

## FY2024 ALPS International Symposium

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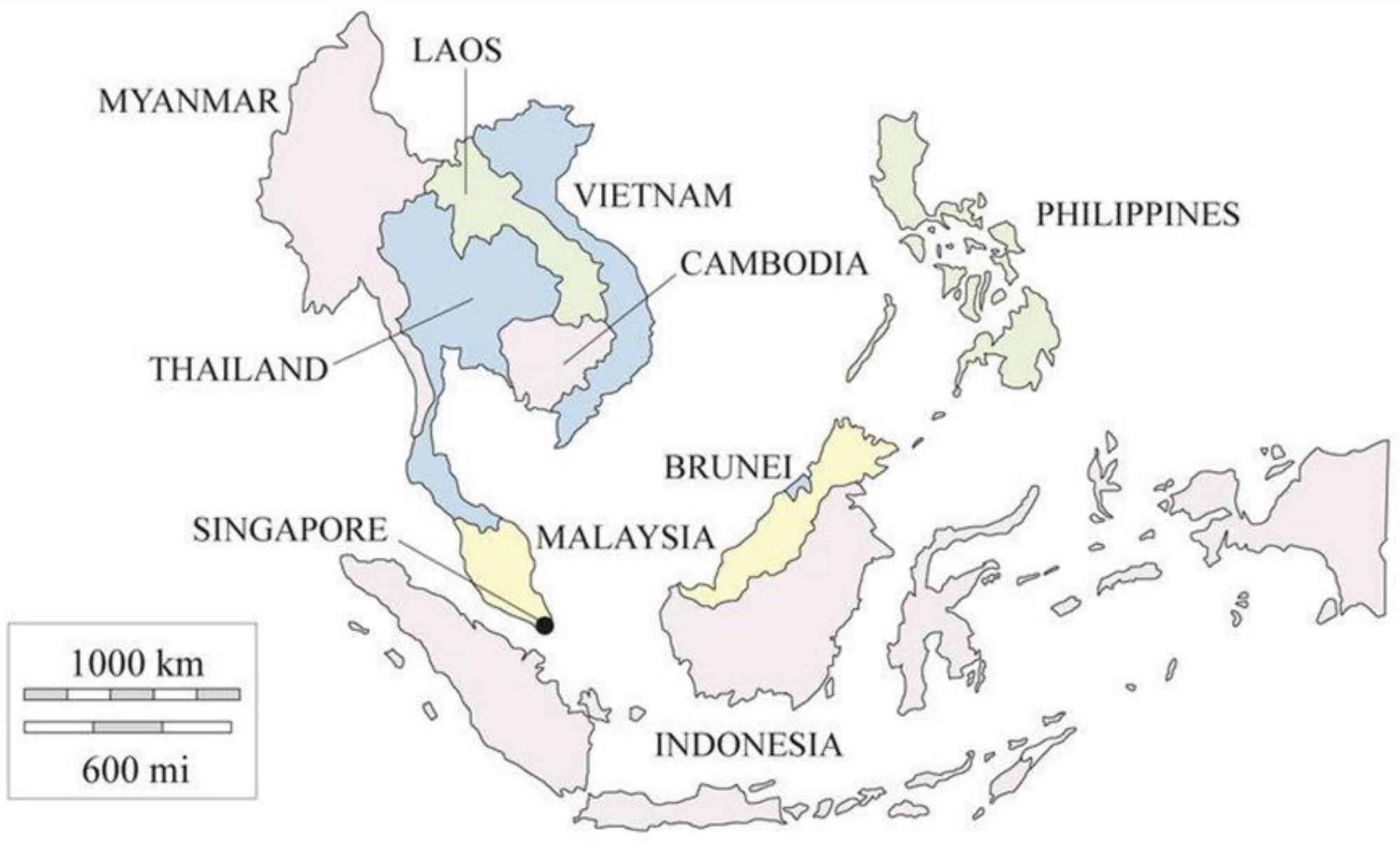
公益財団法人地球環境産業技術研究機構  
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# Carbon Neutrality in South-East Asia: A policy perspective

**Shobhakar Dhakal and Waine Waine Pyee**

Department of Energy and Climate Change  
Asian Institute of Technology, Thailand  
[Shobhakar@ait.ac.th](mailto:Shobhakar@ait.ac.th); [Shobhakar.Dhakal@gmail.com](mailto:Shobhakar.Dhakal@gmail.com)





Source: (von Rintelen et al., 2017)

# Contents



The long-term mitigation aspiration of South-East Asia



The reality – trends, imperatives, interdependencies and policies



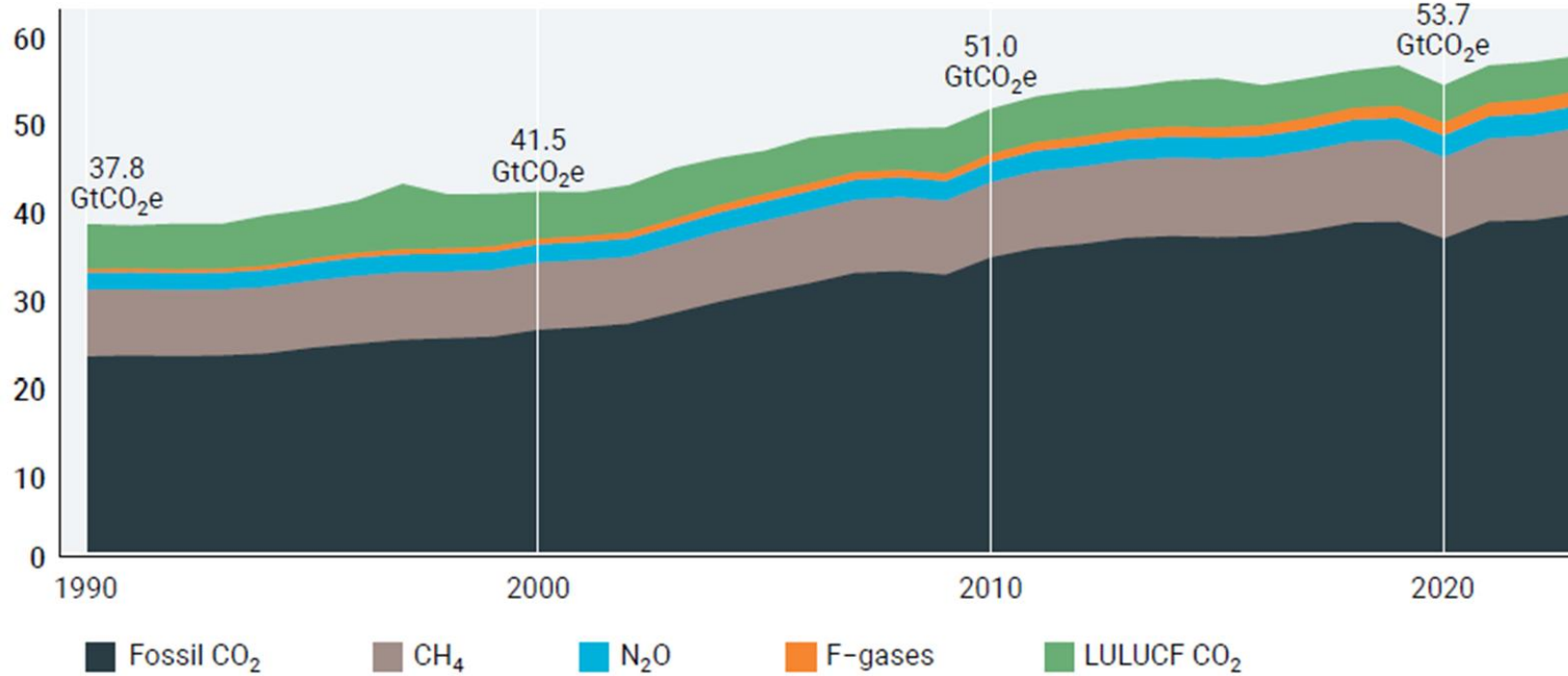
Is South-East Asia on track? Judging the sense and scale of (off)track



What is takes to accelerate towards meeting long-term target?

# Total net anthropogenic GHG emission 1990–2023

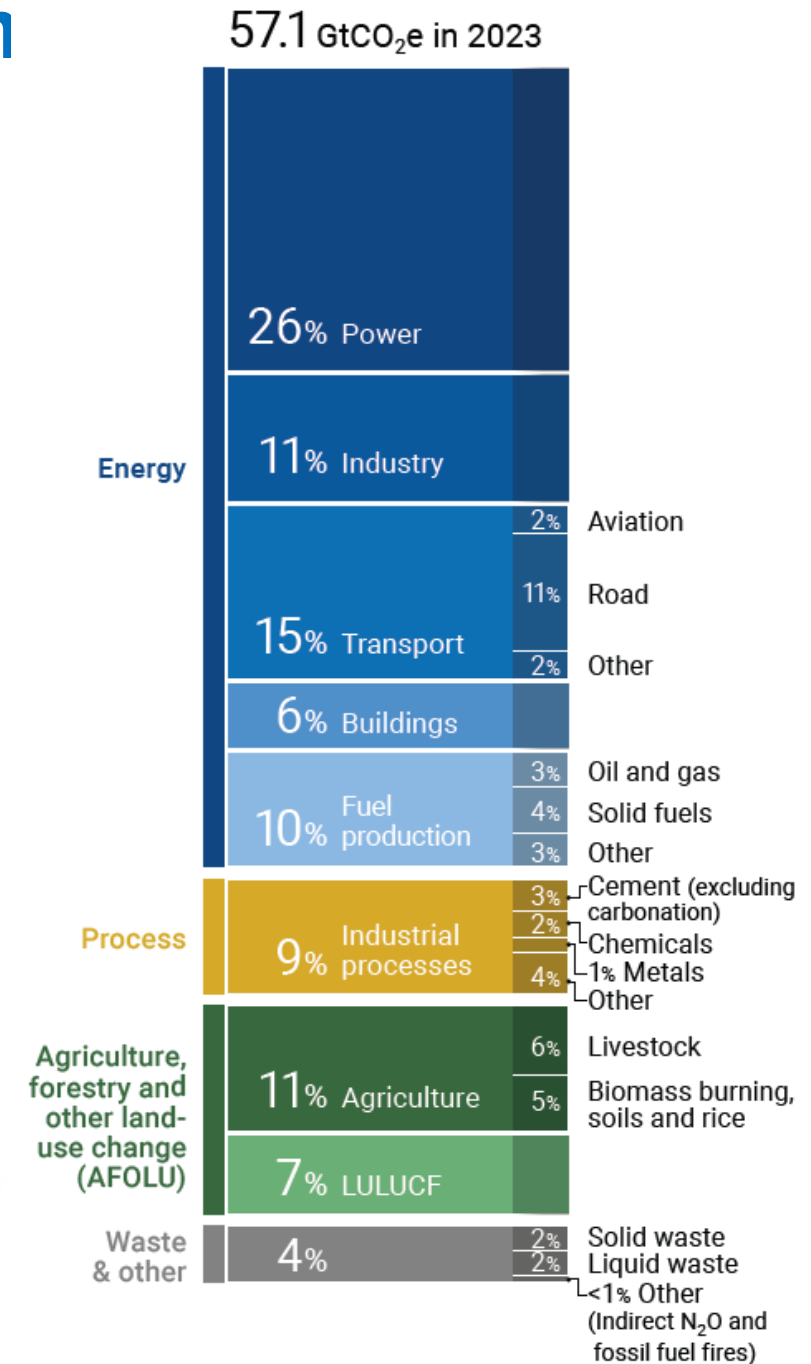
Total GHG emissions 1990–2023 (GtCO<sub>2</sub>e/year)



*Note:* Non-CO<sub>2</sub> GHGs are converted to CO<sub>2</sub>e using global warming potentials with a 100-year time horizon from the IPCC WGI AR6 (Forster et al. 2021).

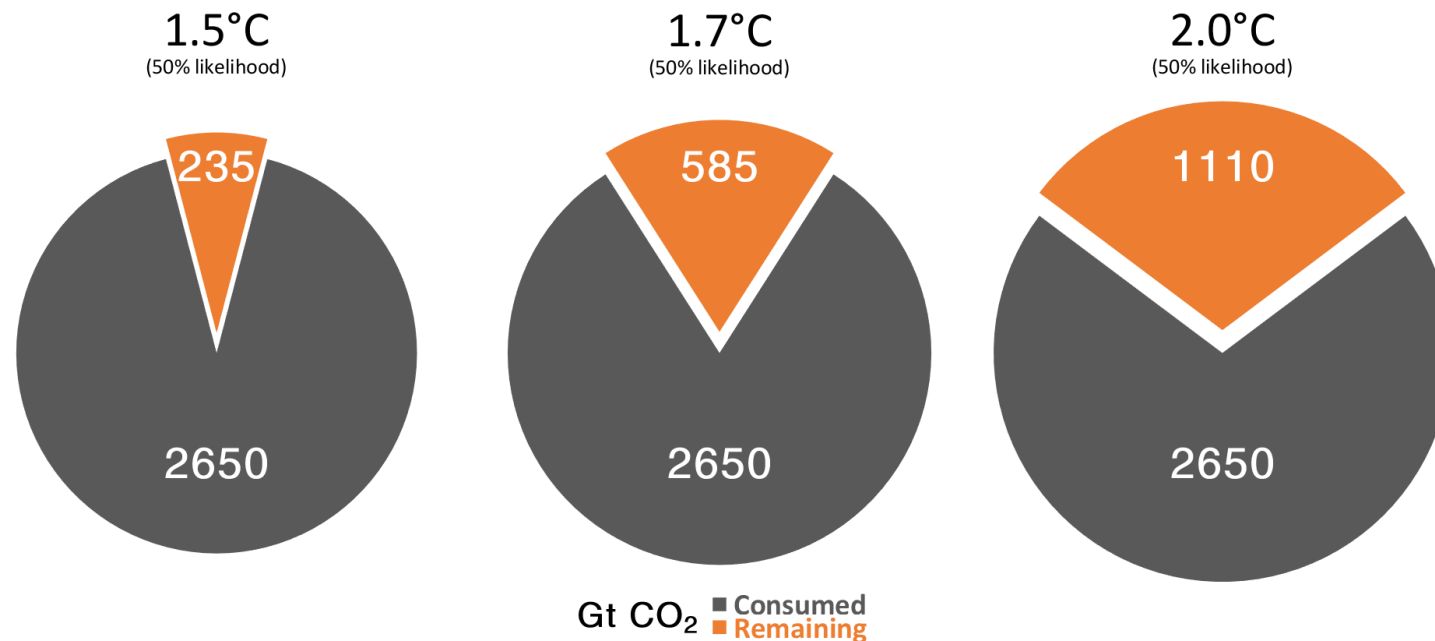
*Sources:* Crippa et al. (2024); Friedlingstein et al. (2023).

