



*TRANSMISSION CONSTRAINTS AND
CONGESTION MANAGEMENT
PROCEDURES*

*By
SAPP*

Johannesburg, South Africa



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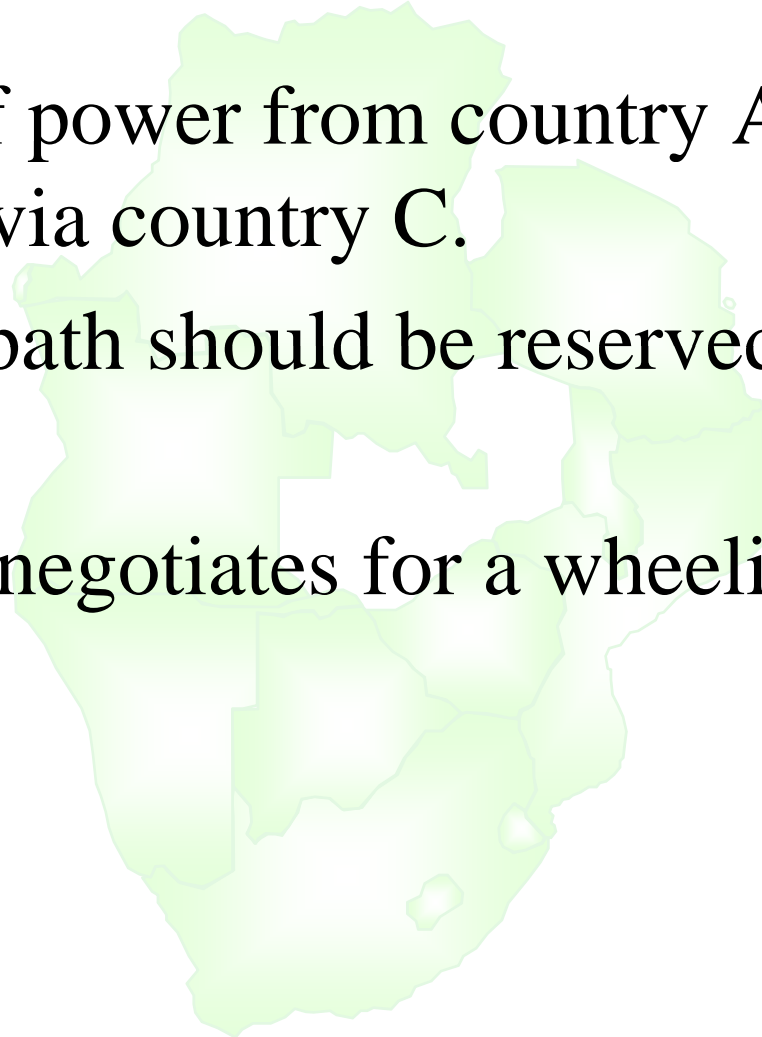
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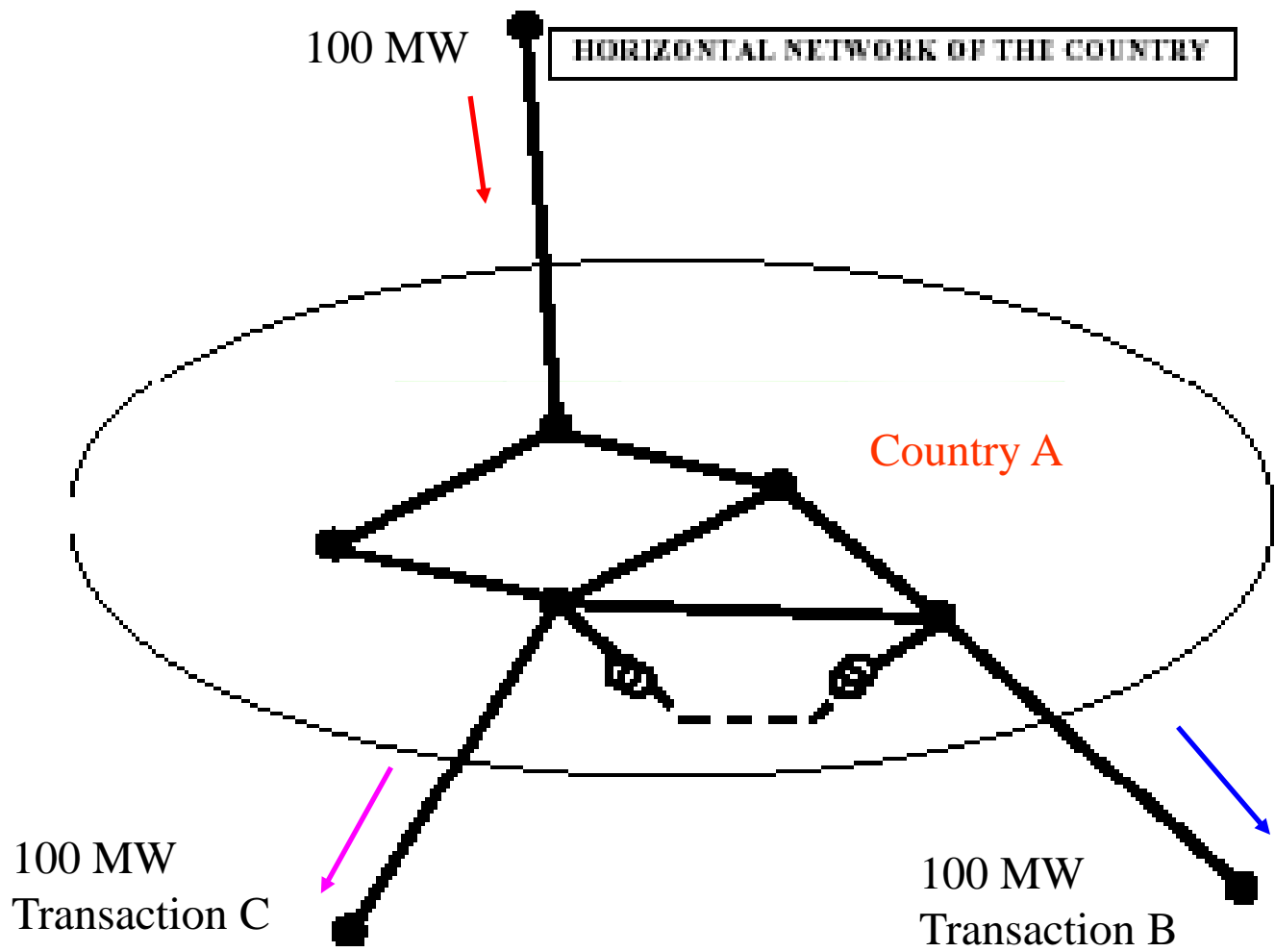


