ESKOM

APPLICATION FOR ALTERNATIVE LIMITS IN TERMS OF THE MINIMUM EMISSIONS STANDARD FOR THE MATIMBA POWER STATION

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Version 1

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AIR	Atmospheric Impact Report
AEL	Atmospheric Emission License
APPA	Atmospheric Pollution Prevention Act, 1965 (Act No. 45 of 1965)
AQMP	Air Quality Management Plan
DEA	Department of Environmental Affairs
DEFF	Department of Environment, Forestry and Fisheries
DOE	Department of Energy
EIA	Environmental Impact Assessment
ERP	Emission Reduction Plan
ESP	Electrostatic Precipitator
FGC	Flue Gas Conditioning
FGD	Flue Gas desulphurisation
GNR	Government Notice No.
HFPS	High Frequency Power Supply
FGD	Flue gas desulphurisation
GNR	Government Notice No.
IRP	Integrated Recourse Plan
IRR	Issues and Response Report
LNB	Low NO_x Burner
LPG	Liquid Petroleum Gas
NAAQS	National Ambient Air Quality Standards
NAQO	National Air Quality Officer
NEMAQA	National Environment Management: Air Quality Act, 2004 (Act No. 39 of 2004)
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NERSA	National Electricity Regulator of South Africa
NO	Nitrogen oxide
NO_2	Nitrogen dioxide
NO_X	Oxides of nitrogen ($NO_X = NO + NO_2$)
PM	Particulate Matter
PM_{10}	Particulate Matter with a diameter of less than 10 µm
$PM_{2.5}$	Particulate Matter with a diameter of less than 2.5 µm
RTS	Return to Service
SO_2	Sulphur dioxide
TSP	Total Suspended Particulates
µm	1 µm = 10^{-6} m
WHO	World Health Organisation

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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 is from coal-fired power stations. One of the 15 power stations is the Matimba Power Station (hereafter referred to as "Matimba"), which is situated near Lephalale, Limpopo Province. Matimba is the third biggest of Eskom's existing fleet (excluding Medupi and Kusile) with a capacity of 3 690 MW. Matimba sources its coal from the nearby Grootegeluk Coal Mine (Exxaro).

In terms of the Integrated Resource Plan and the Eskom Consistent Data Set, coal power stations will generally be decommissioned at 50 years. The exact date of decommissioning is determined by current and future demand, the performance of other electricity generating plants and the cost of generation. Matimba is a relatively new station with the last of Matimba's generating units commissioned in the 1980's and it is intended to decommission the station by approximately the early 2040's.

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) contained in GNR 1207 on 31 October 2018 ("GNR 1207") which was promulgated in terms of Section 21 of the NEMAQA[1]. GNR 1207 provides arrangements in respect of inter alia: a once off postponement with the compliance of minimum emissions for new plant for five years from the date of issue, no once off postponement will be valid beyond 31 March 2025; a once off suspension for plants being decommissioned by 31 March 2030; the National Air Quality Officer may grant an alternate emission limit or emission load if certain conditions are met. The application for any of these requests must be submitted by 31 March 2019. A MES postponement decision was issued to Matimba in 2015 and again in 2018 in respect of compliance to the MES SO_2 limit. With the amendment of the MES regulations in October 2018 it is necessary to submit this application for alternative limits for PM, NOx and SO_2. Eskom has applied and received a condonation for the late submission of an application for Medupi until November 2019.

Matimba already achieves the 100 mg/Nm^3 Particulate Matter (PM_{10}) daily for 'existing' MES limits and the "existing" limit for nitrogen oxide (NO_X - 1100 mg/Nm^3). However, Eskom's Matimba Power Station will not be able to comply with the 750 mg/Nm^3 **daily** 'new plant' MES for NOx, the new plant and existing plant SO_2 limit of 500 mg/Nm^3 and 3500 mg/Nm^3 respectively, and the 50 mg/Nm^3 **daily** PM limit, on a consistent basis. As such Matimba is requesting an alternative **monthly** PM limit of 50 mg/Nm^3, a **monthly** NOx limit of 750 mg/Nm^3 as well as a **monthly** SO_2 limit of 4000mg/Nm3, until decommissioning of the station.

