The 26th AIM International Workshop

ONLINE

National Institute for Environmental Studies
September 3-4, 2020

GHG mitigation in THAILAND

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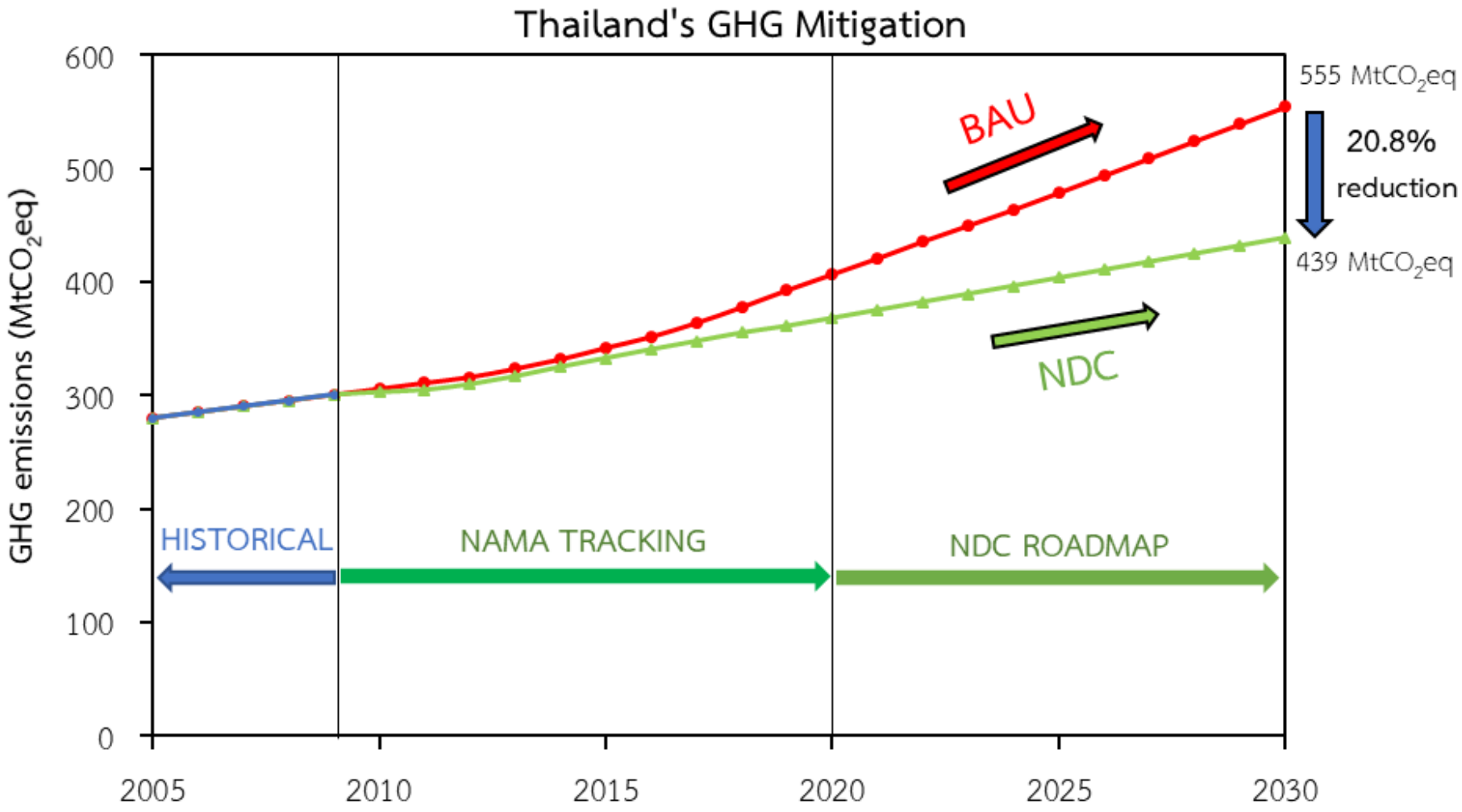
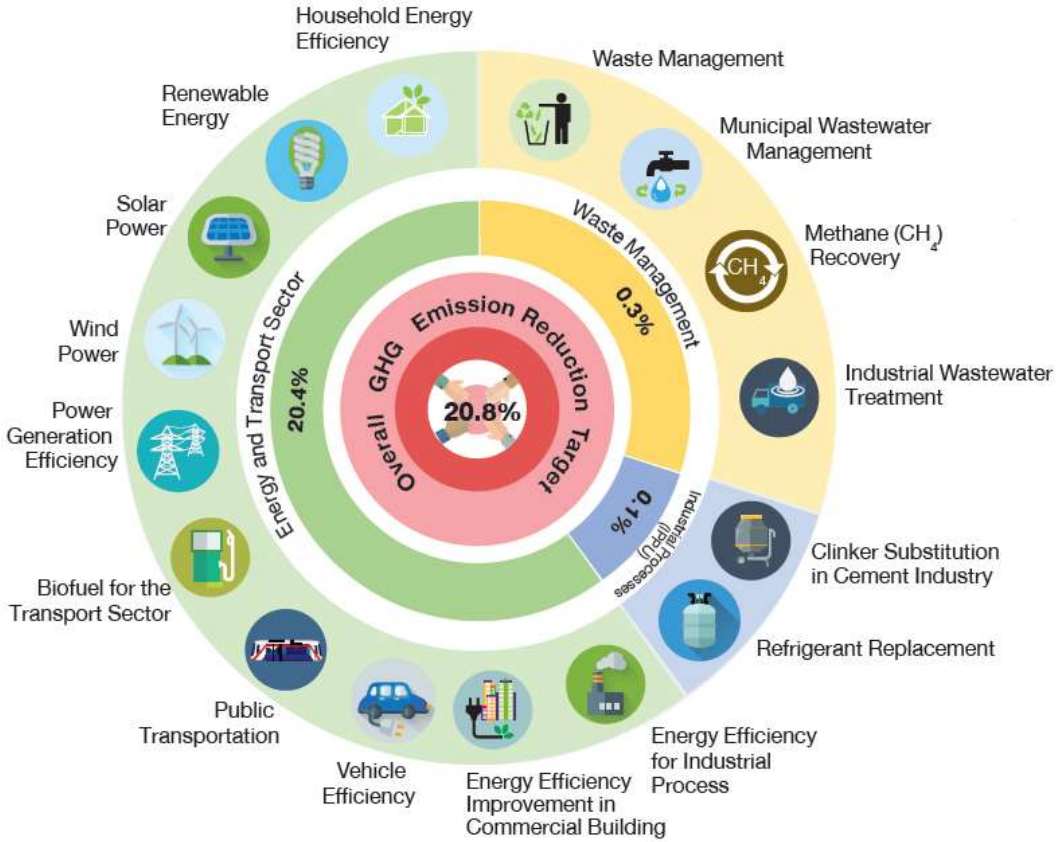
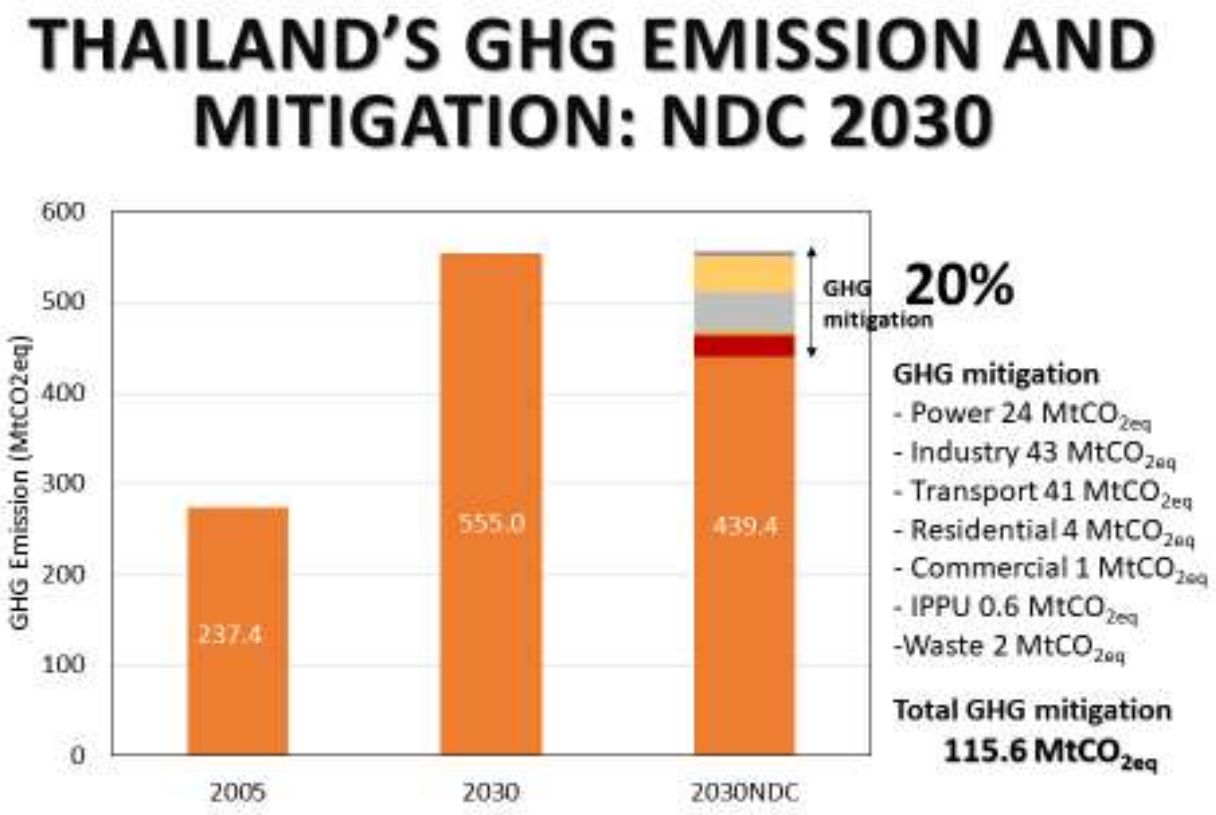
THAILAND'S GHG MITIGATION: NAMA 2020 AND NDC 2030



