



Overview of the SAPP Pool Plan and the Role of Renewables in the Regional Electrical Energy Mix

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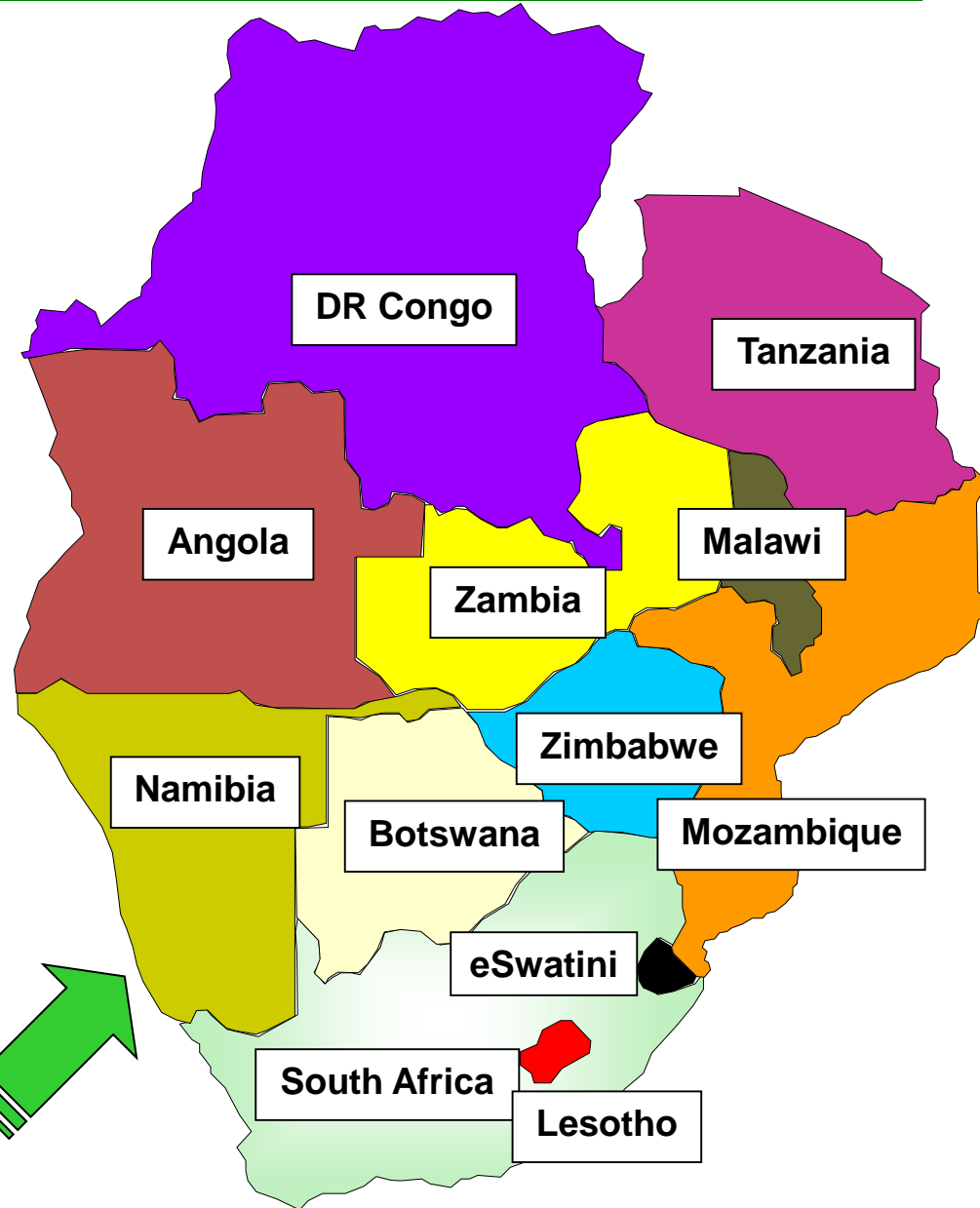
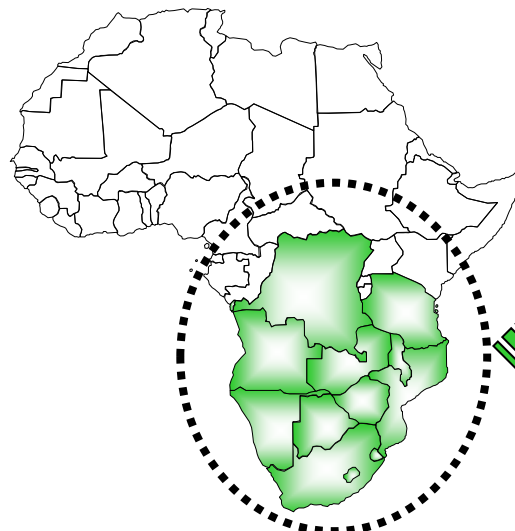
Windhoek, Namibia
October 2018