In terms of sulphur dioxide (SO_2) Eskom has a present postponement decision granting a monthly limit of 3500 mg/Nm^3 monthly limit until 31 May 2025. Eskom will be unable to meet the SO_2 new plant daily limit of 500 mg/Nm^3 from 2025 without the installation of Flue Gas Desulphurisation (FGD) technology - which Eskom argues in this application is not warranted.

The purpose of this document is to present an application for alternative limits for Matimba as required in terms of GNR 1207. The document has been structured to present Eskom's atmospheric emissions reduction plan including the current decommissioning of units, the decommissioning plan and its influence on Eskom's emissions. Based on this application, emission limits to which Matimba could be held and which could then be included in the Atmospheric Emission Licence (AEL) are proposed. The legal basis for the suspension is then

[1] GNR 893 amended the "original: MES regulations GNR 893 which were promulgated on 22 November 2013 in terms of Section 21 of the NEMAQA

presented, including the requirements that must be met in making such an application. Finally, the reasons for the application are presented.

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 of all its stations) 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 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) to support the achievement of the new plant SO_2 limit 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.

Emission reduction interventions to achieve compliance with the new plant emission limit are planned for the following stations:

- Particulate Matter emission reduction: Tutuka, Kriel, Matla and Duvha Units 4-6, Kendal and Lethabo;
- NO_x emission reduction: at Matla, Majuba, Tutuka, Camden; and
- SO_2 emission reduction: at Medupi and a pilot study which will assess possible alternate technologies at Matimba and Kendal.

Currently the Integrated Resource Plan 2019 is based on a general 50-year life for all coal fired power stations however the actual shut down and decommissioning dates of power stations are determined based on economic, technical and environmental criteria. For consistency in the Eskom applications the decommissioning dates as defined in the in the Eskom Consistent Data set (Eskom 36-623 rev 3) for planning have been used. To date, twelve (12) units between Grootvlei, Hendrina and Komati have been shut down prior to the 50 year life and put into extended storage and two into extended inoperability (at Eskom's most costly and oldest plants). The shutting down of these power plants reduces the cumulative emission load and pollution in Mpumalanga. The emissions load will continuously decrease ensuring that health impacts from Eskom's power stations will not increase.

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 with Low NO_x design at Kendal and Matimba;
- Low NO_x Burners (LNBs) at Medupi, Kusile, Ankerlig, Gourikwa, and some units at Camden; and
- Flue gas desulphurisation (FGD) at Kusile.

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

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, Kusile and the renewable , will also result in a substantial decrease in Eskom's and South Africa's emissions over time. 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%.

The level of SO_2 emissions from power stations is directly related to the sulphur content of the coal burnt. The Waterberg coal which supplies Matimba has a high sulphur content, Eskom has investigated and is implementing various methods to reduce the sulphur content of the coal received such a careful management of stockpiles. Ultimately, however the only effective method to support compliance to the SO_2 MES would be the implementation of FGD. Eskom does not believe that the installation of FGD technology to reduce SO_2 emissions at its stations beyond Kusile and Medupi is warranted, as explained in this application. Eskom has however committed to undertake pilot studies of alternate SO_2 reduction technologies at Kendal and Matimba to determine if possible cost and resource effective solutions are viable.

Eskom's proposed atmospheric emission reduction plan is estimated to cost R 67 billion over the next 10 years. The costs have been included in the latest Multi Year Price Determination tariff application and whilst Eskom's full application was not approved by NERSA it remains Eskom's intent to implement the plan described above. Eskom will continue to engage with NERSA through the prescribed processes so that Eskom can recover these costs through the tariff.

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.

A detailed discussion on Eskom's emission reduction plan is provided in the Eskom Summary Document (Annexure 3).

