South Asia Regional Initiative for Energy Integration

Presentation on

- Emerging Trends in Cross-border Electricity Trade in South Asia and Future Outlook: Regulatory Implications and Roadmap
- Common Minimum Grid code for facilitating Cross-Border Electricity Trade in South Asia
- Open access in Transmission and Trading License Frameworks for advancing Cross-Border Electricity Trade and Development of Regional Power Trade in South Asia

Presented by
Rajiv Ratna Panda, Technical-Head, SARI/EI, IRADe

Fourth Meeting of SAARC Energy Regulators, 06-07 Feb. 2020, Thimphu, Bhutan
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- **Common Minimum Grid code for facilitating Cross-Border Electricity Trade in South Asia**
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- **Open access in Transmission and Trading License Frameworks for advancing Cross-Border Electricity Trade and Development of Regional Power Trade in South Asia.**
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Evolution of Cross Border Electricity Trade (CBET) in South Asia
History of evolution of Energy Cooperation, CBET- Key Policy & Regulatory Development

Kosher treaty between Nepal & India

1954

Nepal-India Power Exchange Committee (PEC) constituted

1992

Jaldhaka agreement Indo-Bhutan hydropower cooperation

1961*

Agreement between Govt. of India and Royal Govt. of Bhutan on Tala Hydro Power Project - 1020 MW - first unit commissioned on July 31, 2006 & last unit on March 30, 2007

5th Mar, 1996

Indo-Nepal Power exchange 5 MW in initial Years

1971

Agreement between Govt. of India and Royal Govt. of Bhutan on Chuka hydro power project to India (Plant Inaugurated on October 21, 1988)

Mar 1974 **

Agreement between Govt. of India and Royal Govt. of Bhutan on cooperation in Hydroelectric Power

Jul 2006


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<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>MoU between Govt. of India and Govt. of Bangladesh, on cooperation in power sector</td>
<td>Jan 2010</td>
</tr>
<tr>
<td>Sub-Regional Cooperation between Bangladesh, Bhutan, India and Nepal (BBIN)</td>
<td>Oct 2010</td>
</tr>
<tr>
<td>MoU for carrying out a feasibility study for interconnection of the India-Sri Lanka electricity grids (Signed among GOSL, GOI, CEB &amp; PGCIL)</td>
<td>Jun 2010</td>
</tr>
<tr>
<td>MoU on CASA 1000 Project signed among 4 participating countries*</td>
<td>Apr 2014</td>
</tr>
<tr>
<td>Guidelines on Cross Border Electricity Trade (CBTE) issued</td>
<td>Dec 2016</td>
</tr>
<tr>
<td>Ministry of Power Designates Nodal agency for CBTE</td>
<td>Dec 2016</td>
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<td>Guidelines on Cross Border Electricity Trade (CBTE) issued</td>
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<td>MoU between Nepal &amp; Bangladesh, on cooperation in power sector</td>
<td>Aug 2018</td>
</tr>
<tr>
<td>MoU on BIMSTEC Grid Interconnection</td>
<td>Oct 2016</td>
</tr>
<tr>
<td>New CBTE Guidelines Issued (Repealed 2016 Guideline)</td>
<td>Dec 2018</td>
</tr>
<tr>
<td>CERC Notifies Cross Border Trade of Electricity Regulations, 2019.</td>
<td>March 2019</td>
</tr>
<tr>
<td>CE-A Draft Conduct of Business Rules (CBR) for CBTE.</td>
<td>April 2019</td>
</tr>
<tr>
<td>Indo-Nepal Power Trade Agreement</td>
<td>June 2017</td>
</tr>
<tr>
<td>NEPRA (Import of Electric Power Regulations)</td>
<td>June 2017</td>
</tr>
</tbody>
</table>

* Core project agreements viz. Master Agreement and the Power Purchase Agreements between 4 participating countries, Apr 2015
Current Cross Border Electricity Trade (CBET) & Future Scenario
South Asia - Current Cross Border Power Trade (MW) Scenario and It’s Evolution

Across the Region:
- India-Myanmar ~ 3-5 MW of CBET, Pakistan-Iran ~ 10-4 MW CBET, Afghanistan-Imports around 1000 MW collectively from Uzbekistan (326 MW), Iran (164 MW), Tajikistan (433 MW), Turkmenistan (77 MW)

