ESKOM

APPLICATION FOR ALTERNATIVE LIMITS AND SUSPENSION OF THE MINIMUM EMISSIONS STANDARDS COMPLIANCE TIMEFRAMES FOR THE GROOTVLEI POWER STATION

DATE: JUNE 2020

Report reference
ESKOM ENV19-R236 rev 2 Grootvlei

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AIR	Atmospheric Impact Report
AEL	Atmospheric Emission License
AQMP	Air Quality Management Plan
DEA	Department of Environmental Affairs
DOE	Department of Energy
EIA	Environmental Impact Assessment
ESP	Electrostatic Precipitator
FGC	Flue gas conditioning
FGD	Flue gas desulphurisation
GNR	Government Notice No.
HFPS	High Frequency Power Supply
IRP	Integrated Resource 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 lying in coal-fired power stations. One such power station is the Grootvlei Power Station (hereafter referred to as "Grootvlei"), which lies 15km southwest of Balfour in the Gert Sibande District of the Mpumalanga Province. The area surrounding the power station is primarily agricultural. The station is located within the Highveld Priority Area (HPA) in terms of the NEMAQA. Grootvlei has a total installed capacity of 1150 MW, generated in six (6) units, however, it currently has three (3) of its units shut down and in reserve storage.

In terms of Eskom's planning power stations will generally be shutdown (meaning that it no longer produces power) at 50 years. The specific shutdown date depends on circumstances and considerations at that time such as security of supply, social, economic and environmental impacts. Once all the units at a power station are shut down, the required process for the decommissioning of the power station begins. This usually involves dismantling the power station and rehabilitating the site. The timing of the final decommissioning depends on factors such as legislative approval, Eskom's financial position and possible repowering of the power station with 'clean'-energy technology. The last of Grootvlei's generating units was commissioned in the early 1970's and it is planned to shut down the station by 2028 (and no later than 2030).

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) for existing and new plants contained in GNR 893 22 November 2013 as amended in GNR 1207 on 31 October 2018 ("GNR 1207") which was promulgated in terms of Section 21 of the NEMAQA. GNR 1207 provides for transitional arrangements in respect of; a once off postponement with the compliance of minimum emissions for new plant for five years, not 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 postponement application was issued to Grootvlei in 2015 which is reflected in the station's current AEL, however with the amendment of the MES regulations in October 2018 it is necessary to submit this originally unplanned application for suspension of the NOx and SO_2 limits. Eskom has applied and received a condonation for the late submission of an application for Grootvlei until November 2019 and an initial application was made by that date. This document is an update of the November 2019 application with some revised information (in particular an updated Atmospheric Impact Report) as Eskom committed to in the November 2019 application.

Grootvlei already achieves the 50 mg/Nm^3 Particulate Matter (PM_{10}) for 'new' MES limits. Grootvlei complies with the existing plant limit of 1100 mg/Nm^3 for nitrogen oxide (NO_X) and the existing plant limit of 3500 mg/Nm^3

for sulphur dioxide (SO_2). However, Eskom's Grootvlei Power Station will not be able to comply with the 1000 mg/Nm^3 'new plant' MES limit for sulphur dioxide (SO_2) and 750 mg/Nm^3 'new plant' MES limit for nitrogen oxides (NO_x). As Grootvlei will be decommissioned before 31 March 2030, Eskom is applying to the National Air Quality Officer for a once-off suspension of compliance timeframes with minimum emission standards for new plant limits for NOx and SO_2. Eskom proposes that Grootvlei should be required to comply with the minimum emission standards for new plant for PM and existing plant standards for SO_2 and NOx up until decommissioning (anticipated date by 2028, and no later than 2030).

