PARLIAMENT
OF THE REPUBLIC OF SOUTH AFRICA

WATER AND ENERGY CRISIS IN SOUTH AFRICA - COULD THE LESOTHO MOUNTAINS PROVIDE A SOLUTION

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BACKGROUND TO THE CRISIS

- *Crisis*, what does it mean? The Oxford Dictionary defines it as a *time of intense difficulty or danger* while the Merriam-Webister defines it as *a situation that has reached a critical phase, e.g. Energy Crisis or Water Crisis, Unemployment Crisis etc.*
- The World Economic Forum defines a water crisis as a significant decline in the available quality and quantity of freshwater, resulting in harmful effects on human health and/or economic activity).
- Water scarcity/shortage/ rationing/ day zero and electricity load shedding/blackout are examples of a water and energy supply situations that have reached critical phase that presents danger or difficulty to the people and the economy.
- The ultimate consequences of both water and energy crises are diverse but Day Zero (water supply systems are empty) and Electricity Blackout (a state of no electricity at all) are the worst.

CAUSES AND CONSEQUENCES OF WATER & ENERGY CRISIS IN SOUTH AFRICA

- Lack of competition in the energy generation, transmission and distribution value chain (the downside of public monopoly - ESKOM)
- Corruption, fraud, theft, mismanagement and vandalism of public infrastructure and resources
- Regulatory challenges and redtape e.g.
- Lack of skills and poor leadership in the water and energy sectors
- Lack of maintenance of both water and energy infrastructure (power stations, wastewater treatment facilities and related components)
- High debt to GDP ratio (ESKOM debt R400 billion)
- Lack of investment in public infrastructure (IDC, PIC-GEPF, DBSA etc.)
- Illegal water and electricity connections
- Non Revenue Water and poor water & energy use efficiency
- Water Pollution from wastewater and mining
- Unstable geopolitical environment e.g., Russia & Ukraine, Mozambique Cape Delgado insurgency, July unrest
- Uncoordinated nature based solutions – protection and rehabilitation of ecological infrastructure
- Organised labour internal conflicts and quasi political (neglecting interests of workers)
- Southern Africa Power Pool – not all countries are connected to the SAPP grid
- High unemployment, and increased inequality and poverty

SITUATIONAL ANALYSIS – WATER AND ENERGY

- South Africa has installed capacity to produce approximately 46,000 MW of electricity, and at peak times we use about 32,000 MW of electricity. Unfortunately, planned maintenance and unplanned outages reduces the available electricity by 40%.
- The country experienced the worst load-shedding in July 2022 when a combination of factors resulted in a loss of 18,000 MW which led to the implementation of stage 6 load shedding.
- South Africa has an arid to semi-arid climate, with a mean annual rainfall of 500 mm, as compared to the world average of 860 mm. This rainfall produces a total annual runoff of approximately 49 000 million m^3/a.
- A total of 65% of South Africa has a mean annual rainfall of less than 500 mm and 21% of the country with a mean annual rainfall of less than 200 mm. The country, therefore, experiences severe and prolonged hydrological droughts, which may last as long as 10 years at a time.
- The country's water security is mainly reliant on fresh surface water, with ground water and return flows underutilised. There are currently 5 551 registered dams with a total gross storage capacity of 33 291 million m^3.
- Municipalities are losing about 1660 million m^3/a through Non-Revenue Water. At a unit cost of R6/m3 this amounts to R9.9 billion each year
- Agriculture, including afforestation and livestock watering, is the largest user at 66% followed by municipal and domestic use at 27%; power generation (2%), mining (2%) and with bulk industrial use, livestock and conservation and afforestation jointly making up the remaining 8 %.