Source: Thailand NC3

NDC ROADMAP 2030





Source: ONEP, Thailand

COVID19 Effects
MASS RAPID TRANSIT IN BANGKOK

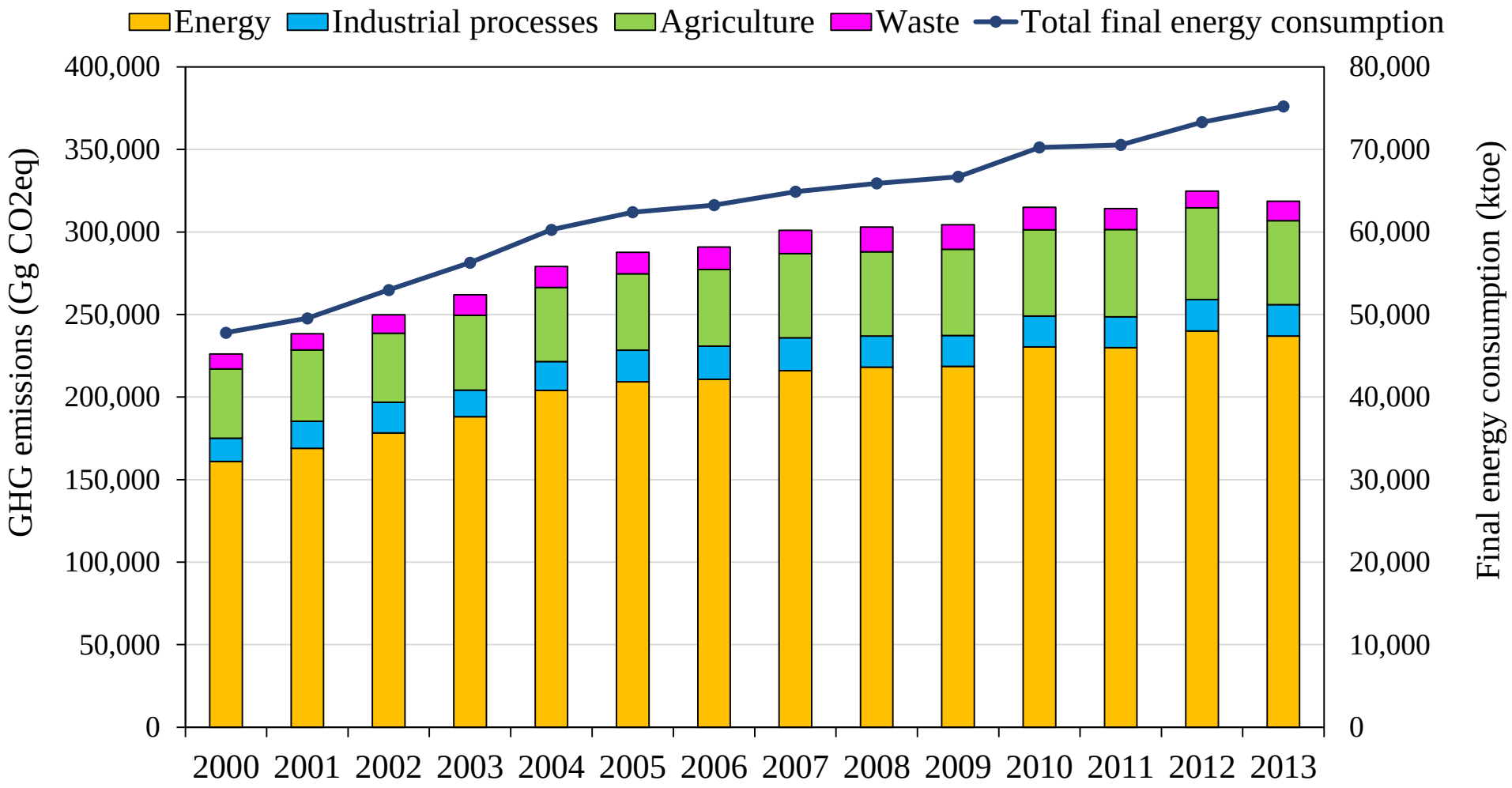
2019 Bangkok area

Monorail, Government Complex, 2021+

Bangkok Area, 2025+

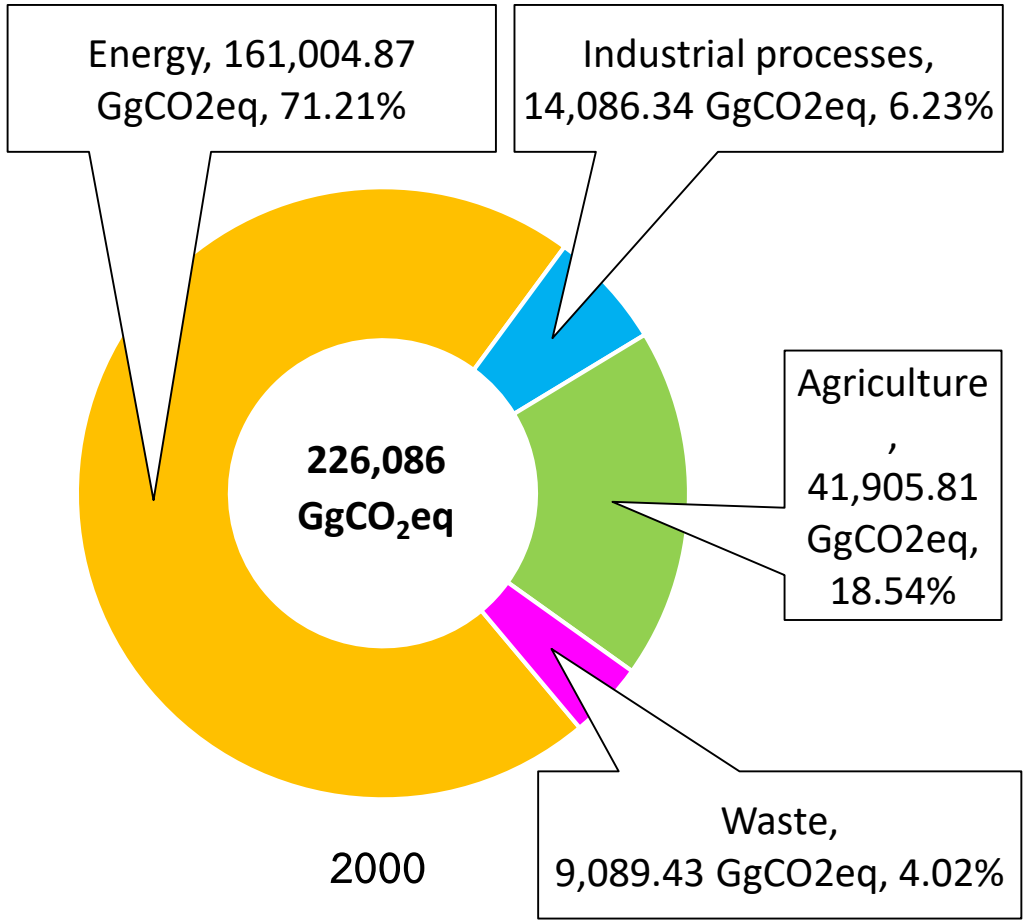
Source: Mass rapid transit authority of Thailand

