Asian Clean Energy Forum 2024

Energy Transition Cross Border Electricity Trade (CBET) – SASEC and Beyond

Takafumi Kadono
Country Director
Sri Lanka Resident Mission

June 2024
Overview: Power system in SASEC region

SASEC region has witnessed rapid power capacity addition

- Mid-size power system (~23.75 GW)
  - Gas & Oil dependence – high power prices
  - Overcapacity issues - idle power plants
  - Limited fuel resources - import dependent

- Small power system (~2.34 GW)
  - High hydropower potential
  - Good portfolio of hydropower projects
  - Leading hydro CBET exporter in SASEC

- Large power system (~416.06 GW)
  - Coal dominated with significant RE addition
  - Competitive power market
  - Major player of the CBET in SASEC

- Very small power system (~0.55 GW)
  - Diesel dependent and scattered projects
  - Highly vulnerable to climate change
  - Limited possibility of interconnection

- Small power system (~7.18 GW)
  - High dependence on hydro and gas projects
  - Increasing power demand-supply gap
  - Affected by ongoing political turmoil

- Small power system (~2.68 GW)
  - High hydropower potential but underutilised
  - Highly vulnerable to natural disasters
  - Can be a leading CBET exporter in future

- Small power system (~4.23 GW)
  - High dependence on oil and hydro projects
  - Economic crisis affected the power sector
  - Power sector reforms to transform the sector

173 GW (2010)
458 GW (2023)

Power capacity mix diverse across nations. However, complements each other facilitating CBET (2023)

- Bangladesh
- Bhutan
- India
- Maldives
- Nepal
- Sri Lanka
- Myanmar

Source: IEA, ESMAP, BPDB, NEA, CEA, PUBSL, CEB, BPCL, SAED

Bangladesh
Bhutan
India
Maldives
Nepal
Sri Lanka
Myanmar

Bangladesh
Bhutan
India
Maldives
Nepal
Sri Lanka
Myanmar

Thermal Nuclear Hydro RES

Economic crisis affected the power sector
Power sector reforms to transform the sector

Source: IEA, ESMAP, BPDB, NEA, CEA, PUBSL, CEB, BPCL, SAED

INTERNAL. This information is accessible to ADB Management and staff. It may be shared outside ADB with appropriate permission.
Current scenario: Electricity trade among SASEC countries

- Major players in CBET in SASEC region are India, Bhutan, Nepal and Bangladesh. India is central to CBET as all power has to go through its grid.

- Maximum peak CBET increased from 1400 MW in FY 2010 to 3,860 MW in FY 2023 (i.e. 2.7 times).

- Out of 3,860 MW peak CBET, Bhutan & India is 2,100 MW, India & Bangladesh is 1,160 MW and Nepal & India is 600 MW.

- Annual CBET increased from 6 TWh in FY 2010 to 16.8 TWh in FY 2022.

- Currently, Nepal and Bhutan are actively engaged in power trading through their representatives on the Indian power exchange. Bangladesh imports power from India through bilateral contracts.

- Other than SASEC, India exports electricity to Myanmar. Potential to expand CBET to BIMSTEC countries and beyond.

In FY 2022

Total CBET in SASEC region = 17,907 MUs

9,748 MUs of electricity import

8,139 MUs of electricity export

Source: BPDB, NEA, CEA, PUCSL, CEB, BPCL, IEX
Emerging outlook of CBET: Deepen and expand electricity trade

1: Clean energy transition in SASEC region

2: Power market development – deepen CBET by introducing more power transaction/trade options

3: Expand CBET across nations and continents – from SASEC to BIMSTEC and Beyond
1: Support clean energy transition through CBET

- Fossil CO2 emission increased by 2.8 X (From 1,048 to 2,878 MT CO2/year) between 2000 to 2022.
- Major sectors contributing to the emissions are Buildings, Power, Processes and Transport.
- Sustainable development necessitates greening the power and transport sector
  - Greening the power sector by shifting from fossil based plants to renewable projects
  - Promoting e-mobility for electronification of the transport sector
- Generation mix across SASEC countries compliment each other making CBET uniquely positioned to support energy transition across the countries.
- India has been adding substantial RE capacity. Flexible hydropower from Bhutan, Nepal and Myanmar can be blended through CBET mechanism to support RE integration into the grid, in the region.
- In this case, Hydro and RE potential in SASEC/BIMSTEC can be utilised to the maximum extent [Hydro potential 350 GW; Solar potential > 1000 GW; Wind potential > 800 GW].

