

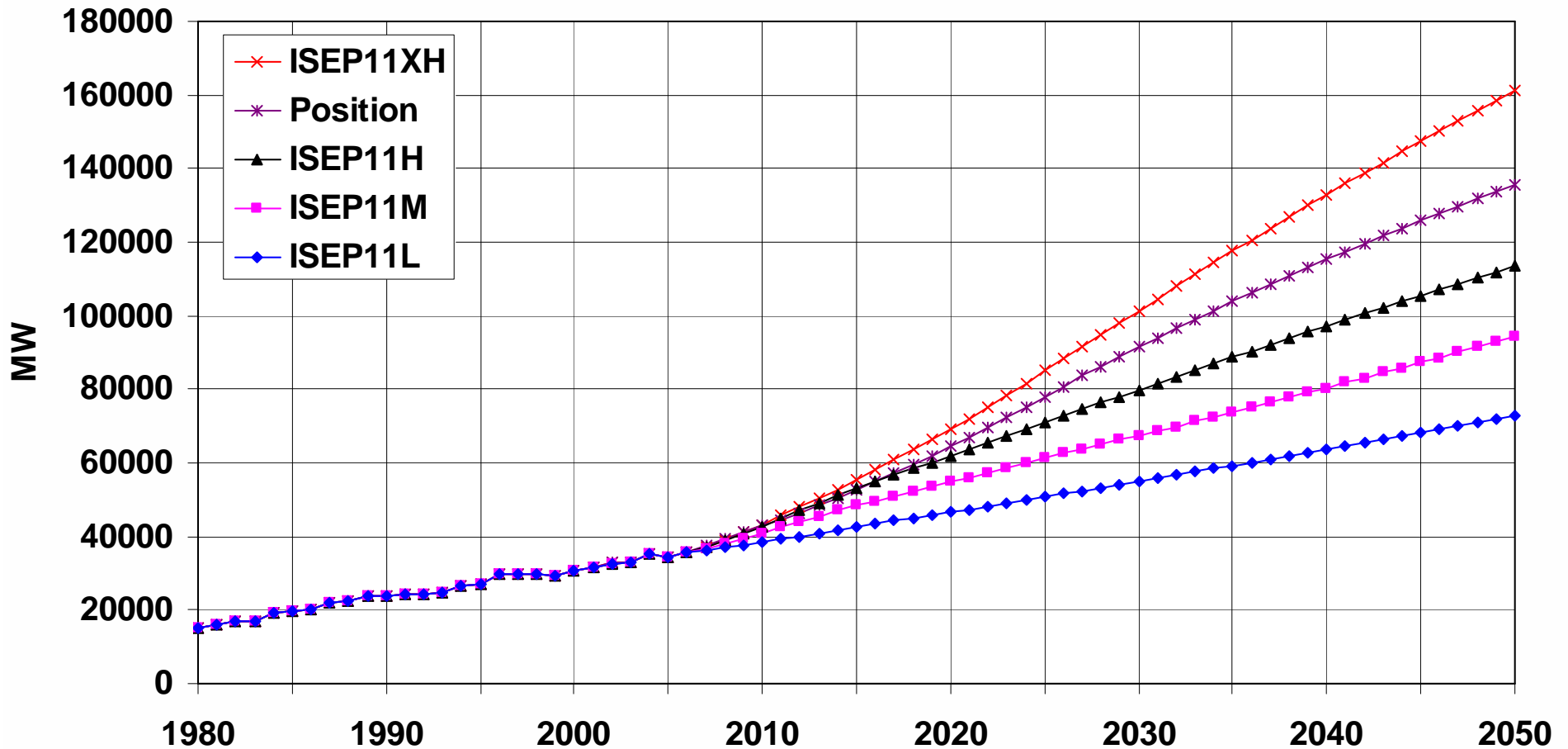
Water for Electricity needs

09 November 2008



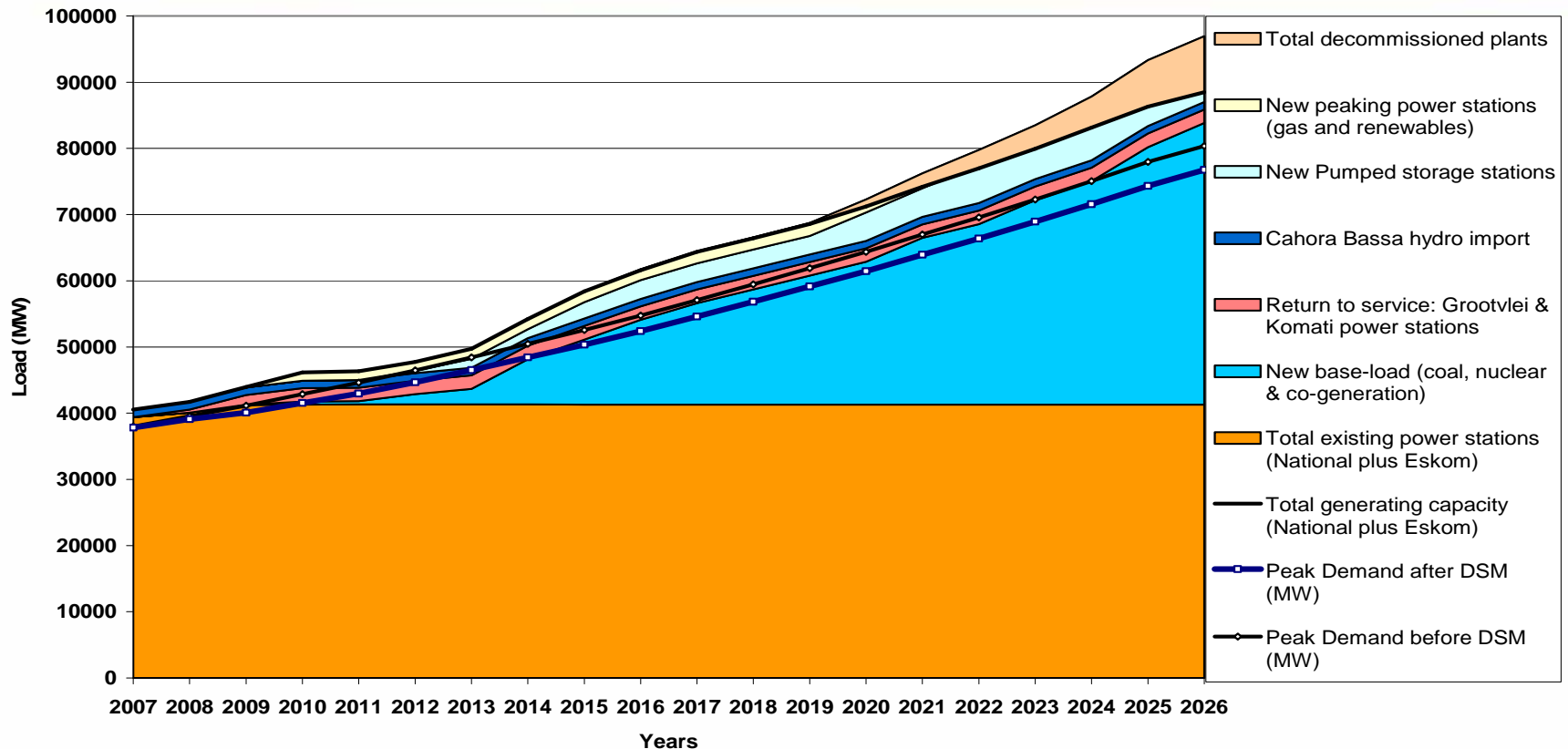
ISEP and Beyond (Electricity Growth)

National + foreign very long term forecasts



Electricity Capacity Outlook 2007 to 2026

Capacity outlook 2007 to 2026



- Structure of the economy is such that 4% GDP growth results in 2.3% electricity growth, whilst 6% GDP growth results in 4% electricity growth;
- Projected electricity requirement is between 56 710 MW and 77 960 MW based on the growth trajectory;
- Electricity demand side program projects to save 8000 MW by 2025;

Future Generation Portfolio

- Mix of various generating technologies but largest proportion will still be coal.