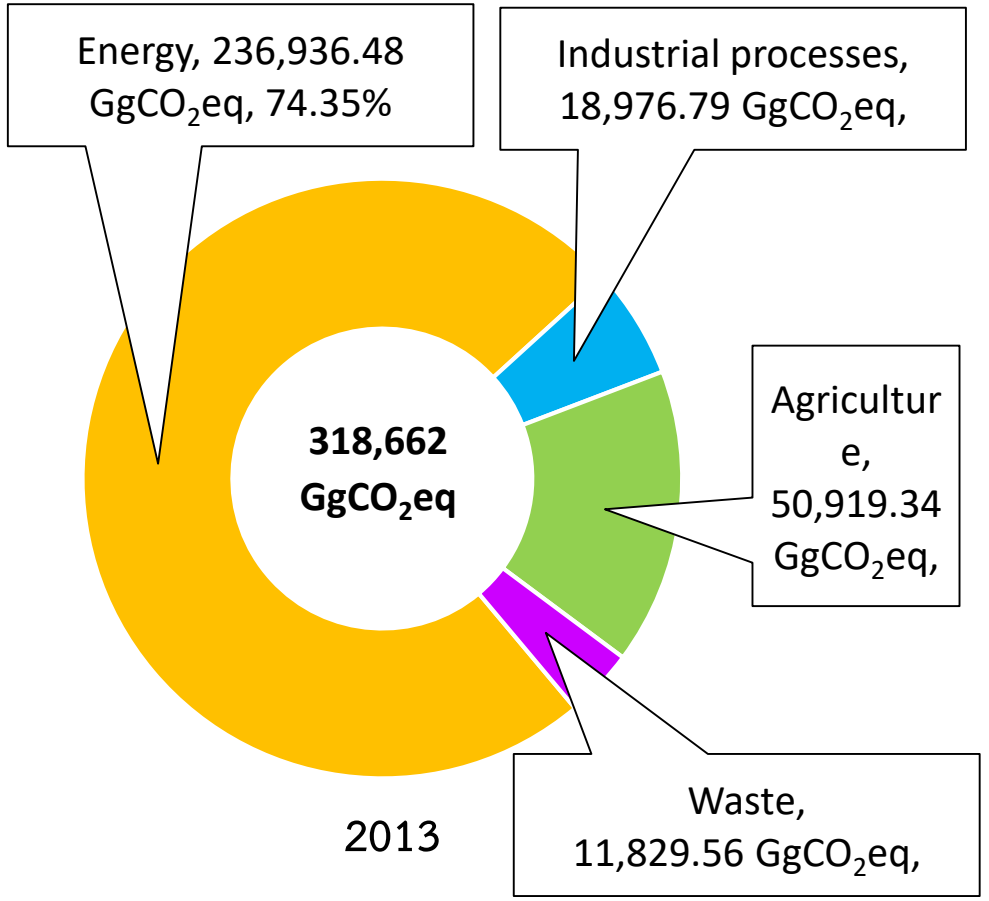
TRENDS OF GHG EMISSIONS AND TOTAL FINAL ENERGY CONSUMPTION: 2000-2013



Source: Thailand's third national communication

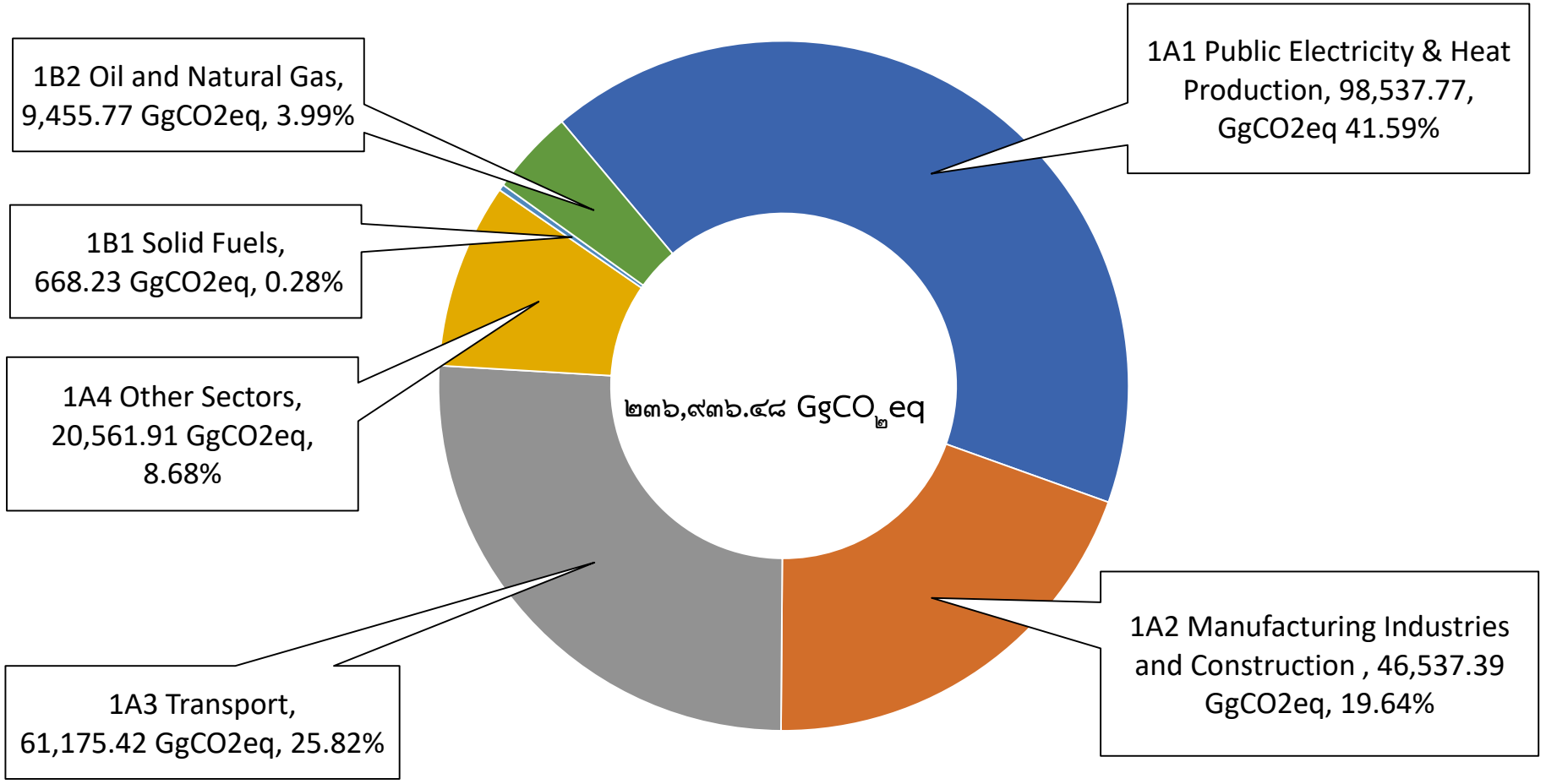
THAILAND GHG EMISSIONS BY SECTOR 2000-2013