Presentation Outline

- 1. Introduction and SAPP Overview**
- 2. SAPP Pool Plan Objectives**
- 3. Overview of Generation Projects**
- 4. The Impact of Renewables in
Generation Mix**
- 5. Conclusion**

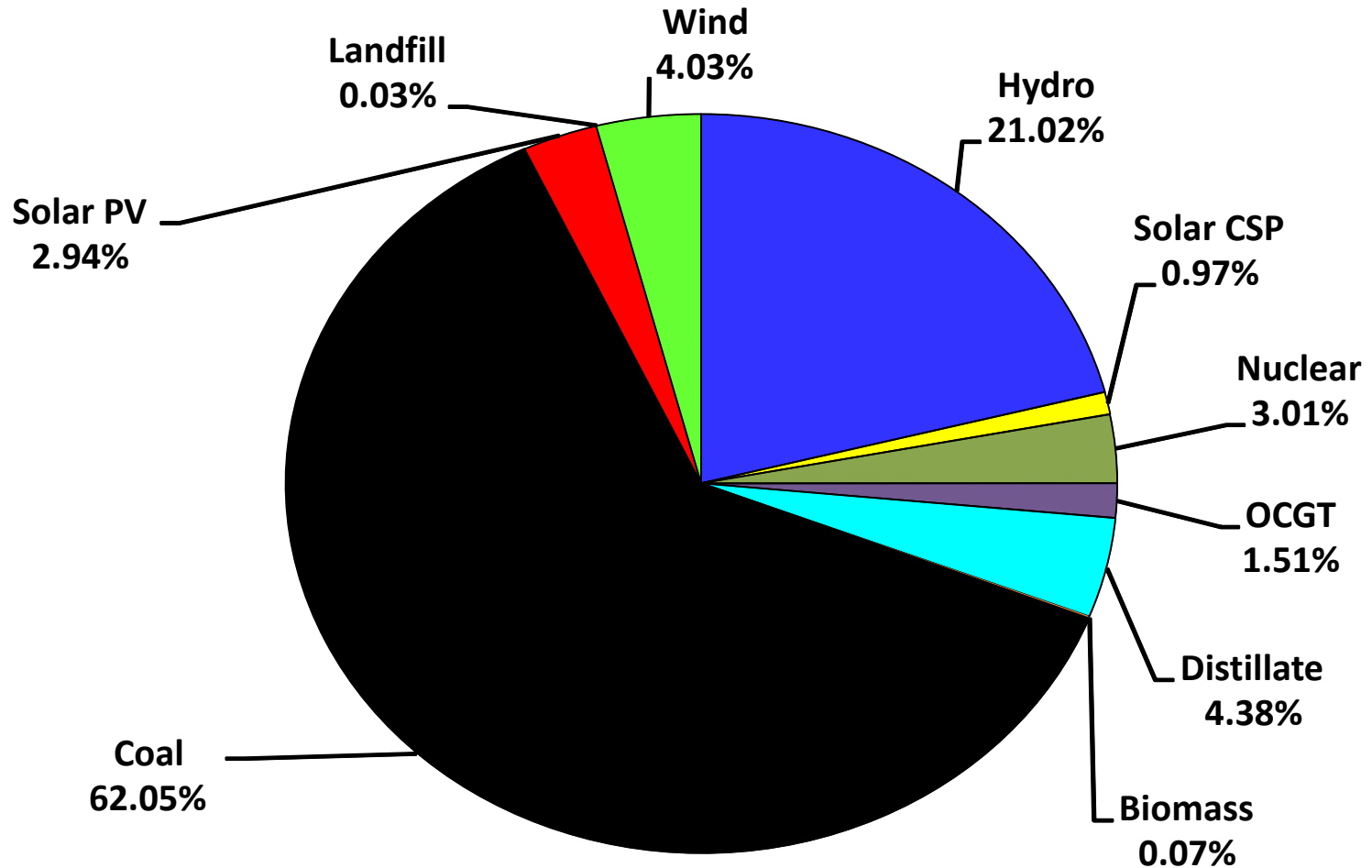
SAPP Key Statistics - 2018

- ❑ 12 Countries
- ❑ 300 Million people
- ❑ Installed Generation Capacity - 62 GW
- ❑ Available Generation Capacity - 61 GW
- ❑ Peak Demand - 58 GW
- ❑ Consumption - 400TWh
- ❑ Capacity Surplus – 3 GW



Generation Mix in SAPP

SAPP Installed Generation Capacity - 2018

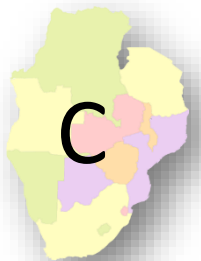
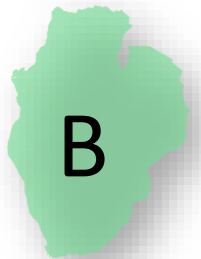


SAPP Pool Plan 2017 Study Objectives

- ❑ To prepare a SAPP Pool Plan for the period to 2040 that shall identify a core set of generation and transmission investments of regional significance:**
 - ✓ that can provide adequate electricity supply to the region under different scenarios,**
 - ✓ in an efficient and economically, environmentally and socially sustainable manner,**
 - ✓ and support enhanced integration and power trade in the SAPP region.”**