Table 1: Indicative Generation Portfolio by 2026

| Generation Mix | Target ranges |
|----------------------------|--------------------------------------|
| Coal-fired generation | < 70% |
| Combined cycle gas turbine | Only use for peak supply when needed |
| Nuclear energy | 17-28% |
| Renewable energy | > 2% |
| Imports | 2-15% |
| Open cycle gas turbine | Only use for peak supply when needed |
| Pumped storage | 4-10% |

Table 2: Indicative Specific Freshwater Requirements of Various Technologies

| Type of Power Station | Specific Water Consumption (l/USO) |
|---------------------------|------------------------------------|
| Wet Cooled | 1.9 - 2.1 |
| Dry Cooled | 0.12 - 0.16 |
| Dry Cooled with FGD (CCS) | 0.37 - 0.41- (0.52) |
| Nuclear | 0.05 |
| Gas | >0.01 |

Drivers of Uncertainty

1. GDP Growth
 - Electricity growth (ISEP)
2. Nuclear Program incl. PBMR
3. UCG
 - CCGT
4. Locality of IPP's
5. Lifex & Decommissioning
6. Location of new power stations
7. Technology options (PF with FGD, FBC, CCS, Coal washing etc.)
8. Generation mix (Coal, UCG, Nuclear, Hydro, Gas, Renewables)
9. Environmental requirements & constraints

Some guiding parameters

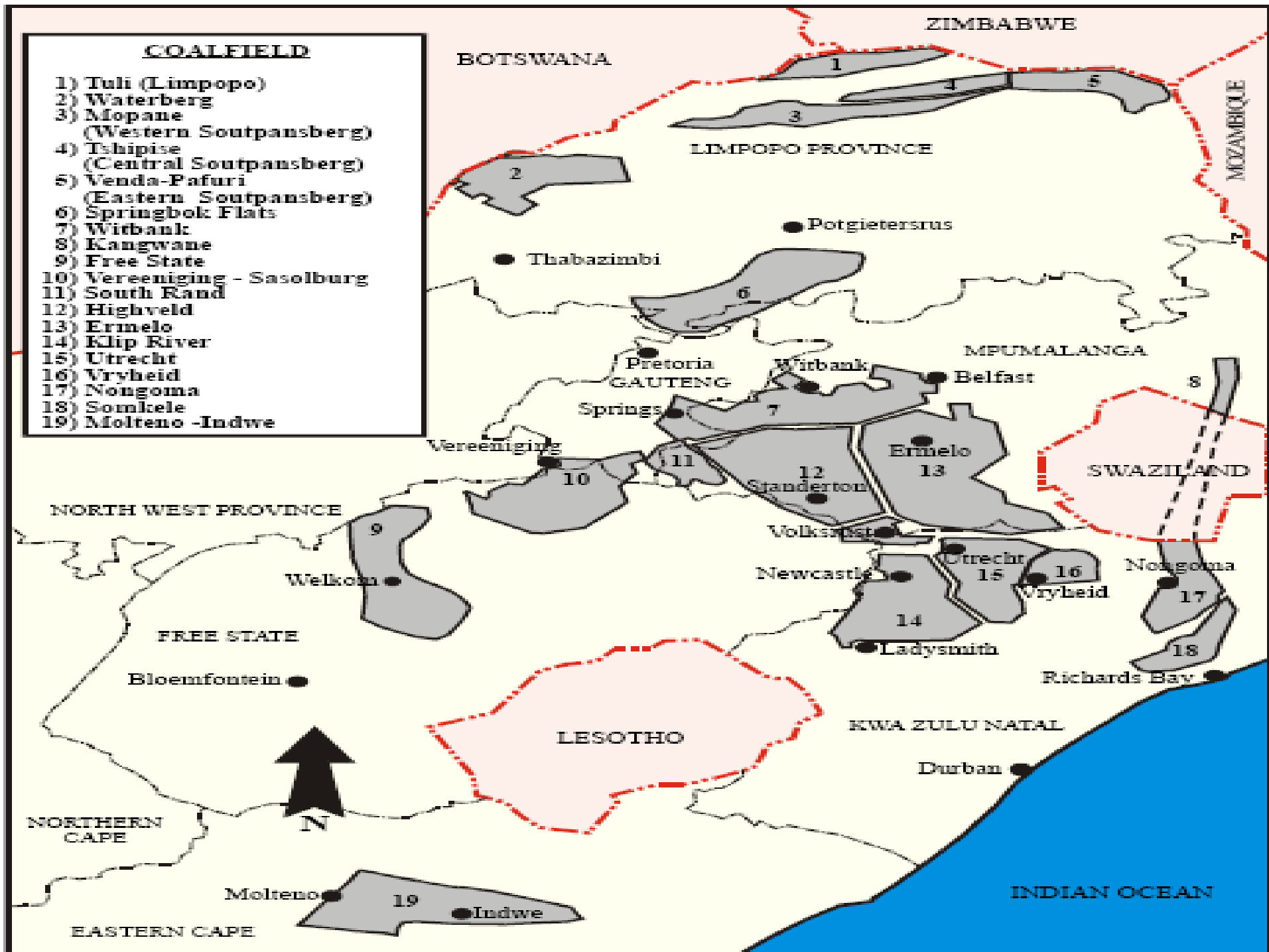
| Name | | LOW | MODERATE | HIGH |
|------------------------|----------|---------------|---------------|----------------|
| Max Demand - MW | | 72,898 | 94,247 | 113,425 |
| | % Ranges | | | |
| COAL MW | < 70% | 51,029 | 65,973 | 79,398 |
| Nuclear LB | 17% | 12,393 | 16,022 | 19,282 |
| Nuclear UB | 28% | 20,412 | 26,389 | 31,759 |
| Other low | 2% | 1,458 | 1,885 | 2,269 |
| Other high | 15% | 10,935 | 14,137 | 17,014 |