Emerging Trends in CBET in SA and Future Outlook:

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South Asia Power Sector: 1068 GW by 2040

Current South Asia-Power Installed Capacity (GW)

- Afghanistan (2017): 22 GW (5%)
- Bhutan (2019): 4.8 GW (1%)
- Bangladesh (2019): 17.3 GW (4%)
- India (Nov-2019): 78.3 GW (20%)
- Nepal (2019): 11.7 GW (3%)
- Sri Lanka (2018): 1.7 GW (0%)
- Pakistan (2018): 14.8 GW (4%)
- Maldives (2017): 0.5 GW (0%)

Total: 364 GW (84%)

South Asia Power Installed Capacity (GW)-2040*

- Afghanistan: 9.3 GW (1%)
- Bhutan: 7 GW (2%)
- Bangladesh: 173 GW (25%)
- India: 783 GW (73%)
- Nepal: 11.7 GW (1%)
- Sri Lanka: 1.7 GW (0%)
- Pakistan: 14.8 GW (2%)
- Maldives: 1000 GW (100%)

Total: 1068 GW

(*) Projection as per the World Bank Report on “How Much Could South Asia Benefit from Regional Electricity Cooperation and Trade?”. For Maldives, 1000 MW of capacity is assumed by 2040.

Source: Compiled from Various Sources

South Asia Power Grid: Transmission Capacity- 2036/2040

- Rapid Expansion is envisaged.

- 43.8 GW of cross border Grid Interconnection by 2036.

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**South Asia Power Installed Capacity (GW)**

- **Afghanistan (2017)**: 0.3 (0%)
- **Bhutan (2019)**: 0.2 (1%)
- **Bangladesh (2019)**: 22 (5%)
- **India (Nov-2019)**: 364 (84%)
- **Nepal (2019)**: 0.5 (0%)
- **Sri Lanka (2018)**: 1.2 (0%)
- **Pakistan (2018)**: 14.8 (2%)
- **Maldives (2017)**: 173 (16%)

**South Asia Power Grid: Transmission Capacity - 2036/2040**

- **Additional 43.8 GW Cross Border Grid Interconnection by 2036**

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- **Emerging Trends in CBET in SA and Future Outlook:**
  - Regulatory Implications and Roadmap
  - Common Minimum Grid code for facilitating CBET
  - Open access in Transmission and Trading License Frameworks for advancing CBET

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**Compiled from:** CEA Perspective Transmission Master Plan, Bangladesh - PSMP-2016, Other Sources

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**Notes:**

1. Nepal - India 15800 MW
2. Bhutan - India 17100 MW
3. India - Sri Lanka 1000 MW
4. Bangladesh - Nepal to India 4000 MW
5. Nepal to Bangladesh via India 2000 MW
6. Bhutan to Bangladesh via India 1000 MW
7. India - Pakistan 1000 MW
8. Afghanistan - Pakistan 1000 MW
9. Total 43800 MW
10. By 2036 MW
11. India - Myanmar 1500 MW
12. Bangladesh - Myanmar 500 MW
13. Total MW 45800 MW

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Cross Border Electricity Trade in South Asia: Emerging Trends
Emerging Trend-1
Power system and Market Integration evolution across the Globe

Establishing Bilateral Connections, bilateral Market

Moving towards Trilateral/Quadrilateral Connection, Trilateral Market

Developing Sub-regional Grids, Sub-Regional Power Market

Fully Interconnecting sub-regional Grids and Creating Common Grid and Unified Market

SA CBET Emerging Trend-1:-Moving from Bilateral to Tri/Multilateral and Market Integration
3.1 The import/export of electricity between India and the neighbouring country(ies) may be allowed through mutual agreements between Indian Entity(ies) and Entity(ies) of the neighbouring country(ies) under the overall framework of agreements signed between India and the neighbouring country(ies) consistent with the provisions of the prevailing laws in the respective country(ies), including:

(a) through bilateral agreement between two countries
(b) through bidding route; or
(c) through mutual agreements between entities

Provided that in case of tripartite agreements, the cross border trade of electricity across India shall be allowed under the overall framework of bilateral agreements signed between Government of India and the Government of respective neighbouring country(ies) of the participating Entity(ies).

