National Institute for Environmental Studies, Japan

IGES Institute for Global Environmental Strategies

NIES International Forum

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Thailand Net Zero Emissions 2050

Research Team

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GHG Mitigation Policies

"Prime Minister Prayut Chan-o-cha expressed Thailand's willingness to fight climate change, aiming to reach carbon neutrality in 2050 and net zero emissions by 2065. "

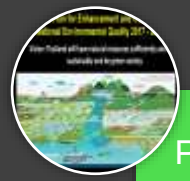
"With the adequate, timely and equitable support, through technology transfer and cooperation and, most importantly, the availability of and access to ample green financing facilities, Thailand can increase our Nationally determined contributions (NDC) to 40% and reach carbon neutrality in 2050."

Source: Thailand 's updated NDC and updated LT-LEDS 2022

National Plans

The 20-Year National Strategy 2018 – 2037

The 12th National Economic and Social Development Plan 2017 – 2021



Policy and Plan for Enhancement and Conservation of National Environmental Quality 2017 – 2036

Climate Change Master Plan (2015 – 2050)

Nationally Appropriate Mitigation Action (NAMA)

Thailand's Nationally Determined Contribution (NDC)

NDC Sectoral Action Plan for the Energy Sector 2021 – 2030

The Second Updated Thailand's Nationally Determined Contribution (2nd Updated NDC)

Thailand's Long-Term Low Greenhouse Gas Emission Development Strategy (LT-LEDS)

Thailand's NDC Roadmap on Mitigation 2021 – 2030

Energy & Transport

- Increase power generation efficiency
- Energy efficiency in buildings/households
- Energy efficiency in transport
- Renewable energy generation
- Promote biofuels
- Etc.

Waste

- Waste reduction
- Municipal wastewater management
- Industrial wastewater management

