ESKOM

APPLICATIONS FOR SUSPENSION, ALTERNATIVE LIMITS AND/OR POSTPONEMENT OF THE MINIMUM EMISSIONS STANDARDS (MES) COMPLIANCE TIMEFRAMES FOR ESKOM'S COAL AND LIQUID FUEL FIRED POWER STATIONS

SUMMARY DOCUMENT

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ABBREVIATIONS

AEL	Atmospheric Emissions Licence
AIRs	Atmospheric Impact Reports
CAPEX	Capital Expenditure
CDS	Consistent Data Set
CO_2	Carbon Dioxide
DEA	Department of Environmental Affairs
ESP	Electrostatic Precipitators
FFP	Fabric Filter Plants
FGC	Flue Gas Conditioning
FGD	Flue-gas Desulphurisation
HFPS	High Frequency Power Supply
IRP	Integrated Resource Plan
LNB	Low NO_x Burners
MES	Minimum Emission Standards
MYPD	Multi-Year Price Determination
NAAQS	National Ambient Air Quality Standards
NAQO	National Air Quality Officer
NEMA	National Environmental Management Act, Act No.107 of 1998
NEMAQA	National Environmental Management: Air Quality Act, Act No. 39 of 2004
NERSA	National Energy Regulator of South Africa
NO_x	Nitrogen oxides
OPEX	Operational Expenditure
PM	Particulate Matter
SO_2	Sulphur dioxide

1 INTRODUCTION

Eskom as South Africa's public electricity utility, generates, transmits and distributes electricity throughout South Africa. The utility also supplies electricity to neighbouring countries including Namibia, Botswana, Zambia, Zimbabwe and Mozambique. Eskom's principal generation technology is pulverised coal with approximately 90% of its current generating capacity lying in coal-fired power stations. Most of Eskom's coal fired power stations are on the Mpumalanga Highveld (some 12 in total, 1 under construction, commissioning and operation) with Lethabo in the Free State and Matimba and Medupi (currently under construction, commissioning and operation) in the Waterberg District of Limpopo province. Eskom also has four liquid fuel-fired peaking stations in East London, Mossel Bay and Cape Town (two).

In terms of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) (NEMAQA), all of Eskom's coal and liquid fuel-fired power stations are required to meet the Minimum Emission Standards (MES) under GNR 893 dated 22 November 2013, and as amended in GNR 1207 on 31 October 2018, which was promulgated in terms of Section 21 of the NEMAQA. GNR 1207 provides for postponement or suspension of compliance time frames. An application may be made to the National Air Quality Officer for the postponement of the compliance time frames to standards for existing and new plant for an existing plant. An existing plant may apply to the National Air Quality Officer for a once-off postponement with the compliance timeframes for minimum emission standards for new plant. A once-off postponement with the compliance timeframes for minimum emission standards for new plant may not exceed a period of five years from the date of issue and no once-off postponement with the compliance timeframes with minimum emission standards for new plant will be valid beyond 31 March 2025. It is noted that an existing plant to be decommissioned by 31 March 2030 may apply to the National Air Quality Officer before 31 March 2019 for a once-off suspension of compliance timeframes with minimum emission standards for new plant. Such an application must be accompanied by a detailed decommissioning schedule and no such application shall be accepted by the National Air Quality Officer after 31 March 2019. In this case, an existing plant that has been granted a once-off suspension of the compliance timeframes must comply with minimum emission standards for existing plant from the date of granting of the application and during the period of suspension until decommissioning. No postponement of compliance timeframes or a suspension of compliance timeframes shall be granted for compliance with minimum emission standards for existing plant (see section 3 for more on the legal basis for this application).

An existing plant may submit an application regarding a new plant standard to the National Air Quality Officer for consideration if the plant is in compliance with other emission standards but cannot comply with a particular pollutant or pollutants. Such an application must demonstrate a previous reduction in emissions and investments implemented towards compliance. The National Air Quality Officer, after consultation with the Licensing Authority, may grant an alternative emission limit or emission load.

Eskom is lodging applications to the National Air Quality Officer for suspensions and alternative emission limits and postponement for some of the power stations emission limits contained within the Minimum Emission Standards (MES) compliance timeframes.

The reason for these applications in most cases is due to design-related limitations, since all of the existing power stations were constructed, and in the case of Medupi and Kusile commenced with construction, before promulgation of the MES. Kusile was required in terms of its Environmental Authorisation to construct with FGD. The existing power stations will not be able to comply with the MES for new plant in all cases for various reasons including with the original design of the plant, financial constraints, age of the power station, the coal quality used, water resources and maintaining a reserve margin. Further, installing abatement technology to achieve full compliance to the MES, on each station for PM, NO_x and SO_2, would cost an exorbitant amount of

money (in excess of R 187 billion overnight), directly impacting on the electricity tariff and requiring an adjustment. Full compliance with the emission limits would have many other socio-economic and environmental implications as outlined further in this report.

Eskom has an emission reduction plan (described further in this report), and in addition to the contribution that Eskom's current Emission reduction plan will have on future air quality improvement, six power stations will be decommissioned by 2030, as per the Integrated Resource Plan (IRP) and the Eskom Consistent Data Set. Two more power stations will be decommissioned by 2035, and a further three will be decommissioned by 2044. The progressive decommissioning along with the planned retrofits/upgrades significantly reduces Eskom's environmental footprint and the impact on air quality. As such, the ambient air quality going forward will be better than what it has historically been. In addition, in 2017/18 eleven (11) units at Eskom's most costly and oldest plants have been shut down and placed in reserve storage which has already yielded some benefit.

While Eskom is committed to implementing the technology elements of its emission reduction plan it has identified this need to submit suspensions, postponements and alternate limit requests to ensure the continued legal operation of its plant where the MES compliance time frames cannot be met or the decommissioning of the plant will occur before 2030.

Eskom has compiled individual applications for each of the power stations as appropriate. The purpose of this document is to summarise those various applications. The document has been structured to present firstly Eskom's atmospheric emissions reduction plan, before presenting the legal basis for the applications. Finally, the reasons for the applications are presented together with a description of the public participation process conducted in support of the applications.

2 ESKOM'S EMISSION REDUCTION PLAN

Eskom considers that it is not practically feasible or beneficial for South Africa (when considering the full implications of compliance and planned decommissioning) to comply fully with the 'new plant' MES by the stipulated timeframes. This is elaborated on in the sections below. As a result, Eskom proposes to continue adopting a phased and prioritised approach to achieve compliance in terms of the MES. Reduction of Particulate Matter (PM) emissions has been prioritised, as PM is considered to be the ambient pollutant of greatest concern in South Africa. In addition, Eskom proposes to reduce NO_x emissions at the three highest emitting stations. Kusile Power Station will be commissioned with abatement technology to achieve the new plant standards for PM, NO_x and SO_2. Medupi is commissioned with abatement technology which can meet PM and NO_x new plant standards and will be retrofitted with flue-gas desulphurisation (FGD) so that the new plant SO_2 limit will also be achieved over time. There are six power stations which will be decommissioned before 2030 (totalling in excess of 10 000MW), and an additional two by 2035 (totalling in excess of 7 000MW) and the remaining existing plants by 2044 (excluding Majuba, Medupi and Kusile).

The updated planned retrofit schedule is depicted in Figure 1. The decommissioning dates for a 50-year power station life are shaded grey. Currently the draft Integrated Resource Plan 2018 is based broadly on a 50-year life for coal power stations. For consistency in this application the decommissioning dates as defined in the Eskom Consistent Data set (Eskom 36-623 rev 3) for planning have been used. There is a variance of one year at some stations between the draft IRP and Eskom Consistent Data Set dates. The final shut down and decommissioning dates of power stations and units within stations are determined based on economic, technical and environmental criteria. In 2017/18 eleven (11) units at Eskom's most costly and oldest plants have been shut down. The remaining units at these three power stations, namely Grootvlei, Hendrina and Komati will be shut down by 2023. The shutting down of these power plants will reduce the cumulative pollution in Mpumalanga. The retrofits listed above are over and above the emission abatement technology which is already installed at Eskom's power stations, which is:

- Electrostatic Precipitators (ESPs) at Matimba, Kendal, Lethabo, Matla, Kriel, Tutuka, Komati, 3 of the 6 units at Duvha. In addition SO_3 injection plants have also been installed at those stations with ESPs, except Tutuka, to improve the efficacy of the same;
- Fabric Filter Plants (FFPs) at Majuba, Arnot, Hendrina, Camden, Grootvlei, Medupi, Kusile and 3 units at Duvha;
- Boilers/Plants with Low NO_x design at Kendal, Matimba, Ankerlig and Gourikwa;
- Flue Gas Desulphurisation (FGD) at Kusile.

Eskom applied and was granted postponements between 2014 and 2015. Since then Eskom has updated its emission reduction plan to also include the enhancement of existing particulate matter abatement technology currently installed at Kendal, Matimba and Lethabo Power Stations.

Some of Eskom's previously committed timelines for technology installation have moved back by 1-3 years. Delays in planning, approval and commercial processes have caused delays in the dates originally outlined for abatement retrofits at Medupi, Majuba, Tutuka and Matla. No delays were however incurred for the Grootvlei FFP installation, and so, since 2017, Grootvlei's abatement technology retrofit was successfully completed, and Grootvlei, which used to count as one of Eskom's highest emitting PM emitters, now easily complies with the new plant PM standard of 50 mg/Nm^3. Additionally, work has successfully been completed on Duvha and Camden to reduce PM and NO_x emissions, respectively.

