ASSESSING THE FINANCIAL VIABILITY OF SMR AND LARGE REACTOR IN MALAYSIA ELECTRICITY MARKET BY USING IAEA FINPLAN MODEL: MALAYSIA CASE STUDY

Presented by:
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Outline of presentation:

• Introduction to Malaysia
• Malaysia energy transition plan
• Case Study: SMRs Deployment in Malaysia Electricity Market
• Results & Discussions
• Conclusions
Introduction to Malaysia:

- Total population: 33.2 million (2023)
- Total landmass: 329,847 km²

Population Distribution

- Peninsular Malaysia: 73%
- East Malaysia: 27%

Electricity Consumption (GWh)

- Peninsular Malaysia: 79%
- Sabah: 4%
- Sarawak: 17%
Introduction to Malaysia:

Electricity Generation Mix in Malaysia:

- **GAS**: 78.3%
- **OIL**: 3.7%
- **HYDRO**: 10.9%
- **COAL**: 6.3%
- **DIESEL/DISTILLATE**: 0.9%
- **OTHERS**: 0.0%

**TOTAL: **64,281 GWh

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- **COAL**: 50.9%
- **GAS**: 30.8%
- **HYDRO**: 15.9%
- **DIESEL/DISTILLATE**: 0.4%
- **OIL**: 1.9%
- **OTHERS**: 0.0%

**TOTAL: **171,456 GWh

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**2000**

**2020**
Malaysia energy transition plan:

- Malaysia is committed towards transition to a low-carbon and climate-resilient economy. The 12th Malaysia Plan has outlined Malaysia's path to net zero emissions, including achieving carbon neutrality by 2050.

- Malaysia’s energy transition plans until 2040 will focuses on power generation plan.
  - Phased-out the current 7000 MW of coal-fired power plant in 2033
  - Renewable energy - 31% by 2025, 40% by 2035, 70% by 2050 (Solar PV)
  - 5000 MW battery energystorage system (BESS)
  - Current installed RE capacity 2020: 7,995 MW (20%)

- However, renewable energy (solar PV) sources facing issues such as vulnerability & intermittent in nature, require large land area, and also dependent on geographic positions and climatic conditions. Solar PV needs battery storage system and currently still low efficiency of capacity factors.
Malaysia energy transition plan:

• There is a need to support variable renewables (VRE) with long term energy storage or alternative, flexible power sources because of the variability in the generation of renewable energy sources such as solar and the electricity demand.

• Since nuclear energy is considered as one of the option for low carbon generating technologies, there is an increased interest in exploring the potential of replacing coal power plant shut down in order to meet the base-load electricity demand.

• SMR also has a potential for hydrogen production, considered as one of the new source of energy for Malaysia in the future.

• However, nuclear energy is also having some limitations including government policies, environmental issues and public apprehensions.
Malaysia energy transition plan:

The Low Carbon Nation Aspiration 2040

- A higher level of RE penetration in the installed capacity and total primary energy supply (TPES), with no new coal power plant.

The National Energy Policy 2022-2040 (DTN)

- Government's commitment towards energy transition.
Case Study: SMRs Deployment in Malaysia Electricity Market

• The case study focuses on the financial viability of 4 units of SMR and 1 large reactors in the Malaysia electricity market using the IAEA FINPLAN model.

• To support Malaysia’s interest in exploring the possibility of nuclear energy for electricity generation in the future, probably for the clean energy transition.
## Construction Timeline of SMR and Large Reactor (LR):

<table>
<thead>
<tr>
<th>Year</th>
<th>2047</th>
<th>2048</th>
<th>2049</th>
<th>2050</th>
<th>2051</th>
<th>2052</th>
<th>2053</th>
<th>2054</th>
<th>2055</th>
<th>2056</th>
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<tbody>
<tr>
<td>SMR #1</td>
<td><strong>Construction period</strong></td>
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<td>SMR#2</td>
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<td><strong>Construction period</strong></td>
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<tr>
<td>SMR#3</td>
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<td><strong>Construction period</strong></td>
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<tr>
<td>SMR#4</td>
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<td><strong>Construction period</strong></td>
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<tr>
<td>Large Reactor</td>
<td><strong>Construction period</strong></td>
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80% Foreign Investment, 20 % Local Investment
Results & Discussion:

• This study focuses on the two key financial indicators of project investment, the Net Present Value (NPV) and Internal Rate of Return (IRR) of 4 SMRs and 1 large reactor projects.

• A positive NPV for 4 units of SMR and 1 unit of large reactor show that both projects are profitable at 7% annual discounted rate.

<table>
<thead>
<tr>
<th>Investment case</th>
<th>SMR 4 Units 250MW</th>
<th>Large Reactor Single 1000MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPV: 19,465.48</td>
<td>NPV: 16,252.99</td>
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<tr>
<td>IRR: 28.7 %</td>
<td>IRR: 16.99 %</td>
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Results & Discussion:

Impact on Electricity Price:
• As the electricity price increased, the IRR & NPV increased, and revenue for SMR & LR also increased.

Impact on Fuel cost:
• The increase of fuel cost has a low impact on both SMR and LR. This is due to the low share of fuel cost in the total project cost.
Results & Discussion:

Impact of Discount Rate on NPV:

- Discount rate has a significant impact on NPV for SMR and LR since both projects are classified as capital-intensive projects.
- At a low discount rate (3-5%), SMR recorded a higher NPV than LR.
- However, as the discount rate increased, SMR recorded a higher depreciation rate of NPV than LR.

Impact of Discount Rate on IRR:

- The IRR for SMR remain constant at 28.7% and for LR at 16.99%.
- If the discount rate for SMR and LR is increased above the IRR rate, the project will definitely record a negative NPV.
Conclusions:

• Small modular reactors (SMR) has potential in supporting United Nations Sustainable Development Goals (SDG) and Malaysia Aspiration towards Net Zero Emission by 2050, as one of the option under the low-carbon dispatchable technologies (LCD) for electricity generation.

• SMR also has a potential for hydrogen production, considered as one of the new source of energy for Malaysia in the future.

• However, Malaysia continues to keep its ‘no nuclear policy’ stance when it comes to power generation. The government recognised the potential of SMR but did not plan to explore nuclear power generation anytime soon following concerns over environmental issues and public acceptance.

• The government request to convince the public before exploring nuclear energy.
Thank you.

Any questions? Please contact:

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