3 MATIMBA REQUESTED EMISSION LIMITS

The current limits listed in Table 1 are as in Matimba's AEL (ref: 12/4/12L-W4/A3 issued by the Limpopo Department of Economic Development, Environment and Tourism on 31 March 2015) as well as the postponement application decision granted by the National Air Quality Officer (DEA) in 2018 (ref: LP/ES-MT/WDM/20170825). A variation of the licence is presently being processed by the Province to give effect to the postponement decision in respect of a monthly SO_2 limit issued on 10 September 2018 by the National Air Quality Officer (DEA). The alternative emission limits requested for Matimba during normal operating conditions are shown in Table 1.

Table 1: Current and requested limits for Matimba

	Current Limit (from AEL/MES)			Requested Emission Limits***		
	Limit value (mg/Nm^3)	Averaging period	Date to be achieved by	Limit value (mg/Nm^3)	Averaging period	Date to be achieved by
Unit 1-3 SO_2	3500	Monthly *	1 April 2015	**4000**	**Monthly**	1 April 2020
	500	Daily	1 April 2025			
Unit 1-3 NOx	1100	Daily	1 April 2015	750	**Monthly**	1 April 2020
	750	Daily	1 April 2020			
Unit 1-3 PM	100	Daily	1 April 2015	50	**Monthly**	1 April 2020
	50	Daily	1 April 2020			
Unit 4-6 SO_2	3500	Monthly *	1 April 2015	**4000**	**Monthly**	1 April 2020
	500	Daily	1 April 2025			
Unit 4-6 NOx	1100	Daily	1 April 2015	750	**Monthly**	1 April 2020
	750	Daily	1 April 2020			
Unit 4-6 PM	100	Daily	1 April 2015	50	**Monthly**	1 April 2020
	50	Daily	1 April 2020			

****The requested alternate emission limits above are in mg/Nm^3 at 273 K, 101.3 kPa, dry and 10% O_2.*

** Limit as per 2018 MES postponement decision*

In summary, the application submitted for Matimba is an:

(i) Alternative **monthly** limit of 50 mg/Nm^3 for PM from 1 April 2020 until decommissioning.

(ii) Alternative **monthly** limit of 750 mg/Nm^3 for NOx from 1 April 2020 until decommissioning.

(iii) Alternative **monthly** limit of 4 000 mg/Nm^3 for SO_2 from 1 April 2020 until decommissioning.

The emission limits proposed in this application are informed by plant design, plant operations, coal quality and the existing regulatory requirements.

In terms of the existing license and postponement decisions, Matimba has until 1 April 2025 to comply with the SO_2 limit. It is understood that the previously granted postponements of limits (monthly limit of 3500 mg/Nm^3) will remain in place until 2025 as a minimum.

Based on the techno-economics and cost benefits assessment (Annexure 1 and 2) any additional measures other than what was committed to above and the emission limits requested are not financially viable.

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

4 LEGAL BASIS FOR DECISION-MAKING

4.1 Regulatory Requirements

In terms of Section 14(1) of the NEMAQA, the Minister of Environmental Affairs ("Minister") must designate an officer in the Department of Environmental Affairs (DEA) as the National Air Quality Officer. In this regard, Dr Thuli Khumalo has been designated by the Minister as the current National Air Quality Officer. Section 14(4)(b) of the NEMAQA provides that the National Air Quality Officer may delegate a power or assign a duty to an official in the service of his/her administration. It is our understanding that no such delegation has been made

for the area of jurisdiction in which the power station is located. Accordingly, Eskom submits this Application to the National Air Quality Officer (NAQO).

In terms of Paragraph (12)(a) – (c) of GNR 893 of 22 November 2013 (the Regulations) as amended by GNR 1207 of October 2018, the application must include:

1. 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;
2. A detailed justification and reasons for the Application; and
3. 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.