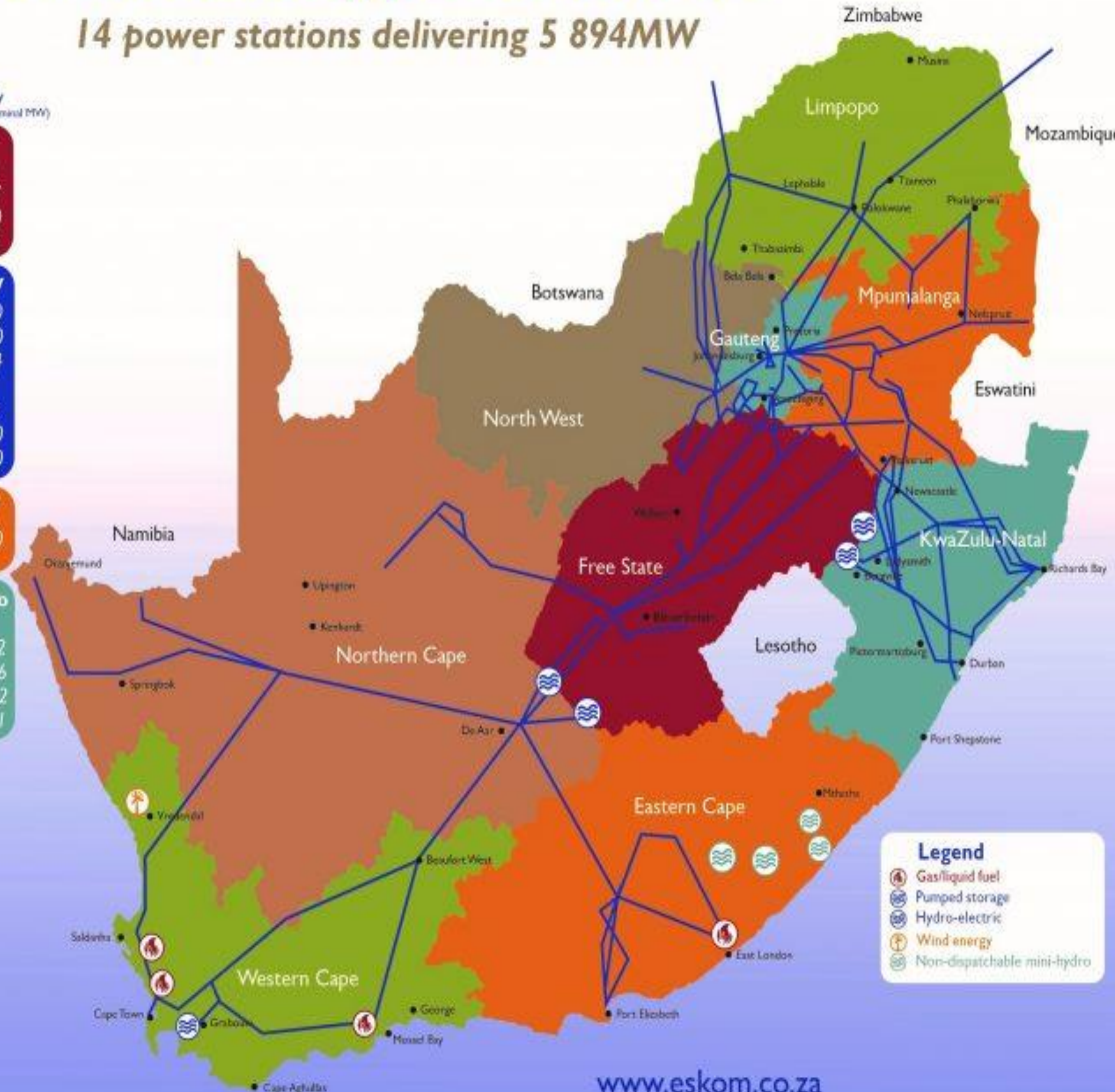
SITUATIONAL ANALYSIS – ENERGY IRP 2019

	Coal	Coal (Decommissioning)	Nuclear	Hydro	Storage	PV	Wind	CSP	Gas & Diesel	Other (Distributed Generation, CoGen, Biomass, Landfill)
Current Base	37 149		1 860	2 100	2 912	1 474	1 980	300	3 830	499
2019	2 155	-2373					244	300		Allocation to the extent of the short term capacity and energy gap.
2020	1 433	557				114	300			
2021	1 433	-1403				300	818			
2022	711	-844			513	400 / 1000	1600			
2023	750	-555				1000	1600			500
2024			1860				1600		1000	500
2025						1000	1600			500
2026		-1219					1600			500
2027	750	-847					1 600		2000	500
2028		-475				1000	1 600			500
2029		-1694			1575	1000	1 600			500
2030		-1050		2 500		1 000	1 600			500
TOTAL INSTALLED CAPACITY by 2030 (MW)	33364		1860	4600	5000	8288	17742	600	6380	
% Total Installed Capacity (% of MW)	43		2.36	5.84	6.35	10.52	22.53	0.76	8.1	
% Annual Energy Contribution (% of MWh)	58.8		4.5	8.4	1.2*	6.3	17.8	0.6	1.3	

