Opportunities of Nuclear Energy to Non-Electric Applications in Thailand

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- Nuclear energy as part of Thailand energy mix
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### Country’s macroeconomics and energy sector

#### Thailand Economic Statistics

<table>
<thead>
<tr>
<th>Population</th>
<th>67.2 million (July 2014)</th>
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</thead>
<tbody>
<tr>
<td><strong>GDP</strong></td>
<td>US$395.28 billion (2015)</td>
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<tr>
<td><strong>GDP rank</strong></td>
<td>32nd (nominal) / 22nd (PPP) (IMF, 2015)</td>
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<td><strong>GDP growth</strong></td>
<td>0.8% (2014), 2.8% (2015e), 2.5% (2016f), 2.6% (2017f)</td>
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<tr>
<td><strong>GDP per capita</strong></td>
<td>US$5,771 (Nominal.)</td>
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<td><strong>GDP by sector</strong></td>
<td>Agriculture (8.4%), Industry (39.2%), Services (52.4%)</td>
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Nuclear energy as part of a national energy mix (2)

**Motivation for nuclear power development**

- High dependency on natural gas for power generation at 64% in 2014
- Reduce power generation cost by introducing new power sources such as Nuclear Power
- Commitment on environmental conservation by reducing the use of fossil fuel


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Nuclear energy as part of a national energy mix - (2)

Tentative Plan on Nuclear Energy Infrastructure Development Program for 1st NPP

- Milestone 1: Ready to make a Knowledgeable commitment to a nuclear programme
- Milestone 2: Ready to invite bids for the first NPP
- Milestone 3: Ready to commission and operate the first NPP

- Phase 1: Pre-project
  - Feasibility study
- Phase 2: Project decision making
  - Preparatory work for the construction of a NPP after a policy decision has been taken
- Phase 3: Construction
  - Activities to implement a first NPP
- Phase 4: Operation / decommissioning
  - Maintenance and continuous Infrastructure improvement

Thailand

100%@12/2010

~10 – 15 years

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Opportunities of Nuclear Energy to Non-Electric Applications in Thailand (1)

Prospects for nuclear energy to other applications

- Improvement of plant efficiency
- Competitive economics
- Environmental friendly by reducing of thermal emission
- Optional energy source for industrial complex
Prospects for nuclear energy to process heat

- Nuclear cogeneration
- Long experiences of thermal cogenerations power plant
- Steam supply to agriculture processing plants
- Opportunities of nuclear cogeneration for industrial estate or manufacturing zone

Plan for cogenerations thermal power plant during 2015-2025 (PDP2015)

- Promote usage of cogeneration in industrial estate or manufacturing zone for Small Power Producer (SPP)
- Renewal of old technology cogeneration plants (25 projects of 424 MWe)
- Construction of new cogeneration plants (41 projects of 3660 MWe)
- EGAT would purchase excess electricity <20%
Opportunities of Nuclear Energy to Non-Electric Applications in Thailand (3)

Review of cogeneration plants in Thailand

Thailand’s Electricity Supply Industry Structure

Additional and Retired Capacity

Figures credited by: Narin Tunpaoboon, Thailand and industry outlook 2016-2018, Krungsri research, 2016

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Opportunities of Nuclear Energy to Non-Electric Applications in Thailand (4)

Industrial Estates in Thailand

Figures credited by: Puttachard Lunkam, Thailand and industry outlook 2018-2020, Krungsri research, 2016

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Opportunities of Nuclear Energy to Non-Electric Applications in Thailand (5)

Conclusions

• Opportunities of nuclear energy for cogenerations in Thailand, specifically in industrial estates or manufacturing zone
• Chances of Small Modular Reactors (SMRs) Technologies
• Preliminary academic study of SMR feasibility in Thailand in 2015-16
• Challenges of related law and regulations, technical aspects such as site selection, nuclear reactor safely, etc.
• Challenges of public acceptances and manufacturing owners opinions
• Excess electricity issues
Opportunities of Nuclear Energy to Non-Electric Applications in Thailand (5)

Prospects for nuclear energy to cooling and refrigeration

• Steam absorption chiller as cooling machine used in several industries such as chemical, drink and food factories
• Possibilities of usage of steam produced by NPP, specifically in industry estate

Prospects for nuclear energy to district heating or cooling

• Climate of Thailand is generally tropical
• District heating may need in northern area in relatively cool season (avg. 5 c at night) from November to February
• District cooling may possible for building or communities
Summary

Roadmap Visualization for Thailand

- Review of Thailand’s macroeconomics and energy sector
- Review of Nuclear energy as part of a national energy mix
- Tentative Plan on Nuclear Energy Infrastructure Devolvement Program
- Opportunities of Nuclear Energy to Non-Electric Applications in Thailand focusing on process heat or cogeneration plants