The Role of Flexible Hydropower in Evolving Power Systems

Presentation by

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Presentation Outline

• Introduction to SAPP

• Historical Role of Hydropower in SAPP

• Planned Hydropower Projects

• Future role of hydropower in SAPP
Introduction to SAPP

- 12 Countries
- 340 Million people
- Installed Generation Capacity - 80 GW

Created in 1995 under Southern Africa Development Community (SADC) through an Inter-Governmental Memorandum of Understanding (IGMOU)

Key objectives:

- Cooperate and coordinate planning and operation of electric power systems
- Facilitate electricity trading
- Promote regional cooperation in power projects
- Increase access to affordable electricity in a reliable and sustainable manner
SAPP Generation Mix

- Coal: 59.0%
- Hydro: 24.0%
- Solar PV: 4.0%
- Wind: 3.0%
- Nuclear: 3.0%
- OCGT: 2.0%
- Distillate: 3.8%
- Solar CSP: 1.0%
- Biomass: 0.1%
- Landfill: 0.1%
- Coal: 59.0%

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• 9 Countries currently interconnected at Transmission level

• 3 not yet connected to the SAPP grid

• **Malawi** being connected through the Mozambique - Malawi Interconnector

• **Tanzania** being connected through the Zambia - Tanzania Interconnector which will lead to interconnection of SAPP & EAPP as Tanzania is also being connected to Kenya

• **Angola** will be connected to Namibia, DRC and Zambia
SAPP Power Market Framework

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FPM
- Forward Physical Contracts
  - Weekly and monthly
    - Auction trading
      - Forwards
        - Week – Peak
        - Week – Standard
        - Week – Off-Peak
      - Monthly – Off-Peak
      - Monthly – Standard
      - Monthly – Peak

SAPP Settlement and financial management
- Settlement of all physical contracts
- Settlement of wheeling and losses
- Market monitoring and reporting

DAM
- Physical Contracts
  - Market equilibrium
    - one day ahead
  - Auction trading

IDM
- Balancing Power
  - @SAPP
    - Regional market
  - Physical contracts
    - Up to hour ahead
    - Continuous Trading

TSOs
- System Operation
  - Real-Time Operation

Services during the Real-Time Operation:
- Controlling frequency and voltage etc.
A huge potential of hydropower exists in the region with less than 10% currently developed.
History of development of major hydropower plants……..

- DRC – Inga
- Zambia & Zimbabwe – Kariba
- Zambia – Victoria Falls, Kafue Gorge
- Mozambique – Cahora Bassa
- South Africa – Pumped storage schemes
- Namibia – Ruacana
Historical Role of Hydropower

• Hydropower has been used to reduce the overall cost of power produced in the generation mix that included coal fired plants and provide load following capabilities.

• Hydropower plants have been providing automatic generation control (AGC) in the system. This made them pivotal to the successful operation of the SAPP competitive electricity market for tie-line controls.

• Hydropower has been the main source of spinning reserves on the interconnected system.

• Pumped storage units have been used to provide quick reserve.
Planned Hydropower projects

- **Julius Nyerere hydropower plant** is under construction in Tanzania.
- A lot of ground work has been done for the development of Mphanda Nkuwa in Mozambique.
- **Cahora Bassa North Bank** in Mozambique is now receiving attention.
- Appropriate preparatory studies were done for **Batoka Gorge** on the Zambia - Zimbabwe border.
- **Inga** in DRC is still on the radar though discussed for many years now.
Planned Hydropower projects .......

• Currently in the SAPP region 16 committed and 87 candidate hydropower stations that would increase the total installed hydropower capacity to just under 60 GW.
• Five primary catchments account for 92% of the hydropower potential in the region
  - Congo River Basin
  - Zambezi River Basin
  - Rufiji River Basin
  - Cuanza River Basin
  - Cunene River Basin.
Future Role of Hydropower in SAPP

• Countries are increasing penetration of renewable energy mainly through auction systems in pursuit of their Nationally Determined Contributions (NDCs) under the Paris Agreement.

• This is increasing wind and solar power in the region and without sufficient flexible generation creates challenges for the system operators.

• Hydro power plants can provide the required flexibility.

• SAPP carried out a study on increased VRE penetration that showed that hydropower’s flexibility can assist in allowing increased levels of penetration and has to be coupled with increased transmission connectivity between the countries.
Thank you!

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