The purpose of this document is to present an application for the suspension of the requirement to meet the new plant compliance date and propose an alternative limit for Grootvlei as required in terms of GNR 1207. The document has been structured to present Eskom's atmospheric emissions reduction plan including the current shutdown of units, the overall shutdown plan and its influence on Eskom's emissions and Eskom's approach to ensuring a just energy transition. Based on this an application for suspension, emission limits to which Grootvlei 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 presented, including the requirements that must be met in making such an application. Finally, the reasons for the Application for suspension 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) to comply fully with the 'new plant' MES by the stipulated timeframes. This is elaborated on in the sections below. Eskom is proposing a phased and prioritised approach to compliance with the 'new plant' 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 four highest emitting stations. Kusile Power Station will continue to achieve the SO_2 new plant limit as each unit is commissioned, and flue gas desulphurisation will be retrofitted at Medupi, so that the new plant SO_2 limit will also be achieved at Medupi over 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 NOx new plant standards and further investigations on technologies to reduce SO_2 emissions are under way. There are six power stations which will be shut down 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, Matimba, Kendal and Lethabo;
- NO_x emission reduction: at Matla, Majuba, Tutuka, Camden; and
- SO_2 emission reduction: at Medupi and pilot studies at Matimba and Kendal.

In terms of Eskom's planning power stations will generally be shutdown (meaning that it no longer produces power) at 50 years. The specific shutdown date depends on circumstances and considerations at that time such as security of supply, social, economic and environmental impacts. Once all the units at a power station are shut down, the required process for the decommissioning of the power station begins. This usually involves dismantling the power station and rehabilitating the site. The timing of the decommissioning depends on factors such as legislative approval, Eskom's financial position and possible repowering of the power station with 'clean'-energy technology. To date, fourteen (14) units between Grootvlei, Hendrina and Komati have been shut down prior to the 50 year life and put into reserve storage. The shutting down of these power plants, which will include Grootvlei 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 shutting down of the older stations (including Grootvlei) and an increased use of the newer less emitting Medupi, Kusile and the renewable IPPs, 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 2039 Eskom's relative PM emissions will reduce by 62%, SO_2 by 39% and NO_x by 43%.

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.

Given its financial position and being cognisant of the air quality in the area Eskom is considering the need to amend the above plan. Any changes to the Eskom Emission Reduction Plan will not material impact on this

application for suspension, which is to a large part based on the limited remaining life of the Grootvlei station given the intention to decommission the station by 2030.

3 ESKOM'S APPROACH TO A JUST ENERGY TRANSITION

The changing energy landscape globally and domestically plays an important role in Eskom's plans for medium to long term sustainability. The changing landscape is itself influenced by the growing need to address climate change in a just manner. Given South Africa's vulnerability to climate change and its commitment to the Paris Agreement as well as its commitment to the Sustainable Development Goals, Eskom's approach is to address climate change holistically in a just manner. The International Labour Organisation (ILO) "Guidelines for a just transition towards environmentally sustainable economies and societies for all" describes the complexity well - "A just transition for all towards an environmentally sustainable economy… needs to be well managed and contribute to the goals of decent work for all, social inclusion and the eradication of poverty." This narrative underpins Eskom's holistic approach to a lower carbon future in a just manner. We are therefore cognisant of Eskom's role in supporting the Just Energy Transition, not only supplying electricity, which is the economic backbone of the country, but also of the impact of our environmental footprint and our social responsibility towards those affected by our operations. The suite of policies, activities and initiatives that contribute to the Eskom Just Transition strategy therefore, are geared towards having a positive impact on our finances, the society we operate in and on the environment.

For this reason Eskom is developing a Just Transition Strategy detailing:

- Eskom's commitment to a lower carbon future
- How the repurposing and renewables plans contribute to meeting this target
- The impact of this approach on all environmental goals – air quality, carbon emissions, water, etc. (no compromise on environmental integrity)
- The impact of this approach on socio-economic factors – including dealing with shutting down of coal plants

The elements of a Just Energy Transition are being integrated into various pieces of work currently underway in the organisation including:

- Based on the 50 year technical life of plant, 6 stations with in excess of 10 000 MW of coal fired capacity is expected to be shut down by 2030 (including Grootvlei). The pace of this transition must consider the capacity of the electricity supply system, elements of the value chain, employees, suppliers and communities surrounding the power station to adapt. Eskom's strategy is to redeploy and reskill affected employees, support local municipalities and actively pursue economic opportunities for local communities. However, Eskom is not able to solely rely on redeployment of people from an old coal supply/generation community to another coal supply/generation area, in order to ease the process of transition – at least beyond what operations at Medupi and Kusile can be expected to absorb.