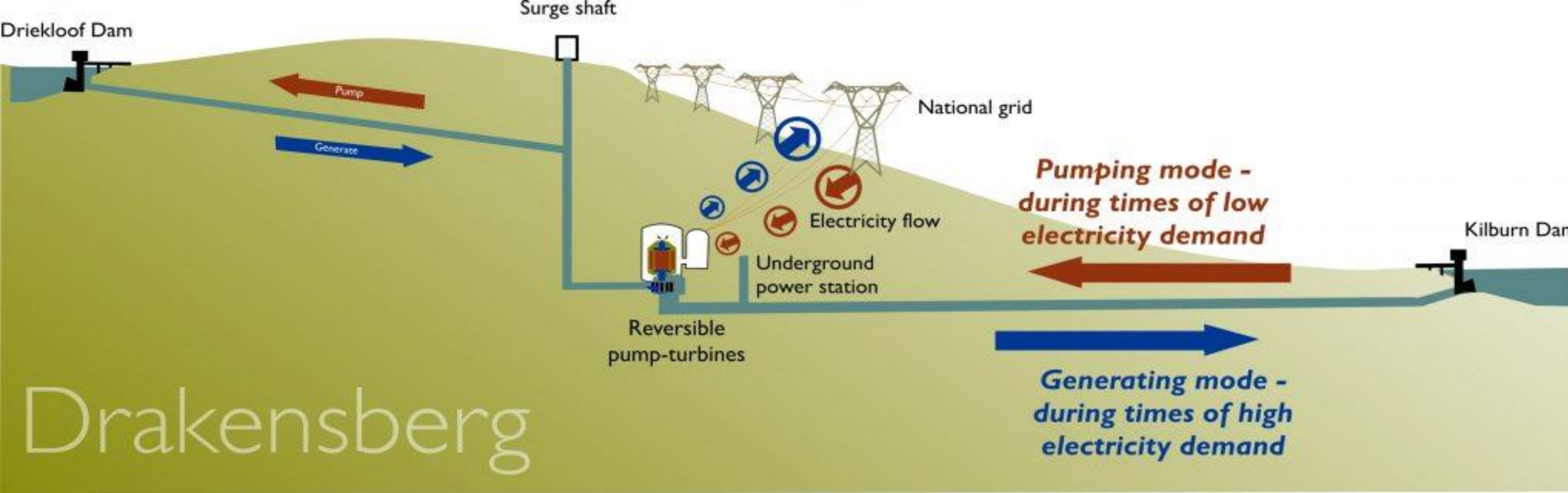
Eskom Peaking power stations

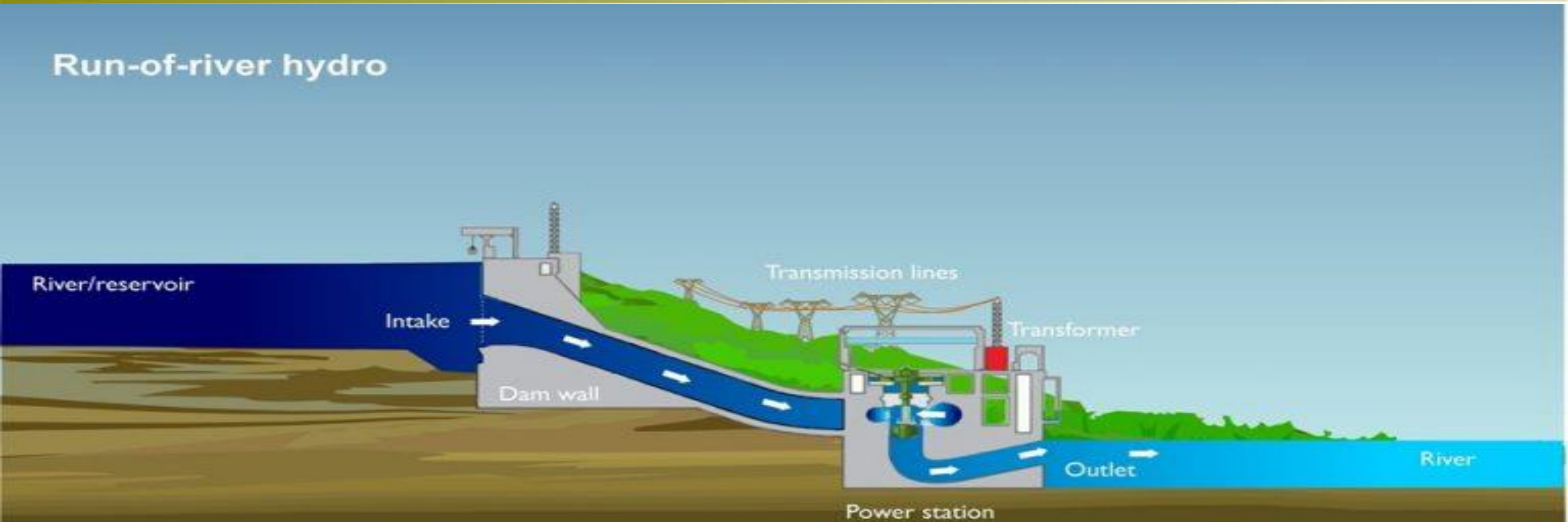
14 power stations delivering 5 894MW

Station	Location	Capacity (Total nominal MW)
4 Gas/liquid fuel		**2 409MW**
Acacia	*Cape Town*	*171*
Ankerlig	*Atlantis*	*1 327*
Gourikwa	*Mossel Bay*	*740*
Port Rex	*East London*	*171*
3 Pumped storage		**2 724MW**
Drakensberg	*Bergville*	*1 000*
Palmiet	*Grabouw*	*400*
Ingula	*Ladysmith*	*1 324*
2 Hydro-electric		**600MW**
Gariep	*Norvalspont*	*360*
Vanderkloof	*Petrusville*	*240*
1 Wind energy		**100MW**
Sere	*Vredendal*	*100*
4 Non-dispatchable mini-hydro		**61MW**
Mbashe	*Mbashe River*	*42*
First Falls	*Umtata River*	*6*
Ncora	*Ncora River*	*2*
Second Falls	*Umtata River*	*11*