UNEP Gap Report (2024)



# Remaining carbon budget

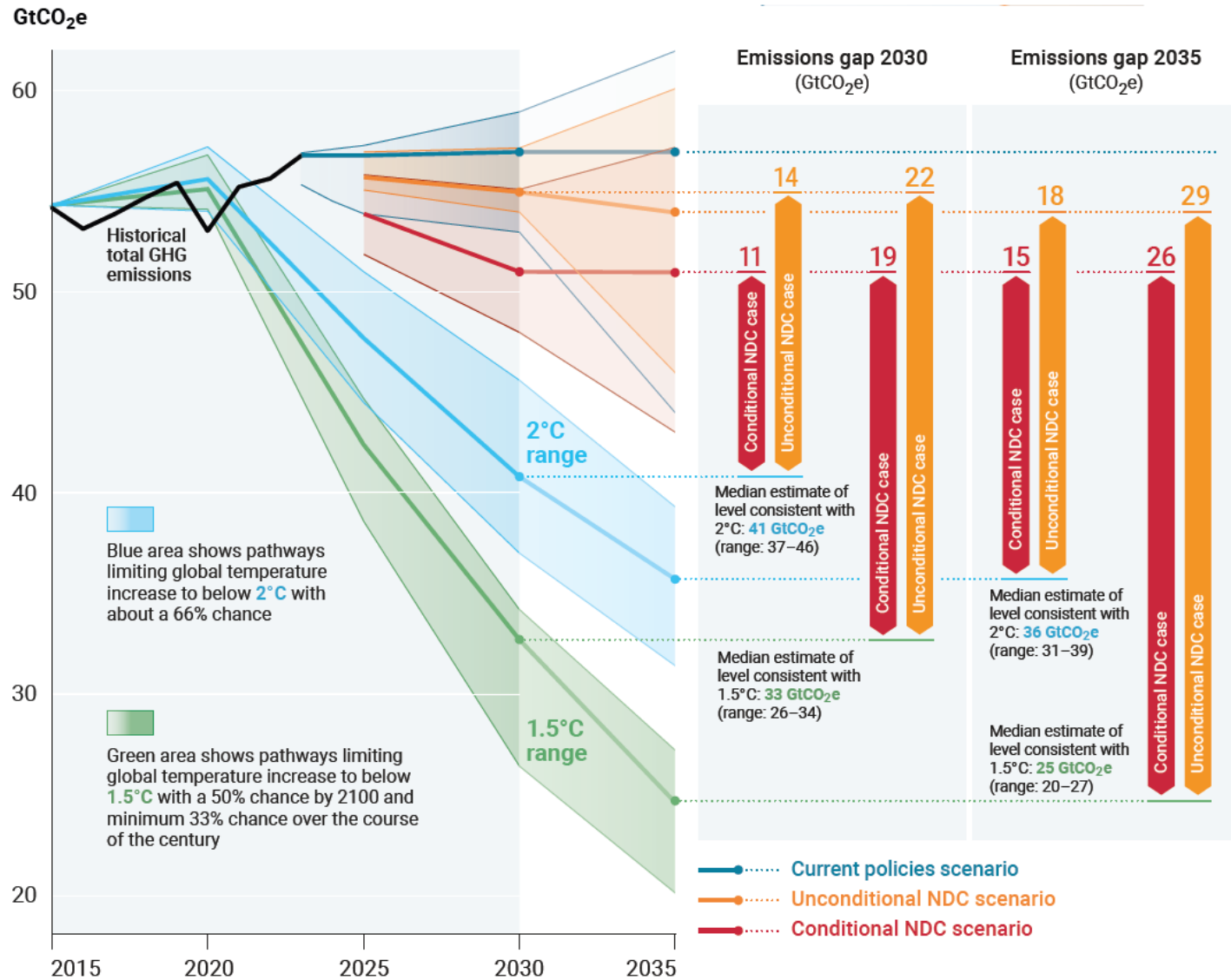
The remaining carbon budget to limit global warming to 1.5°C, 1.7°C and 2°C is 235 GtCO<sub>2</sub>, 585 GtCO<sub>2</sub>, and 1110 GtCO<sub>2</sub> respectively, equivalent to 6, 14 and 27 years from 2025. 2650 GtCO<sub>2</sub> have been emitted since 1850



© Global Carbon Project

The remaining carbon budgets are the average of two estimates (IPCC AR6 and Forster et al., 2023), both updated by removing the most recent emissions. Quantities are subject to additional uncertainties e.g., future mitigation choices of non-CO<sub>2</sub> emissions  
 Source: [IPCC AR6 WG1](#); [Forster et al., 2023](#); [Friedlingstein et al 2024](#); [Global Carbon Project 2024](#)

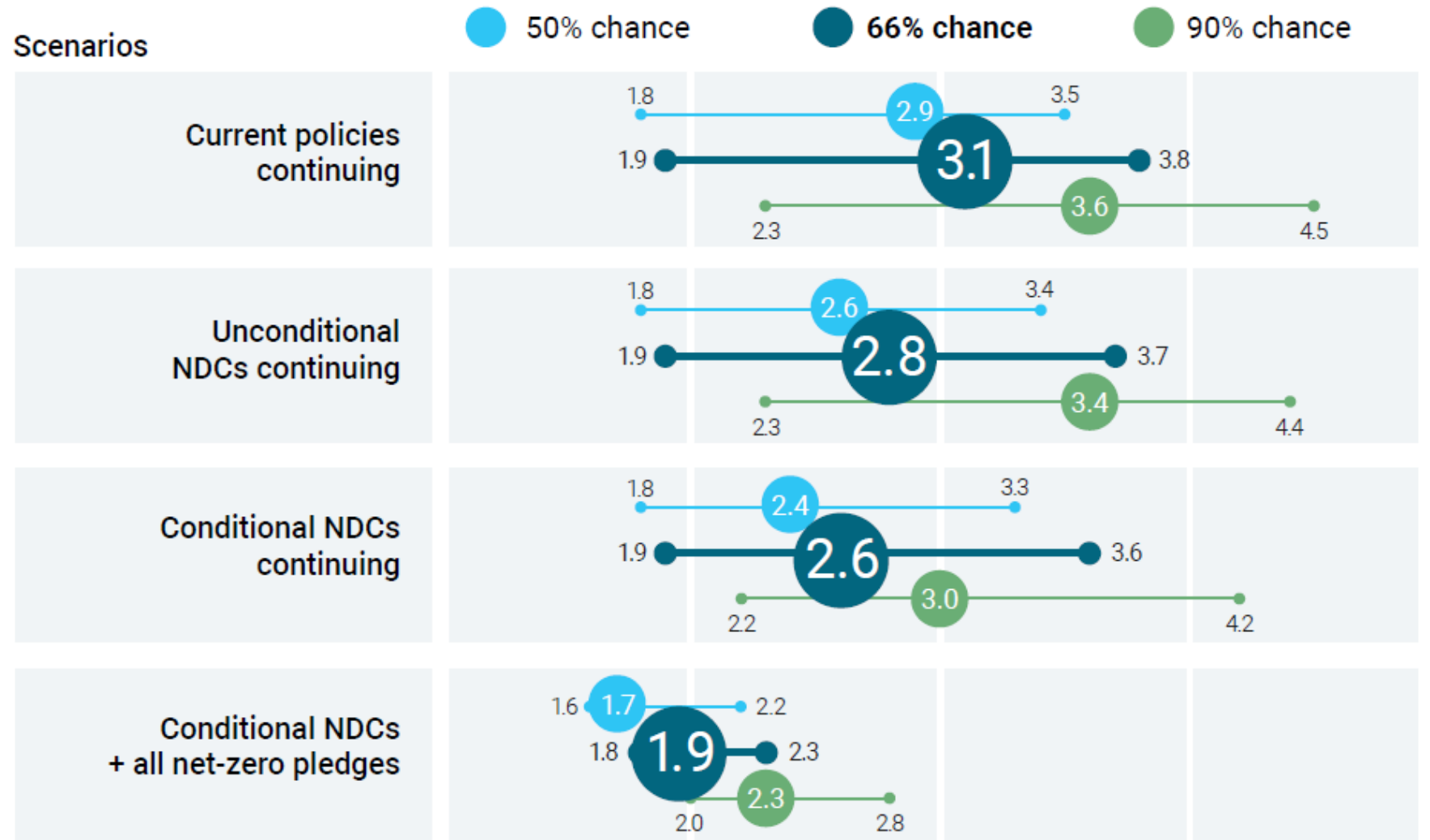
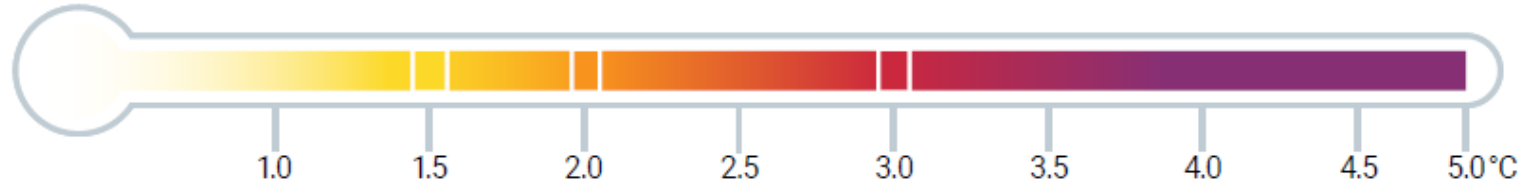
# Global GHG emissions under different scenarios and the emissions gap in 2030 and 2035



Scenario	Projected GHG emissions (GtCO <sub>2</sub> e)	Estimated emissions gaps (GtCO <sub>2</sub> e)		
		Below 2.0°C	Below 1.8°C	Around 1.5°C
2050				
Current policies continued	56 (25–68)	36 (4–48)	44 (12–56)	48 (16–60)
Conditional NDCs + all net-zero pledges	19 (6–30)	-1 (-14–10)	7 (-6–18)	11 (-2–22)

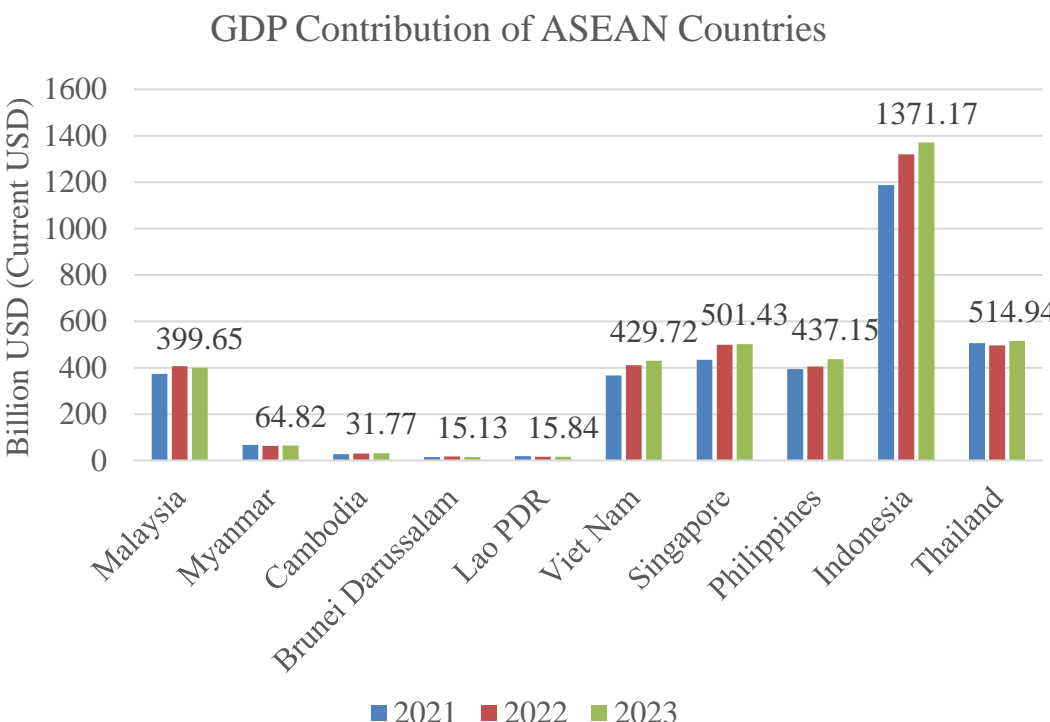
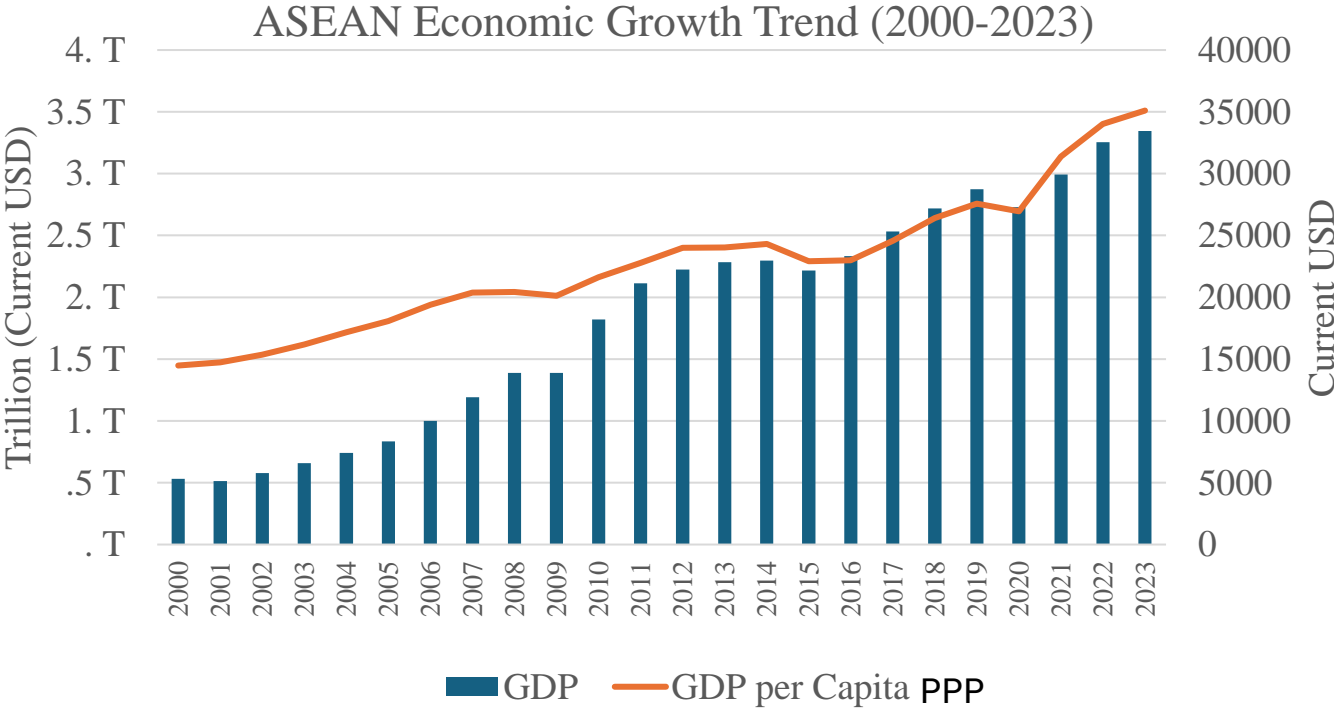
# Projections of global warming under the pledge-based scenarios assessed

Peak warming over the twenty-first century (°C) relative to pre-industrial levels



# South-East Asian Economic Trends

- ASEAN population 672 million, 774 mn by 2040 (ASEAN Secretariate, 2021)
- 5<sup>th</sup> largest economy (2022) after the US, China, Japan, and Germany → projected 4<sup>th</sup> by 2030



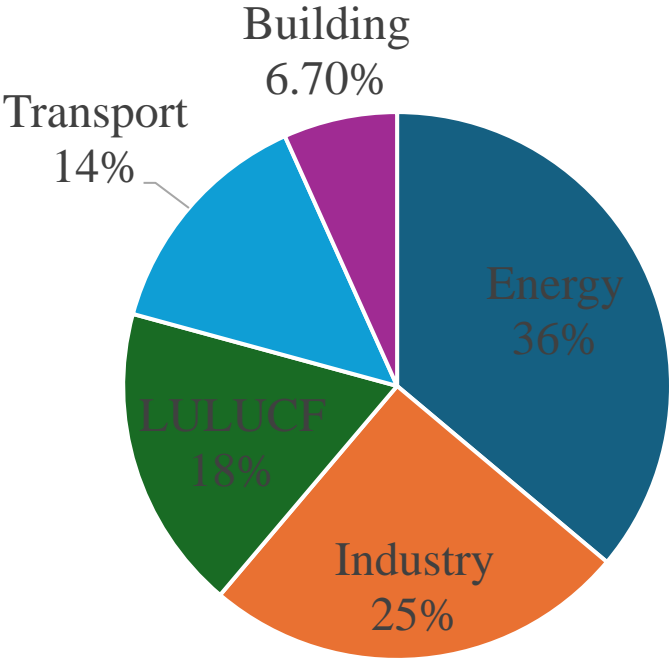
Sources: Data extracted from *World Bank Data Portal* (2024)

Sources: Data extracted from *Our World in Data* (2024)



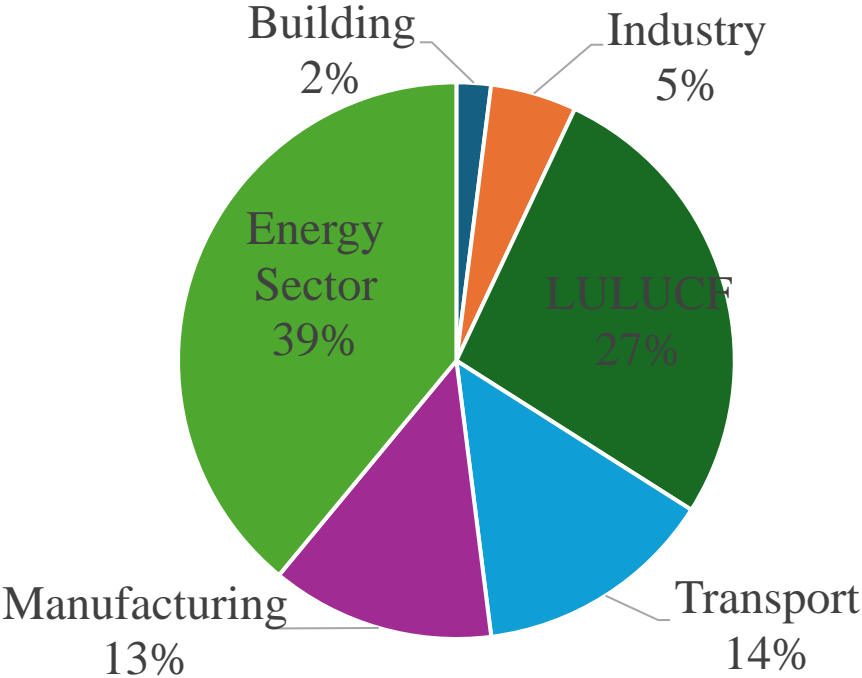
# Global and Regional Emission by Sector