- Position by 2050

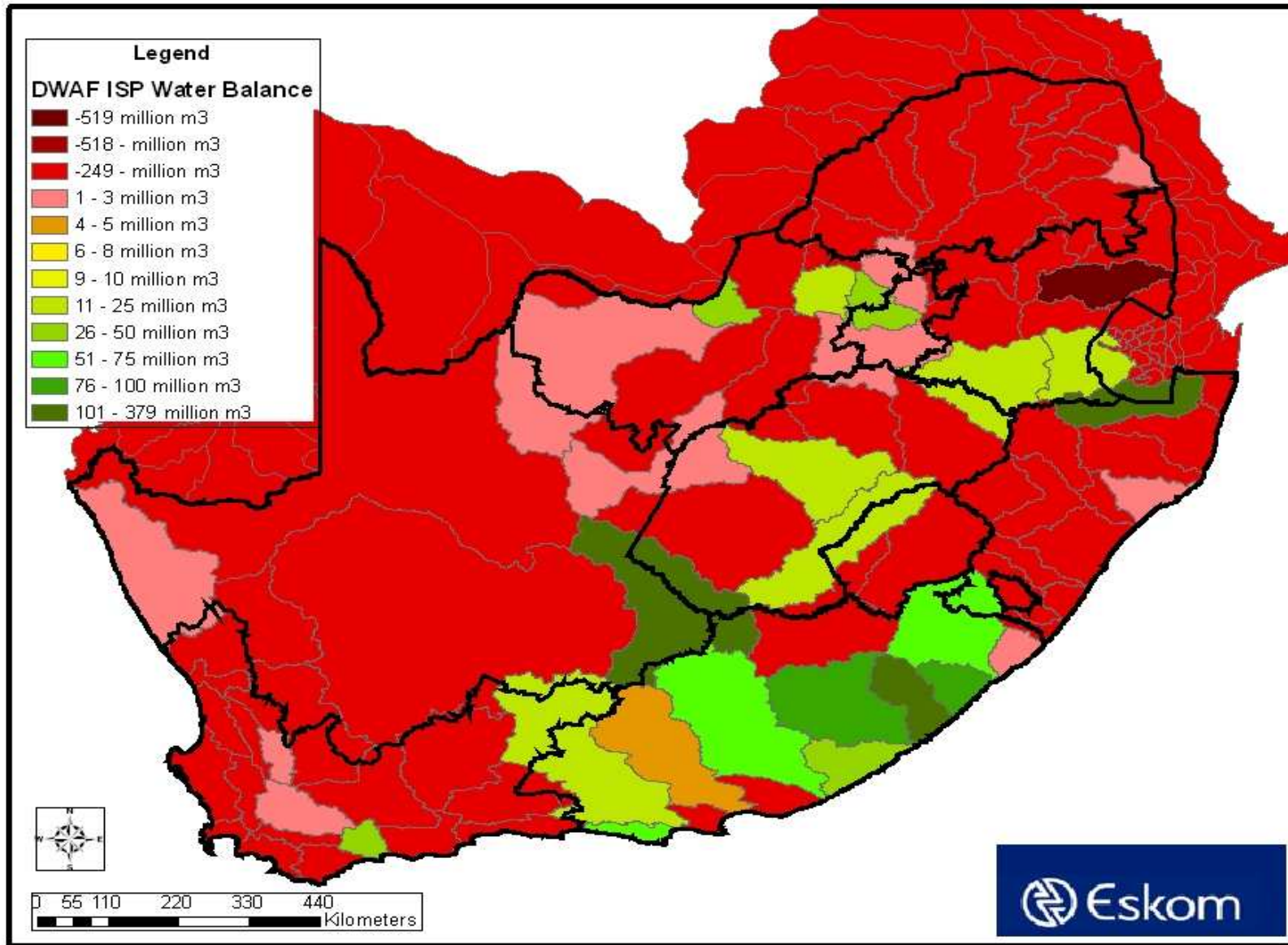
Matrix: New Coal Capacity

| | I | II | III | IV |
|-----------------|---------------|---------------|---------------|--------|
| Growth | LCP | Lo | Mod | Inland |
| Nuclear | No | LB | LB | No |
| Medupi | 2012 | 2012 | 2012 | 2012 |
| Bravo | | | | |
| NC-3 | 2015 | 2022 | 2015 | 2016 |
| NC-4 | 2017 | 2030 | 2017 | 2019 |
| NC-5 | 2019 | 2037 | 2023 | |
| NC-6 | 2021 | 2044 | 2031 | 2023 |
| NC-7 | 2022 | 2046 | 2033 | |
| NC-8 | 2023 | | 2034 | 2024 |
| NC-9 | 2025 | | 2040 | 2027 |
| NC-10 | 2026 | | 2044 | 2029 |
| NC-11 | 2027 | | 2046 | |
| NC-12 | 2029 | | 2050 | 2034 |
| NC-13 | 2030 | | | |
| NC-14 | 2032 | | | 2037 |
| NC-15 | 2033 | | | |
| NC-16 | 2036 | | | 2039 |
| NC-17 | 2039 | | | 2040 |
| NC-18 | 2042 | | | |
| NC-19 | 2043 | | | |
| NC-20 | 2048 | | | |
| Coal: | 97 242 | 31 092 | 48 894 | |
| Nuclear: | 0 | 14 000 | 19 000 | 0 |

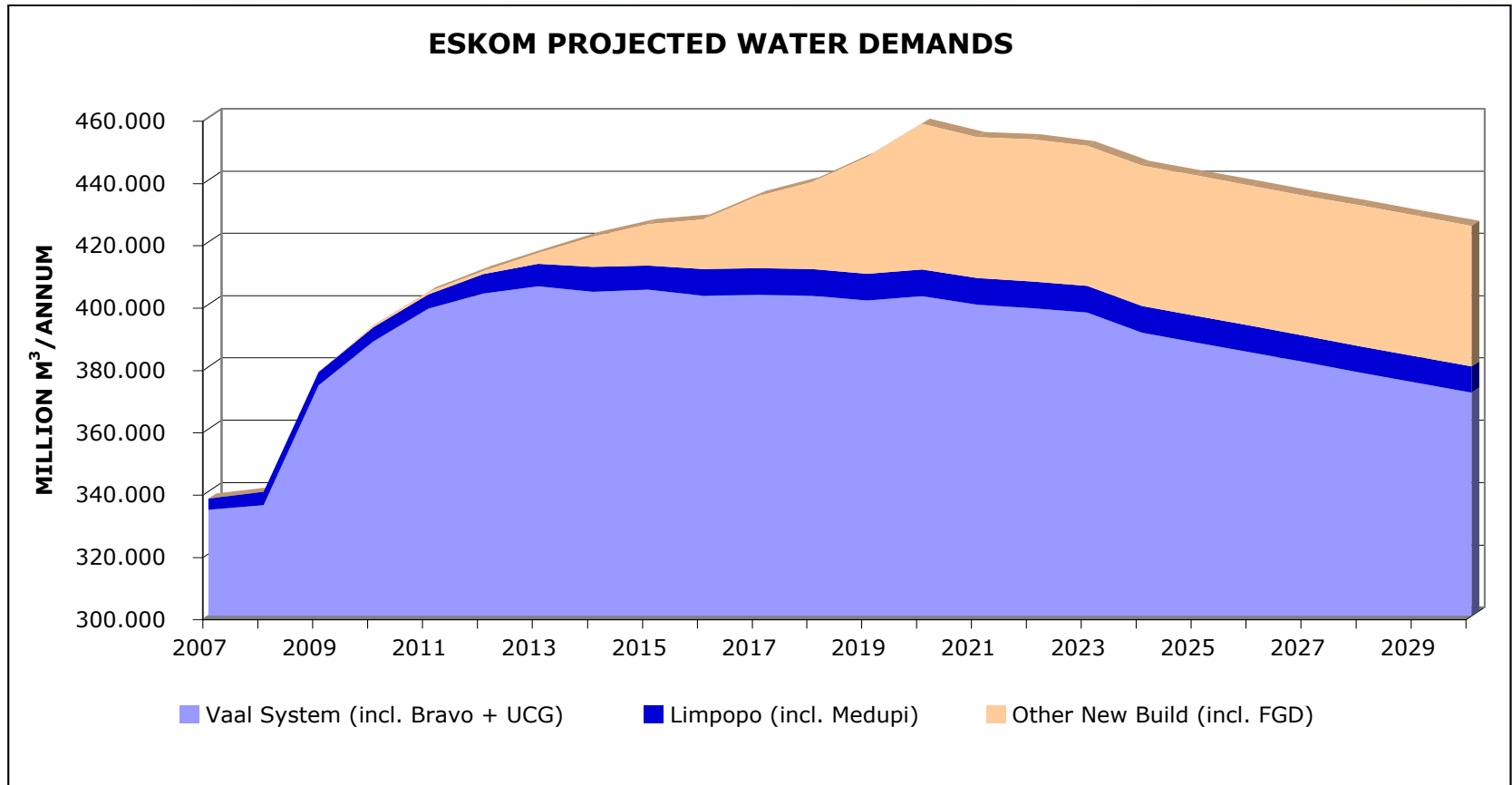
⁸ Provisional, for discussion purposes



Water Management Areas



Water Requirements to Support Capacity Plan



- Current demand requirement is approximately 325 million cubic metres/annum;
- Peak demand will be approximately 460 million cubic metres/annum (2021);
- De-commissioning of older wet cooled plant will reduce water requirement.