In respect of these requirements we have attached –

1. As Annexure A, a copy of the AIR prepared in respect of Matimba for the 2017 Postponement application. The AIR provides, *inter alia*, an assessment of how ambient air quality is likely to be affected by Matimba's and Medupi's requested emission limits by utilising, *inter alia*, atmospheric dispersion modelling. Eskom has appointed properly qualified consultants to prepare and updated AIR and will provide this to the NAQO when completed (anticipated to be May 2020). Eskom believes the status of air quality around the station now is substantively similar to that in 2017 and as such the information presented is appropriate for decision making purposes.
2. Detailed justifications and reasons for the Application (see Section 5 below).
3. A comprehensive report on the public participation process followed, and associated documentation for the overall Eskom 2019 application process (Annexure 4.1 and 4.2). The issues raised in the overall report will be a reflection of the issues relevant to Matimba however, Eskom has also provided a copy of the public participation report prepared for the 2017 Matimba and Medupi postponement applications as these issues are also relevant (Annexure B). Eskom will complete a full public participation process for Matimba based on the updated AIR and a public participation report will be provided to the NAQA when this is available (anticipated May 2020).

4.2 Changes in Regulatory Framework

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. While 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.

There was, prior to October 2018, no requirement for Eskom to complete an immediate application for Matimba, as the station had a valid postponement decision until 2025. Eskom was unable to complete an application by the deadline of March 2019 and as such requested approval for the late submission of an application in March 2019. Approval to submit an application by November 2019 was granted to Eskom in October 2019 by the Minister of Environment, Forestry and Fisheries. Eskom has complied with this request and undertakes to submit an updated AIR and Public Participation report when these are available. It is Eskom's opinion that information submitted with this application does provide sufficient substantive information for the NAQO to make a decision in respect of this application.

4.3 The Need to Amend the Variation Requests

In terms of timing, Eskom is required to submit an AEL variation request parallel to this application. The variation request is prepared based on the assumption that this application is granted by the NAQO. If the NAQO decision is substantially different from that applied for, Eskom reserves its right to amend its variation

request. Eskom will complete the variation request for the Matimba application during the planned public participation exercise.

5 REASONS FOR APPLYING FOR ALTERNATIVE LIMITS

As mentioned above, the application for alternative limits must be accompanied by reasons. Such reasons are set out below and include the fact that; emissions from Matimba will not result in substantial additional non-compliance with National Ambient Air Quality Standards (NAAQS); together with a suite of undesired environmental consequences of compliance with the MES including associated water demands, transport impacts and increases in waste and carbon dioxide (CO_2) production, as well as the need for operational flexibility. These undesired consequences together with the financial costs of compliance (such as an increase in the electricity tariff) 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 and as such the requested suspension and emission limits should be granted (see section 5.5 below for the details of the cost-benefit analysis completed, as well as Annexure 1).

None of these reasons should be seen as exclusive (i.e. it is not one reason alone that indicates full compliance to the MES is not appropriate) but rather all in combination. 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. There is a need to protect the environment, while simultaneously recognising the need for social and economic development. There is the need therefore to maintain the balance in the attainment of sustainable development.

5.1 Remaining Power Station Life

Matimba is currently scheduled to be decommissioned by 2042, according to the Integrated Resource Plan and the Eskom Consistent Data Set. Based on Eskom's experience at Medupi it is estimated that the time required for FGD development and construction would be 12 years (project development 4 years, commercial process 2 years and construction 6 years – one unit per year). Given these project timelines construction of FGD would be completed only in 2032 giving the station a remaining life of less than 10 years. Given the cost of FGD it is as such not considered viable to install FGD at Matimba.

5.2 Water Availability

Water is an extremely limited resource in South Africa and it is argued that the implementation of FGD at Matimba is not an appropriate decision for a water scarce country.

Both wet and semi-dry FGD are critically dependant on 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 9.6 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). Retrofitting Matimba with FGD would require an additional 5.6 million m^3/annum for a semi-dry FGD and up to 8.9 million m^3/annum for a wet FGD. The Matimba and Medupi Power Stations are dry-cooled power stations and the effect of installing FGD would be to undermine the gains in water use minimisation from dry cooling. Currently there is enough water available to operate on FGD on three of the six units at Medupi Power Stations. Additional water will become available when the Mokolo-Crocodile West Transfer Scheme Phase 2A has been completed, which is currently scheduled for beyond 2025.