Source: Second BUR

GHG EMISSIONS IN THE ENERGY SECTOR 2013



Source: Second BUR

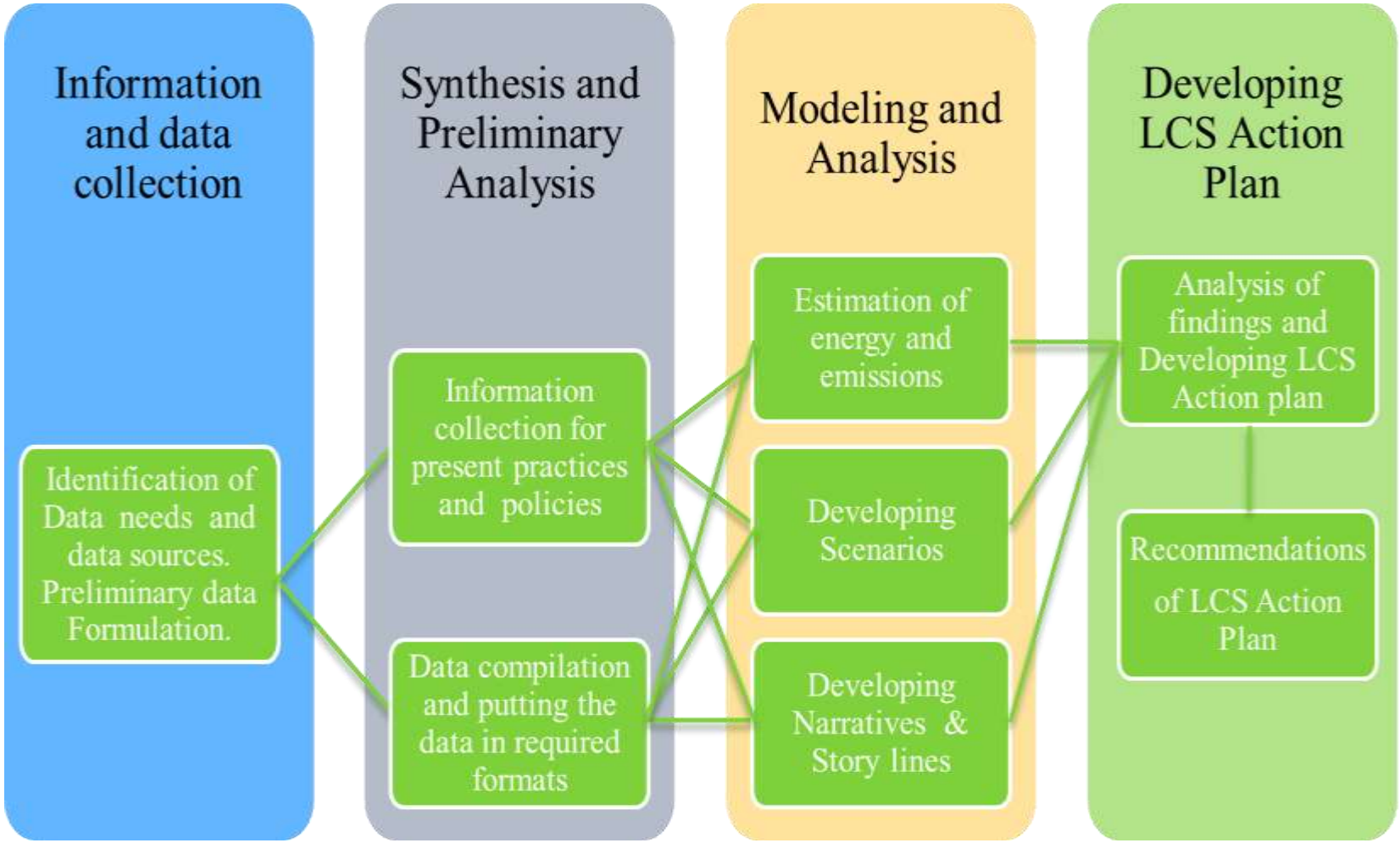
TRENDS OF GHG EMISSIONS IN ENERGY SECTOR

unit : 10^3 ton

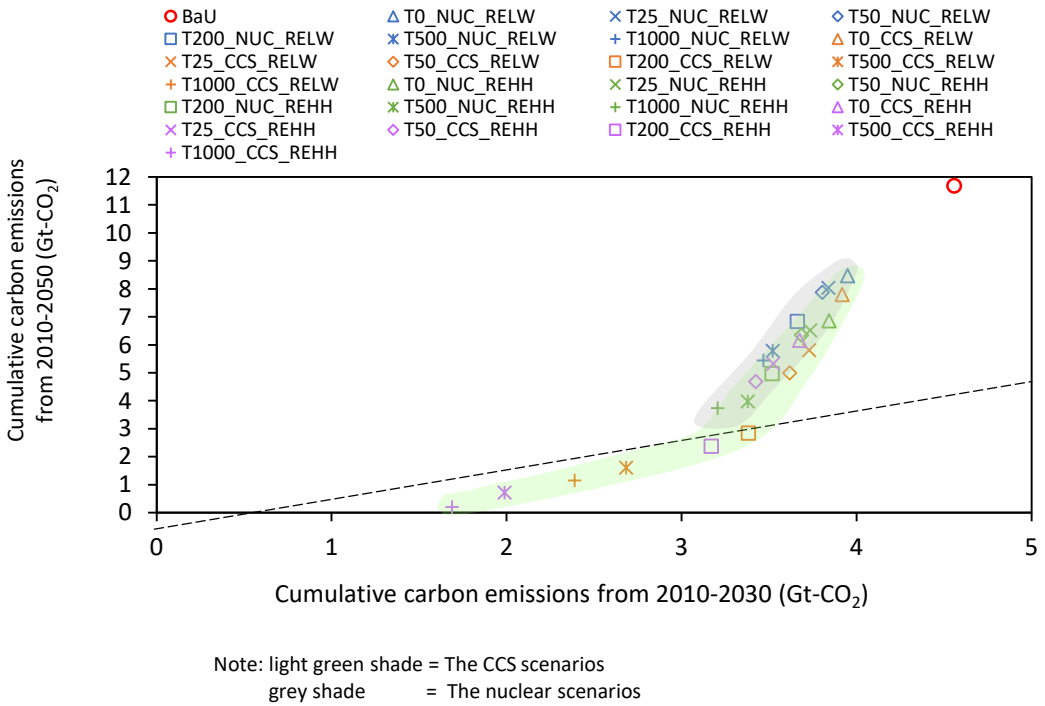
SECTOR	2014	2015	2016	2017	2018
TOTAL	219,028	220,396	234,809	235,788	238,026
TRANSPORTATION	63,935	67,862	72,267	78,447	79,605
POWER	93,080	91,048	97,091	96,814	91,594
MANUFACTURING	42,548	42,462	49,162	45,155	50,730
RES. & COM.	6,814	6,515	6,568	6,696	6,739
OTHERS[2/]	12,651	12,509	9,721	8,676	9,358