8.6 Where tripartite agreement is signed for transaction across India, the participating entities shall sign transmission agreement with Central Transmission Utility of India for obtaining the transmission corridor access. Further the transmission system in India for transmission of electricity across the territory of India under cross border trade of electricity shall be built after concurrence from Government of India and necessary Regulatory approvals.
Bangladesh Power Import as per Master Plan -2016 from SA countries

**High case**

- **Total 8,500MW**
  - **Bangladesh to import from Bhutan and Nepal through India:** Bhutan, 500 MW by 2032, 500MW by 2034 (Bongaigaon/Rangia – Jamarpur);
  - from Nepal, 500 MW 2031, 500 MW by 2035 and 500 MW by 2038.

**Low case**

- **Total 7,000MW**

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**Source:** https://mpemr.gov.bd/assets/media/pdf/files/FR_PSMP_revised.pdf

**FY2035**

- Bangladesh will import 500 MW of electricity from Upper Karnali (GMR) in Nepal @ 7.72 cents per unit for a period of 25 years. (Deal Finalised)
Emerging Trend-2
SAARC - Significant Environment/Climate Change Challenge

SAARC Countries-fossil_CO2_by_sector_in Mt CO2/yr (2018)


Source: Climate Emergency COP 25: India is the only major economy to be ‘2 degree compatible’, Fossil CO2 and GHG emissions of all world countries 2019 Report - JRC SCIENCE FOR POLICY REPORT

SAARC - Significant Environment/Climate Change Challenge

Fossil CO2 Emission by Sector-India (Mt CO2/yr) & Per Capita (t CO2/cap/yr)

Fossil CO2 Emission in Mt CO2/yr (% Share)
4 Nations - 60% Global Emission

Source: Climate Emergency CoP 25: India is the only major economy to be '2 degree compatible', Fossil CO2 and GHG emissions of all world countries 2019 Report - JRC SCIENCE FOR POLICY REPORT


INDIA POWER INSTALLED CAPACITY (MW) IN OCT. 2019

- Hydro *
- Solar
- Coal + Lignite
- Gas
- Nuclear
- Wind
- Biomass

* including small hydro

364 GW
14%
10%
3%
8%
2%
7%
56%

INDIA POWER INSTALLED CAPACITY (MW) IN 2030 **

- Hydro *
- Solar
- Coal + Lignite
- Gas
- Nuclear
- Wind
- Biomass

* including small hydro of 5000 MW and hydro imports of 4356 MW

831 GW
17%
1%
9%
36%
2%
3%
32%

RES (Hydro + Solar + Wind)= 118 GW (32%) RES (Solar + Wind)=68 GW (18%)
RES (Hydro + Solar + Wind)= 513 GW (62%) RES (Solar + Wind)=440 GW (53%)

** As per CEA DRAFT REPORT ON OPTIMAL GENERATION CAPACITY MIX - 2029-30, FEB 2019
Regional Hydro Power can help in Renewable Integration and Grid Balancing

- Role of Cross Border Hydro in Renewable Integration and Grid Balancing.
- India RE Target - 175 GW by 2022
- India: 450 GW of renewable energy by 2030 *
- Hydro share in India has been declining over the years (45% in 1970 to Apprx 12% in 2020)
- National Electricity policy (GoI), spinning reserves at 5%**.
- Developing Regional Ancillary Market - India has started ancillary market.

Source: * https://presidentofindia.nic.in/speeches-detail.htm?798, https://economictimes.indiatimes.com/real-biz/production/power-generation/india-to-have-450-ge-renewable-energy-by-2022-president/articleshow/73804463.cms?from=mdr, while the timing is sometimes unclear, recent government reports indicate 2030 as the target year for the 450 GW target. **CEA’s National Electricity Plan (NEP) 2018 had already projected a higher share of renewables (44%) compared to coal (38%) in 2027. CEA’s CEA report on ‘Optimal Generation Capacity Mix for 2029-30’ projects that renewable energy sources (solar + wind) installed capacity will become 440 GW by the end of year 2029-30 which is more than 50% of total installed capacity of 831 GW.
Regional Hydro Power can help in Renewable Integration and Grid Balancing

- Role of Cross Border Hydro in Renewable Integration and Grid Balancing.

- India RE Target -175 GW by 2022

- India: 450 GW of renewable energy by 2030 *

- Hydro share in India has been declining over the years (45% in 1970 to Apprx 12 % in 2020)

- National Electricity policy (GoI), spinning reserves at 5%**.

