Water Allocation & Policies to Promote Efficiency: Experience from South Africa
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• South African water and energy context
• Legal framework for water allocation
• Promoting water efficiency in energy generation
THE SOUTH AFRICAN WATER AND ENERGY CONTEXT
Rainfall and evaporation

Average rainfall (mm/a)
- < 100
- 100 - 200
- 200 - 300
- 300 - 400
- 400 - 500
- 500 - 600
- 600 - 700
- 700 - 800
- 800 - 1000
- 1 000 - 1 500
- > 1 500

Evaporation Isoptehs mm/a
Comparison of mean annual runoff, population and economic activity per Water Management Area
Water Management Areas and Main Water Transfers
Location of coal fired power stations
South African water context

Gap between existing supply and projected\(^1\) demand in 2030, % of 2030 demand

- Surplus
- Moderate (0 to -20%)
- Severe (-20% to -80%)

2030 projections depict net deficit of 2.7 billion cubic meters. (Estimated supply = 15 billion cubic meters)

Under plausible climate change scenario, deficit could increase to 3.8 billion cubic meters

Water use trends increasing beyond available catchment yields and current water infrastructure capacity and potential climate change impacts
Water and coal mining

- Significant Acid Mine Drainage (AMD) in coal mining areas of the Olifants catchment
- rights for coal mining being issued in headwaters of sensitive and important catchments
- weaknesses in: legislative process and co-operative governance; application process; enforcing regulations, Environmental Management Plans (EMPs) application process; decommissioning
- gaps between legislation and implementation
Water Requirements - Policy Adjusted IRP 2010

- Water requirements peak in 2021 at 380Mm³
- By 2030, water requirements reduce to 275Mm³ (- decommissioning of existing coal stations)
- However: Compared to the Baseline 2030, water requirements will increase by:
  - 23Mm³ - if coal replaces new nuclear capacity and FGD retrofitted on new coal power stations
  - 43Mm³ - if coal power stations are decommissioned and FGD is required on existing, committed and uncommitted fleet
  - 174Mm³ - if there is no decommissioning and FGD is required on all existing and new coal
LEGISLATIVE FRAMEWORK FOR WATER USE
National Development Plan

- Economic growth should be environmentally sustainable and water conservation must be a priority to ensure sufficient water to support equitable economic growth and achievement of national developmental goals.
- All sectors of economy need to prioritise water conservation in development plans.
- A dedicated national water-conservation and demand-management programme, with clear national and local targets for 2017 and 2022, and sub programmes focused on municipalities, industry and agriculture, should be developed between 2012 and 2015.
- All sectors need to move with urgency in the implementation of WCWDM measures.

• All water use (surface and groundwater) is authorised under:
  – Existing lawful use (continuation of use allowed under previous legislation)
  – Licence (abstraction/discharge)
  – General authorisation
  – Schedule 1
• Authorisation required for abstraction and discharge
• Establishment of a National Water Resources Strategy - reviewed every five years
• Can develop regulations e.g for water conservation, water quality etc.
National Water Resources Strategy 2

- Water conservation/efficiency is a top priority
- Water conservation and measures to manage demand are implemented to actively apportion and manage water resources to promote equitable access to water use in desired quantity and reliability.
- In line with the requirements of the National Water Act, water users in South Africa may not waste water and must use water efficiently.
- Partnerships and collaboration between private sector and public sector are adopted and strengthened to ensure the sustained implementation of WCWDM between sectors.
- Research and development ensures appropriate and efficient solutions are discovered and employed.
Eskom value chain: activities associated with water use licenses (abstraction and discharge)

**Primary Energy**
- Coal mining
- Coal stockpiling
- Tailings dumps
- Pollution control dams

**Generation**
- Coal stockpiling
- Ash dump /dams
- Pollution control dams
- Bulk fuel storage
- Water Treatment Plant
- Chemical storage tanks
- Waste sites

**Transmission and distribution**
- Bulk fuel handling
- Waste handling
- Chemical handling
- Transformer oils
- Septic tanks
WATER QUALITY AND COAL
Water quality and coal power

• Eskom has zero effluent discharge policy from power stations
  – internal policy;

• Water quality and mines
  – Approximately 6000 abandoned mines in South Africa (not all coal)
  – Costs of rehabilitation (soil- and land-wise) estimated at $10 billion
  – At current rate of rehabilitation will take 800 years to rehabilitate all abandoned mines
  – Water pollution from mines has already caused die-offs of fish, turtles, crocodiles and water too saline to treat effectively for drinking water quality standards
Water quality and coal power

• Actions taken:
  – Brugspruit Water Pollution Control works built by Dept of Water to deal with AMD from defunct coal mines in Witbank area
    • Hampered by staff shortages, electrical cable theft and lack of maintenance
  • Active mines must have EMP(R)s and Social and Labour Plans including financial means to implement them
    – Anglo Coal spent:
      • $10 million on drainage, storage and treatment systems to improve quality and quantity of water discharge
      • S30 million on water reclamation plant to purify water from three active and one defunct mine to drinking water standards
        – Expensive process – $1 per cubic metre (or kl)
        – Settling process and reverse osmosis
        – Water sold to Emalahleni municipality at below cost ($0.39/kl)
Water use efficiency

- National policies require water use efficiency
- Water authorisation sets maximum abstraction, not efficiency parameters
- Critical driver is physical water shortages and cost of new water infrastructure
  - Voluntary action by Eskom to reduce water use
  - Internal standards, competition between plants
- Eskom committed to installation of dry cooled power stations
  - Will significantly reduce demand for water
  - Trade-offs between water use efficiency and air pollution technology
Thank you
Water and power generation

**Eskom water use:**
- FY2013: 334 Mm³/a; peak in 2021 at 380 Mm³/a; by 2030, reduce to 275 Mm³/a

**Future locality for new coal fired power stations:**
- Waterberg
- Soutpansberg, Free State, Mpumalanga

**Current heavy reliance on relatively water intensive, wet cooled power stations:**
- (78% of MWh; 98% of water use)

**Economic & social development requires reliable and affordable electricity**
- Build program
- R340Bn employ 50% locals

**Water risks:**
- Medium to long water resource security in question due to –
  - Competing interests
  - Increasing water demands and growing water deficits
  - Illegal water use
  - Water losses
  - Climate change impacts

**Water use**

**Adequate maintenance and reliability of water supply infrastructure**
- Costly and timely development of new water infrastructure

**Pollution of water resources**
- will make water unusable or drive up costs of treatment and management of waste
- Pollution from coal mines is a major risk to the country

**Climate variability will impact on yield of water resources and infrastructure availability at local, catchment and national level**
- Higher ambient temperatures impacting dry cooled power stations
- Higher rainfall impacting on coal supply chain
Large coal-fired power station will most likely be developed in Waterberg & smaller coal-fired power stations in Waterberg, Soutpansberg, Free State or Mpumalanga due to the size of respective coal deposits in these locations.
IRP 2010 projections - affected by Generation and Emission Abatement Technologies

Water consumption will increase as flue gases are required to be scrubbed to a higher purity and power station efficiency is reduced. Carbon Capture and Storage would increase water use by between ~30% and 100%.