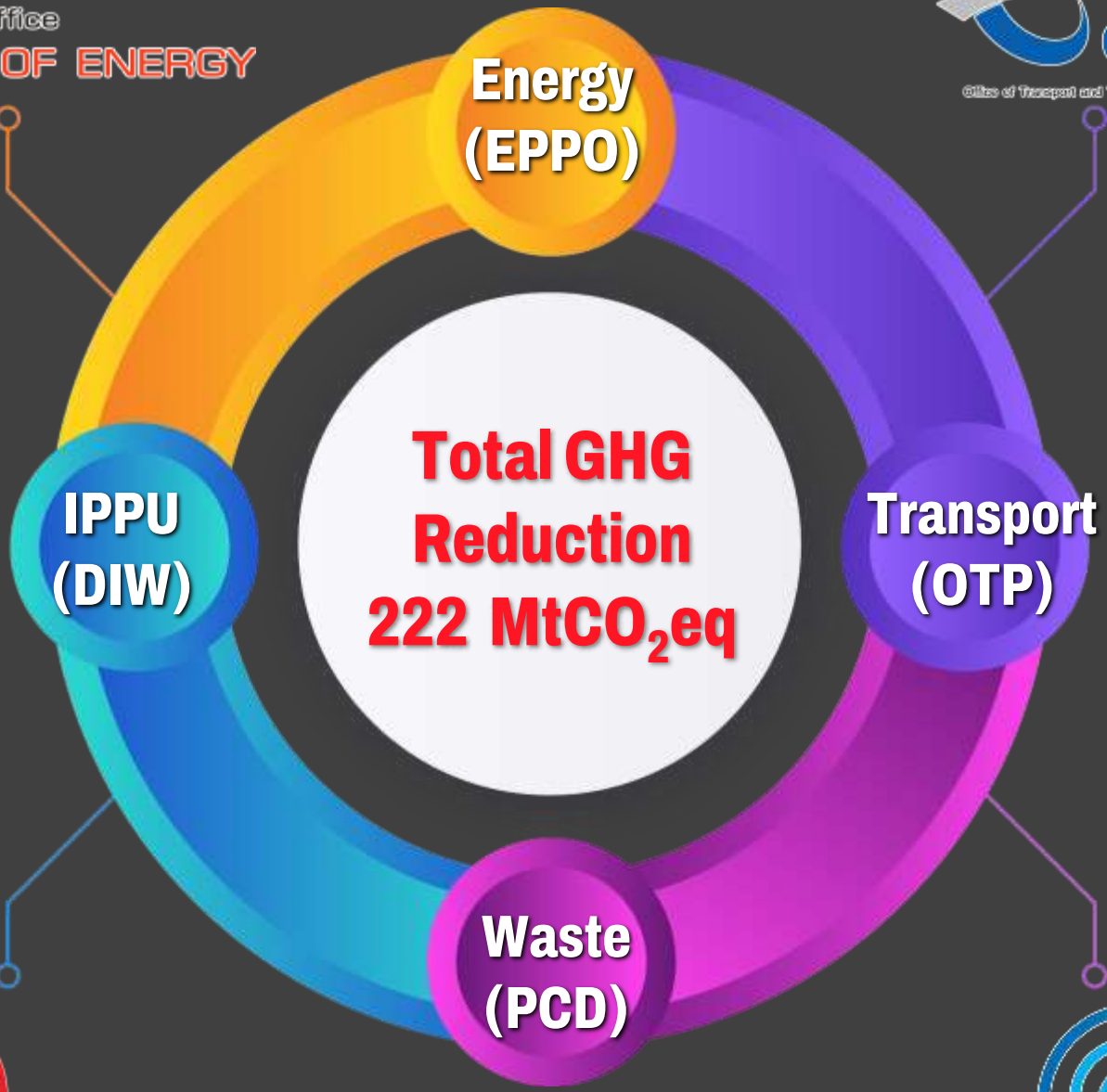
IPPU

- Clinker substitution
- Replacement of refrigerants

Total GHG Reduction 222 $MtCO_2eq$

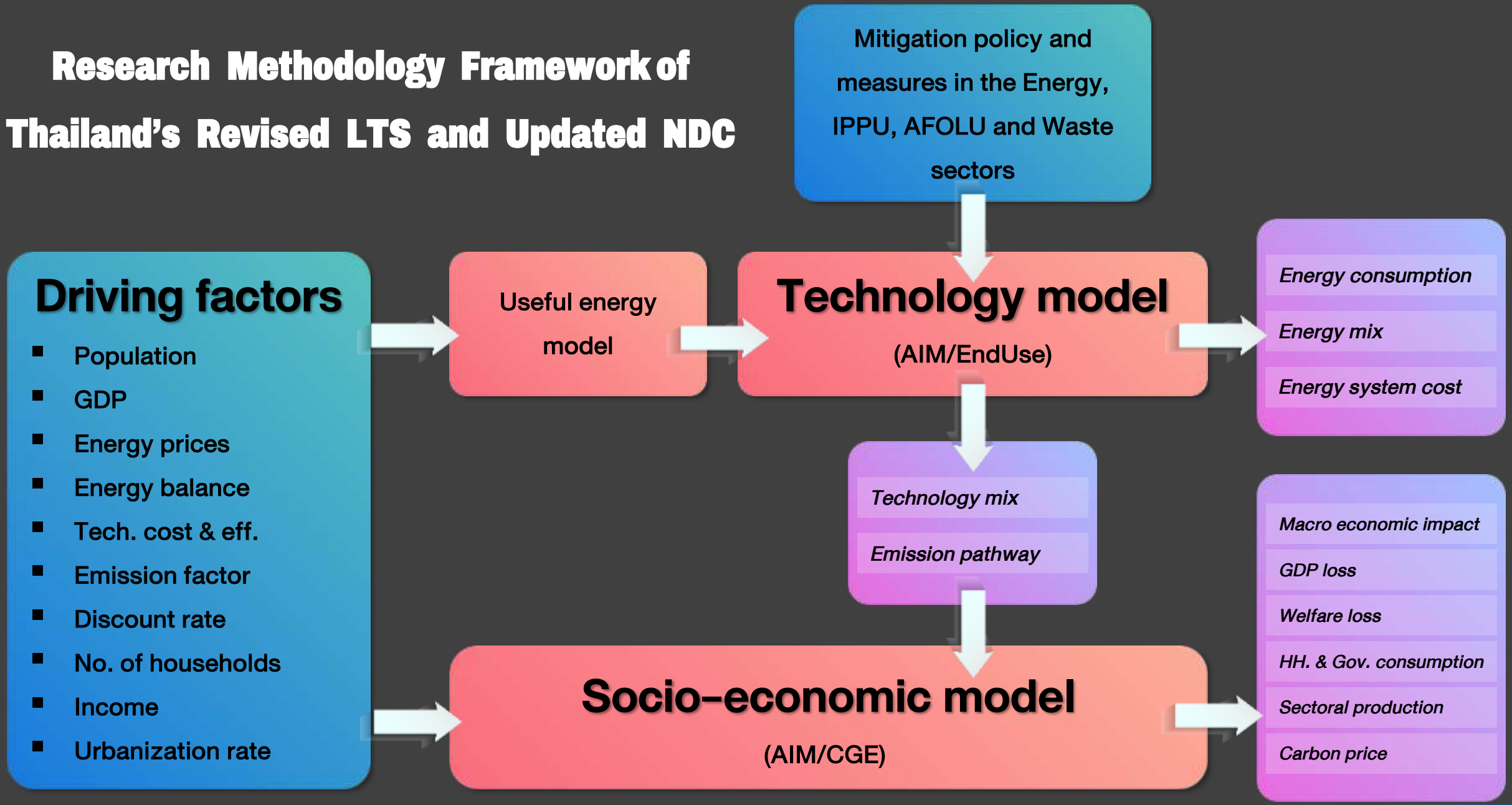
Note: Updated NDC 2022

NDC Sectoral Action Plan Sector 2021 – 2030



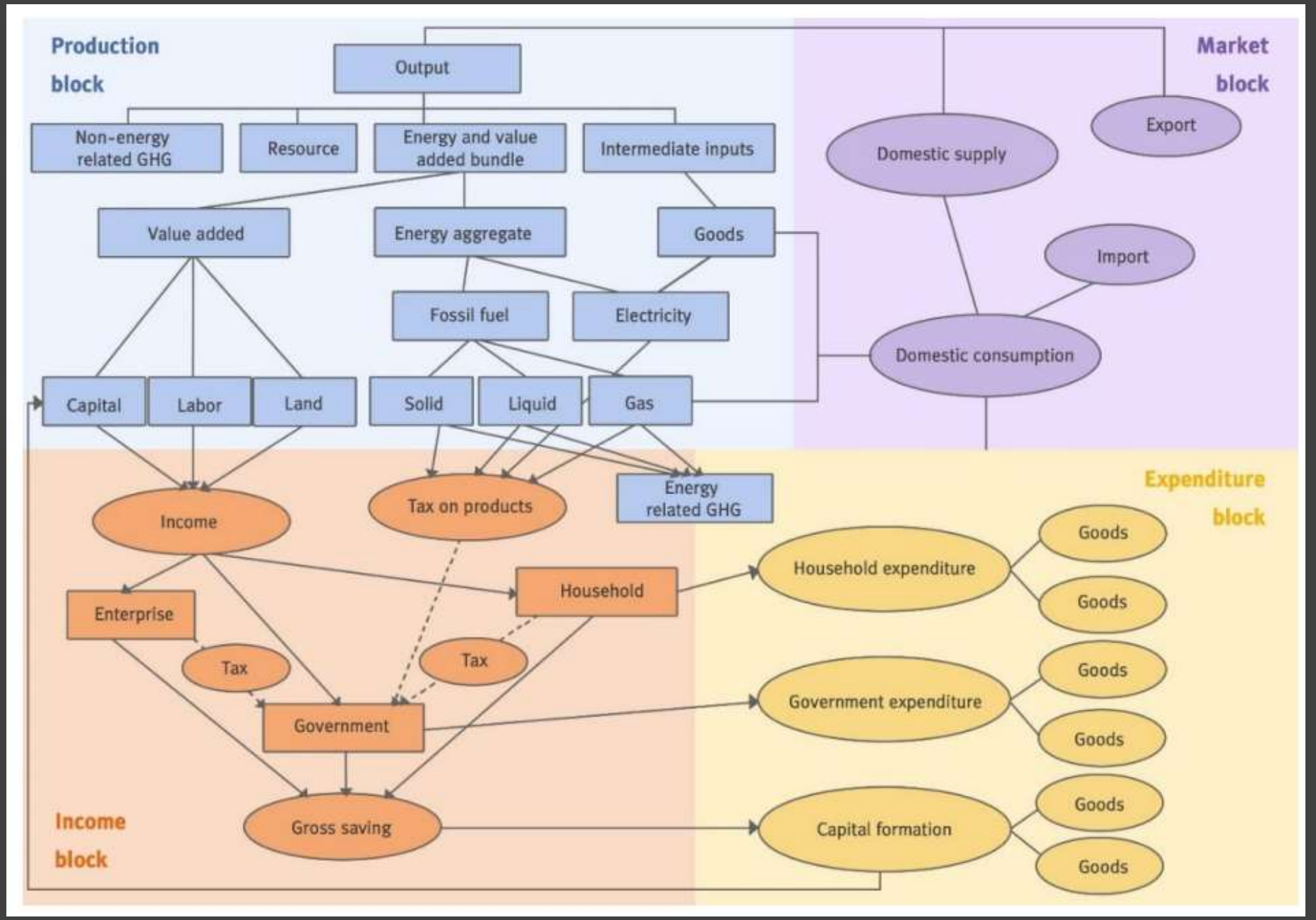
Supportive Action Plan to support NDC Implementation

Research Methodology Framework of Thailand's Revised LTS and Updated NDC



Source: Thailand LT-LEDS (UNFCCC, 2022)