www.eskom.co.za



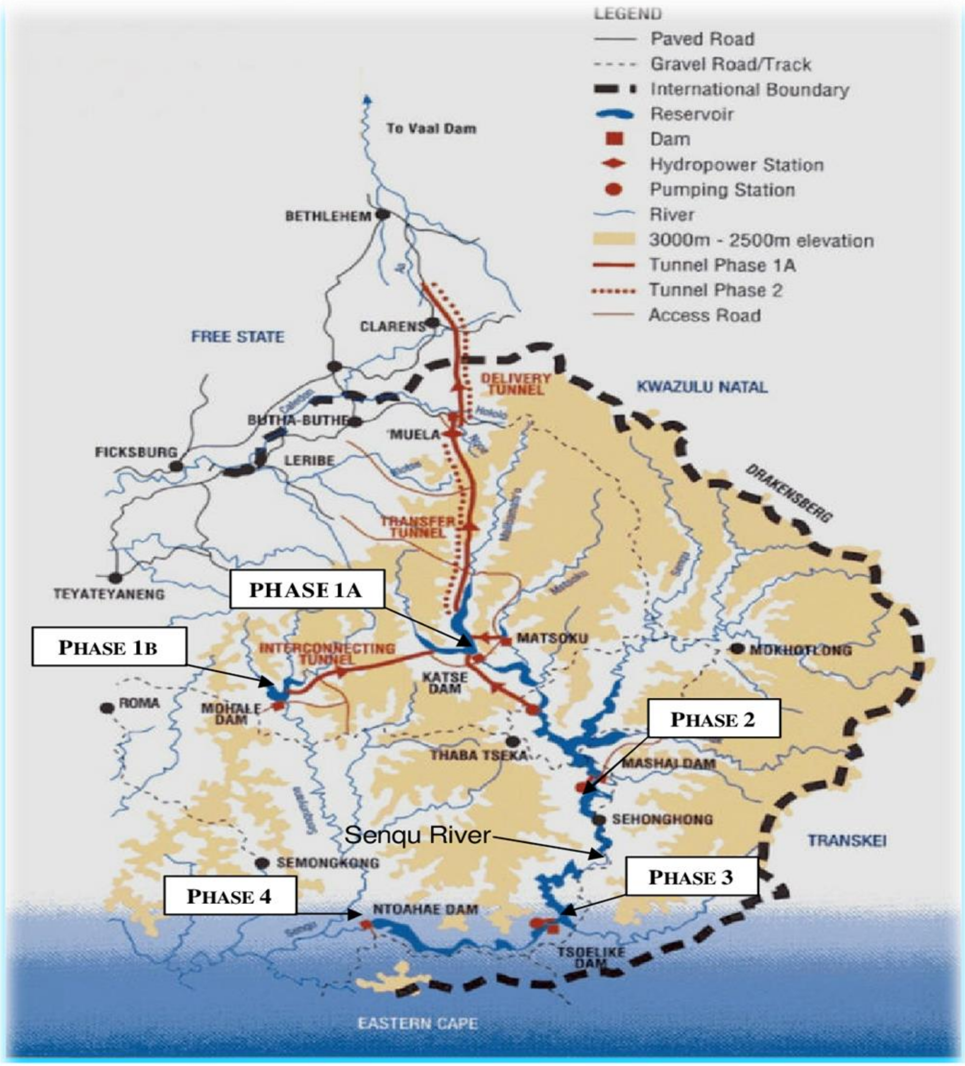


Gariep & Vandekloof Power Stations

SITUATIONAL ANALYSIS – WATER Master Plan 2019

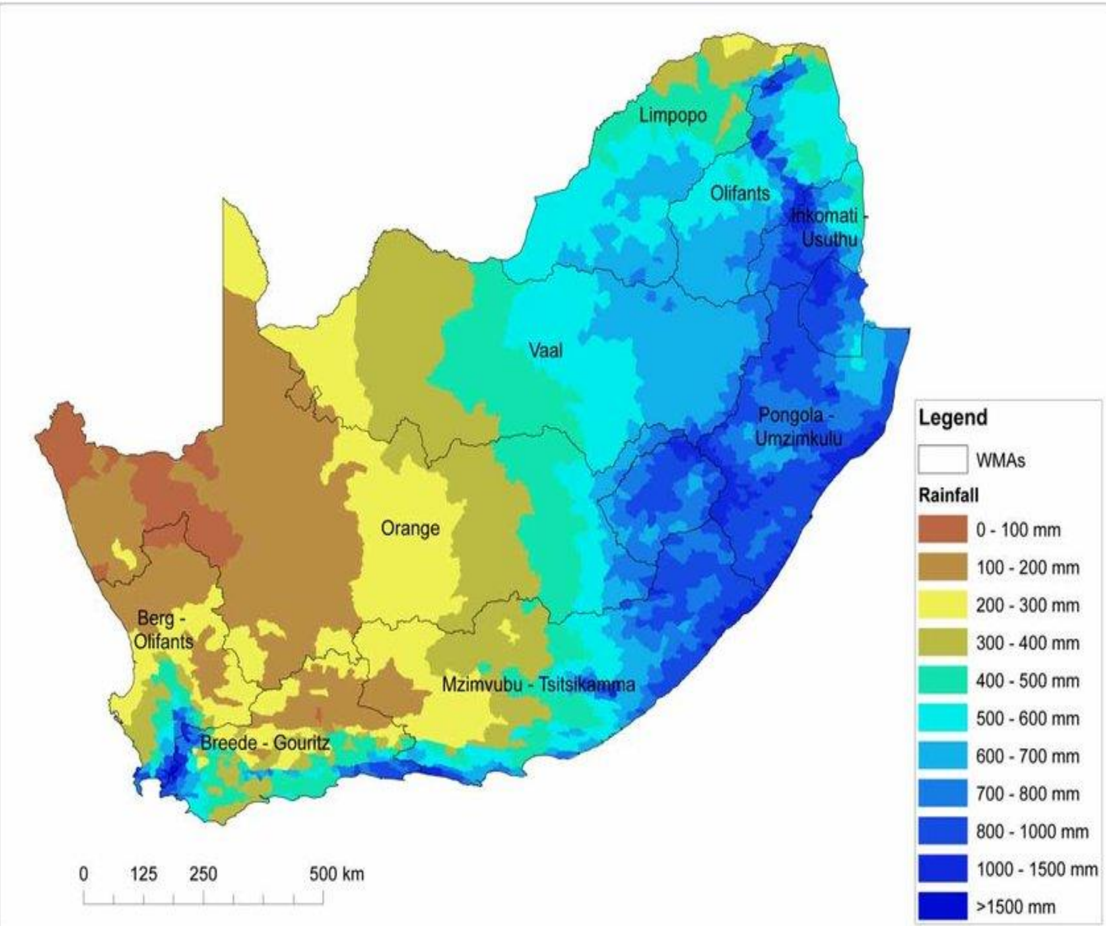
Water use sectors	2030 water requirements projections (million m³)		
	Without demand management interventions	With urban losses reduced from 35% to 15%	Reduce domestic demand from 237 l/c/d to 175 l/c/d
Agriculture (irrigation and livestock watering)	9 700	9 700	9 700
Municipal (industries, commerce, urban and rural domestic)	5 800	4 941	3 696
Strategic/Power generation	430	430	430
Mining and bulk industrial	1 017	1 017	1 017
International obligations	178	178	178
Afforestation	434	434	434
Total water requirements (2030)	**17 559**	**16 700**	**15 455**
Total water available (2015)	13 949		
Increased surface water yield	874		
Increased groundwater use	405		
Desalination (including treated AMD)	588		
Re-use	110		
Total water available (2030)	**15 926**	**15 926**	**15 926**
Deficit/surplus	-1 633	-763	527
Deficit/surplus	-10%	-5%	3%

GEOGRAPHY OF THE LESOTHO MOUNTAINS



- The Drakensberg - Lesotho mountain range is located at more than 3000m asl with the average point sitting at >1400 m.
- It is the headwaters of the Senqu- Orange River Basin fed by Senqu, Makhaleng, & Mohokare Rivers.
- Lesotho’s climate is generally classified as **temperate with alpine characteristics** while escarpment summit and adjacent high peaks, the climate is generally interpreted as **marginal periglacial**
- The country experiences hot summers and very cold winters.
- Its location exposes the country to the influences of both the Indian and the Atlantic Oceans, with wide differences in temperature.
- Annual precipitation is highly variable both temporally and spatially, ranging from 760 mm to > 1500 (relief rainfall)