Source: 2018 Energy Balance of Thailand, Ministry of Energy

METHODOLOGY
THAILAND'S LCS ROADMAP



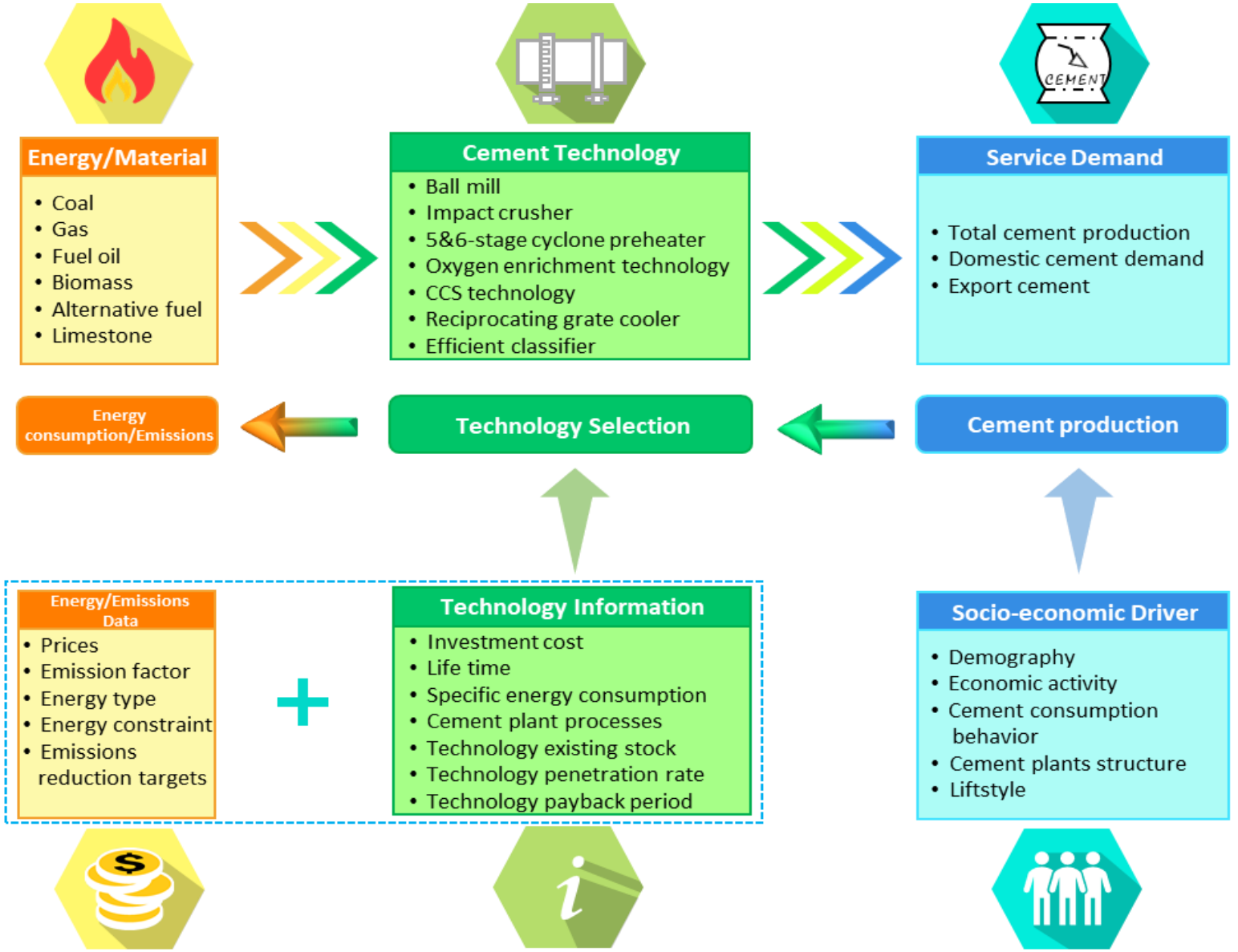
Thailand energy system transition to keep warming Below 1.5 Degrees (Carbon Management, Vol. 9, 2018 - Issue 5)



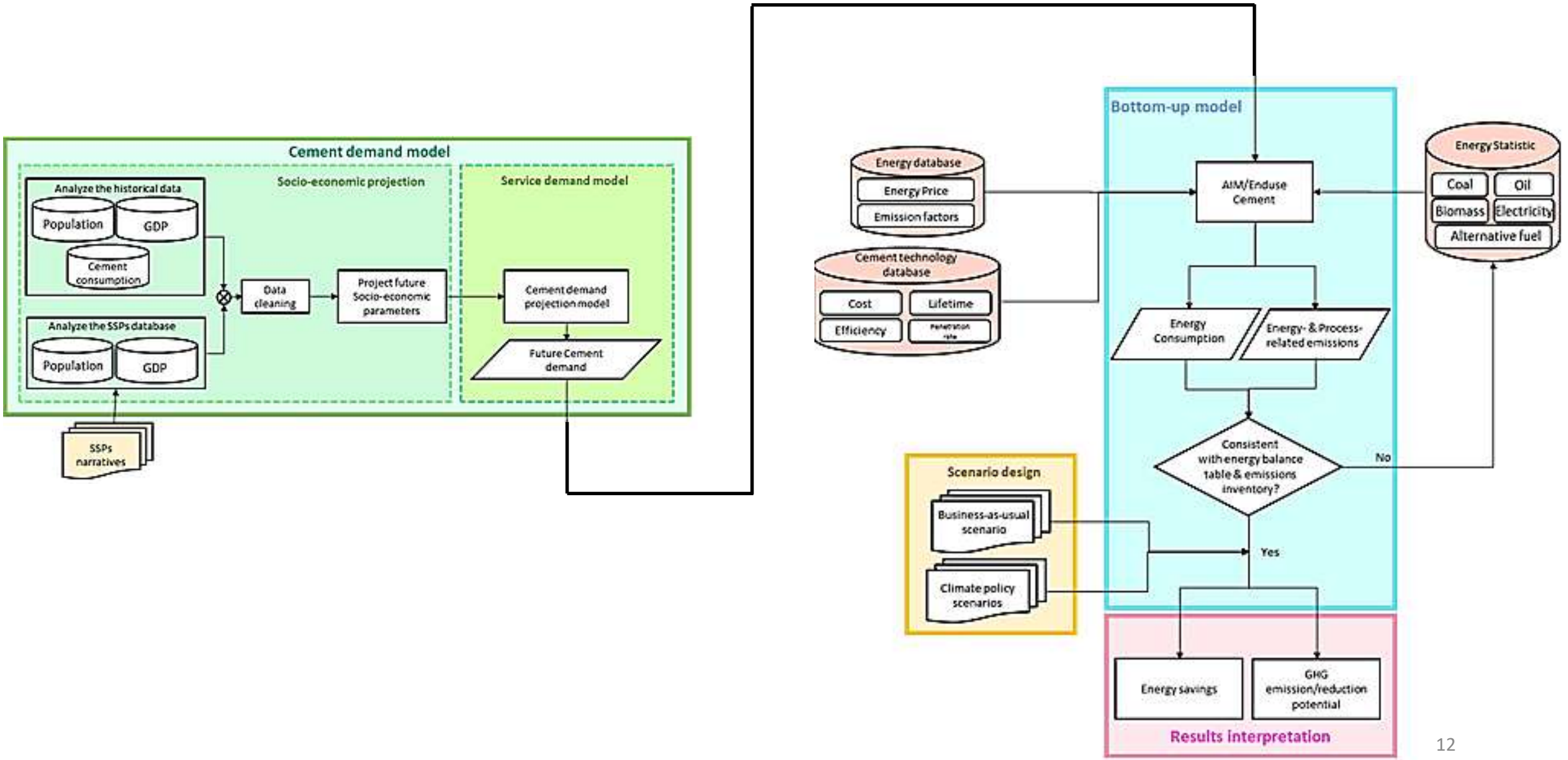
Note: light green shade = The CCS scenarios
grey shade = The nuclear scenarios

- Keeping net cumulative carbon emissions virtually zero can be achieved during 2030-2050.
- Zero CO_2 emissions strategies
  - CCS technologies (fossil-based plants integrated with CCS and BECCS)
  - Stringent RE target
  - CO_2 emission taxes (US$500-US$1000 per t CO_2)
  - Increase climate change awareness.
  - Capacity building within organizations, government offices and communities

