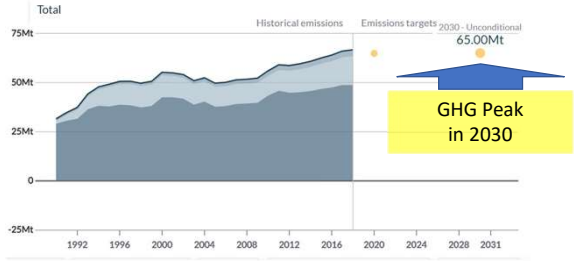
Greenhouse Gas Emissions and Emissions Targets



-ΔGHG by 24.4% from 2017

SINGAPORE

Greenhouse Gas Emissions and Emissions Targets



GHG Peak in 2030

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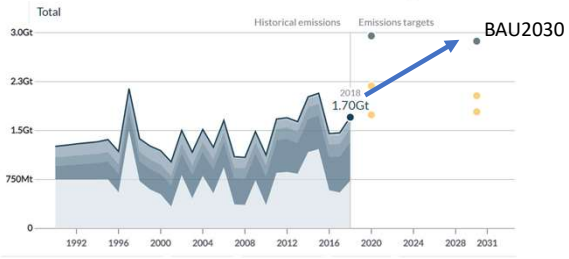
GHG emissions & Targets

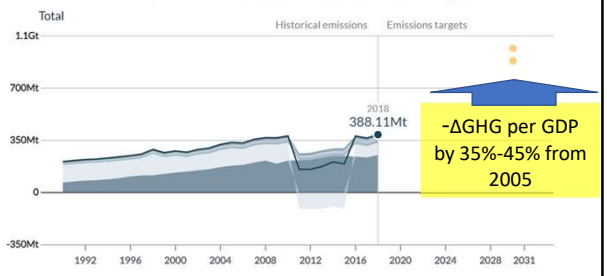
INDONESIA

Greenhouse Gas Emissions and Emissions Targets



MALAYSIA

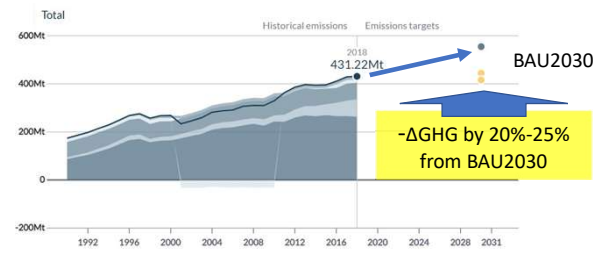
Greenhouse Gas Emissions and Emissions Targets



-ΔGHG per GDP by 35%-45% from 2005

THAILAND

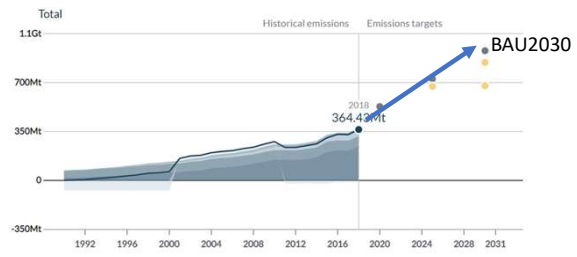
Greenhouse Gas Emissions and Emissions Targets



-ΔGHG by 20%-25% from BAU2030

VIETNAM

Greenhouse Gas Emissions and Emissions Targets



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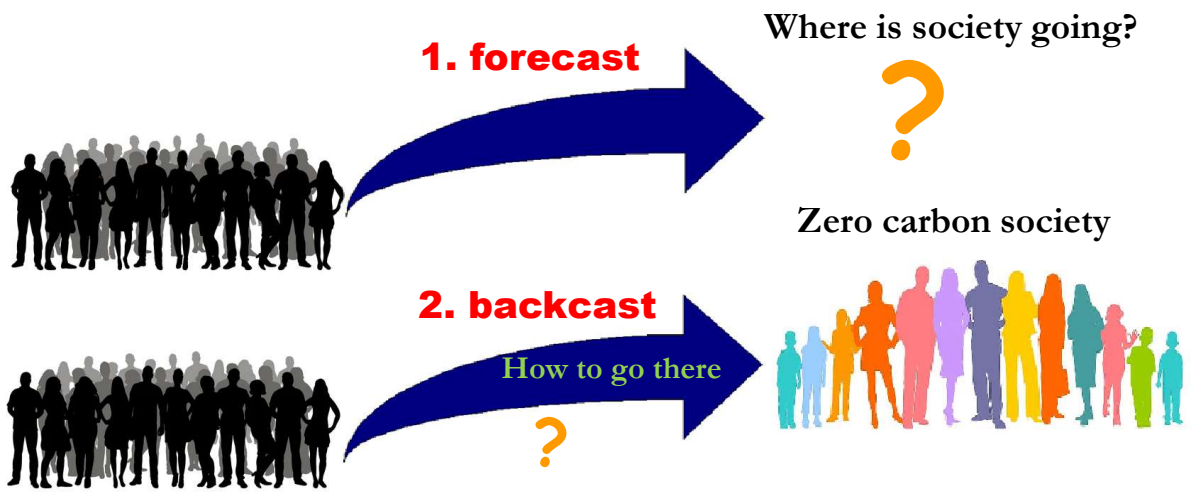
Net-zero Targets: Forecasting vs Backcasting



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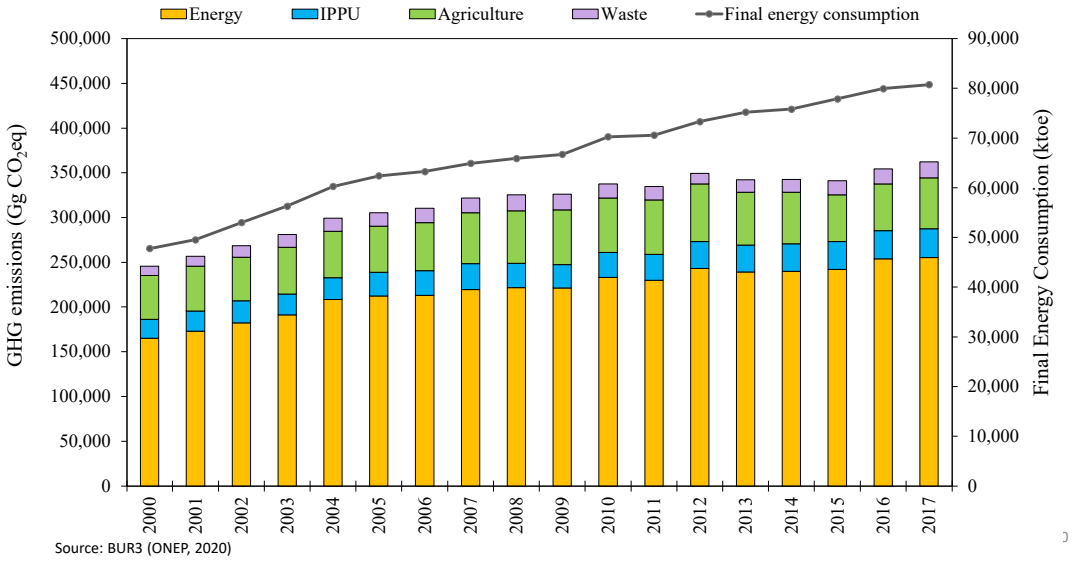
Trends of GHG emissions and Total Final Energy Consumption 2000-2017



Source: BUR3 (ONEP, 2020)

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Setting The Course to Net-zero Targets

1. Cover all greenhouse gases and sectors
2. Aim for net-zero targets then go net negative
3. Include an absolute emissions reduction target
4. Avoid or limit use of offsets
5. Communicate clearly and transparently
6. Inform near and midtem climate actions

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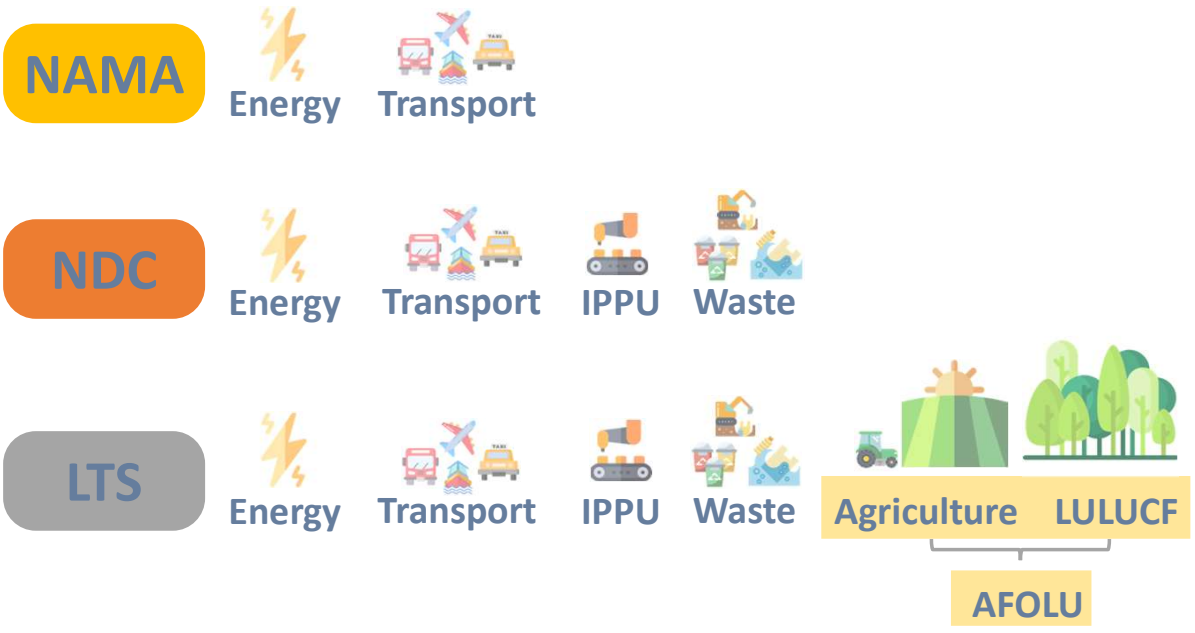
SCOPE of Thailand LTS 2050