The water demands of FGD are thus significant across the power stations and will increase Eskom's water demand by some 59 million m3/annum – a 20% increase in the combined water consumption of Eskom's power stations[2].

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 98% of South Africa's available water has already been allocated.

5.3 Environmental Implications of FGD

Assuming FGD was required for Matimba is would not be without negative environmental consequences:

- Up to 600 000 tons of sorbent (limestone) per annum is required to operate the FGD at Matimba. 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.
- Up to 1 million tons of gypsum will be produced per annum as a by-product of the FGD process. If a high quality limestone is used, a high quality gypsum can be produced by wet FGD, and this could be taken up by the market for e.g. wallboard production. Lower grade gypsum can also be used for agricultural purposes. However, if there is not sufficient demand from the market, the gypsum will 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).
- Matimba is expected to produce an additional approximately 360 000 tons of CO_2 per annum, as the wet FGD process directly produces CO_2 as a by-product through the reaction: $SO_2 + CaCO_3 \rightarrow CaSO_4 + CO_2$. In addition, the electricity output of Matimba would be reduced by around 1% due to the additional auxiliary power requirements of the FGD, and correspondingly the relative CO_2 emissions would increase by 1%.

5.4 Matimba Impact on Ambient Air Quality

A comprehensive analysis of ambient air quality data from Eskom's Marapong monitoring site, which is located approximately 2.2 km northeast of Matimba Power Station, indicates that for the period 01 January 2016 – 31 December 2018, SO_2 and NO_2 concentrations were well within compliance with all the National Ambient Air Quality Standards. However, both PM_{10} and $PM_{2.5}$ were in non-compliance with daily standards. Analysis of the diurnal variations in the concentrations of PM_{10} and $PM_{2.5}$ revealed clear early-morning and late-evening peaks associated with low-level sources. This is in agreement with the results presented in the Waterberg-Bojanala Priority Area Air Quality Management Plan (DEA, 2015).

5.4.1 Particulate Matter

An analysis of ambient air quality monitoring data shows that both PM_{10} and $PM_{2.5}$ are in non-compliance with daily standards at Marapong monitoring site. Diurnal variations in the concentrations of both PM_{10} and $PM_{2.5}$ show that the main contributing sources to the elevated concentrations are low-level sources. This is in agreement with the results presented in the Waterberg-Bojanala Priority Area Air Quality Management Plan.

[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 stations which will be decommissioned by 2030. The October amendment of the MES for SO_2 new plant to 1000 mg/Nm^3 will require a revision of technology choices.*

5.4.2 Nitrogen Oxides

Both hourly and annual average concentrations of ambient NO_2 for the period 01 January 2016 – 31 December 2018, were well within compliance with the National Ambient Air Quality Standards at Marapong monitoring station. In fact, no exceedances of such standards were recorded at the above-mentioned monitoring site during the period of analysis.

5.4.3 Sulphur Dioxide

For the period 01 January 2016 – 31 December 2018, exceedances of the hourly limit value for SO_2 were well within the permissible frequency of exceedance. In addition, no exceedances of the daily or annual standard for SO_2 were recorded at Marapong. Previous studies, including the Waterberg-Bojanala Priority Area Air Quality Management Plan, have shown that SO_2 concentrations are not a problem at Marapong Township. Atmospheric dispersion modeling studies have shown that emissions from Matimba Power Station result in ambient concentrations of priority air pollutants (i.e. SO_2, NO_2 and PM) that are well within the national ambient air quality standards. These studies have also shown that emissions from both Matimba and Medupi Power Stations would lead to non-compliance with hourly and daily standards for SO_2 in some areas in the Waterberg-Bojanala Priority Area. However, after the implementation of the FGD at Medupi, such studies show that emissions from these power stations would no longer lead to non-compliances with standards for SO_2.