**Global Emissions by Sector, 2022**



Sources: Forster et al., 2024

**ASEAN Emissions by Sector, 2020**



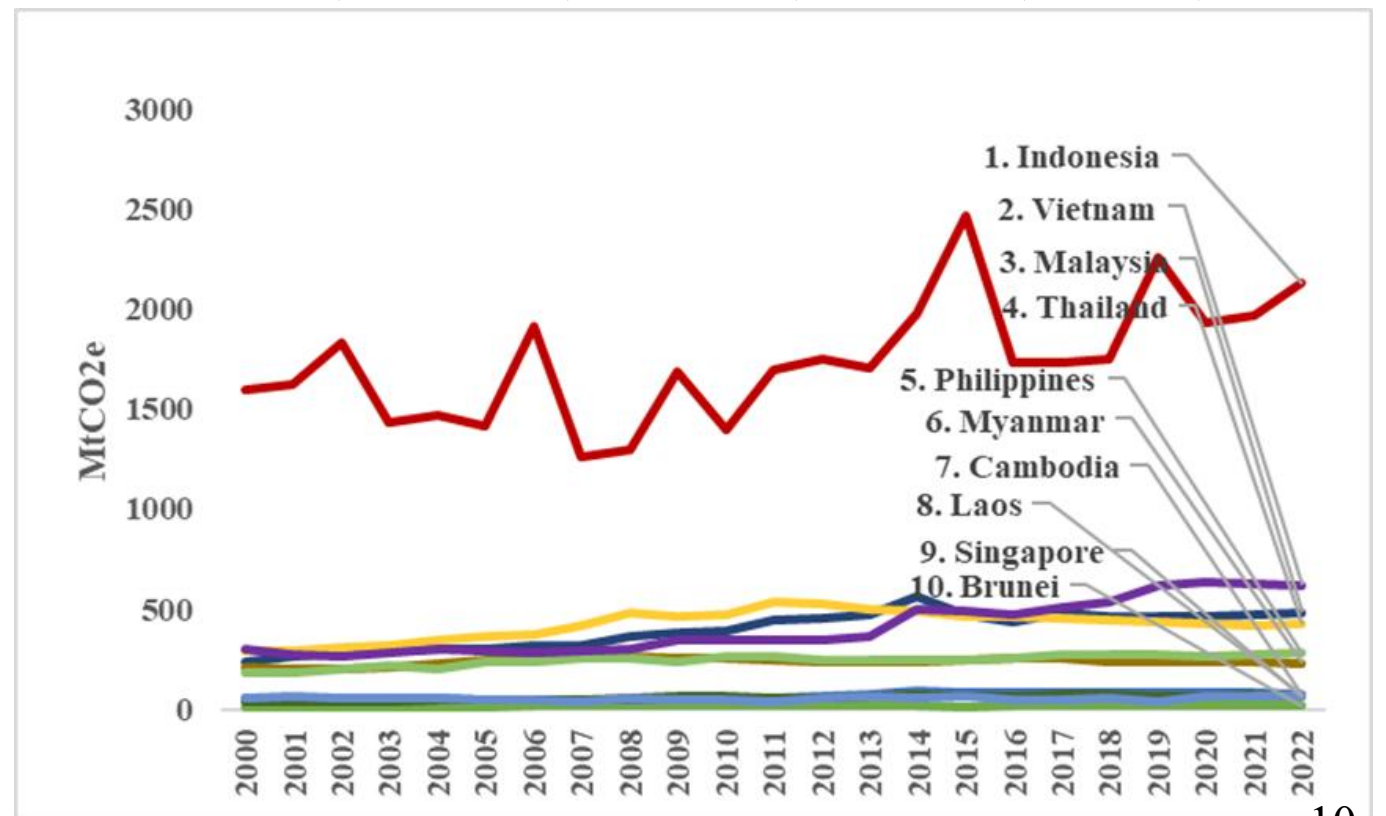
Sources: Data from *Our World in Data*

# ASEAN Emissions Trends

## GHG Emissions Trends in ASEAN

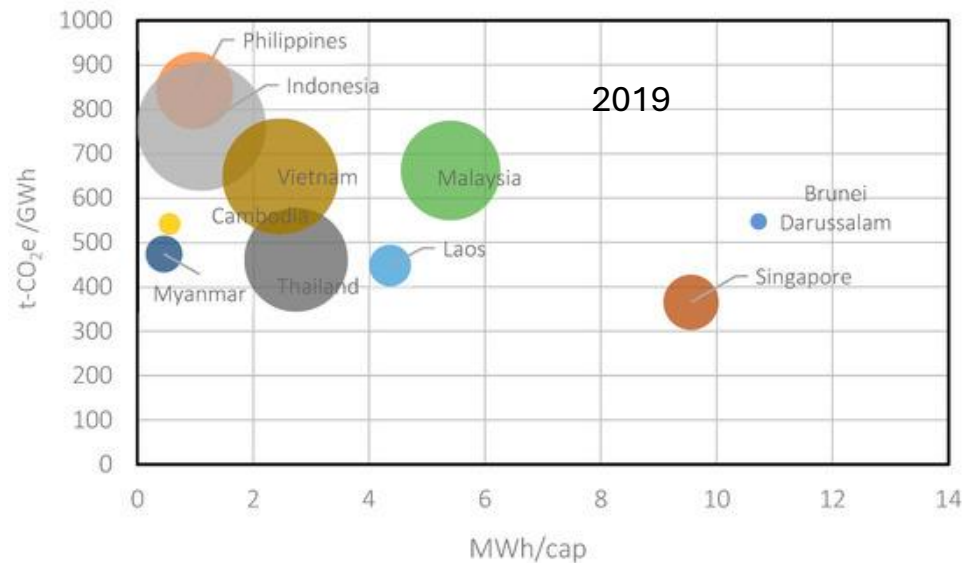
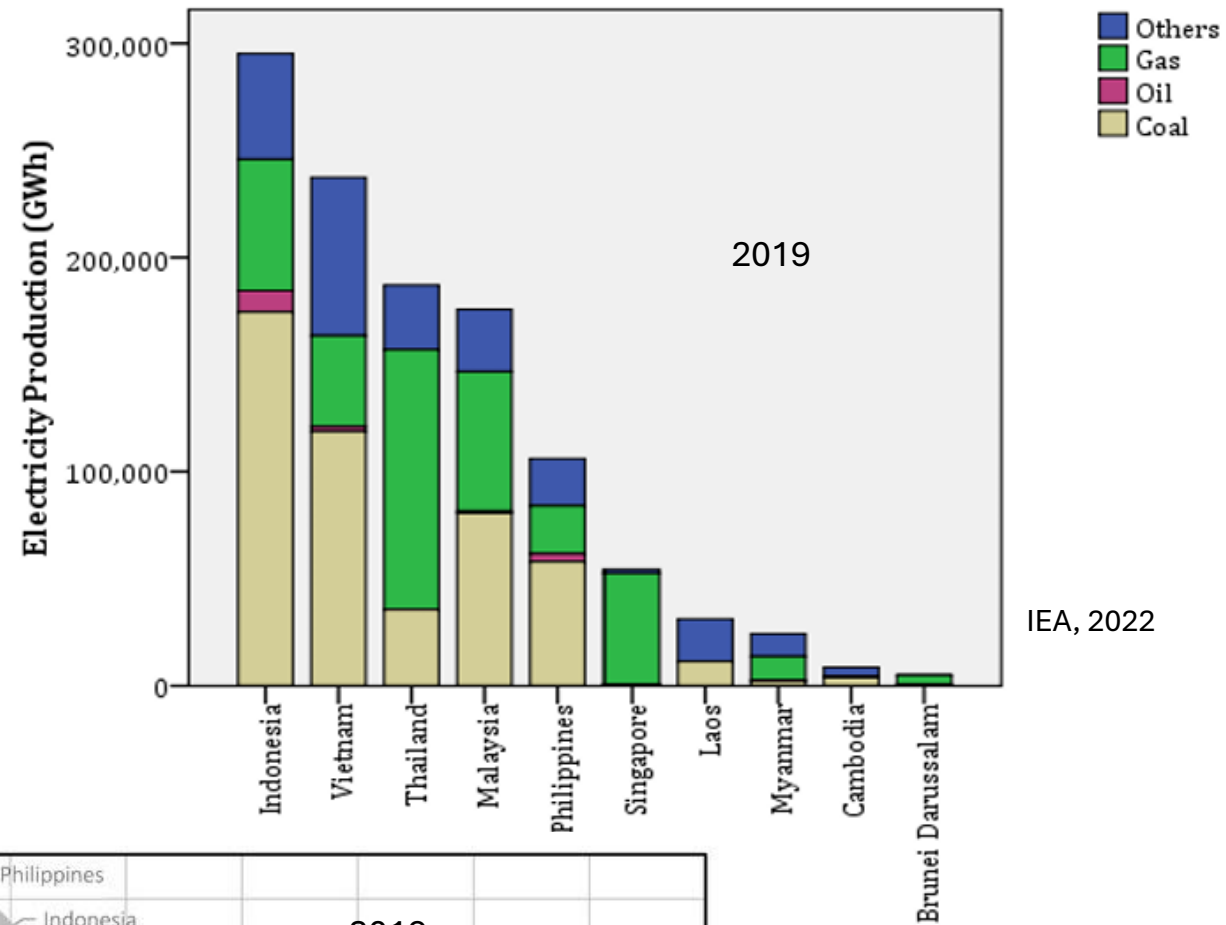
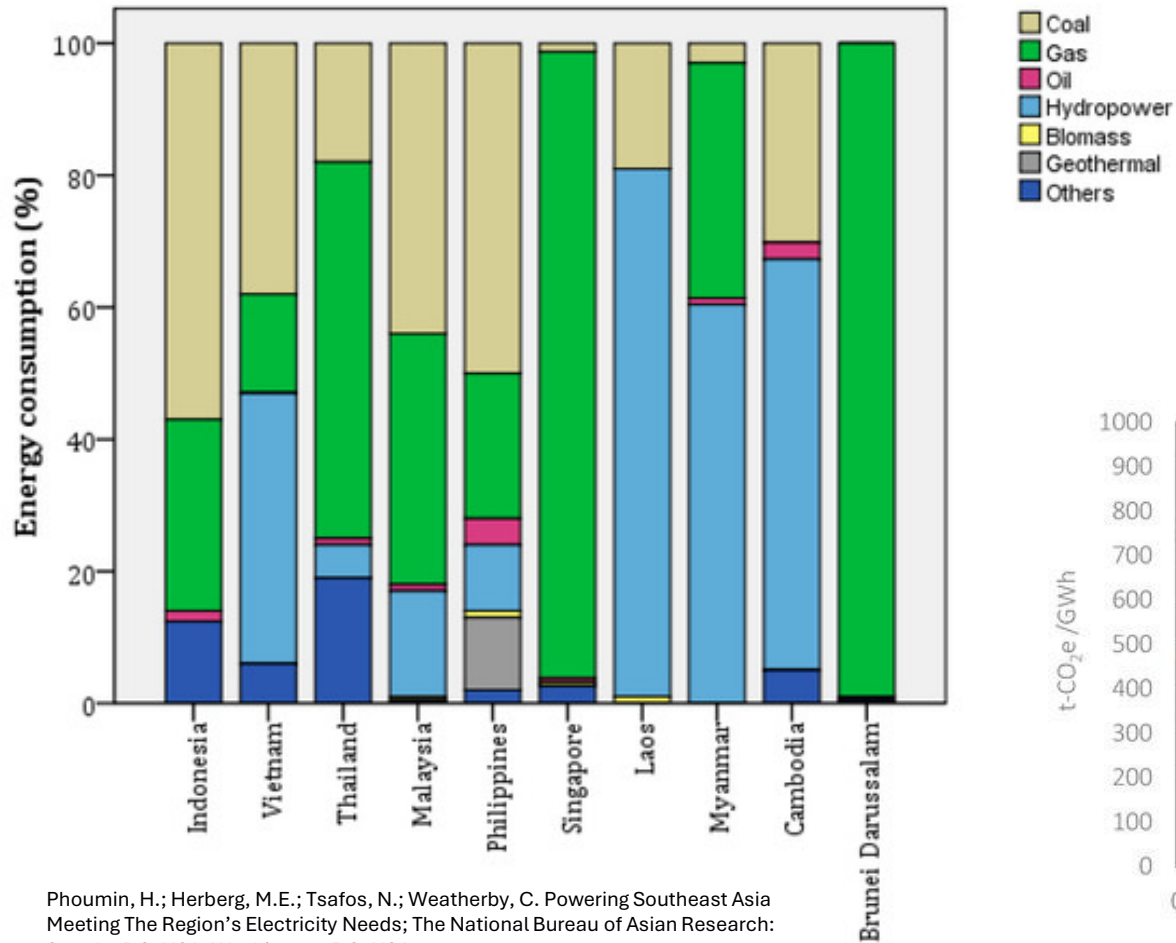
	2022	Per Capita Emissions (2022)
Brunei	16.81	23.95
Cambodia	71.42	1.19
Indonesia	2127.22	2.65
Laos	67.29	3.08
Malaysia	484.12	8.58
Myanmar	229.03	0.64
Philippines	278.72	1.30
Singapore	60.27	8.91
Thailand	422.10	3.78
Vietnam	619.50	3.50

Unit: MtCO <sub>2</sub> e	1990-1999	2000-2009	2010-2019	2020	2021
GHG emissions	2966.22	3025.11	3085.28	4169.03	4223.14
CO <sub>2</sub> - LULUCF	1370.34	1409.10	1448.77	1503.17	1553.28
CO <sub>2</sub> - FFI	607.84	642.96	678.97	1782.51	1803.56
N <sub>2</sub> O	105.45	108.17	110.63	167.58	168.51
CH <sub>4</sub>	572.92	585.19	596.30	880.70	891.97



Sources: Data extracted from Climate Watch

# Electricity production and CO2 emission in ASEAN countries



		Unconditional target to be achieved using domestic resources	Conditional target upon receiving international assistance
Brunei	2015	Sectoral non-GHG targets only (no conditionality element)	–
	2020	Emissions reduction of 20% from 2030 BAU scenario	
Cambodia	2015	–	Emissions reduction of 27% from 2030 BAU scenario
	2020	–	Emissions reduction of 41.7% from 2030 BAU scenario
Indonesia	2016	Emissions reduction of 29% from 2030 BAU scenario	Emissions reduction of 41% from 2030 BAU scenario
	2021	No change →31.89% now	No change →43.2 now
Laos	2015	Sectoral targets only (no conditionality element)	Additional sectoral targets totalling emissions reductions of 45.69MtCO <sub>2</sub> e/yr in 2020–2030
	2021	Emissions reduction of 60% from 2030 BAU scenario	
Malaysia	2015	Carbon intensity reduction of 35% from 2005 levels	Emissions intensity reduction of 45% from 2005 levels
	2021	Carbon intensity reduction of 45% from 2005 levels	–
Myanmar	2015	Sectoral targets only	No economy-wide target; sectoral targets adding up to emissions reductions of 414.75 million MtCO <sub>2</sub> e
	2021	No economy-wide target; sectoral targets adding up to emissions reductions of 244.52 MtCO <sub>2</sub> e	
Philippines	2015	–	Emissions reduction of 70% from 2000 to 2030 BAU scenario
	2021	Emissions reduction and avoidance of 2.71% from 2020 to 2030 cumulative BAU scenario	Emissions reduction of 75% from 2020 to 2030 cumulative BAU scenario; endeavour to peak emissions by 2030
Singapore	2015	Emissions intensity reduction by 36% from 2005 levels	–
	2020	Peak absolute emissions at 65 MtCO <sub>2</sub> e	–
Thailand	2015	Emissions reduction of 20% from 2030 BAU scenario	Emissions reduction of 25% from 2030 BAU scenario
	2020	No change →30% now (2022)	No change (submitted NDC) →40% now (2022) Emissions reduction of 40% from 2030 BAU scenario (Statement at COP26 High Level Segment)
Vietnam	2015	Emissions reduction of 8% from 2030 BAU scenario	Emissions reduction of 25% from 2030 BAU scenario
	2020	Emissions reduction of 9% from 2030 BAU scenario	Emissions reduction of 27% from 2030 BAU scenario

## The NDC pledge

# NET Zero Pledges and Policies in ASEAN

- **Indonesia:** prioritizing forestry (halting deforestation by 2030) and energy transition (23% renewables by 2025, phasing out coal by 2050s).
- **Thailand:** focusing on renewable energy and electric vehicle adoption.
- **Vietnam:** supported by a Just Energy Transition Partnership (JETP) to phase out coal
- **Singapore:** advancing carbon pricing and regional decarbonization hubs, circular economy.
- **Malaysia:** with renewable energy (31% by 2025) and forest conservation, and circular economy.
- **Philippines:** No long-term targets, conditional 70% GHG reduction by 2030, exploring nuclear and renewables.