WHEELING IN SAPP

- 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.



DIAGRAMATIC REPRESENTATION



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.

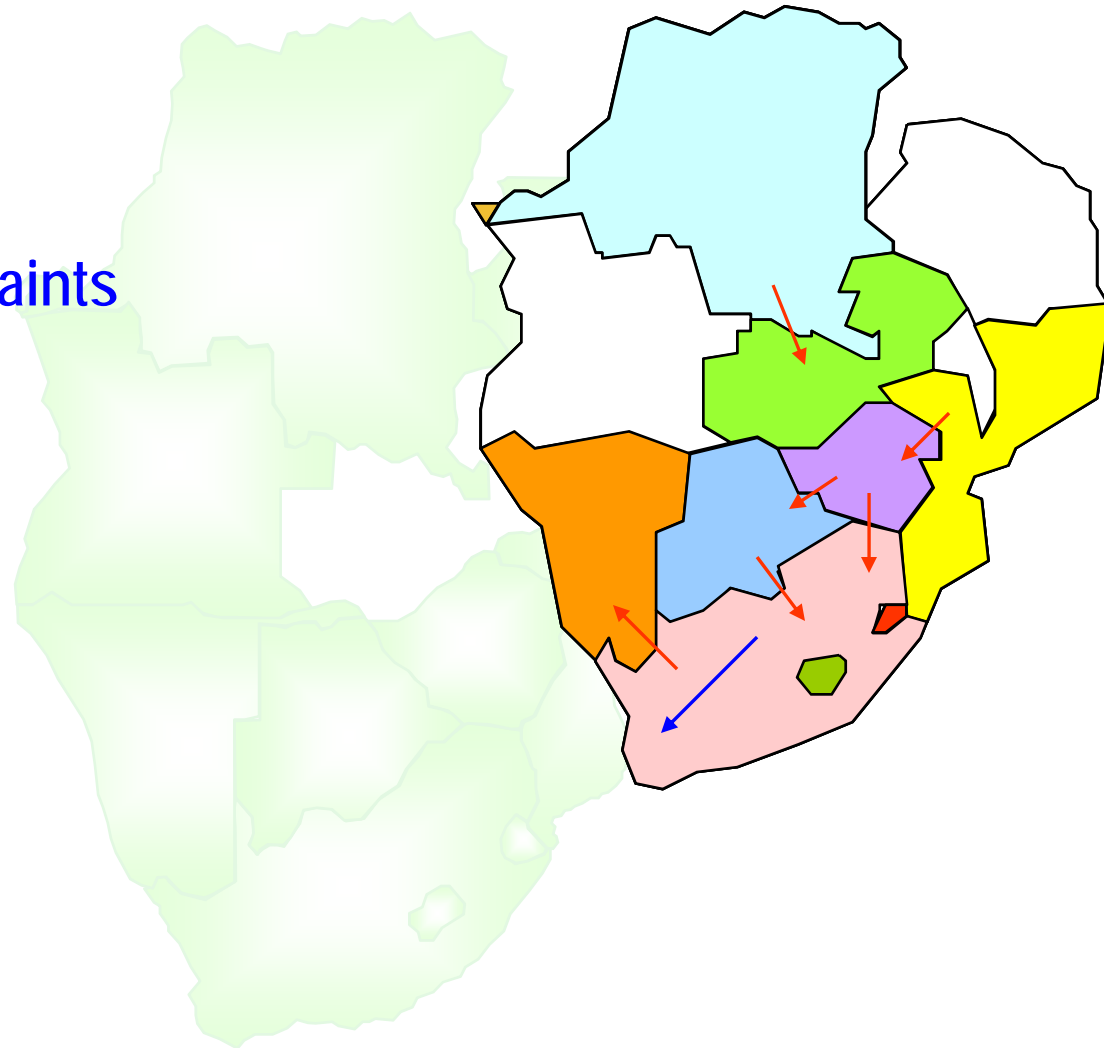
TRANSMISSION CONSTRAINTS

- Internal constraints along wheeling countries
- Cross border constraints.

