Road Map for Cross Border Electricity Trade & Development of Exchanges

South Asia Regional Conference on Cross Border Electricity Trade

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Sri Lanka
Outline of the Presentation

• Sri Lankan Power System
• India-Sri Lanka Electricity Grid Interconnection Project
Sri Lanka Power System in 2012

- Installed capacity: 3050 MW
- Peak Demand: 2163 MW
- Energy Generated: 10714 GWh
- Energy Mix: Hydro 44%, Thermal 56%
- Demand growth: 6.5%
- System losses: 13.5%
- Load Factor: 62%
- Access to Electricity: 90%
- Per Capita Elec. Consumption: 450 kWh
The average per capita electricity consumption in 2011 was 480 kWh/person and generally it has been rising steadily.
Capacity of the Power System

- **Hydro** 1355 MW
- **Thermal** 1695 MW  
  (CEB :845, IPP: 850)
- **Non Conventional Renewable Energy** : 240MW  
  (approx Mini hydro 185MW, Bio mass 10MW, wind 45MW)
## Base Demand Forecast - 2012

<table>
<thead>
<tr>
<th>Year</th>
<th>Demand</th>
<th>Growth Rate</th>
<th>Net Losses</th>
<th>Generation</th>
<th>Growth Rate</th>
<th>Peak</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(GWh)</td>
<td>(%)</td>
<td>(%)</td>
<td>(GWh)</td>
<td>(%)</td>
<td>(MW)</td>
</tr>
<tr>
<td>2013</td>
<td>11104</td>
<td>4.0</td>
<td>11.6</td>
<td>12566</td>
<td>4.0</td>
<td>2451</td>
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<tr>
<td>2015</td>
<td>12834</td>
<td>6.3</td>
<td>11.6</td>
<td>14509</td>
<td>7.4</td>
<td>2894</td>
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<tr>
<td>2020</td>
<td>16937</td>
<td>5.4</td>
<td>11.0</td>
<td>19030</td>
<td>5.2</td>
<td>3731</td>
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<tr>
<td>2025</td>
<td>21737</td>
<td>5.0</td>
<td>10.5</td>
<td>24284</td>
<td>4.9</td>
<td>4717</td>
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<td>2030</td>
<td>27581</td>
<td>4.8</td>
<td>10.0</td>
<td>30645</td>
<td>4.7</td>
<td>5893</td>
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<tr>
<td>2035</td>
<td>34652</td>
<td>4.6</td>
<td>9.6</td>
<td>38320</td>
<td>4.5</td>
<td>7294</td>
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</table>
# Generation Expansion Plan 2013 - 2032

<table>
<thead>
<tr>
<th>YEAR</th>
<th>HYDRO ADDITIONS</th>
<th>THERMAL ADDITIONS</th>
<th>THERMAL RETIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>-</td>
<td>1x300 MW Puttalam Coal (Stage II)</td>
<td>-</td>
</tr>
<tr>
<td>2015</td>
<td>-</td>
<td>1x300 MW Puttalam Coal (Stage II) 3x75 MW Gas Turbine</td>
<td>6x16.6 MW Heladanavi Puttalam 14x7.11 MW ACE Power Embilipitiya 4x15 MW Colombo Power</td>
</tr>
<tr>
<td>2016</td>
<td>35 MW Broadlands 120 MW Uma Oya</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2017</td>
<td>-</td>
<td>1x105 MW Gas Turbine</td>
<td>-</td>
</tr>
<tr>
<td>2018</td>
<td>27 MW Moragolla Plant</td>
<td>2x250 MW Sampoor Coal Power plant</td>
<td>4x5 MW Northern Power 8x6.13 MW Asia Power</td>
</tr>
<tr>
<td>2019</td>
<td>-</td>
<td>2x300 MW Coal plant</td>
<td>5x17 MW Kelanitissa Gas Turbines 4x18 MW Sapugaskanda diesel</td>
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<td>2021</td>
<td>-</td>
<td>1x300 MW Coal plant</td>
<td>-</td>
</tr>
<tr>
<td>2022</td>
<td>49 MW Gin Ganga</td>
<td>1x300 MW Coal plant</td>
<td>-</td>
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</table>
## Generation Expansion Plan 2013 - 2032

<table>
<thead>
<tr>
<th>YEAR</th>
<th>HYDRO ADDITIONS</th>
<th>THERMAL ADDITIONS</th>
<th>THERMAL RETIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2023</td>
<td>-</td>
<td>2x300 MW Coal plant</td>
<td>163 MW AES Kelanitissa Combined Cycle Plant 115 MW Gas Turbine 4x9 MW Sapugaskanda Diesel Ext.</td>
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<td>2024</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>2025</td>
<td>-</td>
<td>1x300 MW Coal plant</td>
<td>4x9 MW Sapugaskanda Diesel Ext.</td>
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<td>2026</td>
<td>-</td>
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<tr>
<td>2027</td>
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<td>2028</td>
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<tr>
<td>2030</td>
<td>-</td>
<td>1x300 MW Coal plant</td>
<td>-</td>
</tr>
<tr>
<td>2031</td>
<td>-</td>
<td>1x300 MW Coal plant</td>
<td>-</td>
</tr>
<tr>
<td>2032</td>
<td>-</td>
<td>1x300 MW Coal plant</td>
<td>-</td>
</tr>
</tbody>
</table>
Percentage Share of the Energy Balance

Year

Energy (GWh)