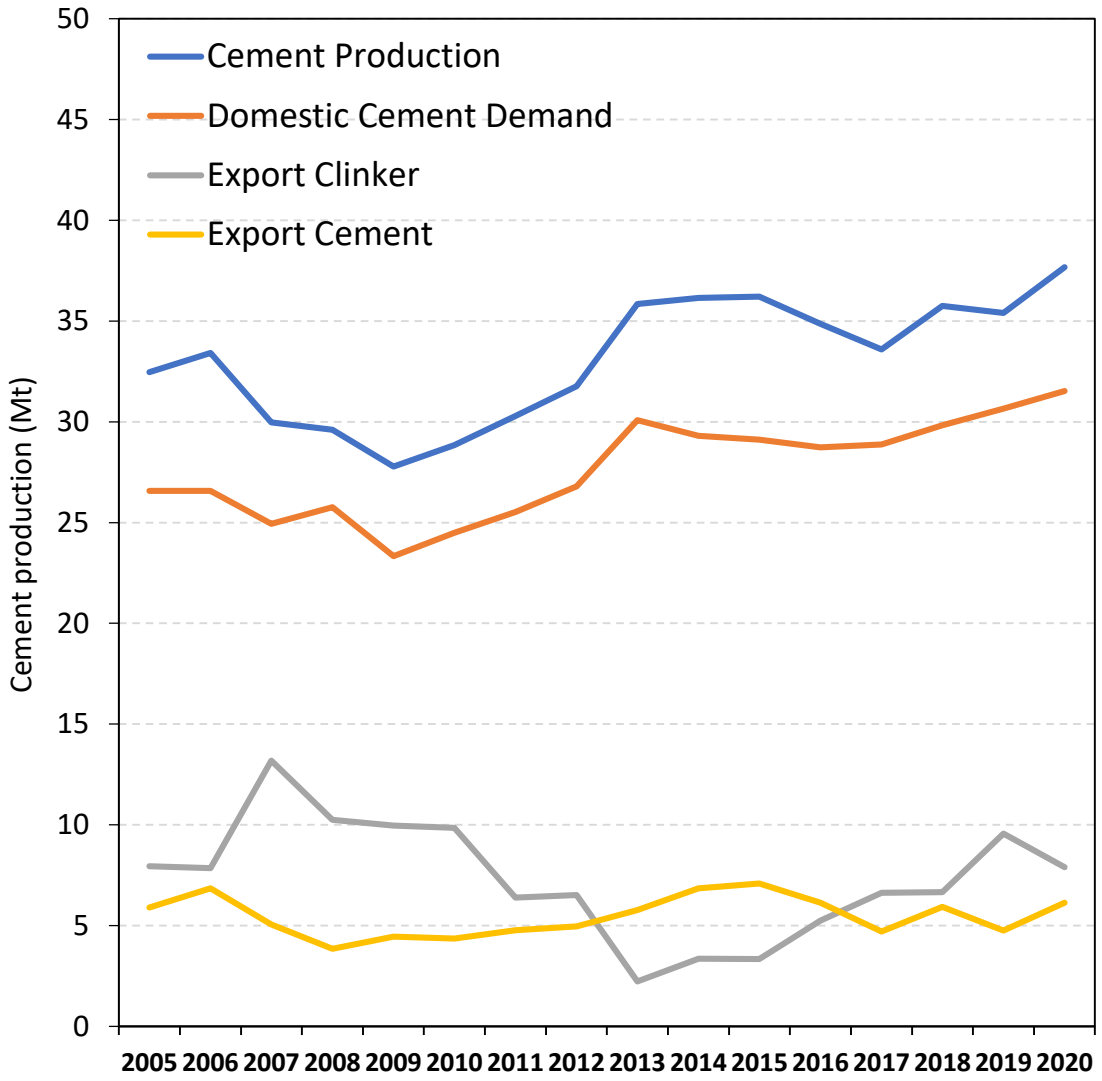
Thailand's cement industry

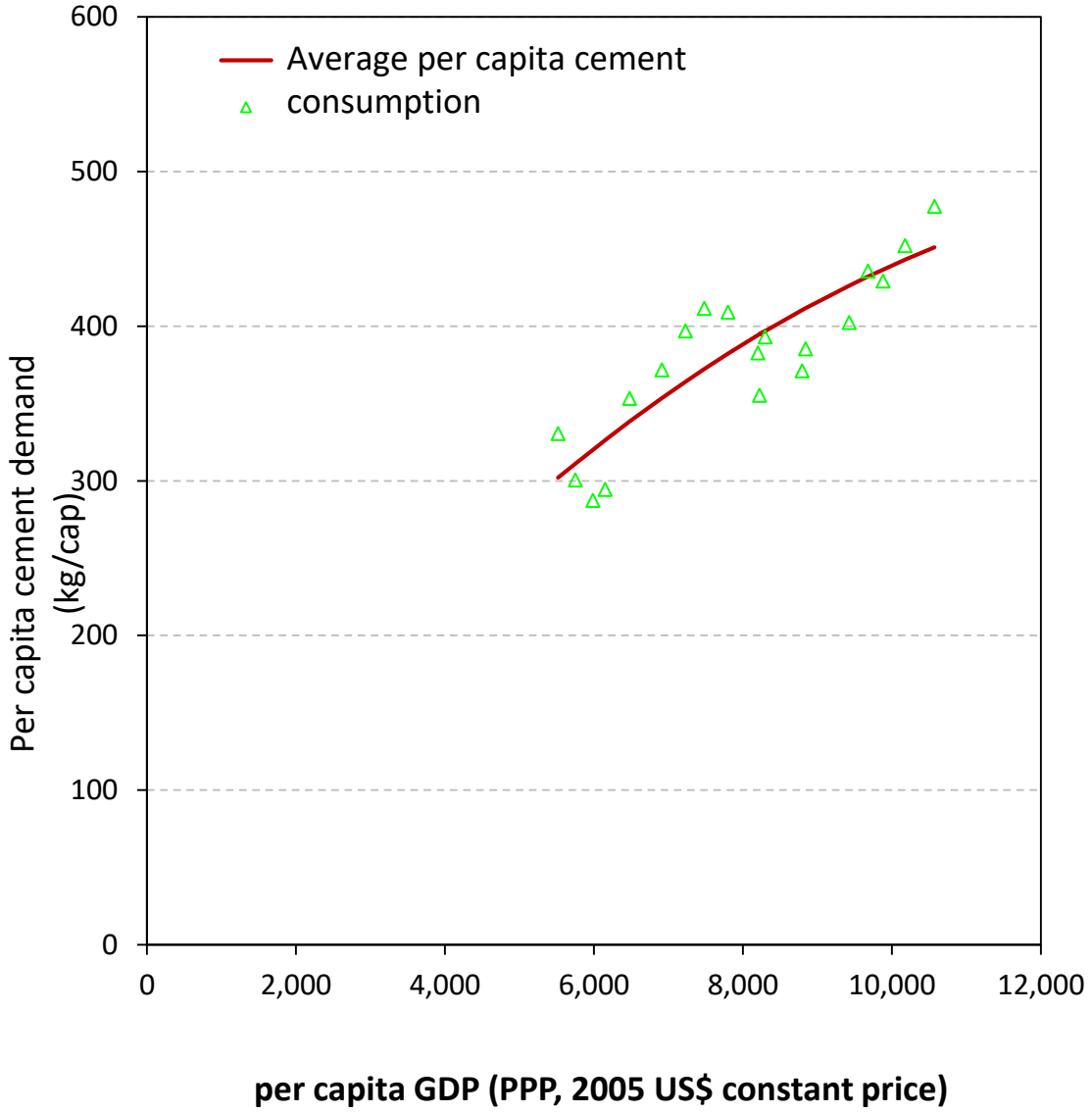


Overall framework for Thailand's cement industry

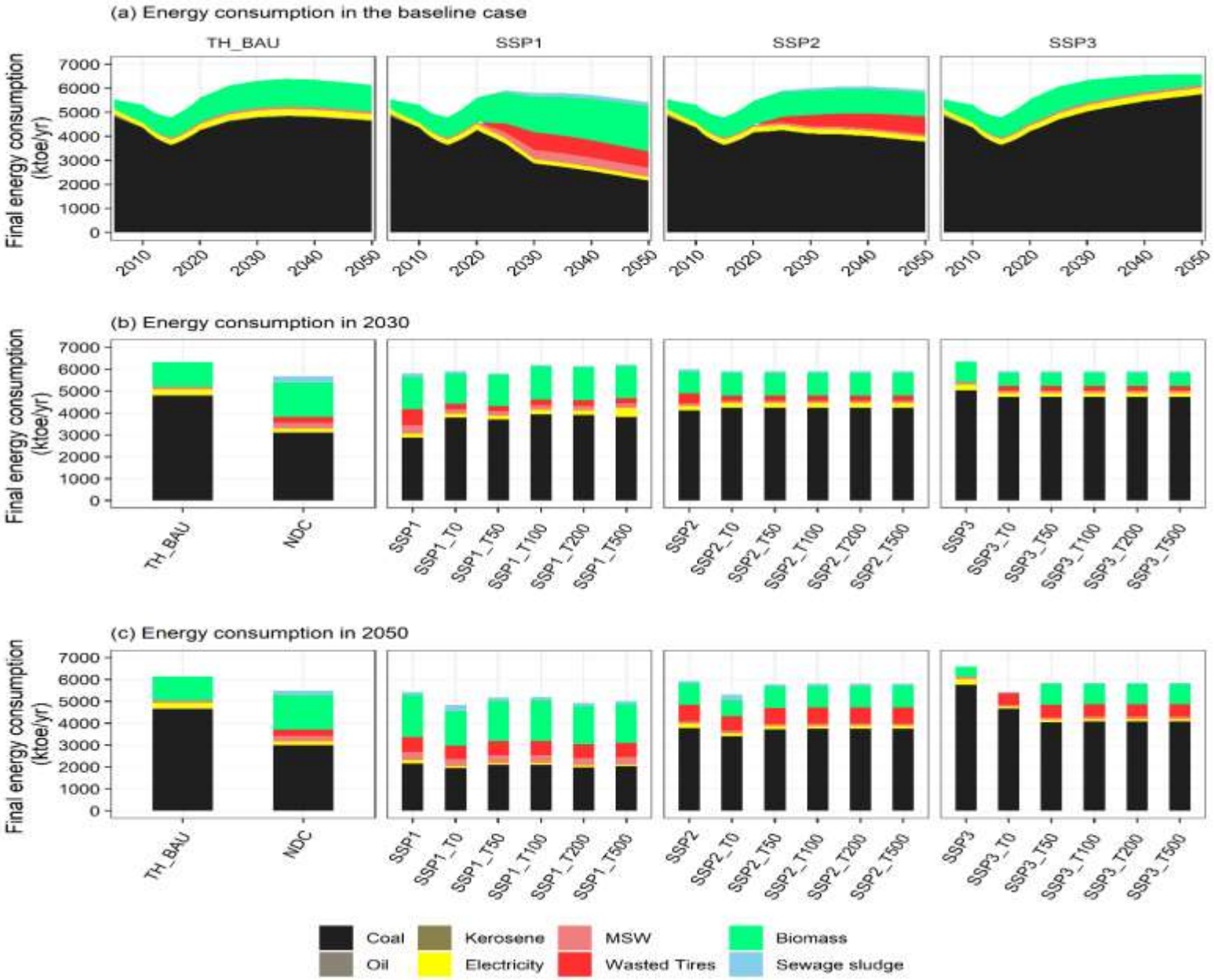


Input Data and Assumptions

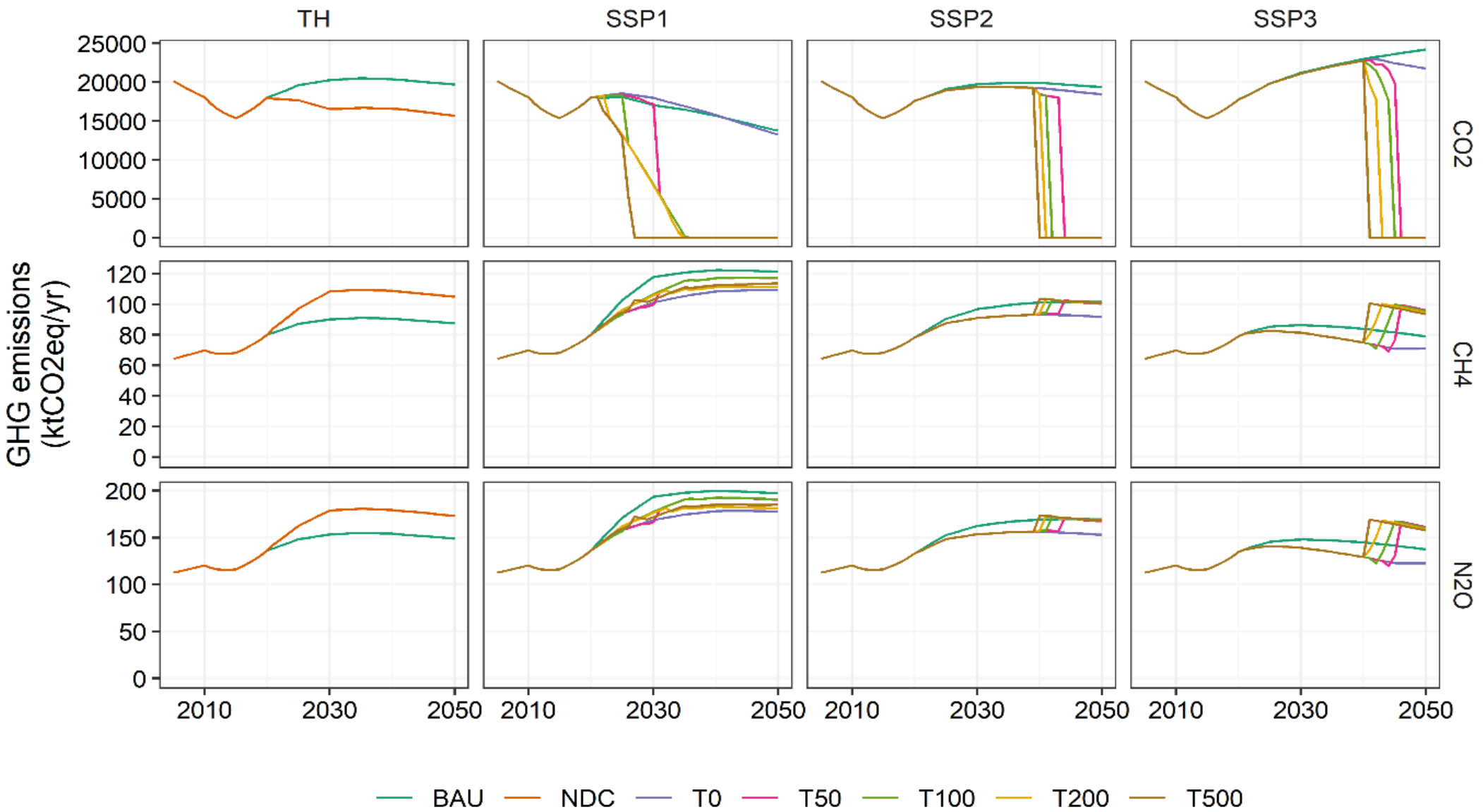




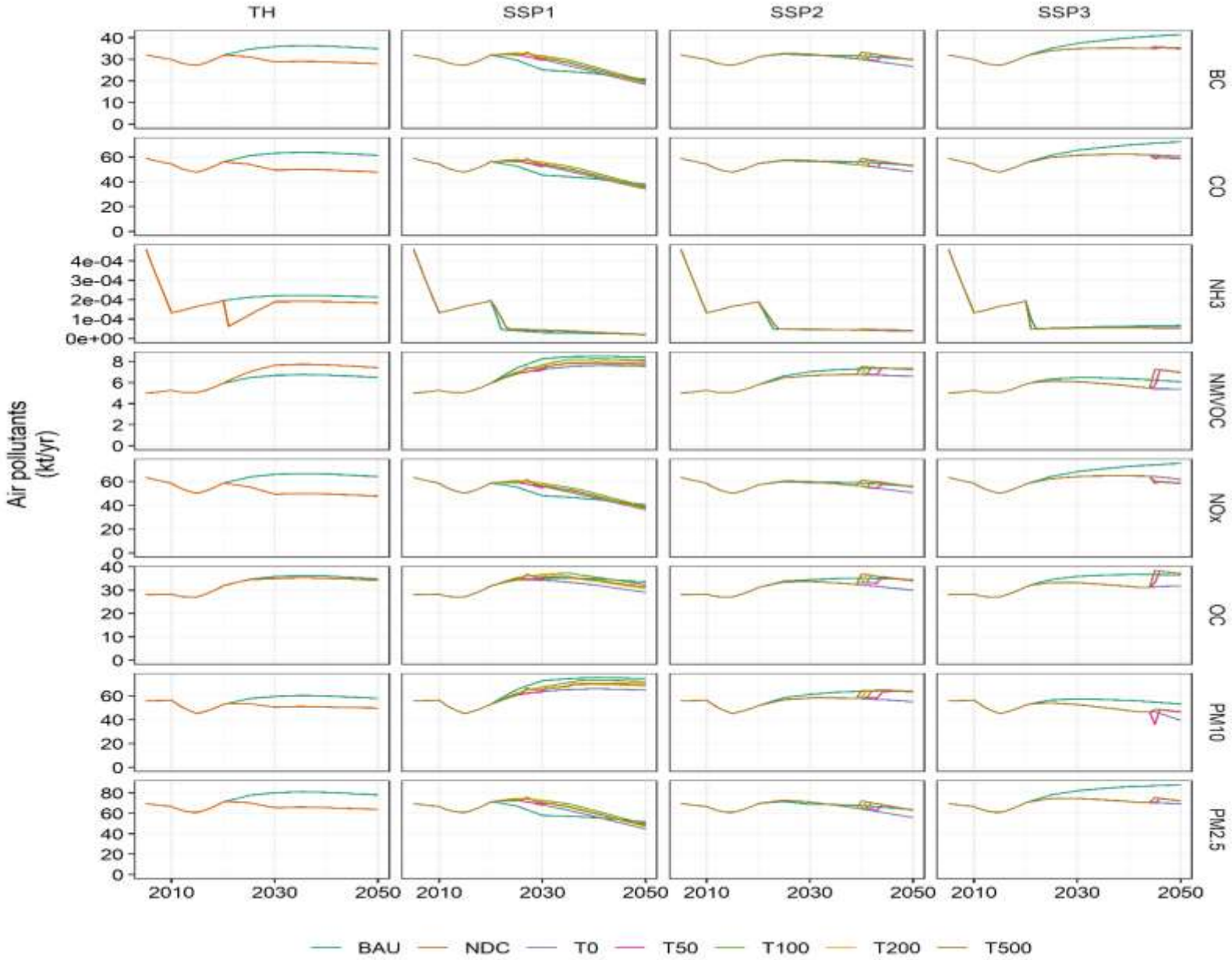
Results: Energy consumption in the cement industry



Results: GHG Emissions



Results: Other air pollutants



Conclusions

- By imposing CO_2 emission taxes in SSP scenarios, CCS technology will be selected from 2022 to 2031.
