Session-3

Theme Presentation

Strategy for Transforming South Asia from Bilateral to Trilateral and Multilateral Power Trade and Development of Competitive Regional Power Market in South Asia Region

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

Conference on “Regional Energy Integration and Cross Border Energy Trade: A New Renaissance for Growth and Development of South Asia Region”
19th February 2020, Hotel The Imperial, New Delhi, India
Contents

• Prevailing volumes of Electricity Trades amongst SACs

• Benefits towards going-in for Trilateral/ Multilateral Trades

• Enablers towards Trilateral/ Multilateral Trades

• Issues requiring focussed attention

• Case study on trilateral and Multilateral Power Trade

• key takeaways

• Discussion Points-Transition from Bilateral to Trilateral/Multilateral Trades
## Power Trading Volume amongst SA Countries_ (G to G & Market)

<table>
<thead>
<tr>
<th>Country</th>
<th>Capacity (MW)</th>
<th>Type</th>
<th>Trader</th>
<th>Tenure (Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bhutan- India</td>
<td>2236</td>
<td>G-G</td>
<td>PTC</td>
<td>35</td>
</tr>
<tr>
<td>India - Bangladesh</td>
<td>126</td>
<td>Market</td>
<td>TPTCL</td>
<td>25</td>
</tr>
<tr>
<td>India - Bangladesh</td>
<td>450</td>
<td>G-G</td>
<td>NVVNL</td>
<td>5/25</td>
</tr>
<tr>
<td>India - Nepal</td>
<td>790</td>
<td>Market</td>
<td>PTC, NVVNL, Sembcorp</td>
<td>2/3/15</td>
</tr>
<tr>
<td>India - Nepal</td>
<td>237</td>
<td>G-G</td>
<td>Bihar/UP state</td>
<td>Long Term Contract</td>
</tr>
<tr>
<td>India - Nepal</td>
<td>280</td>
<td>Market</td>
<td>PTC, NVVN</td>
<td>Renewed Every year</td>
</tr>
<tr>
<td>Year</td>
<td>India - Bangladesh</td>
<td>Bhutan - India</td>
<td>India - Nepal</td>
<td>Total</td>
</tr>
<tr>
<td>---------</td>
<td>--------------------</td>
<td>----------------</td>
<td>--------------</td>
<td>---------</td>
</tr>
<tr>
<td>14-15</td>
<td>3271</td>
<td>5109</td>
<td>997</td>
<td>9377</td>
</tr>
<tr>
<td>15-16</td>
<td>3654</td>
<td>5557</td>
<td>1469</td>
<td>10680</td>
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<tr>
<td>16-17</td>
<td>4419</td>
<td>5863</td>
<td>2021</td>
<td>12303</td>
</tr>
<tr>
<td>17-18</td>
<td>4808</td>
<td>5611</td>
<td>2388</td>
<td>12807</td>
</tr>
<tr>
<td>18-19</td>
<td>5690</td>
<td>4657</td>
<td>2798</td>
<td>13145</td>
</tr>
<tr>
<td>19-20 (8months)</td>
<td>5600</td>
<td>5856</td>
<td>1354</td>
<td>12810</td>
</tr>
</tbody>
</table>
Y to Y Enhancement of the Traded Energy Volume (MUs) amongst SA Countries

**India- Bangladesh**

**India-Nepal**

**Bhutan- India**

**Total**

Theme presentation for session-2 Strategy for Transitioning South Asia from Bilateral to Trilateral and Multilateral Power Trade and Development of Competitive Regional Power Market in the South Asia Region Mr. V. K Agrawal, Technical Director /SARI/EI/IRADE and Rajiv Ratna Panda, Technical-Head /SARI/EI/IRADE
Benefits towards going for Trilateral/ Multilateral Trading

