Road Map for Cross Border Power Trading and Development of Exchanges - Pakistan

South Asia Regional Inaugural Conference of SARI/El
“Cross Border Electricity Trade”

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Hagler Bailly Pakistan
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1. Maximum estimated shortage about 4,000 MW
2. Actual peak shortage touched 6,000 MW due to unavailability of plants due to legal and cash flow reasons
Present Installed Capacity = 20,415 MW (Average Summer = 16,550, Average Winter 12,974)

Notes:
1. Based on net capacity, annual availability of thermal plants and reduction in capability of hydroelectric projects in winter, the shortages during peak winter period are expected to continue in the long term
2. The supply capacity includes imports of 2,000 MW from CASA-1000 Project and other neighboring countries and does not factor in potential imports from India
Even in low demand growth and low capacity additions scenario, the shortages are expected to continue in the long term.
Benefits of Trading

- Curtail load shedding
- Reduce cost of power supply to consumers
- Diversify generation mix
- Optimize resource utilization on regional basis
- Stimulate investment in energy infrastructure
- Enhance regional security of supply
- The India-Pakistan interconnection in particular:
  - will be a key confidence building measure (CBM) for improving the bilateral trade, economic growth, poverty alleviation, and promote regional peace
  - will open the door for expanded regional trade and markets in South Asia
Pakistan is already importing 30 MW from Iran for its Makran grid and is planning to expand it to 70-100 MW in future.

The country is also planning to develop following cross border transmission Interconnection projects to import power from energy rich neighboring countries:

- CASA-1000 Project
- India-Pakistan Transmission Interconnection Project
- Iran-Pakistan Transmission Interconnection Project
- Turkmenistan-Uzbekistan-Tajikistan-Afghanistan- Pakistan Transmission Interconnection
CASA-1000 Project

- Afghanistan, the Kyrgyz Republic, Pakistan, and Tajikistan are joint partners in the Project for the establishment of a Central Asia-South Asia Regional Electricity Market (CASAREM).
- The Project will transmit surplus power from the Kyrgyz Republic and Tajikistan to Pakistan via Afghanistan.
- Power flow will be 1000-1300 MW during five summer months.
- The project will involve construction of following HV infrastructure:
  - 450 Km long 500 kV HVAC TL from Kyrgyzstan to Tajikistan, and
  - 750 Km long ±500 kV HVDC TL from Tajikistan to Pakistan.
  - 1300 MW HVAC/DC convertor in Sangtuda, 300 MW HVDC/AC convertor at Kabul and 1000-1300 MW HVDC/AC convertor at Peshawar.
- SNC Lavalin completed feasibility study in 2012.
- Estimated capital cost of the Project is around US$1.0 billion.
India-Pakistan Transmission Interconnection Project

- Potential import of 500-1000 MW from India in to Pakistan
- Power to be purchased from the two power exchanges (PXIL, IEX) and other sources through competitive trading arrangements
- The project will involve construction of following HV infrastructure:
  - 35 Km long 400/500 kV HVAC TL from Balachak near Amritsar in Indian Punjab across the border to Lahore in Pakistani Punjab
  - A 400/220 kV HVDC back-to-back Substation in Lahore for asynchronous interconnection mode
- NTDC of Pakistan is planning to conduct feasibility study of the transmission lines and 400/220 kV HVDC back-to-back Substation.
- The preliminary estimated cost of the Project is around US$ 120-150 million
- Project can be commissioned in three years
Pakistan is currently importing around 30 MW from Iran for its Makran Grid in the south western Coastal areas of the Province of Baluchistan.

- The power is transmitted by 20 kV and 132 KV transmission lines.
- Power flows expected to increase to 70-100 MW in near future.
- The two countries are also in discussions to conduct a feasibility study to import 1000 MW from Iran through construction of an HVDC transmission line to connect Iranian grid with NTDC grid in Pakistan.
USAID is funding a study in Pakistan for construction of a High Voltage transmission interconnection between Central Asian Republics, Afghanistan and Pakistan.

CAR interconnection will connect the power grids of Central Asian States (CAS) with the power grid of Pakistan by strengthening the power grid of DABS in Afghanistan to import surplus power of CAS countries in to Afghanistan and Pakistan.