	Planned Retrofit	Pollutant to be abated	15/ 16	16/ 17	17/ 18	18/ 19	19/ 20	20/ 21	21/ 22	22/ 23	23/ 24	24/ 25	25/ 26	26/ 27	27/ 28	28/ 29	29/ 30	50-year life
Kusile	Fully compliant	N/A																2068-73
Medupi	FGD	SO_2																2066-69
Majuba	LNB	NOx																2046-51
Kendal	HFT+ESP upgrade	PM																2039-44
Kendal	FGD-Pilot	SO_2																2039-44
Matimba	FGD-Pilot	SO_2																2038-42
Matimba	HFT+ESP upgrade	PM																2038-42
Lethabo	HFT+ESP/SO_3 upgrade	PM																2036-41
Tutuka	FFP	PM																2035-41
Tutuka	LNB	NOx																2035-41
Duvha (4 & 6)	HFT+ESP upgrade	PM																2031-34
Matla	HFT +ESP upgrade	PM																2030-34
Matla	LNB	NOx																2030-34
Kriel	HFT+ESP upgrade	PM												**Dx1**	**D x1**	**D x1**	**D x2**	2026-30
Arnot	FFP installed	N/A							**D x1**					**Dx2**	**D x1**		**Dx2**	2021-29
Hendrina	FFP installed	N/A			**SDx1**	**SDx2**	**SDx1**	**SDx2**	**SDx3**	**SDx1**	**Dx1**	**Dx2**	**Dx1**	**Dx1**	**Dx1**			2020-27
								Dx1	**Dx2**	**Dx1**								
Camden	FFP installed, LNB complete	NOx						**D x1**	**D x2**	**D x2**	**D x3**							2020-23*
Grootvlei	FFP complete	N/A			**SDx3**		**SDx2**	**SDx1**					**Dx1**	**Dx1**	**Dx2**	**Dx2**		2025-28
Komati	No commitments	N/A			**SDx2**	**SDx3**	**SDx2**		**SDx1**	**SDx1**		**Dx2**		**Dx1**	**Dx4**	**Dx1**	**Dx1**	2024-29

Legend	
Completed projects	
Future projects	
Decommissioning	**D**
Shut down for reserve storage	**SD**
Previous commitment	

Abbreviations:
CFB-FGD = Circulating Fluidised Bed – Flue Gas Desulphurisation to reduce SO_2
ESP = Electrostatic Precipitator to reduce PM
FFP = Fabric Filter Plant to reduce PM
FGC = Flue Gas Conditioning to reduce SO_2 * Subject to review

Figure 1: Committed emission abatement retrofits and power station decommissioning dates to illustrate Eskom's overall atmospheric emissions reduction plan

Implementing the emission reduction plan and installing more efficient emission control technology will reduce Eskom's emissions. The decommissioning of the older stations and an increased use of the newer less emitting Medupi and Kusile will also result in a substantial decrease in Eskom's emissions over time (see Figures 2, 3 and 4) and Table 1 for the percentage decrease. For example it is projected that compared to a 2020 baseline that by 2035 Eskom's relative PM emissions will reduce by 58%, SO_2 by 66% and NO_x by 46%. Table 2 and 3 provide an overview of Eskom's current and future compliance status with the existing and new plant MES.

Table 1: Percentage reduction in relative emissions from 2020 with implementation of emission reduction plan

Pollutant	Year		
	2025	2030	2035
PM	38 %	49 %	58%
SO_2	18 %	52 %	66 %
NO_x	15 %	32 %	46 %
Est. Production from Coal PS (GWh)	210 730	189 047	159 103

The retrofit schedule and projected emission reduction above clearly illustrates Eskom has been and remains committed to implementing emission reduction technologies to improve air quality in South Africa. Though there are delays in the implementation of the retrofit plan Eskom remains committed to ensuring these planned technology installations are completed.