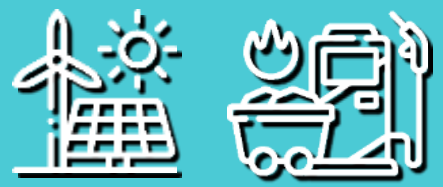
AIM/CGE for Thailand



AIM/Enduse for Thailand

Energy/Material

- Fossil fuel
- Renewable energy

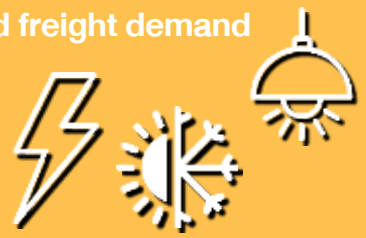


Technology

- Power plants
- Refrigeration
- Vehicle
- Boiler
- LED

Service Demand

- Electricity demand
- Travel and freight demand
- Lighting
- Cooling
- Heating

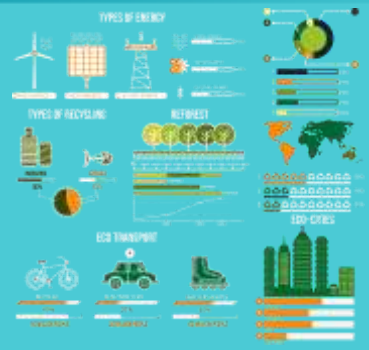


Energy consumption/Emissions

Technology Selection

Energy/material demand

Energy/Emissions Data

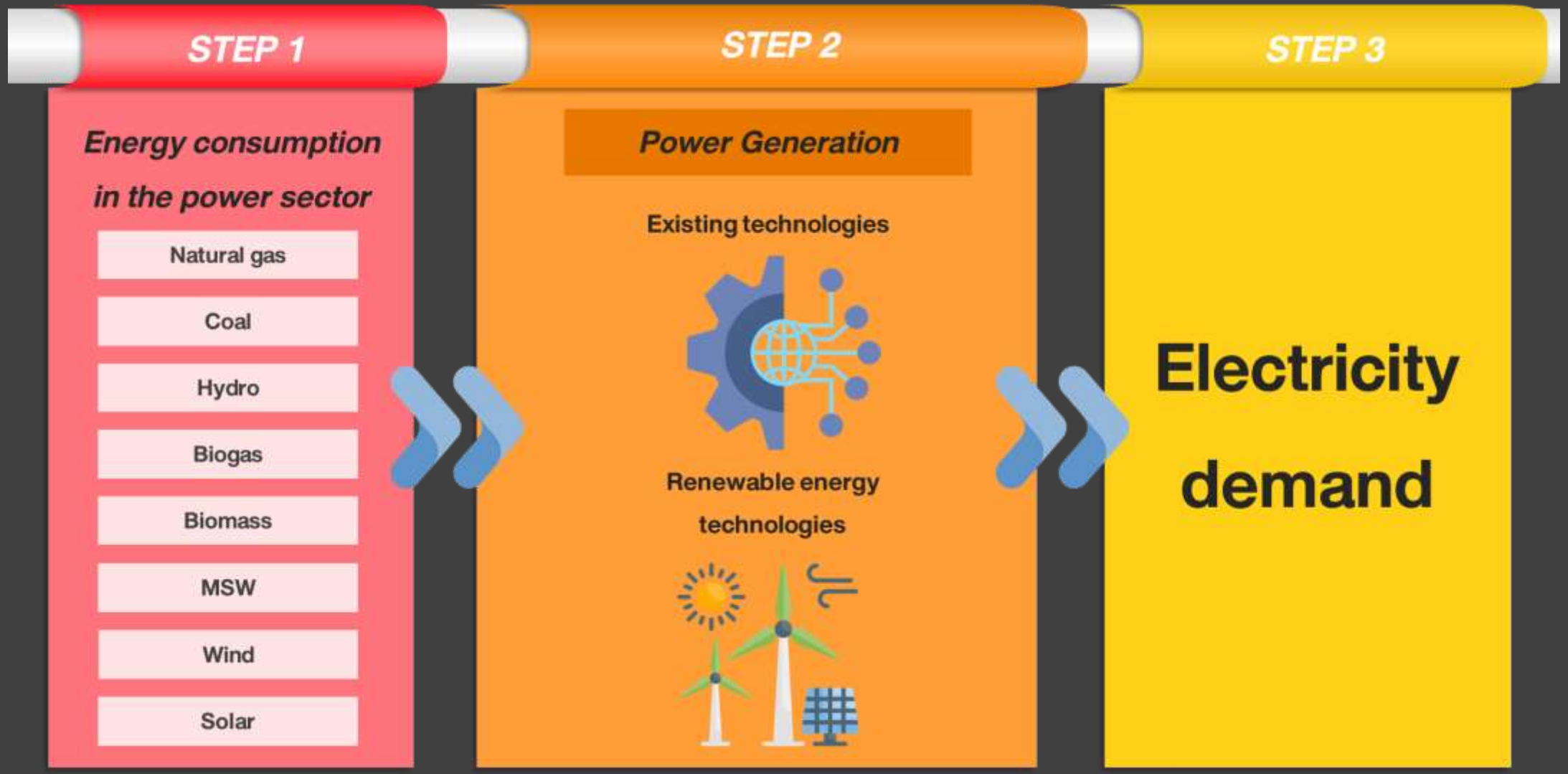


Technology Information

Socio-economic Driver

- Demography
- Economic activity
- Energy/material consumption behavior
- Cement plants structure
- Lifestyle

Power Sector



Building Sector

Manufacturing Industries

Non-metallic

Textile

Paper and pulp

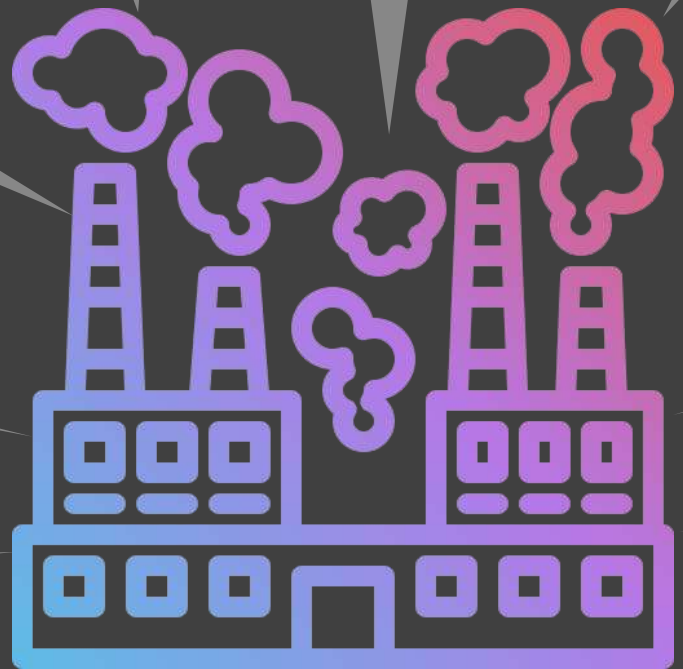
Fabricated metal

Basic metal

Wood

Chemical

Food and beverage



Others

Transport Sector

Domestic Transport

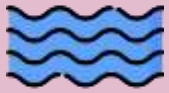
Mode

Type

Transport

Road

Rail



Water

Air

Passenger

Freight

Passenger

Freight

Passenger

Freight

Passenger

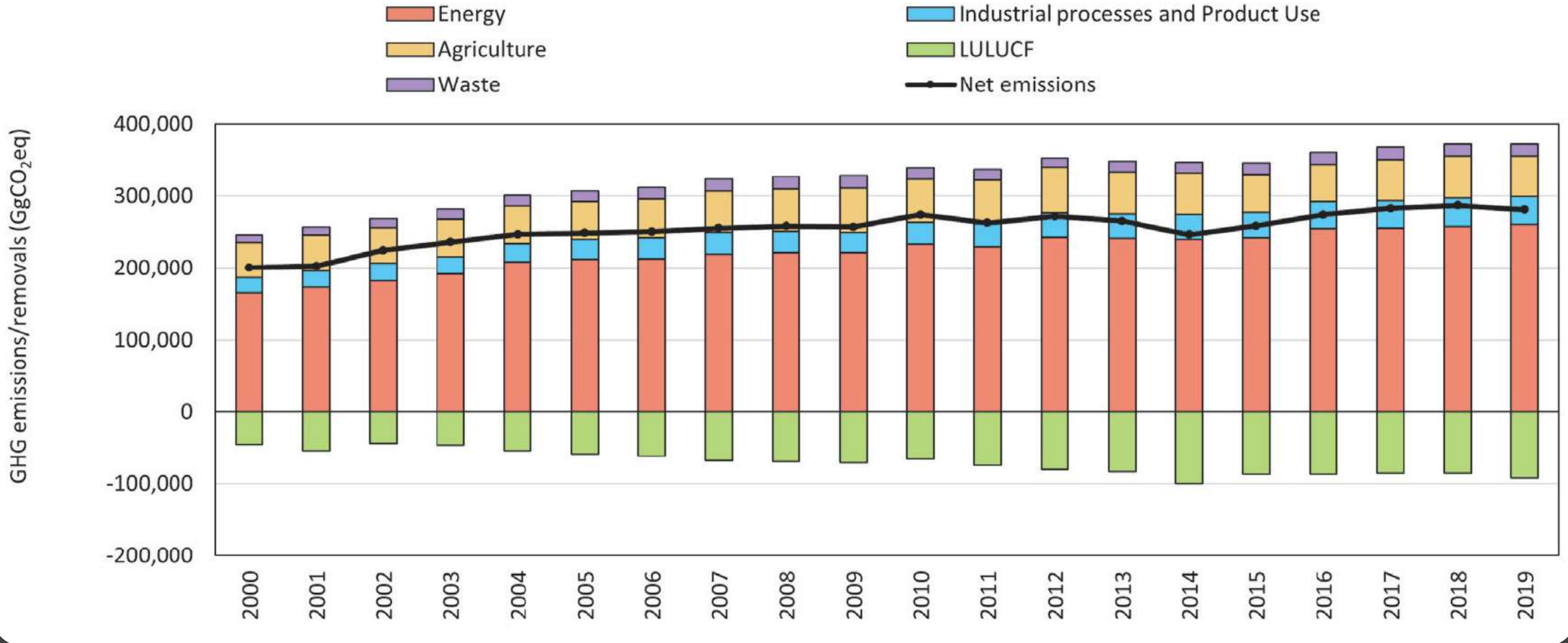
IPCC AR6

IPCC Sixth Assessment Report Global Warming Potentials

Greenhouse Gas	100 Year Time Period			20 Year Time Period		
	AR4 2007	AR5 2014	AR6 2021	AR4 2007	AR5 2014	AR6 2021
CO_2	1	1	1	1	1	1
CH_4 fossil origin	25	28	29.8	72	84	82.5
CH_4 non fossil origin			27.2			80.8
N_2O	298	265	273	289	264	273