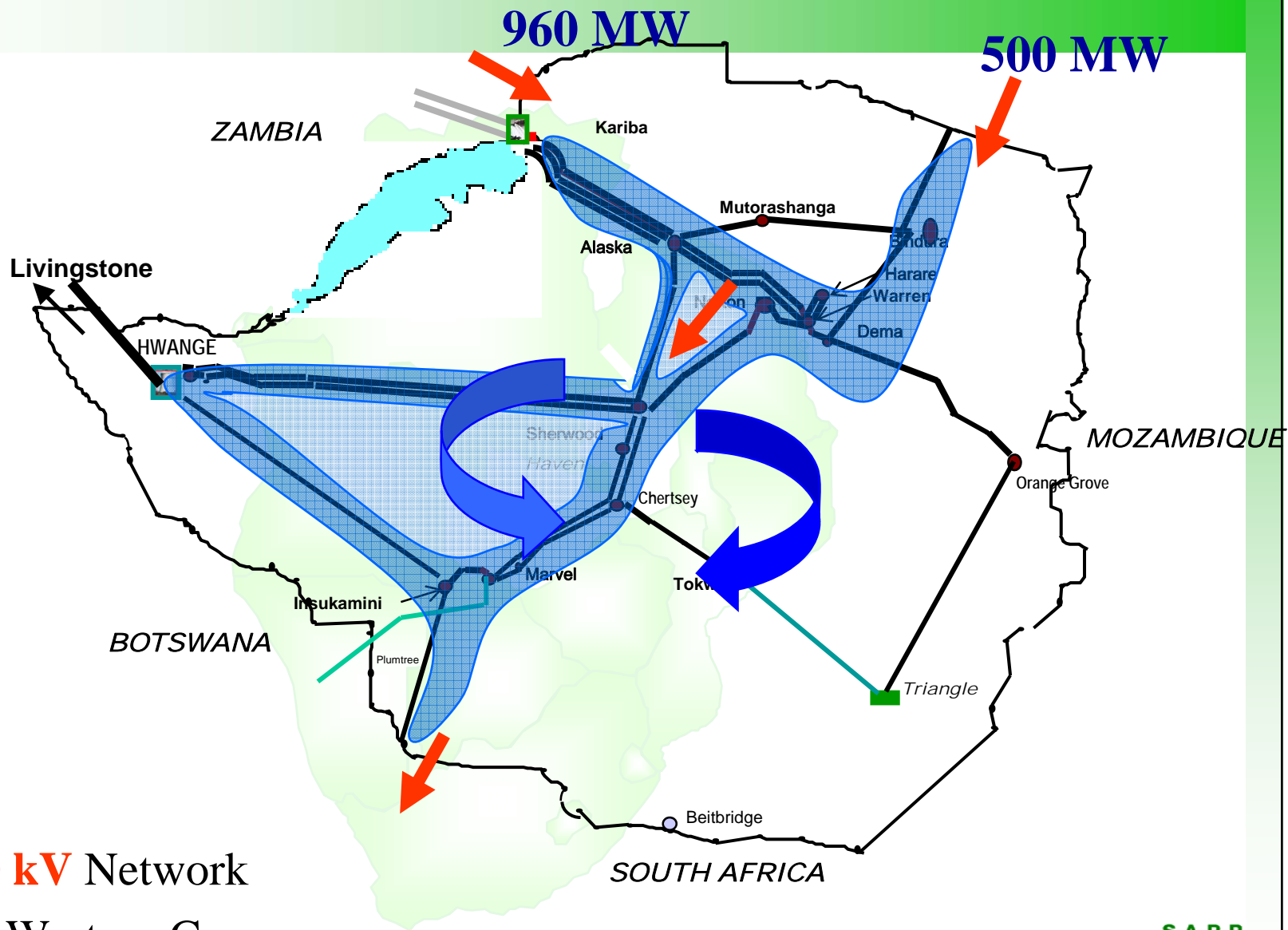


TRANSMISSION CONGESTION

- Internal Constraints
- Cross border constraints



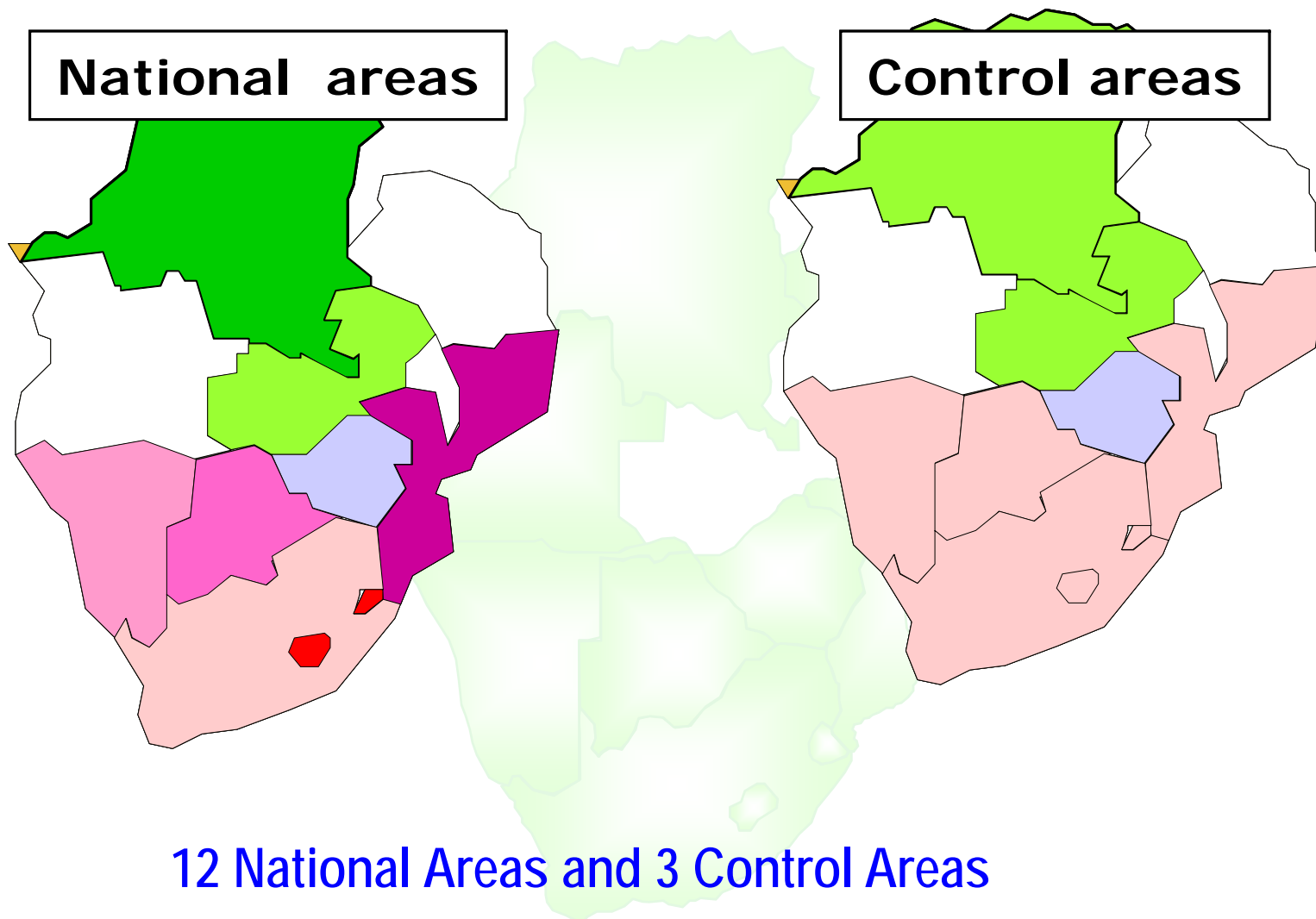
INTERNAL CONGESTION



BPC **220 kV** Network