- The shortages in one country’s power grid can be readily solved by imports from a country without common borders;
- Costlier power in certain countries can be replaced by cheaper power in the other countries;
- Countries can rely on market to provide reserve generation capacity, lowering their own investment costs;
- Fossil fuel-based generation in some countries can be replaced with cleaner hydropower from other countries;
- Curtailment towards the overall carbon footprint in the region;
- Overall regional costs can be brought down by source optimisation and economy of scales;
Trilateral/ Multilateral Trading _Regulatory Enablers

• Permissibility towards use of electricity transmission network under open access;

• Norms towards identification of transmission capabilities and congestion;

• Provision of markets and common open access norms in different countries;

• Participation by more number of power generation and distribution companies;

• Accepted policies and norms towards measurement of deviations and settlements;

• Harmonised policies and norms for accounting and settlement;

• Avenues towards including Renewable power in trades;
POLITICAL
- Political Will
- Inter governmental agreements
- Common working platform

SOCIO ECONOMIC
- Forum for Infra development
- Forum to promote Investment
- Awareness for improved life standards

Trilateral/ Multilateral Trading _Non Regulatory Enablers
Issues requiring focussed attention while going for Trilateral/Multilateral Power Trade
Typical Multilateral Trading Scenario_ BBINS Region

**NEPAL**
Export Surplus Hydro (Imports during low Hydro)

**BHUTAN**
Export Surplus Hydro (Imports during low Hydro)

**INDIA**
Intervening Area
Imports Hydro as well as Exports other forms of Energy

**SRILANKA**
Import Hydro and other forms of Energy (Possibility of exporting off-shore wind)

**BANGLADESH**
Import Hydro and other forms of Energy (Possibility of opportunity Exports)
1A. Deviations in actual flow _ Treatment under Typical Bilateral Transaction

**Details of Deviations:**
Let us assume agreed transaction quantum = ‘X’
Actual transaction quantum = ‘X+ a’
Quantum of Deviations = ‘a’ [Country C is in surplus]

**Avenues towards settlement of Deviations:**
- Country C may pay to Country A1 @ Contract price;
- Country C may pay to Country A1 @ Prevailing Market price;
- Country C may pay to Country A1 @ Mutually agreed price;
- The settlement can be done under the running contract;

**Settlement of deviations in case of bilateral transaction is relatively simple and straight**
1B. Deviations at different Seams _ Treatment under Multilateral Trade

Country A1 (Exporting Country)

Country A2 (Exporting Country)

Country B (Intervening Country)

Country C (Importing Country)

Total Deviation through Intervening Country

- Deviation with Country A1 = ‘a’ [surplus]
- Deviation with Country A2 = ‘b’ [deficit]
- Deviation with Country C = ‘c’ [surplus]

Deviations at all the seams with the intervening country will have to be identified
1C. Deviations at different Seams _ Treatment under Multilateral Trade

Critical points related to settlement of deviations in case of Multilateral Transactions:

- The nature of contract and rates for the two transactions may be different;
- There may be no co-relation between the contract rates vis a vis the rates prevailing in the intervening country;
- The rates in the intervening country may vary from time to time and at times may even become negative;
- At no stage the intervening country may like to get exposed to any financial loss;
- There also has to be an agreed financial instrument to ensure dispute free and timely settlement;

Pre-conceived philosophy is important to compute the deviations at different seams
2A. Computation of Transfer Capability_ Treatment under Bilateral Transaction

Transfer Capability can be found out based on the minimum of:

- Thermal limit of the intervening circuit;
- Stability limit of the connecting network;
- Export capability at the Exit Point;
- Import Capability at the Entry Point;

Practice of declaration of Transfer Capability between two countries is already in vogue;

