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**

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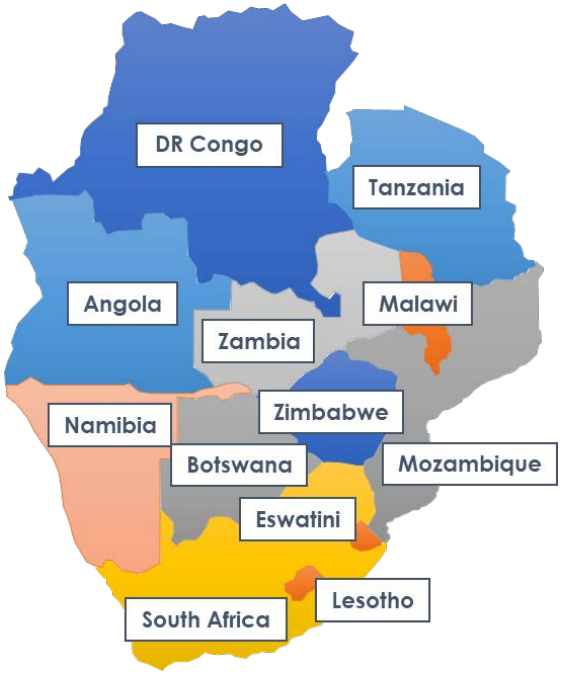
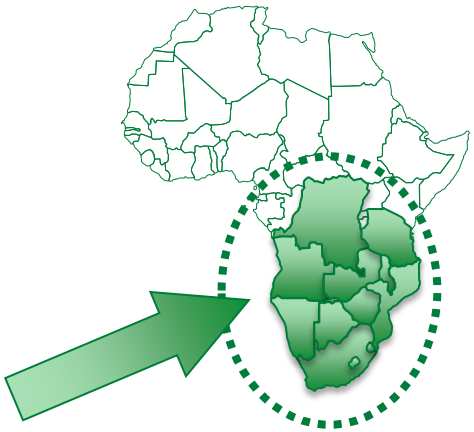
Introduction to SAPP

- 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**

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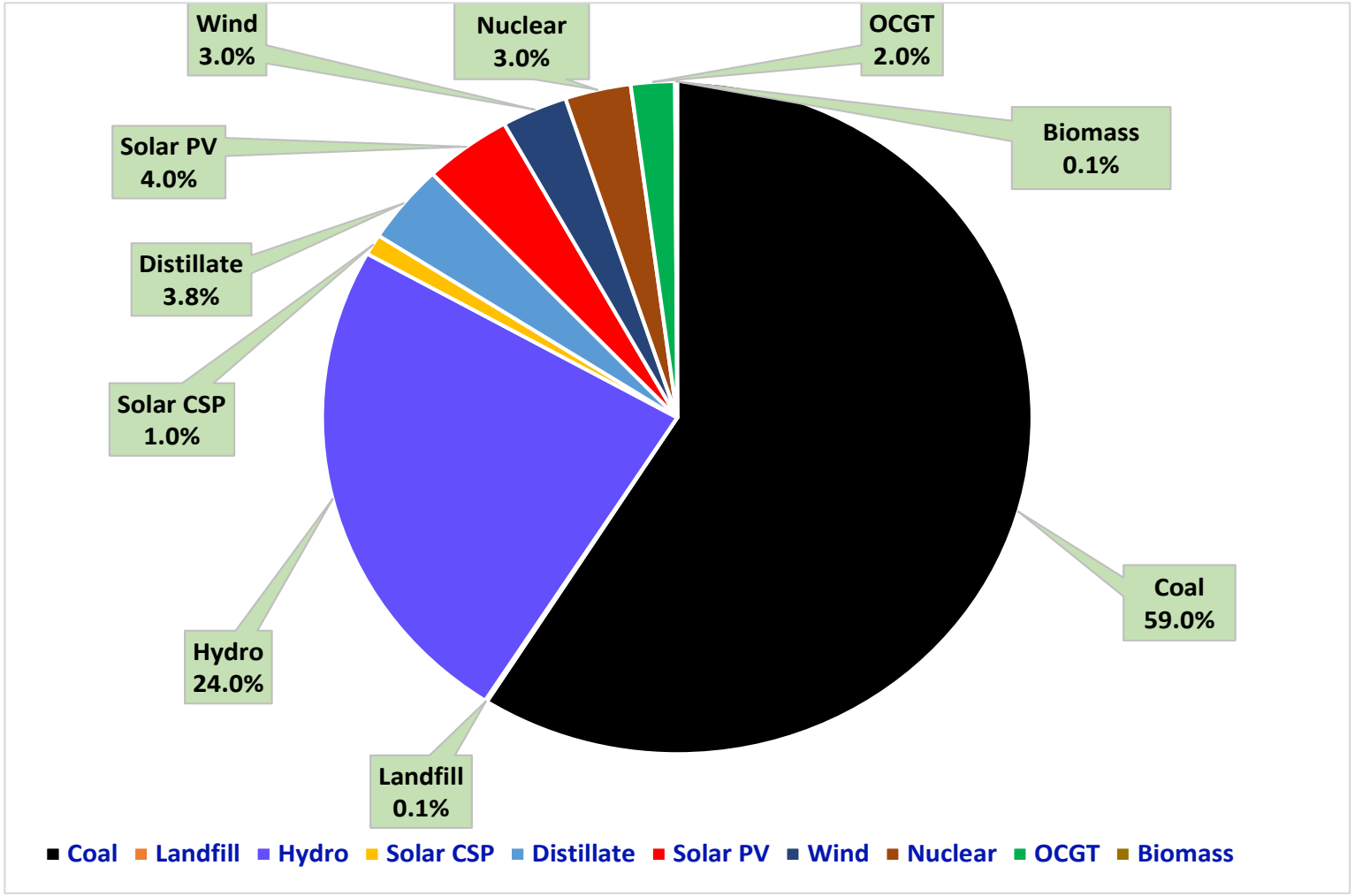
SAPP Generation Mix



