Future perspectives on Mekong energy systems

Tira Foran & John Ward
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Outline

• Summary of Mekong energy system - eight dimensions drawn from the energy security literature
• Challenges associated with current policy dynamics in the electricity sector
• Improving policy responses – role of modelling and dialogue
Greater Mekong Subregion energy system - eight dimensions

Cambodia, Laos, Myanmar, Thailand, Vietnam, Yunnan, Guangxi
317 million people

I Metabolism

II Governance

III Availability

IV Access

V Affordability

VI Technological Development & Long Term Sustainability

VII Resilience

VIII Environmental Sustainability

Greater Mekong Subregion

Energy System - eight dimensions

Cambodia, Laos, Myanmar, Thailand, Vietnam, Yunnan, Guangxi
317 million people

I Metabolism

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## Highlights – Mekong energy system

<table>
<thead>
<tr>
<th>Dimension / Indicator</th>
<th>Metric</th>
<th>Baseline (2005)</th>
<th>Reference Scenario (2025 unless indicated otherwise)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I Metabolism</strong></td>
<td>Annual growth rate of GDP</td>
<td>8%</td>
<td>6.3% (2005-2025)</td>
</tr>
<tr>
<td><strong>III Availability</strong></td>
<td>Regional sufficiency</td>
<td>83%</td>
<td>73% (2001-2025)</td>
</tr>
<tr>
<td></td>
<td>Regional production of primary energy divided by Total regional primary energy supply (%)</td>
<td>83%</td>
<td>73% (2001-2025)</td>
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<tr>
<td></td>
<td>Diversification to hydropower</td>
<td>2.0%</td>
<td>5.5%</td>
</tr>
<tr>
<td><strong>IV Access</strong></td>
<td>Access to electricity in low access Mekong countries</td>
<td>26% Cambodia</td>
<td>40% (Cambodia)</td>
</tr>
<tr>
<td></td>
<td>Share of population in Cambodia and Myanmar electrified (%)</td>
<td>13% Myanmar</td>
<td>20% (Myanmar)</td>
</tr>
<tr>
<td><strong>V Affordability</strong></td>
<td>Proportion of population in all Mekong countries unable to afford modern energy services</td>
<td>23% (Cambodia)</td>
<td>0% (all countries excluding Myanmar)</td>
</tr>
<tr>
<td></td>
<td>Maximum national poverty headcount at $1.25 PPP (2005 USD) (%)</td>
<td>34% (Laos)</td>
<td></td>
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## Highlights – Mekong energy system (cont)

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>VI Technological Development &amp; Long-Term Sustainability</td>
<td>% NRE in regional primary energy supply</td>
<td>0.22%</td>
<td>3.5%</td>
</tr>
<tr>
<td>Diversification to ‘Nonconventional’ Renewable Energy (NRE)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VII Resilience</td>
<td>Biomass share of regional primary energy supply</td>
<td>28%</td>
<td>15.6%</td>
</tr>
<tr>
<td>Decentralization</td>
<td>Biomass power share of regional electricity supply</td>
<td>2.1%</td>
<td>8.4%</td>
</tr>
<tr>
<td>Energy resources and stockpiles</td>
<td>Years of energy reserves left [Total of Grade 1 (lowest-cost) coal oil gas reserves divided by TPES]</td>
<td>84</td>
<td>18</td>
</tr>
<tr>
<td>VIII Environmental Sustainability</td>
<td>Million tons of CO2 equivalent</td>
<td>523</td>
<td>1665</td>
</tr>
<tr>
<td>Climate change</td>
<td>1.7 t/capita</td>
<td>4.8 t/capita</td>
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</table>
Challenges associated with current dynamics (1)
Higher-order impacts on food and livelihood systems

Hydropower expansion
-> lowers availability of living aquatic resources -> weakens food security
-> exacerbates saline intrusion in the Mekong Delta -> lower rice production?