- Developing Regional Ancillary Market- India has started ancillary market.

Very Important Recent Development: Innovative Model to Address RE Intermittency and Ensure RE Grid Integration

- SECI -Bids called to develop 1200 MW ISTS- Connected RE Projects* with assured Peak Power Supply in India i.e. with Energy Storage System
  - (01.08.2019)

- Provided a flat tariff payment of Rs. 2.70/kWh (Off Peak power)

- peak power tariff through e-Reverse Auction

- Greenko-awarded 900 MW peak power tariff - rate of Rs 6.12 (~$0.086)/ kWh,

- ReNew Power - 300 MW, peak tariff Rs 6.85 (~$0.096)/ kWh on 31.01.2020

Source: * https://presidentofindia.nic.in/speeches-detail.html?

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\* WIND-SOLAR HYBRID POWER PROJECT* means the wind-solar hybrid power project where the rated power capacity of one resource is at least 25% of the rated power capacity of the other resource

PEAK HOURS shall mean the energy scheduling hours between (& including) 06:00 hrs to 09:00 hrs, and between (& including) 18:01 hrs to 24:00 hrs of the same day. For the purpose of scheduling, a ‘day’ shall commence from 00:00 hrs and end at 24:00 hrs, minimum 6-hour Peak Power supply, on daily basis, during the Peak Hours Source: https://energy.economictimes.indiatimes.com/news/renewable/greenko-renew-win-worlds-largest-renewable-cum-storage-based-firm-supply-tender-for-1-2-gw/73825401

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Total installed capacity of 835 GW. **With 775 GW generating capacity and nearly 150 GW peak demand. Technical Committee for “Large-Scale Integration of Renewable Energy, need for balancing, Deviation Settlement Mechanism (DSM) and associated issues.”

BUSINESS MODEL

- Provided a flat tariff payment of Rs. 2.70/kWh (Off Peak power)

- peak power tariff through e-Reverse Auction

- Greenko-awarded 900 MW peak power tariff - rate of Rs 6.12 (~$0.086)/ kWh,

- ReNew Power - 300 MW, peak tariff Rs 6.85 (~$0.096)/ kWh on 31.01.2020

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Source: * http://presidentofindia.nic.in/speeches-detail.html?
### Implementation Roadmap

<table>
<thead>
<tr>
<th>Goal 04</th>
<th>Enhance cross border trade through market products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal</td>
<td>Potential Interventions/ Actions</td>
</tr>
<tr>
<td></td>
<td>• Introduce standardized products in Day-Ahead Markets, Intra-day, Term-Ahead market for cross-border electricity trading – physical delivery</td>
</tr>
<tr>
<td></td>
<td>• Introduce products in Balancing market for trading of balancing services from fast response plants such as Hydro</td>
</tr>
<tr>
<td></td>
<td>• Introduction of financial products – futures &amp; derivatives</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Goal 03</th>
<th>Deepen products in markets to enhance clean energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal</td>
<td>Potential Interventions/ Actions</td>
</tr>
<tr>
<td></td>
<td>Introduction of <strong>Real Time Market (RTM)</strong> for improved reliability and control and better absorption of RE</td>
</tr>
<tr>
<td></td>
<td>Move from regulated to market based mechanism for Ancillary Services</td>
</tr>
<tr>
<td></td>
<td>Inclusion and scale up of innovative models for Decentralised Renewable Energy (DRE) based access</td>
</tr>
</tbody>
</table>

Source: [https://www.egmapro.com/five-year-vision-document-for-power-sector/](https://www.egmapro.com/five-year-vision-document-for-power-sector/)
**South Asia: Market Integration Evolution**

- **Legal** (G to G, bilateral agreements, trade of excess power etc.)
- **Contractual**
- **Regional Power Market**

**Moving Towards Market form of Trade**

- Possible Phases of Market development for CBET
- Continuous Trading
- Spot Markets on exchanges
- Auction Markets
- OTC Markets
- Trading Licence
- Deemed Trading Licence
- Nodal Agency

**Level of Energy Cooperation among SAARC Member countries**

An mix of Long Term, Medium Term, Short term and PX based Trade will be desirable one for A Journey towards the Vision of a Competitive Power Market

**Level of Standards, Grid Code, System operation, planning (Technical), Policy, Regulatory Harmonization**

- Low
- High
## Moving Towards Market form of Trade (G-G & Market)