- Developing comprehensive and implementable social plans for each power station that will be shutdown. We have started with the social plans for the three power stations planned for shutdown soonest (Grootvlei, Komati and Hendrina) and will extend this work to all in the fleet.
- Investigating how we can repurpose power plants and/or power plant sites, including through the deployment of renewables repurposing with gas and assessing the use of the sites for other industries
- Given the shutdown of plants the need to develop new revenue and employment pathways plus the desire to reduce its carbon footprint, Eskom aspires to expand its renewables portfolio significantly through large scale grid connected wind and PV plants at selected greenfield sites, power stations and offices.
- Additionally, Eskom will investigate rooftop PV on a commercial basis and adopt energy storage solutions to provide balance to the system.
- Eskom has also extended an Expression of Interest to the public to provide further ideas for repurposing

In looking at these various options and the development of Eskom's overall Just Transition Roadmap we are also assessing the options for alternative financing, including climate financing.

Historically the South African economy was built on cheap coal and cheap energy to power a primary commodity economy. Despite the growth of the services sector, the structural underpinnings of the economy have not changed and are ill suited to this global transition that is underway. In a context where the world's largest economies and key trading partners are beginning to decarbonise, these global changes and the vulnerability of our economy, exacerbated now by COVID-19, if ignored, threatens to retard economic growth further in South Africa increasing poverty, unemployment, inequality and reducing the opportunity for economic growth. In this context the risks related to a just transition to a lower carbon economy are immense but not insurmountable if we address this as a collective (business, government, civil society and labour unions). Therefore in addition to it's own efforts, Eskom is engaged in national efforts through government and business to determine the Just Transition pathway for South Africa.

4 REQUESTED POSTPONEMENT EMISSION LIMITS

The current limits listed in Table 1 are as in Grootvlei's AEL (ref: Dipaleseng/Eskom H Soc Ltd GPS /0015/2019/F03 25 April 2019). The alternative emission limits that are requested for Grootvlei during normal operating conditions based on a suspension of the new plant limits for NOx and SO_2 are also shown in Table 1:

Table 1: Current and Requested Emission Limits for Grootvlei

	Current Limit (from AEL)			Requested Emission Limits*		
	Limit value	Averaging period	Date to be achieved by	Limit value	Averaging period	Date to be achieved by
Stack 1 (Units 1-3) PM	100	Daily	1 April 2018 to 31 March 2020	No change - 50	Daily	1 April 2020 to decommissioning
	50		1 April 2020 to 31 March 2025			
Stack 2 (Units 4-6) PM	100		1 April 2018 to 31 March 2020			
	50		1 April 2020 to 31 March 2025			
Stack 1 (Unit 1-3) SO_2	3500	Daily	Immediately	3500	Daily	1 April 2020 until decommissioning
			1 April 2020 to 31 March 2025			
Stack 2 (Unit 4-6) SO_2			Immediately			
			1 April 2020 to 31 March 2025			
Stack 1 (Unit 1-3) NOx	1100	Daily	Immediately	1100	Daily	1 April 2020 until decommissioning
			1 April 2020 to 31 March 2025			
Stack 2 (Unit 4-6) NOx			Immediately			
			1 April 2020 to 31 March 2025			

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

In summary the postponement/suspension for Grootvlei requested is:

1. Suspension of compliance from the new plant MES NOx limit (750M mg/Nm^3); and
2. Suspension of compliance from new plant MES SO2 limit (3500 mg/Nm^3); both until station decommissioning anticipated by 2028 and no later than 2030.

The station was retrofitted with Fabric Filter Bags and can comply with the MES new plant standard of 50mg/Nm^3 and as such no postponement for the PM standards is requested.

In terms of the existing license Grootvlei has until 1 April 2025 to comply with the new plant NO_x and SO_2 limit. It is therefore understood that the previously granted postponements of limits will remain in place until 2025 and thereafter until decommissioning based on this request for suspension. Practically an alternative daily limit of

1100 mg/Nm^3 for NO_x is requested and a daily limit of 3500 mg/Nm^3 for SO_2 both from 1 April 2000 until shutdown anticipated by 2028, and no later than 2030.

Eskom recognises that the authorities have an option to establish an emission load instead of emission limits. Given the complexities of calculating an emission load Eskom has not phrased its application in terms of load but is willing to engage with the authorities in respect of load if this is deemed acceptable.

Based on the remaining life of the Grootvlei power station, the techno-economics and cost benefits assessment any additional measures other than what was committed to above and the alternative 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.