Brunei	Net zero by 2050	No specific carbon neutrality Policy apart from NDC targets
Cambodia	Net Zero and carbon neutrality by 2050	Cambodia's Long-term Strategy for Carbon Neutrality (2021)
Indonesia	Net Zero by 2060 or sooner	An Energy Sector Roadmap to Net Zero Emissions in Indonesia Indonesia: Long-term Strategy for Low Carbon and Climate Resilience 2050, (UNFCCC, 2021)
Laos	Net Zero by 2050 (conditional target)	No specific policy for carbon neutrality Updated NDC (2021) National Strategy on Climate Change of Lao PDR (2023)
Malaysia	Net Zero by 2050	National Energy Transition Roadmap (2023) National Energy Policy (DTN- 2022-2040) 12 <sup>th</sup> Malaysia Plan
Myanmar	Net Zero from forest and other land use by 2040	No Specific policy. Committed as NDC target
Philippines	Not specified	-
Singapore	Net Zero by 2050	Addendum to Singapore's Long-term Low Emissions Development Strategy (2022) (NCCS, 2022)
Thailand	Carbon Neutrality by 2050 Net zero by 2065	Thailand's Long-term Low Greenhouse Gas Emission Development Strategy (2022) (UNFCCC, 2022)
Viet Nam	Net Zero by 2050	National Strategy on Climate Change (2022)

# Pledges in COP28

Countries	Actions
Brunei, Malaysia, Singapore	Commit to triple the renewable energy capacity to 11 TW by 2030
Brunei, Malaysia, Singapore, Vietnam	Join the Global Cooling Pledge to eliminate 68% of refrigeration and air conditioning emissions by 2050, compared to 2022 levels.
Cambodia	Commits to shut down coal-fired power projects and increase 70% of renewable projects by 2030.
Indonesia, Malaysia, Vietnam	Join the Powering Past Coal Alliance (PPCA) to phase out coal
Loas	Join Declaration on Climate and Health, to transform health systems towards low-carbon models and achieve net zero emissions from the health sector.
Indonesia, Vietnam	Made significant financial commitments to support just energy transitions, securing USD 20 billion (Indonesia) and \$15.5 billion (Viet Nam) for the transition of cleaner energy. <small>G20 Summit, 2022 led by US and Japan      International Partners Group, 2022 led by EU, UK, US, Japan, Germany, France, Italy, Canada, Denmark and Norway</small>

# Sectoral Targets of ASEAN



	Energy	Transport	FOLU	Waste	IPPU
Brunei	30% RE in power sector by 2035	Increase 60% EV sales by 2035	Increase carbon sinks, 500,000 tree covers	Reduce to 1 kg/person/day by 2035 (landfill)	Carbon tax 2025
Cambodia	70% RE by 2030	70% E-motorcycles, 40% E-cars	50% deforestation reduction in 2030 No deforestation by 2045	Reduce open burning, waste collection coverage 85% in 2050	
Indonesia	23% RE in 2025 and 31% in 2050 66% RE in power sector by 2050 Near to 0% power generation from coal by 2050	15 mn EVs: 2 mn four-wheeled and 13 mn two-wheeled by 2030	AFLOU as a Net Sink		
Laos	300 MW biomass, 1 GW solar and wind power capacity by 2030 (conditional) 13 GW hydro capacity by 2030	10% biofuels for transport and 30% EVs by 2030 (conditional) Railway and Bus system (unconditional)	Increase 70% forest cover – 45,000 ktCO2e per year (conditional) Reduce 1,100 ktCO2e per year by 2030	500/tons per day solid waste management	
Malaysia	70% RE by 2050 No new coal power plant	Increase Evs by 9% in 2025 and 12% in 2030 and 80% in 2050	50% forest cover of total land		
Myanmar	53.5% RE by 2030 and 73.5% in 2030		50% deforestation reduction in 2030 (conditional) 25% deforestation reduction in 2030 (unconditional)		
Philippines	35% RE in power generation by 2030 and 50% by 2040 5% energy saving by 2030	50%EV fleet share by 2040 2.45 million EVs by 2028			
Singapore	80% EE improvement in building sector	60,000 EV charging points by 2035		30% landfill reduction each day	Carbon Tax
Thailand	74% RE in electricity by 2030 Phase out coal power plants	30% new Evs by 2030 Phase down ICE vehicles by 2035			
Viet Nam	15% to 20% RE by 2030 65% to 70% by 2045 No new coal power plant after 2035		70% Emission reduction and 20% increase carbon sequestration by 2030 90% remission reduction and 30% increase carbon sequestration by 2050		

# Enhancement in NDC v2 – differential approaches to ambition enhancement → some setting new targets while others expanding existing coverage and proposed mitigation actions and policies

- **Cambodia, Laos and Myanmar:** set or strengthened economy-wide and sectoral targets and consolidated new mitigation actions → can explore the expansion of target coverage in future
- **Brunei, Singapore and Vietnam:** made greater efforts to strengthen, add, or expand coverage of economy-wide GHG targets → yet overall ambition gaps remain
- **Malaysia, Philippines and Thailand:** enhanced their economy wide targets → clarity on sector-scale implementation needed
- **Indonesia:** did not add significant updates on mitigation ambition in their new NDCs compared to other national planning documents → need more details in future to facilitate international support

Category 1: Strengthen economy-wide commitment		Category 2: Expand coverage of commitment	
1.1	New economy-wide GHG target	2.1	Additional coverage of GHGs
1.2	GHG targets increased in stringency	2.2	Additional sectors covered in an existing GHG target
1.3	Changed the type of an existing GHG target	2.3	Strengthen the modality of land-use accounting
1.4	Advanced target year for an economy-wide GHG target		
1.5	Declared intent to overachieve an existing GHG target		
Category 3: Strengthen sector-level commitment (including non-GHG targets)		Category 4: Strengthen or add policies and actions	
3.1	New sectoral target	4.1	Existing policy/action strengthened
3.2	Sectoral target increased in stringency	4.2	New policy/action strengthened
3.3	Advanced target year for a sectoral target		
3.4	Declared intent to overachieve a sectoral target		

Economy-wide

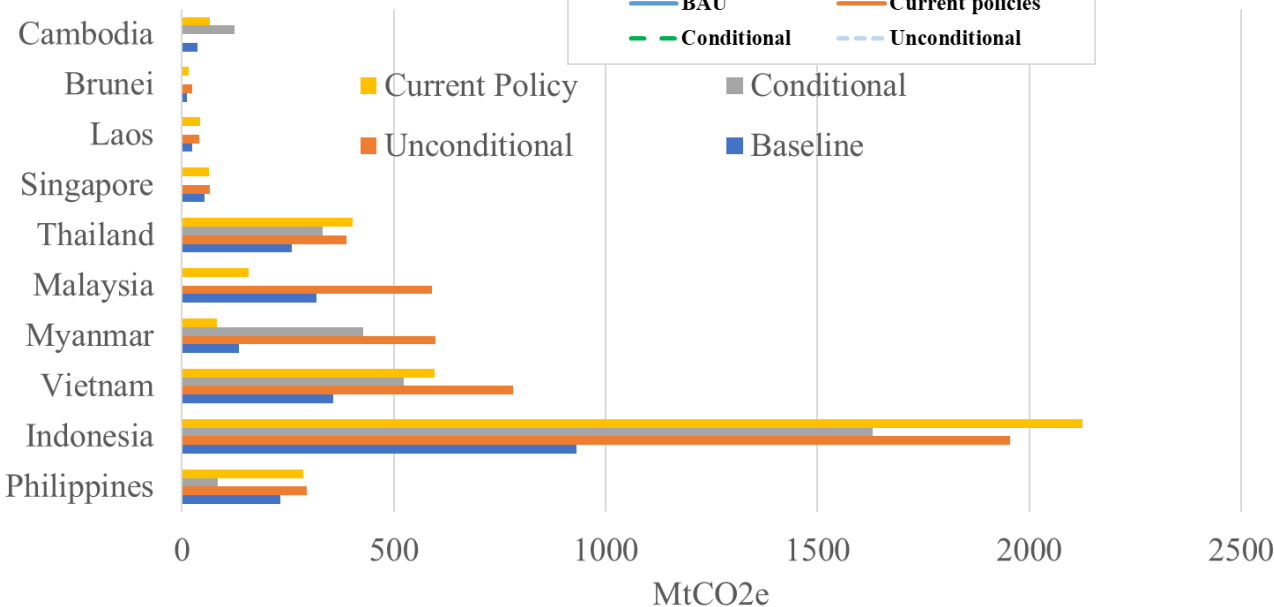
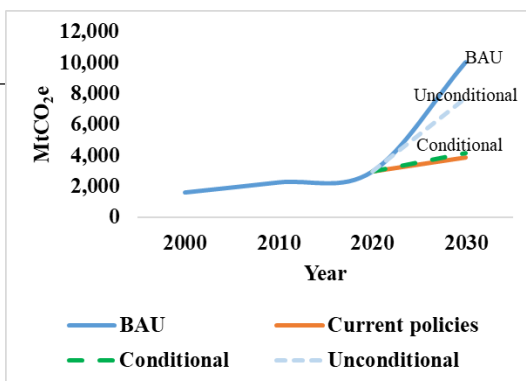
Sector/subsector



# Future emission trends/expectations in ASEAN

CO2 emissions in ASEAN will increase 46% by 2050 compared to 2022 levels, with heavy reliance on fossil fuels (World Energy Outlook, IEA, 2023).

Scenarios: Unit: MtCO <sub>2</sub> e	ASEAN Countries Emissions level by 2030
Current Policy Emissions	3,848
Conditional (plus unconditional target of Singapore, Malaysia and Brunei)	3,387
Unconditional Targets	4,739
Business as usual (BAU) emissions	6,979



## Emissions in 2030 (mn tons of CO<sub>2</sub>e)

Countries	Baseline MtCO <sub>2</sub> e (2015)	BAU (2030)	Unconditional (2030)	Conditional (2030)	Current Policy (2030)
Brunei	12	30	24		17
Cambodia	37	213	0	124	65
Indonesia	931	2869	1954	1630	2125
Laos	23	104	42		42
Malaysia	318		591	500	158
Myanmar	135	843	598	428	83
Philippines	233	3340	3250	835	287
Singapore	54	60	65	0	63
Thailand	259	555	389	333	404
Vietnam	358	928	781	524	597

Source:  
 Fetched from latest NDC submitted by countries  
 Current policy related GHG emissions in 2030 are from PBL

# Several points of analyses

- ❑ Current Status Index by **UNEP**
- ❑ Progress towards meeting- tracking method by **den Elzen et al. (2019)**

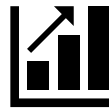


Tracking NDC progress

## Required Data

- ❑ Baseline Emissions (2015)
- ❑ GHG emissions (2022)
- ❑ Current Policy emissions (2030)
- ❑ BAU emissions (2030)
- ❑ NDC targets (2030)

- ❑ LMDI-I decomposition Analysis by **Ang (2015)**.



Emissions Drivers

## Required Data

- ❑ CO<sub>2</sub> emissions from fuel combustion
- ❑ Sectorial CO<sub>2</sub> emissions
- ❑ Total energy consumption
- ❑ Total GDP
- ❑ Sectorial GDP share
- ❑ Population

- ❑ Tapio's decoupling analysis
- ❑ **Multi-dimensional decoupling analysis by Tong and Sun (2024)**



Decoupling Status

## Required Data

- ❑ CO<sub>2</sub> emissions from fuel combustion
- ❑ Sectorial CO<sub>2</sub> emissions
- ❑ Total energy consumption
- ❑ Energy consumption per capita
- ❑ Human development Index

# Current Status Index- Measuring the current emissions status compared to baseline and target emissions (unconditional)

$$CS = \frac{E_{cv} - E_0}{|TV - E_0|} \times D$$

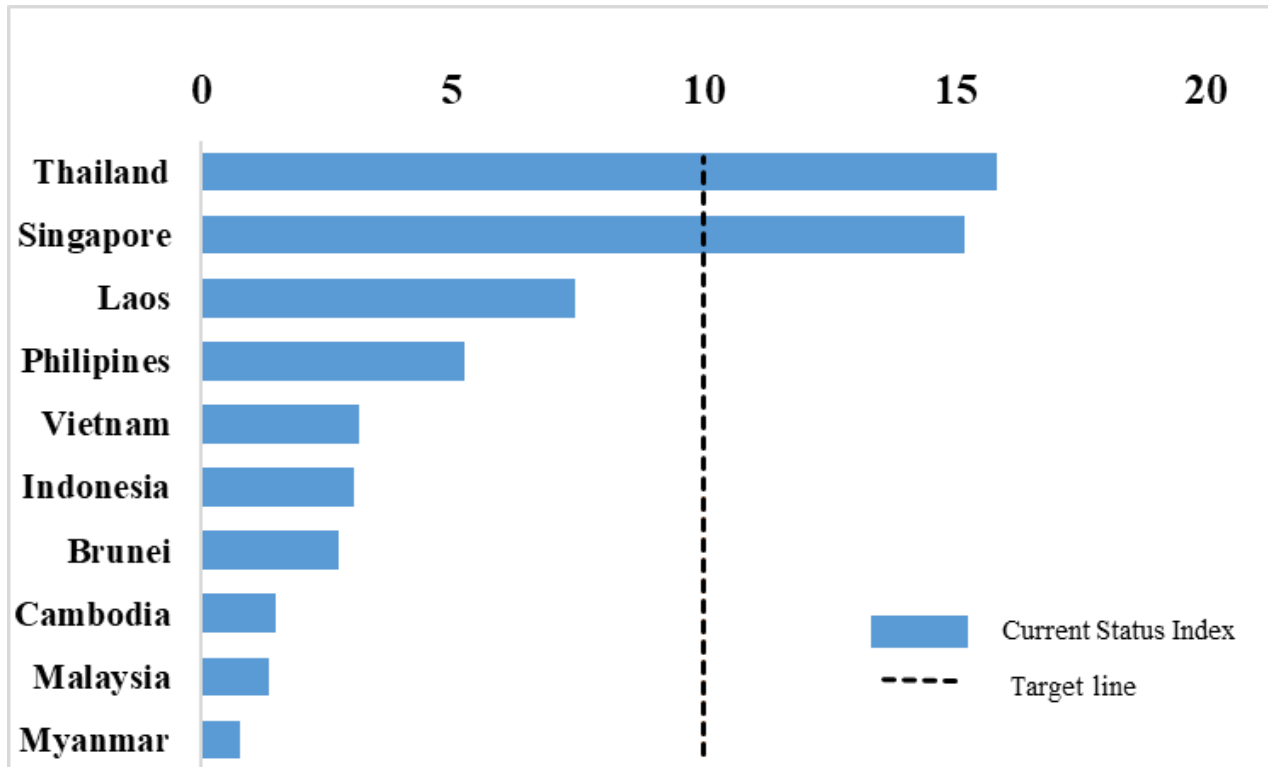
Where,  $E_{cv}$ = current emission (2022),  $E_0$ =baseline emissions (2015),  $TV$ =target value,  $D$ =normalized scale from 1-10

**Interpretation:** measures the distance of current emissions from target value and baseline

- $CS = 10$ : The current emissions reach the target emissions
- $0 < CS < 10$ : Indicates that current emissions are close to the target.
- $CS < 0$ : It suggests that current emissions are below the baseline emissions and far beyond to reach target
- $CS > 10$  Current emissions exceeded the target level

**Note:** This method is adopted from UNESCAP (2023)

# Current Status Index for ASEAN's unconditional target



**Thailand:** CS= 15.8, current emissions of 463.87 surpassed the unconditional target of 388.50 MtCO<sub>2</sub>e

**Singapore:** CS= 15.2, Peaking emissions before reduction was proposed

**Laos:** CS= 7.4, closer to its target level

Work under progress: Please do not quote

**Caution:** Do not be too happy with low values because it compares within targets but not across countries; meaning, country's target could have been conservative, ambitious or more ambition. Therefore, it cannot conclude which country is performing well.

