The Southern African Power Pool

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Meeting growing power demands through Southern African regional integration

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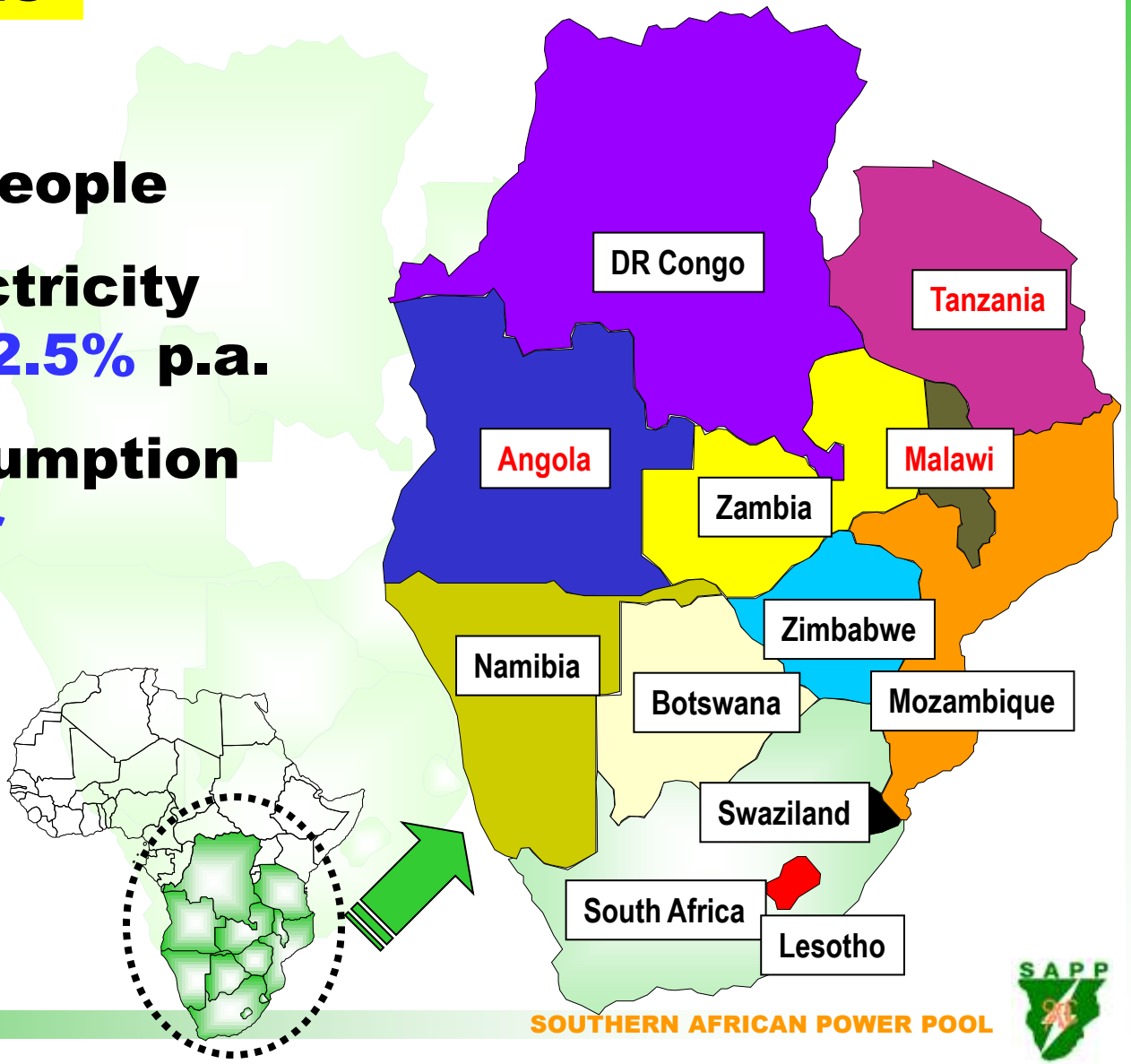
1. OVERVIEW OF THE SAPP

1.1 Geographic

- 12 Countries
- 280 Million people
- Average Electricity growth rate 2.5% p.a.
- Energy consumption 400TWh/year