5 LEGAL BASIS FOR DECISION-MAKING

5.1 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 1207 of 22 November 2013 (the Regulations) as amended by GNR 1207 of 31 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 Grootvlei for this application. The AIR provides, *inter alia*, an assessment of how ambient air quality is likely to be affected by Grootvlei's requested emission limits by utilising, *inter alia*, atmospheric dispersion modelling. This AIR is an update of the one completed in 2014. Annexure B is a Cumulative AIR for the Highveld showing the combined impact from all Eskom's Higveld power stations.
2. Detailed justifications and reasons for the Application (see Section 6 below) (including a Health impact focused cost benefit analyses, Annexure C1 and C2) and,
3. A comprehensive report on the public participation process followed, and associated documentation (Annexure D). The public participation report deals with the overall Eskom 2019 MES application process but only phase 1 of the public participation process (comments on the Eskom 2018 MES postponement application Background Information Document) for Grootvlei as the public participation process for Grootvlei was halted in September 2018. The issues raised in the overall report will be a reflection of the issues relevant to Grootvlei, however Eskom is through this June 2020 application initiating a further round of public participation specific to Grootvlei and a supplementary final public participation report will be provided to the NAQO when this is available (anticipated August 2020).

5.2 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. There was, prior to October 2018, no requirement for Eskom to complete an immediate application for Grootvlei 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 undertook to submit an updated AIR and Public Participation report when these were available. The update AIR is part of this application and an updated public participation report will be prepared as indicated on completion of the present public participation process.

5.3 The Need to Amend 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 the requested suspension is granted by the NAQO. If the NAQO decision is substantially different from the requested suspension application, Eskom reserves its right to amend its variation request. The final AEL variation request will be submitted on the South African Atmospheric Emission Licencing & Inventory Portal as is required.

6 REASONS FOR APPLYING FOR SUSPENSION

As mentioned above, the application for suspension must be accompanied by reasons. Such reasons are set out below and include the fact that Grootvlei has a short remaining life (decommissioned by 2030); emissions

from Grootvlei 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. 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.

None of these reasons should be seen as exclusive (i.e. it is not one reason alone that prevents compliance to MES is not appropriate) but rather all in combination. As set out in the Constitution of the Republic of South Africa, there is a 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 a need therefore to maintain the balance in the attainment of sustainable development.

6.1 Remaining Power Station Life

Eskom has placed a number of its older, less efficient units (14 units totalling 1969 MW from the Komati, Hendrina and Grootlvlei power stations (3 units)) in reserve storage for which we do not anticipate a return to service. This step has been taken earlier than the 50 year life-of-plant norm. However, to address capacity constraints, a decision was taken not to shut down the remaining operating units at these power stations early, as was previously envisaged. These units will need to continue operating in line with their official plant life spans. There are no plans to extend their lives. Grootvlei is currently scheduled to be shut down between 2028 and no later than 2030, 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[1] 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 operation of FGD would be taking place simultaneously with shutdown of the station (assuming all other issues discussed below could be addressed) – an illogical arrangement. Grootvlei has a postponement from the SO_2 limit until 2025 and therefore may well have already commenced with shutdown prior to being required to retrofit for SO_2 reduction.

Eskom believes that given the short remaining life of the station that it does not make financial or economic sense to implement addition additional pollution control measures at the station beyond those already installed,

[1] A number of SO_2 reduction technologies exist but full compliance with the MES at Grootvlei would require a FGD retrofit, and as such, discussion has focused in this document of FGD implementation. Other technologies, which are less capital intensive exist but their implementation would not result in MES compliance.

6.2 Water Availability

Water is an extremely limited resource in South Africa and it is argued that the implementation of FGD at Grootvlei is not an appropriate decision for a water scarce country. Grootvlei Power Station being a predominantly wet-cooled power station means that it uses large quantities of water.

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 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 Grootvlei with FGD would require additional 3.3 million m^3/annum water for a wet system and an additional 1.4 million m^3/annum water for a semi-dry system.

The water demands of FGD are thus significant across the power stations and will increase Eskom's water demand by some 59 million m^3/annum – a 20% increase in the combined water consumption of Eskom's power stations. 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 now being 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 Oct. 2025 when it will get reviewed). Some of Eskom's older power stations are expected to be shut down 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. 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.