<table>
<thead>
<tr>
<th>Date</th>
<th>Time Period in IST (hrs)</th>
<th>TTC from India to Bangladesh from Indian Side</th>
<th>Reliability Margin</th>
<th>Available Transfer Capability (ATC)</th>
<th>Long Term Access (LTA/ Medium Term Open Access (MTOA))</th>
<th>Margin Available for Short Term Open Access (STOA)</th>
<th>Changes in TTC w.r.t. Last Revision Limiting constraint</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st July 19 to 31st July 19</td>
<td>0000-0630</td>
<td>1000</td>
<td>0</td>
<td>1000</td>
<td>510</td>
<td>400</td>
<td>Under N-1 of 400 kV Berhampore Bheramara, voltage at Berhampore tends to dip</td>
<td></td>
</tr>
</tbody>
</table>
2B. Computation of Transfer Capability under Multilateral Transaction

Transfer Capability within Intervening Country:
- Individual Capability between points ‘a’ and ‘c’;
- Individual Capability between points ‘b’ and ‘c’;
- Collective Capability between points (‘a’+‘b’) and ‘c’;

ATC='X'
ATC='Y'
ATC='Z' < ('X'+'Y')

Integrated study of the Regional Grid would be important to compute the ATC.
Country A (Exporting Country) (Loss – 4%)

For injecting 100 MW at ‘a’ the export quantum = 104.2 MW (assuming loss of country A = 4%)

‘a’=100 MW

Country B (Intervening Country) (Loss – 3.5%)

The quantum received by entity in C is = (96.5*.97) 93.6 MW

‘b’=96.5 MW

Country C (Importing Country) (Loss – 3%)

Assuming the loss of Country B = 3.5%
Quantum at point b = 100*.965= 96.5 MW

In addition to the Transmission Losses other charges for intervening Country are:
- Transmission Charges;
- System Op. Charges;

Strategy for losses, trans. charges & op. charges for intervening country?
Case Study on trilateral and Multilateral Power Trade
SA CBET Future Outlook-:-Moving from Bilateral to Tri/Multilateral and Market Integration

* 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
Power System and Market Integration-International Experiences

- **Bilateral, unidirectional power trade**
  - Thailand imports from Lao PDR, Bangladesh – India Power Trade
  - China imports from Myanmar

- **Bilateral, bidirectional power trade**
  - Malaysia–Singapore (non-financial), USA ↔ Baja California, Mexico
  - Nepal-India, India-Bhutan

- **Multilateral, multidirectional trade among differentiated markets**
  - Southern African Power Pool (SAPP)
  - SIEPAC (Central America)

- **Multilateral, multidirectional trade among harmonised markets**
  - European Union Internal Energy Market

- **Unified (pooled) market structure, differentiated operations**
  - Nord Pool

- **Unified market and operations**
  - PJM

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Why Lao PDR, Thailand, Malaysia, Singapore (LTMS) Trade Project
Why Lao PDR, Thailand, Malaysia, Singapore (LTMS) Trade Project?

Both South Asian and ASEAN Region have many similarities

- Eight Countries, 1.76 billion, 23% of world’s population;
- Similar Socio-Economic Conditions, Developing Country Context
- SAARC Existing Cross Border Trade – ~ 3536 MW (All Bilateral)
- SAARC-Steps are being taken to move from Bilateral to Multilateral (Trilateral Trade:- Bhutan-India-Bangladesh, Nepal -India-Bangladesh)
- SAARC-Power Market Structure: Except India all other SA countries have Single Buyer Model. In India-Competitive power market & power exchange exist (Wholesale Competition)

- Ten Countries, 634 Million People, 9% of world’s population;
- Similar Socio-Economic Conditions, Developing Country Context
- ASEAN – Existing Cross Border Trade - ~5502 MW (Mainly Bilateral)
- ASEAN- After Long years of Bilateral Trade, Recently Steps have been taken to move from Bilateral to Multilateral (Lao PDR-Thailand-Malaysia-Singapore - A path breaking Project).
- ASEAN Power Market Structure: Except Singapore, Philippines, Vietnam all other ASEAN countries have Single Buyer Model. In Singapore (Wholesale), Philippines (Wholesale and Retail) Vietnam – Cost Pool.
Why Lao PDR, Thailand, Malaysia, Singapore (LTMS) Trade Project?