Coal
Petroleum
NCRE
Major Hydro
**Present Transmission Network**

- **Transmission voltage levels**
  - 220kV
  - 132kV

- **Transmission Lines/Cables**
  - 220kV: 483 km
  - 132kV: 1823 km

- **Grid Substations**
<table>
<thead>
<tr>
<th>Voltage Level</th>
<th>No.</th>
<th>MVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>132/33 kV</td>
<td>47</td>
<td>3045</td>
</tr>
<tr>
<td>220/132/33 kV</td>
<td>5</td>
<td>2100</td>
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<tr>
<td>220/132kV</td>
<td>2</td>
<td>405</td>
</tr>
<tr>
<td>220/33kV</td>
<td>1</td>
<td>70</td>
</tr>
<tr>
<td>132/11kV</td>
<td>4</td>
<td>306</td>
</tr>
</tbody>
</table>
Transmission System in Year 2013
The Map of Sri Lanka Transmission System in Year 2032
(400kV & 220kV Network)
Indo - Sri Lanka Electricity Grid Interconnection
Trans-border Electricity Exchange

• South Asia Region is very rich in energy resources which are unevenly distributed among the countries of the region.

• The advantages of a South Asian Regional Electricity grid are appreciated by almost all countries in the region.

• For Sri Lanka to get access to a South Asian Regional Electricity Grid, the only feasible connection is with India through a HVDC marine cable. This interconnection would be different from any other electricity interconnections planned in the South Asia Region.
Background

- Pre-feasibility study conducted with the assistance of USAID in 2002 by Nexant Inc.

- Review of the Pre-feasibility study with assistance of USAID in 2006 by Nexant/Power Grid Corporation of India

- Bilateral discussions by Secretary, Ministry of Power and Energy Sri Lanka and Secretary Ministry of Power, India in Dec 2006.

- Cabinet of Ministers approved in principle in Dec 2006, to study the feasibility of power interconnection and to appoint a Steering Committee Co-Chaired by Secretaries of Power Ministries and to appoint a Task Force for technical, commercial, regulatory and legal aspects.
A MOU on Feasibility Study for India - Sri Lanka Electricity Grid Interconnection was signed among GOSL, GOI, CEB and Power Grid Corporation of India Limited (PGCIL) on 9th June 2010.

Executing Agencies; CEB and PGCIL are jointly carrying out the feasibility study.
Benefits and Opportunities for Sri Lanka

- Meeting growing power demand with imported power
- Improved load profile - valley filling
- Improved system reliability and security
- Access to electricity from cheaper sources of power generation in the South Asia Region
- Reduction in operational cost through better resource management
- High voltage direct current (HVDC), operating at ±400 kV
- Total interconnection capacity will be 1000 MW
- Total project investment will be in the range 769 and 953 million USD
Electricity Market in Sri Lanka

• Sri Lanka does not have an operational power market
  ▪ CEB operates as the single buyer
  ▪ Meets customer demand at all times
Challenges in Power Exchange

- Price of electricity
  - Contract price (Capacity cost + Energy cost)
  - Investment and operational costs of the interconnection
  - Transmission fees to be paid for transfers
  - Energy loss attributed to power transfers
Potential for Power Exchange Contracts

• Short term contracts
  ✓ Monthly average prices reported in Indian short term market are in the range of 6.60 to 9.50 UScts/kWh (capacity + energy)
  ✓ Monthly average purchase prices forecast for Sri Lanka are in the range of 6.50 to 13.45 UScts/kWh (energy only)
  ✓ During peak hours, Sri Lanka can make use of the lower cost Indian short term market
  ✓ During off peak, the excess coal based generation in Sri Lanka could be sold to the Indian short term market

• Long term contracts
  ✓ Owing to economies of scale, Sri Lanka signing up with an Indian UMPP could be cheaper than building own plants
  ✓ Similarly, if Sri Lanka can build an UMPP, it can also serve the Indian base load, owing to the persistent shortfall in India
For Project Viability

- Target project cost is 375 MUSD
- Reduction of investment considering re-routing
- Limit the investment for a 500 MW (monopolar) capacity
- Sri Lankan power system shall relax its maximum load share condition and allow the interconnection to supply at the optimal capacity level
Regulatory and Bilateral Trade Issues

- Analyzing the legal and regulatory framework related to the project
  - CEB needs to be empowered to enter into cross-border power transfers
  - The Transmission and Bulk Supply license held by CEB is required to be amended
  - Dispute resolution in the Sri Lanka Electricity Act requires to be further strengthened,
  - CEB Act has to be amended to enable the functions of trader or broker, as relevant
  - A new Act may also be prepared to enable the interconnection to be implemented, to address the impediments in the legal basis in which the present operations are conducted.

- Trade related issues and concerns
  - The India Sri Lanka Free Trade Agreement (ISFTA) does not mention electricity in any of its lists, but Sri Lanka Customs specifies a preferential duty rate of 1.8 per cent for electrical energy
Envisaged Operation Issues for Cross-Border Electricity Trade in Sri Lanka

1. HVDC Technology is new to Sri Lanka - Operation and maintenance of 400kV HVDC interconnection is challenging
2. Marine cable is involved - unique feature in interconnections of South Asia Region
3. Security of power supply
4. Tariff
Road Map

1. Select and agree on technically feasible and economically viable development option
2. Finalize the Detailed Feasibility Study with POWERGRID India
3. Settle policy, legal and commercial issues
4. Secure finances for implementation the interconnection
THANK YOU