6.3 Environmental Implications of FGD

Assuming FGD was required for Grootvlei, which is as said is impractical, FGD is not without negative environmental consequences:

- Up to 360 000 tons of sorbent (limestone) per annum is required to operate FGD at Grootvlei. 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 420 000 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).
- Grootvlei is expected to produce an additional approximately 115 000 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 Grootvlei 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%.

6.4 Grootvlei Impact on Ambient Air Quality

6.4.1 Ambient monitoring

An assessment of monitored ambient air quality data at the Grootvlei monitoring station 2 km from the power station between 2015 and 2017 reveals that although SO_2 loading is elevated, there is compliance with the National Ambient Air Quality Standards (NAAQS). There are exceedances of the 10-minute, hourly and daily NAAQS limit values for SO_2 but there is still compliance with the SO_2 standard other than for the 2017 daily concentrations where the limit value was exceeded 6 times (only 4 is permissible). The annual average SO_2 concentration is in compliance with the standard being just more than half the standard limit value.

Measured hourly ambient NO_2 concentrations see exceedances of the NAAQS limit values but compliance with the standard, although compliance cannot be assured given the poor data recovery in especially 2015. Annual average NO_2 concentrations are in compliance with the NAAQS although again data recovery does not allow such compliance to be confirmed for either 2015 (where data recovery is less than 50%) or 2016.

Ambient daily PM_{10} concentrations indicate exceedance of the NAAQS limit values but full compliance with the standard. Ambient daily $PM_{2.5}$ concentrations indicate non-compliance with the daily standard (6 exceedances of the limit value where 4 are allowed) for 2016 but it seems that instrument drift may also be the cause of the exceedances. Annual average PM_{10} concentrations comply with the NAAQS although again data recovery does not allow either compliance to be confirmed for 2015 (where data recovery is less than 50%) or 2016. The annual average PM_{10} concentrations are of the lowest across the entire network of the Eskom Highveld monitoring stations.

Additional monitoring data reviewed for 2019 indicates compliance to NAAQS for NOx and SO_2 (in excess of 90% data availability) and PM_{10} (71% data availability) but not the $PM_{2.5}$ (90% data availability) daily standard.

6.4.2 Dispersion modelling

Dispersion modelling of the current emissions for SO_2, NO_x, PM_{10} and $PM_{2.5}$ from Grootvlei alone, indicates compliance with the relevant NAAQS for all averaging periods. The direct contribution of Grootvlei alone to local ambient emissions is negligible even taking into account predicted concentrations of secondary $PM_{2.5}$. With the shutdown of the station by 2030 this contribution will be further limited to the fugitive dust impact of the station ashing facility.

The Cumulative Assessment Report in which all emissions from all stations in the Highveld were modelled collectively (Annexure B) showed that for current actual emissions the predicted ambient SO_2, NO_2 and secondary particulates as $PM_{2.5}$ comply with the respective NAAQS throughout the Highveld modelling domain. The predicted annual average concentrations for PM_{10} also complies with the NAAQS over the Highveld. Non-compliance with the 24-hour PM_{10} NAAQS are predicted in a small area between Matla and Kriel power stations (90 km from Grootvlei power station). Non-compliance is also predicted for the annual $PM_{2.5}$ NAAQS but over a similar very small area. Some exceedances of the 24-hr $PM_{2.5}$ NAAQS limit value are predicted but there is still compliance with the standard. These areas of predicted elevated PM_{10} concentrations are close to Kriel power station. The particulate exceedances are attributed to low-level fugitive sources and that all particulate emissions are assumed to be both PM_{10} and $PM_{2.5}$[2].

As part of the dispersion modelling the maximum predicted ambient concentrations at sensitive receptors such as schools and clinics were calculated. Sensitive receptors close to Grootvlei included Grootvlei town, Laerskool Grootvlei and Tokoloho Primary School. Predicted ambient concentrations comply with the NAAQS for all three pollutants for the respective averaging periods at all the sensitive receptor points.

[2] There is no established ratio of how much of total PM is PM_{10} and how much is $PM_{2.5}$. For that reason ALL PM is assumed to be PM_{10} and ALL PM is also assumed to be $PM_{2.5}$. The assumption obviously results in the exaggeration of the emissions but also ensures that the emissions are never underestimated.