5.4.4 The Waterberg-Bojanala Priority Area

Matimba is situated within the Waterberg-Bojanala Priority Area (WBPA) and Eskom has and is implementing substantial financial investment into its power stations in the region to promote acceptable air quality in the area. Medupi is being constructed to meet PM and NOx limits and will be retrofitted with FGD to reduce SO_2 emissions. As described in this document Eskom does not believe the installation of FGD at Matimba is however appropriate or necessary.

5.5 Cost Implications of Compliance with the MES

The financial implications of compliance to the MES, most especially the financial implications of compelling existing plants to comply with 'new plant' standards is presented below.

5.5.1 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 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 Matimba would require a FGD retrofit, which is the only way of supporting compliance to the new plant SO_2 emission limit, which would cost between R15 – R26 billion (real overnight costs).

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 2013 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 two.
- 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, Duvha and Grootvlei and to approximately a factor of two 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.

5.5.2 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 different 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 the Multi Year Pricing 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 3 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 (i.e. opex recovered annually, capex recovered over the operational life of the assets), failing which Eskom's financial health will further deteriorate and the ability to raise funding for these projects would be limited. The original assumptions however, 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 Emission Reduction Plan. 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).

5.5.3 Cost Benefit Analysis

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 (Further detail is provided in the Health Impact Focused Cost Benefit Analysis document, Annexure 1).

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 attached as Annexure D. 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). Whilst the CBA focussed on the Highveld area the outcomes are informative for decision making in respect of the Matimba application and are discussed further below.

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.The scenarios evaluated in the study (against the baseline) included:

1. Full compliance with new plant standards (FC) (Scenario 1 (Sc1))
2. Eskom Emission Reduction Plan (ERP) (Scenario 2 (S2))
3. ERP + FGD at Kendal (Scenario 3 (S3))
4. ERP + Early Decommissioning (ED) of Komati, Hendrina and Grootvlei (Scenario 4 (S4))

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 (See table 2). 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 2: Cost and benefits Net Present Value 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 most absolute benefits, 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 Net Present Value (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 cost-benefit terms the financial cost will result in no real benefit and the financial cost will bring about potentially material negative social consequences in further hindering access to electricity.

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 this application 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.

5.6 Project Planning and Delays

Emission retrofit of the type being planned require years of planning, which precede a lengthy 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. 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 (in this case for NOx and PM to meet 'new plant' emission standards). 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.

The process to implement projects such as the emission retrofit projects is complex and there is a continual risk of delays affecting planned project completion dates. Notwithstanding implementing controls to reduce project delays such as high level project oversight and attempts to ensure the commercial processes are completed within reasonable timelines some of the retrofit projects have been subject to delays.

In terms of the 2014 postponement application, it was intended to install FGD at Medupi between 2021 and 2026, present planning for the project indicates construction will take place between 2026 and 2030.

A review of the process described above clearly illustrates that given the station is planned for decommissioning by 2042 and that FGD construction could take up to 12 years there is a risk that with project delays the effectiveness and value of any FGD project could be significantly undermined.

5.7 Coal quality

Monitoring at the station has shown that a daily SO_2 emission limit of 3500 mg/Nm^3 is exceeded sporadically at Matimba when batches of high Sulphur coal are received. The root cause of the high SO_2 emissions experienced is the high Sulphur content in the coal supplied to the station by the Exxaro Grootegeluk Coal Mine. The high Sulphur content is an inherent property of the coal available in the Waterberg coal seams. In the short- to medium-term, there is no simple remedy to the situation and all potential solutions bring along with them huge operational, environmental and financial implications. Load losses, coal beneficiation practices, alterations to existing coal contracts and options to source coal from other mines are all options that have been looked into to find potential solutions but have proven not to be feasible.