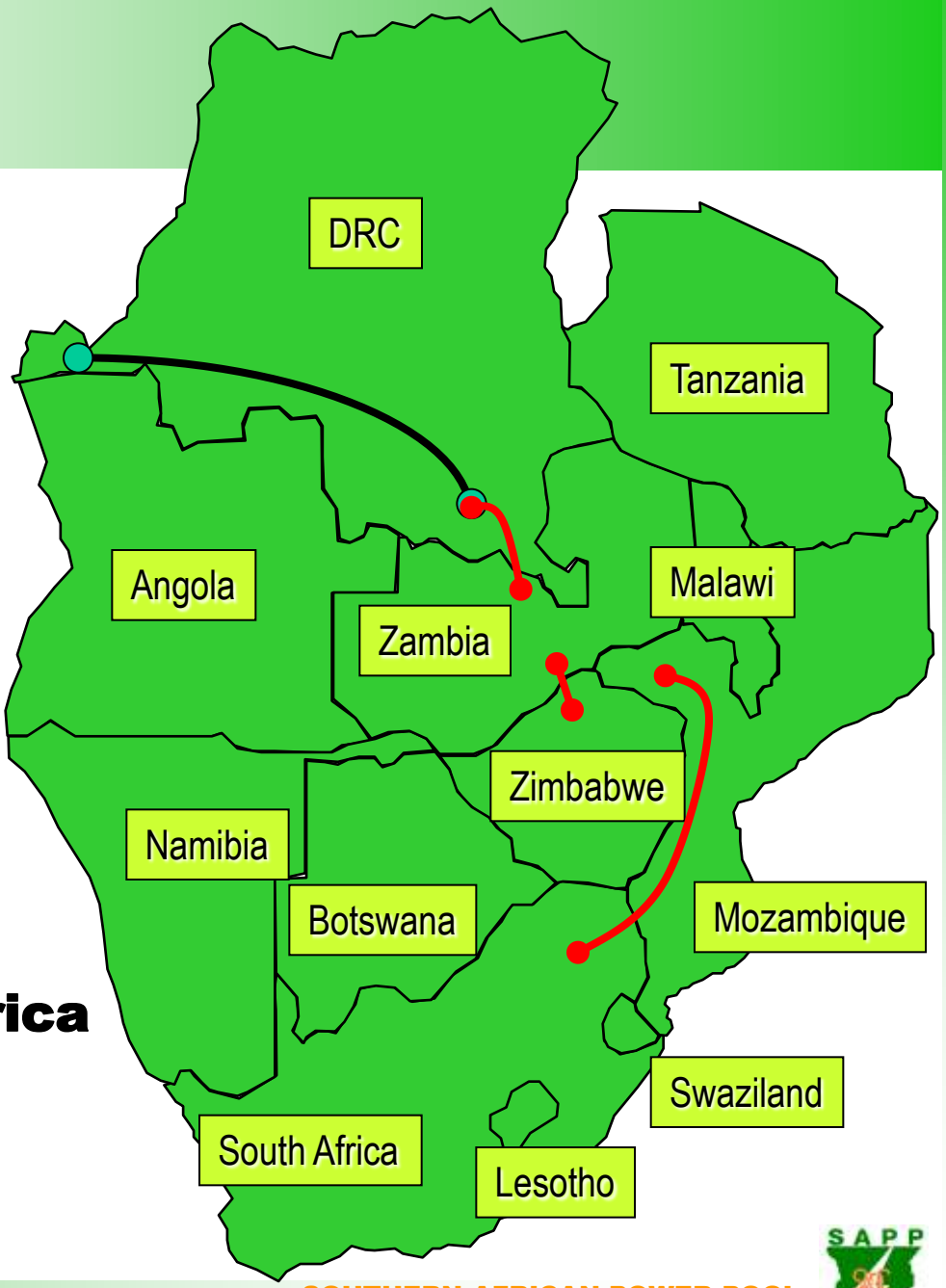


1.2 Historic (1)

1950s: DRC-Zambia
500kV HVDC 1700km
1x220kV AC, 210MW

1960s: Zambia – Zimbabwe
2x330kV AC, 1400MW

1975: Mozambique – South Africa
533kV HVDC – 1400km
2000MW



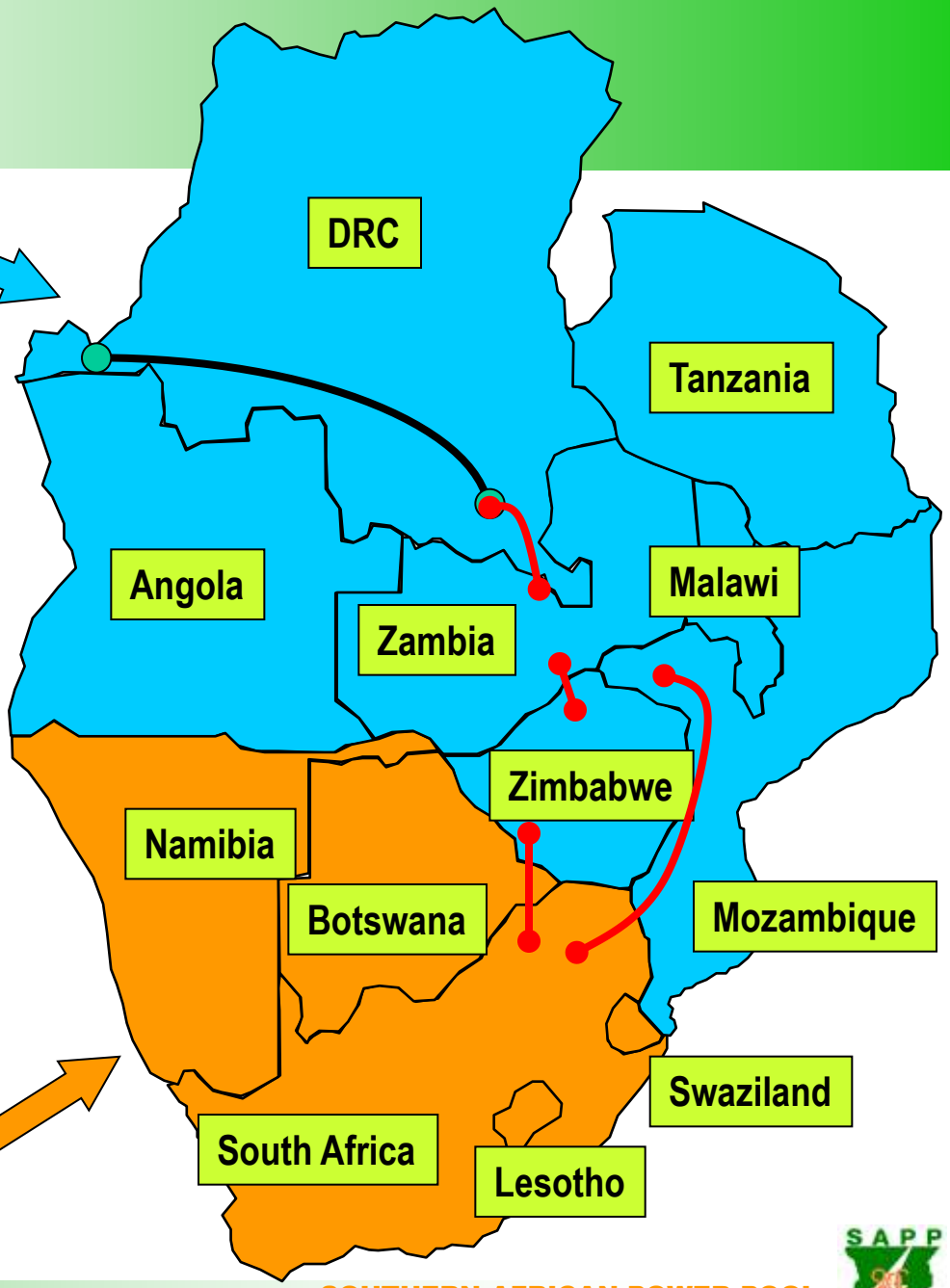
1.2 Historic (2)

Hydro Northern Network

Two networks linked by weak lines at 220kV & 132kV via Botswana

In 1995 the 400kV was constructed from Zimbabwe to South Africa via Botswana.

Thermal Southern Network



1.2 Historic (3)

- The interconnection of the northern and southern networks created a platform for regional trade and cooperation.

- In 1995, the Ministers responsible for energy in the Southern African Development Community (SADC) signed Inter-Government MOU that lead to the creation of a power pool under the name, Southern African Power Pool (SAPP).

