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A CASE STUDY OF THAILAND'S CEMENT INDUSTRY TO ACHIEVE THE 1.5°C TOWARDS 2050

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Highlights

- The shared socioeconomic pathways (SSPs) and the extended NDC2050 scenario in Thailand's cement industry reveal difference in energy mixes and GHG emissions
- The use of alternative energy sources in cement production will increase other air pollutants
- The CCS technology in cement industry will play a vital role in the carbon tax scenarios
- The material substitution will play a key role in the process-related CO_2 emission reduction

Background

- The non-metallic industry dominated the highest fossil fuel consumption among the manufacturing industries (DEDE, 2018)
- Thailand's national inventory confirmed that the cement industry contributed the highest GHG emissions compared to other manufacturing industries (UNFCCC&MNRE,2018)
- In Southeast Asia, Thailand was ranked at the top three cement producer after Indonesia and Vietnam (USGS, 2014)
- The situation clearly showed that there will be a turning point and a saturated point of the domestic cement consumption in the upcoming decades (see Figure 1).
- There is a lack of long-term GHG emissions reduction perspectives in the cement industry.
- The extended NDC and the 1.5-degree target under the SSPs are needed in Thailand's cement industry in 2050

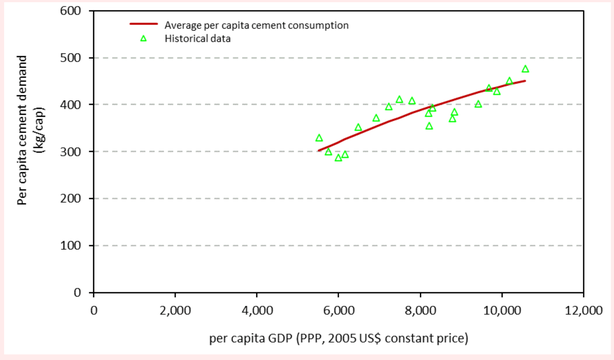

Figure 1 The relationship between per capita cement demand and per capita GDP PPP during the period 1998-2017

Objectives

- What is the cement demand under several economic and demographic development pathways in Thailand's cement industry?
- How Thailand's cement industry achieves 1.5°C by 2050

Methodology

- The Methodology consists of two main parts (see Figure 2). The first part is a projection of the cement demand, called "the cement demand model". The second part, called "an optimized bottom-up model", attempts to provide the optimized results using the AIM/Enduse model.
- The population and GDP projection are illustrated in Figure 3
- The AIM/Enduse cement is used in this study (see Figure 4)
- Figure 5 illustrates the simple material and energy flow diagram in Thailand cement industry
- The Gompertz model is used to estimate the domestic cement demand. The export cement is assumed to be 15% of total cement production during 2020-2050.