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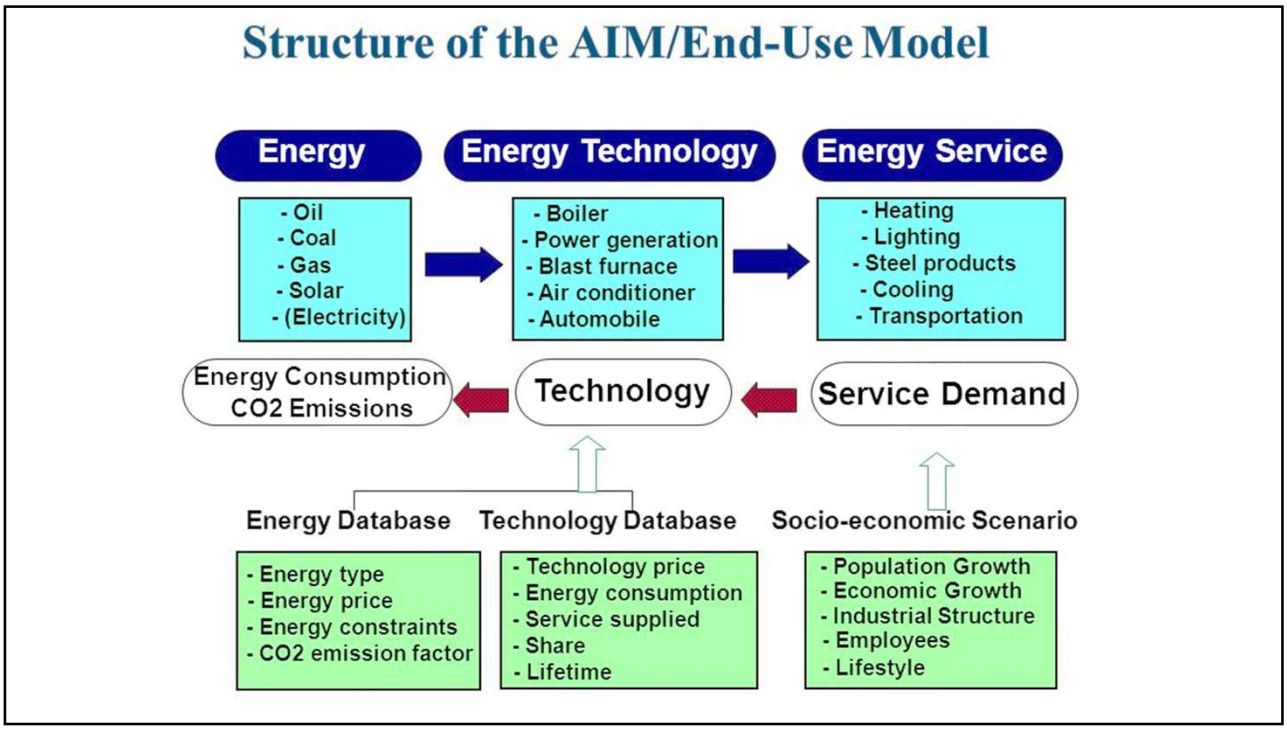
Structure of the AIM/End-Use Model
Energy
Energy Technology
Energy Service
- Oil
- Coal
- Gas
- Solar
- (Electricity)
- Boiler
- Power generation
- Blast furnace
- Air conditioner
- Automobile
- Heating
- Lighting
- Steel products
- Cooling
- Transportation
Energy Consumption
CO2 Emissions
Technology
Service Demand
Energy Database
Technology Database
Socio-economic Scenario
- Energy type
- Energy price
- Energy constraints
- CO2 emission factor
- Technology price
- Energy consumption
- Service supplied
- Share
- Lifetime
- Population Growth
- Economic Growth
- Industrial Structure
- Employees
- Lifestyle

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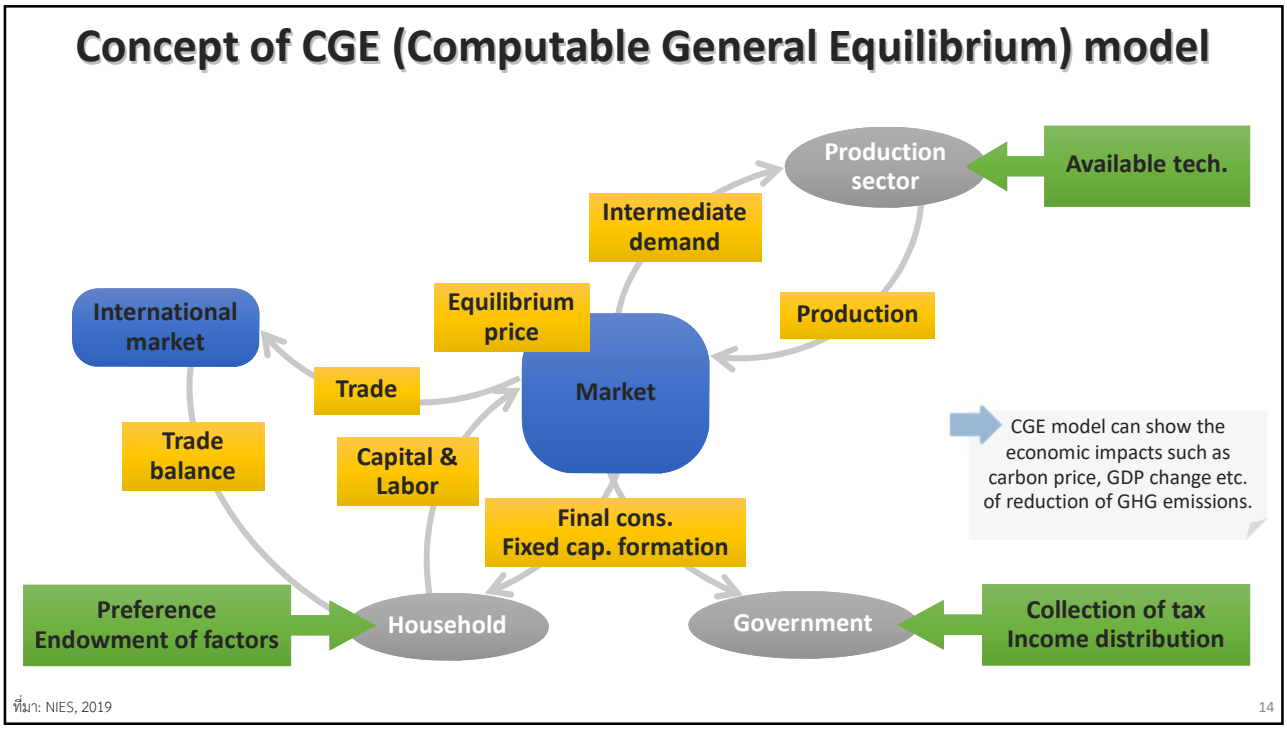
Concept of CGE (Computable General Equilibrium) model
Production sector
Available tech.
Intermediate demand
Equilibrium price
Production
International market
Trade
Market
Trade balance
Capital & Labor
Final cons.
Fixed cap. formation
CGE model can show the economic impacts such as carbon price, GDP change etc. of reduction of GHG emissions.
Preference
Endowment of factors
Household
Government
Collection of tax
Income distribution
ที่มา: NIES, 2019
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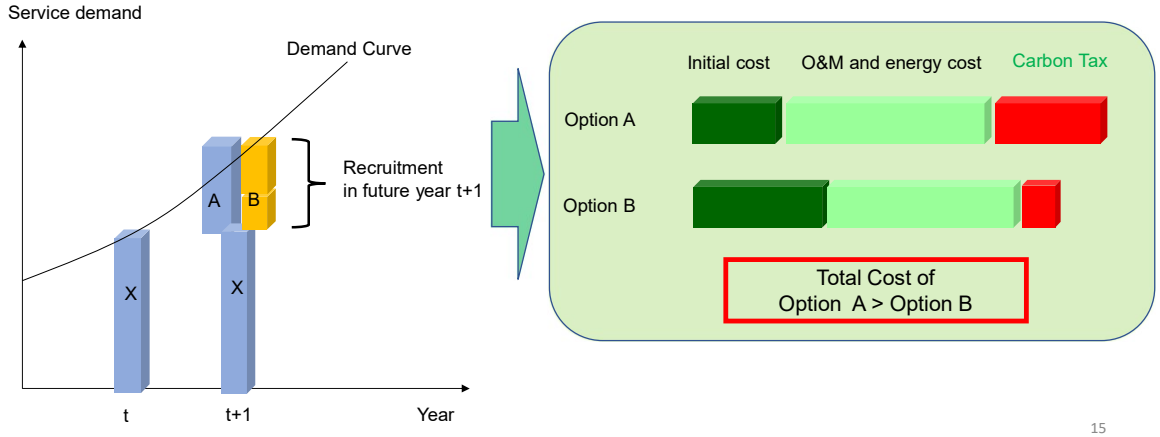
Selection of GHG Countermeasures

- The model selects minimum cost options subject to given constraints e.g. demand.
- PW of total cost = Investment cost + O&M cost + Energy cost + Carbon Tax → minimize



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Manufacturing Industries

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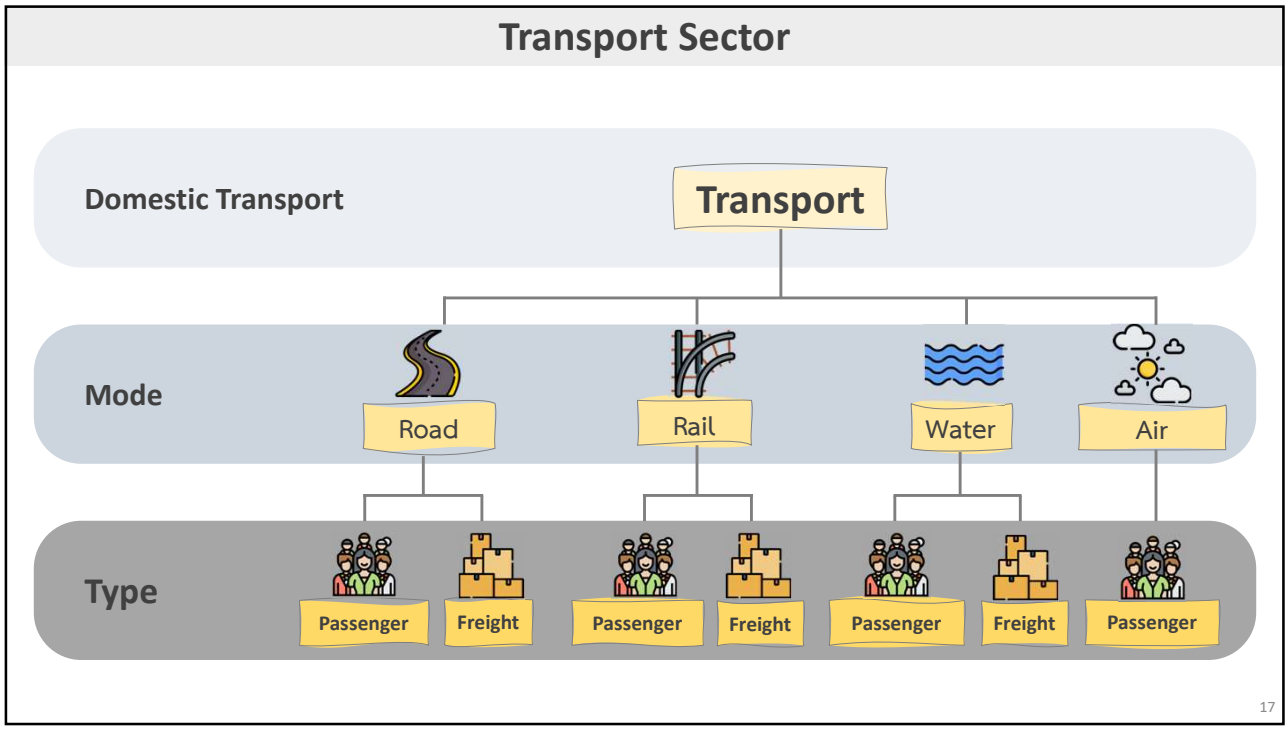
Transport Sector
Domestic Transport
Transport
Mode
Road
Rail
Water
Air
Type
Passenger
Freight
Passenger
Freight
Passenger
Freight
Passenger
17