New Build Water Balance

Waterberg

| | Min use | Max use |
|---|---------|---------|
| 1 | 92 | 181 |
| 2 | 53 | 80 |
| 3 | 43 | 51 |
| 4 | 82 | 148 |

Free-State

| | Min use | Max use |
|-------------------|---------|---------|
| 2 x PF (with FGD) | 0 | 30 |

Mpumalanga

1 x PF (with FGD) 15 mcm/a

Decommissioning:

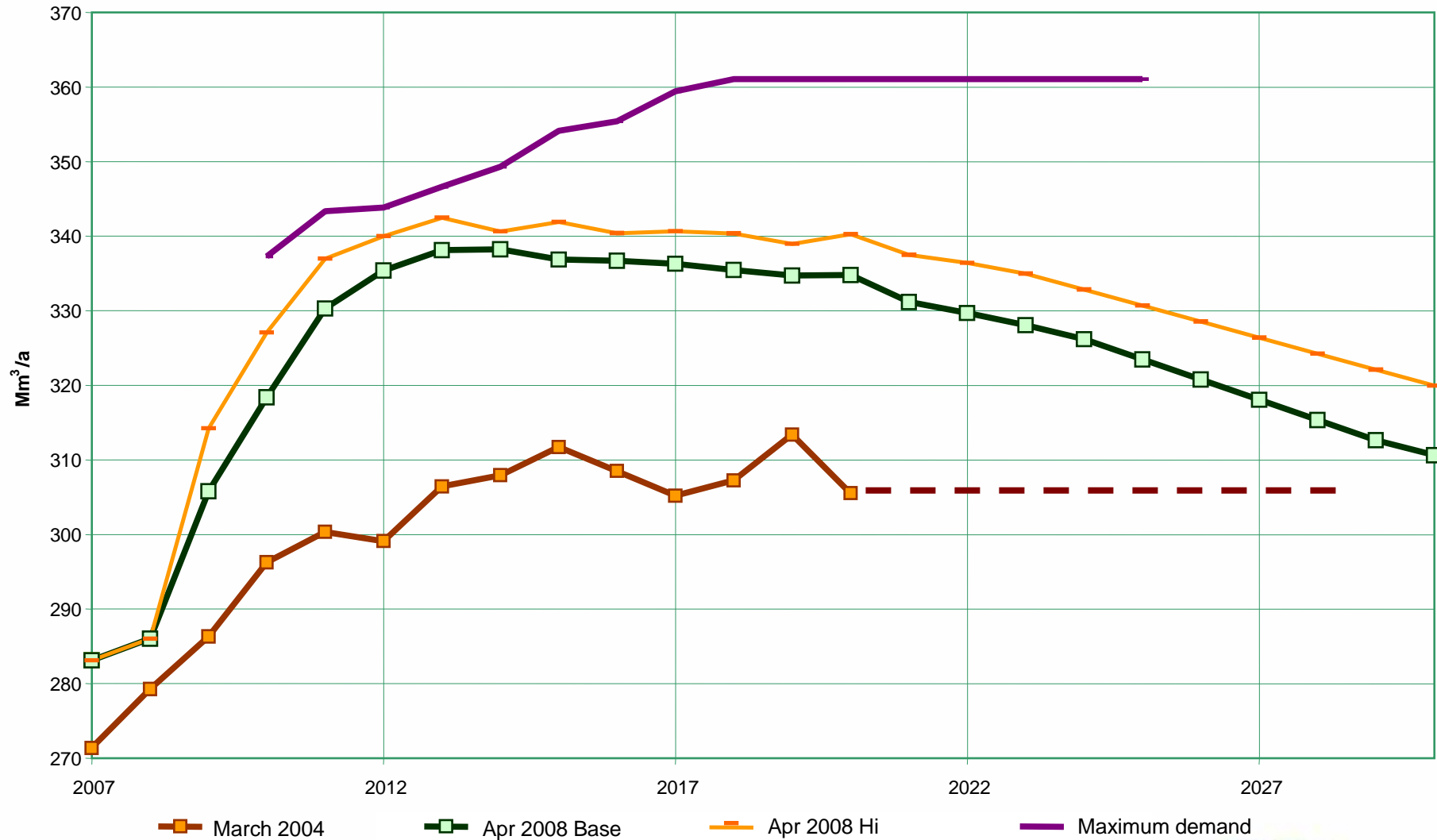
RTS: 2025-2030: 30
 He: 2030-2035: 30
 Ar: 2035-2040: 35
 95