- Bhutan & LAO PDR-Hydro Power Surplus/Export*
- Large Hydro Potential
- Looking to Diversify Market

- India & Thailand large Power Sector
- Transit and Wheeling Country
- Have Bilateral Connection - Neighbours

- Bangladesh & Malaysia— rapidly growing power demand
- Dominance of Fossil Fuel (Bangladesh – Gas & Malaysia- Gas & Coal

Very Similar Motivation

* 1878 MW of coal capacity – Export to Thailand
* 399.35MW in November 27, 2018 at 18:18 hrs.

"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"
1st multilateral power trade: LAO PDR (cheap hydro power) to Singapore/Malaysia via Thailand & Malaysia to support ASEAN Power Grid. Idea came up in 2014.

The project is being implemented in 2 phases

- **Phase 1- 2018-2019 (LTM-PIP)**
  - Power Trade of up to 100MW btw. Lao PDR & Malaysia via Thailand only utilizing existing network & interconnections. Later up to 300 MW

- **Phase 2- 2020 or beyond (LTMS-PIP)**
  - Possible expansion to include Singapore when second interconnection cable btw. Singapore & Malaysia is back in service.

Singapore—fully liberalised power market. Exporting country will need to establish a local subsidiary to sell electricity directly in Singapore’s market.
To implement this project, a LTMS–PIP Working Group (WG) was formed with four technical task forces looking into:

- Technical
- Legal and Regulatory
- Commercial
- Tax and tariff aspects of the project

As a first step, each country developed a grid study to confirm technically possible -100 MW trade from Lao PDR to Singapore.
Idea mooted during a special ASEAN Senior Officials Meeting on Energy (SOME) in Manado, Indonesia. (11 number of Interconnection with 3500 MW of Capacity)

Nov 2015
Intergovernmental (IG) Mechanism formed
LTMS-PIP Working Group (WG) and 4 Technical Task Forces (TTFs) were formed on technical, commercial, legal and tariff aspects

Sept 2016
Report Finalised and IG MoU signed at the 34th ASEAN MINISTERS ON ENERGY MEETING (AMEM) held in Nay Pyi Taw, Myanmar for implementation of Phase 1
MoU is valid for five years

Sept 2017
Energy Purchase & Wheeling Agreement (EPWA) signed between Electricite Du Laos (EDL), Electricity Generating Authority of Thailand (EGAT) and Tenaga Nasional Berhad (TNB) was signed at the 35th AMEM held in Manila, Philippines for implementation of Phase 1

Jan 2018
Trade Commenced
As of March 2019, 24.97 GWh has been traded

4th Sept 2019
Agreed to Increase to 300 MW & Renewal of EPWA
37th AMEM
4 September 2019, Bangkok, Thailand

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Wheeling charge comprised of a) transmission - the distance of the trade (megawatts mile); b) loss charge - a loss charge (charged per megawatt hour); c) balancing charge (also per megawatt hour); and d) administrative charges - a fixed administrative charge.
Agreements:
- Lao PDR and Malaysia Power Purchase Agreement (L-M PPA)
- Thailand and Malaysia Wheeling Charge Agreement (T-M WCA)

Wheeling charges are being paid by Lao PDR to Thailand (the transmission system owner). Lao PDR recovers this wheeling charge from Malaysia under the terms of the bilateral PPA.

* Signed between Electricité Du Laos (EDL), Electricity Generating Authority of Thailand (EGAT) and Tenaga Nasional Berhad (TNB)
Key takeaways from LTMS PIP Project
LTMS Project: Key takeaways form LTMS PIP Project for SA

- Can start with existing infrastructure with small level of trilateral trade as a pilot case. Builds Confidence

- Political support is essential.

- Marrying of Overall Economics and Political interests – Objective of achieving Better Regional Integration across ASEAN across sectors.

- Critical Roll Played by Intergovernmental Mechanisms- ASEAN Ministers on Energy Meeting (AMEM), Senior Officials Meeting on Energy (SOME).