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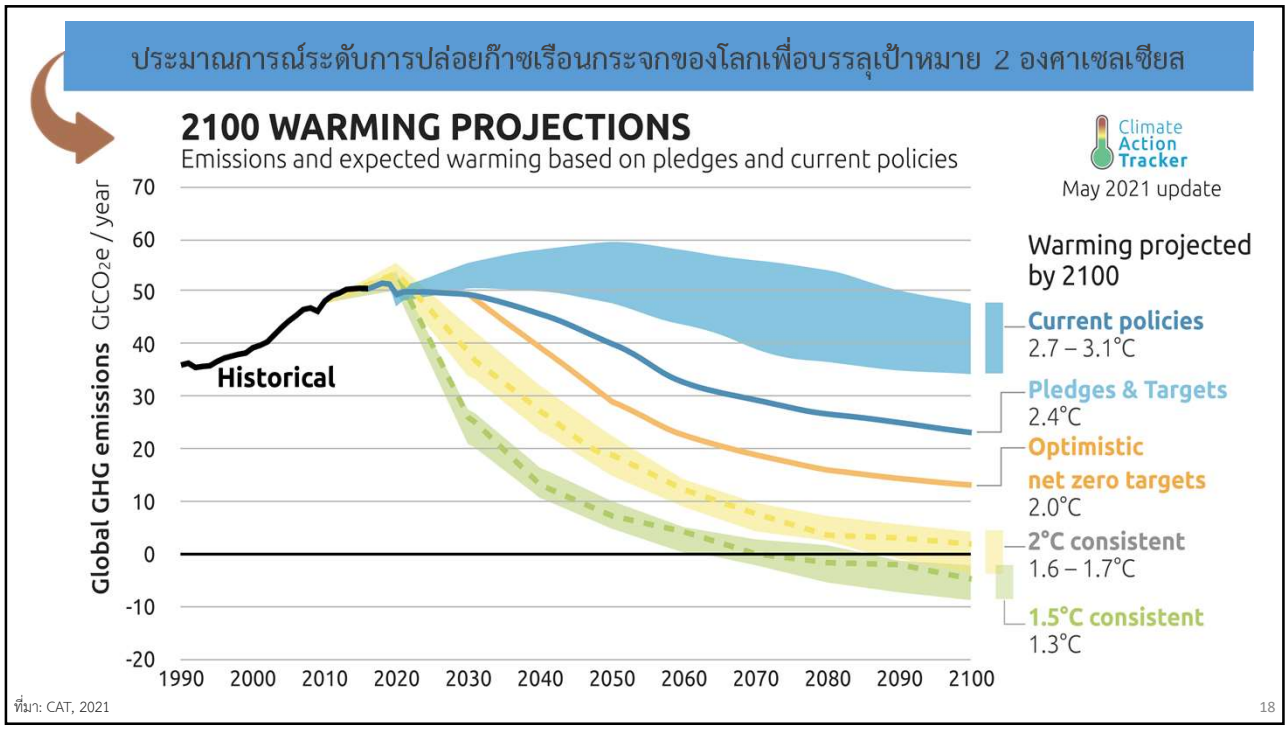
ประมาณการณ์ระดับการปล่อยก๊าซเรือนกระจกของโลกเพื่อบรรลุเป้าหมาย 2 องศาเซลเซียส
2100 WARMING PROJECTIONS
Emissions and expected warming based on pledges and current policies
Climate Action Tracker
May 2021 update
Global GHG emissions GtCO2e / year
70
60
50
40
30
20
10
0
-10
-20
1990
2000
2010
2020
2030
2040
2050
2060
2070
2080
2090
2100
Historical
Warming projected by 2100
Current policies
2.7 – 3.1°C
Pledges & Targets
2.4°C
Optimistic net zero targets
2.0°C
2°C consistent
1.6 – 1.7°C
1.5°C consistent
1.3°C
ที่มา: CAT, 2021
18

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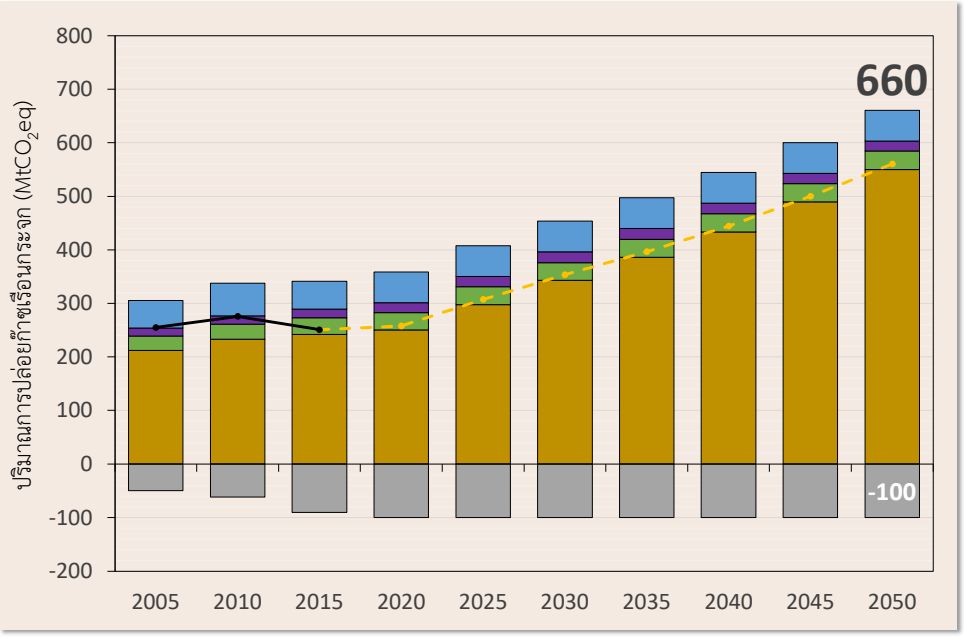
Sectoral GHG emissions in the BAU



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Energy

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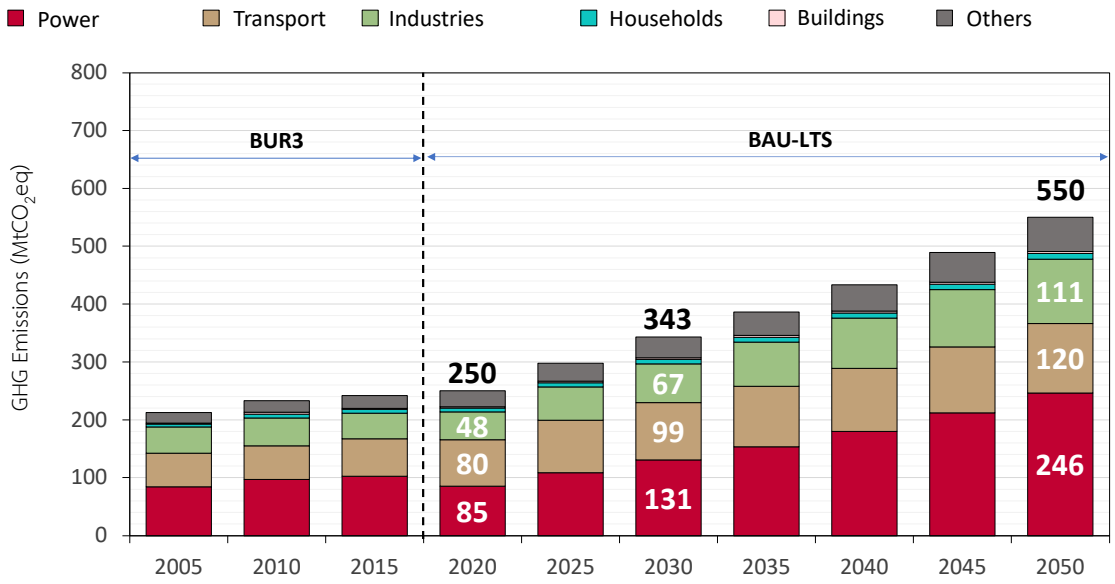
GHG Emissions in Energy sector in BAU



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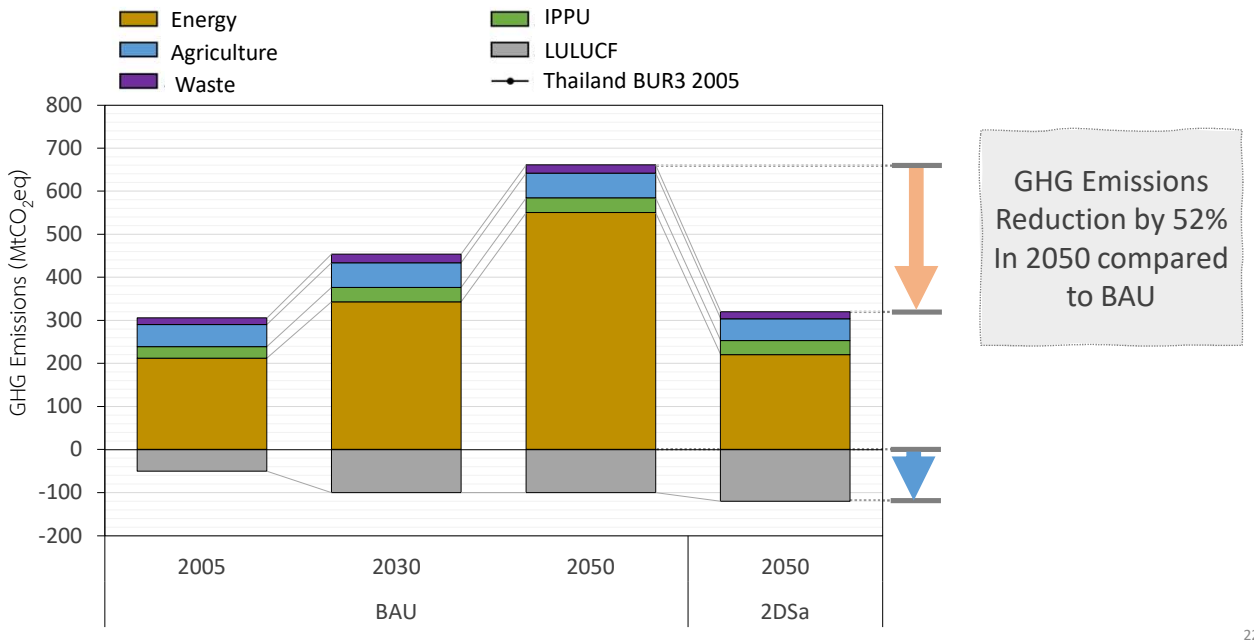
GHG emissions in 2D scenario by IPCC sectors



