Brief Report
On
SARI/EI Participation in the
“High Level Panel Discussion: Policy & Regulatory Aspects and Reforms”
of the POWER-GEN India & Central Asia Conference

18th -20th May, 2016
Pragati Maidan
New Delhi, India
Brief Report

Based on the invitation from conference director of Power-Gen India & Central Asia Conference, Mr. Rajiv Ratna Panda, Head-Technical, SARI/EI/IRADe participated in the Session-1 on “High Level Panel Discussion: Policy & Regulatory Aspects and Reforms” of the POWER-GEN India & Central Asia Conference held on 18th -20th May, 2016 at Pragati Maidan, New Delhi, India

Mr. Rajiv also made a brief presentation titled “South Asian power sector and Cross Border Electricity Trade” covering a) Overview of South Asian power sector b) Regional energy resource potential: hydro potential c) Current status of Cross Border Electricity Trade (CBET) and Future CBET trading scenarios d) Key drivers for CBET and regional exploitation of energy resources e) Power sector reform in South Asia and CBET Policy governing framework f) Regional transmission capacity by 2033-34, 2040 g) Role of regional hydro power in renewable integration and grid balancing h) Key challenges and risk for CBET: Need for a comprehensive policy framework i) Brief about South Asia Regional Initiative for Energy Integration (SARI/EI) and overall framework for development of CBET in South Asia. He explained about the key drivers for CBET and highlighted that Low per capita electricity consumptions, electricity shortages, poor access to electricity, resource crunch and seasonal complementarities are the driving force for advancing CBET in the region.

He explained in detail about the Power Sector Reform in South Asia and the CBET Policy Governing Framework in South Asia. Currently, CBET Policy Governing Framework is mainly through Bilateral Agreements/MoU between Countries and countries are taking steps on domestic Regulation and on Policy side to remove any barrier to CBET. His detailed presentation is attached as annexure-I. The session deliberated on various aspects of Policy & Regulatory Aspects and Reforms and development of power sector.

The session was chaired Shri. Gireesh Pradhan, Chairman, Central Electricity Regulatory Commission, India. The other distinguished speakers of the session were Dr. Somit Dasgupta, Member, Central Electricity Authority, India; Mr. Deepesh Nanda, CEO, Gas Power System, GE South Asia, India; Mr. Dominik Hofman, Vice President- Power and Gas Division, Siemens Ltd. India; and Mr. Rathin Basu, Chairman, Alstom India Ltd & Managing Director, Alstom T and D Ltd. (a GE group Company), India.
Annexure-I
South Asian Power Sector &
Cross Border Electricity Trade (CBET)

High Level Panel Discussion: Policy & Regulatory Aspects and Reforms

Rajiv Ratna Panda
HEAD-TECHNICAL, SARI/EI/IRADe

Power-Gen India & Central Asia Conference
18th -20th May, 2016
Pragati Maidan, New Delhi, India
Overview of South Asian Power Sector

Total Installed capacity of around 3,47,593 MW

Afghanistan: Small Power system (1341 MW), High Electricity Imports high, Hydro Dominated.

Bhutan: Small Power system (1614 MW); Hydro Dominated, Surplus Hydro, Exporting to India. Leading Exporter of Hydro Electricity.

Bangladesh: Gas Dominated, Resource Crunch, Imports Electricity from India and in future will remain as one of the Leading electricity importing country.

India: Large Power System, Coal dominated, reducing deficits, long terms electricity demand are huge and potential large market, The Leading Electricity importing and exporting nation. Large Renewable Capacity Addition.

Nepal: Very small power system (765 MW), Hydro based, very high deficits, Importing Electricity from India, Potential for Larger exporter for Hydro Electricity in medium term and importer of electricity in Short Term.

Sri Lanka: Hydro dominated but the flex mix is changing, High peak demand.