<table>
<thead>
<tr>
<th>Country (~ CBET)</th>
<th>Capacity/Source (MW)</th>
<th>Type</th>
<th>Trader</th>
<th>Tenure in Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bhutan- India (~1800-1900 MW)</td>
<td>2136</td>
<td>G-G</td>
<td>PTC</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>126</td>
<td>Commercial/Market based</td>
<td>TPTCL</td>
<td>25</td>
</tr>
<tr>
<td>India – Bangladesh (~1160 MW)</td>
<td>410</td>
<td>G-G</td>
<td>NVVNL</td>
<td>25/5 (Tripura)</td>
</tr>
<tr>
<td></td>
<td>750</td>
<td>Commercial/Market based</td>
<td>PTC*, NVVNL, Sembcorp</td>
<td>15/3 (PTC)</td>
</tr>
<tr>
<td>India-Nepal (~550 MW)</td>
<td>237</td>
<td>G-G</td>
<td>NVVN/PTC**</td>
<td>Renewed Every year</td>
</tr>
<tr>
<td></td>
<td>280- Upto 350 MW</td>
<td>Commercial/Market based</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Gol guidelines allows CBET through PXs, Trade is expected to start in near future**

Bhutan-India; G-G: 1020 MW Tala; 336 MW Chhukha; 60 MW Kurichhu I Market: 126 MW Dagachhu I India – Bangladesh; G-G: 250 NVVN, 160 NVVN (Tripura) I Sembcorp: 250 MW, NVVN:300 MW BPDB Short & Long Term contract with NVVN for 300 MW power from DVC I PTC: 200 MW (BPDB Short-term contract for 200 MW with WBSEDCL + long term with Meenakshi Power through PTC) I India-Nepal, BSPHCL(Bihar to Nepal) 200MW **PTC 20 to 35 MW of power to NEA on commercial terms during dry season - 132 kV Tanakpur – Mahendranagar line.
Regulatory Implications and Road Map

- SAARC countries need to continue to work on developing harmonious policy & regulatory frameworks across countries.

- Developing Complementary/parallel regulations across SAARC countries, taking steps for development of appropriate Regulation based on Model SAARC Electricity Regulation for Regional Power Trade (SERRPT) as a reference.

- SAARC countries Need to develop Regulatory Framework including rules/procedures for facilitating Trilateral Power trade.

- SAARC countries needs to develop Regulatory Framework for developing power market, region grid balancing market, ancillary services market for RE grid integration.

- SAARC countries needs Develop Rule and associated Regulatory framework for trading through Power Exchange and other Power market platforms.

- SAARC Countries-Some Minimum Requirements for Market, trilateral trade :-grid code, Open access, trading license, Transmission Pricing, connectivity, deviation settlement etc.
Common Minimum Grid Code for Facilitating CBET
Common Minimum Grid Code: Objective

• The Common Minimum Grid Code for South Asia: lays down the rules, guidelines and standards to be followed by various South Asia country participants in the system for cross border trading in electricity, while operating the power system, in the most secure, reliable, economic and efficient manner.

• Facilitation of cross border trading of power, while ensuring secure, reliable, economic and efficient operation of the grid.

• Facilitation of the coordinated optimal operation of the South Asian Grid.

• Facilitation of coordinated and optimal maintenance planning of generation and transmission facilities in the South Asian grid.

Common Minimum Grid Code: Applicability

Applicable to all countries of South Asia (SA), who get connected to the SA grid through a synchronous or a-synchronous (i.e. HVDC) connection.

Each SA country will initially be represented by a single point of contact for the initiation of implementation of the Common Minimum Grid Code.

Single point of contact will be supported by the relevant Ministry dealing with power, the Regulator of the respective country, the transmission agency of the respective country, the system operator of the respective country and the accounts settlement/market operator of the respective country.

Later, to formalize the process of implementation, Regional coordination bodies need to be formed for South Asia, i.e. South Asia Forum at the Government level, at the Regulator level, at the planning body level, transmission utility level, at the system operator level and at the accounts settlement/market operator level.