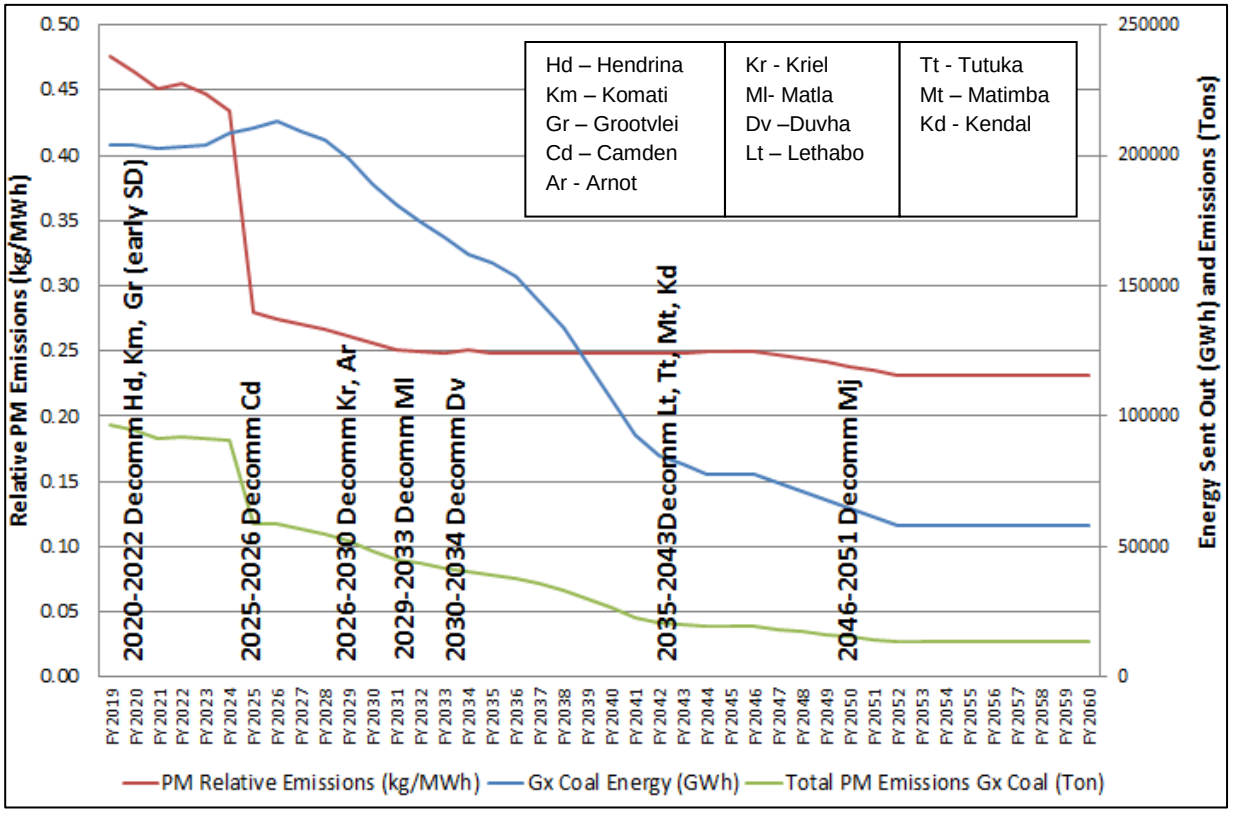

Figure 2: Projected reduction in particulate matter emissions

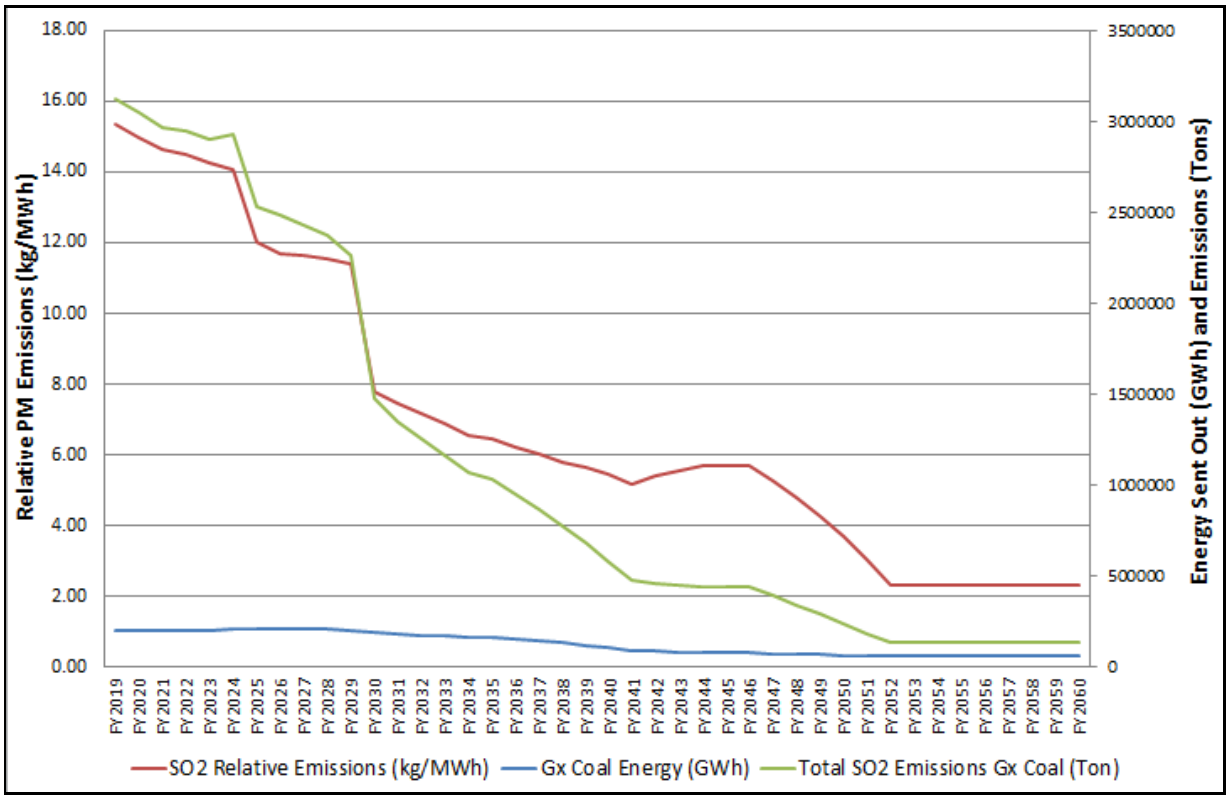

Figure 3: Projected reduction in SO_2 emissions

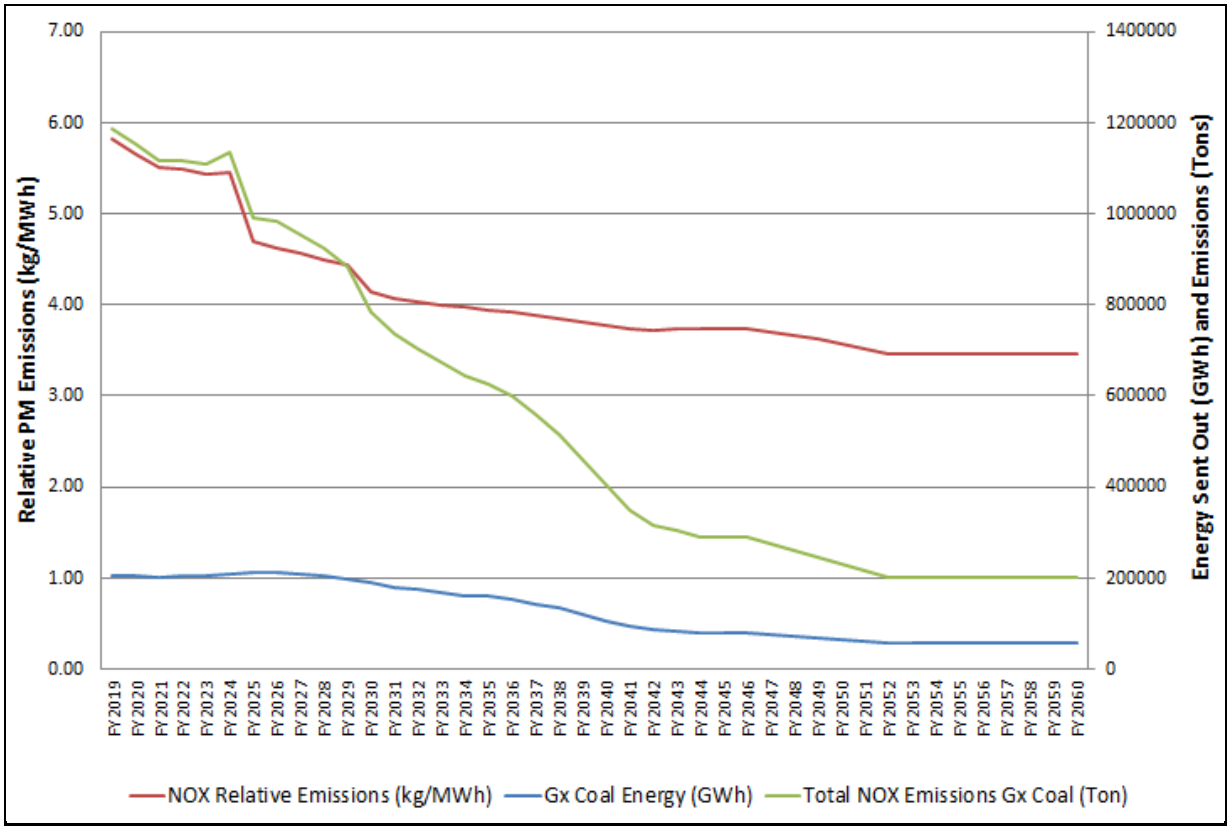

Figure 4: Projected reduction in NO_x emissions

Table 2: Overview of Eskom's current and future compliance status with the new plant MES

Station fully complies with respective limit within 5 year window
Station does not comply with respective limit within 5 year window
Some units comply within 5 year window
Decommissioning*

	Compliance between 2015-2020 with existing plant standards			Compliance between 2020-2025 with new plant standards			Compliance between 2025-2030 with new plant standards			Compliance between 2030 - 2035 with new plant standards		
	Existing plant standards			New plant standards			New plant standards			New plant standards		
Pollutant	PM	SO_2	NO	PM	SO_2	NOx	PM	SO_2	NOx	PM	SO_2	NOx
Limit – coal	100	3500	1100	50	1000	750	50	1000	750	50	1000	750
Limit – liquid	75	3500	1100	50	500	250	50	500	250	50	500	250
Power Station												
Kusile												
Medupi												
Majuba												
Kendal												
Matimba												
Lethabo												
Tutuka												
Duvha												
Matla												
Kriel												
Hendrina												
Arnot												
Camden												
Grootvlei												
Komati												
Ankerlig												
Gourikwa												
Acacia												
Port Rex												

* These decommissioning dates have been aligned with the Eskom Consistent data set using a 50 year life expectancy

Table 3: Overview of Eskom's current and future compliance with the existing plant MES

	Compliance between 2015-2020 with existing plant standards			Compliance between 2020-2025 with existing plant standards			Compliance between 2025-2030 with existing plant standards			Compliance between 2030 - 2035 with existing plant standards		
	Existing plant standards			Existing plant standards			Existing plant standards			Existing plant standards		
Pollutant	PM	SO_2	NO	PM	SO_2	NOx	PM	SO_2	NOx	PM	SO_2	NOx
Limit – coal	100	3500	1100	100	3500	1100	100	3500	1100	100	3500	1100
Limit – liquid	75	3500	1100	75	3500	1100	75	3500	1100	75	3500	1100
Power Station												
Kusile												
Medupi												
Majuba												
Kendal												
Matimba												
Lethabo												
Tutuka												
Duvha												
Matla												
Kriel												
Hendrina												
Arnot												
Camden												

	Compliance between 2015-2020 with existing plant standards			Compliance between 2020-2025 with existing plant standards			Compliance between 2025-2030 with existing plant standards			Compliance between 2030 - 2035 with existing plant standards		
	Existing plant standards			Existing plant standards			Existing plant standards			Existing plant standards		
Pollutant	PM	SO_2	NO	PM	SO_2	NOx	PM	SO_2	NOx	PM	SO_2	NOx
Limit – coal	100	3500	1100	100	3500	1100	100	3500	1100	100	3500	1100
Limit – liquid	75	3500	1100	75	3500	1100	75	3500	1100	75	3500	1100
Power Station												
Grootvlei												
Komati												
Ankerlig												
Gourikwa												
Acacia												
Port Rex												

* These decommissioning dates have been aligned with the Eskom Consistent data set using a 50 year life expectancy

Most of Eskom's fleet is able to comply with existing plant limits for PM and NO_x. Only Tutuka, Matla units 1-4 and Kriel are currently unable to comply with existing standards for PM. Matla and Kriel will comply with 100mg/Nm^3 and Tutuka with 50 mgNm^3 once the retrofits or upgrades had been completed. Only Matimba and Medupi do not currently consistently comply with the existing SO_2 plant limit due to the high sulphur coal mined in the Waterberg area, Medupi will be retrofitted with FGD. A pilot study will be undertaken to confirm the appropriate technology for ensuring Matimba and Kendal meet the existing or alternate plant limits. Lastly, of the seven stations that currently do not comply with the existing plant NO_x standards, retrofits at three stations will ensure new plant standards for NO_x are met (Tutuka, Matla, Majuba).

It will be more difficult for stations to come into compliance with new plant standards for all three pollutants, and installing abatement technology on each station for PM, NO_x and SO_2 would cost an exorbitant amount of money (in excess of R 187 billion), directly impacting on the electricity tariff. Additionally, full compliance with the emission limits would have many other socio-economic and environmental implications as outlined further in this report. Eskom has only submitted the costs to NERSA for the planned retrofits which are estimated to cost R 46 billion for the MYPD 4 window. Should the outcome of the postponement application result in additional costs, it would be necessary for Eskom to update the submission to NERSA which will result in a tariff adjustment, thereby passing the cost to the end-user. If the additional costs are not allowed Eskom's financial health will further deteriorate and the ability to raise funding for these projects would be limited. The Eskom requested electricity price increase was declined by NERSA on 7 March 2019, days before finalisation of this application. Eskom will now have to further prioritise its operations which may require amendment to the ERP and Eskom reserves it rights to amend its ERP and submit additional information if required.

As per the IRP and Consistent Data Set Grootvlei, Komati, Camden, Hendrina, Arnot and Kriel will in addition be decommissioned by 2030. Matla and Duvha will be decommissioned by 2035; Lethabo, Matimba and Kendal will be decommissioned by 2044. The progressive decommissioning along with the planned retrofits/upgrades significantly reduces Eskom's environmental footprint and the impact on air quality. As such, the ambient air quality going forward will be better than what it has historically been. The earlier shut downs in 2018 of the eleven units mentioned previously in this report already yields some benefit.