The Pool Plan study's 3 components

- ❑ **Component A / Benchmark Case** – This is a combination of country-by-country expansion plans based on national master plans extended (where necessary) to 2040 with a consistent set of assumptions.
- ❑ **Component B / Full Integration Case** – This is full optimisation case whereby the region is treated as though it is a single country and a least cost sequence of generation and transmission expansion projects is derived.
- ❑ **Component C / Realistic Integration case** – This is an intermediate integration case, whereby certain constraints are applied to Component B to ensure that each country, at a minimum, fulfils SAPP security and reliability planning criteria and large thermal plants continue to operate at minimum capacity factors.



SAPP Pool Plan Results

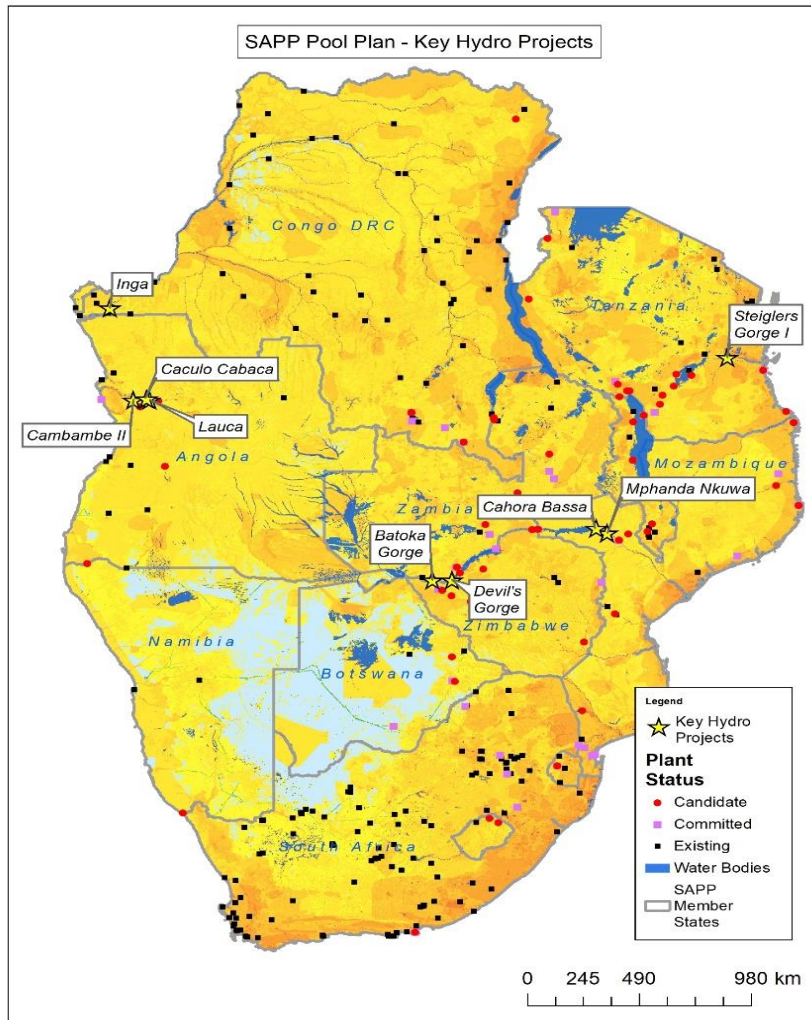
Installed Generation Capacity	130 GW
New Generation Capacity	75 GW
Item	Cost, USD billion
Generation Investments	117.7
Transmission Investments	3.3
Total Investments	121