- The Aim was to optimise the use of available energy resources in the region and support one another during emergencies.

1.4 Governing Legal Documents

- **Inter-Governmental MOU**
  - Established SAPP.
  - Signed by SADC Member Countries in 1995.
  - Revised document signed on 23 February 2006.
- **Inter-Utility MOU**
  - Established the Management of SAPP.
  - Revised document signed on 25 April 2007.
- **Agreement Between Operating Members**
  - Signed by Operating Members only.
  - Review document signed in April 2008.
- **Operating Guidelines**
  - Signed in in 2013.

1.5 Membership

No	Full Name of Utility	Status	Abbreviation	Country
1	Botswana Power Corporation	OP	BPC	Botswana
2	Electricidade de Mocambique	OP	EDM	Mozambique
3	Hidro Electrica Cahora Bassa	OB	HCB	Mozambique
4	Mozambique Transmission Company	OB	MOTRACO	Mozambique
5	Electricity Supply Corporation of Malawi	NP	ESCOM	Malawi
6	Empresa Nacional de Electricidade	NP	ENE	Angola
7	ESKOM	OP	Eskom	South Africa
8	Lesotho Electricity Corporation	OP	LEC	Lesotho
9	NAMPOWER	OP	Nam Power	Namibia
10	Societe Nationale d'Electricite	OP	SNEL	DRC
11	Swaziland Electricity Board	OP	SEB	Swaziland
12	Tanzania Electricity Supply Company Ltd	NP	TANESCO	Tanzania
13	ZESCO Limited	OP	ZESCO	Zambia
14	Copperbelt Energy Corporation	ITC	CEC	Zambia
15	Lunsemfwa Hydro Power Company	IPP	LHPC	Zambia
16	Zimbabwe Electricity Supply Authority	OP	ZESA	Zimbabwe

OP = Operating Member
NP = Non-Operating Member
OB = Observer
IPP = Independent Power Producer
ITC = Independent Transmission Company

CEC & LHPC (Zambia) are new Members of SAPP

As at the end of January 2017 available capacity was 46,522 MW against a peak demand plus reserve of 53,036 MW giving a shortfall of 6,514 MW

2. Generation Projects Commissioned in 2016

No	Utility	Country	Name	Type	Capacity [MW]
1	RNT	Angola	Cambambe 1 & 2	Hydro	350
2	RNT	Angola	Cambambe 3 & 4	Hydro	350
3	RNT	Angola	Cambambe I Rehabilation	Hydro	80
4	IPP	RSA	OCGT IPP	Gas	1070
5	IPP	South Africa	Renewable Round 3	PV,CSP,Wind	454
6	NamPower	Namibia	Ruacana	Hydro	15
7	IPP	Mozambique	Gigawatt	Gas	100
8	IPP	South Africa	Cogen	Gas	100
9	IPP	Zambia	Maamba Colliery	Coal	300
10	IPP	Mozambique	Kuvaninga	Gas	40
11	IPP	Mozambique	Nacala Power Ship	Gas	100
12	BPC	BOTSWANA	Morupule A	Coal	90
13	IPP	Malawi	Diesel	Diesel	10
TOTAL					3059

2. Generation Projects to be Commissioned by 2022

No	Country	Commited Generation Capacity, MW							
		2016	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	Total
1	Angola	780	2571	200	0	0	0	0	3,551
2	Botswana	-	120	-	300	300	-	-	720
3	DRC	-	150	-	-	360	-	1,500	2,010
4	Lesotho	-	20	-	-	-	-	-	20
5	Malawi	-	36	12	132	340	310	100	930
6	Mozambique	140	-	100	-	-	900	1,900	3,040
7	Namibia	15	-	-	800	-	-	-	815
8	RSA	1,503	999	2,169	2,169	1,446	1,446	1,528	11,260
9	Swaziland	-	-	-	12	-	-	-	12
10	Tanzania	-	900	1,040	250	1,000	-	-	3,190
11	Zambia	420	15	113	300	790	930	1,200	3,768
12	Zimbabwe	200	120	540	630	600	2,210	1,200	5,500
TOTAL		3,058	4,931	4,174	4,593	4,836	5,796	7,428	34,816

3. REGIONAL INTERCONNECTIONS

Since 1995, the following transmission lines have been commissioned by the SAPP:

1. The 400kV Matimba-Insukamini Interconnector linking Eskom of South Africa and ZESA of Zimbabwe in 1995.

2. The 330kV Interconnector between Mozambique and Zimbabwe was commissioned in 1997.

3. BPC Phokoje substation was tapped into the Matimba line to allow for Botswana's tapping into the SAPP grid at 400kV in 1998.