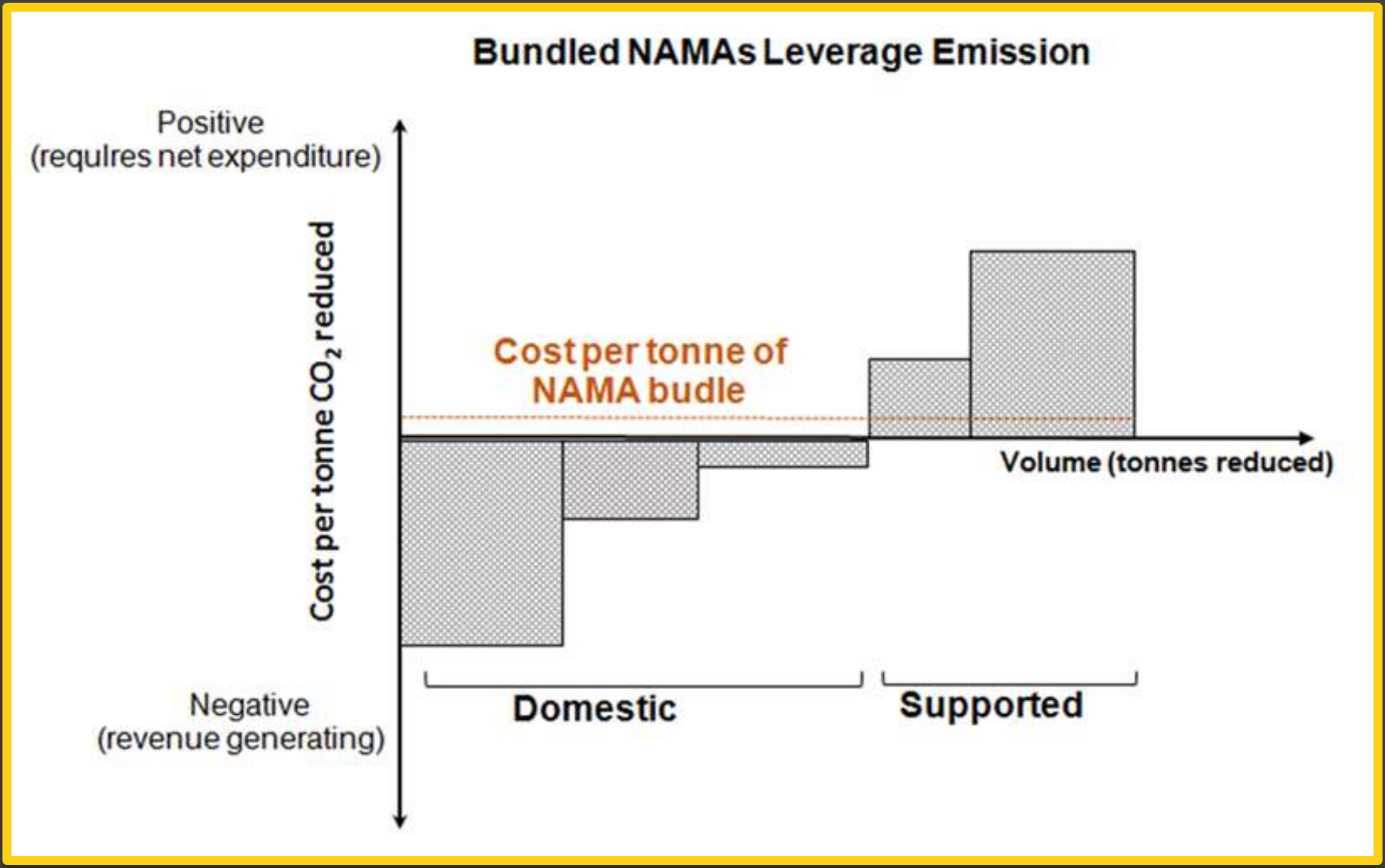
Source: AR6 (IPCC-WGI, 2021)

Thailand's Greenhouse Gas Emission Situation in BUR4



Source: Thailand BUR4 (UNFCCC,2022)

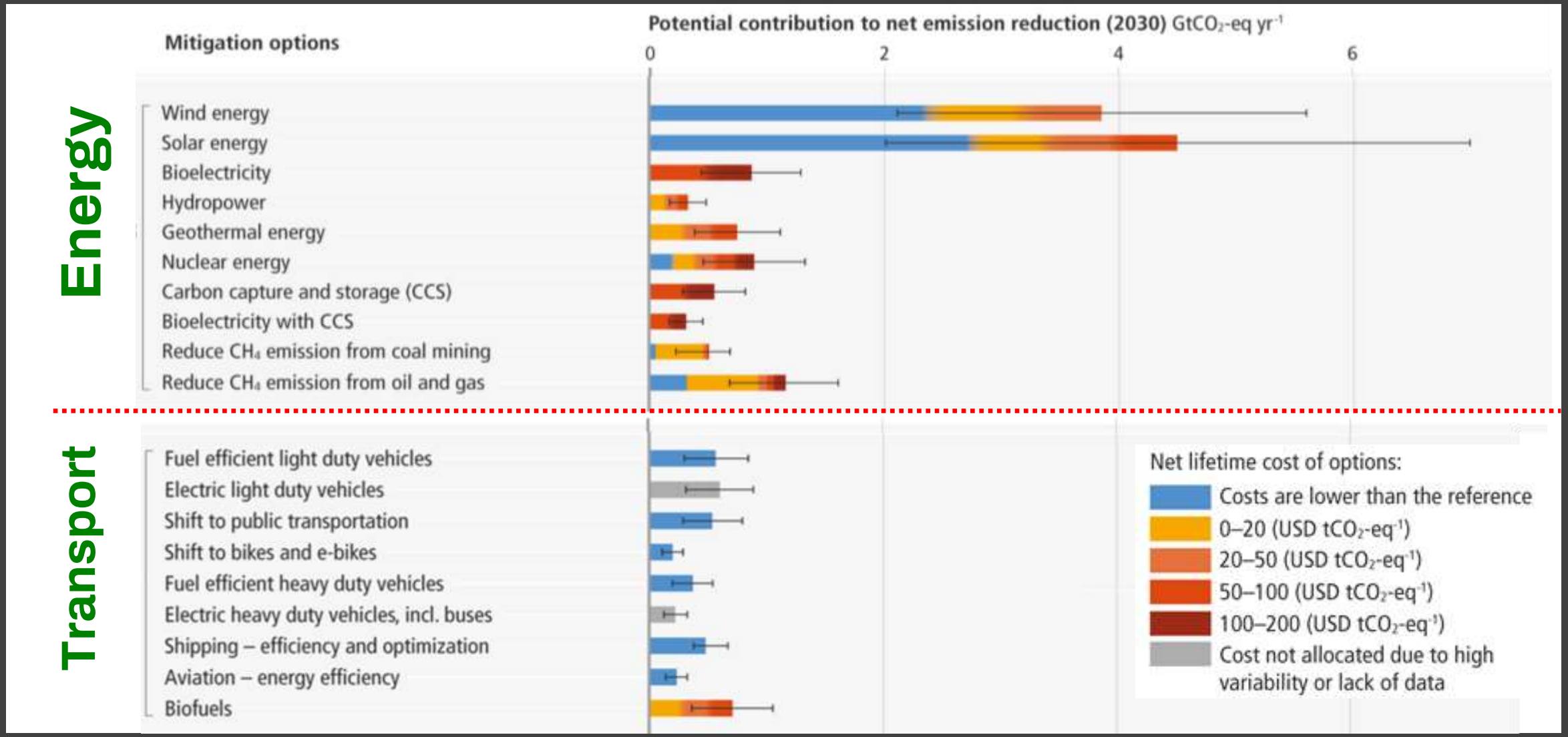
Criteria for MAC Analysis



Source: SIIT-TU (2011)

Many options are available now in all sectors to offer net emissions by 2030

Relative costs vary across countries and in the longer term compared to 2030



Source: AR6-WGIII (IPCC, 2022)

Many options are available now in all sectors to offer net emissions by 2030

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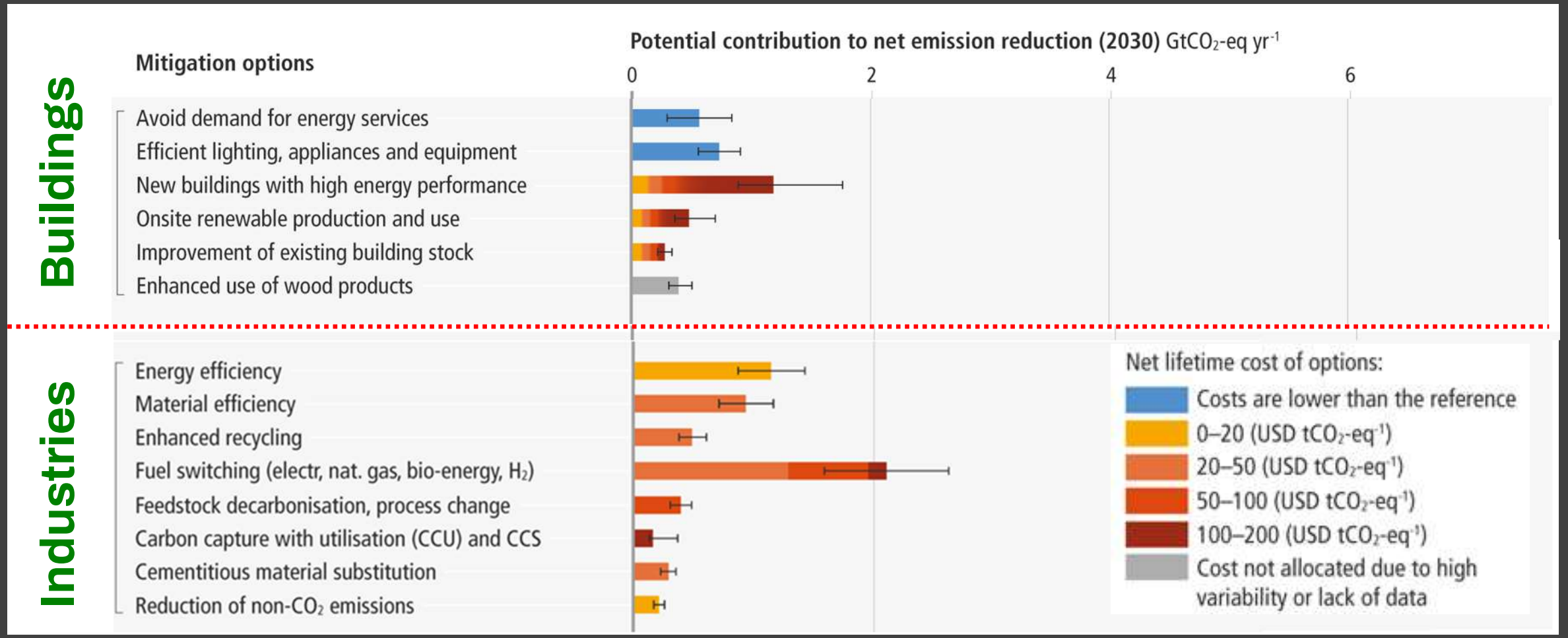