While Eskom is committed to implementing the technology elements of its emission reduction plan it has also identified the need to submit suspensions, postponements and alternate limit requests to ensure the continued legal operation of its plant where the MES compliance time frames cannot be met or the decommissioning of the plant will occur before 2030. An overview of the postponements, alternative limits requested and in the case of plant to be decommissioned by 2030 suspension requests is described in section 4.

3 LEGAL BASIS FOR THE APPLICATIONS

All the Eskom Power Stations hold a valid Atmospheric Emission Licence for electricity production, the storage and handling of coal, and the storage of petroleum products in terms of the listed activities promulgated in the Minimum Emission Standards (GNR 893 dated 22 November 2013, and as amended in GNR 1207 on 31 October 2018) under the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) [NEMAQA]. The AEL specifies permissible stack emission concentrations for NO_x, SO_2 and for PM. The licence specifies a number of compliance conditions as well as conditions for emission monitoring and management of abnormal releases.

In October 2018 the 2017 National Framework for Air Quality Management in the Republic of South Africa and the Amendment to Listed Activities and Associated Minimum Emission Standards Identified in terms of Section 21 of NEMAQA were published. Eskom and the independent consultants appointed to complete the AIR have made every effort to provide complete information, Eskom reserves the right to supplement the information if it deems appropriate or if requested to do so by the NAQO.

In terms of timing, Eskom is required to submit an AEL variation requests parallel to the MES applications. The variation request is prepared based on the assumption that the requested MES postponement is granted by the NAQO. If the NAQO decision is substantially different from the requested postponement, Eskom reserves its right to amend its variation request.

3.1 Minimum Emission Standards

In terms of NEMAQA, all of Eskom's coal- and liquid fuel-fired power stations are required to meet the Minimum Emission Standards (MES) contained in GNR 893, and as amended in GNR 1207, promulgated in terms of Section 21 of the NEMAQA. GNR 893 does provide arrangements in respect of the requirement for existing plants to meet the MES and provides that less stringent limits had to be achieved by existing plants by 1 April 2015, and more stringent “new plant" limits need to be achieved by existing plants by 1 April 2020. The MES are listed in the table below.

Table 4: Minimum emission standards for Category 1: Combustion Installations, sub-category 1.1: Solid Fuel Installations and sub-category 1.2: Liquid fuel installations

		Subcategory 1.1: Solid fuel		Sub-category 1.2: Liquid fuel
Description:		Solid fuels combustion installations used primarily for steam raising or electricity generation.		Liquid fuels combustion installations used primarily for steam raising or electricity generation.
Application:		All installations with design capacity equal to or greater than 50 MW heat input per unit, based on the lower calorific value of the fuel used		All installations with design capacity equal to or greater than 50 MW heat input per unit, based on the lower calorific value of the fuel used.
Substance		**Plant status**	mg/Nm^3 under normal conditions of 10% 0_2, 273 Kelvin and 101,3 kPa.	mg/Nm^3 under normal conditions of 15% 0_2, 273 Kelvin and 101,3 kPa.
Common name	**Chemical symbol**			
Particulate matter	N/A	Existing	100	75
		New	50	50
Sulphur dioxide	SO_2	Existing	3 500	3 500
		New	1000	500
Nitrogen oxides	NO_x	Existing	1 100	1 100
		New	750	250

Note: * Existing plants shall comply with a new plant emission standard of 1000 mg/Nm^3 for sulphur dioxide (SO_2).

Further, the Amendments to the listed activities and associated minimum emissions standards identified in terms of section 21 of the NEMAQA, GN 1207 31 October 2017, (also in the 2017 National Framework for Air Quality Management in the RSA (GN 1144, 26 October 2018)) provides certainty regarding postponement or suspension of compliance timeframes in the following order:

(11A) An existing plant may apply to the National Air Quality Officer for a once-off postponement with the compliance timeframes for MES for new plant. A once-off postponement with the compliance timeframes for the MES for new plant may not exceed a period of 5 years from the date of issue. No once off postponement will be valid beyond 31 March 2025;
(11B) An existing plant to be decommissioned by 31 March 2030 may apply to the NAQO before 31 March 2019 for a once-off suspension of compliance timeframes with MES for new plant. Such an application must be accompanied by a detailed decommissioning schedule. No such application shall be accepted by the NAQO after 31 March 2019;
(11C) An existing plant that has been granted a once off suspension with the compliance timeframes must comply with MES for existing plant from the date of granting the application and during the period of suspension until decommissioning.
(11D) No postponement of compliance timeframes or a suspension of compliance timeframes shall be granted for compliance with the MES for existing plant.
(12A) a) An existing plant may submit an application regarding a new plant standard to the National Air Quality Officer for consideration, if the plant is in compliance with other emission standards but cannot comply with a particular pollutant or pollutants.

b) An application must demonstrate previous reduction in emissions of the said pollutant or pollutants, measures and direct investments implemented towards compliance with the relevant new plant standards.

c) The National Air Quality Officer, after consultation with the Licensing Authority, may grant an alternative emission limit or emission load if:

- there is material compliance with the national ambient air quality standards in the area for pollutant or pollutants applied for; or
- the Atmospheric Impact Report does not show a material increased health risk where there is no ambient air quality standard.

3.2 Regulatory requirements

In terms of Paragraph (11)(a) – (c) of GNR 1207 of 31 October 2018 (the Regulations), the postponement or suspension applications must include:

a) An air pollution impact assessment compiled in accordance with the regulations prescribing the format of an Atmospheric Impact Report (AIR) (as contemplated in Section 30 of the NEMAQA), by a person registered as a professional engineer or as a professional natural scientist in the appropriate category;
b) A detailed justification and reasons for the Application; and
c) A concluded public participation process undertaken as specified in the National Environmental Management Act and the Environmental Impact Assessment (EIA) Regulations made under section 24(5) of the afore mentioned Act.

4 APPLICATIONS TO BE SUBMITTED OR PROPOSED REQUESTED ALTERNATIVE LIMITS

As per the Amendments to the listed activities and associated minimum emissions standards identified in terms of section 21 of the NEMAQA (GN 1207, 31 October 2017) and the 2017 National Framework for Air Quality Management in RSA (GN1144, 26 October 2018), there are 3 options available to Eskom to support compliance with the MES, these include:

OPTION 1 (paragraph 11A of GN 1207) - Apply for a postponement from only the MES new plant standards until 2025
OPTION 2 (paragraph 11B of GN 1207) – Apply for suspension from the new plant standards until decommissioning and Eskom must comply with the existing plant standards
OPTION 3 (paragraph 12A of GN 1207) – Apply for alternative emission limit to the new plant standards with assurance of compliance to the national ambient air quality standards in the area or demonstration of no increased health risk where there is no increase in the ambient air quality standards.

As such, the applications that Eskom is submitting, or the alternative emission limits that are requested during normal operating conditions, are summarised in Table 5.

Table 5: Applications or proposed alternative limits to be requested for Eskom's various coal and liquid fuel- fired powers stations

Station	**Pollutant – new plant limit (existing plant limit)**		
Coal-fuelled	**PM – 50 (100)**	**NO_x – 750 (1100)**	**SO_2 - 1000 (3500)**
Majuba (Decom 2046-51)	None- Eskom will comply	OPTION 3 - Alternative limit of 1400 mg/Nm^3 monthly (retrofit only complete in 2026 – then compliance)	OPTION 1 - Postponement OPTION 3 - Alternative limit of 3000 mg/Nm^3 until decommissioning (from 2025 until 2051)
Kendal (Decom 2039-44)	OPTION 1 - Postponement OPTION 3 - Alternative limit of 85 mg/Nm^3 from 2025	OPTION 1 - Postponement OPTION 3 - Alternate monthly limit of 750 mg/Nm^3 from 2025 until decommissioning	OPTION 1 - Postponement OPTION 3 - Alternative limit of 3000 mg/Nm^3 until decommissioning
Lethabo (Decom 2036-41)	OPTION 1 - Postponement OPTION 3 - Alternative limit of 100 mg/Nm^3 (HFPS only complete in 2025 – then 80 mg/Nm^3)	OPTION 1 - Postponement OPTION 3 - Alternative limit of 1100 mg/Nm^3 from 2025 until decommissioning	OPTION 1 - Postponement OPTION 3 - Alternative limit of 2600 mg/Nm^3 until decommissioning
Tutuka (Decom 2035-41)	OPTION 3 - Alternative limit of 300 mg/Nm^3 daily or 200 mg/Nm^3 monthly (retrofit only complete in 2027 then compliant)	OPTION 3 - Alternative limit of 1200 mg/Nm^3 (retrofit only complete in 2027 then compliant)	OPTION 1 - Postponement OPTION 3 - Alternative limit of 3000 until decommissioning
Duvha (U1-3) (Decom 2031-34)	None- Eskom will comply	OPTION 1 - Postponement OPTION 3 - Alternative limit of 1100 mg/Nm^3 from 2025 until decommissioning	OPTION 1 - Postponement OPTION 3 - Alternative limit of 2600 until decommissioning
Duvha (U4 -6) (Decom 2031-34)	OPTION 1 - Postponement OPTION 3 - Alternative limit of 80 mg/Nm^3 from 2025 until decommissioning		
Matla (U1-4) (Decom 2030–34)	OPTION 1 - Postponement OPTION 3 - Alternative limit of 200 mg/Nm^3 from 2020 to April 2021 (when ESPs are upgraded) • Alternative 100 mg/Nm^3 from April 2021 to 2025 • Alternative limit of 80 mg/Nm^3 from 2025 until decom	OPTION 1 - Postponement OPTION 3 - Alternative limit of 1200 mg/Nm^3 (retrofit only complete in 2027 – then compliance)	OPTION 1 - Postponement OPTION 3 - Alternative limit of 2600 mg/Nm^3 until decommissioning (from 2025 until 2034)
Matla (U5&6) (Decom 2030-34)	OPTION 1 - Postponement OPTION 3 - Alternative limit of 100 mg/Nm^3 from 2020 to 2025 • Alternative limit of 80 mg/Nm^3 from 2025 until decom		
Kriel (N stack) (Decom 2026-30)	OPTION 2 – SUSPENSION OPTION 3 - Alternative limit of 125 mg/Nm^3 until 2025, then 100	OPTION 2 – SUSPENSION OPTION 3 – Alternative limit of 1600 mg/Nm^3 until	OPTION 2 – SUSPENSION OPTION 3 – Alternative limit of 2800 mg/Nm^3 until