Cambodia is conditional

# Tracking NDC Progress in terms of expected impacts of current policies - policy adequacy !!

Country	Conditional	Unconditional	Current Policy
A	From NDC	From NDC	PBL projection data

$$\text{Progress of policies towards NDC} = \frac{E(\text{Current Policy}) - E(\text{Targets})}{E(\text{Target})} \times 100$$

- **Current policies are on track:** Expected emissions from current policy in 2030 meet or surpass 2030 targets
- **Low level of additional policy efforts are needed:** current policy < 15% of the targets
- **High level of additional policy efforts are needed:** current policy > 15% of the targets

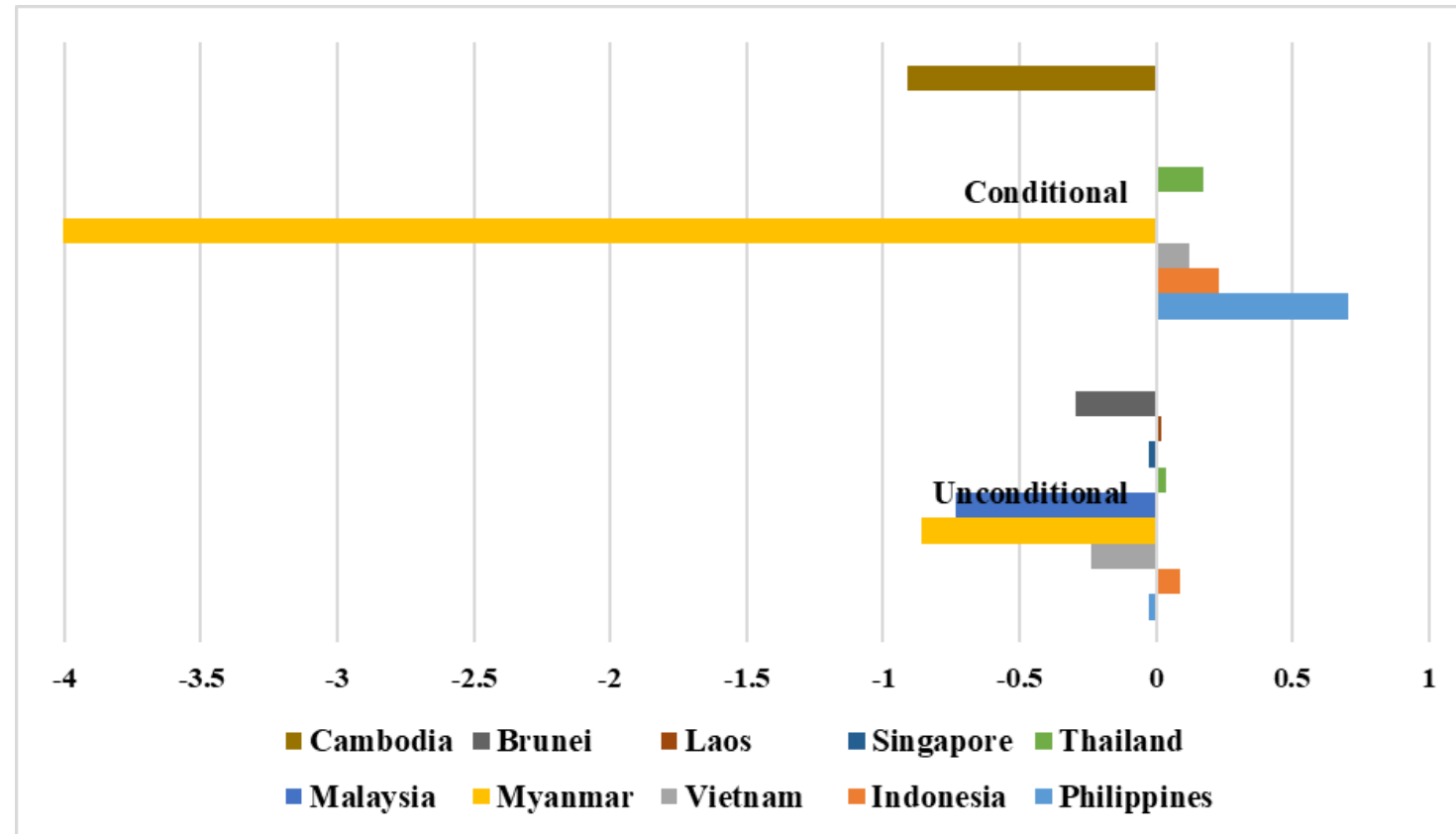
Note: This method was derived from Den Elzen et al. (2019). Source: NDCs, UNFCCC, PBL Netherlands Environmental Assessments Agency <https://themasites.pbl.nl/o/climate-ndc-policies-tool/>

# Progress of policies to meet NDCs in ASEAN

- Laos committed to net zero as a conditional target
- Cambodia has no unconditional target
- Singapore, Malaysia and Brunei has no conditional target

Countries	Baseline MtCO <sub>2</sub> e (2015)	BAU (2030)	Unconditional (2030)	Conditional (2030)	Current Policy (2030)
Brunei	12	30	24		17
Cambodia	37	213	0	124	65
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Work under progress: Please do not quote



Philippines data is cumulative emissions for 2020-2030

# Progress of policies to meet NDCs in ASEAN

Unconditional Target Progress by 2030			Conditional Target Progress by 2030		
On Track	Low Additional Effort	High Additional Effort	On Track	Low Additional Effort	High Additional Effort
Philippines, Viet Nam, Myanmar, Malaysia, Singapore, Brunei	Indonesia, Thailand, Laos	-	Myanmar, Cambodia	Viet Nam	Indonesia, Thailand, Philippines

Work under progress: Please do not quote

- ❑ **Unconditional targets:** Most ASEAN countries are on track to meet their targets by 2030 if they fully implement their current climate policies
  - ❑ Indonesia, Thailand and Lao's policies are not enough and likely to miss its unconditional NDC target → but they need a low level of additional policy efforts
- ❑ **Conditional targets:** In Indonesia, Thailand, Vietnam and Philippines, policies are far off to meet conditional NDC targets, significant new policy efforts needed
  - ❑ Philippines has unusual 75% conditional target

# Log Mean Divisia Index (LMDI) Analysis (Aung, 2015)

## Kaya Identity

$$CO_2 = \sum_{i=1}^n \left( \frac{CO_{2i}}{E_i} \times \frac{E_i}{GDP_i} \times \frac{GDP_i}{GDP} \times \frac{GDP}{P} \times P \right)$$

To simplify,  $CO_2 = \sum_{i=1}^n (CI_i \times EI_i \times SGDP_i \times GDPPC \times P)$

**LMDI-I(additive)**,  $\Delta CO_{2,tot} = \sum_{i=1}^n (\Delta CO_{2,CI,i} + \Delta CO_{2,EI,i} + \Delta CO_{2,SGDP,i} + \Delta CO_{2,GDPPC} + \Delta CO_{2,P})$

**Carbon intensity effect** equation,  $\Delta CO_{2,CI,i} = \sum_i L(CO_{2,i}^T, CO_{2,i}^0) \ln\left(\frac{CI_i^T}{CI_i^0}\right)$

**Energy intensity effect** equation,  $\Delta CO_{2,EI,i} = \sum_i L(CO_{2,i}^T, CO_{2,i}^0) \ln\left(\frac{EI_i^T}{EI_i^0}\right)$

**Structural effect** equation,  $\Delta CO_{2,SGDP,i} = \sum_i L(CO_{2,i}^T, CO_{2,i}^0) \ln\left(\frac{SGDP_i^T}{SGDP_i^0}\right)$

**GDP per capita effect** equation is,  $\Delta CO_{2,GDPPC} = \sum_i L(CO_{2,i}^T, CO_{2,i}^0) \ln\left(\frac{GDPPC^T}{GDPPC^0}\right)$

**Population effect** equation,  $\Delta CO_{2,P} = \sum_i L(CO_{2,i}^T, CO_{2,i}^0) \ln\left(\frac{P^T}{P^0}\right)$

Where,  $L(x, y) = \frac{x-y}{\ln x - \ln y}$  for  $x \neq y = x$  for  $x = y$



# Changes of CO<sub>2</sub> Emissions in ASEAN

Decomposition Analysis Result for Sectoral Emissions in ASEAN: Unit: MtCO<sub>2</sub>e

In 2008, emissions dropped by  $\Delta\text{CO}_2 = -6.39$  MtCO<sub>2</sub> driven by EI, likely due to financial crisis.

In 2013, emissions dropped by  $\Delta\text{CO}_2 = -13.69$  MtCO<sub>2</sub> with CI = -22.27 and EI = -22.20, due to RE adaptation.

This finding aligns with Liu et al. (2017) and the 4th ASEAN Energy Outlook, where RE contribute to this decline.

In 2020, emissions declined  $\Delta\text{CO}_2 = -55.78$  MtCO<sub>2</sub> due to SGDP effect (-50.25) and income effect (-36.55), likely due to COVID-19 pandemic.

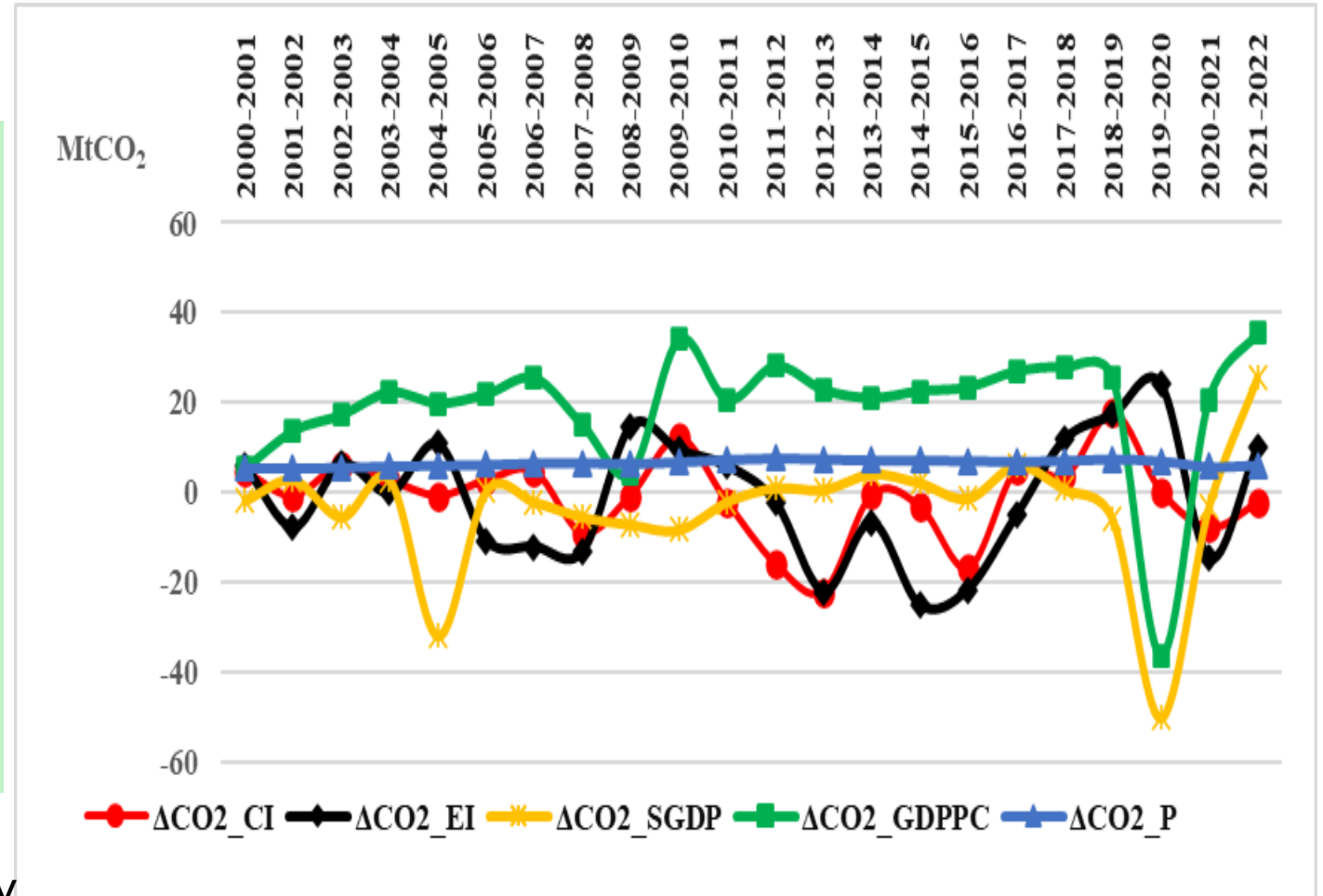
In 2022, emissions surged  $\Delta\text{CO}_2 = 74.43$  MtCO<sub>2</sub> during the recovery period and became the fifth largest economy in the world.

Additive	$\Delta\text{CO}_2_{\text{CI}}$	$\Delta\text{CO}_2_{\text{EI}}$	$\Delta\text{CO}_2_{\text{SGDP}}$	$\Delta\text{CO}_2_{\text{GDPPC}}$	$\Delta\text{CO}_2_{\text{P}}$	Total
2000-2001	4.68	5.75	-1.78	5.28	5.39	19.33
2001-2002	-0.79	-7.84	2.80	13.66	5.45	13.29
2002-2003	6.02	6.20	-5.51	17.22	5.54	29.47
2003-2004	2.69	-0.17	2.82	22.29	5.85	33.49
2004-2005	-0.80	10.72	-32.00	19.79	6.02	3.72
2005-2006	2.61	-10.84	0.28	21.83	6.17	20.05
2006-2007	4.70	-12.18	-2.13	25.43	6.49	22.31
2007-2008	-9.15	-13.23	-5.48	14.93	6.54	-6.39
2008-2009	-0.72	14.78	-7.14	4.21	6.42	17.54
2009-2010	12.13	9.36	-8.36	34.00	6.75	53.87
2010-2011	-2.32	5.87	-2.11	20.63	7.25	29.32
2011-2012	-16.09	-2.22	1.02	28.16	7.55	18.43
2012-2013	-22.27	-22.20	0.64	22.79	7.35	-13.69
2013-2014	-0.52	-6.79	4.11	21.02	7.13	24.95
2014-2015	-3.28	-25.29	2.08	22.56	7.11	3.17
2015-2016	-17.07	-21.73	-1.34	23.40	6.99	-9.75
2016-2017	5.20	-5.16	5.98	26.97	6.85	39.84
2017-2018	3.54	11.78	0.68	27.82	7.01	50.82
2018-2019	17.68	17.31	-5.99	25.38	7.35	61.74
2019-2020	-0.02	24.09	-50.25	-36.55	6.95	-55.78
2020-2021	-7.99	-14.76	-3.21	20.72	5.74	0.49
2021-2022	-2.38	9.90	25.45	35.35	6.11	74.43

# Major Emission Drivers of ASEAN

The **Income effect** (GDPPC) is major driver and some **Population** effect in emissions in ASEAN.

**EI, CI** and **SGDP** fluctuate but lead to emissions reductions in most times. Structure effect strong in crisis time

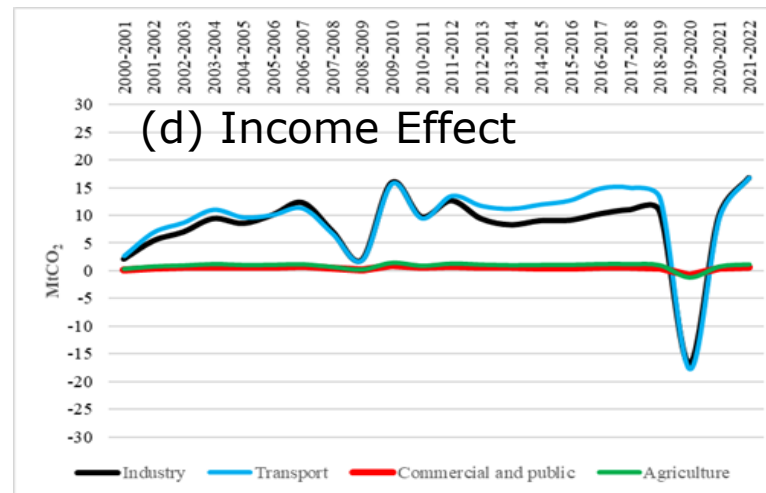
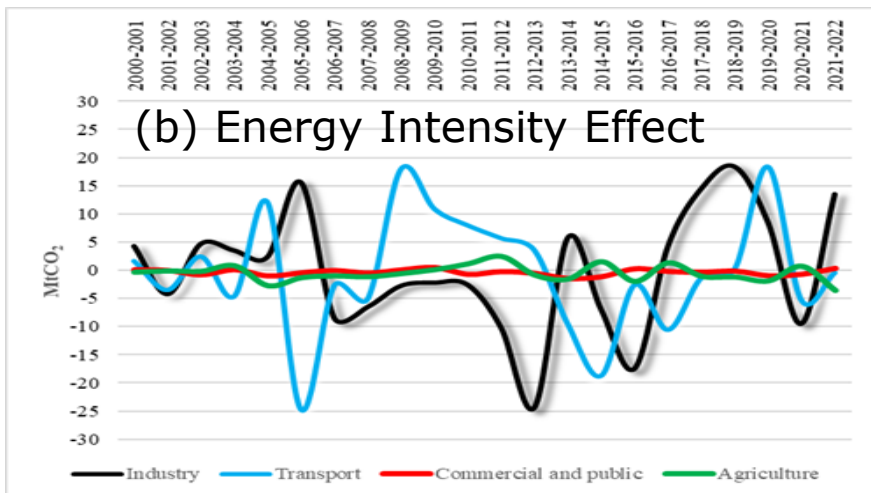
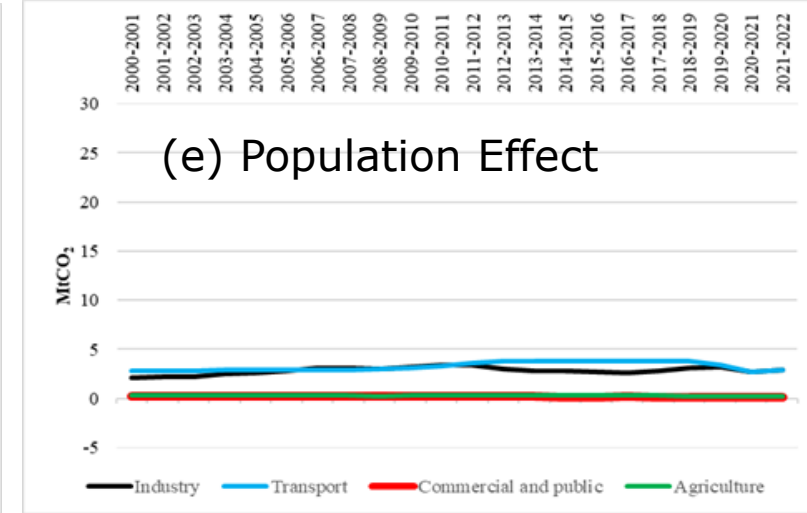
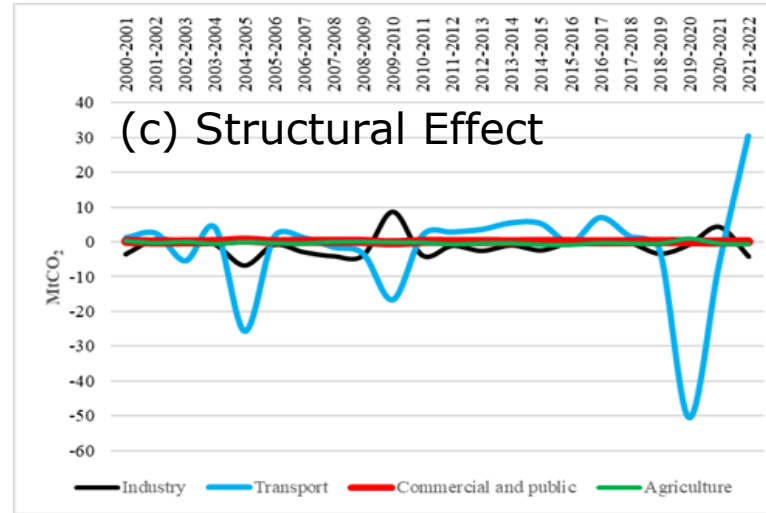
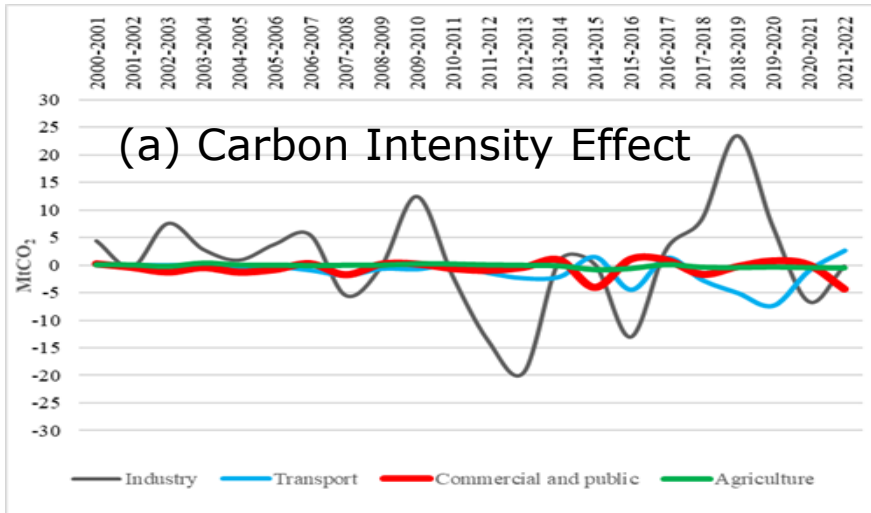