- Dividing work across the participating countries - giving everyone has a stake in, and a sense of ownership.

- A country to be actively involved in development process even if it does not take part in trading arrangement initially (Singapore).

- A small country like LAO –PDR can succeed in accessing far distance markets.

- Time bound (with 3 years from LMTS PIP WG, trade started) and Negotiations and agreement on Wheeling charge Methodology.

- TNB is under no obligation to purchase any minimum amount of energy from EDL*.

- Initial Success of trilateral trade accelerate trade – Decided to increase the power trade (100 mw to 300 mw).

### Minimum Requirement for Trilateral/Multilateral

<table>
<thead>
<tr>
<th>Political</th>
<th>Regulatory</th>
<th>Technical and Commercial</th>
<th>Institutional</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Strong Political will</td>
<td>• No legal and Regulatory Obstacle - Minimum to have Access to Third Party Network.</td>
<td>• Harmonised technical standards (grid codes) or agreed norms</td>
<td>• Institutional arrangements</td>
</tr>
<tr>
<td>• Intergovernmental agreement(s)</td>
<td>• Some Forum for Regulators for Discussion.</td>
<td>• Harmonised wheeling charge methodology or agreed methodology.</td>
<td>• Imbalance Settlement and payment mechanism</td>
</tr>
<tr>
<td>• Regional Outlook/Vision.</td>
<td>• Common Understanding on dealing with Regulatory Aspects</td>
<td>• Co-ordinated Grid Planning</td>
<td>• Dispute resolution mechanism</td>
</tr>
<tr>
<td>• Structured Intergovernmental Political Forum</td>
<td></td>
<td>• Data &amp; information sharing</td>
<td>• Regional Forums</td>
</tr>
</tbody>
</table>

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Learning from examples of Regional Integration having multilateral trades?

How the different countries in SA are going to be benefited with multilateral trades?

Specific advantages trilateral/multilateral trades bring over bilateral trades, particularly towards accelerating regional power market?

How the transmission capacity in the intervening country can be channelized under multilateral trades?

What kind of socio-economic impact this transition can bring?

With multilateral trades what are the specific challenges in respect of accounting and settlement?
Thank You
LTMS - Existing Interconnection & Physical Flow-2018*

Power flow control through interconnections:

- Between Lao PDR and Thailand: without power flow control (without ACE)
- Between Thailand and Malaysia: controlled by pole control of HVDC
- Between Malaysia and Singapore: AGC setting of Area Control Error (ACE)

1. Lao-Thailand: TNL and PHT to NK, Paxan-BKN, Thakhek-NN, Pakbo-MD2, Bangyo-SRD all are 115 kV
2. Thailand-Malaysia is a monopolar 300 kV overhead line with a maximum transmission rate of 300 MW
3. Malaysia-Singapore only after 2020. This slide indicates the whole LTMS project as Planned including M-S connection. There is no flow between M-S in 2018

Source: Lao PDR – Thailand – Malaysia – Singapore on Power Integration Project (LTMS-PIP) related various sources, [web link] [web link] [web link] Models of the Trilateral/Multilateral Trade and
Power flow control through interconnections:

- Between Lao PDR and Thailand: without power flow control (without ACE)
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- Between Malaysia and Singapore: AGC setting of Area Control Error (ACE)

1. Lao-Thailand: TNL and PHT to NK, Poxan-BKN, Thakhek-NN, Pakbo-MD2, Bangyo-SRD all are 115 kV
   Thailand – Malaysia: KNE-Gurun 300 kV 300 MW HVDC Between Malaysia – Singapore: Plentong-Senoko 273 kV HVAC
2. Thailand-Malaysia is a monopolar 300 kV overhead line with a maximum transmission rate of 300 MW
3. * Malaysia-Singapore only after 2020. This slide indicates the whole LTMS project as Planned including M-S connection. There is no flow between M-S in 2019