Source: AR6-WGIII (IPCC, 2022)

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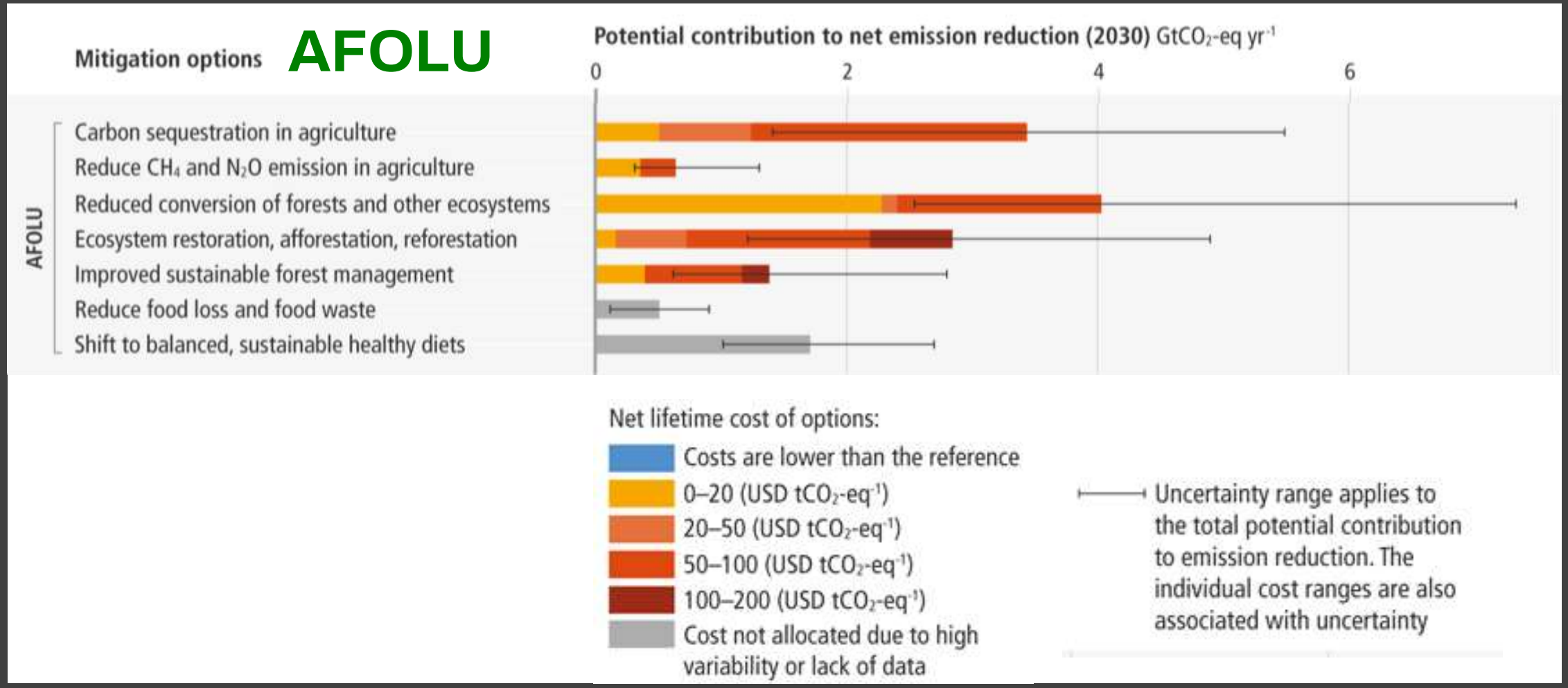
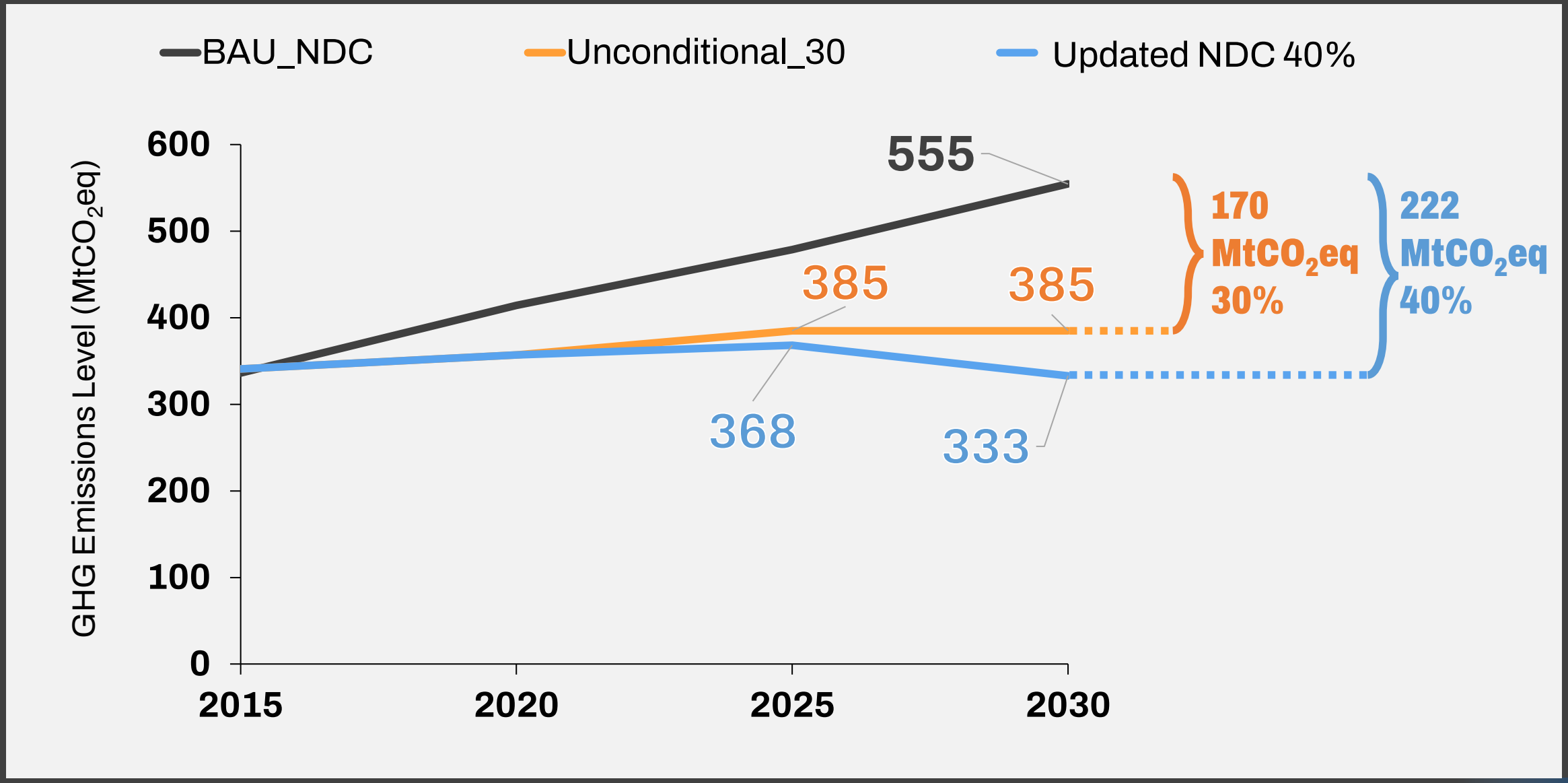