ESKOM Western Cape

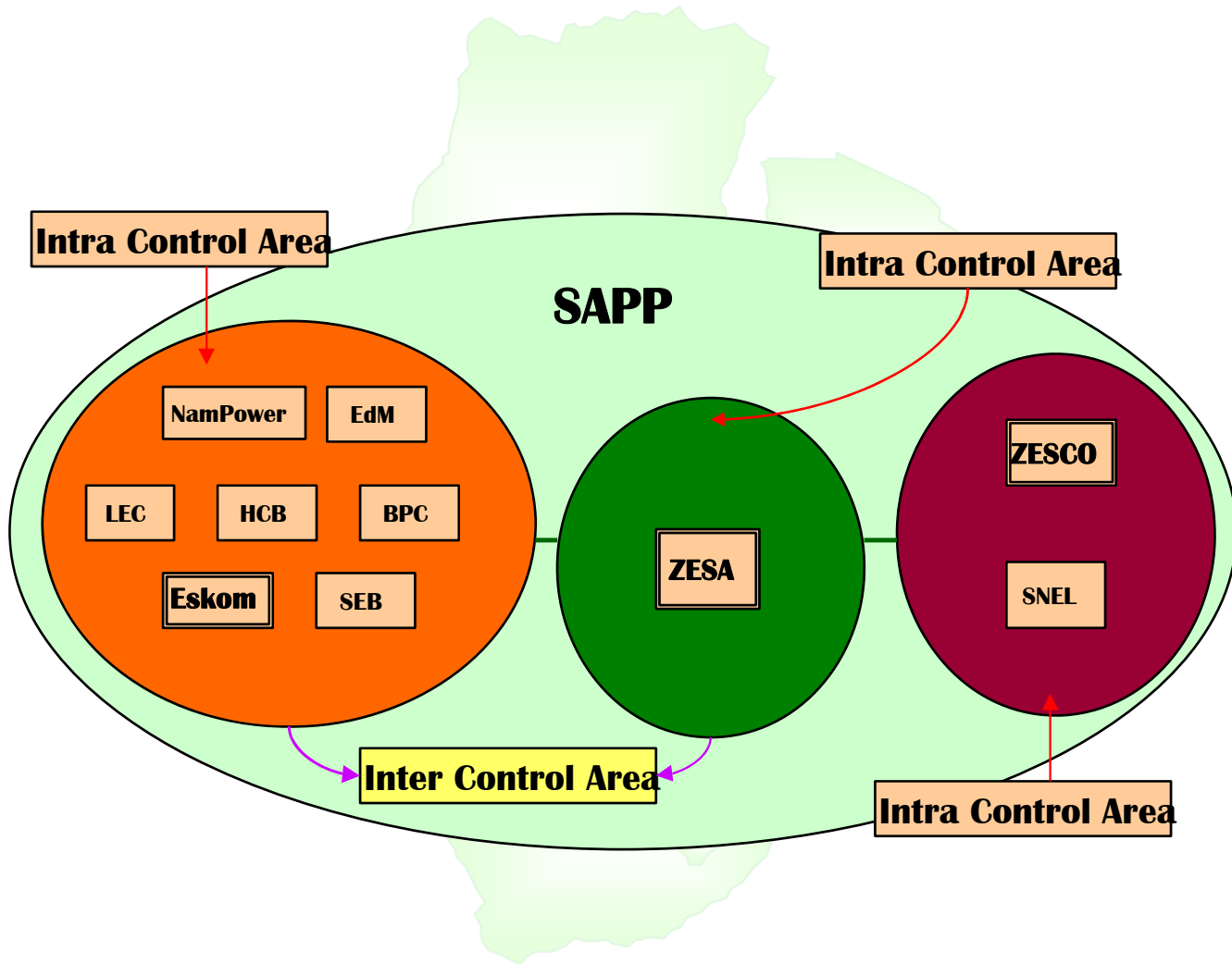


AREA DEFINITION



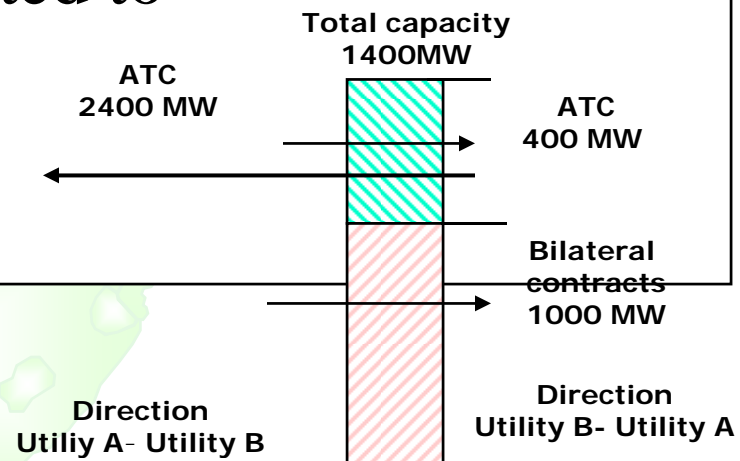
12 National Areas and 3 Control Areas

Inter/ Intra Control Areas



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