<table>
<thead>
<tr>
<th>Country</th>
<th>Installed Capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afghanistan</td>
<td>1341</td>
</tr>
<tr>
<td>Bhutan</td>
<td>1,614</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>12,071</td>
</tr>
<tr>
<td>India</td>
<td>30,283</td>
</tr>
<tr>
<td>Nepal</td>
<td>765</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>4050</td>
</tr>
<tr>
<td>Pakistan</td>
<td>24,829</td>
</tr>
<tr>
<td>Maldives</td>
<td>90</td>
</tr>
<tr>
<td>Total</td>
<td>3,47,593</td>
</tr>
</tbody>
</table>

### Regional Resource Potential: Hydro Potential: 350 GW!

**Vast potential of hydro power: 350 GW**

**Bhutan, Nepal, Pakistan, India, 30,83, 59, 150 GW respectively.**

**Nepal and Bhutan can build exported oriented hydro plants.**

**Significant Coal deposits in India and Pakistan.**

**Coal deposits in Bangladesh yet to be exploited effectively.**

In addition, there is a huge renewable energy resources like solar and wind.

<table>
<thead>
<tr>
<th>Country</th>
<th>Coal (million tons)</th>
<th>Oil (million barrels)</th>
<th>Natural Gas (trillion cubic feet)</th>
<th>Biomass (million tons)</th>
<th>Hydro (GW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afghanistan</td>
<td>440</td>
<td>NA</td>
<td>15</td>
<td>18–27</td>
<td>25</td>
</tr>
<tr>
<td>Bhutan</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>26.6</td>
<td>30</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>884</td>
<td>12</td>
<td>8</td>
<td>0.08</td>
<td>0.33</td>
</tr>
<tr>
<td>India</td>
<td>90,085</td>
<td>5,700</td>
<td>39</td>
<td>139</td>
<td>150</td>
</tr>
<tr>
<td>Maldives</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.06</td>
<td>0</td>
</tr>
<tr>
<td>Nepal</td>
<td>NA</td>
<td>0</td>
<td>0</td>
<td>27.04</td>
<td>83</td>
</tr>
<tr>
<td>Pakistan</td>
<td>17,550</td>
<td>324</td>
<td>33</td>
<td>NA</td>
<td>59</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>NA</td>
<td>150</td>
<td>0</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>108,961</strong></td>
<td><strong>5,906</strong></td>
<td><strong>95</strong></td>
<td><strong>223</strong></td>
<td><strong>349.33</strong></td>
</tr>
</tbody>
</table>

Source: SAARC Secretariat (2010) for Bangladesh, Bhutan, India, Nepal, Sri Lanka; CWC (2005) for Indian States and WAPDA (2011) for Pakistan

<table>
<thead>
<tr>
<th>Renewables</th>
<th>Bangladesh</th>
<th>India</th>
<th>Nepal</th>
<th>Bhutan</th>
<th>Pakistan</th>
<th>Sri Lanka</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar Power (Kwh/sq. m per day)</td>
<td>3.8 - 6.5</td>
<td>4 - 7</td>
<td>3.6 - 6.2</td>
<td>2.5 - 5</td>
<td>5.3</td>
<td>NA</td>
</tr>
<tr>
<td>Wind (MW)</td>
<td>limited potential</td>
<td>151,918</td>
<td>3,000</td>
<td>4,825</td>
<td>24,000</td>
<td>25,000MW</td>
</tr>
</tbody>
</table>
## Current Status of Cross Border Electricity Trade (CBET) and Future Trading Scenarios

### Current India
- **India→Bangladesh**: approx. 600 MW
- **India→Nepal**: approx. 330 MW
- **India→Bhutan**: approx. 1400 MW

### Source: Compiled from various resources, News Paper articles etc.

<table>
<thead>
<tr>
<th>Current India-Bhutan</th>
<th>Current India-Bangladesh</th>
<th>Current India-Nepal</th>
</tr>
</thead>
<tbody>
<tr>
<td>** approx. 1400 MW**</td>
<td>approx. 600 MW</td>
<td>approx. 330 MW</td>
</tr>
</tbody>
</table>

### Electricity Import (GW) by India from Neighbouring Countries

- **Export Least Effort (GW)**
- **Export Determined Effort (GW)**
- **Export Aggressive Effort (GW)**
- **Export Heroic Effort (GW)**

### Electricity Export (GW) from India to Neighbouring Countries

- **Import Least Effort (GW)**
- **Import Determined Effort (GW)**
- **Import Aggressive Effort (GW)**
- **Import Heroic Effort (GW)**