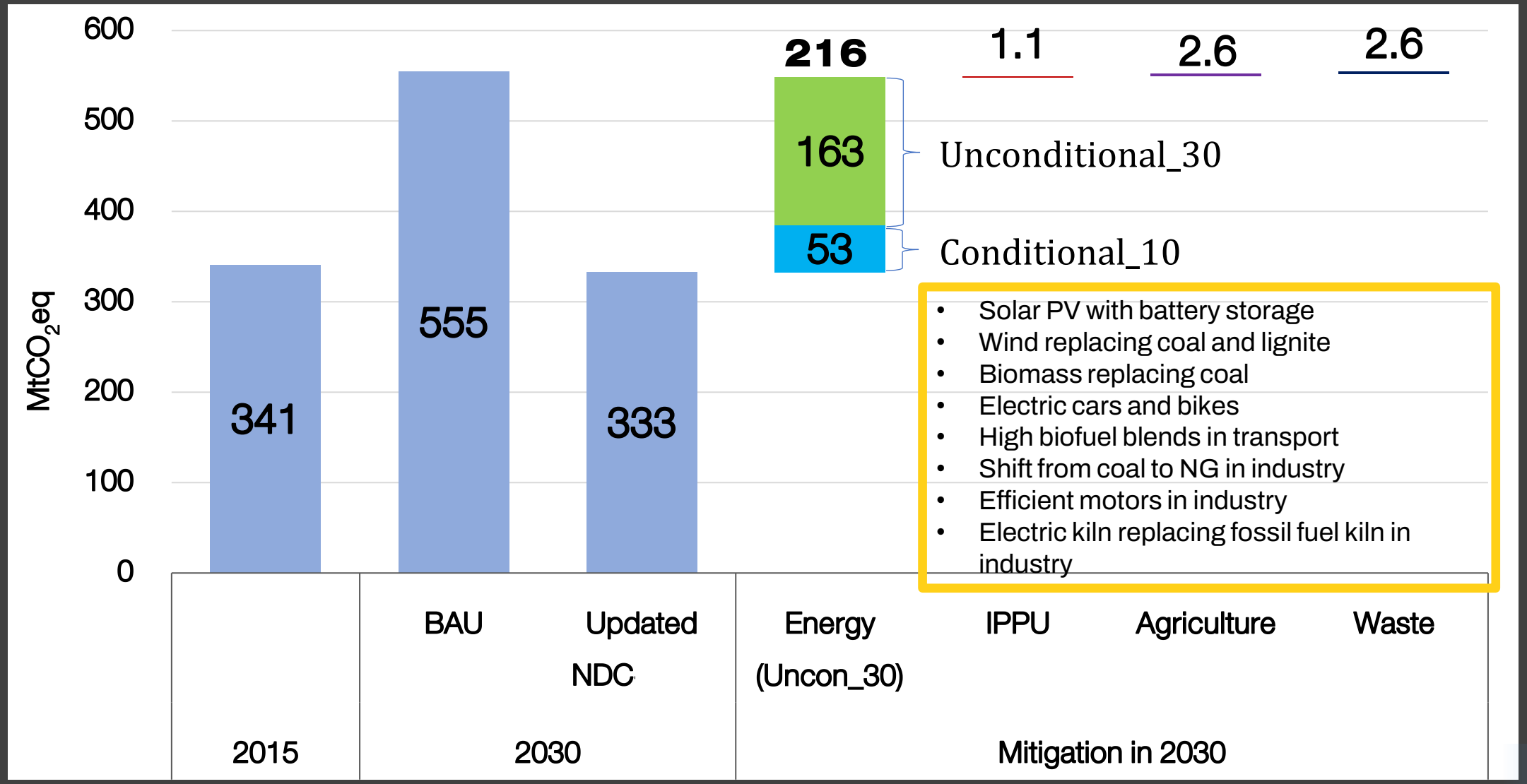
Source: AR6-WGIII (IPCC, 2022)

