Cambodia- Effective country strategies

Asia LEDS Partnership Regional Workshop: Mechanisms that Catalyze Finance for Grid-Connected Clean Energy

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1. Country Context, General Status of Energy Sector in Cambodia, National Policies, What policy measures and financing mechanisms are being employed in Cambodia to help scale up investment for grid-connected clean energy?.

2. Noteworthy success (the case of Cambodia)

3. What is a main barrier/challenge to catalyzing finance for grid-connected clean energy in Cambodia?

4. Possible resolutions
Decades of conflict destroyed infrastructure and human capital.

After stabilization in early 1990s, economic growth restored and now ~ 7% / year.

Electric power system re-built on least-cost principles with emphasis on large coal, hydro, and imports.

Multiple cross-border power connections; imports declining as domestic generation capacity grows.
**Structure of Electricity Organization**

**Royal Government of Cambodia**

- **Electricity Authority of Cambodia**: Regulation
- **Ministry of Mines and Energy**: Policy Maker
- **Ministry of Economic and Finance**: Owner

**Cambodia’s Electricity Business**

- **REE**: -Ownership of EDC
- **IPP**: -Policy, Planning, Technical Standard
- **PEC**: -Tariff, License, Financial Performance, Enforce the regulations, Rule and Standard
- **EDC**

**Definitions**

- EDC = Electricite du Cambodge
- IPP = independent power producer
- PEC = provincial electricity company
- REE = rural electricity enterprise
RE Resources Estimates

Biomass: 18,852 GWh/y > 3500 MW @ 60% PLF
• ~ 3x total electricity supply in 2015

Hydropower:
• > 10,000 MW; installed capacity was 927 MW in 2015
• long-term climate / meteorological risk

Solar: 5 kWh/m2/day
• 14,781 GWh/y 8,100 MW @ 20% PLF
• ~ 2.5x total electricity supply in 2015

Wind: 3,665 GWh/y ~ 1,390 MW @ 30% PLF

Biomass & Solar Preferred: widely distributed, scalable, replicable, private sector interest
Climate Change Policies

Cambodia Climate Change Strategic Plan (CCCSP) 2014-2023

- Reduce vulnerability to climate change impacts of people, in particular the most vulnerable and critical systems.
- Shift towards a green development path by promoting low carbon development and technologies.
- Promote public awareness and participation in climate change actions.

Intended Nationally Determined Contributions

- 1.8 MtCO2e reduction by 2030 for energy sector
Energy Policies

To provide an adequate supply of energy throughout Cambodia at reasonable and affordable price,

To ensure a reliable and secured electricity supply at reasonable price, which facilitates investment in Cambodia and development of national economy,

To encourage exploration and environmentally and socially acceptable development of energy resources needed for supply to all sectors of Cambodia economy,

To encourage the efficient use of energy and to minimize the detrimental environmental affects resulted from energy supply and consumption.
Cambodia Power Strategy

A-Development of Generation

Increase diversity of power supply such as hydro, coal power, importing electricity, biomass and other renewable energy to meet the electricity demand and reduce fuel oil for power generation.

B-Development of Transmission lines

Develop the national transmission line, GMS & ASEAN power grid, maximize mini-grid to rural areas, upgrading the HV, MV & LV.

C-Development of Rural Electrification

Supply from the national grid, mini-grid, grid extension and stand-alone system (BCS, SHS, Micro Hydropower, biomass, etc.)
Rural Electrification Goals

All villages in the Kingdom of Cambodia have access to electricity of any type by the year 2020

At least 70% of all households in the Kingdom of Cambodia have access to grid quality electricity by the year 2030

Targets and Progress

<table>
<thead>
<tr>
<th>Rural Areas</th>
<th>2014</th>
<th>Now</th>
<th>2020</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household Connections</td>
<td>51%</td>
<td>57%</td>
<td>65%</td>
<td>70%</td>
</tr>
<tr>
<td>Village Connections</td>
<td>56%</td>
<td>62%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>
Current Generation Expansion Plan