This validates the previous studies by Heidari et al. (2015), Damayanti et al. (2024), and Kiwan & Kalib (2022).

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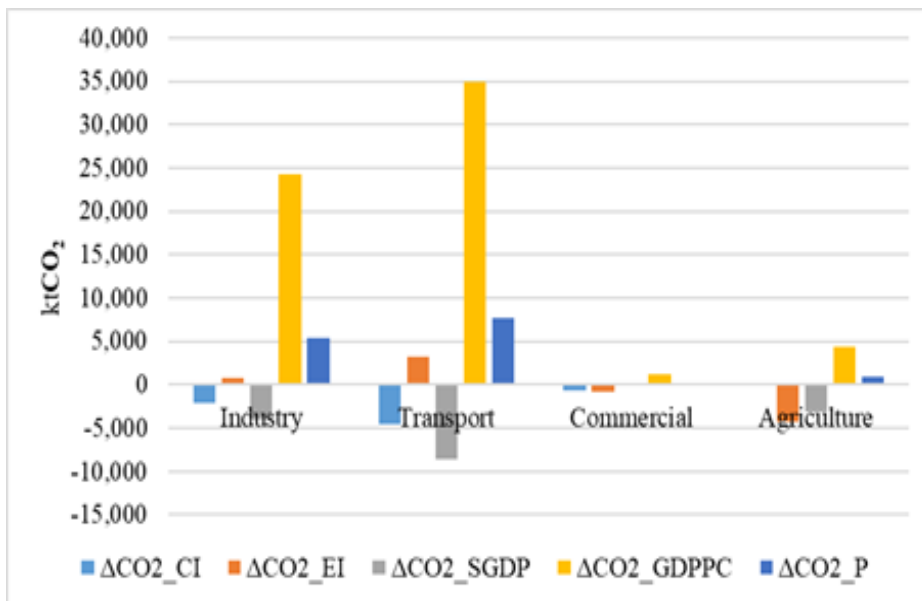
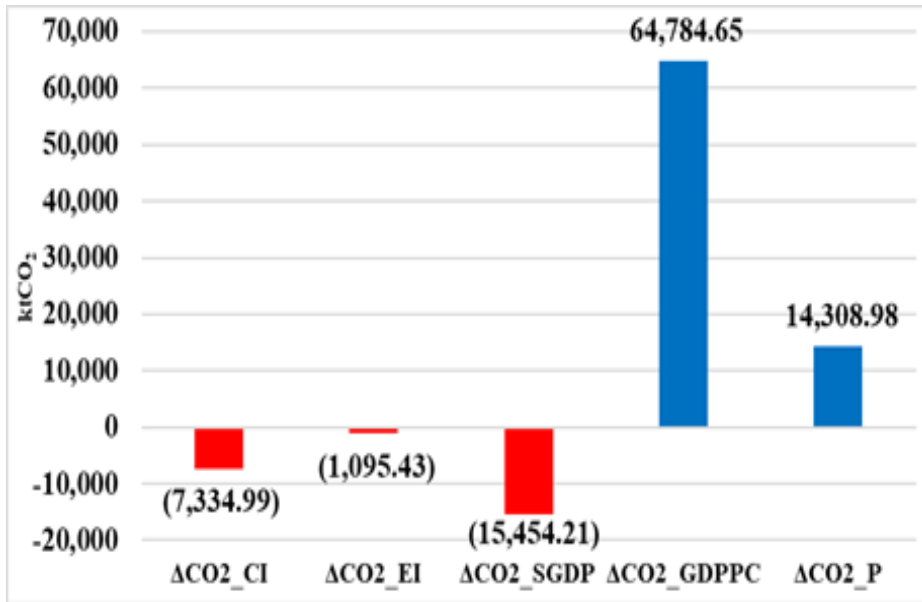
# Sector-wide Emission Drivers

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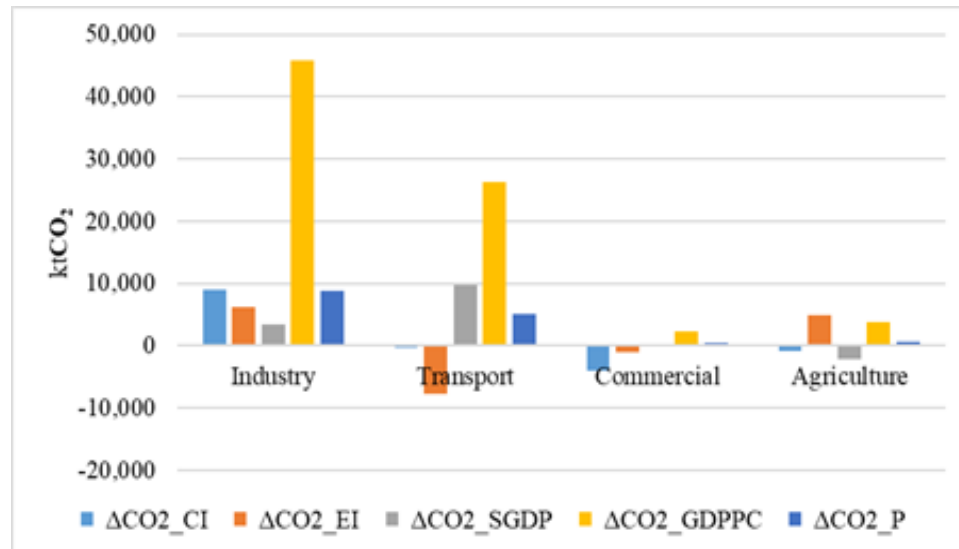
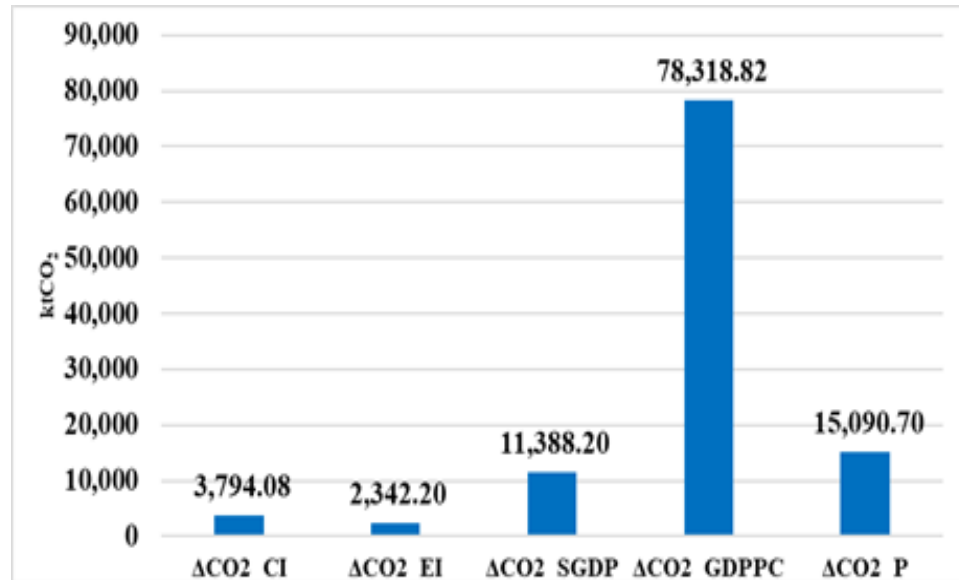
Industry and transport are key sectors affected by drivers amongst demand sectors

# Thailand (2000- 2022)



- Income and population growth drove the emissions across all sectors, especially the industry and transport sector.
- In the transport sector, the structural effects reduced emissions by -15,454.21 ktCO<sub>2</sub>.
- This suggests improvements such as increased public transport adoption and an early shift to EVs under the 30@30 EV policy (The Government Public Relations Department, 2023).
- The industry sector shows progress in reducing energy and carbon intensity, likely driven by cleaner technologies and efficiency measures.

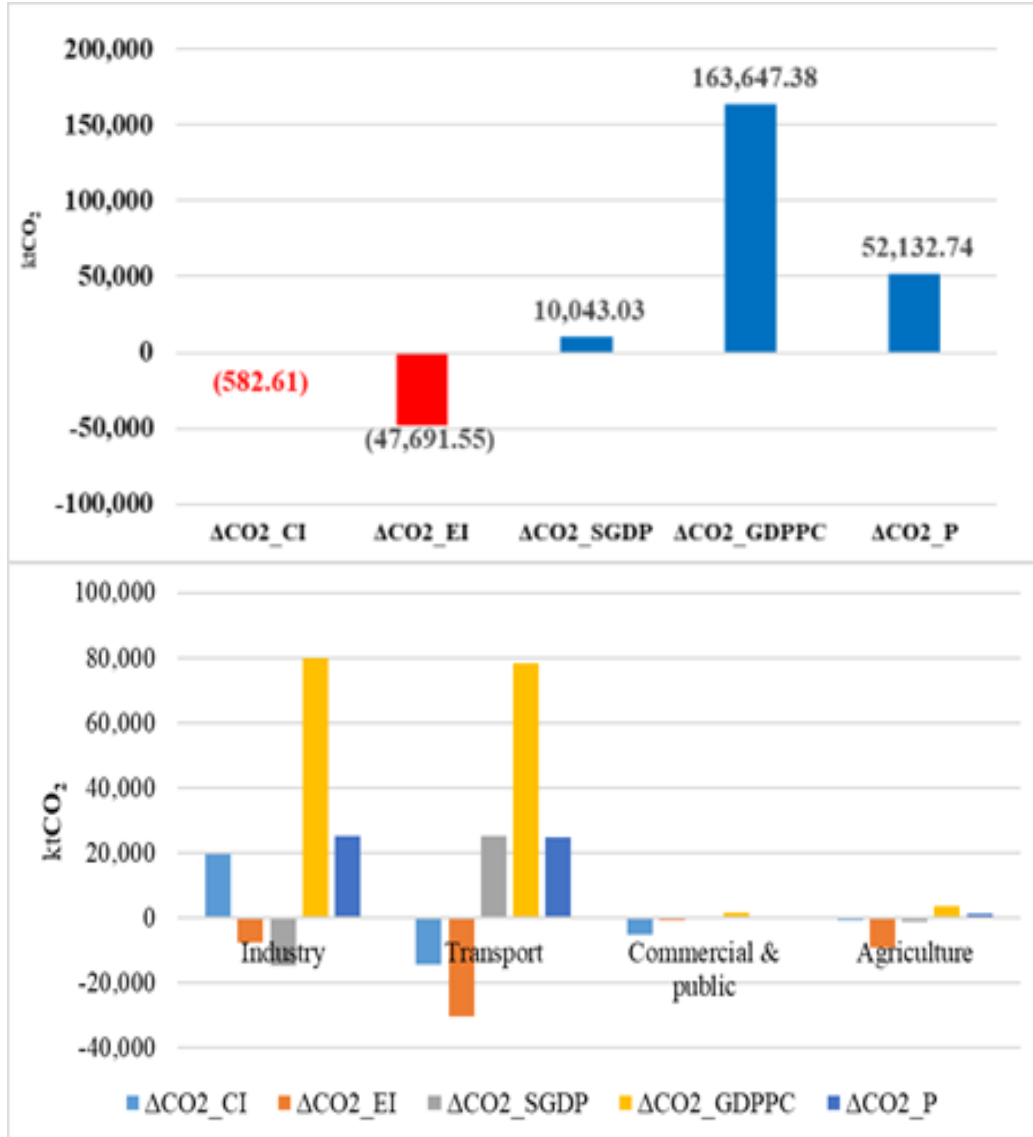
# Viet Nam (2000- 2022)



## Viet Nam (2000 – 2022)

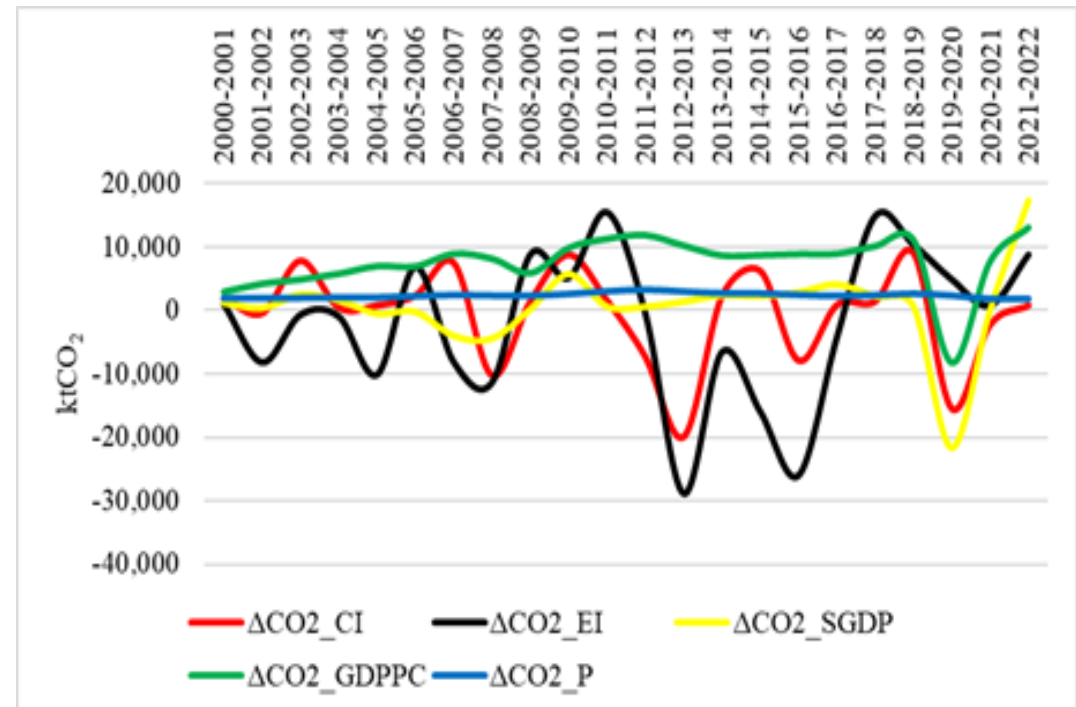
- ❑ Emission is primarily driven by income growth.
- ❑ The industry sector is the major contributor to emissions, paralleled by its economic growth.
- ❑ The transport sector is the only sector where the energy intensity effect has successfully reduced emissions.
- ❑ The commercial and agriculture emissions are comparatively smaller but still positive.