- SASEC region is highly vulnerable to climate change.
- Bangladesh (7) and Nepal (10) among 10 most affected nations between 2010-19.
- India (20) and Sri Lanka (23) among 30 most affected.
## 2: Power market development

### Power Exchange (India)

<table>
<thead>
<tr>
<th>Day Ahead Market (DAM)</th>
<th>Presently, Nepal and Bhutan are engaged in power trading in DAM through their representatives on the Indian power exchange. Potential for Bangladesh to participate in the regional market through DAM.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real Time Market (RTM)</td>
<td>RTM can serve as an additional market-based product, enabling the SASEC countries to participate in CBET by fulfilling last minute power requirement in real time.</td>
</tr>
<tr>
<td>Green Energy Markets</td>
<td>To meet the NDCs and national Renewable Energy (RE) targets, the SASEC countries (esp. those having limited RE potential) can participate in G-TAM &amp; G-DAM of India, allowing direct procurement of RE.</td>
</tr>
<tr>
<td>Ancillary Market</td>
<td>Tertiary Reserve Ancillary Services (TRAS) market introduced in India’s DAM and RTM segments, to maintain grid frequency &amp; accommodate RE fluctuations. This provides opportunity for hydro surplus nations.</td>
</tr>
</tbody>
</table>

### Power Contracts

- Presently, there are bilateral contracts for CBET e.g. India – Bangladesh power trade
- Transition from bilateral to trilateral contracts can be planned esp. by countries to trade power through Indian power grid. Few examples are:
  - Bangladesh to import from 900 MW Upper Karnali project in Nepal through Indian grid
  - 1,125 MW Dorjilung Project in Bhutan to be jointly set up by the Bhutan, Bangladesh and India.
  - Bangladesh Master Plan envisaged to import 1 GW from Bhutan and 3 GW from Nepal through Indian power grid
- RE based trilateral power contracts can boost green energy transition in the region.

Source: [BPDB, NEA, CEA, BPCL](#)
3: Expand CBET across nations and continents

One Sun, One World, One Grid (OSOWOG)

- OSOWOG adopts a three phase approach: Phase I (Middle East-South Asia-South East Asia interconnection or MESASEA interconnection); Phase II (MESASEA interconnected with African Pool); Phase III (Global interconnection)

- Government of India constituted a OSOWOG task force to steer the agenda.

- Task force studied the techno-economic feasibility of the MESASEA grid and it was agreed that initially the following interconnections will be explored to complete the interconnection among the South Asian grid:
  - HVDC line from Madurai (India) to New Habarana (Sri Lanka)
  - HVDC line from Trivandrum (India) to Male (Maldives)
  - HVDC line from Moreh (India) to Southeast Asia

Source: International Solar Alliance, Energy Atlas
Overview: Proposed India-Sri Lanka Interconnection Project

Project Details

Interconnection Option: (Phase 1: 500 MW, Phase 2: 500 MW) 400 kV HVDC line from Madurai (India) to New Habarana (Sri Lanka)

The interconnection consists of about 397 km, ±320 kV VSC HVDC BIPOLE based HVDC transmission system (overhead TL: India Portion; Under sea Cable crossing the Sea; overhead TL: Sri Lanka portion)

India Portion

- Madurai – Madurai New 400kV D/c line: 49 km
- Madurai New – New Habarana ±320 kV HVDC Bipole (Overhead) line for 1000 MW
- Dedicated Metallic Return (DMR): Indian portion (172 km)

Sri Lanka Portion

- Madurai New – New Habarana ±320 kV HVDC Bipole (Overhead) line for 1000 MW
- Dedicated Metallic Return (DMR): Sri Lankan portion (225 km)

DPR Review

- The total estimated cost of the project based (Phase 1) on September 2019 has been updated recently in Q4 2023
- Review of cost estimates is in progress

The Phase 1: 500 MW of the proposed interconnection is scheduled to be commissioned within 48-54 months from the date of investment approval

The Phase 2: 500 MW of the proposed interconnection is expected to be expedited based on the envisaged renewable energy development and demand growth on both sides.
Benefits and Trends: Proposed India-Sri Lanka Interconnection Project

While the project promotes CBET in the SASEC region and offers a key interconnection link for OSOWOF, to establish the financial viability, the recent trends need to be looked into especially given the high project cost.

<table>
<thead>
<tr>
<th>Reliable &amp; uninterrupted power supply</th>
<th>Availability of stable and cost competitive power</th>
<th>Energy export</th>
</tr>
</thead>
<tbody>
<tr>
<td>24X7 power supply to meet increasing demand. Reduction in power outages</td>
<td>Reduce reliance on imported fuel (susceptible to supply chain shocks) &amp; provide cost competitive power</td>
<td>Export power to India, majorly during Oct-Dec when hydro supply peaks</td>
</tr>
</tbody>
</table>

Recent Trends

- Sri Lanka targets to achieve 70% RE in electricity generation by 2030 and Carbon Neutrality by 2050.
- India and Sri Lanka both pursuing accelerated RE capacity addition to meet their respective NDCs
  - Excess RE at same timeslots in both countries.
  - Power market assessment is necessitated to address the excess RE esp. exploring possibility of banking with excess hydro power (in Nepal and Bhutan).
  - Timely commissioning of the hydro power projects a concern due to ecological concerns (Nepal).
  - RE power integration into the grid still a concern given limited flexible / storage capacities.
- Power sector reforms in Sri Lanka will transform industry structure and commercial arrangements
  - National Power System Operator to be established
  - Competitive bidding in renewable energy projects
  - Competitive power markets and open access
- ADB is supporting CEB in feasibility assessment of the proposed interconnection project.

Sri Lanka has ambitious RE target and desires to achieve Carbon Neutrality by 2050 – Considering the transformative impact of the ongoing power sector reforms, it is imperative for the nation to participate in the CBET to accelerate clean energy transition and enhance the financial health of the nation’s power sector.
Thank You