GHG Emissions Reduction by 52% In 2050 compared to BAU

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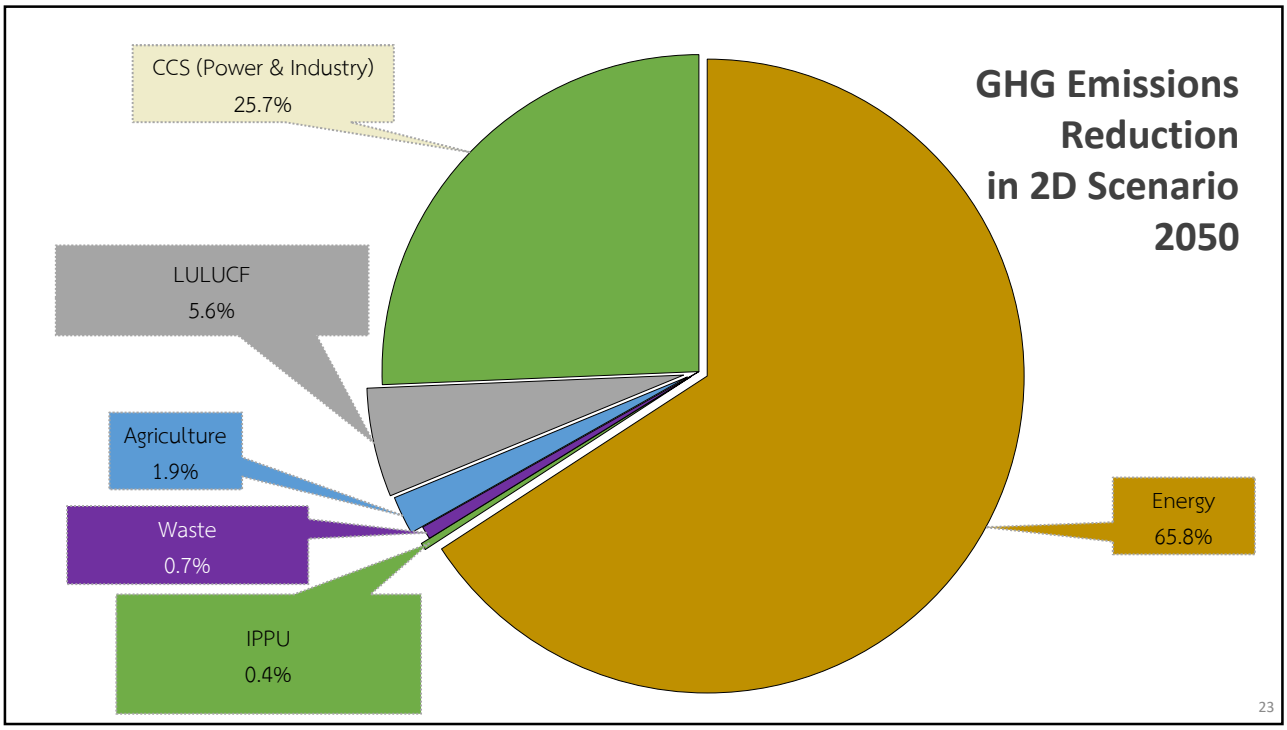
GHG Emissions Reduction in 2D Scenario 2050
CCS (Power & Industry) 25.7%
LULUCF 5.6%
Agriculture 1.9%
Waste 0.7%
IPPU 0.4%
Energy 65.8%
23

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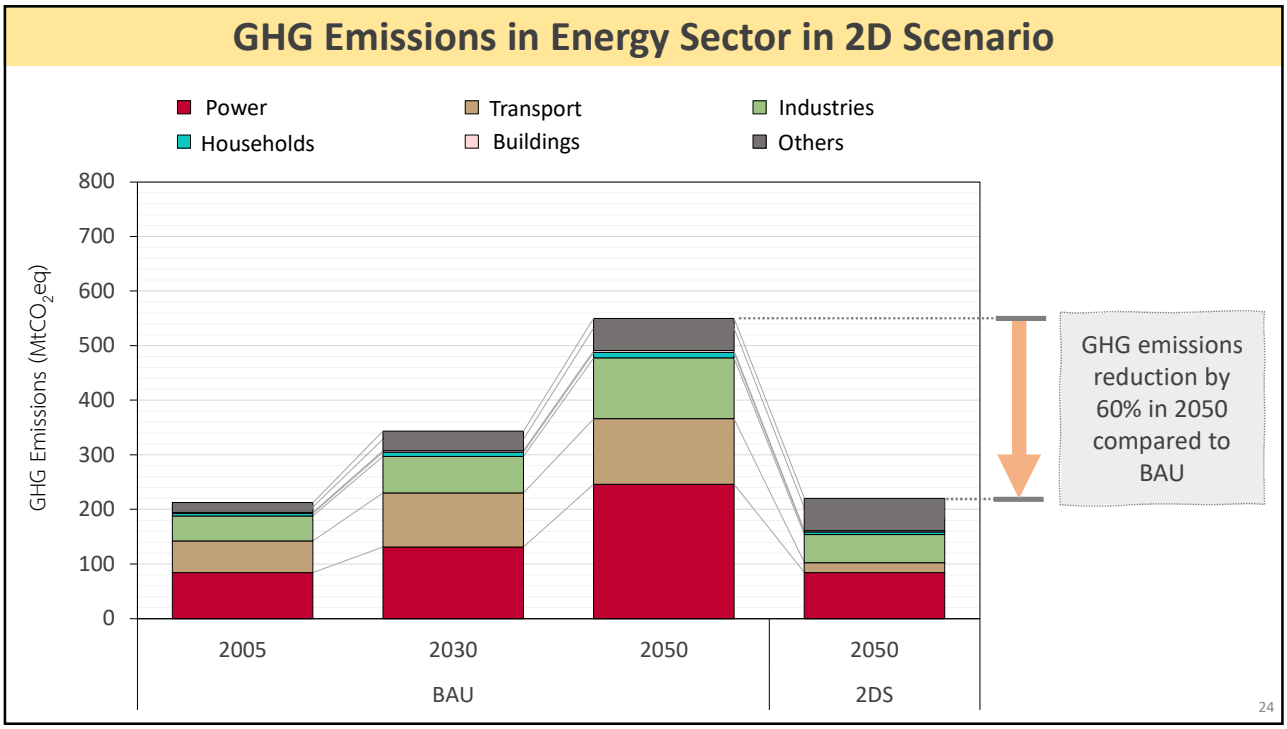
GHG Emissions in Energy Sector in 2D Scenario
Power
Transport
Industries
Households
Buildings
Others
GHG Emissions (MtCO2eq)
800
700
600
500
400
300
200
100
0
2005
2030
BAU
2050
2050
2DS
GHG emissions reduction by 60% in 2050 compared to BAU
24

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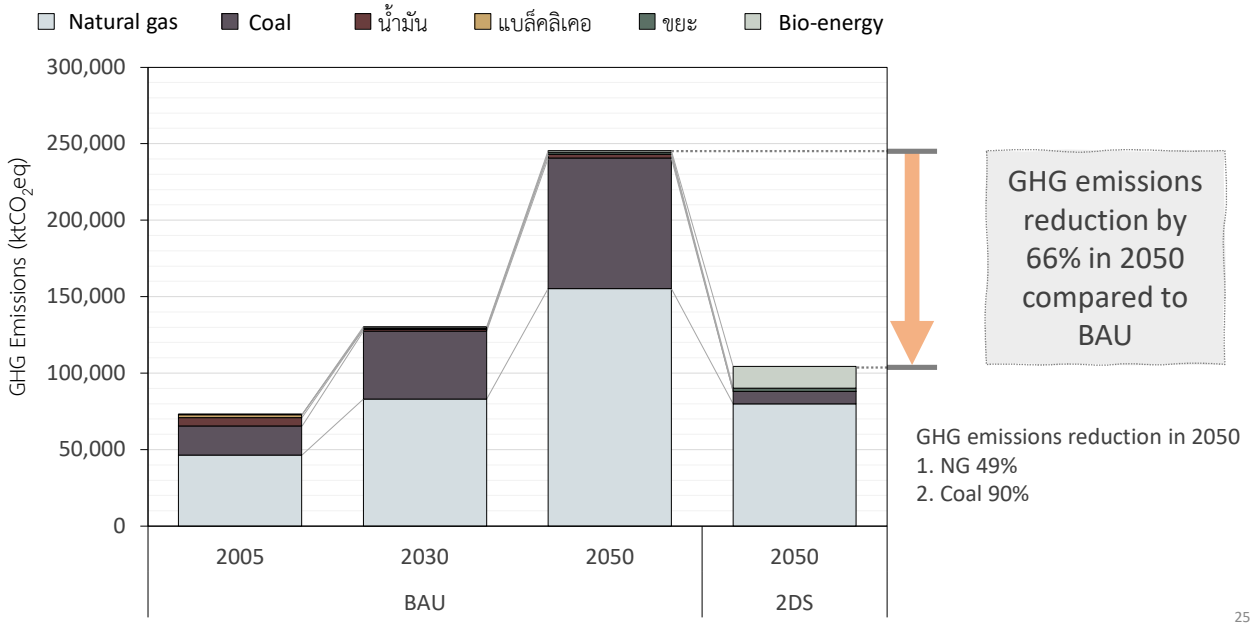
GHG Emissions in Power Generation in 2D Scenario



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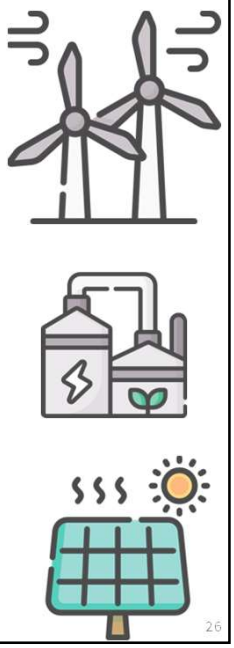
Shares of power generation in 2D scenario