GHG Emission Levels in BAU and Updated NDC 2022

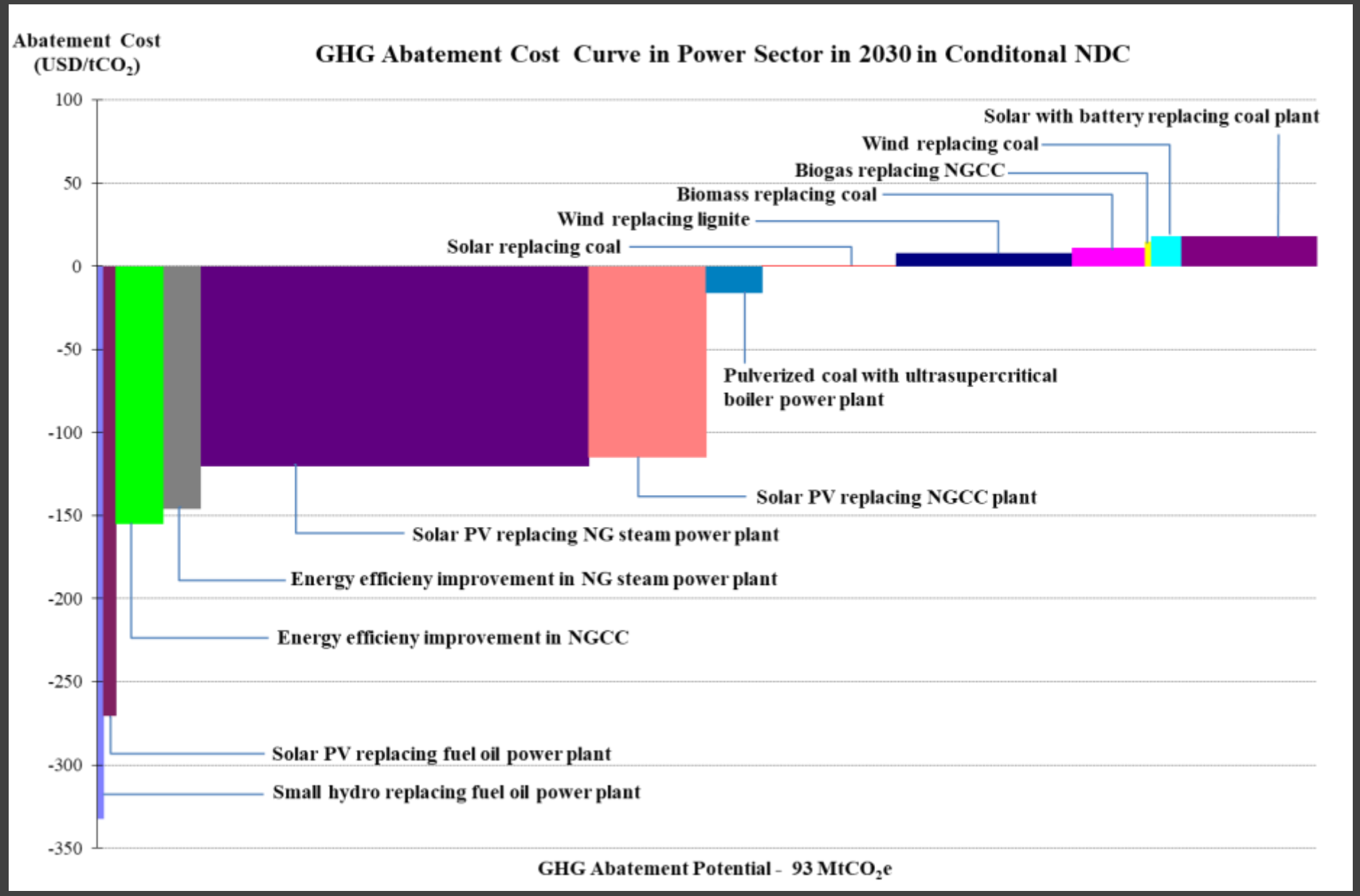


Updated NDC 2022

GHG reduction by sector in 2030 in the case of Unconditional NDC 30%

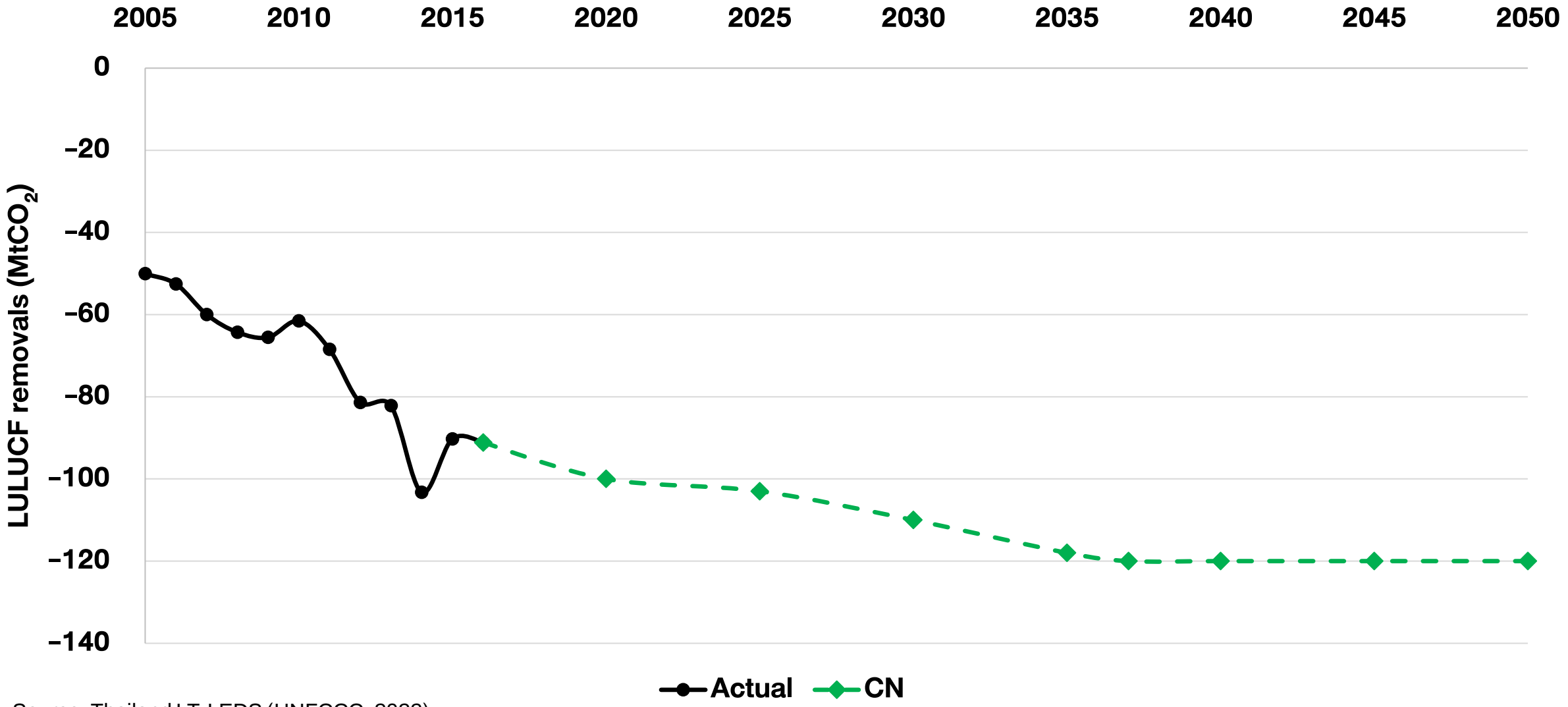


GHG Reduction Potential and Cost in Electricity Generation in 2030



Thailand CO_2 Emissions Removals by Sinks

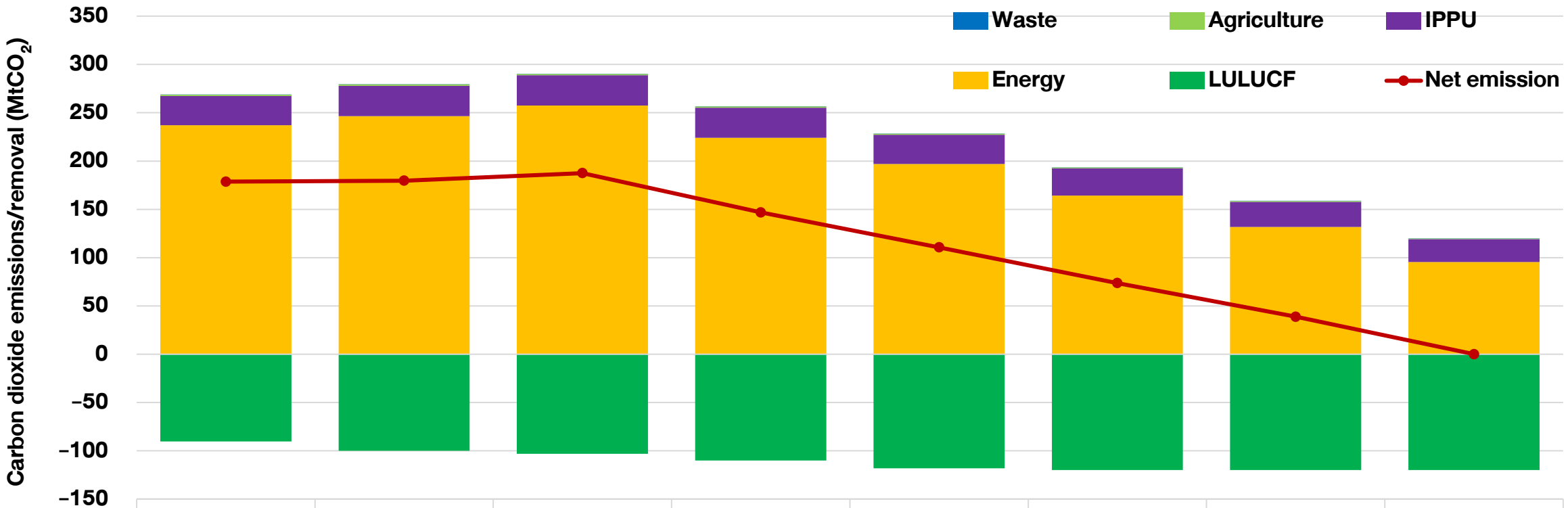
CO_2 emission removals by sinks in LULUCF sector



Source: Thailand LT-LEDS (UNFCCC, 2022)

Carbon Neutrality in 2050

Thailand CO_2 emissions sources and sinks to achieve Carbon Neutrality in 2050

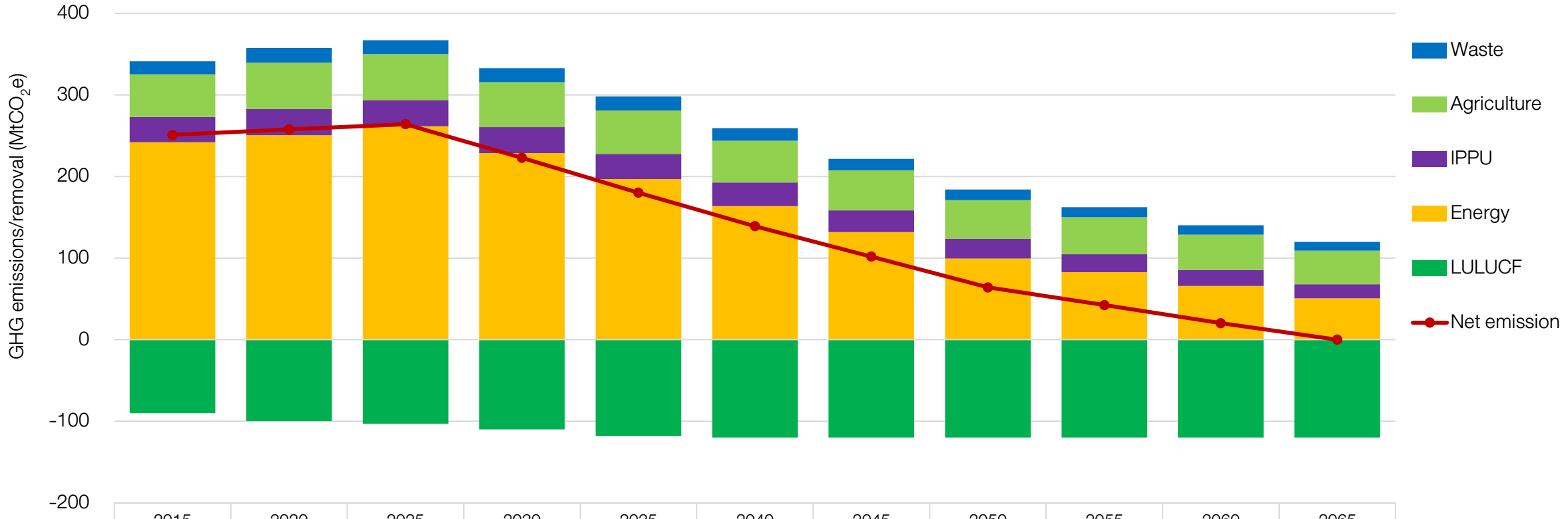


	2015	2020	2025	2030	2035	2040	2045	2050
Waste	0.20	0.26	0.24	0.24	0.24	0.22	0.20	0.18
Agriculture	1.40	1.40	1.40	1.40	1.25	1.00	0.75	0.50
IPPU	30.32	31.43	31.43	31.16	30.31	28.19	26.03	23.82
Energy	237.00	246.56	257.44	224.00	196.89	164.30	131.80	95.50
LULUCF	-90.26	-100.00	-103.00	-110.00	-118.00	-120.00	-120.00	-120.00
Net emission	178.65	179.64	187.50	146.80	110.69	73.70	38.77	0.00

