Status of Sri Lanka Cross Border Interconnection with India & Expected Benefits

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Structure of the Sri Lankan Power Sector

Government

Ministry of Power & Energy

Ceylon Electricity Board (CEB)

Lanka Electricity Company (LECO)

Lanka Transformers Ltd.

Lanka Coal Company

Sri Lanka Energies

Public Utilities Commission of Sri Lanka (PUCSL)
Overview of Energy Sector

- Hydro, Wind, Biomass, Solar - indigenous resources
- Large hydro resources developed
- Gas reserve indications positive
- No proven oil or coal resources
Electricity Data for 2012

- Installed capacity: 3334 MW
- Peak Demand: 2146 MW
- Electricity Generated: 11800 GWh
- Generation Mix: Hydro 28% Thermal 72%
- Capacity Mix: Hydro 46% Thermal 54%
- System losses: 11%
- Load Factor: 62.8%
- Access to Electricity: 94%
- Elec. Consumption per Capita: 515 kWh
- Avg. Cost per unit (at selling point): 22.13 Rs/kWh
- Avg. selling price: 15.56 Rs/kWh
Capacity of the Power System

- **Hydro** 1355 MW
  
  - CEB - 828 MW - Coal fired steam 300MW
  - Diesel fired CCY 165MW
  - Diesel fired GT 195MW
  - HO fired diesel engines 168MW

- **Thermal** 1590 MW
  
  - IPP - 762 MW - Diesel fired CCY 163MW
  - FO fired CCY 270MW
  - HO fired diesel engines 329MW

- **Non Conventional Renewable Energy** - 388 MW
  
  (Approx. Mini hydro 277MW, Bio mass 18.5MW, Wind 91.5MW, Solar 1.5MW)
Hydro Thermal Share
Load Curve

Demand (MW) vs. Time (GMT+06:00)

- 2007
- 2006
- 2008
- 2009
- 2010
- 2011
- 2005
- 2004
<table>
<thead>
<tr>
<th>YEAR</th>
<th>RENEWABLE ADDITIONS</th>
<th>THERMAL ADDITIONS</th>
<th>THERMAL RETIREMENTS</th>
<th>LOLP %</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>-</td>
<td>-</td>
<td>4x5 MW ACE Power Matara 4x5 MW ACE Power Horana 4x5.63 MW Lakdanavi</td>
<td>1.821</td>
</tr>
<tr>
<td>2014</td>
<td>-</td>
<td>4x5 MW Northern Power** 3x8 MW Chunnakum Extension** 1x300 MW Puttalam Coal (Stage II)</td>
<td>1.357</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 HeladanaviPuttalam 14x7.11 MW ACE Power Embilipitiya 4x15 MW Colombo Power</td>
<td>1.228</td>
</tr>
<tr>
<td>2016</td>
<td>35 MW Broadlands 120 MW Uma Oya</td>
<td>-</td>
<td>-</td>
<td>1.017</td>
</tr>
<tr>
<td>2017</td>
<td>-</td>
<td>1x105 MW Gas Turbine</td>
<td>-</td>
<td>1.483</td>
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<td>2018</td>
<td>27 MW Moragolla Plant</td>
<td>2x250 MW Trincomalee Coal Power plant</td>
<td>4x5 MW Northern Power 8x6.13 MW Asia Power</td>
<td>0.399</td>
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<tr>
<td>2019</td>
<td>-</td>
<td>2x300 MW Coal plant</td>
<td>5x17 MW Kelanitissa Gas Turbines 4x18 MW Sapugaskanda diesel</td>
<td>0.080</td>
</tr>
<tr>
<td>2020</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.247</td>
</tr>
<tr>
<td>2021</td>
<td>-</td>
<td>1x300 MW Coal plant</td>
<td>-</td>
<td>0.162</td>
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<tr>
<td>2022</td>
<td>49 MW Gin Ganga ***</td>
<td>1x300 MW Coal plant</td>
<td>-</td>
<td>0.085</td>
</tr>
</tbody>
</table>
Percentage Share of the Energy Balance

Year
Coal
Petroleum
NCRE
Major Hydro
Energy (GWh)

Present Transmission Network

- Transmission voltage levels
  - 132kV
  - 220kV

- Transmission Lines
  - 220kV 501 km
  - 132kV 1791 km

- Grid Substations
  - 132/33 kV 47 3138
  - 220/132/33 kV 5 2100
  - 220/132 kV 2 105
  - 132/11kV 5 306
Present Transmission

The Map of Sri Lanka Transmission System in Year 2011

- 220kV Line
- 132kV Line
- 132kV Line (not in operation)
- 220/132 kV Sub Station
- 132kV GS
- Hydro Power Station
- Thermal Power Station
India - 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.
Benefits and Opportunities for Sri Lanka

- Opportunity to enter into India Power Exchange for energy trading
- Access to electricity from cheaper sources of power generation in the South Asia Region
- Reduction in operational cost through better resource management
- Meeting growing power demand with imported power
- Improved load profile - valley filling
- Improved system reliability and security
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.
Background Conts.

- 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
Line Route

- Maduari to Panaikulam: 130km overhead
- Panaikulam to Thirukketiswaram: 120km submarine
- Thirukketiswaram to A’Pura: 110km overhead

- High voltage direct current (HVDC), operating at ±400 kV
- Total interconnection capacity will be 1000 MW
Wholesale Markets in India and Sri Lanka

• Indian Wholesale Power Market
  – bilateral long-term contracts are dominant
  – Two power markets are in operation
  – Only 12% of demand served through day ahead and real-time (frequency based, UI) short term market
  – Total generating capacity is inadequate to serve the demand
  – At times, utilities shed loads when purchase price of electricity in day-ahead and UI market is above a pre-agreed threshold

• Sri Lanka does not have an operational power market
  – CEB operates as the single buyer
  – Meets customer demand at all times
Potential for Power Exchange Contracts

• **Short term contracts**
  – Monthly average prices reported in Indian short term market are in the range of 6.68 to 9.52 UScts/kWh (capacity + energy)
  – Monthly average purchase prices forecast for Sri Lanka are in the range of 6.50 to 13.46 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
Power Transfer Costs

- Following costs will further reduce any apparent benefits of power exchange between India and Sri Lanka
  - Investment and operational costs of the interconnection
  - Transmission fees of about 0.52 UScts/kWh require to be paid to the Indian grid for transfers within southern grid (based on current regulatory determinations in India)
  - Energy loss attributed to power transfers between India (southern region) and Sri Lanka (Anuradhapura) amounting to at least 6%
Legal and Regulatory Issues

- 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
To achieve project viability

– The project must be structured as a 1x500 MW monopolar interconnection with no specific assets or commitments now to raise the capacity to 1000 MW

– If the project costs are further reduced by reconsidering the routing options, the 1x500 MW monopolar option has the potential to be viable

– Target project cost for a POWERGRID-CEB joint venture to be profitable is 372.4 MUSD (excluding customs duty and taxes), which at present is estimated to be 554 MUSD

– Both Sri Lanka and India be allowed participation in the wholesale market in each others’ country, with full options and freedom to participate in the short-term, day-ahead and unscheduled interchanges market

– Sri Lankan power system shall relax its maximum load share condition and allow the interconnection to supply at the optimal capacity level
Revised Electricity Grid Interconnection
2032 Sri Lankan Transmission System
Thank You

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