# Indonesia (2000-2022)



Work under progress: Please do not quote

- Income and Population effects drove the emissions.
- Industry & transport: major contributors to emissions driven by CI.
- Committed to decarbonise the transport sector by 2060 (NDC,2021); 15 million EVs (2 mn cars, 13 mn motorbikes by 2030(Kusuma & Limanto, 2023).
- Industries consuming more than 6,000 toes/year are mandated to follow energy management practices.
- During 2011-2012, EI dropped, likely due to Fuel subsidies reforms (IISD, 2014).
- During 2019-2020, emissions temporarily dropped due to COVID.
- Emissions surged gain during the recovery period.



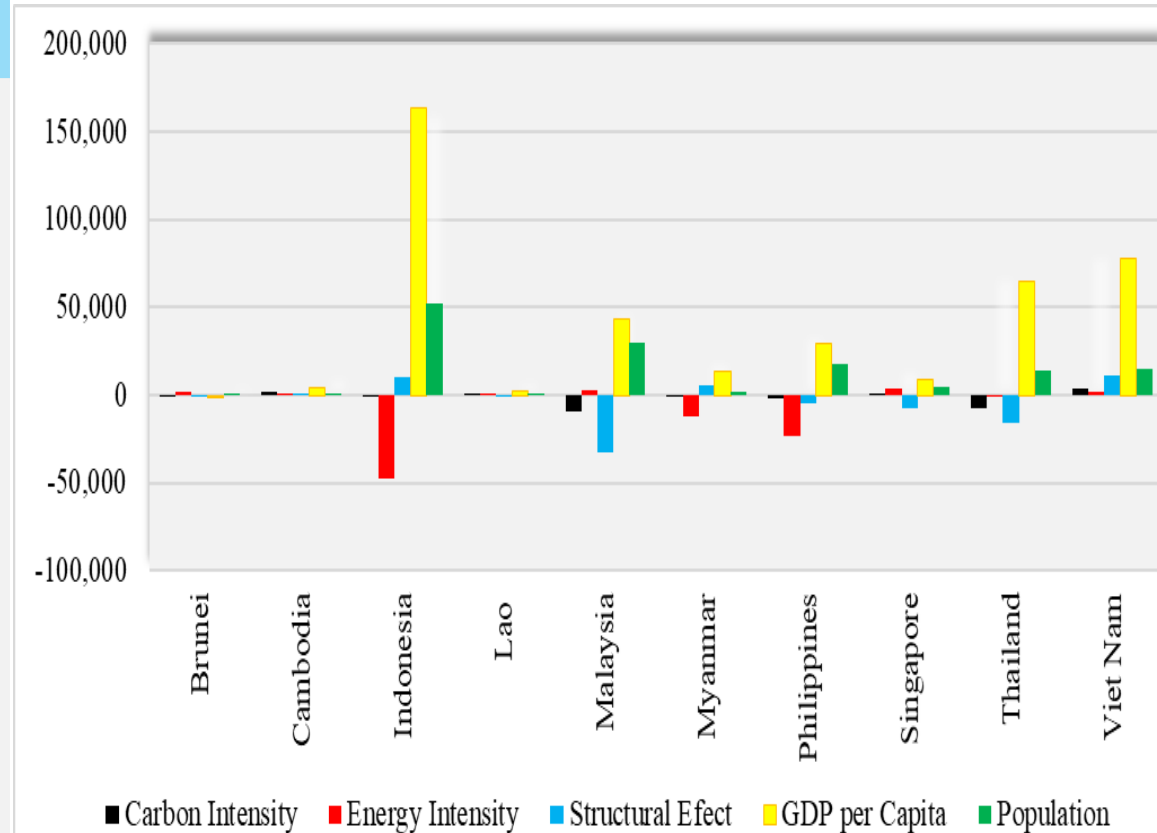
# Commonalities and Differences (2000-2022)

## Commonalities

- ❖ Income and population are emissions drivers.
- ❖ Industry and transport contribute significantly.
- ❖ CI and EI achieved in the industry sector.
- ❖ Emissions from commercial and agri sectors are low.
- ❖ Fluctuation in EI and SGDP in emerging countries.

## Differences

- ❖ **Improvement in EE** in Indonesia, Philippines, Thailand, and Myanmar - **neg EI**
- ❖ **Transition to low carbon economy** in Singapore, Malaysia and Laos - neg SGDP.
- ❖ Negative CI: Indonesia, Brunei, Malaysia, Philippines, Thailand and Myanmar
- ❖ Cambodia, Vietnam, Singapore and Laos - reliance on FF with (+) CI



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# Tapio's decoupling & Multidimensional Decoupling Analysis

(1) Well-being decoupling,  $DI = \frac{\Delta TFEC_{pc}/TFEC_{pc0}}{\Delta HDI/HDI_0}$  Eq (1)

Where,  $HDI = \sqrt[3]{Health \times Education \times GNI}$  Eq (2)

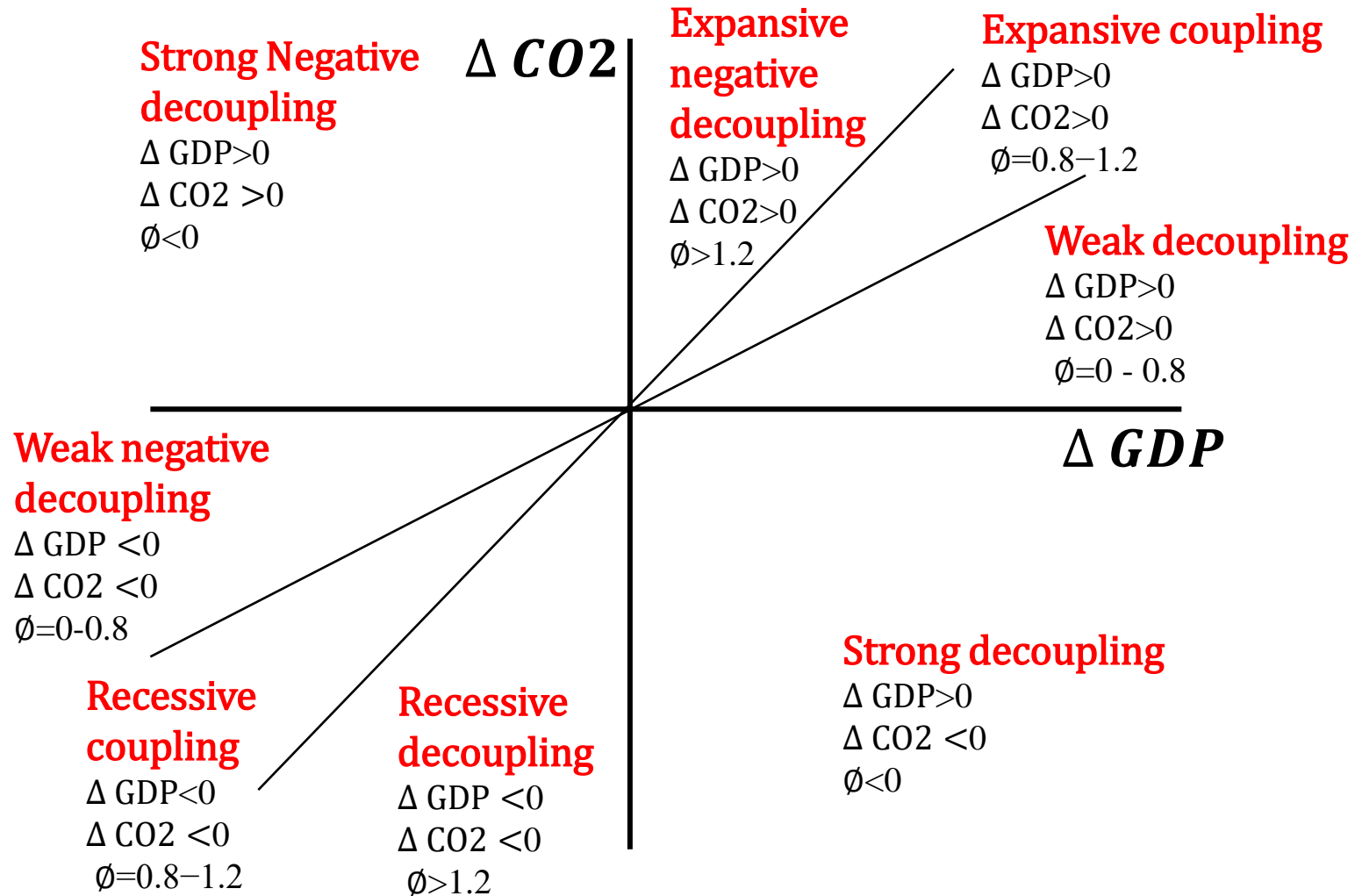
(2) Resource decoupling,  $DI = \frac{\Delta TFEC/TFEC_0}{\Delta GDP/GDP_0}$  Eq(3)

(3) Impact decoupling,  $DI = \frac{\Delta CO2/CO2_0}{\Delta GDP/GDP_0}$  Eq(4)

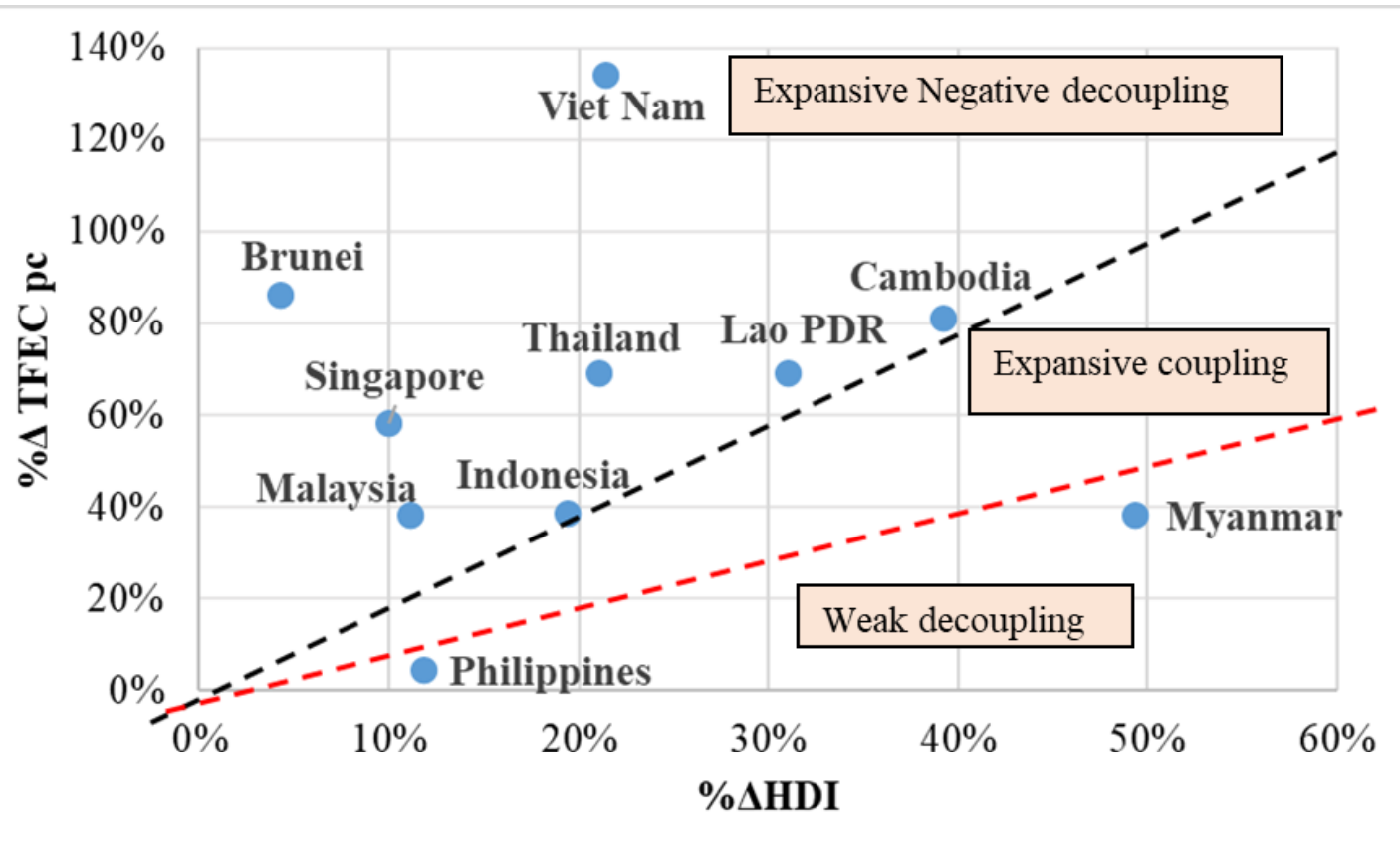
Sectoral decoupling,  $DI_i = \frac{\Delta CO2_i/CO2_{i,0}}{\Delta GDP_i/GDP_{i,0}}$  Eq(5)