Station	Pollutant – new plant limit (existing plant limit)		
Coal-fuelled	**PM – 50 (100)**	**NO_x – 750 (1100)**	**SO_2 - 1000 (3500)**
	mg/Nm^3 until decommissioning	decommissioning	decommissioning
Kriel (S stack) (Decom 2026-30)	OPTION 2 – SUSPENSION OPTION 3 - Alternative limit of 100 mg/Nm^3		
Arnot (Decom 2021-29)	None- Eskom will comply	OPTION 2 – SUSPENSION OPTION 3 – Alternative limit of 1 000 mg/Nm^3 until decommissioning	OPTION 2 – SUSPENSION from 2025 until 2029 OPTION 3 – Alternative limit of 2500 mg/Nm^3 until decommissioning
Hendrina (Decom 2020-27) (Shutdown 2017-23)	None- Eskom will comply	OPTION 2 – SUSPENSION OPTION 3 – Alternative limit of 1200 mg/Nm^3 until decommissioning	OPTION 2 – SUSPENSION OPTION 3 – Alternative limit as per AEL of 3200 mg/Nm^3 until decommissioning
Camden (Decom 2020-23) [+]	None- Eskom will comply	OPTION 2 – SUSPENSION OPTION 3 – Alternative limit of 1 100 mg/Nm^3 until decommissioning	None- Eskom will comply. The AEL limit is 3 500 mg/Nm^3.
Komati (Decom 2024-29) (Shutdown 2017-23)	OPTION 2 – SUSPENSION OPTION 3 – Alternative limit of 100 mg/Nm^3 until decommissioning	OPTION 2 – SUSPENSION OPTION 3 – Alternative limit of 1100 mg/Nm^3 until decommissioning	OPTION 2 – SUSPENSION OPTION 3 – Alternative limit of 2600 mg/Nm^3 until decommissioning
Grootvlei* (Decom 2025-28) (Shutdown 2017-2021)	None- Eskom will comply	OPTION 2 – SUSPENSION	OPTION 2 – SUSPENSION
Matimba* (Decom 2038-42)	None- Eskom will comply	OPTION 1 - Postponement OPTION 3 – Alternate monthly limit of 750 mg/Nm^3 from 2025 until decommissioning	OPTION 1 - Postponement OPTION 3 - Alternate limit of 3 500 mg/Nm^3 monthly from 2025 until decommissioning
Medupi* (Decom 2066-69)	None- Eskom will comply	None- Eskom will comply	OPTION 1 - Postponement OPTION 3 - Alternate limit of 3 500 mg/Nm^3 monthly from 2025 until 2028
Kusile	None- Eskom will comply	None- Eskom will comply	None- Eskom will comply
Liquid fuel	**PM – 50 (75)**	**NO_x - 250 (1100)**	**SO_2 - 500 (3500)**
Acacia* (Decom 2026)	None- Eskom will comply	OPTION 2 – SUSPENSION	None- Eskom will comply
Port Rex* (Decom 2026)	OPTION 2 – SUSPENSION	OPTION 2 – SUSPENSION	None- Eskom will comply
Ankerlig	None- Eskom will comply	None- Eskom will comply	None- Eskom will comply
Gourikwa	None- Eskom will comply	None- Eskom will comply	None- Eskom will comply

[+] Subject to review and possible extension

*Due to the recently promulgated new regulations (GNR 1207, 31 Oct 2017) and noting the lengthy SoE procurement processes Eskom reserves the right to submit postponement applications at a later stage with a request for condonation for these sites.

It is further requested that the proposed alternative limits only apply during normal working conditions, and not during start-up or shut-down periods.

5 REASONS FOR THE POSTPONEMENT, SUSPENSION OR ALTERNATIVE LIMIT APPLICATIONS

In terms of the NEMAQA requirements, the applications must be accompanied by reasons. Such reasons are set out below and include the fact that Eskom is committed to emissions reduction (as detailed above) and to being held to legally defined emissions limits but the implications of full compliance with the MES have potentially serious implications for the country in their own right. These potentially serious implications include increasing consumption of water, an already limited resource; transport and mining impacts related to the supply of sorbent (limestone/lime) and increases in waste and CO_2 production. In addition the direct financial costs of the required retrofits will result in a significant increase in the electricity tariff. These undesired consequences must be weighed up against the benefits that will accrue as a result of compliance with the MES. It is Eskom's view that the benefit of compliance does not justify the non-financial and financial costs of compliance. Moreover, even if Eskom were to comply fully with the MES, the main air quality problems in South Africa would still remain.

None of these reasons should be seen as exclusive (i.e. it is not one reason alone that prevents compliance) but rather all in combination. Eskom has had to apply for a postponement or suspension of the compliance timeframe for the MES, or alternative limits to the MES, in many cases because it is not possible for Eskom to plan, design, get approvals for, and construct major capital projects required for compliance with the MES.

5.1 Timing

Upgrading a power station's technology to include specific pollutant abatement equipment requires achievement of numerous strategic milestones (Figure 5).

Eskom has a rigorous planning and approval process in order to ensure compliance with the Public Finance Management Act, and ensure that there is sufficient certainty for budgeting purposes.

Simplistically speaking, an upgrade of this type requires years of planning, which precedes a six month installation process, as well as substantial capital funding and power station down-time. The planning process involves Eskom internal processes that allow for technology concept and design approval after which significant funds need to be allocated to the project. Being a state owned entity, government approval for projects of such a nature is also required which lead to the additional project development time-lines. For contracts to commence the project are only put in place once carefully regulated commercial processes have been completed. Over and above the aforementioned milestones, the actual commencement of the installation of the abatement technology at a unit needs to be carefully scheduled to fit into a six-month unit outage time, which is usually planned alternatingly for each unit (i.e. one unit per year) as part of an official longer term outage schedule.

Once a unit is taken down for maintenance, it is not operational, and thus does not contribute power to the grid. Unit down-time needs to take into account fleet generation capacity and can only take place, if Eskom is sure the country's energy demands can be met. Once the pollutant specific abatement technology has been installed, it takes months for the relevant technology to function optimally (optimisation period), as test-runs and assessments take place to ensure the equipment functions to its design capacity. The optimisation period for FFPs is typically 9 months and the optimisation period for LNBs can typically take up to a year, emphasising that abatement technology installation completion does not automatically signify immediate full compliance.

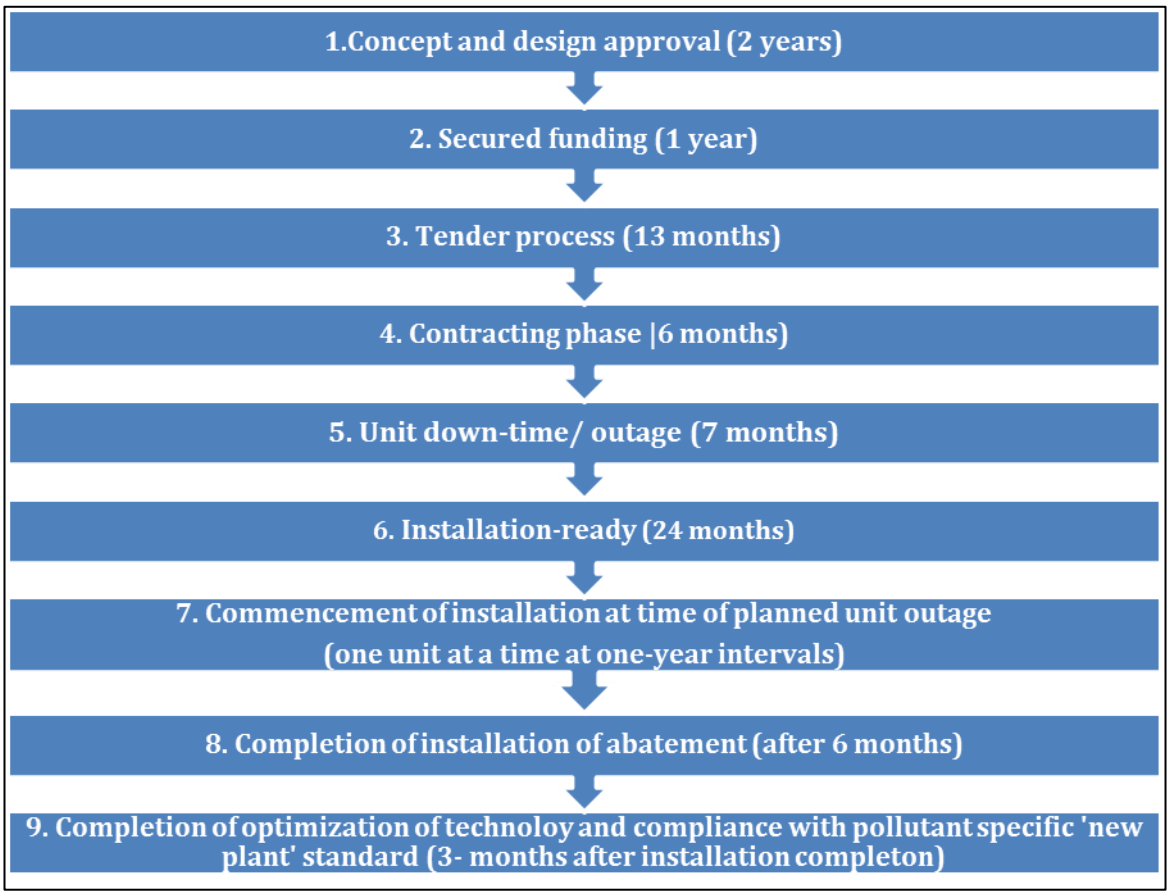

Figure 5: Process-flow diagram outlining the simplified process from abatement technology concept design approval to compliance of unit's emissions with 'new plant' standards.