- Cumulative CO_2 reduction from CCS will range from 300 to 410 Mt CO_2.
- Carbon tax rate of US$ 500/t CO_2 will enforce the cement manufacturers to install the CCS in 2022 (SSP1), 2030 (SSP2) and 2031 (SSP3).

Strategy 1

BECCS

- Biomass co-firing in cement kilns

Strategy 2

Stringent RE

- Electricity generation
- Vehicle

Strategy 3

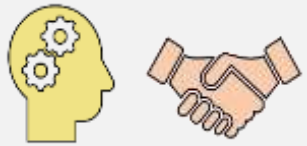
CO_2 emission taxes

Strategy 4

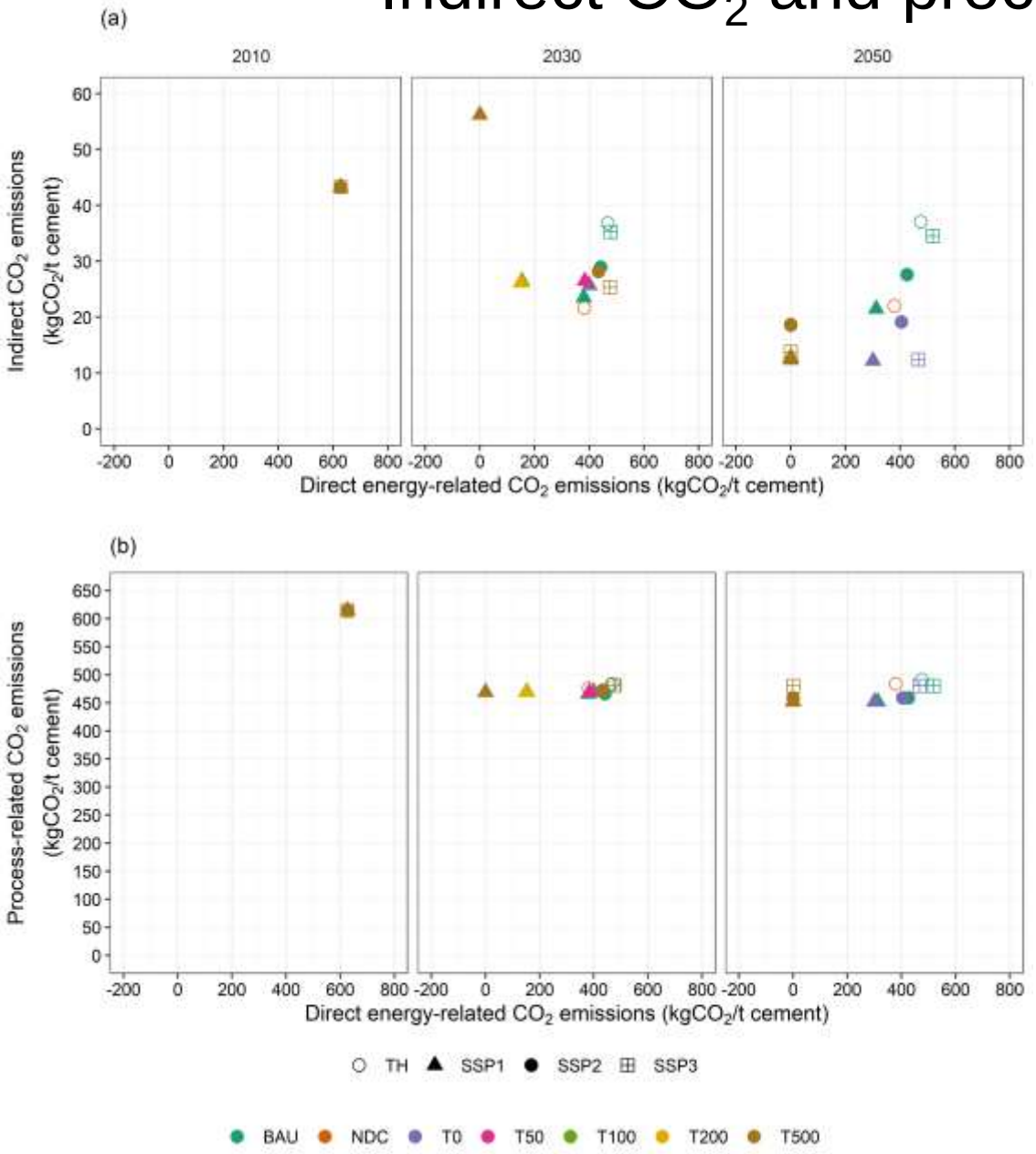
Climate change awareness

Strategy 5

Capacity building



Indirect CO_2 and process-related CO_2 intensities



- In 2030, the SSP1_T500 scenario will show the lowest direct energy-related CO_2 emissions.
- However, it will consume the highest electricity due to the CCS deployment.
- The extended NDC2050 scenario will consume the lowest electricity in 2030.
- Direct energy-related CO_2 intensity will be reduced to 400 kg CO_2/ton cement.
- In 2050, process-related CO_2 emissions in the extended NDC2050 scenario will be higher than those in the SSP scenarios.

Thank you

Khob Khun Krub

Arigato