4. Restoration of the 533kV DC lines between Cahora Bassa in Mozambique and Apollo substation in South Africa was completed in 1998.

5. 400kV line between Camden in South Africa via Edwaleni in Swaziland to Maputo in Mozambique in 2000.

6. 400kV line between Arnot in South Africa and Maputo in Mozambique in 2001.

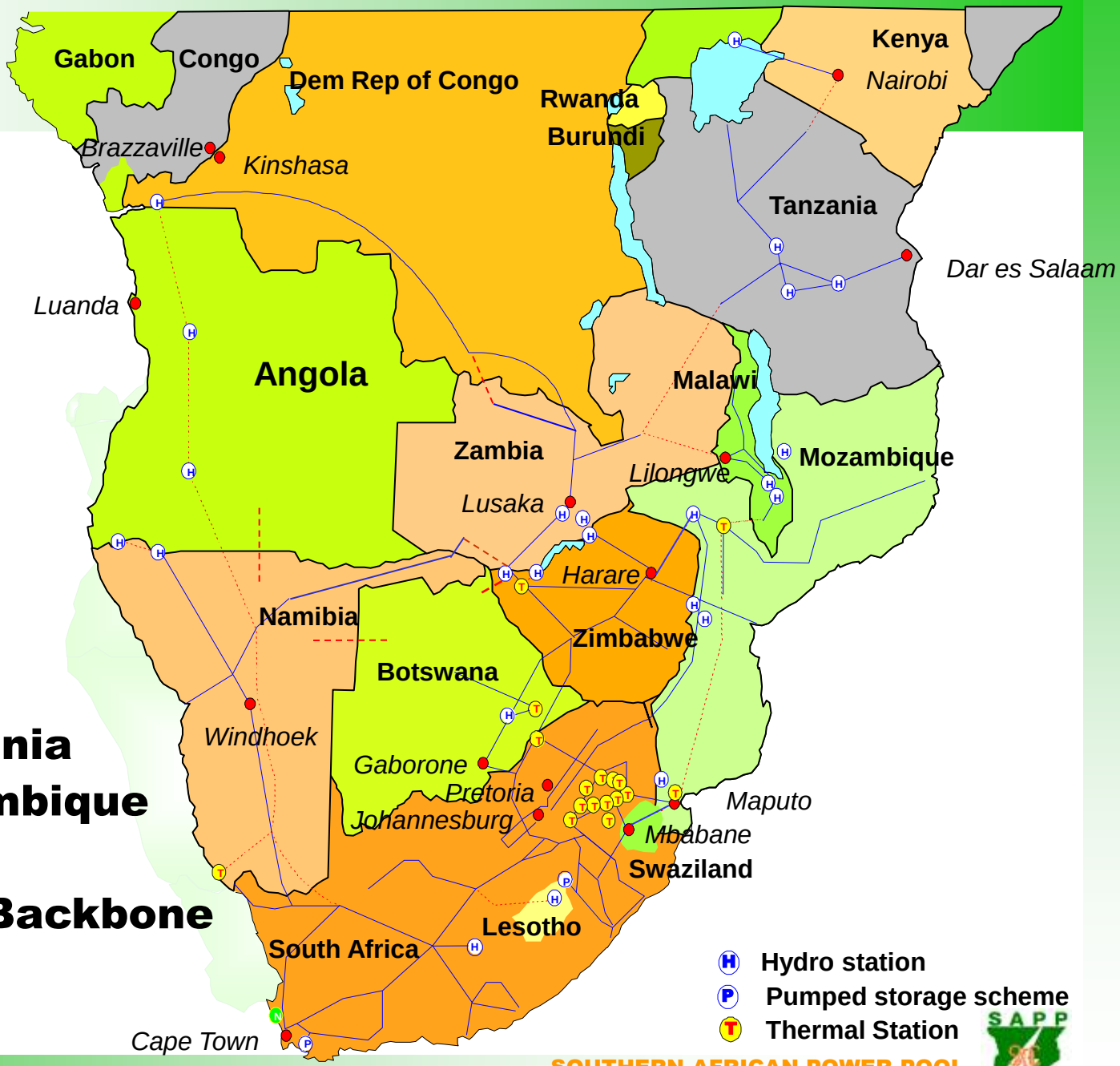
7. 400kV line between Aggeneis in South Africa and Kookerboom in Namibia in 2001.

