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THE GREEN CONNECTION

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The Director General
Department of Mineral Resources and Energy
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31st January 2022

COMMENTS ON

DEPARTMENT OF MINERAL RESOURCES AND ENERGY

GAS MASTER PLAN 2022

BASE CASE REPORT

Dear Sir,

1. Introduction

The Green Connection is a small environmental and social justice civil society organisation which promotes sustainable livelihoods and the achievement of environmental rights.

The Green connection is an ecojustice organisation and believes that empowering people to participate in decision making about their environment is the only way that truly sustainable development can take place. Our environmental resources are limited and not ours to squander but to protect for future generations. We believe that economic growth and development, improvement of socio-economic status and conservation of natural resources can only take place within a commonly understood framework of sustainable development.

At the outset The Green Connection wish to state that the proposed Base case Gas Master Plan (BGMP) is *fatally flawed.* Our reasons for making this blatant statement are provided in the pages that follow.

2. Purpose and Limitations of Report

It is stated in the section 1.2 of the BGMP that "*The Gas Master Plan document, once developed, will serve as a policy instrument, providing a roadmap for taking strategic, political and institutional decisions which will guide industry investment planning and coordinated implementation".* It is therefore apparent that it is intended that the BGMP will provide *"The report will set the scene for the Gas Master Plan development process"*

The GMP Baseline Report says it is presented for stakeholder comments does not confine itself to current baseline scenarios but throughout the document many future predictions and assumptions have been included. Many of these assumptions and speculations will be addressed in this report.

However, contrary to the claimed aims and objectives stated in the GMP, section 1.3, states that "*At the time of finalizing this report the Department was yet to procure a suitable modelling tool to model the current gas sector in the country as well as to develop immediate sector expansion scenarios. This work is current underway and will be published in due course, together with natural gas demand projections."* The fact that the Department of Mineral Resources and Energy (DMRE) have not acquired, let alone conducted basic energy demand modelling, yet have issued the BGMP for public comment without conducting the most basic modelling is unacceptable. This alone renders the GMP incomplete and therefore fatally flawed.

2.1. Integrated Energy Models

Many integrated energy models (IEM) have been developed and applied in the African context. Models such as Long-range Energy Alternative and Planning (LEAP)[1] [2], Targets IMage Energy Regional (TIMER)[3] have been used on a regional basis in Africa, while IEM's such as MARKet and Allocation (MARKAL)[4], PLEXOS[5] and PowerPlan[6] have been specifically developed for the unique South African scenario.

[1] Energy Commission of Ghana. Strategic national energy plan 2006-2020 for Ghana. Ghana: energy commission of Ghana; 2006 Jan. p. 135. Report No.: 1,
[2] Ouedraogo NS. Africa energy future: alternative scenarios and their implications for sustainable development strategies. Energy Pol 2017;106:457–71.
[3] Lucas PL, Dagnachew AG, Hof AF. Towards universal electricity access in Sub- Saharan Africa. https://www.pbl.nl/sites/default/files/cms/publicaties/pbl-201 7-towards-universal-electricity-access-in-sub-saharan-africa-1952.pdf.
[4] Winkler H. Energy policies for sustainable development in South Africa. Energy Sustain Dev 2007;11:26–34.
[5] Wright JG. (PDF) developing an integrated energy model for the eastern african power pool (EAPP). 2014..
[6] Thiam D-R, Benders RMJ, Moll HC. Modeling the transition towards a sustainable energy production in developing nations. Appl Energy 2012;94:98–108.

As stated by Avila et. Al (2017)[7] the objective of applying IEM is to determine an optimal combination of supply, transmission, storage, and demand–supply efficiency of energy is key for stimulating resource development and fuelling economic growth. For the optimal delivery of energy services, decision makers must invest in the development of energy models for testing and assessing cost and benefits of different energy resource expansion scenarios. Additionally, the models must be able to simulate how these expansion scenarios fit with existing and expected future transmission and demand–supply situations.

The BGMP has failed in the methodology applied and can therefore only be considered to be a guideline and not a policy document upon which rational and long-term decisions can be based. It is therefore worthwhile to highlight comments and observations included in Musonye et. al (2020)[8] *"Some of the impediments to universal energy access among these countries include ineffective energy institutions, ineffective planning, inappropriate legal and regulatory frameworks, inadequate technical and financial mechanisms, politically driven energy decisions, and corruption."*

3. Natural gas as an energy source.

In section 2 of the GMP, the drafters of the document make the following incorrect statement. *" When burned, natural gas is one of the cleanest and most powerful forms of energy available."* Without providing peer reviewed reference to this statement, it must be concluded that this statement is the opinion of the author.