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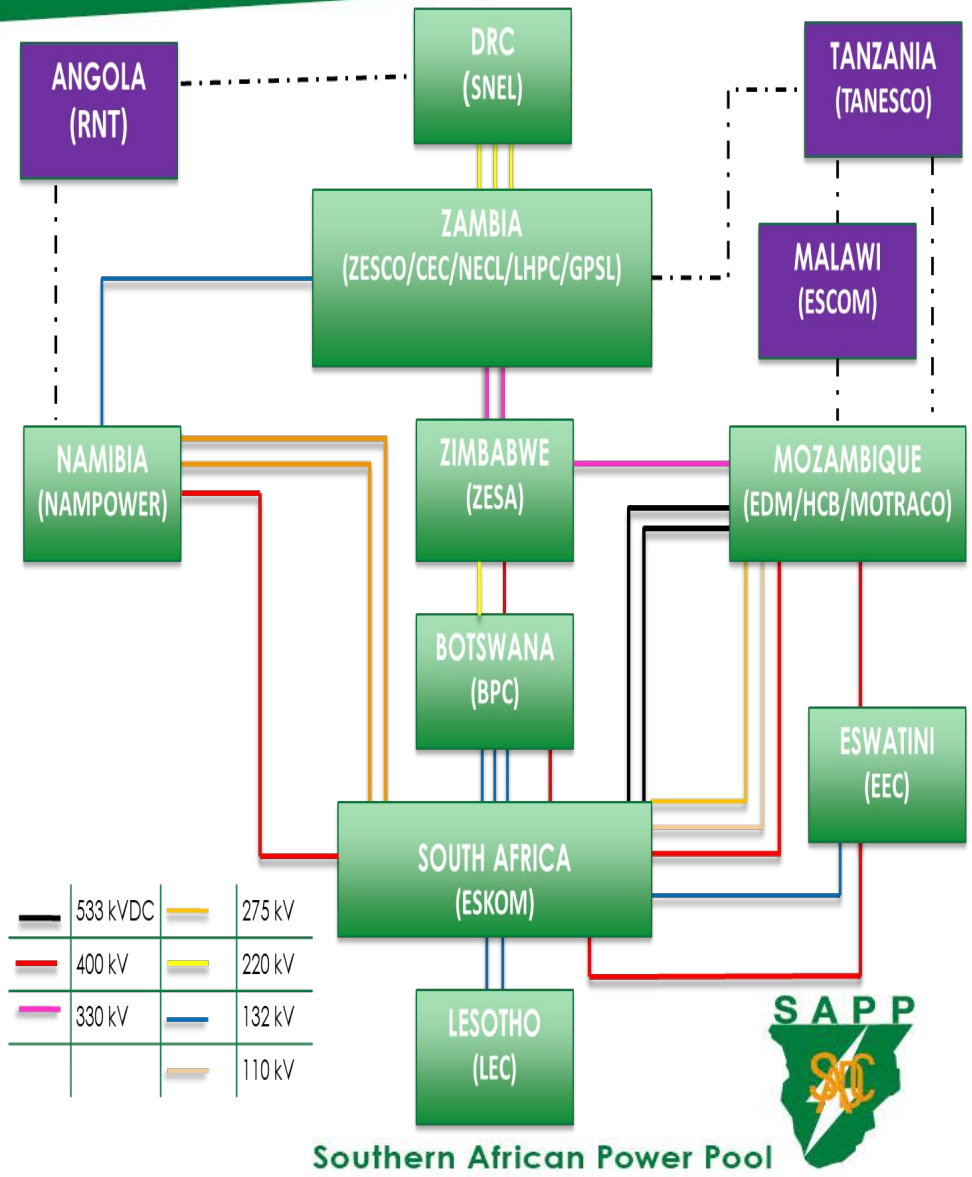
Status of Electrical Connectivity in SAPP