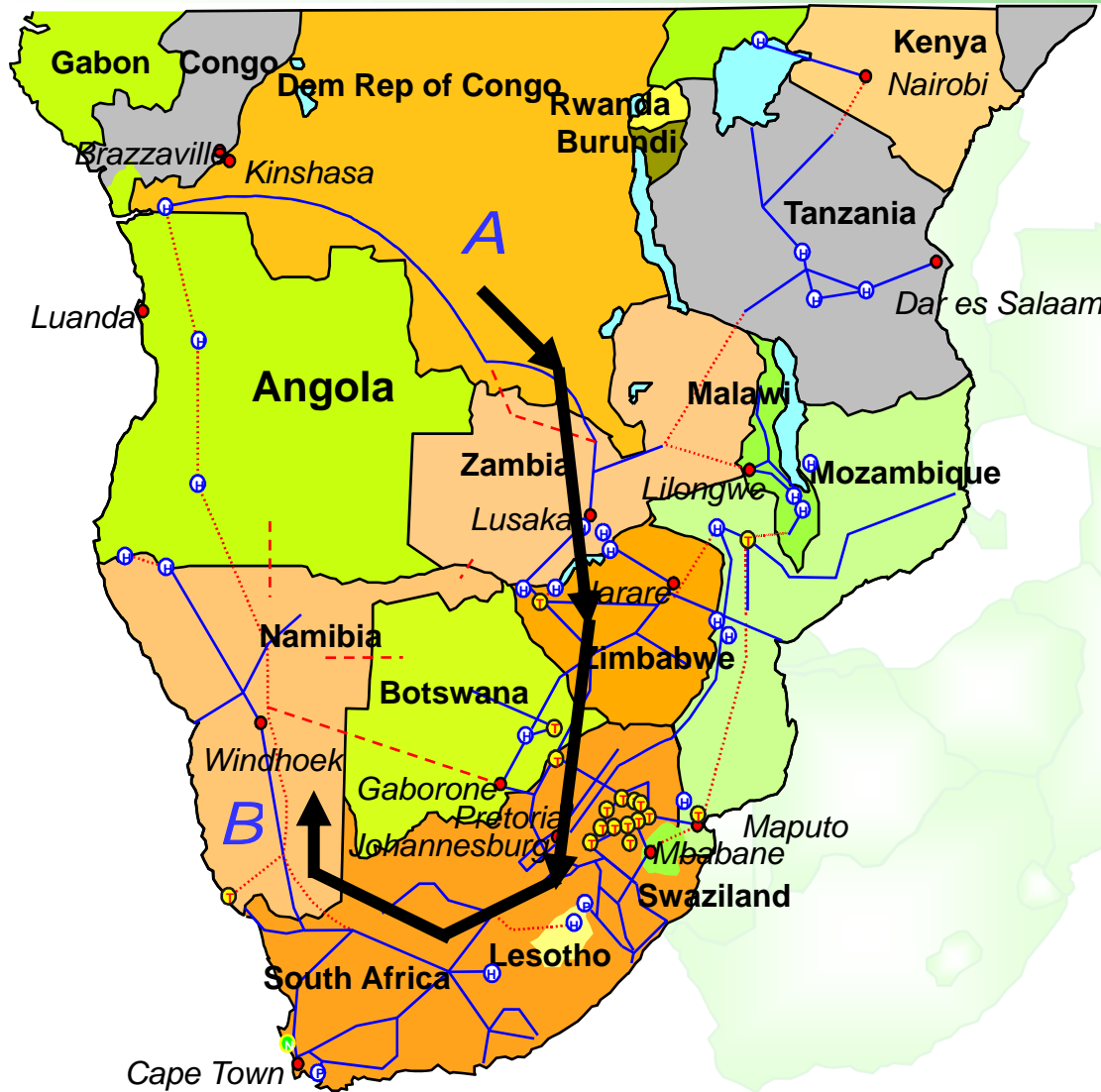
- Each utility will each trading day register the hourly **volumes of bilateral contracts** between the different areas for the delivery day
- Each trading day, buyers and sellers of bilateral contracts will **confirm** the bilateral contracts for the delivery day
- The SAPP CC determines the **available 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.