The process outlined above can typically take 12 or more years to complete from start to finish (based on the Medupi experience), and because the successful completion of the entire project requires the conclusion of a myriad of factors it is often difficult to predict, with certainty, the associated execution and completion timelines.[1]

5.2 Water availability

Water is an extremely limited resource in South Africa and it is argued that the implementation of FGD at some stations is not an appropriate decision for a water scarce country. The only technology which would enable Eskom's coal-fired power stations to achieve the new plant SO_2 limit is flue gas desulphurisation (FGD). Both wet and semi-dry FGD are critically dependant on the availability of large quantities of water being available at the power stations where FGD is deployed. Recent investigations undertaken for Medupi indicate that the implementation of FGD will increase its water requirement to up to 9 Mm^3/annum. Wet FGD approximately triples the water consumption of a dry-cooled power station; semi-dry FGD more than doubles the water consumption of a dry-cooled power station (a wet cooled power station uses more than 10 times the amount of water of an equivalent dry-cooled power station. Typically 0.12 l/kWh for dry cooled to 2 l/kWh for wet cooled). The water demands of FGD are significant across the power stations and will increase Eskom's water demand by some 59 million m^3/annum – a 20%[2] increase in the combined water consumption of Eskom's power stations. Some 95% of South Africa's water has already been allocated leaving a low reserve margin to deal

[1] During the public participation process various queries in respect of Eskom's projected time frames, technology choices and costing were raised. Eskom's decisions and assumptions in regards to these are based on local experience and the local context and are considered appropriate.

[2] Assuming that wet FGD is installed on the 5 newest stations excluding Kusile, and semi-dry FGD is installed on the rest of the coal-fired fleet, excluding station decommissioned by 2030. The October amendment of the MES for SO_2 new plant to 1000 mg/Nm^3 will required a revision of technology choices as it may be possible to meet the limit using semi-dry FGD at the 5 newest stations.

with droughts and future water demand and it is further argued that were it not for the prolonged period of above average rainfall in Gauteng specifically, that water restrictions would be in place.

The total water demands in the Integrated Vaal River Catchments presently exceed the water availability in the catchment until Phase 2A of the Lesotho Highlands Water Project (LHWP) is implemented. The projected completion date of Phase 2A of the LHWP is now beyond 2026. The water supply deficit is expected to grow with the growing urban demand in the greater Gauteng area. It is unlikely that DWS will license new major demands in this system until then. Thus far all efforts by DWS to reduce demand in the Vaal River system have been delayed or ineffective. Rand Water for example are requesting an increase in its water license volume to cater for the additional demand and DWS have refused thus far as there is no water available in the Vaal System.

Eskom has a combined water licence of 360 million m^3/annum from the Vaal River Eastern Subsystem to generate electricity (licensed to October 2025 when it will be reviewed). Some of Eskom's older power stations are expected to be decommissioned within the next 5 to 10 years but that does not significantly contribute to reducing the shortages in the Vaal River System as the declining demand for Eskom's water use is already taken into account in the annual operating analysis. Eskom will not be able to re-allocate its water allocation to FGD as a relinquishing of our licenced volume goes back to DWS to determine who would be the best user for the water being made available.

Beyond 2026 when LHWP 2 comes into operation it is possible that water is available for retrofits to the current fleet supplied from the Vaal System.

Similarly the power stations in the Limpopo are not able to retrofit FGD until further water becomes available through an inter-basin transfers system. The local water resources cannot supply more than its current allocation of water. DWS have considered a project to bring additional water into the area but the project (MCWAP 2) has been on hold while Government confirms the sizing of the infrastructure. The expected date is also beyond 2025.

The argument is also not just one of having water available in the catchment, it is also one of determining whether FGD is a judicious use of what is an extremely scarce resource in South Africa in the face of multiple competing demands for that same resource. Especially since more than 95% of South Africa's available water has already been allocated.

5.3 Sorbent consumption and waste production

FGD across the generating fleet to meet full compliance of the MES would require 5.2 million tonnes of sorbent (limestone or lime) per annum, and 1.5 million tons/annum for Eskom's emission reduction plan. The main source of sorbent is the Northern Cape, so the sorbent would need to be transported over hundreds of kilometres, preferably by rail or otherwise by road. The transport of the sorbent would result in environmental impacts, notably greenhouse gas emissions, and fugitive dust emissions. An increase in truck traffic would also result in an increase in driver mortalities, as has been observed in association with coal transport in Mpumalanga. New mines would also need to be opened to supply sorbent to all Eskom's power stations, and this would also have significant environmental impacts, including a potential deterioration in water quality and an increase in fugitive dust emissions.

It is estimated that approximately 9.7 million tonnes of by-product will be produced per annum from FGD units across the fleet for full compliance, and 2.7 million tons/annum for Eskom's emission reduction plan. If a high quality limestone is used, high quality gypsum can be produced by wet FGD, and this could be taken up by the market for wallboard production, for example. Lower grade gypsum can also be used for agricultural purposes.

However, indications are that there is only enough demand from the market to take up at most two power stations' worth of by-product. Furthermore, there are limited supplies of high quality sorbent in South Africa, so it is likely that most gypsum or by-product would need to be disposed of, in which case it would need to be managed carefully to ensure that there are no impacts on groundwater or air quality (from fugitive dust emissions).

5.4 CO_2 production

The wet FGD process directly produces CO_2 as a by-product, through the reaction:

$$SO_2 + CaCO_3 \rightarrow CaSO_4 + CO_2$$

If wet FGD is installed on all power stations, an additional approximate 3 million tons per annum of CO_2 would be produced if Eskom has full compliance to the MES. An additional 435 000 tons/annum would be produced from the implementation of Eskom's emissions reduction plan. Semi-dry FGD, which typically uses lime as a sorbent, does not produce CO_2 directly in the FGD process, but the CO_2 is produced instead through the manufacture of lime from limestone.

In addition, the auxiliary power requirements for full MES compliance are some 2 500 GWh/year (and just over 400 GW/h/ year from Eskom's emission reduction plan). This reduction in the efficiency of the power stations would result in a further increase in Eskom's relative CO_2 emissions.

5.5 Direct financial costs

Eskom estimates that the CAPEX cost of full compliance with the MES at all Eskom's power stations is greater than R187 billion in 2018 real terms (excluding financing costs), and that annual OPEX costs are at least R5.9 billion per annum. This includes the costs for emission control for the entire existing fleet and flue gas desulphurisation at Medupi. Medupi's other emission abatement costs and all emission abatement costs for Kusile have been excluded from these totals because they have already been incorporated into the Medupi and Kusile projects. These costs are considered to be accurate to a factor of two.

The breakdown of the CAPEX costs is as follows:

- SO_2 emission reduction by FGD is estimated to cost R 140 – 175 billion. The estimated cost assumes R 15 - 26 billion per power station dependent on installed capacity and wet or dry FGD technology. It is taken that wet FGD is implemented on Medupi, Majuba, Matimba, Kendal, and Tutuka, (power stations being decommissioned after 2035) and that semi-dry FGD is implemented on Duvha, Lethabo and Matla (stations decommissioned between 2030 and 2035). For the tariff impact calculation an amount of R150 billion is used.
- NO_x emission reduction by the most appropriate technology is estimated to cost between R10 and R40 billion for all power stations. This includes Low NO_x Burner retrofits at stations which need them, and burner optimisations at others. For the tariff impact calculation an amount of R20 billion is used.
- Particulate Matter emission reduction by FFP retrofits is estimated to cost between R15 and R40 billion. For the tariff impact calculation an amount of R40 billion is used.

Full compliance with the MES at Lethabo would require a FGD retrofit, which is the only way of consistently achieving the new plant SO_2 emission limit, an cost of between R 15 – 20 billion and a LNB retrofit estimated to be around R2 billion, as well as FFP retrofit and dust handling plant upgrade (CAPEX of over R5 billion).

The CAPEX cost estimates were derived as follows:

- FGD: Costs for existing stations are based on a study done by EON Engineering for all Eskom's power stations in 2006, adding on provisions for balance of plant considerations and owner's development

costs, and inflated to 2018 costs. Costs are considered to be accurate to a factor of 2. Costs for Medupi are according to the Concept Design Report, and are considered to be accurate to within 20%.