Power Development Plan 2008-2020

Install Capacity [MW]

- Gas/Coal
- Coal
- Hydro
- Import Elec.
- DO&HFO

Years: 2008 to 2020
2- Noteworthy Success

Possible fund for Catalyzing Finance for Grid-Connected Clean Energy Development in Cambodia

Possible funding sources:

• Grant from other countries;
• Soft loan from development banks;
• RGC’s fund for assistance in development of rural electrification;
• EDC’s participation in development of rural electrification from its budget
• Private Sector participation
## Power Development Plan with private sector participation

<table>
<thead>
<tr>
<th>No.</th>
<th>Generation Expansion Plan</th>
<th>Fuel Type</th>
<th>Installed Capa.MW</th>
<th>COD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kamchay Hydro Power Plant</td>
<td>Hydro</td>
<td>194.1</td>
<td>2011</td>
</tr>
<tr>
<td>2</td>
<td>Kirirom III Hydro power Plant</td>
<td>Hydro</td>
<td>18</td>
<td>2013</td>
</tr>
<tr>
<td>3</td>
<td>Stung Atay Hydro Power Plant</td>
<td>Hydro</td>
<td>120</td>
<td>2013</td>
</tr>
<tr>
<td>4</td>
<td>200 MW Coal Power Plant (I) in Sihanouk Province - Phase 1</td>
<td>Coal</td>
<td>100</td>
<td>2013</td>
</tr>
<tr>
<td>5</td>
<td>Stung Tatay Hydro Power Plant</td>
<td>Hydro</td>
<td>246</td>
<td>2014</td>
</tr>
<tr>
<td>6</td>
<td>Lower Stung Russei Chrum Hydro Power Plant</td>
<td>Hydro</td>
<td>338</td>
<td>2015</td>
</tr>
<tr>
<td>7</td>
<td>700 MW Coal Power Plant (II) -Phase 1</td>
<td>Coal</td>
<td>270</td>
<td>2014-2015</td>
</tr>
<tr>
<td>8</td>
<td>700 MW Coal Power Plant (II) -Phase 2</td>
<td>Coal</td>
<td>100</td>
<td>2017</td>
</tr>
<tr>
<td>9</td>
<td>700 MW Coal Power Plant (II) -Phase 3</td>
<td>Coal</td>
<td>100</td>
<td>2018</td>
</tr>
<tr>
<td>10</td>
<td>200 MW Coal Power Plant (I) in Sihanouk Province - Phase 2</td>
<td>Coal</td>
<td>135</td>
<td>2016</td>
</tr>
<tr>
<td>11</td>
<td>Lower Se San II Hydro Power Plant</td>
<td>Hydro</td>
<td>400</td>
<td>2017</td>
</tr>
<tr>
<td>12</td>
<td>700 MW Coal Power Plant (II) -Phase 4</td>
<td>Coal</td>
<td>100</td>
<td>2018</td>
</tr>
<tr>
<td>13</td>
<td>Stung Chay Areng Hydro Power Plant</td>
<td>Hydro</td>
<td>108</td>
<td>2019</td>
</tr>
<tr>
<td>14</td>
<td>700 MW Coal Power Plant (II) -Phase 5</td>
<td>Coal</td>
<td>100</td>
<td>2019</td>
</tr>
<tr>
<td>15</td>
<td>Sambor Hydro Power Plant</td>
<td>Hydro</td>
<td>450/2600</td>
<td>2019</td>
</tr>
<tr>
<td>16</td>
<td>Coal Power Plant (III) or Gas Power Plant</td>
<td>Coal/Natural Gas</td>
<td>400</td>
<td>2020</td>
</tr>
<tr>
<td>17</td>
<td>Stung Treng Hydro Power Plant</td>
<td>Hydro</td>
<td>900</td>
<td>2020</td>
</tr>
<tr>
<td>18</td>
<td>Solar farm 10 MW in Bavet</td>
<td>Solar</td>
<td>10</td>
<td>2017</td>
</tr>
</tbody>
</table>
Scale Up Renewable Program (SREP)