Measures	%		
	2015	2030	2050
Existing plants	90	89	24
New Plants	-	-	43
RE plants	10	11	33
Solar and wind	*1*	*2*	*20*
Bio-energy	*7*	*7*	*8*
Hydro	*2*	*2*	*1*
BECCS	*-*	*-*	*4*



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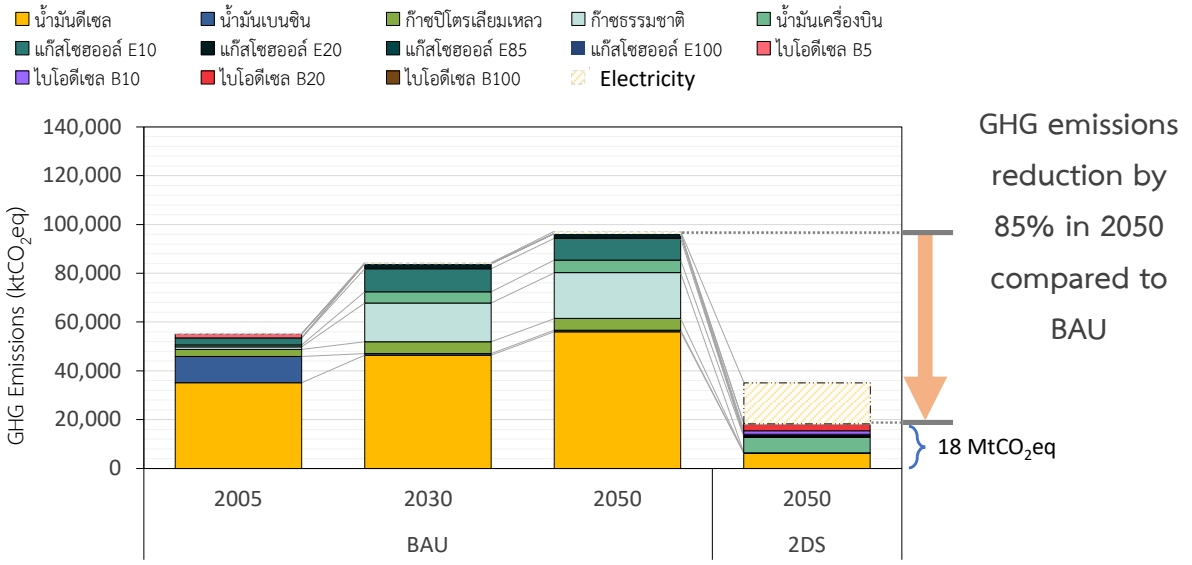
GHG Emissions in transport sector 2D Scenario



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Shares of measures in transport sector in 2D scenario

Measure	%		
	2015	2030	2050
EEP+	-	82	68
AEDP+	5	8	34
Bio-energy			

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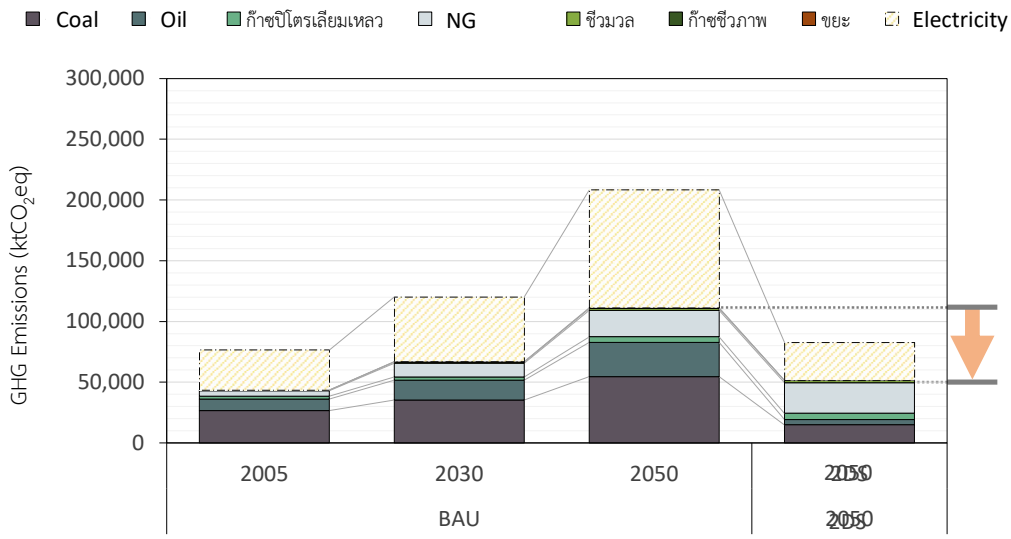
GHG Emissions in manufacturing industries in 2D Scenario



GHG emissions reduction by 54% in 2050 compared to BAU

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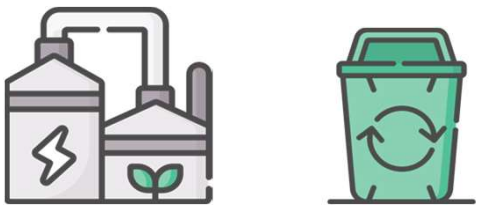
Shares of measures in manufacturing industries in 2D scenario

Measure	%		
	2015	2030	2050
EEP+	-	39	77
AEDP+	37	46	50
Bio-energy	37	46	50
Waste	0	0	0
CCS	-	-	18 $MtCO_2$



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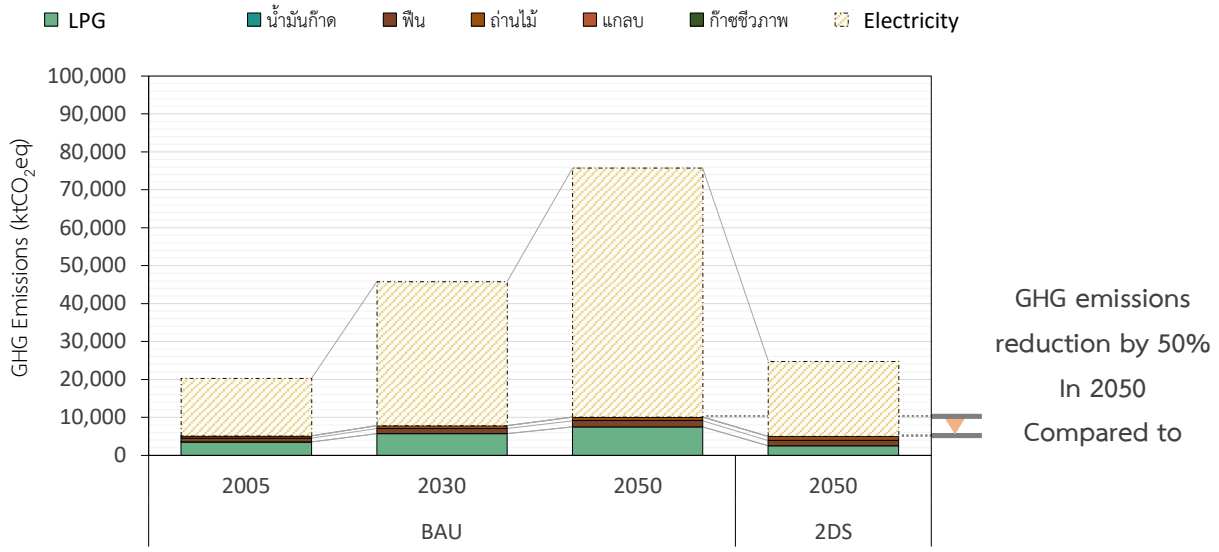
GHG Emissions in households in 2D Scenario

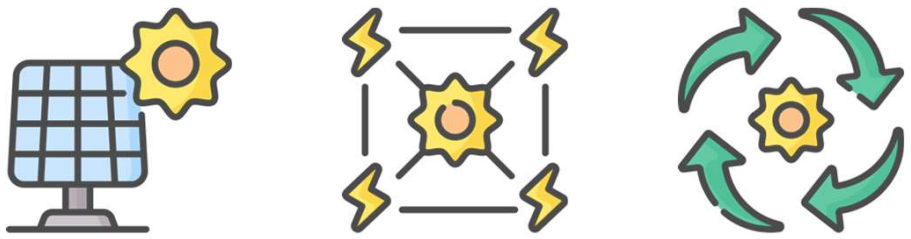


31

31

Shares of measures in households in 2D scenario

Measure	%		
	2015	2030	2050
EEP+	-	28	29
AEDP+	53	51	49
Solar Thermal	0	0	1
Bio-energy	53	51	48



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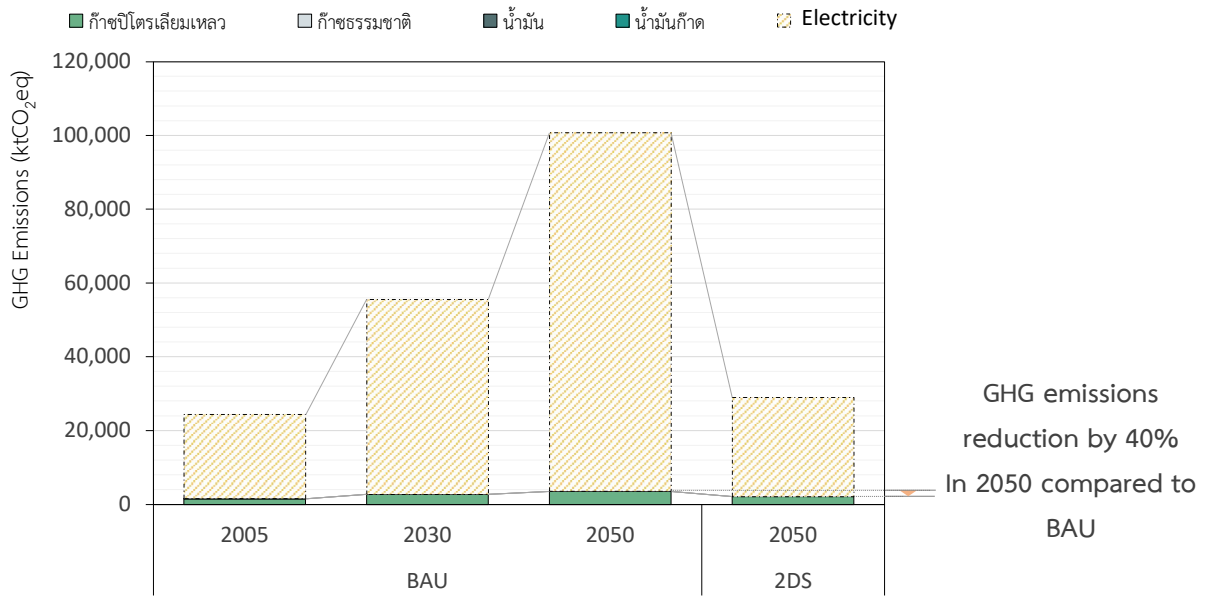
GHG Emissions in buildings in 2D Scenario