- Low NO_x Burners and/or Overfired Air: Costs are based on International Energy Agency (2006) costs, escalated for inflation, rate of exchange and Owner Development Costs. Costs are considered to be accurate to a factor of 2.
- FFPs: Costs are based on actual tender prices for an enquiry for FFP retrofits at Matla and Duvha in 2011/12. Costs are considered to be accurate to 40% for Tutuka, Matla and Duvha and to approximately a factor of 2 for other power stations.

The OPEX costs are only for flue gas desulphurisation, and are also based on costs in the EON Engineering report for the existing fleet, and on costs in the Medupi Concept Report for Medupi. Again, the OPEX costs do not include OPEX for Kusile. The main cost items are the sorbent (limestone), water, gypsum disposal, auxiliary power and maintenance costs. For the tariff impact calculation an amount of R6.3bn per annum is used.

The certainty with which Eskom presents costs depends on the stage of the project. Before concept release approval, costs are based on averages of published international data and benchmarks for similar technologies, and so are considered to be accurate to a factor of two. Once the conceptual designs have been done, costs are generally accurate to within 50%. Once the detailed designs are completed, costs are considered to be accurate to within 20%. Once the contracts have been placed, costs are considered to be accurate to within 10%. There is only complete certainty about the costs once the contract has been completed.

5.6 Electricity tariff implications

The electricity tariff is the mechanism through which the cost of producing electricity is recovered from the consumers thereof. The cost of compliance with the MES would be part of the inherent cost of production of electricity in future. Eskom has estimated that full compliance with the MES by 2020 would require the electricity tariff to be on average between 7 and 10% higher than what it would be in the absence of the emission abatement retrofits, over a 20-year period. The difference between the base tariff and the tariff including the costs of MES compliance would be slightly higher (than the mentioned average) in the earlier years and slightly lower than the mentioned average in the later years. The implications for the tariff are of course dependent on when the emission abatement retrofits are installed, and what assumptions are used for interest and inflation rates and future base electricity tariffs.

This tariff calculation is based on the following assumptions:

- The CAPEX and OPEX costs are the mid-point amounts as provided above.
- The CAPEX costs are incurred in 2020, and fully implemented over a period of up to six years (with a shorter period resulting in the higher %, in the range mentioned above).
- The average remaining power station life is 20 years, thus the CAPEX costs for the retrofits are depreciated over a 20-year period.
- The inflation rate is 6%.
- Nominal pre-tax cost of capital is 14%.
- Cost-reflective electricity tariffs are reached within five years after Multi Year Price Determination 4 (MYPD4) electricity tariff agreement (from 2018-20).

The electricity tariff is applied for by Eskom, but decided on by the National Electricity Regulator of South Africa (NERSA). Eskom has included the CAPEX required to cover the proposed emission reduction plan with an estimated cost of R 67 billion over the next 10 years, it is covered in the MYPD4 application (for costs over the next 5 years). If there is a requirement for additional retrofits based on the DEA response to this application, these costs would need to be provided for through the tariff, failing which Eskom's financial health will further deteriorate and the ability to raise funding for these projects would be limited. The original assumptions are still

at risk. The Eskom requested electricity price increase of 15% per annum was not approved by NERSA on 7 March 2019, and Eskom will now have to further prioritise its operations which may require amendment to the ERP. In addition, Eskom has not reached a level where it is recovering its efficient and prudent costs (even at the end of the MYPD 4 period if the 15% increase is approved).

5.7 Cost benefit

The basis of the assessments of the impact of power stations emissions on human health and the environment is a comparison of the measured and predicted air quality concentrations with the NAAQS. Stakeholders have argued correctly that the NAAQS cannot be interpreted to imply no health risk at all but the counter argument is that the NAAQS express a 'permissible' level of risk. To manage air quality to a point that it is completely free of risk is to invoke such significant financial and non-financial costs that those costs will in themselves result in severe potential economic and social consequences. In these terms it is necessary to present here some perspectives on the cost-benefit of full MES compliance.

In the 2017 National Air Quality Framework for Air Quality Management provision is made for suspensions and alternative emission limits due to the potential economic implications of emission standards on existing plant. The provision is provided because a sector specific Cost Benefit Analysis (CBA) was not completed prior to setting standards. Eskom commissioned a health impact focussed CBA to support the decision making process for this application. The aim of the CBA was to determine the health costs associated with current emissions, health benefits associated with compliance to the new MES, and the direct and indirect costs of compliance under the scenarios tested. The CBA followed the approach recommended by the World Health Organisation (WHO) and it used input (exposure response functions) provided by the South African Medical Research Council (SAMRC).

Health benefits associated with each scenario were calculated against the baseline that assumed no new abatement technologies would be installed, and all plants would continue to emit air pollution at their current rates until decommissioning. Scenario costs were calculated using Eskom's estimates of abatement technology capital and operational spending requirements.

Scenarios were then compared in a cost-benefit analysis with a cost:benefit ratio, in terms of which a number greater than 1 indicates that the costs outweigh the benefits, and a number less than 1 indicates that the benefits outweigh the costs. The CBA ratios need to be interpreted with care. They are meant only to provide a perspective on and inform the decision-making process underlying the scenarios. It is further to be noted that the cost benefit ratios were assessed using different discount rates (8.4%, 1% and -1%) and the order of the scenarios as measured by cost benefit ratio remained the same for all discount rates.

Table 6: Cost and benefits NPV estimates for each scenario and cost:benefit range

	FC (S1)		**ERP (S2)**		**ERP+FGD (S3)**		**ERP+ED (S4)**	
Million Rands	*lower*	*upper*	*lower*	*upper*	*lower*	*upper*	*lower*	*upper*
NPV of Costs	-43 369	-65 053	-16 923	-25 385	-21 205	-31 808	-16 923	-25 385
NPV of benefits	2 403	21 625	1 962	17 661	2 252	20 264	3 374	30 367
NPV of Benefits minus Costs	-40 966	-43 428	-14 961	-7 724	-18 954	-11 544	-13 549	4 982
Cost:Benefit Ratio *(range)*	18.0	3.0	8.6	1.4	9.4	1.6	5.0	0.8
Cost:Benefit Ratio *(central)*	4.5		2.2		2.4		1.3	

The modelling shows the early decommissioning of the coal-fired power stations assessed in S4 ERP+ED (implementation of the ERP and early decommissioning of Grootvlei, Hendrina and Komati), would have a significantly larger beneficial effect on health costs than abatement technologies alone. This plays a large role in positioning Scenario 4 as the most beneficial scenario, both in terms of largest health cost benefits, lowest cost of abatement, as well as relative cost:benefit ratio.

While S1 FC (full compliance to the MES) would eventually have the second most absolute benefits (after S4 ERP+ED), the uncertainty of the effectiveness of actual emission reduction (even if Eskom complies with the MES ambient concentrations will remain high due the significance of other sources) as well as the long implementation timeframe mean that NPV of benefits values are reduced.

Implementation of the Eskom Emission Reduction Plan (S2 – ERP) is shown to be more beneficial from a cost benefit perspective than implementation of the ERP with the addition of FGD at Kendal (S3) and full compliance to the MES (S1).

In addition it should be noted that increased implementation of the PM reduction technology will inflate the cost of electricity, making it more unaffordable to poor communities who are typically exposed to elevated PM10 concentrations thereby curtailing access to one of the most potentially effective means of mitigating the current health risk.
In respect of SO_2 emissions the cost-benefit is more difficult to qualify. Although the risk of non-compliance with the NAAQS is generally low, stakeholders have presented that it is 'unacceptable to allow the continued emissions of large quantities of SO_2'. In principle this comment is accepted but again the argument is one of weighing up both the financial and non-financial costs of reducing those emissions. The argument has already been made that the water use implications of SO_2 control are untenable and that the cost benefit ratio does not support FGD as the best option to reduce the impact on health.

No argument is presented anywhere in these applications that reducing atmospheric emissions is not required. The argument is simply one of ensuring that emissions reductions are carefully planned and phased so that the associated cost-benefit is positive. A key consideration is that half of the existing Eskom power stations will be shut down and decommissioned in the next 10 – 15 years significantly reducing the emissions. The planned offset project which will reduce low level emissions in communities in the vicinity of Eskom power station has not been studied long enough to conclusively provide cost benefit. However initial assessment indicates a significant reduction in exposure to indoor air pollution. In cases where solid fuel stoves are removed and replaced with LPG equipment (and in the absence of regression), the particulate matter emissions are avoided completely. Focussing on coal only and taking the annualised coal use of 1206kg per household (control group mean, 2016) – the resulting PM emissions that can be avoided are 14.48kg of PM2.5 per year per household and 15.57kg of PM10 per year per household.

5.8 Impact on ambient air quality

It is common cause that the Minimum Emission Standards (MES) serve to ensure that there is compliance with the National Ambient Air Quality Standards (NAAQS). It is also common cause that there are many areas in South Africa in which NAAQS are not met consistently, exposing people and the environment to pollutants at concentrations that are above those considered to be protective of human health as seen in the state of air report for the Highveld Priority Area (HPA).

In addition to the individual AIR completed for each power station, an air quality report, considering the cumulative impact of the Eskom stations over the HPA was completed. The analysis included three scenarios;

which considered (1) the actual emissions, (2) emissions if the MES was complied with and (3) emissions if six power stations are decommissioned by 2030. The general conclusions of the analysis is that the quality of air will be in compliance with NO_2 National Air Quality Standards (NAAQS), but noncompliance with the daily and annual SO_2 standards in several areas across the Highveld. Daily and annual average PM10 and PM2.5 concentrations could be in noncompliance and for extended periods of time. The effect of the above is that PM ambient levels currently result in increased health risk for a large part of the Highveld.

