QUANTIFYING THE DEEP DECARBONIZATION STRATEGIES OF ENERGY SYSTEM IN THAILAND TOWARDS 2050

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

Source: Thailand's third national communication
TRENDS OF GHG EMISSIONS & TOTAL FINAL ENERGY CONSUMPTION: 2000-2013

Source: Second BUR
THAILAND NDC ROADMAP

Source: ONEP
**SOCIO-ECONOMIC ASSUMPTIONS**

### Population

- **Historical data**
  - Growth rate: 1990-2005 = 1.04%

- **Forecasted data**
  - Growth rate: 2006-2013 = 0.48%
  - Growth rate: 2014-2030 = 0.03%

### GDP

- **Historical data**
  - Growth rate: 1990-2005 = 4.66%
    - (As an average)

- **Forecasted data**
  - Growth rate: 2006-2013 = 3.78%
  - Growth rate: 2014-2030 = 3.97%
    - (As an average)
OVERALL METHODOLOGY SCHEMATIC DIAGRAM
SSPS: THAI POPULATION & GDP IN 2017-2050

Socio-economic challenges for mitigation

SSP1:
Average growth rate
-0.06%,
4.21%

SSP2:
Average growth rate
0.03%,
3.62%

SSP3:
Average growth rate
0.15%,
2.56%

SSP4:
Average growth rate
-0.13%,
3.25%

SSP5:
Average growth rate
-0.02%,
4.91%

Socio-economic challenges for adaptation
THAILAND’S AIM/ENDUSE MODEL IN THE RESIDENTIAL SECTOR

ENERGY

TECHNOLOGIES

SERVICE/ENERGY

TECHNOLOGIES (DUMMY)

SERVICE

ELY

SOLAR

LPG

KER

FWD

CHAR

PAD

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Conclusion
The installation of kiln shell heat loss and upgrading the current preheater in the clinker making process; and heat recovery in the clinker cooler process, will be the most effective energy saving options.

In the extended NDC scenario by 2050, CCS technologies will not be deployed. Material efficiency is a strategy to decrease the total energy use and GHG emissions by reducing the clinker to cement ratio.
A SET OF SCENARIOS

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Thai government</th>
<th>SSP1</th>
<th>SSP2</th>
<th>SSP3</th>
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<tr>
<td>BAU</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>T0 (No C-tax)</td>
<td>X</td>
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<td>✔</td>
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Remark: The symbol “✓” means the selected combination between socioeconomic assumption and climate policy. The symbol “✗” means the deselected scenarios.
Residential sector

FINAL ENERGY CONSUMPTION

Energy consumption (Mtoe/yr)

- BAU-TH
- SSP1
- SSP2
- SSP3

Energy sources:
- Electricity
- LPG
- Kerosene
- Fuel wood
- Charcoal
- Biomass
- Biogas
- Solar
- Coal
- Oil
- Agricultural waste
- RDF
- Tire
- Sewage sludge

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Cement sector

FINAL ENERGY CONSUMPTION

- Cement sector
- BAU-TH
- SSP1
- SSP2
- SSP3

Energy consumption (Mtoe/yr)

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<tr>
<th>Year</th>
<th>BAU</th>
<th>BAU</th>
<th>NDC</th>
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<td>2050</td>
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- Electricity
- LPG
- Kerosene
- Fuel wood
- Charcoal
- Biomass
- Biogas
- Solar
- Coal
- Oil
- Agricultural waste
- RDF
- Tire
- Sewage sludge

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Residential sector

Cement sector

GHG EMISSIONS

BAU-TH

SSP1

SSP2

SSP3

Greenhouse gas emissions (MtCO₂eq/yr)

BAU                     NDC

T0                     T30
CONCLUSIONS: THE RESIDENTIAL SECTOR

- In the NDC scenario, the GHG emissions will be reduced by 10% in 2030 and 12% in 2050.
- GHG emissions in SSP3_T0 and SSP3_T30 scenarios will be reduced by 32% in 2050 compared with SSP3_BAU scenario.
- While GHG emissions in SSP1_T0 and SSP1_T30 scenarios will be reduced by 44% in 2050 when compared with SSP1_BAU scenario.
- Carbon tax will not affect the GHG mitigation.

**Strategy 1: Energy Efficiency**
- Efficient space cooling
- Efficient refrigerator
- Efficient cooking

**Strategy 2: Stringent RE**
- Solar water heater
- Biogas for cooking

**Strategy 3: Behavioral Change**

**Strategy 4: Climate change awareness**
CONCLUSIONS: THE CEMENT SECTOR

- In the NDC scenario, GHG emissions will be reduced by 18% in 2030 and 20% in 2050
- **Energy savings** and the **clinker to cement ratio reduction** will be the effective strategies in the NDC and SSP scenarios
- With the carbon tax, **CCS** will be deployed to reduce the energy-related CO₂ emissions in the SSP scenario. However, the process-related CO₂ emissions remain challenges.

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<th>Strategy</th>
<th>Energy Efficiency</th>
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<tr>
<td>1</td>
<td>Efficient cement kiln</td>
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<td>Waste heat recovery for electricity generation</td>
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<tr>
<th>Strategy</th>
<th>Stringent RE &amp; Alternative Energy</th>
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<td>Waste tires</td>
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<table>
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<th>Strategy</th>
<th>Material Efficiency</th>
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<td>Clinker to cement ratio reduction</td>
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<th>Climate change awareness</th>
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<td>Post-combustion capture using solid sorbents: Ca looping</td>
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<table>
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<th>Strategy</th>
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THANK YOU
ありがとうございます