A South Asia Power Portal would be made for information of all South Asian countries. This would be maintained by the South Asia Forum at the planning level.
Emerging Trends in CBET in SA and Future Outlook: Regulatory Implications and Roadmap, Common Minimum Grid code for facilitating CBET, Open access in Transmission and Trading License Frameworks for advancing CBET and Development of Regional Power Trade in SA:

4th Meeting of SAARC Energy Regulators, 06-07 Feb. 2020, Thimphu, Bhutan by Rajiv Ratna Panda, Technical Head /SARI/EI/IRADE

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Common Minimum Grid Code: Structure

Connection Code

Operating Code

Scheduling & Despatch Code

Administration of the Grid Code
**Common Minimum Grid Code**

**Connection Code**
- Procedure for Inter Country connection
- Important Technical Requirements for Connectivity to the Grid
- Connection Agreement

**Operating Code**
- Frequency Band 49.9 – 50.05 Hz
- Voltage Band for 400 kV at inter. Point 380-420 kV
- System Security-Protection Coordination & periodic Protection testing
- Operation liaison.
- Restoration Plans including Black Start.
- Periodic Reports – Daily, Monthly Reports.
- Outage Planning

**Scheduling and Despatch Code**
- Scheduling and Despatch Procedure.
- maintaining actual drawal from SA Asia grid close to schedule
- Deviation Settlement mechanism.
- Reactive power drawals to be controlled at inter-country connection points.

**Administration of the Grid Code**
- Ultimately, the Forum of South Asia Regulators would do that.
Open access in Transmission and Trading License Frameworks for advancing Cross-Border Electricity Trade and Development of Regional Power Trade in South Asia
### Article 12: Transmission Access
- Member States shall, for the purpose of cross-border trade, enable non-discriminatory access to the respective transmission grids as per the applicable laws, rules, regulations and applicable inter-governmental bilateral trade agreements.

### Article 6: Promoting Competition:
- Member states will encourage the process of opening up of the electricity sector, guided by the respective national priorities with the aim of promoting competition.

### Article 13: Facilitating Buying and Selling Entities:
- ‘Member states shall enable Buying and Selling Entities to engage in cross border electricity trading, subject to the laws and regulations of the concerned member states’.

### Article 9: Transmission Service Agreements
- Member States may facilitate authorized Buying and Selling Entities to enter into transmission service agreements with the transmission service providers for the purpose of cross-border electricity trade.

### Article 7: Planning of Cross-border interconnections
- Member States may enable the transmission planning agencies of the Governments to plan the cross-border grid interconnections through bilateral/trilateral/mutual agreements between the concerned states based on the needs of the trade in the foreseeable future through studies and sharing technical information required for the same.

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**SARI-EI Study: Open Access Desirable pre-requisites availability in South Asia power sector**

<table>
<thead>
<tr>
<th>Article 12</th>
<th>Transmission Access</th>
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<tbody>
<tr>
<td><strong>Member States</strong> shall, for the purpose of cross-border trade, <em>enable non-discriminatory access</em> to the respective transmission grids as per the applicable laws, rules, regulations and applicable inter-governmental bilateral trade agreements.</td>
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<tr>
<th>Article 6</th>
<th>Promoting Competition</th>
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<td><strong>Member states</strong> will encourage the <em>process of opening up of the electricity sector</em>, guided by the respective national priorities with the aim of <em>promoting competition</em>.</td>
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<th>Facilitating Buying and Selling Entities</th>
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<td>‘<strong>Member states</strong> shall enable <strong>Buying and Selling Entities</strong> to engage in cross border electricity trading, subject to the laws and regulations of the concerned <strong>member states</strong>’.</td>
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<thead>
<tr>
<th>Article 9</th>
<th>Transmission Service Agreements</th>
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<td><strong>Member States</strong> may facilitate authorized <strong>Buying and Selling Entities</strong> to enter into transmission service agreements with the transmission service providers for the purpose of cross-border electricity trade.</td>
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SARI-EI Study: Open Access Desirable pre-requisites availability in South Asia power sector