It is USD 34 billion cheaper (-22%) over a 40 year period to go for the regional integrated approach than pursuing national plans. More transmission corridors are developed. It is better to pursue component C than A.

Benefits of regional integration in the power sector

- Within the electricity sector
 - Technical benefits – frequency stability, security of supply through shared reserves
 - Planning benefits – greater flexibility in developing generation projects
 - Financial benefits
 - Reduced investment and operational costs of meeting demand
 - Improved utility viability
 - Accelerated attainment of electrification targets
- Within the wider economy
 - Resources freed up for investment in the productive sectors
 - More competitive industries due to lower electricity tariffs
 - Electrification (esp. on-grid) gives multi-fold benefits at the household level, which also feed into the macro-economy
 - Enhanced employment and national income

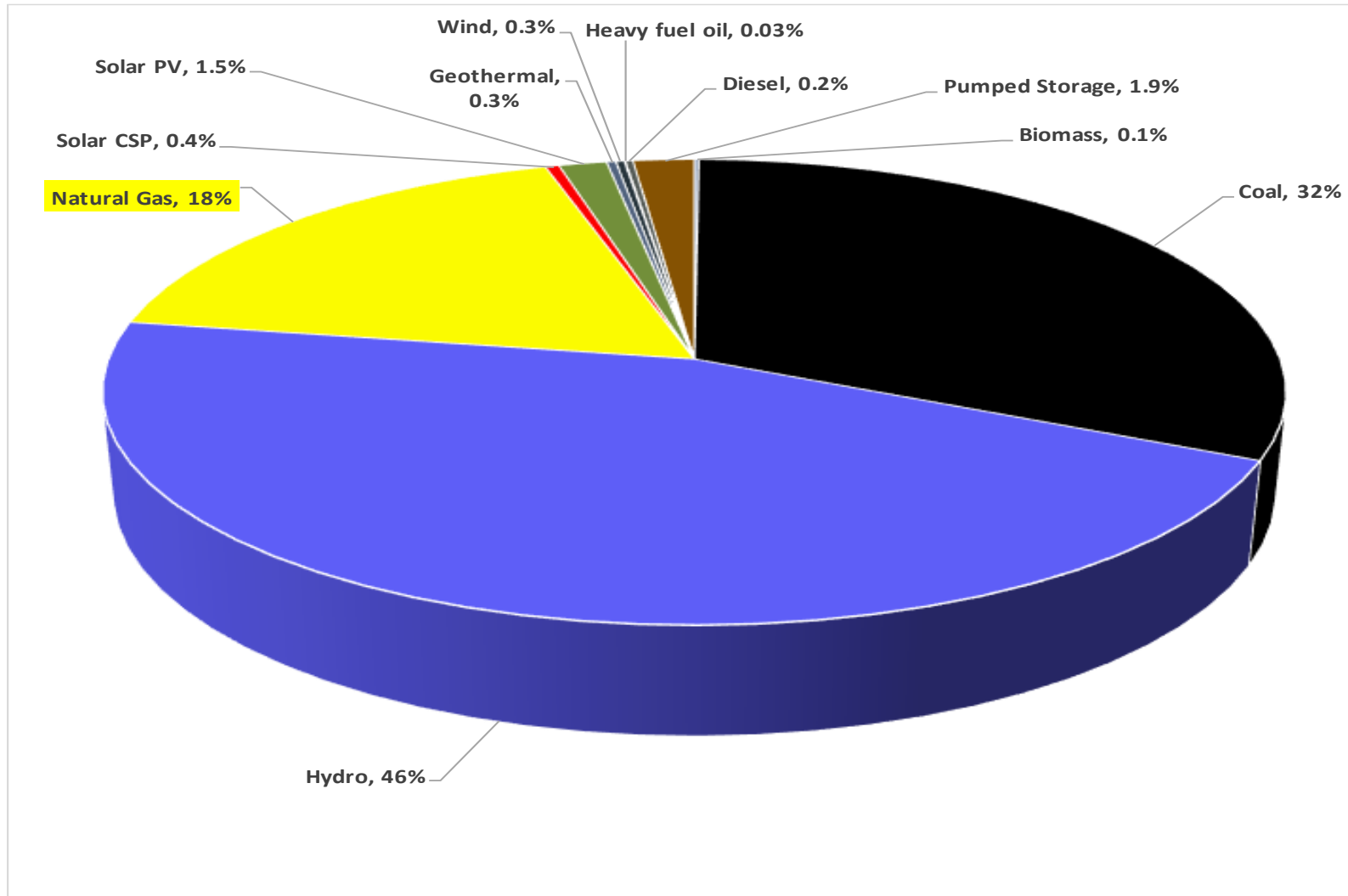
SAPP – Key Hydro Generation Projects



Generation Projects	Countries	Generation Capacity MW	Commissioning Dates
Batoka	Zambia and Zimbabwe	2,400 MW	2023
Mphanda Nkuwa	Mozambique	1,500 MW	2028
Devil's Gorge	Zambia and Zimbabwe	1,200 MW	2032
Inga 3&4	DRC	4800 MW	2030
		4,626 MW	2032
		2,228 MW	2034
Stiegler's Gorge	Tanzania	1,048 MW	2036
		1,048 MW	2039

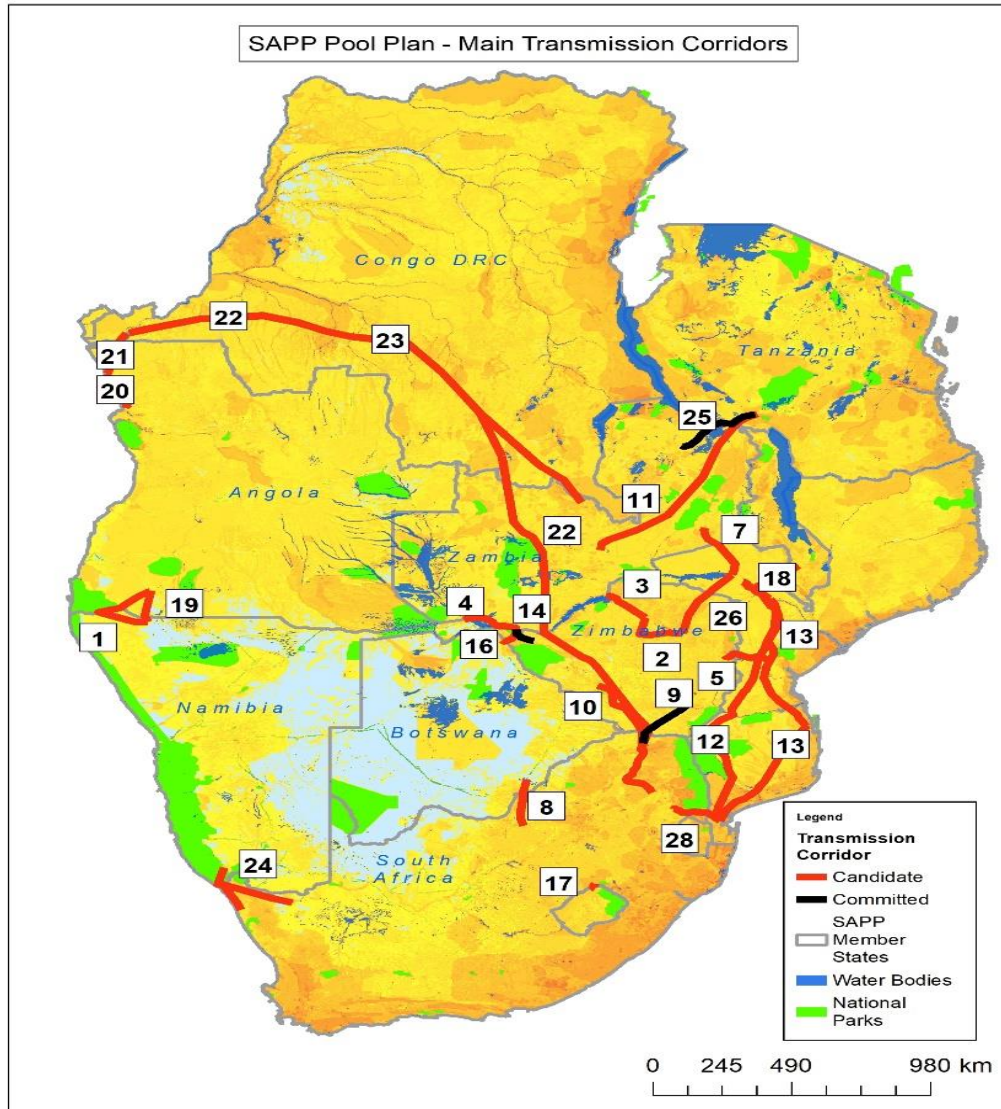
Committed Country Generation Projects considered as given
Key Projects of Regional Significance

