TRANSMISSION CONSTRAINTS AND CONGESTION MANAGEMENT PROCEDURES

By

SAPP

Johannesburg, South Africa
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WHEELING IN SAPP

- Transfer of power from country A to country B via country C.
- Wheeling path should be reserved in advance.
- The buyer negotiates for a wheeling path.
All Transmission equipment used in wheeling identified in Country A.
WHEELING COSTS

- Transmission infrastructure identification

- Wheeling Fees are **incremental costs** for the **use** of transmission infrastructure.

- A ‘**rent**’ for the provision of wheeling services, including an **allowance** for O&M costs.

- Charges vary between **0.24 to 11.7 US$ kW/year** (**0.003 to 0.236 USc/kWh**).

- As the **Competitive Market** is being developed in SAPP the current methodology might be revised.
TRANSMISSION CONSTRAINTS

- Internal constraints along wheeling countries
- Cross border constraints.
TRANSMISSION CONGESTION

- Internal Constraints
- Cross border constraints
INTERNAL CONGESTION

BPC 220 kV Network
ESKOM Western Cape
AREA DEFINITION

12 National Areas and 3 Control Areas
Inter/ Intra Control Areas

SAPP

Intra Control Area

NamPower
EdM
LEC
HCB
BPC

Eskom
SEB

ZESA

ZESCO
SNEL

Inter Control Area

SOUTHERN AFRICAN POWER POOL
Allocation of Transmission Capacity

- Bilateral contracts given priority
- Use-it-or-lose-it
- Bilateral flow in one direction permits increased STEM flow in the opposite direction
- Remaining Capacity allocated to STEM

**ATC = Available Transmission Capacity**
Allocation of Transmission Capacity

• Each utility will each trading day register the hourly **volumes of bilateral contracts** between the different areas for the delivery day

• Each trading day, buyers and sellers of bilateral contracts will **confirm** the bilateral contracts for the delivery day

• The SAPP CC determines the **available transmission capacity** and publishes to all.

• Bidding then takes place.
TRANSMISSION CONGESTION
(Current practice)

- Congestion on tie lines affect electricity trade
- No congestion fees are charged
- Wheelers compensated in kind for incremental transmission losses due to wheeling.
- The buyer of energy compensates the wheeler.
The longest route in the SAPP is from the DRC (A) to Namibia (B).

Studies have shown that if 100MW is dispatched from A to B, only about 86MW would arrive at B.

The losses of up to 14 MW are to be supplied by either the seller or the wheelers.

If the seller supplies the losses, then over 114MW is to be dispatched at A for a supply contract of 100MW at B.
i. Load flow studies carried out to determine incremental losses.

ii. Losses determined for different time periods and seasons

Peak and off peak

Winter and summer Period
- Transmission Constraints updated & published each year.
- Daily transmission constraints published
- Transmission line overloads.
- Voltage collapse problems noted.
- Mitigation measures highlighted.
- Priority given to wheeling corridor.
CONGESTION MANAGEMENT

i. Bilateral Agreements are given priority

ii. If congestions occur, it will be economic to utilise all available transmission capacity from the surplus area to the deficit area.

iii. The utilisation can be obtained by practicing the "use it or lose it" principle for firm transmission rights and make the remaining capacity available for market participants.

iv. The available capacity should be allocated in a neutral way, by explicit or implicit auction. The latter give the best results.
i. All bids are aggregated into a supply curve and a demand curve.

ii. The intersection between the two curves is the MCP.

iii. The MCP is the unconstrained price.
Congestion Management by Market Splitting

- Balance for each area is determined
- Congestion detected if balance in an area available import/export capacity
- Market will reduce price in surplus areas until surplus equals the available transmission capacity.
- The price in the deficit area will in the same way be increased until deficit covered by available import capacity
- Transmission Constraints updated & published each year.
- Electricity will flow from low to high price areas
### Congestion Income

**Settlement**

**Area A:**
- **Sale:** 500 MW
- **Purchase:** 400 MW
- PL = $5
- PH = $7

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<th>Transaction</th>
<th>Quantity</th>
<th>Price</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Sale</td>
<td>500 MW</td>
<td>$5</td>
<td>-2500</td>
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<tr>
<td>Purchase</td>
<td>400 MW</td>
<td>$5</td>
<td>2000</td>
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\[
\text{Area A: } -500 \times 5 = -2500 \\
\text{Area A: } 400 \times 5 = 2000 \\
\hline
\text{Net: } -500
\]

**Area B:**
- **Sale:** 200 MW
- **Purchase:** 300 MW
- PL = $7
- PH = $7

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</thead>
<tbody>
<tr>
<td>Sale</td>
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<td>-1400</td>
</tr>
<tr>
<td>Purchase</td>
<td>300 MW</td>
<td>$7</td>
<td>2100</td>
</tr>
</tbody>
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\[
\text{Area B: } -200 \times 7 = -1400 \\
\text{Area B: } 300 \times 7 = 2100 \\
\hline
\text{Net: } 700
\]

So, this settlement results in \((700-500)=200\), collected by the MO.

This is equal to \((\text{price difference}) \times \text{capacity}\)

\[
(7-5) \times 100 = 200
\]
CONGESTION MANAGEMENT

- Identified areas which needs capacitor banks and SVCs
- Identified transmission relief projects.
- Need for new interconnectors
- Under n-1 criteria low transfer limits noted
- Promote projects from a regional perspective
- Challenge is to obtain funding
THANK YOU