- 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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TSOs

FPM → DAM → IDM

FPM

Forward Physical Contracts

Weekly and monthly
- auction trading -

Forwards
Week – Peak
Week – Standard
Week – Off-Peak

Monthly – Off-Peak
Monthly – Standard
Monthly – Peak

DAM

Physical Contracts
Market equilibrium
one day ahead
- auction trading -

IDM

Physical contracts
Up to hour ahead
Continious Trading

114,25 (50)
114,00 (20)
113,75 (60)
113,50 (45)
113,00 (25)
112,75 (55)
112,50 (40)
112,25 (15)

Balancing Power @SAPP

Regional market

Balancing generation and consumption in realtime

System Operation

Real-Time Operation

Services during the Real-Time-Operation: Controlling frequency and voltage etc.

SAPP Settlement and financial management

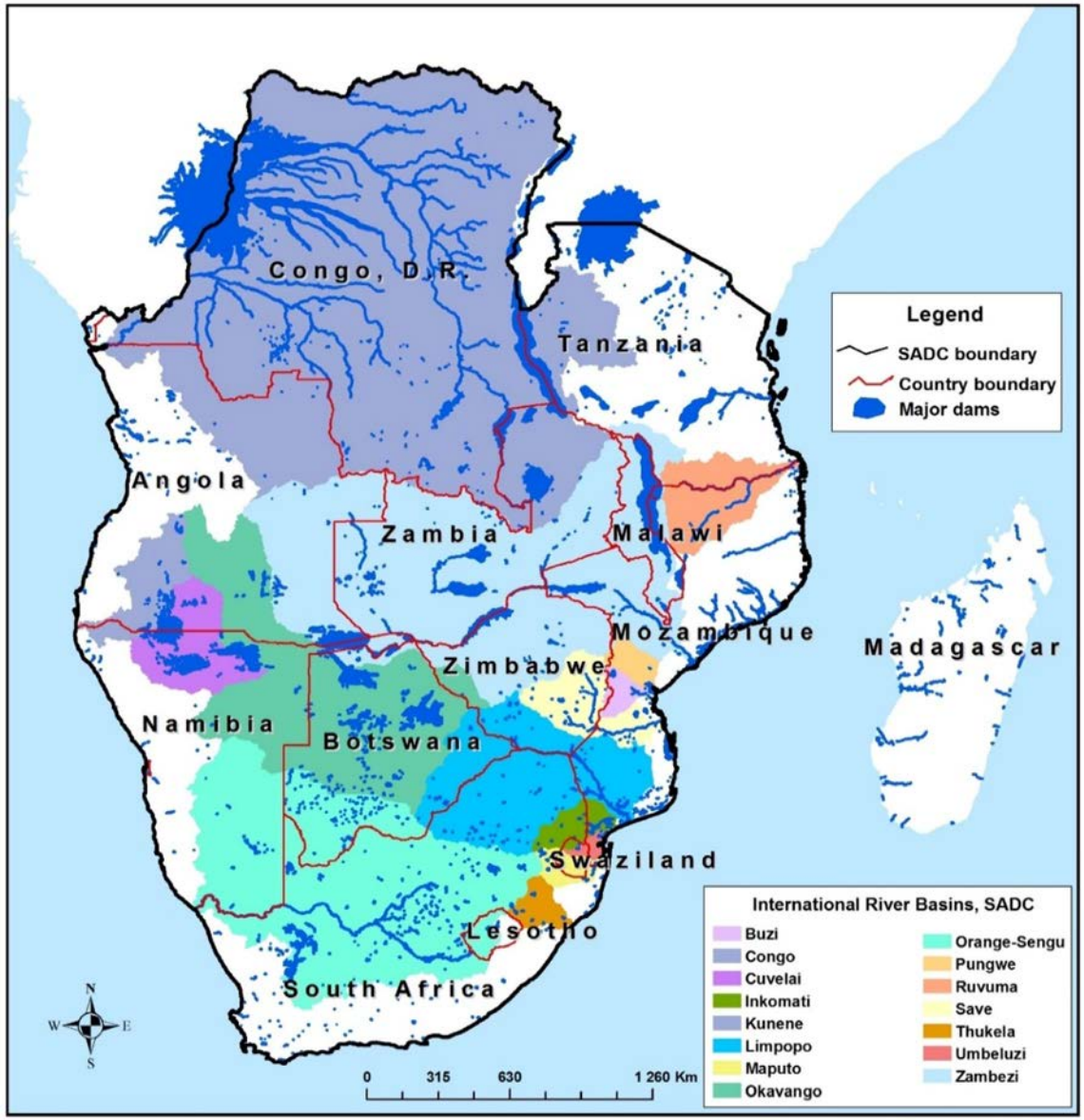
Settlement of all physical contracts

Settlement of wheeling and losses

Market monitoring and reporting

Southern Africa hydropower potential.....

- **A huge potential of hydropower exists in the region with less than 10% currently developed.**



Source: GeoTerraImage, 2023

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.

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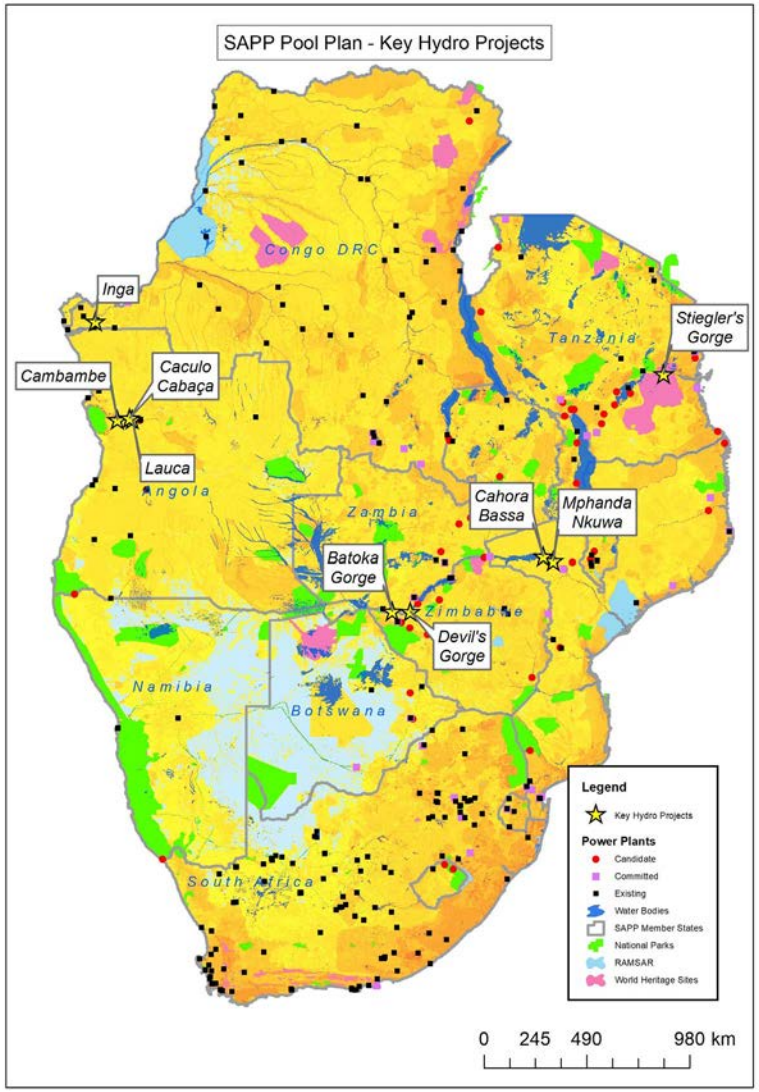
Planned Hydropower projects

- 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



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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.

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Thank you!