Vaal Dam

TWP

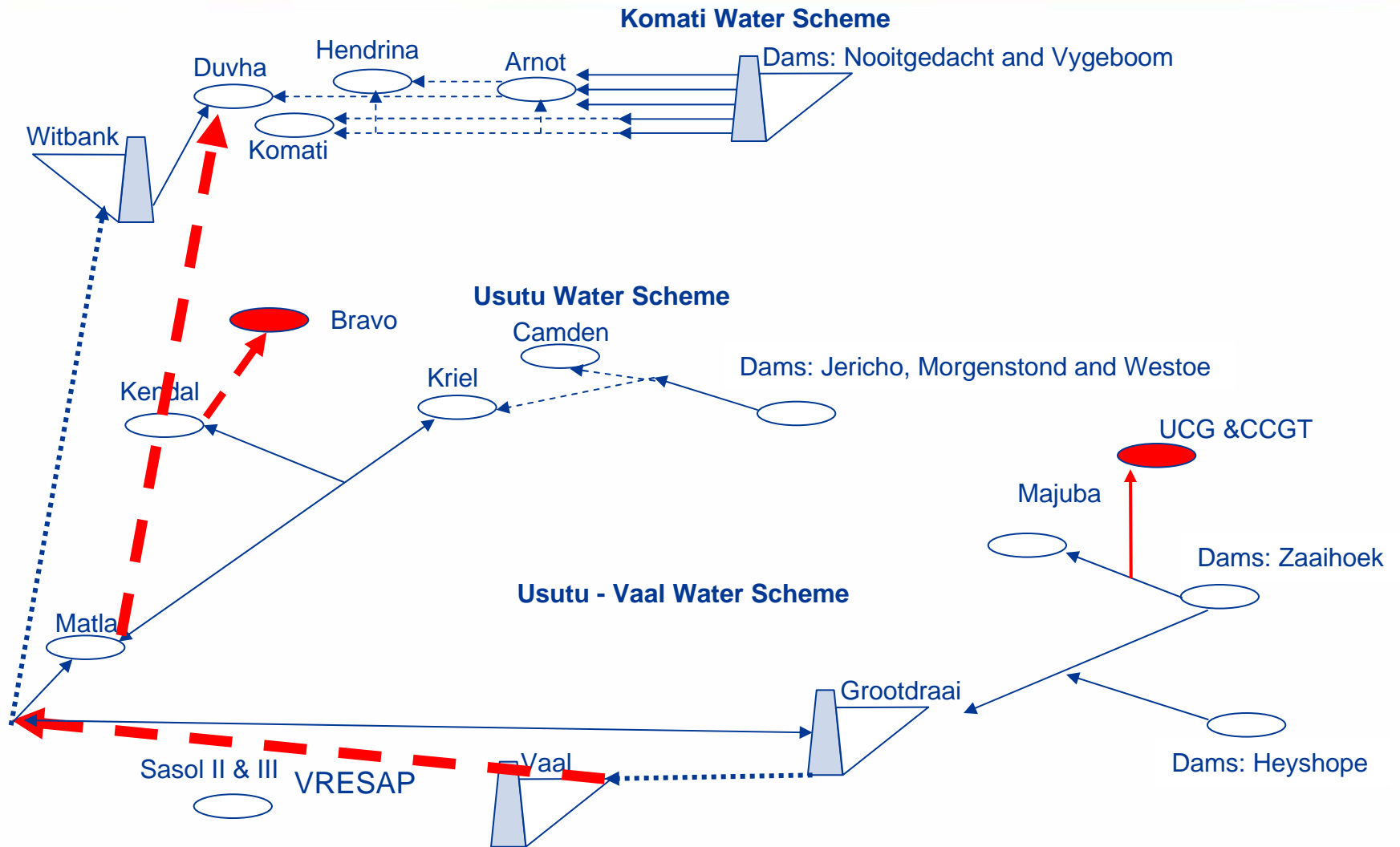
LHWP

Eastern sub-system



13 60 year life assumed

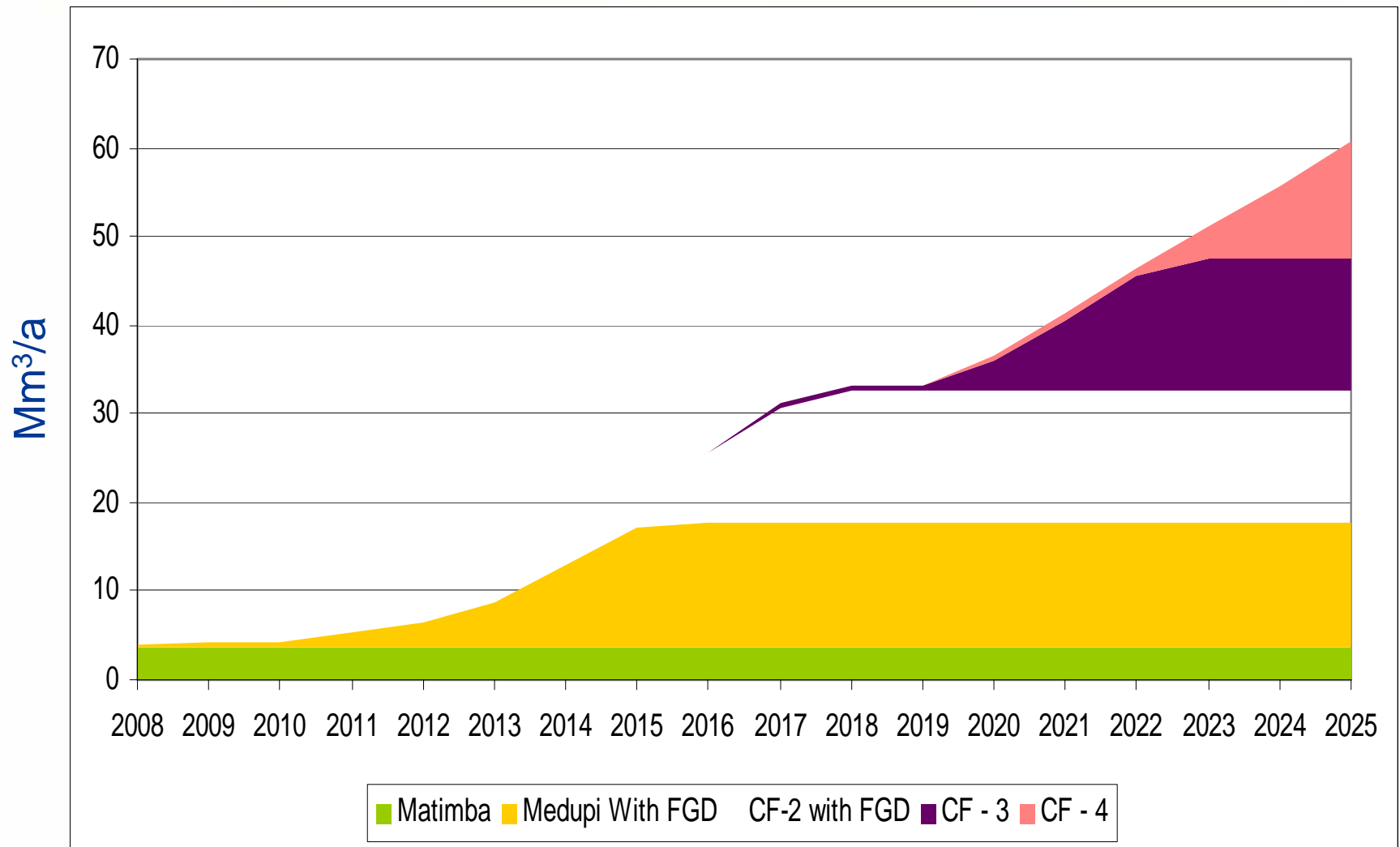
Water Availability: VRESS Map



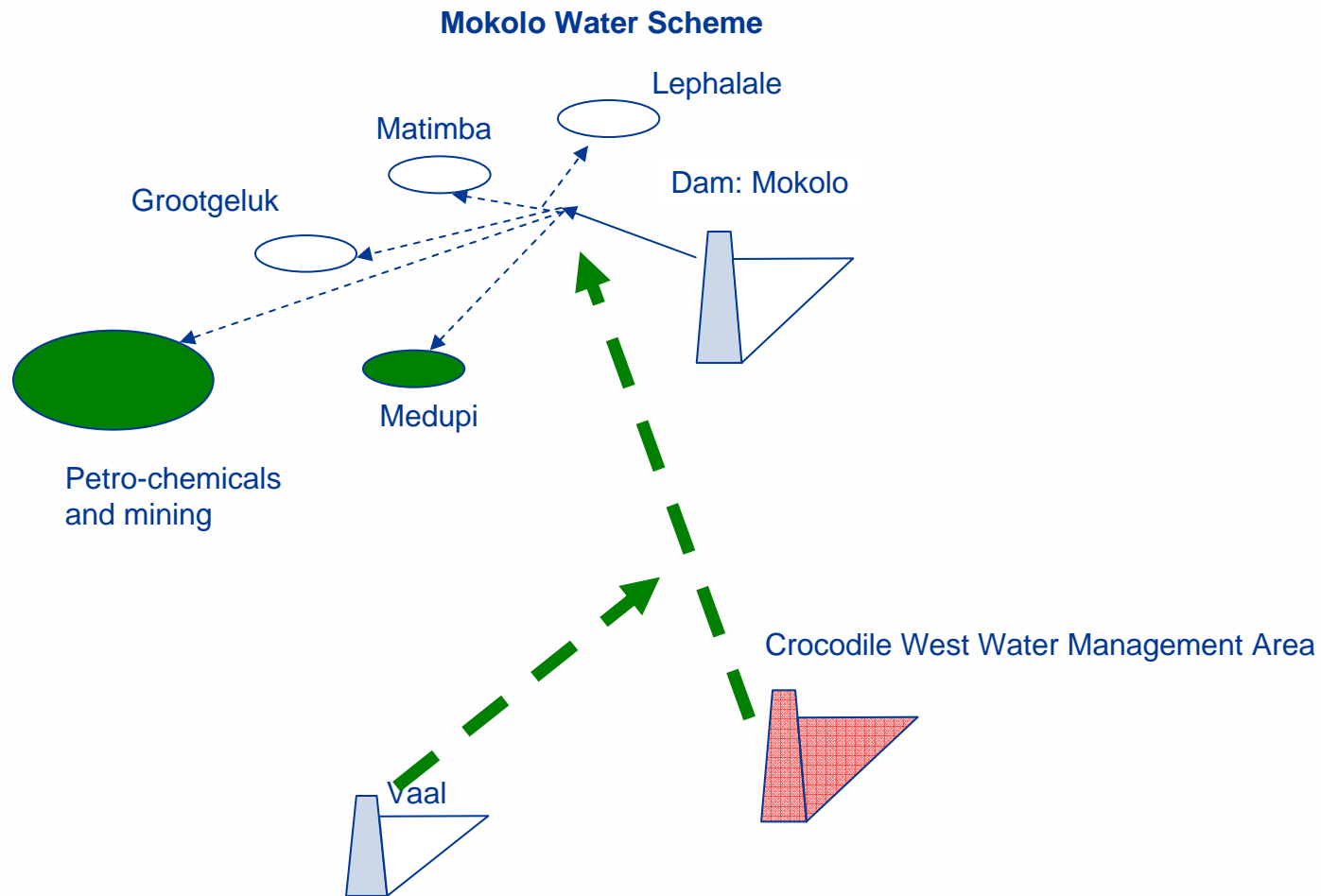
Water Supply Demands

- Water demands in Waterberg will increase due to:
 - Eskom's new power stations
 - Independent Power Producers
 - Increased mining activities:
 - Exxaro and others
 - Population growth and development
 - Coal to Liquid Plants

