Sustainability Challenges for Electricity Industries in ASEAN Newly Industrializing Countries

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Presentation Outline

- Background
  - Sustainability aspects and the electricity industry
  - Background of ASEAN
- Overview of the ASEAN-5
  - Social and economic context
  - Electricity demand situations
- Description of 3A’s energy sustainability objectives framework
- Sustainability challenges in electricity industries in ASEAN-5 and their implications
Sustainability and the Electricity Industry

- Energy sustainability involves vital social, economic and environmental dimensions
  - **Social** – energy is a human basic need which improve quality of life
  - **Economic** – energy consumption is a key driver in economic growth
  - **Environmental** – energy consumption leads to GHG emissions

- The electricity sector presents sustainability challenge given its role in socioeconomic development and environmental deterioration

![World GHG emissions by sector (IEA, 2009)](image)

Background of ASEAN

- Large population size
- Rapid economic expansion
- Play an increasing role in the world energy demand
  - Rapid energy demand growth due to socioeconomic development
  - 4.3% share of world energy demand compared with 2.1% in 1980
  - Share of global CO₂ emissions is 3.5% compared with 1.1% in 1980

- Low per capita energy consumption - *one fifth of the OECD.*

- Five largest energy consumers in ASEAN are Indonesia, Thailand, Malaysia, Philippines and Vietnam – referred as ASEAN-5
Characteristics of ASEAN-5

- Countries in ASEAN-5 share some important characteristics:
  - Large population and rapid urban growth
  - Improving social development (based on the HDI)
  - Rapid economic growth 5-8% on average
  - Increasing per capita income
  - Increasing contribution of industry sector value added to GDP at the expense of service and agricultural sectors - moving towards industrialisation.

- According to the International Energy Agency (IEA), the above factors constitute the major factors in electricity demand growth in developing countries.

Energy Sustainability Framework

- Apply the 3A’s energy objectives as a sustainability analytical framework to analyse sustainability challenges in electricity industries in ASEAN-5.

- **Accessibility**: Access to electricity at prices that are affordable and sustainable (i.e. reflect marginal & external costs)
- **Availability**: Reflects energy security aspect which cover short-term quality of supply and long-term continuity of supply
- **Acceptability**: Relates to public attitudes and the environmental impacts. This aspect also include nuclear security issues
Indicators and Criteria

- Draw together a set of indicators and criteria to assess each aspect of the 3A’s energy objectives under the electricity industry context.

<table>
<thead>
<tr>
<th>3A’s Energy Objectives</th>
<th>Dimension</th>
<th>Indicators and Criteria</th>
</tr>
</thead>
</table>
| Accessibility          | Affordable price | 1) Electricity prices ($)  
|                        |            | 2) Avg. expenditure on electricity bills (% of income)  
|                        |            | 3) Electricity tariff subsidy  
| Energy Services        |            | 4) Electrification rate (%)  
|                        |            | 5) Electricity intensity (kWh/GDP)  
|                        |            | 6) Electricity consumption per capita (kWh)  

Indicators and Criteria

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<thead>
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<th>3A’s Energy Objectives</th>
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</table>
| Availability           | Short-term reliability of supply | 1) Reserve Margin (%)  
|                        |            | 2) SAIFI (no. of interruptions/year), SAIDI (minutes/year)  
|                        |            | 3) Reliability operating standards (Checklist)  
|                        |            | 4) Cross-border interconnections (Checklist)  
|                        | Long-term continuity of supply | 5) Fuel mix in electricity generation (% share)  
|                        |            | 6) Reliance of import (fuel and electricity)  
|                        |            | 7) Fuel diversity (Shannon-Wiener Index)  
| Acceptability          | Safety     | 1) Strategy for nuclear power  
|                        | GHG emissions | 2) Renewable energy policy  
|                        |            | 3) Share of renewable energy in electricity generation  
|                        |            | 4) CO₂ emission per capita  
|                        |            | 5) CO₂ intensity  

*Acceptability is mostly related directly or indirectly with CO₂ emissions*
Accessibility

- **Electrification rate**
  - Urban - Nearly 100%
  - Rural - low in Indonesia & Philippines due largely to geographical barriers

- **Electricity intensity is increasing**
  - Electricity consumption grew faster than economic growth
  - Likely due to structural change of economy and increased electricity access

Per capita electricity consumption is still well below OECD average.