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Shares of measures in buildings in 2D scenario

Measure	%		
	2015	2030	2050
EEP+	-	33	33
AEDP+	-	0	5
Solar Thermal	-	0	5

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Industrial Process & Product Use (IPPU)

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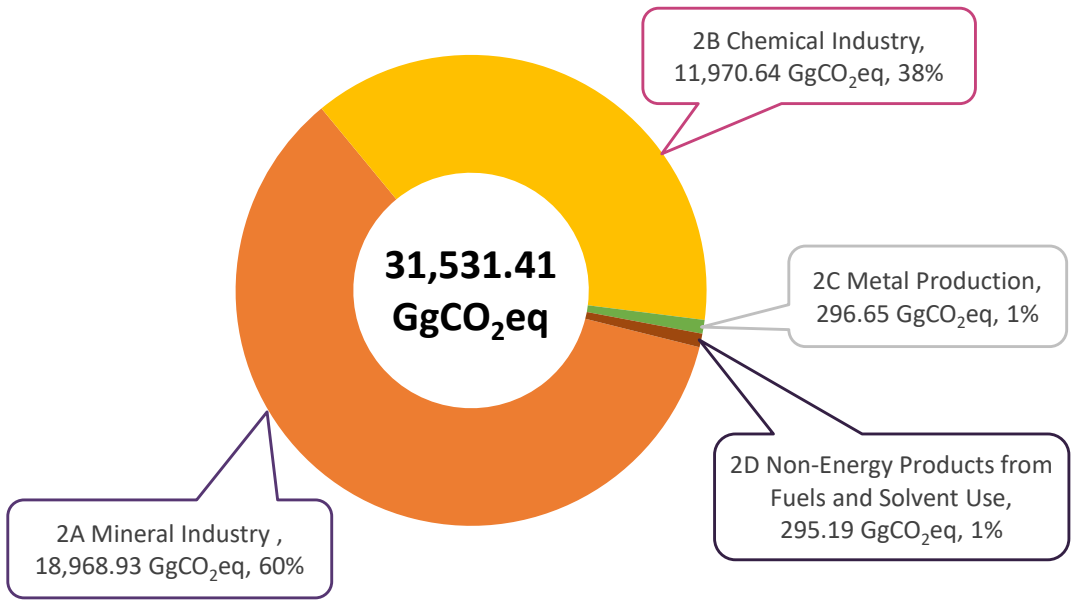
Industrial Processes and Product Use (IPPU) 2016, BUR3



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Industrial Processes and Product Use (IPPU) 2016, BUR3

Greenhouse gas source and sink categories	CO_2 emissions	CO_2 removals	CH_4		N_2O		Total
Unit	**$GgCO_2eq$**	**$GgCO_2eq$**	**Gg**	**$GgCO_2eq$**	**Gg**	**$GgCO_2eq$**	**$GgCO_2eq$**
2. industrial processes and Product Use	**30,797.78**	**NO**	**13.09**	**327.39**	**1.61**	**480.03**	**31,531.41**
2A Mineral Industry	**18,968.93**						**18,968.93**
2A1 Cement Production	17,829.34						
2A2 Lime Production	124.61						
2A3 Glass Production	217.13						
2A4b Other Uses of Soda Ash	267.09						
2A4d Other	530.76						
2B Chemical Industry	**11,163.22**		**13.09**	**327.39**	**1.61**	**480.03**	**11,970.64**
2C Metal Production	**296.65**		**NA**	**NA**			**296.65**
2C1 Iron and Steel Production	296.65		**NA**	**NA**			
2D Non-Energy Products from Fuels and Solvent Use	**295.19**						**295.19**
2D1 Lubricant Use	295.19						
2H Other	**NA**						
2H1 Pulp and Paper Industry							
2H2 Food and Beverages Industry							

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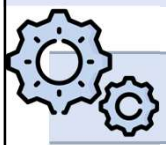
Measures in IPPU sector



Measures	GHG emissions reduction in 2030 ($MtCO_2eq$)
มาตรการทดแทนปูนเม็ด (Clinker substitution)	
• การใช้วัสดุทดแทนปูนเม็ดในกระบวนการผลิตปูนซีเมนต์ไฮดรอลิก	0.85
• การใช้วัสดุทดแทนปูนซีเมนต์ในคอนกรีตผสมเสร็จ	
มาตรการทดแทน/ปรับเปลี่ยนสารทำความเย็น (Refrigerant)	
• การปรับเปลี่ยนสารทำความเย็นภายใต้โครงการ RAC NAMA	0.40
• การกำจัดทำลายของเสียและสารทำความเย็นที่เสื่อมสภาพอย่างถูกวิธี	
TOTAL	**1.25**

Source: DIW (2019)

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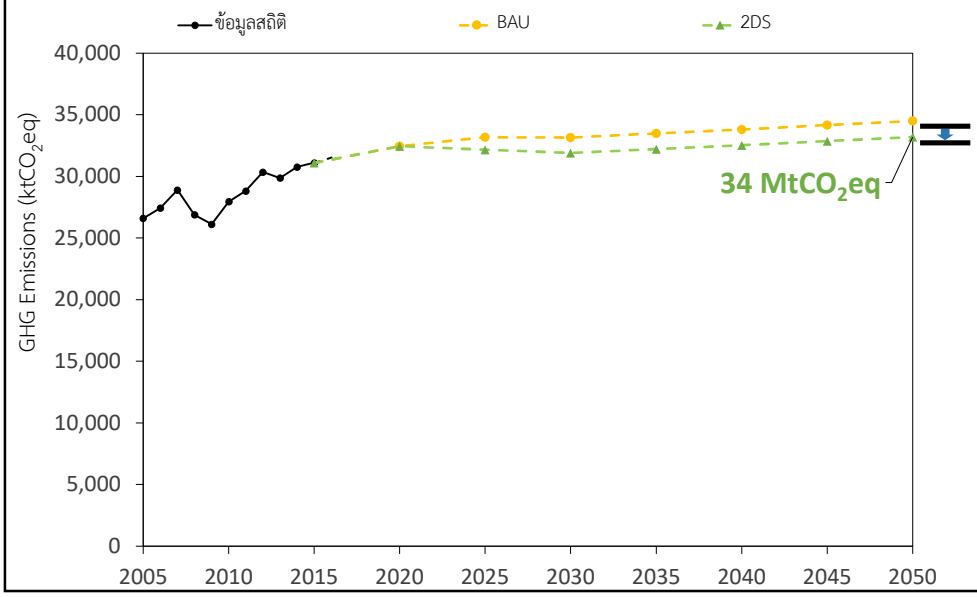
GHG emissions in IPPU in 2D scenario



GHG Emissions Reduction by 3% In 2050 Compared to BAU

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Waste

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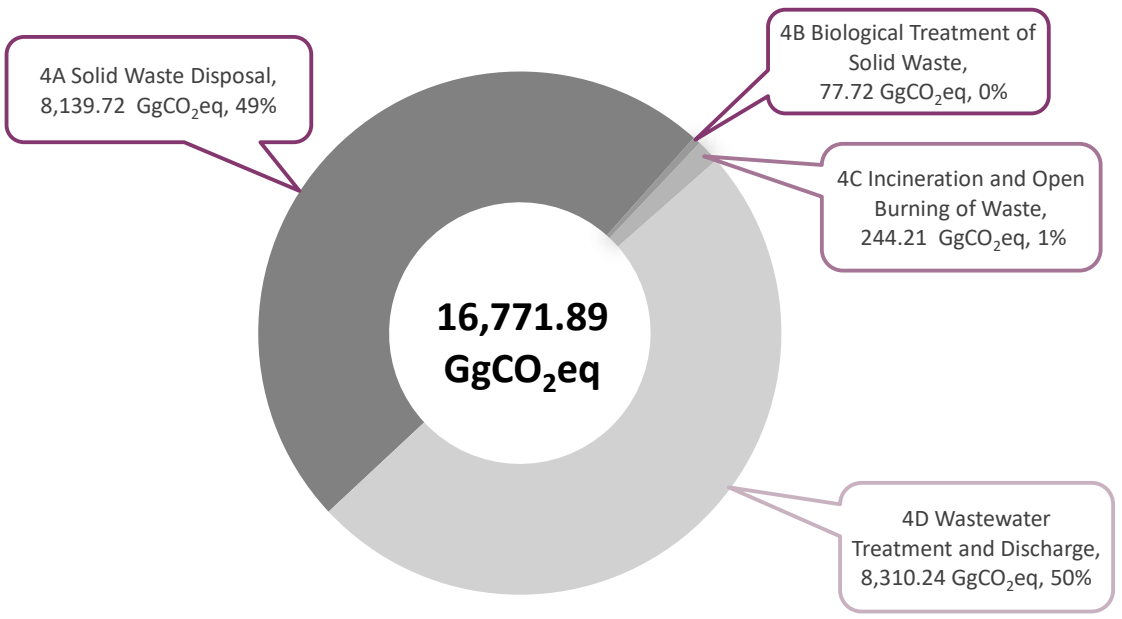
Waste 2016, BUR3



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Waste 2016, BUR3

Greenhouse gas source and sink categories	CO_2 emissions	CO_2 removals	CH_4		N_2O		Total
Unit	$GgCO_2eq$	$GgCO_2eq$	Gg	$GgCO_2eq$	Gg	$GgCO_2eq$	$GgCO_2eq$
5. Waste	**233.99**		**631.00**	**15,775.01**	**2.56**	**762.89**	**16,771.89**
5A Solid Waste Disposal			**325.59**	**8,139.72**			**8,139.72**
5A1 Managed Waste Disposal Sites			194.97	4,874.26			
5A2 Unmanaged Waste Disposal Sites			130.62	3,265.46			
5B Biological Treatment of Solid Waste			**1.61**	**40.19**	**0.13**	**37.53**	**77.72**
5C Incineration and Open Burning of Waste	**233.99**		**0.004**	**0.09**	**0.03**	**10.13**	**244.21**
5C1 Waste Incineration	233.99		0.004	0.09	0.03	10.13	
5D Wastewater Treatment and Discharge			**303.80**	**7,595.01**	**2.40**	**715.23**	**8,310.24**
5D1 Domestic Wastewater Treatment and Discharge			75.64	1,891.08	2.40	715.23	
5D2 Industrial Wastewater Treatment and Discharge			228.16	5,703.93			