Bio-energy expansion
-> increased production of sugar cane, palm oil, cassava will increase regional sufficiency and long-term sustainability of fuel supply, but plantations may -> land access problems
Challenges associated with current dynamics (2): High rates of metabolism

Primary Energy demand = (Population) x (GDP/year/capita) x (primary energy/unit GDP)

4.9% increase in primary energy demand
GMS Integrated Scenario (IRM-AG 2008)

2.1% increase in primary energy demand
IEA ‘450 ppm’ Scenario for ASEAN (IEA 2009)
Challenges associated with current dynamics (3)
Potential under-investment in renewable technologies

- Global warming: current atmospheric CO2 = 390 ppm. Compare to 450 ppm, a target associated with global warming in the range of 1.5-4.5°C

C emissions under BAU and permitted for stabilization at various CO2 concentrations

Challenges associated with current dynamics

- Peaking fossil fuel supplies. Some analysts believe that global emissions under BAU scenarios (where climate policy targets such as 450 ppm are not observed) will be forced to decline because of shortages in fossil fuels.

Source: Harvey (2010)
Improving policy responses
Role of modelling: Providing longer time scale perspectives

Emissions =

(Population) x (GDP/year/capita) x (primary energy/unit GDP) x (carbon emissions/unit primary energy)

*Carbon intensity of energy system*

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<tr>
<td>Population growth</td>
<td>+1.65%</td>
<td>[Peak at 9 Billion]</td>
<td>H +0.49%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>L - 0% [Peak in 2040]</td>
</tr>
<tr>
<td>GDP/yr/capita (2005 = 8,800 USD)</td>
<td>+1.97%</td>
<td>+1.6%</td>
<td>HIGH +1.6%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LOW +1.0%</td>
</tr>
<tr>
<td>Energy intensity of economy (% p.a.)</td>
<td>-1.07%</td>
<td>-1.0%</td>
<td>SLOW -1.0%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>FAST -2.0%</td>
</tr>
<tr>
<td>Carbon intensity of energy system</td>
<td>-0.27%</td>
<td>+0.13%</td>
<td>Slow - 2.7%</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Fast -7.2%</td>
</tr>
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</table>

Source: Authors, based on data in Harvey (2010)
Primary energy demand for HIGH P and GDP/P growth (red), vs. LOW P and GDP/P growth (blue) + either 1%/yr decline in energy intensity (solid) or 2%/yr decline (dashed).

Source: Harvey (2010)
Needed: longer time perspectives on energy dynamics in developing regions such as Mekong

Total fossil fuel CO₂ emission (GtC/yr) for two contrasting global scenarios (right axis) and two Mekong scenarios (left axis)

Source: IRM-AG (2008); Harvey (2010)
Concluding points – Mekong energy system

- High rates of economic and energy metabolism compared to world
- Affordability should improve with growth in GDP/P
- But access is projected to lag in low capacity countries
- Long term sustainability of supply can improve very rapidly with biomass and ‘new’ renewables (solar PV, solar heating, biofuels, etc)
- Hydropower expansion (an ‘old’ renewable) lowers CO\text{2} emissions slightly but leads to impacts on food security
- Longer term perspectives are needed to 2100
- Also, more spatially detailed analysis is needed
  - E.g. What will an interconnected power system cost (transmission loss and infrastructure)
  - E.g. Is there adequate biomass distribution for traditional & modern uses?  
    - Depends in part on assumptions about rural change
- Participatory multi-stakeholder approaches are preferred
Thank you

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Fossil fuel CO₂ emissions for three BAU cases: (1) base case fossil fuel supplies (‘Low’); (2) A case where the remaining natural gas, oil and coal is twice as large (‘Medium’); (3) A case where remaining natural gas and oil are same as ‘Medium’ but remaining coal is three times as large as ‘Low’ (‘High’) (that is, remaining coal for ‘High’ is 6 times cumulative use to 2005). Also given are emissions for the two extreme climate-policy scenarios.