### Key Points:
- **Tala**: 1.80 INR/kWh for 1st year (now 1.98 INR/kWh)
- **Dagachhu**: 2.40 INR/kWh for 1st year (started in 2015)
- **NVVN**: 2.40-2.86 INR/kWh (Aug’14-May’15)
- **PTC**: 4.26-5.00 INR/kWh (Dec’13-May’15)
- **Tripura-Bangladesh**: Rs 5.50 per unit
- **NVVN-NEA PPA (80 Mw)** INR 3.44
- **Treaty/Bilateral**: Current 5.40 INR/kWh
- **PTC**: 4.55, 4.35, 4.30, 3.75 INR/kWh (FY11-FY14)
- **NVNL-NEA PPA (80 Mw)** INR 3.44
- **NVNL**: 2.40-2.86 INR/kWh (Aug’14-May’15)
- **PTC**: 4.55, 4.35, 4.30, 3.75 INR/kWh (FY11-FY14)
- **NVNL-NEA PPA (80 Mw)** INR 3.44

### Total CBET in SA
- **2330 MW**

### Arrow Direction shows Net Flows
- **Bhutan→India**
- **India→Bangladesh**
- **India→Nepal**
Key Drivers for CBET and Regional Exploitation of Energy Resources

- Low per Capita electricity consumptions
- Electricity Shortages.
- Poor access to electricity.
- Optimal utilization of energy resources.
- Fostering Economic Growth and Regional Integration
- Resource Crunch
- Opportunity - regional electricity market.
- Seasonal complementarities

Nepal and Bhutan
Large hydropower resources; Nepal - severe power shortages, Economic benefits of Trade

Bangladesh: Power shortages, Large Suppressed Demand, heavy reliance on natural gas and plans for large coal power

Afghanistan and Pakistan
Access to large hydropower resources, Severe power shortages, High Demand Growth

Sri Lanka
Heavy reliance on liquid fuel and plans for large coal power development

India: High demand growth, coal power dominated, power deficits, Renewable energy Growth

Economic Benefits of The Planned Interconnection in South Asian Region

- Annualized cost of Interconnection (USD million)
- Annual joint benefit in 2016/17 (USD million)

Source: Cross-Border Power Trading in South Asia: A Techno Economic Rationale
Power Sector Reform in South Asia and CBET Policy Governing Framework

Vertically Integrated
- Afghanistan (DABS)
- Maldives (FENAKA)
- Nepal (NEA)
- Sri Lanka (CEB)

Partially un-bundled
- Bangladesh (Separate Trans. Utility)
- Bhutan (Separate Gen. utility)

Un-bundled
- India (Separate G,T,D utilities)
- Pakistan (Separate G,T,D utilities)

Country Policy Regulation Trading

Afghanistan Ministry of Energy and Water Afghanistan Electricity Regulatory Authority (AERA) (Proposed) SB Model , AERA
Bangladesh Ministry of Power, Energy and Mineral Resources Bangladesh Energy Regulatory Commission (BERC) SB Model , BPDB
Bhutan Ministry of Economic Affairs Bhutan Electricity Authority (BEA) Export Licensees, SB Model
India Centre- Mop, GOI State: Power/Energy Department State Government Central: CERC, State: SERCs/JERCs MB and MS Model Central: Inter-state Licensees State: Discoms/Trade Cos / Intra-state Licensees
Nepal Ministry of Energy (MoE) Electricity Tariff Fixation Commission (ETFC) SB Model , NEA
Pakistan Ministry of Water and Power National Electric Power Regulatory Authority Central Power Purchase Agency
Sri Lanka Ministry of Power and Energy Public Utilities Commission of SL SB Model , CEB

CBET Policy Governing Framework
It is mainly through Bilateral Agreements/MoU between Countries.

India-Bhutan:
1. 2006 Framework Agreement on Hydropower development & Trade
2. Framework IG Agreement for joint venture projects.

India-Bangladesh: A MoU signed on January 2010 between 2 Governments for bilateral Co-operation in the areas of Power Generation, Transmission.....