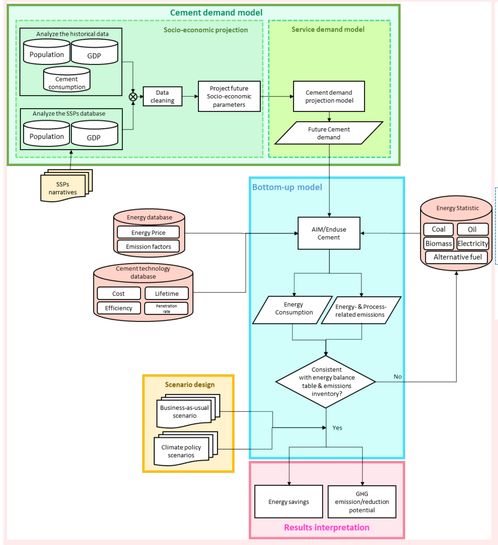

Figure 2 Schematic diagram of the research methodology

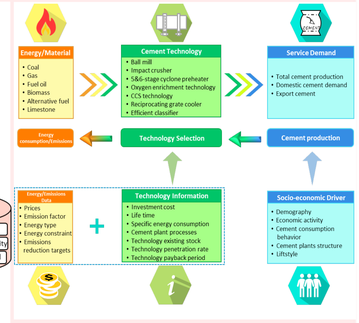

Figure 4 The AIM/Enduse model in the cement industry

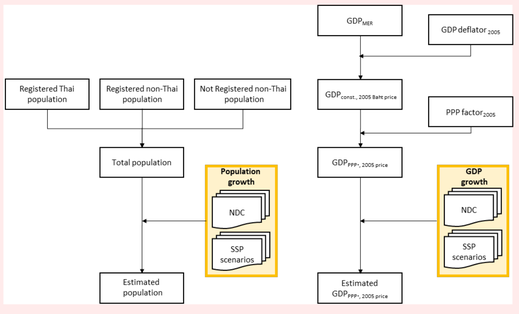

Figure 3 Schematic diagram of population and GDP projection

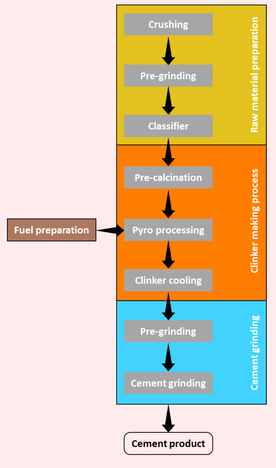

Figure 5 Schematic diagram in the cement production process

Results

- Coal steadily continues its consumption pattern from 2020-2050 in the extended NDC scenario
- The environmental awareness results in the decline of the coal consumption in the SSP1 scenario.
- The SSP3 scenario consumes coal about 80% of total final energy consumption in 2050
- There are a substantial increases in the wasted tire and the biomass used as a co-firing fuel in the cement kiln in all SSP scenarios

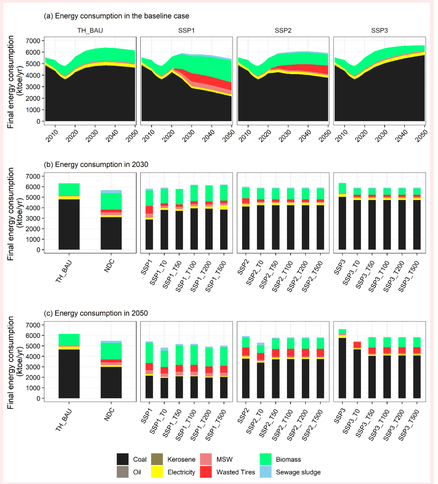

Figure 6 The energy consumption in Thailand's cement industry

Figure 7 GHG emissions

- The energy improvement and alternative fuel will be key measures in lowering the energy-related CO_2 emission in the NDC2050 scenario
- The energy-related CO_2 emission will be reduced by the CCS technology; however, energy penalty will rise the CH_4 and N_2O emissions in the SSP cases (see Figure 7)

- The faster CCS deployment, the higher the cumulative CO_2 reduction will increase (see Figure 8)
- In 2050, the energy penalty by the CCS technology will lower the energy intensity reduction (see Figure 9)

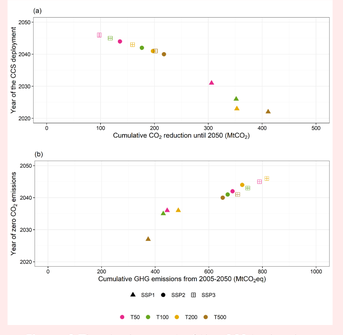

Figure 8 The deployment of the CCS technology

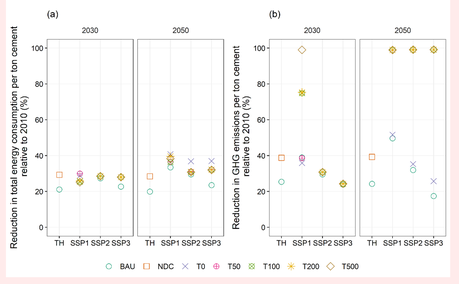

Figure 9 The energy and the GHG intensities reduction of the cement production

Acknowledgement

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USGS (United States Geological Survey). (2014). Cement production in Asia and the Pacific. Retrieved from https://minerals.usgs.gov/minerals/pubs/country/2014/myb3-sum-2014-asia-pacific.pdf

Conclusions

- The reduction in the clinker to cement ratio and the alternative fuels will play key roles in the extended NDC in 2050.
- By imposing the CO_2 emission taxes, the CCS technology will be deployed. However, it depends on the level of those taxes