TRANSMISSION LOSSES



- ➔ 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**.

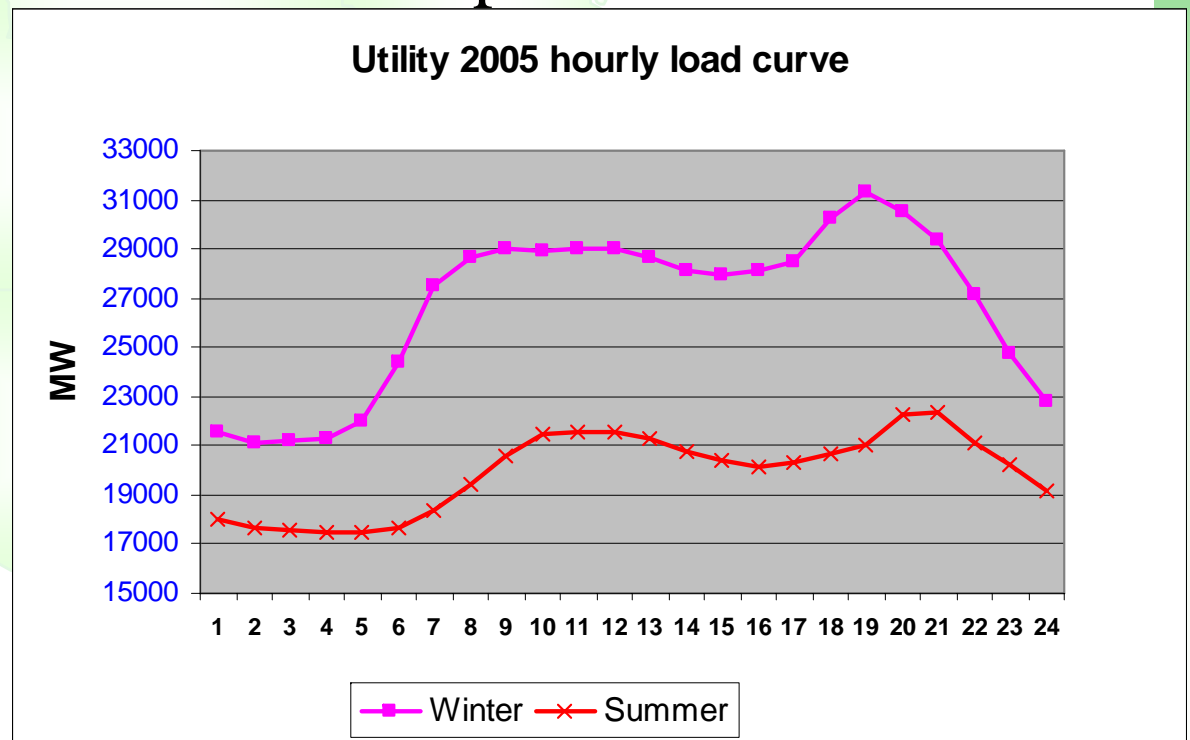


TRANSMISSION LOSSES

- 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 CONGESTION & RELIEF

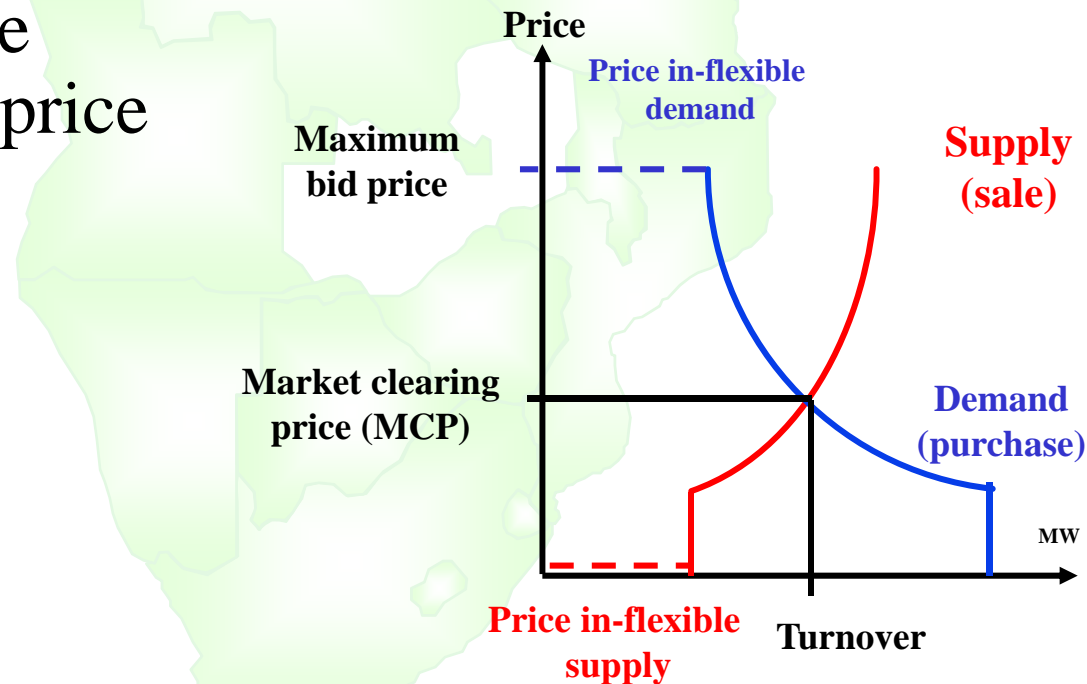
- Transmission Constraints updated & published each year.
- Daily transmission constraints published
- Transmission line overloads.
- Voltage collapse problems noted.
- Mitigation measures highlighted.
- Priority given to wheeling corridor.

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