- But electricity consumption growth rate is quite high
  - especially Vietnam – corresponds to the economic growth

Increased electricity consumption have subsequent impact on the environment – particularly CO₂ emissions.
Availability
Short-term reliability of supply

<table>
<thead>
<tr>
<th>Country</th>
<th>Reserve Margin (%)</th>
<th>Cross border interconnection</th>
<th>SAIFI*</th>
<th>SAIDI* (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thailand</td>
<td>25</td>
<td>Malaysia &amp; Laos PDR</td>
<td>1.85</td>
<td>45.9</td>
</tr>
<tr>
<td>Indonesia a</td>
<td>Deficit</td>
<td>-</td>
<td>6.8</td>
<td>293</td>
</tr>
<tr>
<td>Malaysia b</td>
<td>40</td>
<td>Thailand &amp; Singapore</td>
<td>Not available</td>
<td>68.6</td>
</tr>
<tr>
<td>Philippines c</td>
<td>30</td>
<td>China, Laos PDR &amp; Cambodia</td>
<td>Not available</td>
<td>80</td>
</tr>
<tr>
<td>Vietnam</td>
<td>25</td>
<td>Thailand &amp; Laos PDR</td>
<td>Not available</td>
<td>Not available</td>
</tr>
</tbody>
</table>

* At distribution level
a Java-Bali network
b Malaysia (Peninsular)
c Philippines (Luzon)

- For reasonable electricity supply: SAIFI = 0.9 – 0.92 interruptions, SAIDI = 53.4 - 69.6 minutes/year
- Typical reserve margin targets – 18 to 25% (IEA, 2002)
- Lack of interconnections in Indonesia & Philippines

Availability

Long-term continuity of supply

- Increased use of natural gas except Indonesia
- Share of coal increased again after 2000

Data source: IEA, “Electricity information 2009”
Availability

- Thailand & Malaysia highly dependent on natural gas ~ 60%
- Relatively well diversified fuel mix in Indonesia, Philippines, Vietnam

SWI is applied to measure fuel diversity

- SWI < 1.0 – highly dependence on a particular fuel
- SWI > 2.0 – numerous fuel sources

- Thailand, Malaysia – SWI < 1.0 due to high dependence on gas
- Higher SWI in Indonesia, Philippines, Vietnam
- But SWI does not reflect fuel types – energy security implications
  - i.e. Significant share of oil in Indonesia affects energy security
Acceptability

Environmental Acceptability

Relatively close to OECD!!

- CO₂ emissions are still below those of OECD but the rate of increase is rather alarming
  - Increased between 100-300% since 1990
  - While emissions in OECD remain rather constant

- Many factors contributed to CO₂ emissions – i.e. fuel mix, efficiency of generating plants.

- CO₂/GDP is increasing, except Philippines
  - CO₂ emissions from the electricity sector outpaced economic growth
  - Responds to changes in electricity intensity

- CO₂/kWh is decreasing
  - Change in fuel mix – to lower emitting natural gas
Acceptability

- Keen interests by the Governments in nuclear power
  - *Meet rising demand and reduce fossil-fuel dependence*
- Considerable social and environmental implications
  - *Lack information and regulations concerning safety, waste management, etc. – led to social consensus issues*
  - *Directions in addressing these issues are still unclear*

<table>
<thead>
<tr>
<th>Country</th>
<th>Plan for 2000MW to be operated in 2020-2021.</th>
<th>Planned to build 4 nuclear plants by 2025 but was cancelled due to tight credit and public opposition.</th>
<th>Express interest in the possible deployment of nuclear power after 2020</th>
<th>Plan for 2400 MW of nuclear power during 2025-2034 and also contemplating reviving the Bataan nuclear power plant (mothballed in ‘86)</th>
<th>To commission the first nuclear plant in around 2017-2020.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thailand</td>
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<tr>
<td>Indonesia</td>
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<tr>
<td>Malaysia</td>
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<tr>
<td>Philippines</td>
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</tbody>
</table>

Acceptability

- The ASEAN-5 see the importance of renewable energy
  - *to mitigate rising CO₂ emissions and enhancing energy security*
- Policies and targets to promote renewable energy
  - *Feed-in tariffs, investment incentives (i.e. tax & duties exemption)*
- Promising technical potential for renewable energy resources
  - *Biomass, geothermal, mini- & micro-hydro and solar*
  - *But still largely unexploited*