A second modelled scenario which assumed new plant MES compliant emissions indicates that the predicted ambient SO_2 concentrations are lower than for actual emissions while ambient NO_2 concentrations are generally higher. (Note that actual SO_2 emissions provided for modelling are generally higher than the MES, but actual NO_X emissions are lower than the MES.) The predicted annual, 24-hour and 1-hour ambient concentrations of SO_2 and secondary particulates as $PM_{2.5}$ comply with the respective NAAQS throughout the modelling domain. For NO_X emissions, the predicted annual NO_2 concentrations comply with the NAAQS, but the 1-hour NO_2 concentrations are predicted to exceed the NAAQS in a relatively small area near the Kusile Power Station. The predicted annual average PM_{10} concentrations comply with the NAAQS over the Highveld. Exceedances of the PM_{10} 24-hour NAAQS are predicted in a small area between Matla and Kriel power stations. Exceedances of the annual and 24-hour NAAQS for $PM_{2.5}$ are predicted to occur close to some power stations (not Grootvlei). The particulate exceedances are again attributed to low-level fugitive sources and the assumption that all particulate emissions are both PM_{10} and $PM_{2.5}$.

6.4.3 Analysis of air quality - conclusions

Analysis of ambient monitoring stations and the dispersion modelling across the Highveld indicates that NO_2 is generally compliant with the NAAQS. Similarly SO_2 concentrations are generally compliant across the Highveld but daily and even annual SO_2 concentrations are seen to be non-compliant in several 'hot spots' across the Highveld known to be large sources of SO_2 (Kendal, Komati and Witbank). KwaZamokuhle is also seen to be non-compliant with the daily SO_2 NAAQS. The fact that there are daily and annual average non-compliances indicates the large and sustained SO_2 loading in these areas. Daily and annual average PM_{10} and $PM_{2.5}$ concentrations are seen to be non-compliant at almost all the monitoring stations and for extended periods of time, well more than 180 days in the case of PM_{10} (Sharpville) and more than 230 days for $PM_{2.5}$ for Sebokeng, when 4 is the allowable number of exceedances.

The general conclusions of the analysis across the Highveld indicates that the quality of air will be in compliance with the NO_2 NAAQS, but noncompliance with the daily and annual SO_2 standards will occur in several areas across the Highveld. Daily and annual average PM_{10} and $PM_{2.5}$ concentrations are generally not in compliance with the NAAQS and indeed for extended periods. As such ambient PM concentrations are deemed to pose a direct health risk for communities across a large part of the Highveld.

Dispersion modelling results based on individual and combined power station emissions, excluding all other sources, indicate a generally negligible contribution from the power stations to the measured PM concentrations. In addition the diurnal pattern in PM concentrations based on monitored ambient data clearly indicate a morning and early evening peak, typical of low elevation source contributions and not the high elevation stacks of the power stations. However, a combination of SO_2 and NO_x emissions from all the Highveld power stations is predicted to form an important component of the secondary $PM_{2.5}$ load especially over the Emalahleni area where there is noncompliance with NAAQS PM standards.

In addition, the combined SO_2 emissions from all Eskom power stations are predicted to contribute a significant amount to the SO_2 load 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.

Implementing the Eskom emission reduction plan and installing more efficient emission control technology will reduce Eskom's emissions. The shutting down of the older stations (including Grootvlei) and an increased use of the newer less emitting Medupi, Kusile and the renewable IPPs, will also result in a substantial decrease in Eskom's and South Africa's emissions over time. As mentioned it is projected that compared to a 2020 baseline that by 2039 Eskom's relative PM emissions will reduce by 62%, SO_2 by 39% and NO_x by 43%.

The dispersion modelling and ambient air quality monitoring data indicate that the elevated pollution levels in the Highveld require a holistic approach, addressing all identified and potential sources. Therefore, a single approach, targeted at only reducing Eskom power station emissions is unlikely to result in compliance with the NAAQS especially in respect of PM_{10} and $PM_{2.5}$.