8. 220kV line from Zambia to Namibia in 2007.

Transmission Projects

Over **USD 5.6 billion** would be required to develop the identified transmission projects

- **ZIZABONA**
- **Zambia-Tanzania**
- **Malawi-Mozambique**
- **DRC-Zambia**
- **Mozambique Backbone**



3. Planned Transmission Projects

TRANSMISSION PROJECTS (PRE-FEASIBILITY)				
No.	Project Name	Voltage Level , kV	Countries	Status
1	Angola - Namibia	330	Angola, Namibia	Concept / pre-feasibility stage
2	Botswana - Namibia	330 /400	Botswana, Namibia	Concept / pre-feasibility stage
3	Zambia - Malawi	330 /400	Zambia, Malawi	Concept / pre-feasibility stage
4	Zambia - Mozambique	330 /400	Zambia, Mozambique	Concept / pre-feasibility stage
5	Tanzania - Malawi	400	Malawi, Tanzania	Concept / pre-feasibility stage
6	Tanzania - Mozambique	400	Tanzania, Mozambique	Concept / pre-feasibility stage
7	Kolwezi - Solwezi	400	DRC , Zambia	Concept / pre-feasibility stage

4. POWER POOLING AND ENERGY TRADING

4.1 Power Pooling (1)

- Linking utilities electricity production facilitates the dispatch of excess capacity from one system to another.
- Thus the output from different power plants is pooled, scheduled according to increasing marginal cost, and dispatched according to merit order to meet demand.
- The benefits and platform created by power pooling include:

1. **Increased security and reliability of supply**
   - ✓ Provision of emergency support
   - ✓ Sharing spinning reserve capacity
   - ✓ Balancing generation mix (74% coal, 20% hydro, 4% nuclear, 2% gas/diesel)

2. **Improved sector investment environment**
   - ✓ Aggregation of individual power markets
   - ✓ Improved access to creditworthy
   - ✓ Diversification

4.1 Power Pooling (2)

3. **Reduced operating costs**

- ✓ Balancing non-coincidental peak-loads
- ✓ Optimization of generation resources

3. **Reduced & deferred investment costs**

- ✓ Advantage of economies of scale
- ✓ Reduced total reserve requirements (SAPP has managed from 20% to 10%)
- ✓ Postponed investments in new peak power capacity

4.2 Energy Trading (2)

- Energy trading has been facilitated by the fact that some members have excess power supply and others are in a deficit.
- Balancing supply and demand is done via energy trading arrangements:

EARLY YEARS

- Bilateral contracts

CURRENT AND FUTURE OUTLOOK

- Bilateral contracts
- Day-Ahead Market (DAM) – From 2009
- Post DAM Market - From 2014
- Ancillary Services Market – From 2015

FROM YEAR 2001

- Bilateral contracts
- Short-Term Energy Market (STEM) - 2001
- Post STEM (Balancing Market) - 2002