In order to better manage coal quality Eskom is monitoring the sulphur content of the coal on a daily basis, and, where high levels are seen, the station engages with the mine to increase off-take from low sulphur mine sources. The mine and station are also engaging in quality forecast and blending low and high sulphur areas in the mine to improve average quality of the station feed.

Given the variability in coal quality and the impact it has on SO_2 emission levels Eskom believes it prudent to request a monthly SO_2 emission limit of 4000 mg/Nm^3.

5.8 Plant performance

Matimba is one of Eskom's newer power stations and is operated at high levels of thermal and process efficiency in terms of emission reduction and generally. Emission levels and plant performance are however strongly affected by coal quality and ambient conditions. The quality of coal received from the Grootegeluk mine can be variable and efforts to manage it are being implemented as described above. Notwithstanding efforts to optimise processes the individual station boilers, ESP and burners react differently to the various coal qualities and any operational changes. Often responses to manage elevated emissions require plant and process re-optimisation which takes time to see the effect. This results in varying levels of emissions being produced at the different units. While there is general compliance to the daily limits for PM, NO_x and SO_2 occasional periods of higher emissions do thus occur. Given this practical reality, Eskom believes it prudent to request monthly PM, NOx and SO_2 limits rather than the usual daily limits. Monthly limits provide a degree of operational flexibility such that it is not immediately necessary to implement more extreme emission control measures such as immediate load reduction when the occasional high emission events are recorded.

6 PUBLIC PARTICIPATION

The requirement that the public participation process for this application partially follows 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. For this application Eskom has provided the public participation report completed for the overall 2019 MES application as the issues raised in the overall report will be a reflection of the issues relevant to Matimba (Annexure 4.1 and 4.2). Eskom has also provided a copy of the public participation report prepared for the 2017 Matimba and Medupi postponement applications as these issues are also relevant (Appendix B). Eskom will complete a full public participation process for Matimba based on the updated AIR and a public participation report will be provided to the NAQA when this is available (anticipated May 2020).

An AEL variation request, which will be submitted, will be subject to a public participation process that meets the requirements of Section 46 of NEMAQA.

7 EMISSION OFFSETS

Eskom is willing to implement emission offsets in areas where power stations impact significantly on ambient air quality, and where there is non-compliance with ambient air quality standards, as a condition of an approved postponement. Eskom has however done various studies on the potential for offsets in area impacted by Matimba and Medupi and has been unable to identify an effective offset solution. In the Highveld where household coal burning is a significant pollution source interventions targeted at reducing this source have been developed. In communities around the Limpopo stations household coal burning is not a major pollution source. Source apportionment work done shows local low level source such as quarries are responsible for local PM exceedances and these are not associated with Eskom stack emissions. Eskom is working with Provincial and local authorities on educational and other targeted environmental and emission awareness initiatives and remains committed to doing this going forward.

8 CONCLUSIONS

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. 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. There is a need to protect the environment, while simultaneously recognising the need for social and economic

development. There is the need therefore to maintain the balance in the attainment of sustainable development.

Matimba is requesting alternative monthly limits for its PM, NOx and SO_2 emissions. Reasons for this application include the need for operational flexibility, resources (in particular water), and technical design constraints. Further, it is believed that emissions from Matimba will not result in substantial additional non-compliance with National Ambient Air Quality Standards (NAAQS). Full compliance to the new plant emission limits in the MES will result in a suite of undesired environmental consequences including associated water demands, transport impacts and increases in waste and carbon dioxide (CO_2) production. These undesired consequences together with the financial costs of compliance (such as an increase in the electricity tariff) 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 and as such the requested suspension and emission limits should be granted.

Eskom has complied with the requirement to submit this application by November 2019 but intends to supplement the application with an updated AIR and public participation report.

Eskom believes given the motivation presented above in terms of Matimba's limited air quality impact of its operations; Eskom's complete emission reduction plan and its implications; and the specific detail in respect of Matimba, that the application of alternative limits is appropriate and in line with the relevant Constitutional, regulatory and policy requirements and as such the application should be approved by the NAQO.