Projected Water Demand Scenarios incl FGD

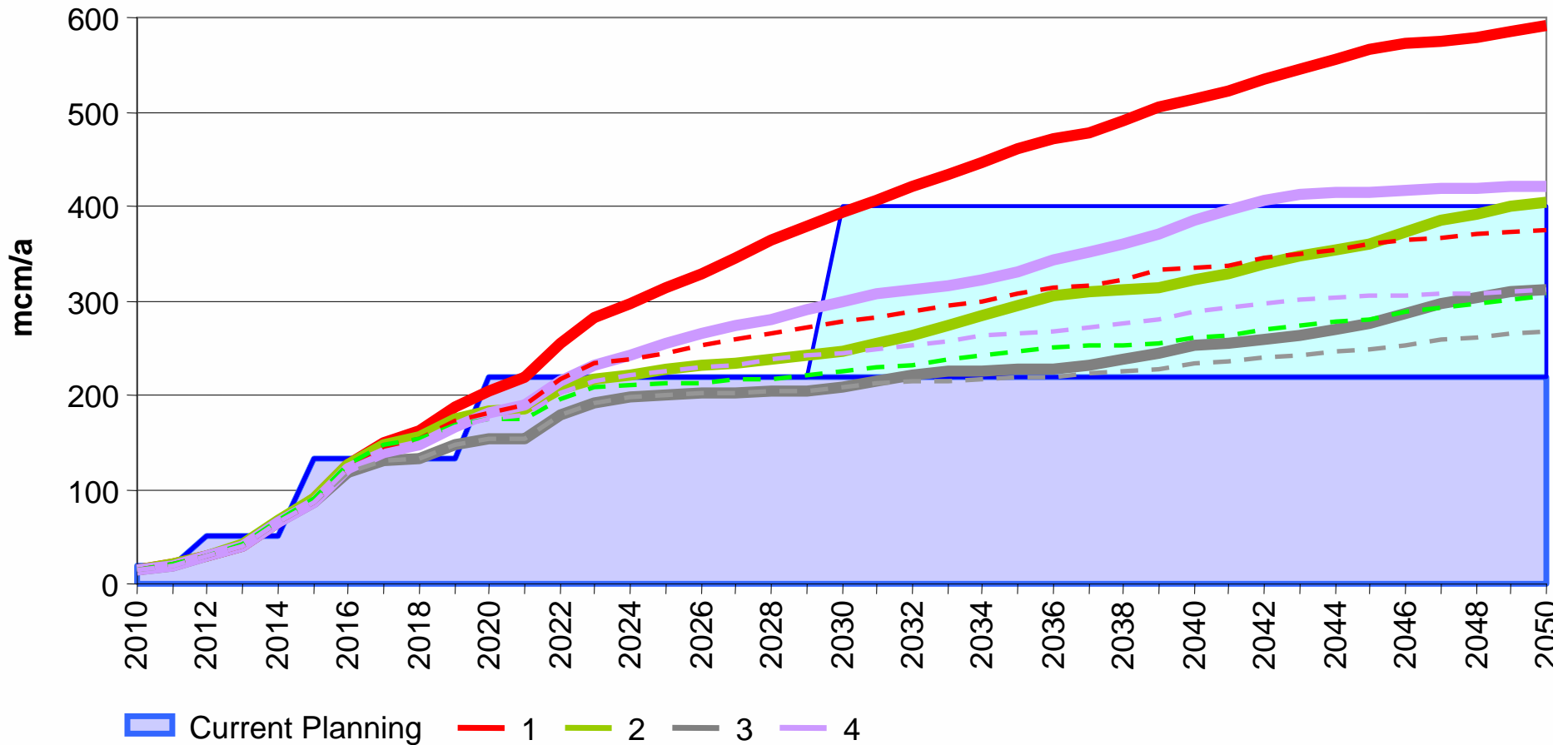


Schematic of Water Supply to Mogol System



Scenario Overview

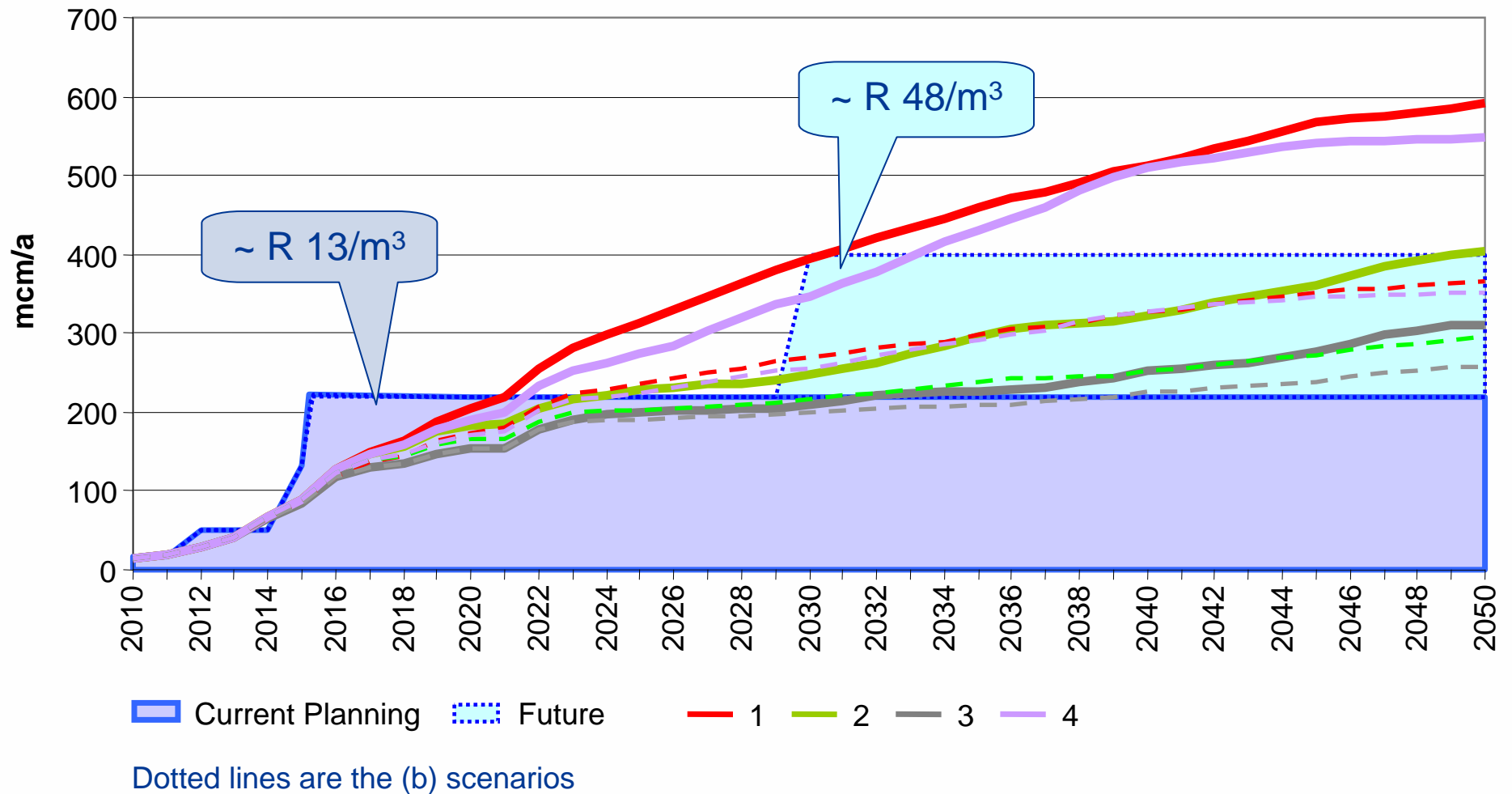
Waterberg Demand Scenarios



Dotted lines are the (b) scenarios

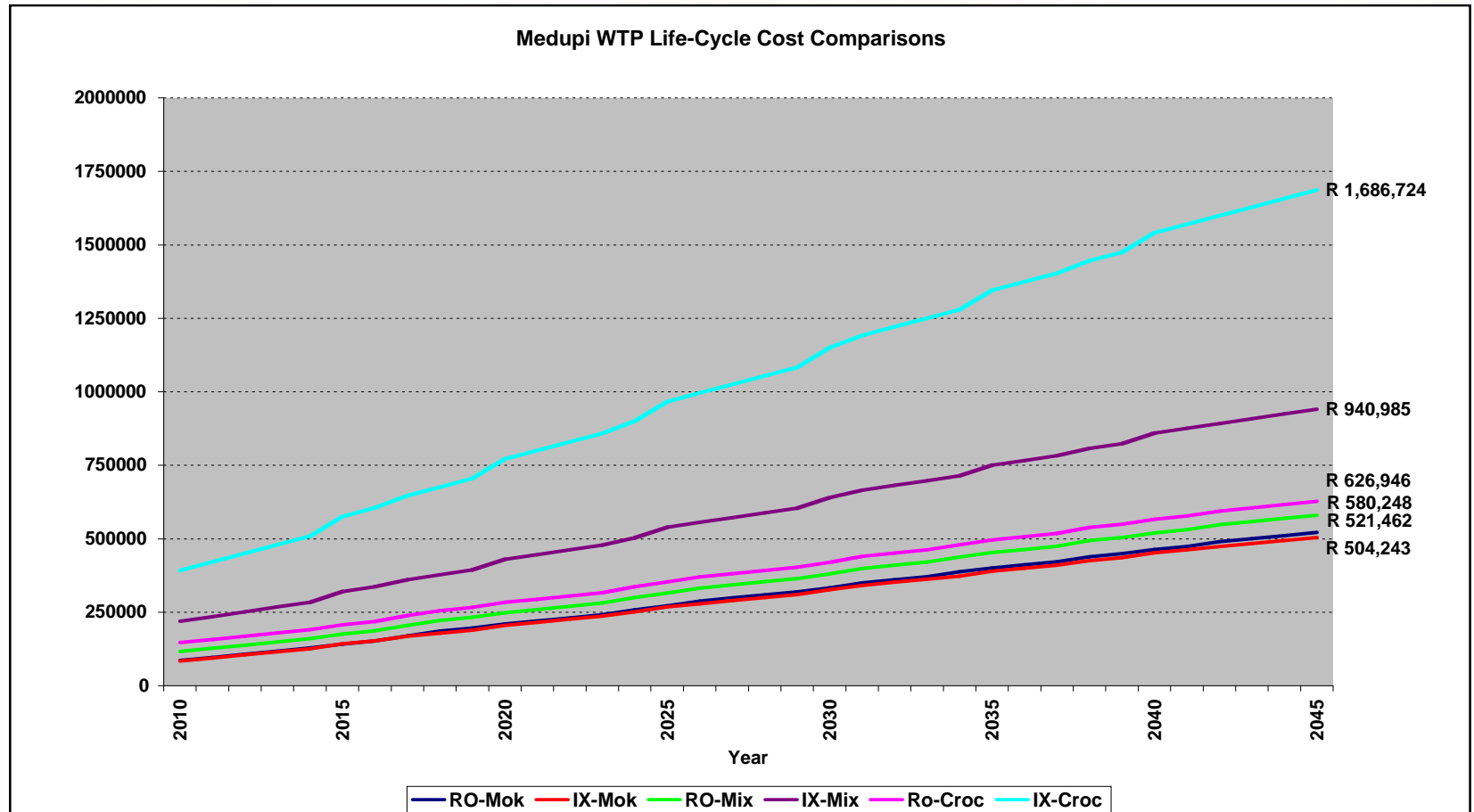
Scenario Overview

Waterberg Demand Scenarios



Medupi Power Station treatment costs

Rands x 1000



- From the above, based on moving water abstraction from the ideal quality (Mogol water) to impacted water quality (Crocodile West) requires additional treatment costs.

Medupi Environmental Impact Report

- Creation of employment opportunities. It was determined that the proposed power station would lead to the creation of a number of job opportunities, both during its construction and operation.
- Impacts on the local municipality. It was determined during the scoping study that the power station would bring about a significant increase in the demand for housing and infrastructure in the surrounding area. This increase would have a substantial impact on the local municipality.
- Impacts on public safety and daily movement patterns. It was determined that the construction and operation of the power station are likely to result in an increase in traffic volumes. This could lead to damage of local roads and increased speeding through town, thereby impacting on the safety and daily movement patterns of residents in surrounding communities.
- Social investment and infrastructural improvements. Social investment initiatives by Eskom, as well as by Exxaro, could have significant positive impacts on surrounding communities. Such initiatives could include upgrading of existing infrastructure such as services.

Medupi Environmental Impact Report

- Impacts on owners and residents of surrounding farms. It was determined that the power station could impact on surrounding communities' way of life and on the area's sense of place. This, in turn, could have a negative effect on property values and on the attractiveness of the area as a destination for hunters and tourists.
- Relocation of households. It was determined that the construction of the power station might necessitate the relocation of certain farm owners and/or farm residents.
- Influx of job seekers. Because of high unemployment rates in the region, it is possible that news of the proposed development could lead to an influx of job seekers into the area.
- Possible conflict between local residents and newcomers. If construction workers are not sourced locally, but are housed close to the site, this may give rise to conflict between local residents and newcomers. If the area experiences an influx of job seekers, competition over scarce employment opportunities may also lead to conflict with locals.
- Impacts on the residents of Marapong. It was determined during the scoping study that, if the proposed power station were to be located on one of the northern sites (Nelsonskop or Appelvlakte), the residents of Marapong might suffer significant negative effects in terms of changes in air quality, noise pollution and the like.