6.4.4 The Highveld Priority Area

Eskom is aware that Grootvlei is situated within the Highveld Priority Area and is, as such has implemented substantial financial investment into reducing particulate emissions from Grootvlei's operations, through the retrofitting of the station with Fabric Filter Plants (FFP). Grootvlei thus already achieves the new plant emission standard for PM. However due to Grootvlei power station's short remaining life, with some 3 of 6 units already shut down with final shutdown anticipated to be no later than 2030 there are no plans to upgrade any additional pollution abatement equipment at the station.

6.5 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 and comment on Eskom's overall financial position is presented below.

6.5.1 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. [3]
- 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 Grootvlei would require a FGD retrofit, which is the only way of consistently achieving the new plant SO_2 emission limit, in excess of R10 billion and a LNB retrofit estimated to be around R1 billion. The instillation of FFP at Grootvlei has already cost approximately R800 million.

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,

[3] Recent revision of cost indicate Medupi FGD is likely to cost R32 billion (real overnight cost 2018 base) and as such these figures are an underestimate of the costs.

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%. Eskom also has to factor in to the costs the national prerogatives of localization, industrialisation, local market maturity & competitiveness, efficiency, financing etc. in the determination of the total project costing.
There is only complete certainty about the costs once the contract has been completed.

6.5.2 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 Multi Year Price Determination 4 tariff 4 (MYPD4) electricity tariff agreement (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 2019 emission reduction plan with an estimated cost of R 67 billion over the next 10 years, it was covered in the 2018/9 MYPD4 application (for costs over the next 3 years). If there is a requirement for additional retrofits based on the DEFF 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 price increase of 15% per annum was not approved by NERSA on 7 March 2019, and Eskom is now having to further prioritise its operations and may amend the overall Eskom Emissions

Reduction Plan. The estimated capital cost of the 2019 Emission Reduction Plan is R46 billion (2018 overnight costs). In addition, Eskom has not reached a level where it is recovering its efficient and prudent costs.

6.5.3 Eskom's overall financial position

Eskom's financial health has deteriorated over the years due to above inflationary cost increases, non-cost reflective price of electricity and couples with an ambitious capital expansion plan. As a result most financial ratios trended negatively with the EBITDA margin at 20% at 31 March 2020 while the margin should at least be more than 35%. The debt service cover ratio is 0.5 indicating that Eskom has to borrow money to settle debt, interest and principal. Although there was some improvement in the financial ratios it is still far below acceptable norm.

As a result of the weakening position, and the fact that Eskom relied mostly on debt financing, the shareholder had to provide support through an equity injection and providing loan guarantees.

6.5.4 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 C1 and C2).

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 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.

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 (2019) (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
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).

The CBA was completed using the 2019 Eskom Emission Reduction plan, as indicated this plan may be amended due Eskom's financial situation. This change may impact on the CBA ratios, however given that the cost of FGD far exceeds that of the LNBs (an order of magnitude), and that the relative risk ratio of NOx exceeds that of SOx by a mere 1%, it is highly likely that the Scenario 1 would remain the least favoured Scenario. A consistent change in the other scenarios would not impact on the order of the scenarios.

It should also be noted that the cumulative AIR (Annexure C1) was revised to include fugitive emissions from ash dams and coal stockyards. An assessment of the impact of this change on the CBA was completed and is included as Annexure C2. The assessment concluded that the additional effect of fugitive emissions is extremely unlikely to have a significant effect on the Health CBA outputs. Health effects resulting from fugitive emissions are highly localised and is likely to have a significant effect on the model output at a localised level. Note however that the exposed population in the Wards covering the highest 20 average PM concentration grid points is a mere 0.4% of the total modelling domain, and thus the health outcome effect will be small.

In addition the 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 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 (including Grootvlei) will be shut down 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.

6.6 Project 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 FFP at Grootvlei and this technology was installed, ahead of schedule, by 2017. There were no further emission reduction projects planned for Grootvlei in the past 5 years and as such no delays in implementation of station specific commitments have been experienced there.

A review of the process described above clearly illustrates that given the station is already mostly shutdown and will be shutdown by no later than 2030, it is practically inappropriate to attempt further retrofits at Grootvlei.

7 PUBLIC PARTICIPATION

The requirement that the public participation process for an application for postponement from the MES followed the process specified in the NEMA Environmental Impact Assessment (EIA) Regulations for round 1 of PPP, however this will be done differently for the second round following the restrictions posed by COVID-19.