4.3 Bilateral Market

All SAPP members are active on the bilateral market

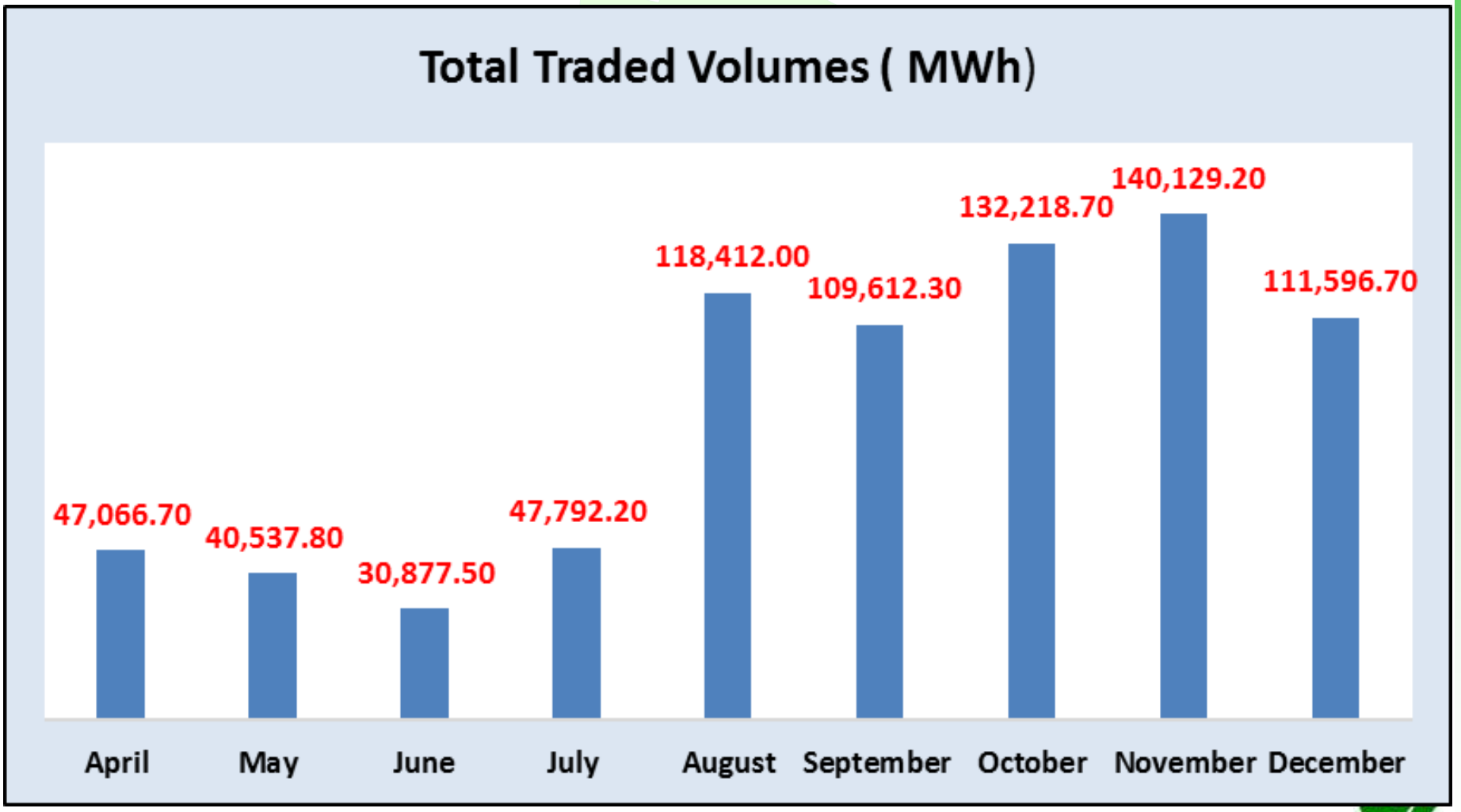
- **Bilateral Contracts registered in 2012 - 28**
  - **Firm 18**
  - **Non firm 10**
  - **Active Contracts 15**

- **Generation and transmission capacity constraints are noted as the key factors affecting bilateral trading in SAPP**

4.4 Day-ahead Market (DAM)

- The following members have been active on the market, BPC, CEC, EDM, ESKOM, SEC, NAMPOWER, ZESA and ZESCO.

4.4 Day-ahead Market (DAM)



4.6 Advantages of a Competitive Market

The creation of a competitive market would:

- **Help to optimise the use of available regional resources**
- **Assist in determining correct pool electricity price**
- **Send signals for investments and real time utilization of existing assets; transmission, generation and consumption.**
- **Enable the demand side to respond to the supply side price signals.**

5. CONCLUSION

1. Meeting a growing power demand in SAPP would require a coordinated approach in planning and implementation of both generation and transmission projects.

2. Generation and transmission capacity constraints are affecting bilateral and DAM trades.

3. SAPP has planned to commission approximately 18,000MW of generation capacity by 2019. if commissioned, the reserve margin will improve.

4. A secure, reliable and developed regional integration would ensure availability of power to all SAPP Members via the established energy trading platforms.

THANK YOU