The Interconnection facilities may consist of multiple HVDC transmission interconnections in to Pakistan from the CAR countries to be constructed in phases.

Estimated import of power will be start from 300 MW by 2016-18 and may expand in future depending upon available surplus in the CAR and development of transmission network in Afghanistan.
India-Pakistan Power Trade

- Based on project demand and supply position, the power shortages in Pakistan are estimated to be:
  - 3,000-4,000 MW during summer months through 2020
  - 2,000-3,000 MW during winter months through 2027
- India having an installed capacity of 207 GW against the demand of 140 GW, is also facing shortages of around 10-13 GW (10% of demand)
- India is planning to add nearly 75 GW during 12th five year plan (2013-2017)
- Traders and IPPs have surplus capacity and are keen to supply power to Pakistan as many distribution companies in India prefer load shedding over purchasing more power due to financial considerations.
- 500-1000 MW of electricity trading in the initial stage seems feasible in the immediate term that can expand in the future based on relative growth of markets on either side of the border
Power Market Structure in Pakistan
Single Buyer Plus Model for Pakistan’s Wholesale Electricity Market
Proposed Power Trading Model Between India and Pakistan
Issues

- No existing interconnections that can facilitate cross border trading in the immediate future
- Network integration require HVDC operations for large quantities and sustained operations requiring investment in cross border infrastructure facilities
- No power exchange envisaged in the medium term Pakistan Power Market that continues to expand on long term secured contracts backed by sovereign guarantees.
- Present shortages and fuel mix highly support the power imports but makes power exports uncompetitive for potential purchasers.
- In country transmission infrastructure may need strengthening to improve the reliability of transmission network
Cost of Power Generation Options for Pakistan in the Long-term

<table>
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<tr>
<th>Option</th>
<th>Fuel Cost</th>
<th>O&amp;M Cost</th>
<th>Capital Cost</th>
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<tbody>
<tr>
<td>Existing - Jamshoro (Fuel Oil)</td>
<td>0.8</td>
<td>0.6</td>
<td>2.67</td>
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<td>New Imported Coal Fired Steam at Jamshoro</td>
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<td>CCGT-LNG/Imported Gas</td>
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<tr>
<td>Diesel Engine-Fuel Oil</td>
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<tr>
<td>New Steam-Fuel Oil</td>
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<td>Hydel RoR</td>
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<tr>
<td>Wind</td>
<td>15.37</td>
<td>1.7</td>
<td>0.00</td>
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Strategy to Promote Electricity Trading

Power market in Pakistan has entered in to Single Buyer Plus (SBP) stage allowing bilateral trading contracts between generator and distributors/consumers. The investors, however, prefer sale to central power purchaser under long term contracts backed up by government guarantees. For setting up the trading environment within the country and neighboring markets, GoP needs to:

- Promote competition in the power markets at the whole sale level by announcing a road map and regulatory frame work by the National electricity regulator (NEPRA)

- Inter-governmental agreements to promote cross border power trading

- Harmonize and simplify electricity regulations, procedures and commercial codes for cross border trading with minimum governmental interventions and approvals
Strategy to Promote Electricity Trading (...Continued)

- Expedite implementation of key network interconnections to facilitate power trading
- Encourage private sector in setting up the power exchanges and power trading activities
- Facilitate setting up of regional power plants that are allowed to trade freely across the borders on competitive basis
Road Map to Promote Electricity Trading

Pakistan needs to fast track introduction of electricity trading to reap the benefits of competition both within the country as well as from its neighboring markets.

- **Short Term – 1-2 years**
  - Government to issue policy guidelines to NEPRA for introduction of competition in the market and promotion of cross border trading activities
  - Government to initiate Inter-governmental agreements to facilitate bilateral trade

- **Medium Term – 2-4 years**
  - NEPRA to introduce legal and regulatory frame work and instruments to establish competitive market in the country at the whole sale level
  - Governments and national regulatory bodies to work together for development of regional Inter-governmental agreements to facilitate bilateral trade
Road Map to Promote Electricity Trading (…Continued)

- **Long Term – beyond 4 years**
  - NEPRA to introduce legal and regulatory framework to expand competition to retail level
  - Construction of transmission interconnections between the countries