Generation Mix – New Generation Capacity by 2040



26,000 MW of new generation capacity from Renewables

SAPP – Key Transmission Corridors



**Transmission Investments
USD 3.3 billion**

SAPP Pool Plan Sensitivities on Components C

Case	Description	Cost on recommended Plan
SC1	Delay of large projects (Inga)	USD 1.8 billion increase
SC2	Climate Change Condition (Dry), Impacts hydro availability	USD 17.2 billion increase
SC3	Max import cap by RSA of 2,800 MW	USD 6 billion increase
SC4	High renewable Energy Policy	USD 10.7 billion increase
SC5	Low demand	USD 58 billion Less

The Role of Renewables

- ❑ **Sensitivity tests the impact of SAPP countries implementing a policy of high renewables, matching the level posed in the 2013 IRENA report. Impact is an increase in total costs of \$10.7 b (4.1%).**
- ❑ **Increase in renewables results in 27 GW more of new generation capacity**

The Role of Natural Gas

- ❑ **Access to natural gas and geographic factors noted.**
- ❑ **Significant Trade of up to 114,000 GWh can be realised by 2040 with significant contributions from natural gas.**
- ❑ **There is significant additional capacity from CCGT in Mozambique (1325-1880 MW) if there is dry climate scenario or other hydro projects are delayed.**
- ❑ **There are higher investment in gas particularly CCGT if optimal investment decisions are followed.**