Water Resources and Waste Management I

| | Activity | Activity Leader | Task | Task Leader | Budget | |
|-----|----------------|-----------------|--|-------------|--------------|----------------|
| W&W | Water Research | M Michael | Surface Water Research | M Michael | R 865,000.00 | |
| | | | Scanning of Water Related Research | G Gericke | R 50,000.00 | |
| | | | Impact of deteriorating water quality on Eskom | T Jongwane | R 300,000.00 | |
| | | | Remediation of AMD with Flyash | N Misheer | R 105,000.00 | |
| | | | Statistical Analysis of Production Risk Exposure to the Orange River Hydro Plant | R Kydd | R 600,000.00 | |
| | | | AMD Recovery | N Misheer | R 100,000.00 | |
| | | | | | | R 2,020,000.00 |

Water Resources and Waste Management II

| | | | | | |
|----------------|-----------|---|------------|----------------|----------------|
| Waste Research | G Gericke | Ash Applications | K Reynolds | R 2,500,000.00 | |
| | | Water/Salt Sinks for Ashless Power Stations | N Misheer | R 100,000.00 | |
| | | Feasibility of Application Of Zeolites made from Fly-Ash | N Misheer | R 500,000.00 | |
| | | Management of Waste Streams in Eskom | R Bothma | R 50,000.00 | |
| | | Recycling Opportunities related to E-Waste Streams in Eskom | R Bothma | R 50,000.00 | |
| | | Development of Appropriate Sampling and Analysis for Chromium in ash Dam tailings | T Jongwane | R 700,000.00 | |
| | | Impact of Road and Rail Transport of Coal | M Couto | R 50,000.00 | |
| | | Mercury Speciation | T Jongwane | R 450,000.00 | |
| | | Monitoring of Impacts of Mercury Deposition | M Couto | R 200,000.00 | |
| | | Eskom Sasol Joint Research: Brine | G Gericke | R 1,400,000.00 | R 6,000,000.00 |

| | |
|----------------|----------------|
| R 8,020,000.00 | R 8,020,000.00 |
|----------------|----------------|

Potential Risks

- Climate change impacts the available yields of water resources requiring greater flexibility on the water supply systems;
- Implementation of the Reserve impacts the water available for power generation and other users;
- Asset Management of bulk water schemes impacts the reliability and availability of water supply to the power stations;
- Water infrastructure development is not synergistic with power generation development;
 - Long lead times for augmentation schemes;
 - Other options such as water trading could take long to negotiate;
- Institutional reform impacts the current operations of the various schemes and ability to deliver on new augmentation schemes
 - DWAF increasing regulatory capacity;
 - SANWRIA establishment;
 - Catchment Management Agencies
- Deteriorating water quality increases water requirement and creates an induced water stress;
- Skills impact on the operational effectiveness of power generation facilities & water supply to the power generation facilities.
- Funding and implementation of raw water infrastructure will be done “off-budget” and by DWAF.