Water Availability in the Lesotho Mountains

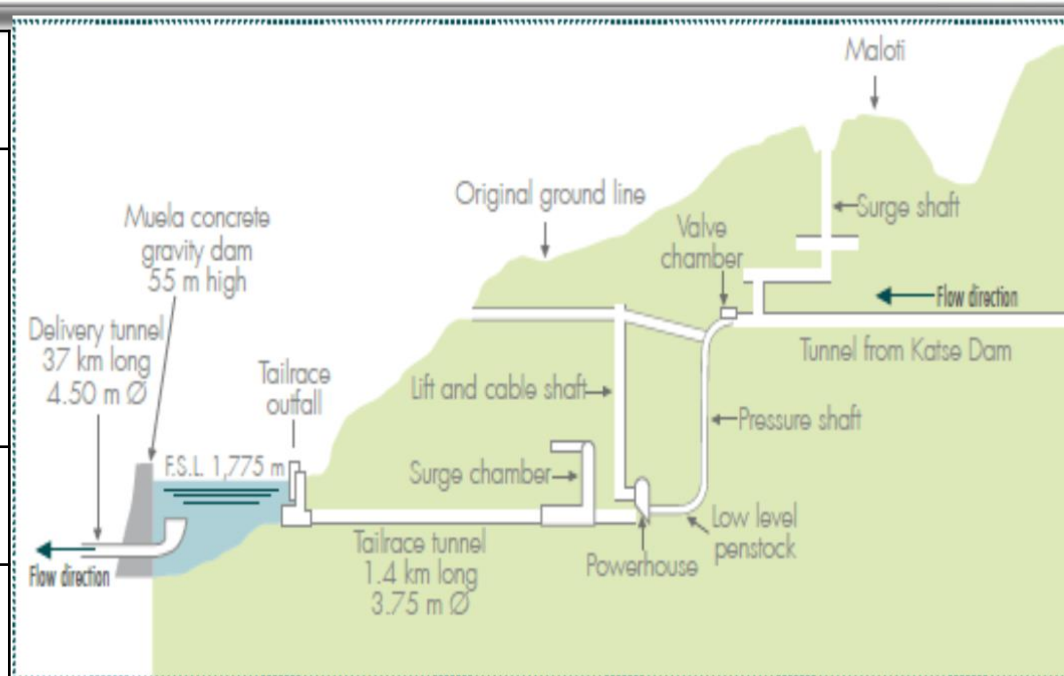


- Lesotho's natural renewable water resources are estimated at 5.2 million km^3 /a, far exceeding its water demand.
- The total water consumption in Lesotho is about 2 m^3/s, while the total availability is about 150 m^3/s. This is well below 2% of its available water.
- Lesotho mountains are a water & energy tower

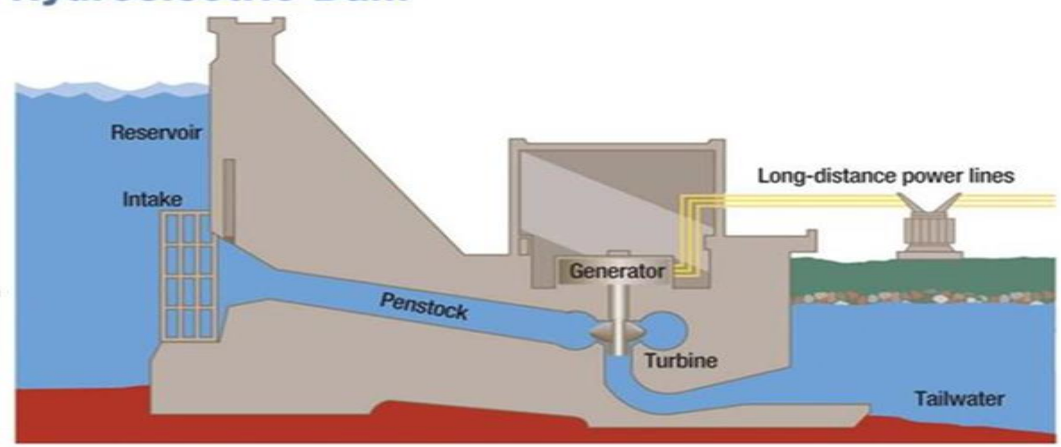
Energy Generation (Muela Hydropower 72 MW) in Lesotho

Table 1 Hydroelectricity Generation

Year	Electricity Generated (GWhr)	Actual Value (M millions)	Export Value (M millions)
2015	518.9	54.9	0.7
2016	530.7	60.6	0.8
2017	508	57.3	0.8
2018	520.1	60	0.5
2019	496.5	56.3	0.6
2020	392.4	43.7	0.2