Price Determination – Market Clearing Price

- 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



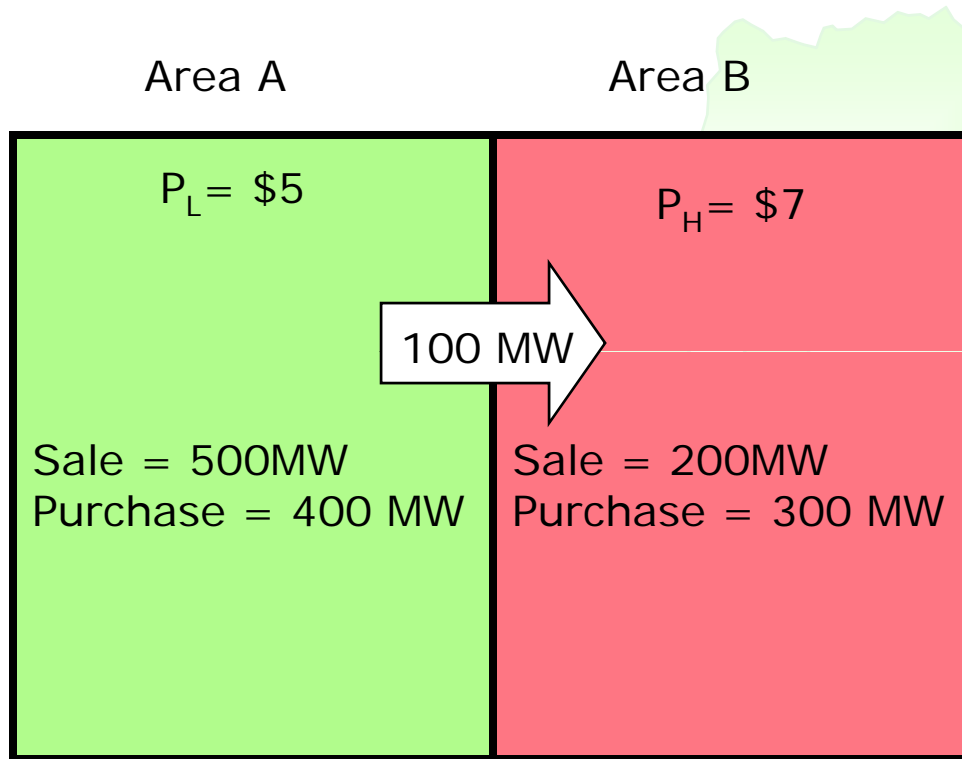
PROPOSED CONGESTION MANAGEMENT PROCEDURES

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:

$$S: -500 * \$5 = -\$2500$$

$$P: 400 * \$5 = \$2000$$

$$-\$500$$

Area B:

$$S: -200 * \$7 = -\$1400$$

$$P: 300 * \$7 = \$2100$$

$$\$700$$

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

This is equal to
 (price difference) * capacity

$$\underline{(\$7 - \$5) * 100 = \$200}$$

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