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Measures in Waste sector

Measures	GHG Emissions Reduction in 2030 ($MtCO_2eq$)
Solid Waste Management	1.48
• การลดปริมาณขยะมูลฝอยก่อนเข้าสถานที่กำจัด	
• การนำก๊าซจากบ่อฝังกลบขยะมูลฝอย (Landfill Gas) ไปเผาทิ้งหรือนำไปใช้ประโยชน์ เช่น การผลิตไฟฟ้า	
• การเผาขยะมูลฝอยในเตาเผาเพื่อผลิตไฟฟ้า (Waste to energy)	
• การฝังกลบขยะมูลฝอยแบบกึ่งใช้อากาศ (Semi Aerobic Landfill)	
• การนำขยะอินทรีย์ไปทำปุ๋ยหมัก (Composting) และน้ำหมักชีวภาพ	
• การนำขยะอินทรีย์ไปหมักแบบไร้อากาศ (Anaerobic Digestion ส่งเสริมการนำก๊าซไปใช้ประโยชน์	
• การนำขยะอินทรีย์ไปบำบัดเชิงกลชีวภาพ (Mechanical Biological Treatment)	
• การยุติการเผากลางที่แจ้งและการกำจัดขยะมูลฝอยแบบเผาให้ถูกต้อง	
Waste-Water Management	0.05
• การเพิ่มการรวบรวมน้ำเสียเข้าสู่ระบบและเพิ่มจำนวนระบบบำบัดน้ำเสียรวมของชุมชน	
Industrial Waste-Water Management	1.00
• การเพิ่มการผลิตก๊าซชีวภาพจากน้ำเสียอุตสาหกรรมด้วยการนำก๊าซมีเทนกลับมาใช้ประโยชน์	
TOTAL	**2.53**

Source: PCD (2018) & DIW (2019)

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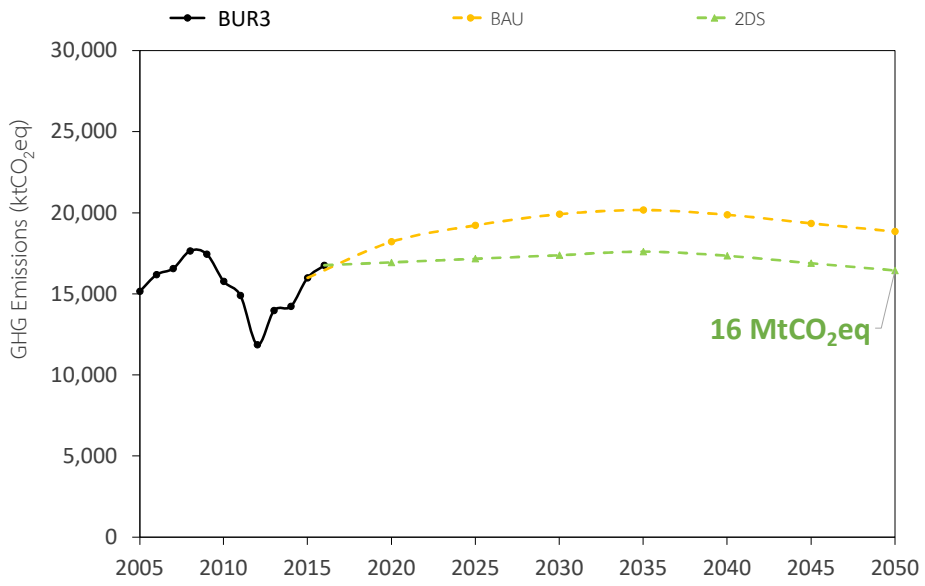
GHG emissions in Waste sector in 2D scenario



GHG Emissions Reduction by 13% in 2050 compared to BAU

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Agriculture

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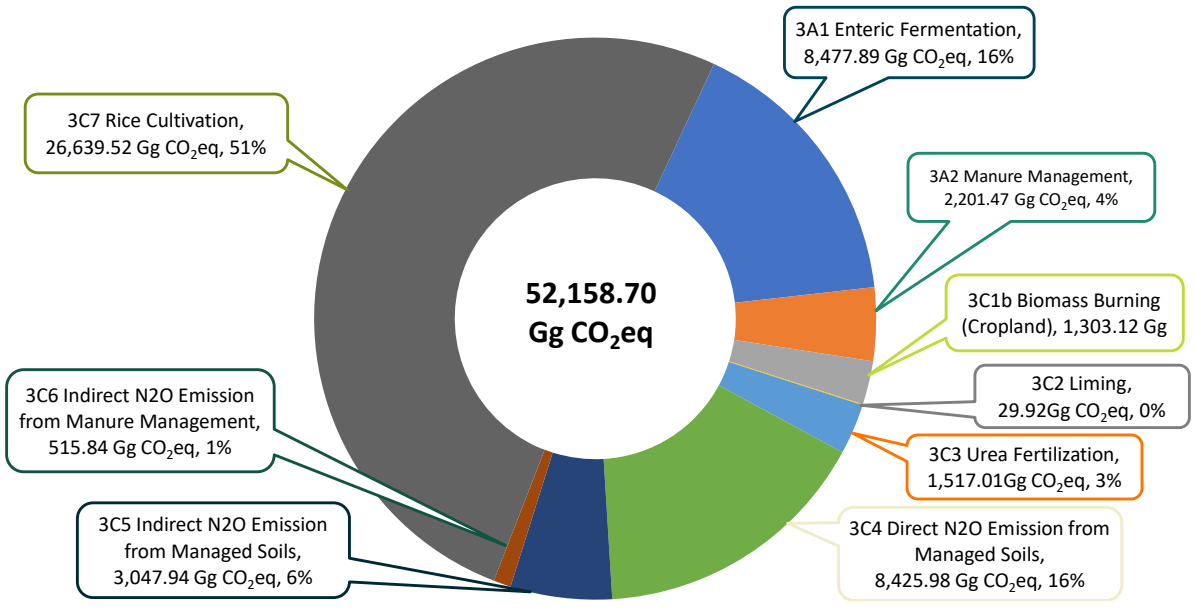
Agriculture 2016, BUR3



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Agriculture 2016, BUR3

Greenhouse gas source and sink categories	CO_2 emissions	CO_2 removals	CH_4		N_2O		Total
Unit	$GgCO_2eq$	$GgCO_2eq$	Gg	$GgCO_2eq$	Gg	$GgCO_2eq$	$GgCo_2eq$
3. Agriculture	**1,546.94**		**1,513.66**	**37,841.44**	**42.85**	**12,770.32**	**52,158.70**
3A Enteric Fermentation			339.12	8,477.89			8,477.89
3B Manure Management			69.14	1,728.55	1.59	472.92	2,201.47
3C Field Burning of Agricultural Residues	NA		39.82	995.48	1.03	307.64	1,303.12
3D Liming	29.92						29.92
3E Urea Fertilization	1,517.01						1,517.01
3F Direct N_2O Emission from Managed Soils					28.28	8,425.98	8,425.98
3G Indirect N_2O Emission from Managed Soils					10.23	3,047.94	3,047.94
3H Indirect N_2O Emission from Manure Management					1.73	515.84	515.84
3I Rice Cultivation			1,065.58	26,639.52			26,639.52

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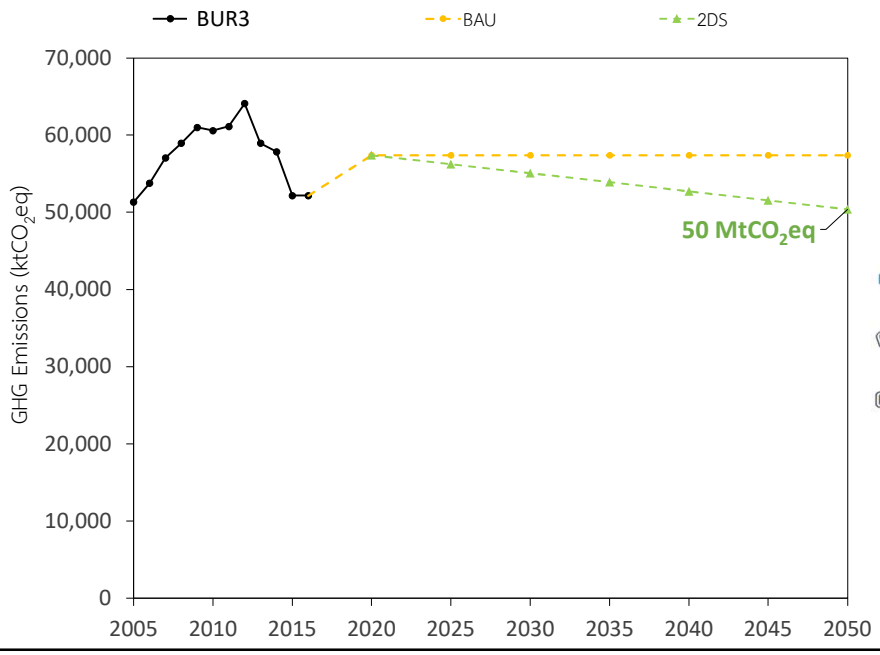
GHG emissions in Agriculture in 2D scenario



GHG Emissions Reduction by 7% in 2050 compared to BAU

Measures	GHG Emissions Reduction (tCO_2eq/unit/year)
Enteric Fermentation (head)	
Improved feeding	0.45
High genetic merit	0.32
Manure Management (head)	
Dome digester	0.62
Daily spread of manure	0.33
Rice Cultivation (hectare)	
Midseason drainage	0.39
Rice straw management	0.45
Agricultural Soil (hectare)	
High efficiency fertilizer application	0.65
Slow-release fertilizer application	0.76
Tillage and residue management	0.08

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Land Use, Land-Use Change and Forestry (LULUCF)

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LULUCF 2016, BUR3

Greenhouse gas source and sink categories	CO_2 emissions	CO_2 removals	CH_4		N_2O		Total
Unit	$GgCo_2eq$	$GgCo_2eq$	Gg	$GgCO_2eq$	Gg	$GgCO_2eq$	$GgCO_2eq$
4. Land use, land-use change and forestry	52,051.55	-143,427.09	7.15	178.74	0.21	62.27	-91,134.15
4A Forest Land Remaining Forest Land	16,467.91	-41,585.56	NO		NO		-25,117.65
4B Cropland Remaining Cropland	28,383.57	-101,841.53	NO		NO		-73,457.96
4C Land Converted to Cropland	7,100.54	NO	NO		NO		7,100.54
4D Land Converted to Other Land	99.53	NO	NO		NO		99.53
4E Biomass Burning	NO	NO	7.15	178.74	0.21	62.27	241.40
4E1 Biomass Burning (Forest Land)	NO	NO	0.88	22.01	0.03	7.72	29.72
4E2 Biomass Burning (Cropland)	NO	NO	6.20	154.94	0.18	54.32	209.27
4E3 Biomass Burning (Other Land)	NO	NO	0.07	1.79	0.00	0.63	2.41