<table>
<thead>
<tr>
<th>Institutional Framework</th>
<th>Afghanistan</th>
<th>Bangladesh</th>
<th>Bhutan</th>
<th>India</th>
<th>Maldives</th>
<th>Nepal</th>
<th>Pakistan</th>
<th>Sri Lanka</th>
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<tr>
<td>Power Market Structure</td>
<td>⬜️</td>
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<tr>
<td>Independent Transmission Operator</td>
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<td>Commercial – Tariff, etc.</td>
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<td>Open access in domestic</td>
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</table>
| **Introduce enabling provisions for open access**        | • Introduction of **open access in the legislative framework** for electricity where it does not exist  
• Treatment of open access for cross border trade  
• Introducing **changes in the power market structure** to aid and enable open access  
• **Enable system operators** to co-ordinate cross border power flows                                                                 |
| **Define features and eligibility criteria for connectivity and open access** | • **Types** of open access  
• **Tenure and priority** of various types of open access  
• Eligibility **criteria for connectivity and open access**                                                                                   |
| **Fixation of open access charges**                       | • **Segregation and fixation** of transmission & system operation charges  
• **Application fees**  
• **Relinquishment** charges for open access                                                                                                    |
| **Terms and conditions, and information system for open access** | • **Terms and conditions** for open access  
• Open access register and other information systems                                                                                          |
| **Procedure for grant of connectivity and open access**   | • **Procedure** for connectivity  
• Procedure for STOA, MTOA and LTOA  
• **Nodal agencies**, processing time lines, required documents etc.                                                                                 |
| **Establishing the operational and commercial mechanisms** | • Approval of **detailed procedures** for open access  
• Committee to prepare **monthly energy accounts**  
• **Standard agreements.**                                                                                                                  |
| **Encouraging regional mechanisms for co-ordination in CBET** | • Ensuring co-operation and support in the operationalization of **regional forums** for collaboration in CBET                                         |

SARI-EI Study: Trading License - Desirable pre-requisites availability in South Asia power sector

- Trader are important market intermediaries.
- In SA, CBET is transacted through Trading Licenses.
- CBET through PXs through Traders of India in future.
- Act as counter party in the transactions.
- Transparency, reduce information asymmetry.
- Increase liquidity market, facilitate competitive discovery of price, Offer risk mitigation options.
- Aiding in wholesale competition & power market development.

Diagram:
- Generator
- Distributor / Supplier
- Power Exchange
- Power Trader
- Distributor / Supplier
- Bulk consumer
- Power Exchange

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In SA, CBET is transacted through Trading Licenses.

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### Trading license framework in South Asian countries

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<tr>
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<tbody>
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<tr>
<td>Bangladesh</td>
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<tr>
<td>Bhutan</td>
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<td>India</td>
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<td>Nepal</td>
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</tbody>
</table>

- Yes
- No
- Partial
SARI-EI Study: Summary of model Framework & guidelines Trading License

- **Operationalization of legal and regulatory framework for trading licensees**
  - **Introduce trading** as a defined & allowed activity under statutory legislation.
  - **Empower national electricity regulators** to exercise market oversight & price control through measures such as trading margin cap and emergency provisions.

- **Extending the trading license framework in the context of cross border trade**
  - Introduce the concept of “**authorization for cross border trade**”, so that domestic trading license regime can be extended to cover cross border trade.

- **Categories of trading licensees and qualification criteria**
  - **Categorization** of trading licensees; based on annual trading volume.
  - **Authorization for CBET** initially, only traders falling in **highest category**.

- **Grant and revocation of trading licence**
  - Clearly define the **procedures for issue, renewal, amendment and revocation of trading licenses**.

- **Terms, conditions and obligations of trading licensees**
  - Trading licensees to be made responsible for **fair, transparent and competitive market operations** and safe grid operation through **terms & conditions & obligations** specified in legal/regulatory framework.

- **Market development**
  - Hurdles against the introduction and participation of power traders in the power market may be **removed through legal/regulatory changes**.

- **Regional forum for coordination of trading license**
  - All efforts to **operationalize the proposed regional electricity regulatory forum**. SAFER can issue non-binding recommendations on regulatory harmonization for CBET trading licensees.
Thank You

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rajivratnapanda@gmail.com
+91-9650598697
SARI-EI Study: Summary of guidelines for open access regime in South Asia

Customer is situated in Country C procuring power from generating station in Country A using transmission system of Country B

Country A
- Generator
- Bhutan LTOA
- 220 kV Inj.
- Country A NLDC

Country B
- India-PGCIL
- Inter-State Open Access
- Country 2 NLDC

Country C
- Bangladesh
- Intra-State OA
- Country 3 NLDC
- Withdrawal 220 kV

Landed Tariff for Customer
- Other Charges

Injection
- Generation Tariff for 100 MW
- Country A Transmission charges
- Country A Operating charges
- Country B Transmission charges
- Country B Operating charges
- Country B Transmission charges
- Country B Operating charges