A different PPP Plan was put together to encourage and support the public's participation in the second round, as stipulated in the Public Participation Report (Annexure D). Eskom supports and aligns its public participation process with the requirements as stipulated within the NEMA EIA Regulations. The public participation process for the first phase of this project in 2018 increased the number of public meetings to include communities in the vicinity of the power station. Meetings took place in the towns of Balfour and Grootvlei both close to the station in 2018. The public participation report (Annexure D) deals with the overall Eskom 2019 application process but only round 1 of the public participation process (comments on the Eskom 2018 MES postponement application Background Information Document) for Grootvlei is reflected in this report as the public participation process for Grootvlei was halted in September 2018. The issues raised in the overall report are a reflection of the issues relevant to the station however, Eskom is continuing with round 2 of PPP for Grootvlei through different social media platforms (due to COVID-19), for the updated AIR and supplementary public participation report which will be provided to the NAQO when available. With regards to the AEL variation request to be submitted, the public participation process undertaken meets the requirements of Section 46 of NEMAQA. For details pertaining to the public participation process, the reader is referred to Annexure D of this Application

8 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 is of the view that in many cases household 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. 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 a deterioration in air quality in low income areas.

Eskom has undertaken several feasibility and pilot studies (2011 – 2018) in KwaZamokuhle, a township near Hendrina Power Station to identify and test potential offset interventions. Based on the results of the studies conducted to date, it was concluded that ambient air quality in the affected communities could be improved by replacing household's coal stoves with a hybrid gas electricity stoves and a LPG heater together with retrofitting the houses with a ceiling to insulate the houses.

The recommended Air Quality Offset intervention for the lead implementation (in KwaZamokuhle and Ezamokuhle) entails the following (Figure 1)

Provision of a basic plus retrofit which consists of;

- Insulation entailing installation of a SPF ceiling system and draft proofing
- Electrical rewiring and issuance of Certificate of Competence (CoC).

Stove swap which entails

- Provision of electricity based energy source with LPG backup. This will include a hybrid electric gas stove, LPG heater plus 2x9 kg LPG cylinders and Compact fluorescent lamp (CFL) for energy efficiency lighting.
- Removal and disposal of the coal stove

Figure 1: Household Intervention for Lead Implementation Sites (KwaZamokuhle and Ezamokuhle)

The lead implementation in KwaZamokuhle and Ezamokuhle has been delayed by various factors including the COVID 19 pandemic and is likely to commence late in 2020. The large-scale rollout of offset intervention is planned for 2021 to 2026.

9 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 and that it assist South Africa moving forward in terms of a just energy transition. 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 requirement 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.

Grootvlei will be shut down by no later than 2030, with three (3) of six (6) units already shutdown. Given this time frame it is not practically possible to install FGD on the station before decommissioning. In addition compliance with the new plant MES for SO_2 will result in additional environmental impacts in terms of water

demand, increases in CO_2 emissions and waste production, and significant financial costs. The financial costs of compliance with the new plant MES at Grootvlei are in excess of R11 billion for a 9 year investment and will contribute to an increase in the electricity tariff.

The Eskom Emission Reduction Plan will lead to a reduction in total emissions in the Highveld stations especially in respect of particulate emissions. Further six power stations (including Grootvlei) will be shutdown fully by 2030 reducing the total load of all emissions in each of the three air sheds applicable to this application.

The impact of Grootvlei's emissions on ambient air quality has been comprehensively assessed in the station specific AIR and the Summary Atmospheric Impact Report. Dispersion modelling of the current emissions for SO_2, NO_x PM_{10} and $PM_{2.5}$ from Grootvlei alone, indicates compliance with the relevant NAAQS for all averaging periods. The direct contribution of Grootvlei alone to that situation is negligible even taking into account predicted concentrations of secondary $PM_{2.5}$. Indeed the cumulative dispersion modelling done shows that ambient concentrations are below the NAAQS for all three pollutants for the respective averaging periods at all the sensitive receptor points across the Highveld, including receptors close to Grootvlei such as Grootvlei town, Laerschool Grootvlei and Tokoloho Primary School.

Eskom believes given the motivation presented above in terms of: general air quality in the area; Grootvlei already complying with the new plant emission standards for PM; the cost, time and the impact of installing further emission reduction equipment for a station which will decommission by 2030, that the application for the suspension and requested alternate 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.