<table>
<thead>
<tr>
<th>Country</th>
<th>Share of non-hydro Renewable capacity</th>
<th>Share of Renewable capacity (with hydro)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thailand</td>
<td>2.9%</td>
<td>8.6%</td>
</tr>
<tr>
<td>Indonesia</td>
<td>4.9%</td>
<td>12.9%</td>
</tr>
<tr>
<td>Malaysia</td>
<td>0%</td>
<td>6.4%</td>
</tr>
<tr>
<td>Philippines</td>
<td>17.2%</td>
<td>31.6%</td>
</tr>
<tr>
<td>Vietnam</td>
<td>0%</td>
<td>43%</td>
</tr>
</tbody>
</table>

- Although some off-grid solar PV i.e. water pumping, lighting
<table>
<thead>
<tr>
<th>Country</th>
<th>Renewable energy policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thailand</td>
<td><strong>Target:</strong> Increase renewable generation capacity by 80% by 2011 mainly from biomass.</td>
</tr>
<tr>
<td></td>
<td>• Feed-in tariffs for electricity generation from renewable energy.</td>
</tr>
<tr>
<td>Indonesia</td>
<td><strong>Target:</strong> Increase renewable generating capacity of micro-hydro, geothermal, wind,</td>
</tr>
<tr>
<td></td>
<td>solar and biomass to 17% by 2030</td>
</tr>
<tr>
<td>Malaysia</td>
<td><strong>Target:</strong> 350 MW of grid connected renewable electricity by 2010</td>
</tr>
<tr>
<td></td>
<td>• Established the Small Renewable energy power program so that developers can sell</td>
</tr>
<tr>
<td></td>
<td>power to utilities under the Renewable Energy Power Purchase Agreement.</td>
</tr>
<tr>
<td>Philippines</td>
<td><strong>Target:</strong> 700 MW of new geothermal capacity between 2010-2014</td>
</tr>
<tr>
<td></td>
<td>• Taxes and duties exemption for geothermal power projects.</td>
</tr>
<tr>
<td></td>
<td>• Feed-in tariffs.</td>
</tr>
<tr>
<td>Vietnam</td>
<td><strong>Target:</strong> Adding 25-50 MW of renewable energy capacity including micro-hydro, wind,</td>
</tr>
<tr>
<td></td>
<td>biomass and solar PV.</td>
</tr>
<tr>
<td></td>
<td>• Investment incentives, preferential pricing, and preferential taxes for development</td>
</tr>
<tr>
<td></td>
<td>of new and renewable energy resources</td>
</tr>
</tbody>
</table>

### Accessibility

- ASEAN-5 is progressing in terms of accessibility:
  - **Higher electricity consumption, increasing electrification rate**
- Indonesia and Philippines need to improve electricity access in rural areas
- **Off-grid renewable energy**
- Electricity tariff subsidies
  - **Need to implement appropriate subsidy policies**

### Availability

**Short-term**
- Reliable supply in Malaysia and Thailand
  - **Low interruption indexes, high reserve margin**
- Low reliability in Indonesia

**Long-term**
- Long run energy security implication
  - **High gas dependence & indexed with international prices**

### Acceptability

- **Challenging aspect for every country in the ASEAN-5**
  - Rapid increased in CO₂ emissions
  - Social acceptability on large power projects (e.g. nuclear, geothermal)
- **Require effective measures to promote renewable energy**
Key challenges for electricity industries

- In general, these challenges concern:
  - Satisfying rapid demand growth in a sustainable manner
  - Energy security due to fossil-fuel reliance
  - Environment emissions and public consensus on power projects

- More specifically
  - Sufficient generation investment to meet the demand
  - Improve electricity access in rural areas – Indonesia, Philippines
  - Tariff subsidy revision – maintain affordability for low income group while still obtain sufficient revenue
  - Diversify fuel mix – enhance security of supply
  - Increase the share of renewable energy

Implications of such challenges

- Generation investment and resource planning in these countries
  - Significant investment in power sector is predicted to meet rapid demand growth
  - Total investment is power sector in ASEAN is predicted to be $0.6 trillion in the next 20 years (IEA, “World energy outlook 2009”)
  - Need to consider these challenges during investment decision-making processes – i.e. generation & fuel mix (energy security), CO₂ emissions

- Complex nature of generation and network investment
  - Must build ahead of time, capital intensive.
  - Key drivers are uncertain – fuel prices, demand, environmental policies (carbon prices)
Thank you,
and
Questions?
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