Countries are taking steps on domestic Regulation and on Policy side to remove any barrier to CBET if any.
Significant Transmission System Interconnection (Both AC and DC) are being Planned and Proposed. Bangladesh is in the process of Planning to Import around Apprx. 6000 MW by 2034 (PMSP 2015-JICA Presentation, 4th June, 2015).

Regional Transmission Capacity by 2033-34, 2040

Source: How Much Could South Asia Benefit from Regional Electricity Cooperation and Trade, World Bank

All Fig are in MW

Source: MoP, Gol, Perspective Transmission Plan Twenty Years (2014-2034) and Author's assessments for 278 MW of Transmission Capacity (132 & 33 kV levels) ~1200 MW (Dhalikebar-Musarbarpur 400 KV Line)


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Regional Hydro Power May help in Renewable Integration and Grid Balancing

- Hydro share in India has been declining over the years (45% in 1970 to Apprx 15% in 2015)

- In terms of National Electricity policy, spinning reserves at 5%. With 275 GW generating capacity existing as on date and nearly 150 GW peak demand, the quantum of reserves has been estimated at about 4 GW of primary reserve, 3.6 GW of secondary reserve and 7 GW of other reserves.

- Regional Ancillary Market- India Has started ancillary market recently.

All India Installed Capacity = 288 GW (As on 18th Feb, 2016)

Projected All India Installed Capacity = 535 GW (Projection 2022)
Key Challenges and Risk for CBET: Need for a Comprehensive Framework

Key Challenges

1. Political Consensus: Regional Cooperation and Recognition of CBET/Trade in the National Policy, Law etc.
2. Government Commitment & Policy Coordination
3. Financial Challenges, Investment, Financial Viability
4. Mechanism of Inter-connection
5. Market form of Trade
6. Regional Cooperation on Regulatory and Contractual Aspects
7. Open Access in Transmission
8. Transmission Charges/Pricing
9. Transmission Plan
10. Commercial Mechanisms to Settle Imbalances
11. Dispute Resolution

Motivation behind these challenges is to address the typical Risks in Cross-Border Projects. What are the Risk?

- Funding Risk
- Financial Risk
- Exchange Rate Risk
- Financing Risk
- Legal & Regulatory Risk
- Security Risk
- Currency Transfer Restriction Risk
- Dispute Resolution Risk
- Expropriation and Breach of Contract
- Planning & Construction Risk
- Commercial Risk
- Pricing and Payment Risk
- Supply Risk
- Cross Border Electricity Trade
- Regional Power System at Initial Stages
- Regional Power System in Transition and in Mature Stages
- Country Risks
- Regional Power System/ Initial Stages

South Asian Power Sector Regional Energy Cooperation-RRGs for CBET & Hydro Power Development in SA/SAARC Workshop/ Nepal/ Rajiv/SARI/EI/ IRade
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SARI/E is a long standing program of USAID started in the year 2000.

Program has consistently strived to address energy security in South Asia by focusing

1) Cross Border Energy Trade
2) Energy Market Formation and
3) Regional Clean Energy Development.

Three Key Development Outcomes:

1. Coordinate policy, legal and regulatory issues.
2. Advance transmission interconnections.
3. Establish South Asia Regional Electricity Markets.

First Three Year of the Program is Completed.

Demand Driven ‘Bottom Up’ Approach

IRAdE, a regional organization, is implementing partner

• Project Steering Committee (PSC) consist of government nominated Senior level officials from the country governments, SAARC, ADB, Independent Energy Experts/Diplomats.

• Intergovernmental Task Forces: Task Force Members are represented by government nominated members from Regulatory Technical, market related institution of each SA countries.
Overall Framework for development of CBET in South Asia

SAARC Framework Agreement on Energy (Electricity) Cooperation

CBET facilitation through

Institutional Mechanism

Regional Regulatory Guidelines
Regional Investment Framework and Investment Policy Guidelines
Harmonization of Grid Codes
Assessment of trading Potential
Model framework for Open Access and Trading License Regime
Transmission Pricing rules & methodology
Model Regulation for Power Market Development
Standard Contracts (Bankable PPAs/TSA s)
Mock Exercise for SARPEX

Suggested Changes/Amendments in Electricity Laws, Regulations and Policies (L&R&P) of South Asian Countries.

Undertaken as part of the TF-1 and has been Published
Thank You