1. There are 27 countries participating in SREP
2. There are around 165 MUSD
   - CIF 29.7 MUSD
   - ADB 31 MUSD
   - Private Sector 95 MUSD
   - Government 10 MUSD for 7 years 2017-2023
3. For Cambodia, SREP had approved on IP on 17th June 2016 in Oaxaca, Mexico with the total grant from CIF 29.7 MUSD
National Level
- 55% access to grid
- 85% of households use charcoal or wood for cooking
- 1/3 of grid-supplied electricity from coal and diesel
- 400 KWh per capita consumption of electricity, among the lowest
- Retail prices of electricity are among the highest in the world

Urban (0.66 million households)
- 100% access to grid
- Retail electricity price $0.18 - $0.19/kWh

Rural (2.5 million households)
- 40% access to grid
- 50% access to alternative energy
- 5 KWh/month per person average consumption
- Electricity price up to $0.70/kWh

Solar farms can supply electricity at grid parity when deployed at sufficient scale

SREP Entry Points
- Customers can save 30 - 40% on electricity bill with rooftop solar
- Biomass can displace diesel and coal
- Solar home system and mini-grid for off-grid access to electricity
- Retail electricity price $0.18 - $0.19/kWh
- 40% access to grid
- 5 KWh/month per person average consumption
- 55% access to grid
- 85% of households use charcoal or wood for cooking
- 1/3 of grid-supplied electricity from coal and diesel
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Solar farms can supply electricity at grid parity when deployed at sufficient scale
SREP IP Conceptual Approach

Expected Results
- Increase access to clean energy
- Displacement of diesel generation
- Minimize additional coal capacity
- Utility-scale grid-connected RE complementing large hydro
- Clear path for scale up and replication

SREP-Supported Activities

**Learning by doing investments**
- Scale-up of solar home systems
- Solar mini-grids
- Rooftop solar
- Solar farms
- Biomass power

**Policy support**
- Net metering and Feed-in Tariffs
- Grid integration analysis
- Capacity building and training for government agencies, suppliers, service companies
- Public awareness

Current Status
- 67% village electrification
- 55% households connected to national grid
- 85% of households use charcoal and wood for cooking
- High retail electricity prices with up to $0.70/kWh in rural areas and $0.19/kWh in urban areas
- Grid-connected electricity mostly coal and large hydropower

National Objectives 2030
- 100% village electrification
- 70% of households connected to national grid
- Additional 1,305 MW coal and 900 MW hydro
- New RE for improved access to energy and more sustainable energy pathway
1. The major challenges is investment funds;
2. Government and social acceptance, policy and national budget
3. Awareness of optimizing the use of clean energy, and lack of know-how, and expertise
4. State owned electricity company (EDC) may not support clean energy except hydropower as tariff from solar farm is much higher than tariff generated by hydro and coal power plants even more expensive than imported power
5. Land acquisition for solar
6. Decision making process is over complicated due to more than one decision making body
7. Benefits of clean energy except hydro may not be clear and obvious, especially among policy makers in Cambodia
8. No specific legislation/regulation, intangible benefits to the government
9. Lack of proper monitoring and control as grid-connected clean energy might contribute to instability of the national grid integration
10. Intermittent clean energies are challenging for daily operation of the national grid, their power fluctuate over multiple time horizons, forcing the grid operator to adjust its day-ahead, hour-ahead, and real time operating procedures
11. Grid has very little storage capacity, balancing between electricity supply and demand must be maintained at all times to avoid a blackout or other cascading problems
4- Possible resolutions/mechanisms to overcome these barrier/ challenges

1. Pilot project before going to full scale - For example Cambodia we just awarded this month a BOO 10 MW solar farm project to Singaporean Company for first pilot project

2. National funding comprises of Public, Government, Financial Institution and Private Sectors participation

3. Even hydropower generation also faces long-term climate change and meteorological risks – therefore other clean energy must be considered and adopted properly

4. Meaningful cooperation with proper knowledge and technology transfer
Thank you !