Source: Thailand LT-LEDS (UNFCCC, 2022)

Net Zero Emission in 2065

Thailand GHG emissions sources and sinks to achieve Net Zero Emission 2065



	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	2065
Waste	16.00	18.00	17.17	17.39	17.19	15.37	14.19	13.07	12.33	11.58	10.84
Agriculture	52.17	57.00	56.23	55.07	53.09	51.11	49.13	47.15	45.17	43.19	41.20
IPPU	31.07	32.00	32.17	31.90	31.03	28.86	26.65	24.39	22.06	19.69	17.28
Energy	242.02	250.77	261.62	228.63	196.77	163.84	131.80	99.48	82.81	65.81	50.69
LULUCF	(90.26)	(100.00)	(103.00)	(110.00)	(118.00)	(120.00)	(120.00)	(120.00)	(120.00)	(120.00)	(120.00)
Net emission	250.99	257.77	264.20	222.99	180.07	139.17	101.77	64.10	42.37	20.28	(0.00)

Source: Thailand LT-LEDS (UNFCCC, 2022)

Solar PV in 2050 & 2065

YEAR	2050	2065
Solar electricity generation (GWh)	217,804	312,202
PV installed capacity (GW)	62	71
PV land requirement (km^2)	235	269
PV area required (%)	0.05	0.05

Technology Selections to Achieve Updated NDC and Thailand's Revised LTS Targets

Power Generation

- *Efficiency improvement in power plants*
- *Use of renewable energy (biomass, biogas, solar, wind)*
- *Phase out of oil power plants*

- *Phase down of coal power plants*
- *59% share of Solar and Wind*

2025 | 2030 | 2035 | 2040 | 2045 | 2050 | 2055 | 2060 | 2065

- *Solar/wind with battery storage*

- *CCS & BECCS technologies*

- *Combined cycle natural gas used best in class*
- *65% share of solar and wind power*
- *Phase out coal power plants*
- *Net zero emission electricity*
- *Biomass-based generation fully equipped with CCS technologies*

Source: Thailand LT-LEDS (UNFCCC, 2022)

Technology Selections to Achieve Updated NDC and Thailand's Revised LTS Targets

Energy in Transport

- *Efficient engine vehicles (gasoline & diesel)*
- *Renewable energy (E10, E20, E85, B10, B20)*
- *Electric train*

- *30@30*
- *Phase down of IC engines*

2025 | 2030 | 2035 | 2040 | 2045 | 2050 | 2055 | 2060 | 2065

- *Most efficient IC engine vehicles*
- *Renewable energy (E10, E20, E85, B10, B20, B100)*
- *Electric vehicles*

- *Most efficient IC engine vehicles with biofuels*
- *High share of electric vehicles, xEV = 69%*
- *Fuel cell vehicles*

Source: Thailand LT-LEDS (UNFCCC, 2022)

Technology Selections to Achieve Updated NDC and Thailand's Revised LTS Targets

Energy in Industries

- *Efficient lighting technologies*
- *Efficient cooling technologies*
- *Efficient motor technologies*
- *Efficient boiler*
- *Renewable energy (bioenergy)*
- *Industrial heat pumps*

- *Electric heating technologies*

- *Green hydrogen fuel*

2025 | 2030 | 2035 | 2040 | 2045 | 2050 | 2055 | 2060 | 2065

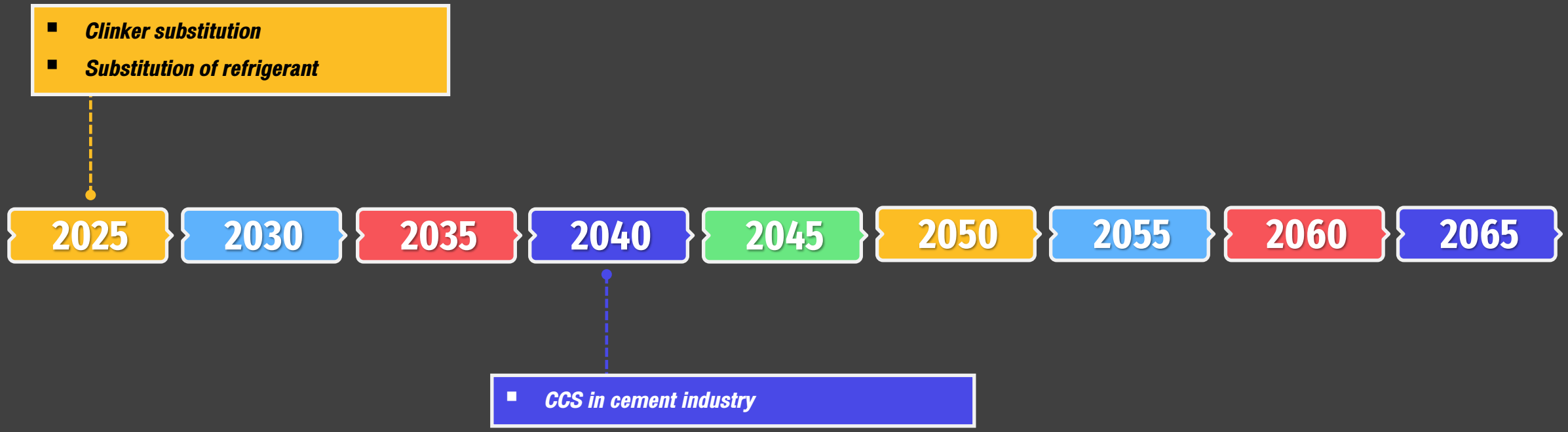
- *Most efficient lighting technologies*
- *Most efficient cooling technologies*
- *Most efficient motor technologies*
- *Most efficient boiler*
- *Renewable energy (bioenergy)*

- *Most efficient electrical devices*
- *Most efficient boiler*
- *Renewable energy (bioenergy)*

Source: Thailand LT-LEDS (UNFCCC, 2022)

Technology Selections to Achieve Updated NDC and Thailand's Revised LTS Targets

IPPU



Source: Thailand LT-LEDS (UNFCCC, 2022)

Technology Selections to Achieve Updated NDC and Thailand's Revised LTS Targets

Agriculture

- *Improved rice cultivation practice*
  - *Alternate wetting and drying*
  - *Mid-season drainage (MSD)*
  - *Incorporation of straw*
  - *Direct dry seeded rice*
  - *Early maturing varieties*
- *Dome digester*

- *Lifestyle changes (change in how we eat)*

2025 | 2030 | 2035 | 2040 | 2045 | 2050 | 2055 | 2060 | 2065

- *Improved feeds for ruminant animals*
- *High genetic merit breed selection*
- *Soil management practices*

Source: Thailand LT-LEDS (UNFCCC, 2022)

Technology Selections to Achieve Updated NDC and Thailand's Revised LTS Targets

Waste

- *Community waste management*
- *Recycling of municipal waste*
- *Industrial wastewater treatment*
- *Community wastewater treatment*

2025 | 2030 | 2035 | 2040 | 2045 | 2050 | 2055 | 2060 | 2065

- *Reduction in municipal solid waste through behavioral changes*
- *Efficient use of water*

Source: Thailand LT-LEDS (UNFCCC, 2022)

Macroeconomic Impacts and Cost-Benefit Analysis

Updated NDC2030

	25%	30%	40%
1. GDP loss (%)	-0.3	-0.4	-0.5
2. Government consumption expenditure (%)	7.5	8.3	10.6
3. Welfare loss (%)	-2.1	-2.4	-3.0
4. Carbon prices (Baht/tCO_2eq)	739	1,060	1,766

Conclusion

- AIM models can be used for policy analysis
  - Projection of local emission and impacts using AIM models
  - Analysis of climate policies and local air pollutants
  - Co-benefit analysis
  - Marginal abatement cost
  - Carbon tax policies, etc.
- Opportunities for young researchers to write research paper using AIM family of models as analytical tools.

THANK YOU