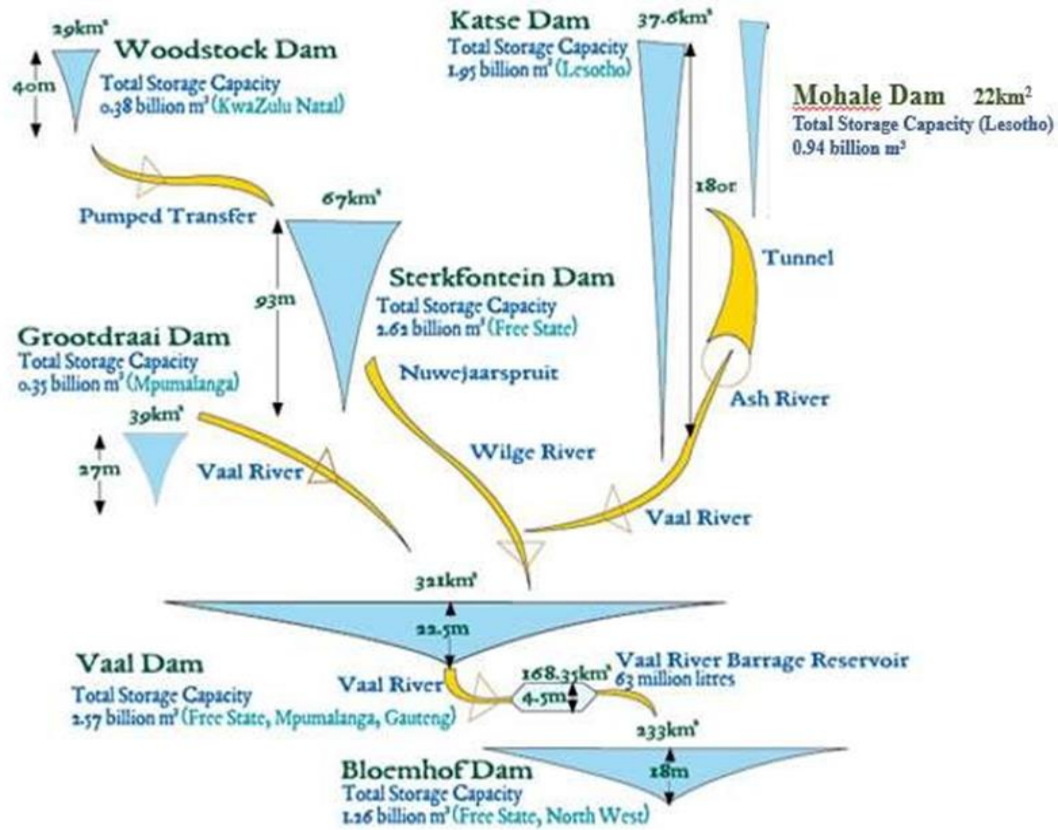
Hydroelectric Dam



Water and Energy Generation in Lesotho

Table 2 Gravitational Water Transfer		
Year	Water Transfer red (Million m^3)	Royalties paid to Lesotho (M Million)
2015	780	735.9
2016	779.9	736.9
2017	794	861.8
2018	810	942.5
2019	777.7	937.5
2020	640.6	839.5

- Lesotho Highlands Water Project currently transfers water to South Africa from Katse and Mohale dams



Katse Dam (Skypixels, 2022)

CONCLUDING REMARKS

- Geographically, Lesotho mountain hold much potential to solve water and energy crisis in South Africa as it is already providing in excess of 40% of Gauteng water requirements
- Hydropower is like a big battery, you can store power in the form of water which you can use when you want and generate electricity on demand. The water remains available for other uses.
- There is a need to increase energy generation capacity of the Lesotho Highlands Water Project for mutual benefit between South Africa and Kingdom of Lesotho
- The Lesotho Hydropower should be connected to the Southern Africa Power Pool
- Climate change poses the greatest risk to water and energy supply from Lesotho mountains therefore climate risk assessment should be integral part of future expansion planning
- Environ-societal rights should be considered and mainstreamed into the planning of the expansion of this project
- This project should be done through the SADC provisions on economic integration to avoid conflicts with other riparian states
- What is to be done? (the role of parliament)