Conclusions

- Water will be crucial for the power generation sector in the long term;
- Planning needs to be co-ordinated between power generation and water sectors to ensure adequate water is made timeously to the power stations;
- Freshwater use is expected to increase in short and medium term but will decrease over the long term as the portfolio of power generation has more dry cooled plant;
- There is potential for regulatory and institutional reform to impact on water availability;
- Co-operative action is required to meet the challenges in the water sector;
- A number of risk mitigation strategies have been developed and are being implemented to ensure adequate water supply to the existing and new power stations.



Thank You

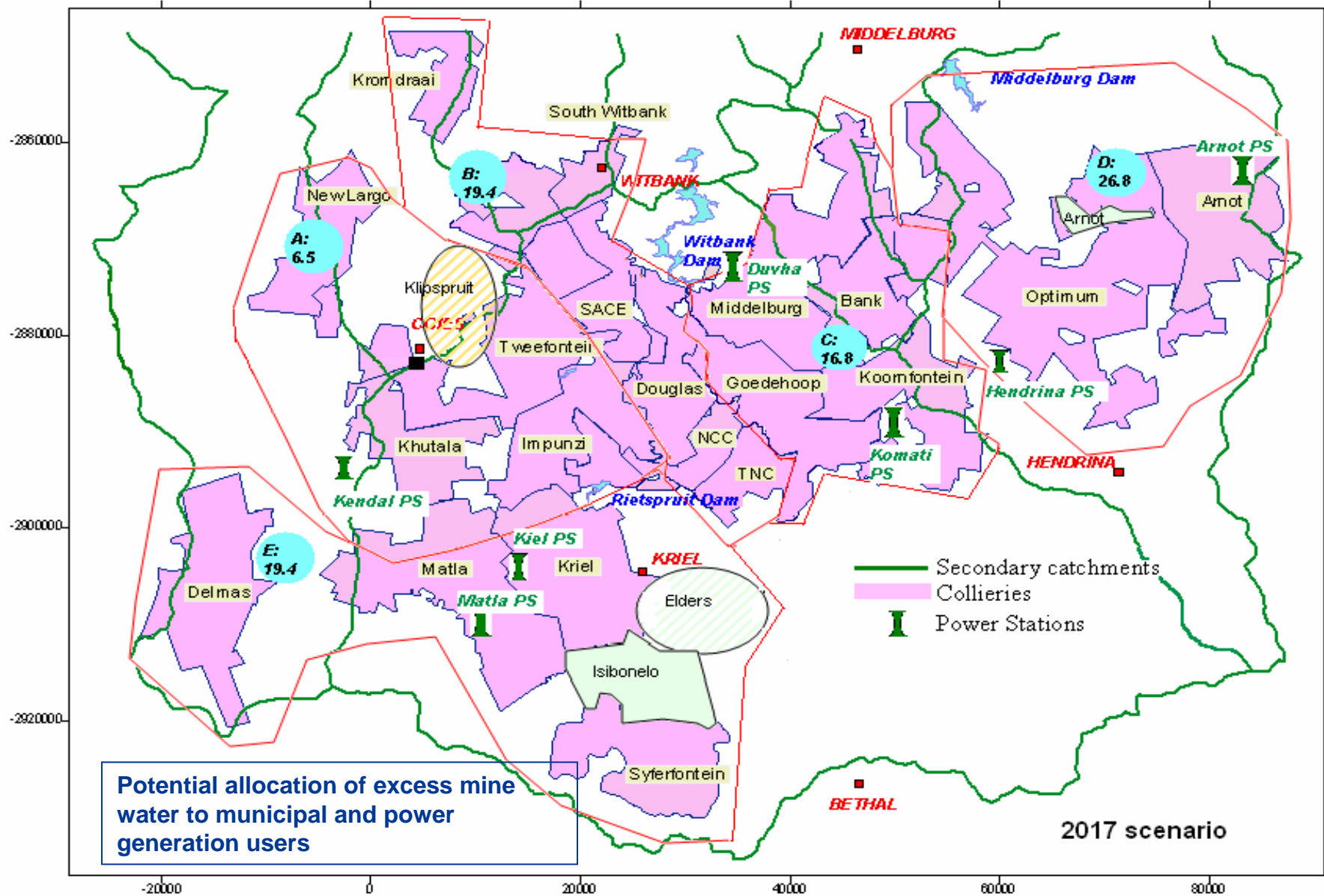
South African Water Situation

- SA is a water scarce region with competing uses and users for water;
- Effective and efficient water management is required to preserve the water resources in ensuring sustainable water quality and availability into the future;
- The impending implementation of the Waste Discharge Charge System by DWAF* has led to various initiatives to mitigate against the impacts of excess mine water;
- Of particular interest to Eskom is the Joint Initiative Agreement between the major coal mining houses:
 - BECSA
 - Exxaro
 - Xstrata
 - Anglo Coal

Eskom's Interest

- Largest concentration of Eskom's generating capacity is in the Upper Olifants Water Management Area;
- Greatest proportion of water abstraction by the power stations in Upper Olifants Water Management Area;
- Water quality impacts by the coal mines have the potential to impact Eskom's water use;
- Excess mine water has the potential to provide an additional source of water to particular processes within the power stations;
- Research undertaken by the participants in the JIA could be beneficial to Eskom in different areas of exploiting opportunities and mitigation of long-term risks e.g. research on use of FGD waste in building systems could benefit Eskom

Excess Mine Water: Upper Olifants



Purpose of the JIA

- Strategic partnership between Eskom and the aforementioned mining houses to jointly:
 - Undertake studies and projects related to water and waste management in order to
 - Quantify future impacts of excess mine water and mine closure rehabilitation;
 - Develop and implement mitigation strategies related to excess mine water;
 - Research water and waste management issues of interest to all the parties

Objectives of the JIA

- Contribute to the improvement of the resource quality of the Upper Olifants Water Catchment;
- Pursue alternative water sourcing and supply options to meet Eskom's growing water demands and
- Reduce Eskom's long term mine closure liabilities by
 - Promoting a collaborative effort in addressing water and waste management problems;
 - Exchanging information regarding strategies, plans, technologies and research on water and waste management that are of common interest to all the parties;
 - Investigating and implementing mutually beneficial and cost effective projects;
 - Promoting, encouraging and supporting good water and waste management practices at the participating parties' facilities in the chosen areas governed under the JIA;
 - Assisting the various parties in mitigating the long term mine closure liabilities for water and waste management that each may have by collaboratively developing mitigation options for implementation.

Joint Initiative Agreement Principles

- Joint decision-making on JIA studies, projects and initiatives to be jointly undertaken;
- Sharing of expertise in various areas of knowledge in water and waste management as approved by each organisation's governance structures;
- Joint research and development of water and waste management initiatives or other initiatives that are of importance to the parties;
- Joint awareness, education and marketing of the activities of the JIA;
- Funding approvals to be vetted by the governance structures of the individual organisations taking note that there should be no duplication of the activities done by CoalTech 20/20;
- Confidentiality of information and Intellectual Property will be protected by non disclosure agreements between all the parties.

Eskom Benefits

- Contribute to the improvement of the resource quality of the Upper Olifants Water Catchment Area;
- Excess mine water provides an alternative water sourcing and supply option to meet Eskom's growing water demands;
- Reduce Eskom's long term mine closure liabilities;
- Enhance Eskom's public image with respect to water and waste management;
- Exploit collaborative efforts in water and waste management research to mitigate future liabilities related to the management of excess mine water;
- Opportunity to improve Eskom's position and branding in the water sector.