# Decoupling

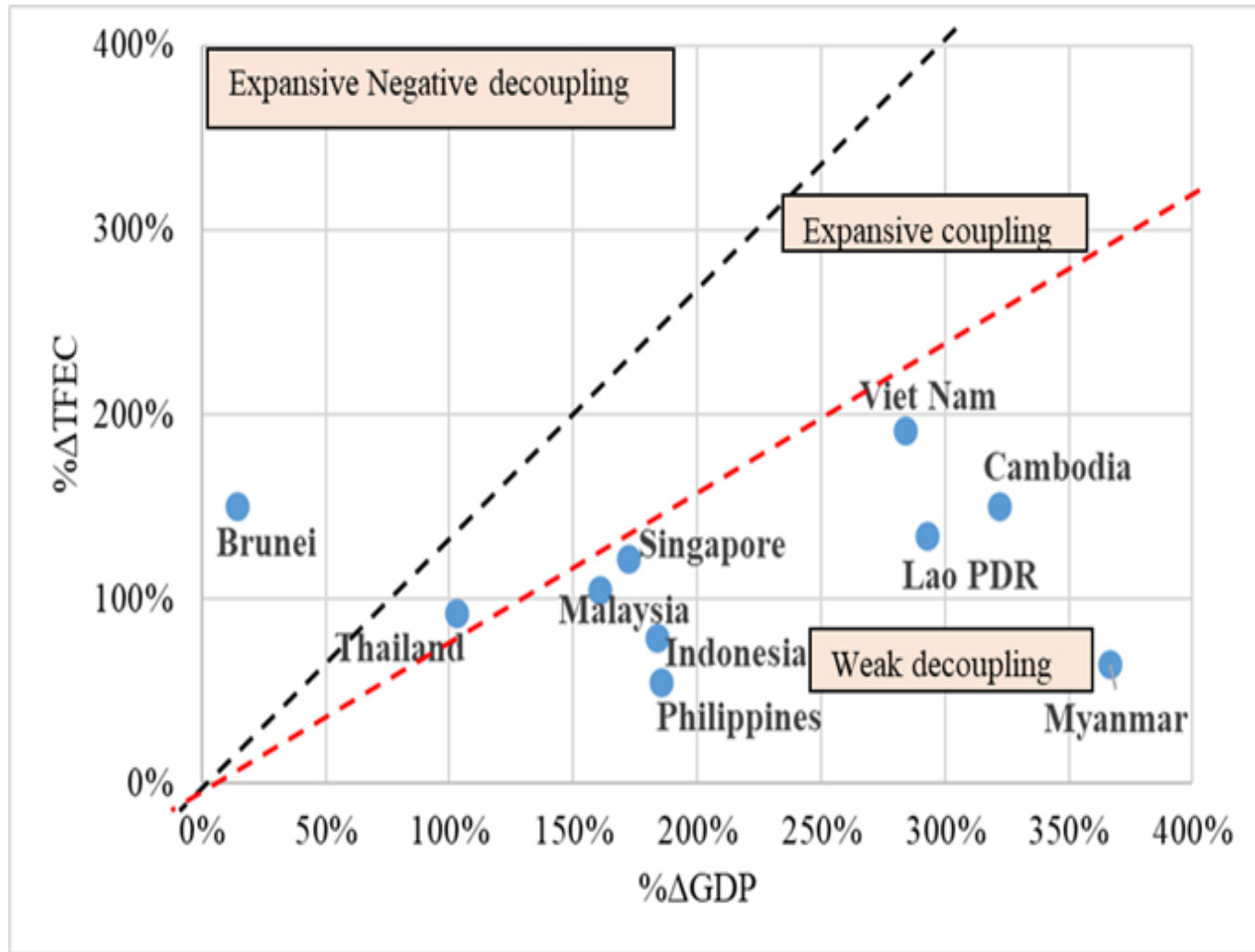


# Well-being Decoupling (2000- 2022)



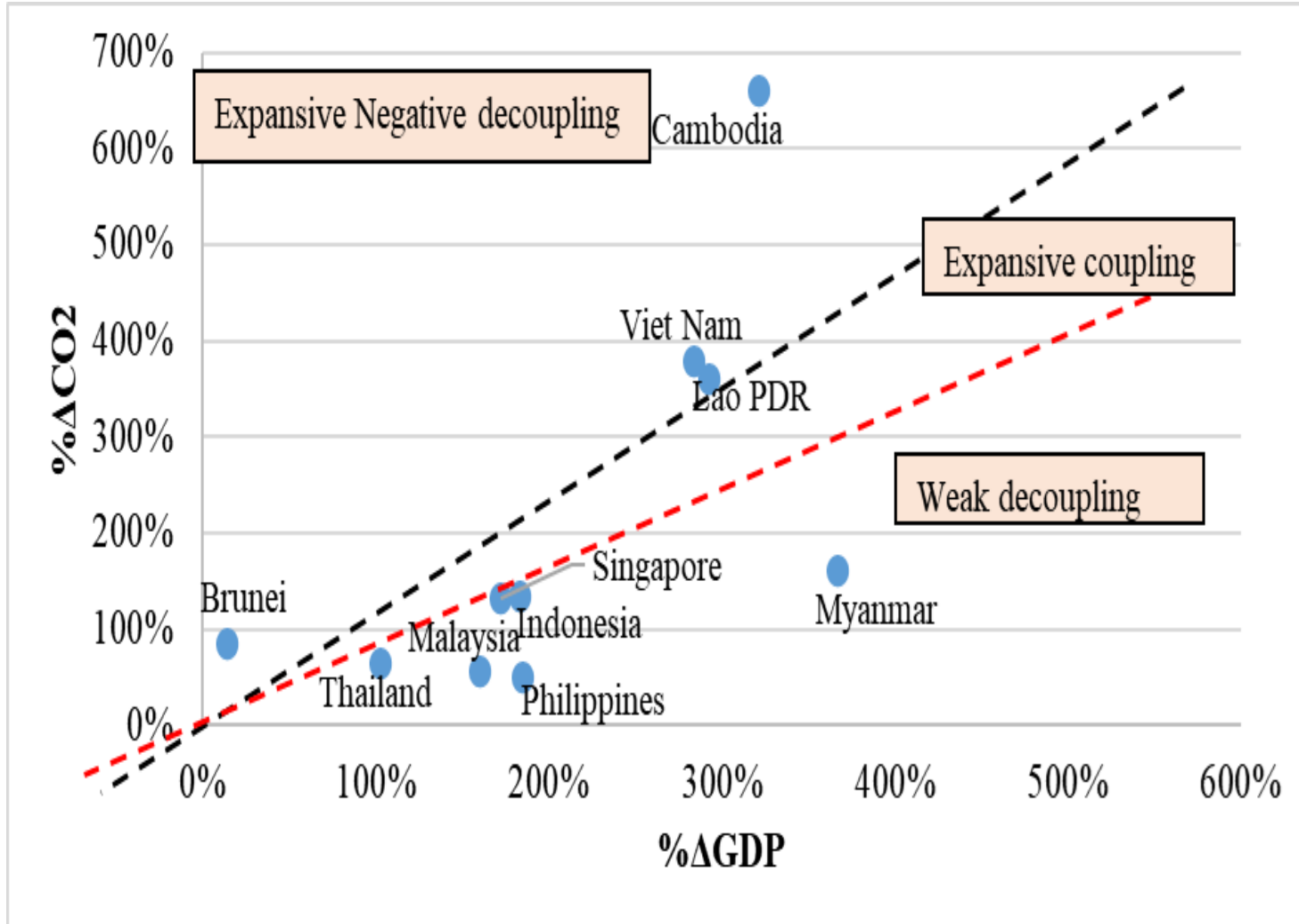
- ❑ **Well-being** decoupling measures whether HDI improves without an increase in resource consumption or environmental impacts.
- ❑ Most countries experienced expansive negative decoupling.
- ❑ Only two countries, Myanmar and the Philippines, faced weak decoupling – lower industrialisation and energy consumption.
- ❑ HDI may be driven by investment in health, education and other rather than energy-intensive economic activities.

# Resource Decoupling (2000 – 2022)



- ❑ **Resource decoupling** is measured with two variables: the percentage change.
- ❑ Most countries experienced weak decoupling.
- ❑ Only Thailand experienced expansive coupling.
- ❑ Only Bruni experienced expansive negative decoupling.
- ❑ Shared need to adopt renewable energy and improve energy efficiency for sustainable development.

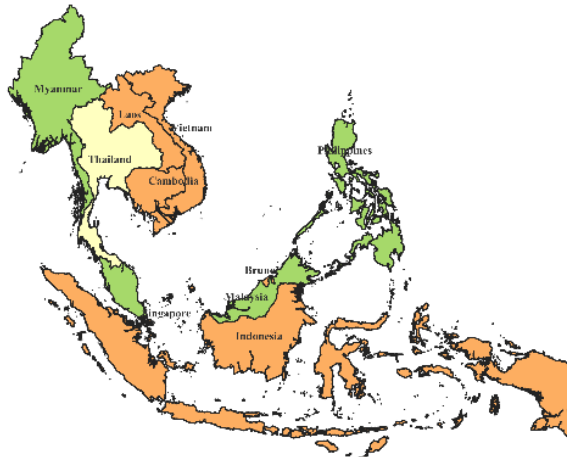
# Emissions Impact Decoupling (2000- 2022)



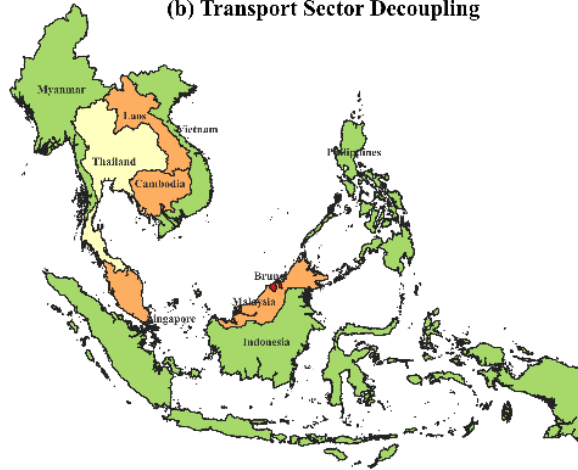
- ❑ **Impact decoupling:** the ratio between  $\% \Delta \text{CO}_2$  and  $\% \Delta \text{GDP}$ .
- ❑ Brunei, Vietnam, and Cambodia had expansive negative decoupling, which shows their energy-intensive development.
- ❑ Most countries face weak decoupling, meaning their economy is decoupled from emissions but still insufficient.

# Emissions decoupling in sectors (2000-2022)

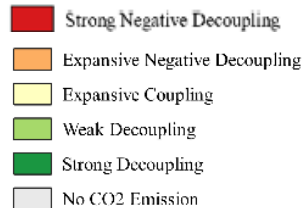
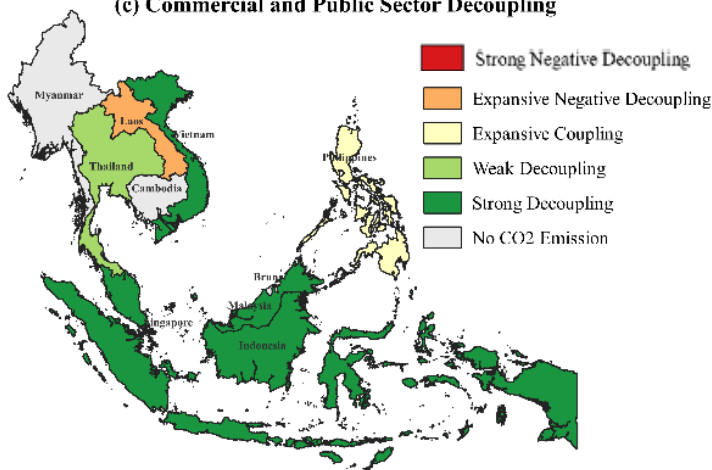
(a) Industry Sector Decoupling



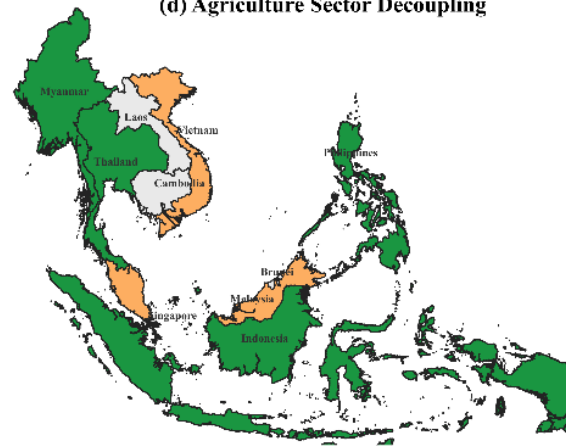
(b) Transport Sector Decoupling



(c) Commercial and Public Sector Decoupling



(d) Agriculture Sector Decoupling



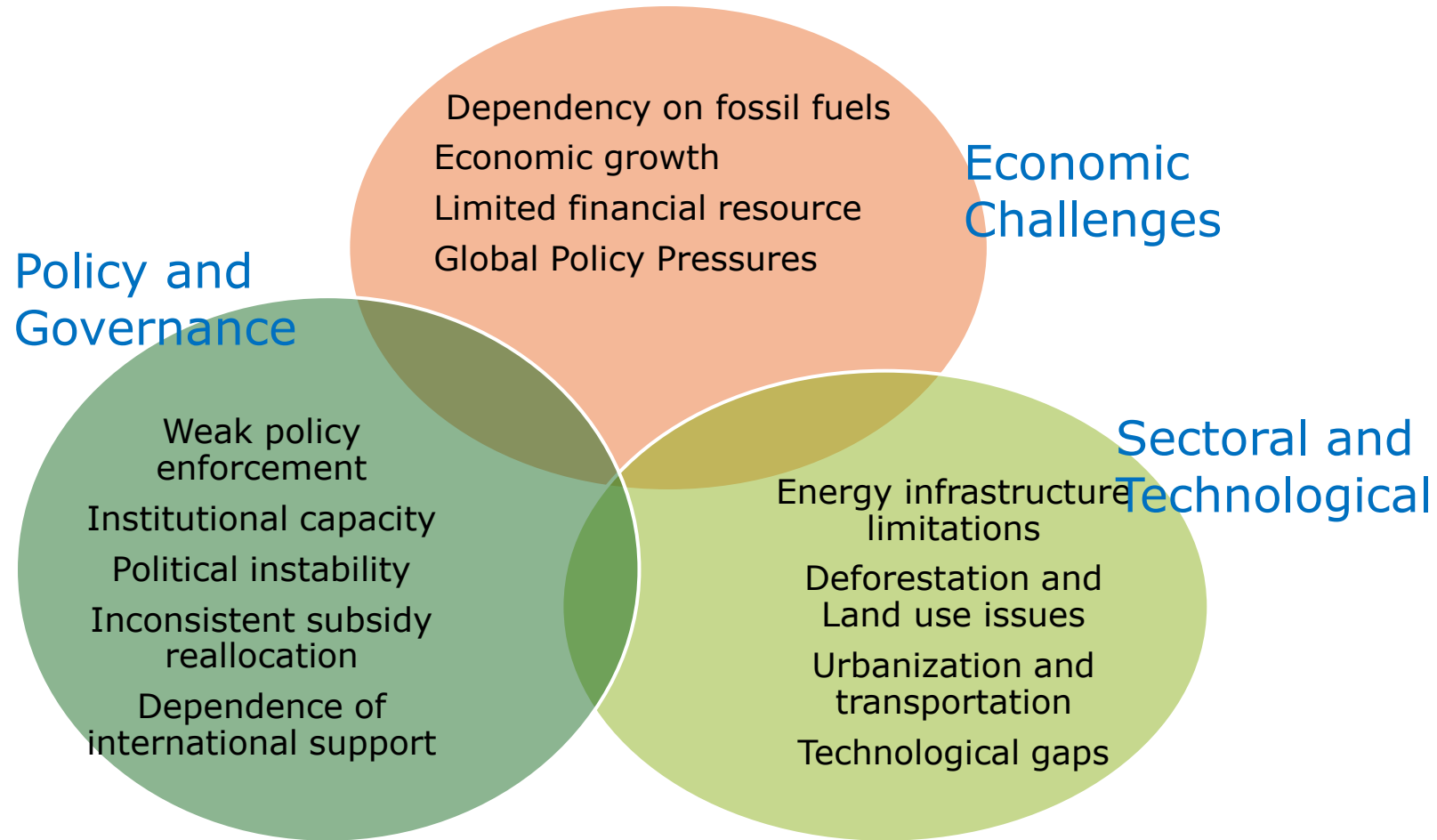
❑ **Industry**- expansive negative decoupling, shows reliance on carbon-intensive industries.

❑ **Transport** –experienced weak decoupling, where Strong negative decoupling occurred in Brunei

❑ **Commercial and public** – strong decoupling trend while the Philippines and Singapore show expansive coupling.

❑ **Agriculture**- strong decoupling has occurred where Malaysia and Viet Nam show expansive negative decoupling

# Challenges of ASEAN to Achieve Climate Goals



Examples:

- Coal dependency in Indonesia and Vietnam
- Economic priorities conflicting with decarbonization
- Deforestation pressures from palm oil and logging
- Funding gaps requiring international climate finance

# Key policy implications for meeting long-term climate mitigation targets

## Balancing Economic Growth with Decarbonization

- Rapid industrialization and urbanization prioritize short-term economic gains, often conflicting with climate goals.
- Example: Vietnam and Indonesia face pressure to maintain GDP growth while transitioning to green industries.

## Far reaching economy wide policies

- Carbon pricing in national economies, ASEAN-wide regional emission trading like EU-ETS, realistic policies with longer term horizon for carbon neutrality

## Phasing Out Coal and Ensuring Energy Security

- Heavy reliance on coal (e.g. Indonesia's electricity) creates resistance to phase-outs due to energy security and job concerns.
- Policy hurdle: Designing "just transition" frameworks to retrain workers and subsidize renewable alternatives

# Key policy implications for meeting long-term climate mitigation targets

## Managing Deforestation and Land-Use Conflicts

- Agriculture (e.g., palm oil in Malaysia/Indonesia) drives deforestation; weak enforcement of land-use policies and corruption exacerbate the issue.
- Challenge: Aligning economic incentives for farmers with forest conservation (e.g., Indonesia's peatland moratorium enforcement gaps).

## Mobilizing Sufficient Climate Finance

- High costs of renewable infrastructure (e.g., offshore wind in the Philippines) require international aid (e.g., JETP deals), but domestic budget constraints persist. Indonesia JTEP → **US**/Japan, Vietnam JETP
- Policy gap: Creating tax incentives, green bonds, and mechanisms to attract private-sector investment.

## Coordinating Multi-Level Governance

- Fragmented policies across ministries (e.g., energy vs. environment departments) and weak local implementation (e.g., Indonesia's decentralized forest governance).
- Need: Integrated national frameworks and stronger institutions to harmonize climate action.



# Key policy implications for meeting long-term climate mitigation targets

## Addressing Technological and Infrastructure Gaps

- Limited grid capacity for renewables (e.g., Thailand's solar expansion); reliance on imported clean tech.; slow development of EV infrastructure
- Solution: Policies promoting R&D, regional tech-sharing, and infrastructure modernization.

## Ensuring Social Equity and Political Will

- Public resistance to carbon pricing (e.g., Malaysia's delayed fuel subsidy reforms) and lack of awareness about climate risks.
- Challenge: Building political consensus for long-term targets amid short-term electoral cycles.

## Strengthening Regional and International Collaboration

- Divergent national priorities hinder ASEAN-wide policies (e.g., uneven adoption of the ASEAN Taxonomy for sustainable finance).
- Opportunity: Leveraging platforms related to regional energy integration including market led regional electricity trading, others ASEAN Agreements.

# Thank you

[Shobhakar.dhakal@gmail.com](mailto:Shobhakar.dhakal@gmail.com)

[Shobhakar@ait.ac.th](mailto:Shobhakar@ait.ac.th)

## Progress of NDC – our findings are similar to other studies’ findings

Countries	Source	NDC Progress Findings
Brunei	IMF (2023)	It will meet its unconditional target by 2030.
Cambodia	-	
Indonesia	CAT (2022)	The country will miss its NDC targets
Laos	-	
Malaysia	-	
Myanmar	-	
Philippines	CAT (2023)	The Philippines is on track and will overachieve its unconditional target without additional action.
Singapore	CAT (2024)	Singapore is off track to meet the 1.5°C pathway, but it is on track to meet its own NDC target.
Thailand	CAT (2022)	Thailand is not projected to reach its new targets under current policies, but could reach its unconditional target under planned policies
Viet Nam	CAT (2023)	Viet Nam is on track to exceed its own climate targets but is still far from what is needed to align with global 1.5°C goals.