Country A transmission losses
- Rs. 3 per kWh

Country B transmission losses
- Rs. 3.28 per kWh

Country C transmission losses
- Rs. 3.76 per kWh
- Rs. 4.31 per kWh

*Values are assumed, and not reflective of actual figures
In India, the Central Electricity Regulatory Commission defines the tenure for various open access as follows:

<table>
<thead>
<tr>
<th>Tenure of open access</th>
<th>Tenure of typical power contracts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Term OA STOA</td>
<td>▪ Not more than 1 month</td>
</tr>
<tr>
<td></td>
<td>▪ Equal to or More than 3 months</td>
</tr>
<tr>
<td></td>
<td>▪ Not more than 5 years</td>
</tr>
<tr>
<td>Medium Term OA MTOA</td>
<td>▪ More than 7 years</td>
</tr>
<tr>
<td></td>
<td>▪ Not more than 1 month</td>
</tr>
<tr>
<td></td>
<td>▪ OTC products are more prevalent</td>
</tr>
<tr>
<td></td>
<td>▪ Can even buy/sell power for only a few hours through power exchanges</td>
</tr>
<tr>
<td></td>
<td>▪ Exceeding 1 year but not exceeding 5 year (CBET)</td>
</tr>
<tr>
<td></td>
<td>▪ Usually 3 month to 3 years</td>
</tr>
<tr>
<td></td>
<td>▪ Bilateral contracts</td>
</tr>
<tr>
<td>Long Term OA LTA</td>
<td>▪ 7 years or more</td>
</tr>
<tr>
<td></td>
<td>▪ Usually 12-25 years</td>
</tr>
<tr>
<td></td>
<td>▪ Bilateral contracts</td>
</tr>
</tbody>
</table>
Illustration of OA between Countries

Customer is situated in Country C procuring power from generating station in Country A using transmission system of Country B

<table>
<thead>
<tr>
<th>Country A</th>
<th>Country B</th>
<th>Country C</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Generation</strong></td>
<td><strong>Transmission losses</strong></td>
<td><strong>Transmission losses</strong></td>
</tr>
<tr>
<td>Tariff for 100 MW</td>
<td>1.22%</td>
<td>2.75%</td>
</tr>
<tr>
<td>Injection</td>
<td>0.25 Rs./kWh*</td>
<td>0.24 Rs./kWh</td>
</tr>
<tr>
<td>LTOA</td>
<td>Country A NLDC</td>
<td>Country 2 NLDC</td>
</tr>
</tbody>
</table>

**Country B**

- **India - PGCIL Inter-State Open Access**
- **Transmission charges** 0.90 Rs./kWh
- **POC Injection** 0.24 Rs./kWh
- **POC Withdrawal** 0.002 Rs./kWh

**Country C**

- **Bangladesh Intra-State OA**
- **Transmission charges** 0.25 Rs./kWh
- **POC Injection** 0.01 Rs./kWh
- **POC Withdrawal** 0.09 Rs./kWh

**Customer**

**Other Charges**

- **Landed Tariff for Customer**
  - **Rs 3 per kWh**
  - **Rs 3.30 per kWh**
  - **Rs 3.72 per kWh**
  - **Rs 4.09 per kWh**

Additional Notes:

- * - Assumption
- Bhutan losses as per BPC annual report FY19
- Bangladesh losses as per PGCB MIS October 2019
- India figures as per POC charges on 01 Feb 2020, considering Short Term Open Access

Transiting from Bilateral to Trilateral/Multilateral Power Trade in South Asia - Models of Trilateral and Multilateral Power Trade *Workshop on Deepening Regional Energy Cooperation, CBET & Clean Energy Development in SA, 15th January 2020, Sri Lanka by Rajiv Ratna Panda, Technical-Head /SARI/EI/IRADE
Significant balancing reserves shall be required to manage variability and achieve 175 GW of RE capacity target.

Sample Load Generation in a BAU Scenario in July 2021

RE Scenario in 2022:

1. It is expected that Renewable energy shall induce a swing of over 80 GW in net load in 2021-22. Balancing reserves capacity can be sourced from a range of resources.
2. Coal and hydro power plants shall play a key role in providing balancing reserves. Storage resources such as pumped hydro and batteries shall also be important considerations.
3. Along with these options, RE curtailment shall also be a last resort option.