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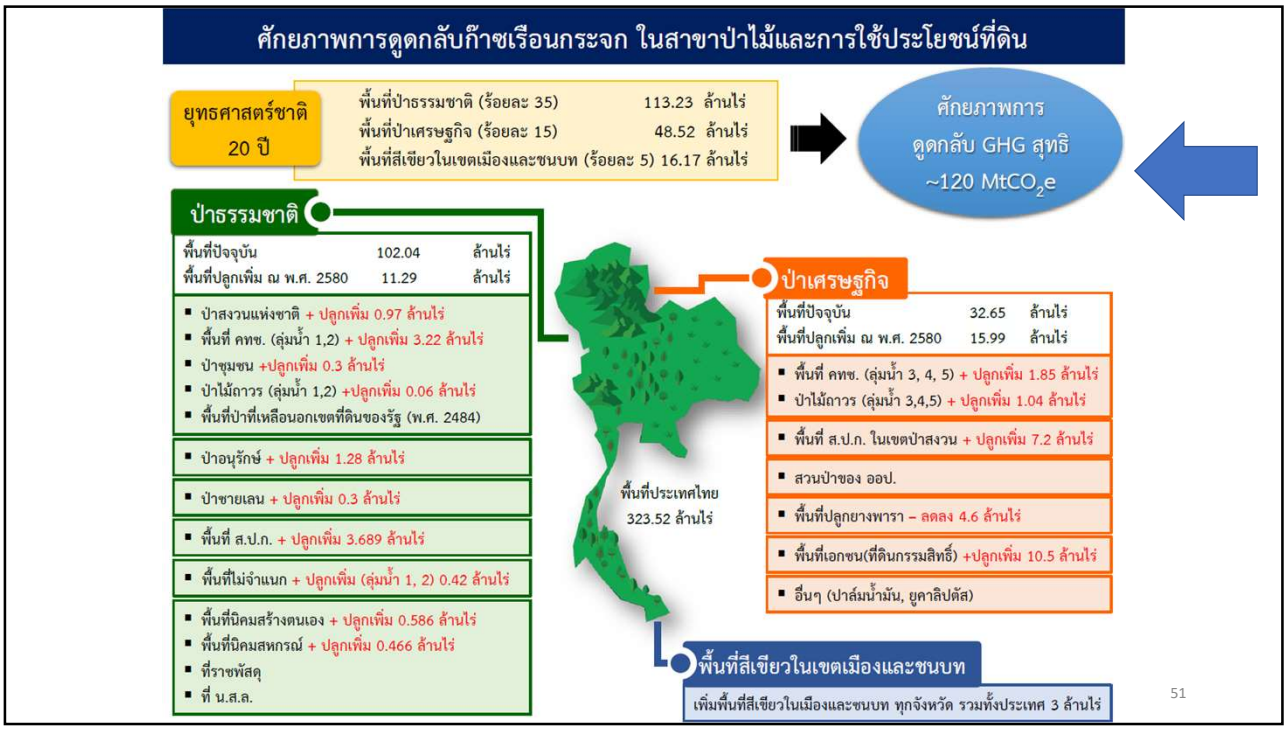

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Global Warming Potential Values

Global warming potential (GWP) values relative to CO_2

Gas	Chemical formula	GWP values for 100-year time horizon		
		Second Assessment Report (SAR)	Fourth Assessment Report (AR4)	Fifth Assessment Report (AR5)
Carbon dioxide	CO_2	1	1	1
Methane	CH_4	21	25	28
Nitrous oxide	N_2O	310	298	265

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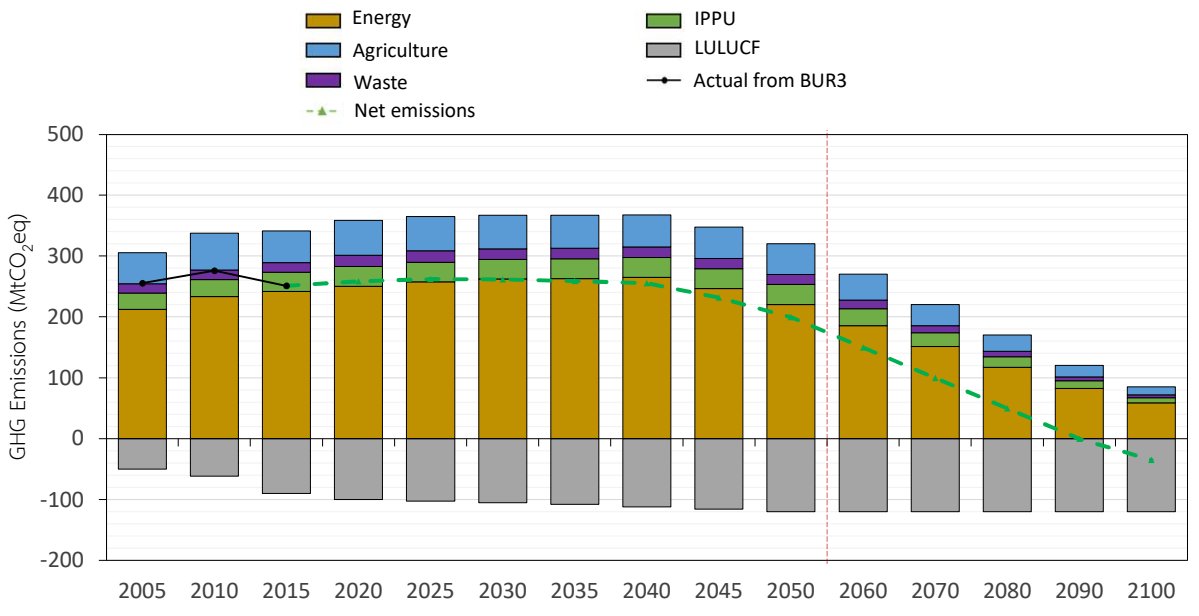
Thailand's GHG Emissions in 2D Target Pathway



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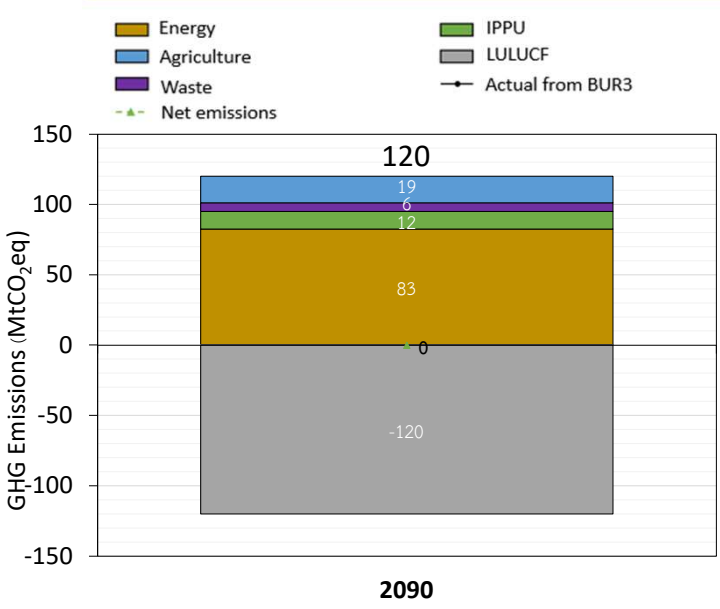
Thailand's GHG Emissions in Net-zero Year



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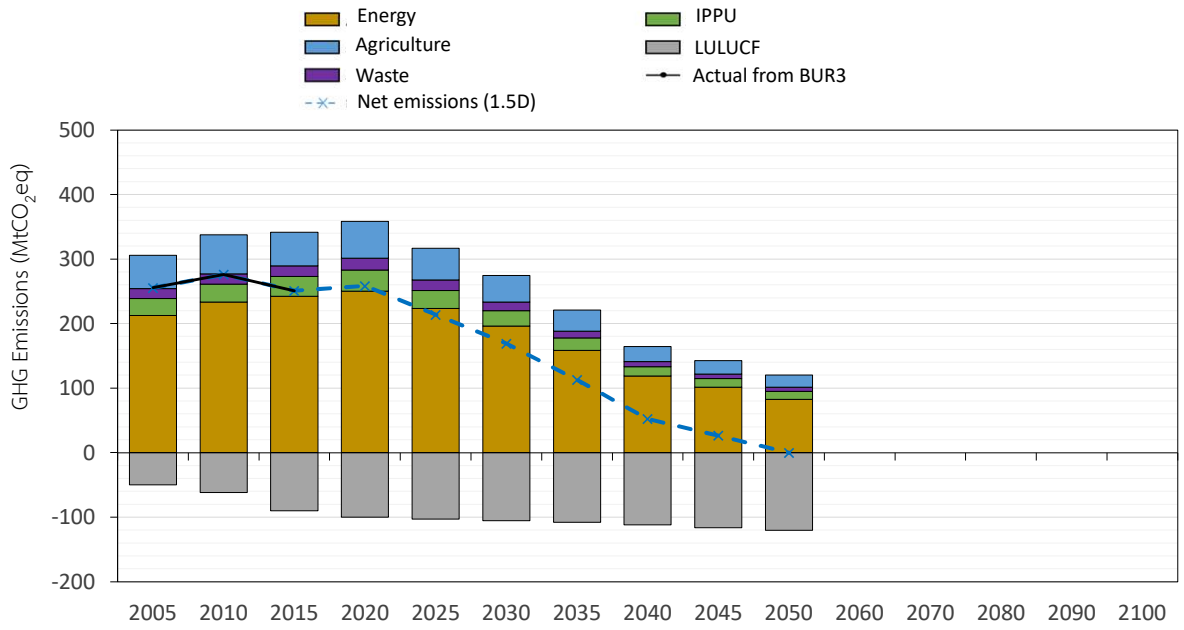
Thailand's GHG Emissions in 1.5D Target Pathway



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Present values of total energy system in 2D target

Sector	Changes in total energy system cost
	%
Power generation	62.0
Transport	16.2
Industries	15.3
Households	-1.3
Buildings	-2.5

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GDP losses

	GDP loss %	
	2D	1.5D
2030	-2.61	-9.22
2040	-6.60	-6.04
2050	-18.01	-66.47

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Welfare losses

Target	% Loss in Cumulative Terms	
	2020 – 2030	2030 – 2050
2D	5.0	21.3
1.5D	14.1	83.0

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Thailand's Long-erm Strategy in GHG Mitigation 2050

1. 2D Net Emissions in 2050 = 200 $MtCO_2eq$.
2. 2D Target in 2050
   - Energy = 220 $MtCO_2eq$
   - IPPU = 34 $MtCO_2eq$
   - Waste = 16 $MtCO_2eq$
   - Agri = 50 $MtCO_2eq$
   - LULUCF = -120 $MtCO_2eq$
3. Peak emissions at 370 $MtCO_2eq$ in 2030-2035.
4. Thailand's Net-zero emissions in 2090 following 2D pathways of IPCC.
5. The 1.5D for Net-zero emissions in 2050 is not feasible under given assumptions.

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THANK YOU

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