Dispersion modelling results based on individual and combined power station emissions, excluding all other sources; indicates that Eskom stations have a relatively small contribution to ambient PM pollution. In addition the diurnal pattern in PM concentrations based on monitored ambient data clearly indicate a morning and early evening peaks, typical of low level source contributions. However, a combination of SO_2 and NO_x emissions from all the Highveld power stations is predicted to form a significant component of the $PM_{2.5}$ load especially over Emalahleni area, which is in noncompliance with PM standards, is a cause for concern.

In addition, the combined SO_2 emissions from all Eskom power stations are predicted to contribute a significant amount to the pollution in and around the Emalahleni and Middelburg areas and even extending south towards Komati Power Station. However analysis indicates that the non-compliance is not only due to Eskom Power Stations but a function of a multitude of sources in the Highveld.

The modeling and ambient monitoring illustrates that while there is elevated pollution levels in the area there is generally “material” compliance to the standards. Furthermore Eskom is but one contributor to the emission levels and to reduce them a holistic approach addressing all identified and potential sources is required. Focusing on eliminating Eskom power station emissions alone will not result in acceptable ambient air quality levels that are not harmful to human health and the environment. Given this and the need for the decision maker to consider the Constitutional aspects and the range of NEMA principles it is argued that approving the application is consistent with the Constitution and NEMA.

5.9 Summary

The implications of Eskom’s prioritised plan for emission reduction are summarised in Table 7 together with how these implications will change if full compliance with the MES were to be achieved.

Table 7: Implications of Eskom's prioritised plan for emission reduction, compared with the implications of full compliance with Minimum Emission Standards

Implications		Full compliance with MES	Eskom's emission reduction plan
	SO_2	Wet FGD at: Medupi, Majuba, Kendal, Matimba & Tutuka. Semi-dry FGD at: Duvha, Matla & Lethabo	Wet FGD at: Medupi
	NO_X	LNBs at: Majuba, Matla, Tutuka, Lethabo & Duvha	LNBs at: Majuba, Matla & Tutuka
	PM	FFP at: Tutuka ESP Refurb/Upgrade at: Duvha, Matla, Kendal, Lethabo, Matimba	FFP at: Tutuka ESP Refurb/Upgrade at: Duvha, Matla, Kendal, Lethabo, Matimba
Water consumption increase		20% - (59 million m^3/annum)*	2% - (9.6 million m^3/annum)
CAPEX cost (2019 overnight costs, excluding interest and interest during construction)		Approx R187 billion**	R46 billion
Annual OPEX costs (2019 costs)		Approx R5.9 billion**	R900 million
Tariff increase		7 to 10 %	2 to 3 %
Auxiliary power consumption increase		2 500 123 MWh/year*	400 192 MWh/year
CO_2 emission increase (direct emissions from the FGD process only)		2.8-3.0 million tons/annum	435 000 tons/annum
Increase in coal consumption due to low NOx burner retrofits		735 105 tons/annum	555 369 tons/annum
Waste (FGD by-product) production		9.7 million tons/annum*	2.7 million tons/annum
Sorbent Consumption		5.2 million tons/annum	1.5 million tons/annum

*Assuming that wet FGD is installed on the 5 newest stations excluding Kusile, and semi-dry FGD is installed on the rest of the coal-fired fleet excluding the stations will be decommissioned by 2030.

**Costs are 2019 real (overnight) costs, excluding financing costs and only include stations decommissioned after 2030.

6 PUBLIC PARTICIPATION

The requirement that the public participation process for an application for postponement from the MES follow the process specified in the NEMA Environmental Impact Assessment (EIA) Regulations. Eskom supports and aligns its public participation process with the requirements as stipulated within the NEMA EIA Regulations. The public participation process followed for this postponement application has increased the number of public meetings to include communities in the vicinity of the power stations compared to the previous postponement application. Unfortunately some meetings in the first round of the public participation process had to be postponed and then cancelled due to unrest. Further effort to meet with stakeholders including those missed due the challenges in round 1st was made in the round 2nd public participation process. The draft documents for the MES applications were made available for public comment between the 19th of November 2018 and the 4th of February 2019. Various comments were received on the draft documents and responses to them are provided in the updated Issues and Response Report prepared for this application. Minor edits to this summary document and the final MES applications and supporting documents were made based on comments received

and issues identified through the public participation process. For details on the public participation process refer to the Public Participation Report and the Issues and Response Report.

With regards to the AEL variation request submitted, Eskom believes the public participation process undertaken meets the requirements of Section 46 of NEMAQA.

7 EMISSION OFFSETS

As a condition of the approved 2014 fleet postponement, Eskom has to implement air quality offsets in populated areas where power stations impact significantly on ambient air quality, and where there is non-compliance with ambient air quality standards. Eskom is of the view that in many cases, household or community emission offsets are a more effective way of reducing human exposure to harmful levels of air pollution, than is retrofitting power stations with emission abatement technology at exorbitant costs. Emission retrofits at power stations also increase the cost of electricity, which may make electricity unaffordable for more people, resulting in an increase in the domestic use of fuels and deterioration in air quality in low income areas. Eskom is planning to roll out interventions in qualifying households around selected power stations aimed at improving ambient air quality in low income communities. Air quality offsets address emission sources directly within vulnerable communities, targeting greater improvement in community experienced air quality than is achievable from other approaches. In addition, such offsets are more cost effective and result in meaningful improvement of air quality within a shorter time frame.

The Air Quality Implementation Plans for each affected District Municipality (refer to http://www.eskom.co.za/AirQuality/Pages/default.aspx) covers the period from March 2018 to March 2025, and aims to improve ambient air quality in several communities around Eskom's coal-fired power stations.

KwaZamokuhle and Ezamokuhle have been selected as a lead implementation site in the Nkangala and Gert Sibande District Municipalities respectively. Physical implementation in KwaZamokuhle and Ezamokuhle is planned to commence during 2019. Waste management interventions have been identified for the Vaal and planning for these continues but capacity constraints of the local authorities are creating challenges.

8 CONCLUSION

Eskom is committed to ensuring that it manages and operates its coal-fired power stations in such a manner that risks to the environment and human health are minimised and socio-economic benefits are maximised. As set out in the Constitution of the Republic of South Africa, there is the need to recognise the interrelationship between the environment and development. It is thus necessary to protect the environment, while simultaneously recognising the need for social and economic development. There is the need therefore to maintain balance in the attainment of sustainable development.

Eskom proposes to adopt a phased and prioritised approach to compliance with the MES. Highest emitting stations will be retrofitted first. Reduction of Particulate Matter (PM) emissions has been prioritised, as PM is considered to be the ambient pollutant of greatest concern in South Africa. In addition, Eskom proposes to reduce NO_x emissions at the three highest emitting stations. Kusile Power Station will be commissioned with abatement technology to achieve the new plant standards. Medupi is commissioned with abatement technology which can meet PM and NO_x new plant standards and will be retrofitted with flue-gas desulphurisation (FGD) so that the new plant SO_2 limit will also be achieved over time. There are six power stations which will be decommissioned before 2030, an additional two by 2035 and the remaining existing plants (excluding Majuba, Medupi and Kusile) by 2044. Where it is not feasible to retrofit within 5 years of the compliance timeframe,

postponement has been requested. Where compliance will take longer than 5 years, or is not feasible before the station is decommissioned, a suspension and or alternative limits have been requested.

As required in terms of section 5.4.3.3 of the National Framework for Air Quality Management Eskom has for each application:

(i) Provided air pollution impact assessments compiled in accordance with the prescribed regulations.

(ii) Through this AIR it has demonstrated that the current air emissions from power stations and proposed limits where applicable will have negligible measured and modelled health and environmental impacts on the on the surrounding environment given the local context. Eskom's commitment to reducing emissions and obtaining compliance where practical is also illustrated.

(iii) Concluded an independently run public participation process as prescribed in the NEMA EIA regulations.

The reasons for the applications include limited water availability, a low reserve margin for which means that retrofits have to be carefully phased to maintain the reserve margin, public pressure to keep the electricity tariff low and other negative environmental consequences including greenhouse gas emissions, transport related impacts and waste. Eskom contends that a decision should be taken in the national interest, weighing up the costs and benefits of compliance and considering the broad Constitutional and NEMA requirements. Eskom further contends that the proposed Eskom emissions reductions plan presents a fair balance between cost and benefit whereas full compliance with the MES does not.

The Air Quality offset programme initiated by Eskom will continue to be implemented, based on current information Eskom believes this programme will reduce direct exposure to harmful indoor pollution and improve the quality of life.

Given that a revised National Framework for Air Quality Management and the Amendment of Listed Activities and Emission Standards were only published in October and there is a requirement to submit applications by 31 March 2019. Eskom will comply with this but reserves the right to submit additional information including additional modelling scenarios which assess the closure of power stations, a high level assessment of technologies which could meet the new 1000 mg/NM^3 SO_2 emission limit and any other aspects of significance if so required.

In conclusion Eskom believes given the emission reduction plan, its implications, and the specific detail in each of the motivations, that the applications and/or the requested alternate limits are appropriate and in line with the relevant policy, Constitutional and regulatory requirements and as such the applications should be approved by the NAQO.