The Role of Natural Gas

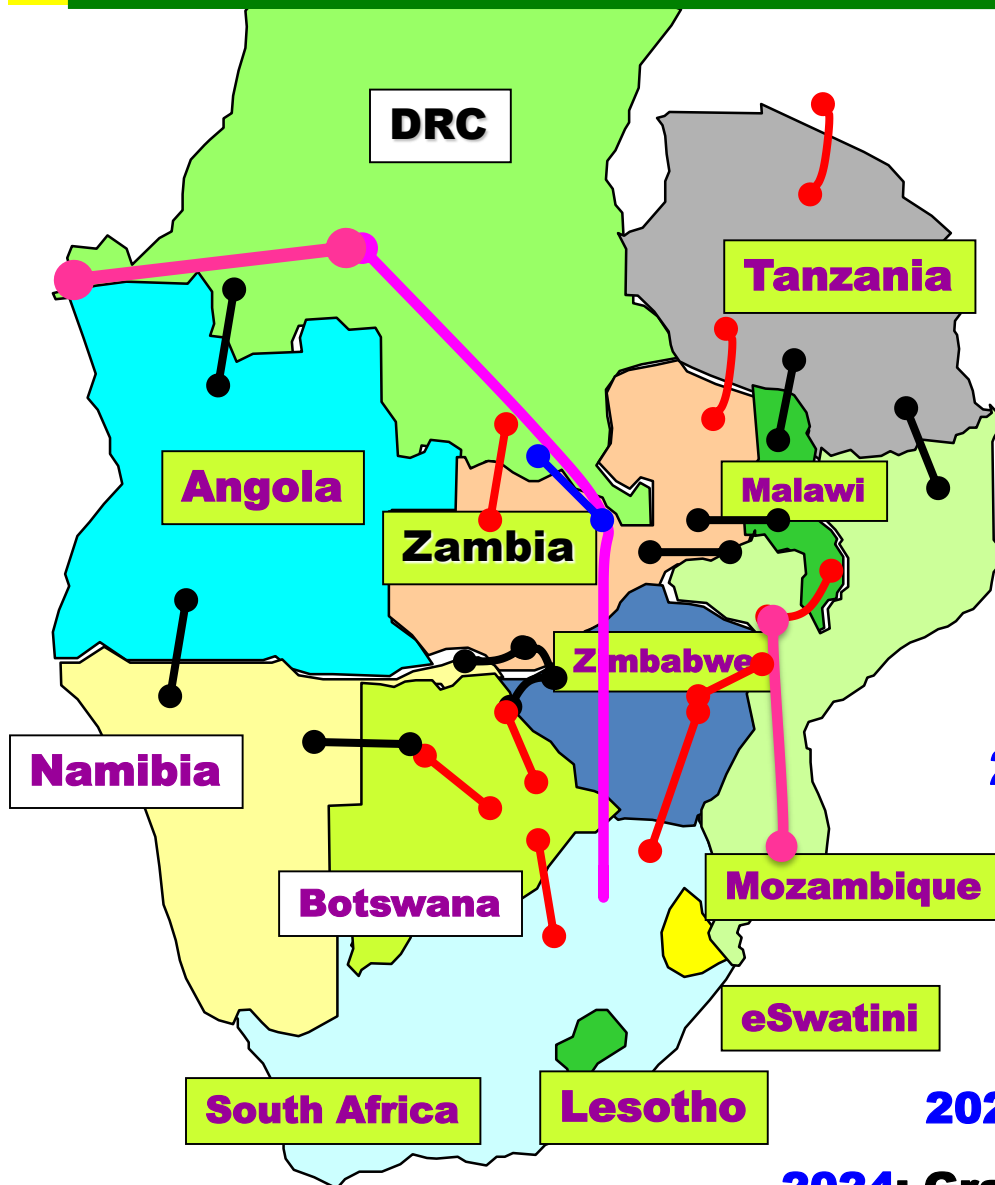
- ❑ **There is significant natural gas projects in Tanzania (6,205MW).**
- ❑ **Natural gas developments of over 13,000 MW can be realised in the future by 2040.**
- ❑ **Contributions from natural gas can reach up to 30 % of new generation mix by 2040.**

TECHNICAL & ECONOMIC PARAMETERS AFFECTING INTEGRATION OF RENEWABLE ENERGY

The following **technical** considerations should be considered when integrating renewable energy into the SAPP grid:

- i.** capacity factor,
- ii.** voltage control capabilities,
- iii.** tolerance to voltage dips resulting from contingencies,
- iv.** ability to help regulate the system for frequenting variations,
- v.** acceptable flicker and harmonise emission performance, and
- vi.** other capability functions.

UPDATE ON TRANSMISSION PROJECTS



2021: ZIZABONA - 330 kV

2021: Mozambique – Malawi 400 kV

2021: Zambia-Tanzania-Kenya 400 kV

**2020: Morupule – Maun 400 kV
(Botswana)**

2022: MOZISA 400 kV

2022: Botswana-RSA 400 kV

2021: Namibia – Angola 400 kV

**2020: Orapa – Pandamatenga 400 kV
(Botswana)**

2024: Mozambique STE – HVDC/AC

2024: Grand Inga Transmission– HVDC/AC

Map Not to Scale: For illustration purposes only

SAPP Pool Plan 2017 Recommendations

- ❑ Country committed generation projects considered as given.**
- ❑ Key regional generation and transmission projects have been identified.**
- ❑ Various sensitivities were carried out on recommended plan and it was found to be robust in the face of risk factors and policy changes analysed.**
- ❑ The SAPP Pool Plan is indicative.**
- ❑ SAPP has approved the SAPP Pool Plan Report and it was endorsed by SADC Energy Ministers.**

SAPP Pool Plan Dissemination and next Steps

- ❑ The economic benefits at national level are to be unpacked and key regional generation and transmission projects are to be highlighted.**
- ❑ SAPP Pool Plan is currently being shared with various stakeholders – and will be shared with all related regional organisations including SACREEE and IRENA**
- ❑ SAPP Pool Plan Dissemination at country level is currently underway with support from the World Bank.**
- ❑ SAPP Pool Plan Dissemination Workshop for Financiers – Nov 2018**

END