Gas, or methane (CH_4), is more efficient at trapping radiation than CO_2 and the Intergovernmental Panel on Climate Change (IPCC) estimates that over a 20-year period, methane will trap eighty-six times more heat than carbon dioxide and over a 100-year period has a carbon equivalence of 34. Furthermore, it is known that the CH_4 molecule is broken down to carbon dioxide and hydrogen over a period of approximately 120 years in the stratosphere.

[7] Avila N, Carvallo JP, Shaw B, Kammen DM. The energy challenge in sub-Saharan Africa: a guide for advocates and policymakers: Part 1: generating energy for sustainable and equitable development. 2017.

8 [8] Musonye, X.S., Davíðsdottir, B., Kristjansson, R., Asgeirsson, E.I., Stefansson, H. (2020). Integrated energy systems' modeling studies for sub-Saharan Africa: A scoping review. Renewable and Sustainable Energy Reviews 128 109915

Carbon dioxide has a longer residence time and molecules of the gas will remain present in the atmosphere for about 300 to 1000 years[9].

During the past decade, meaningful debate has been conducted and numerous studies have been concluded that have investigated climate change consequences due to methane gas emissions. Flaring, venting and fugitive methane emissions associated with oil and gas production and use. Methane escapes to the atmosphere from all parts of the extraction, processing, and distribution system, all the way to the end user.

3.1 Summary of some relevant studies.

A few relevant peer reviewed research findings that have been published during the past decade are summarised below. The catalogue of papers that have been reviewed is by no means complete and represents an overview of the current thinking and conclusions.

As the concept of gas becoming a transitional source of energy, research emphasis has included studies of intentional and fugitive gas emissions from all gas installations.

i. In a major study[10] conducted by Stanford University, Massachusetts Institute of Technology, and the U.S. Department of Energy in 2014 found that methane leaks negate any climate benefits of natural gas as a fuel for vehicles, and that the EPA is significantly underestimating methane in the atmosphere. Brandt et.al (2014) concluded that *"Switching from diesel to natural gas, is not a good policy from a climate perspective."* The study also found that the US national methane leakage rate is likely between 3.6 and 7.2 percent of production.

ii. In an assessment of the heat-trapping potential of greenhouse gases, a study conducted by Edwards and Trancik (2014)[11] revealed that methods of accounting fugitive gas

[9] [9] IPCC. (2013). Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T. F., D. Qin, G.-K. Plattner, M. Tignor, S. K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex & P. M. Midgley (eds.)]. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press.

[10] Brandt, A. R., Heath, G. A., Kort, E. A., O'Sullivan, F., Petron, G., Jordaan, S. M., . . . Harriss, R. (2014). Methane leaks from North American natural gas systems. Energy and Environment, 343(6172), 733-735.

[11] Edwards, M. R., & Trancik, J. E. (2014). Climate impacts of energy technologies depend on emissions timing. Nature Climate Change, 4, 348-352

concentrations underestimate the climate-damaging impact of methane pollution from all sources, including drilling and fracking operations.

iii. An influential study carried out by Busch and Gimon (2014)[12] analysed the level of greenhouse gas emissions attributable to electricity from natural-gas-fired power plants and coal-fired power plants and conclude that, over short time frames and at high rates of leakage, natural gas offers little benefit compared to coal and could exacerbate global warming. Acknowledging that natural gas offers some reductions in greenhouse gas emissions over longer time frames, they point out that such reductions are not large enough for natural gas to play an expanded role in efforts to manage emissions. They conclude that under the best of circumstances, natural gas-fired electric power offers a modest benefit toward abating climate change, while if poorly developed (i.e., with extensive methane leaks, estimated by these authors to be on the order of 4 percent or higher), or if used to displace energy efficiency or renewable energy, natural gas could seriously contribute to increased greenhouse gas emissions.

iv. A similar study by Zhang et al (2014)[13] in which coal and natural gas were compared for power generation. They concluded that over time, natural gas plants can produce some reduction in near-term warming, but only if life cycle methane leakage rates are low and power plant efficiency is high. Relative to coal, there is the potential that *"…deployment of natural gas power plants could both produce excess near-term warming if methane leakage rates are high and produce excess long-term warming."*

v. Howarth (2015)[14] summarized and analysed the evidence documenting the magnitude of methane emissions related to oil and gas development in the United States since 2007. With estimated emission rates ranging from 3.8-12 percent, the high radiative forcing of methane over a twenty-year period prevents natural gas from serving as a bridge fuel. Instead of further investments in natural gas, the study recommended a rapid transition to electric powered vehicles for transportation, high-efficiency heat pumps for space and water heating, and imposition of a methane tax. Howarth (2015) also noted that the EPA

[12] Busch, C. & Gimon, E. (2014). Natural gas versus coal: Is natural gas better for the climate. The Electricity Journal, 27(7), 97-111.
[13] Zhang, X., Myhrvold, N. P., & Calideira, K. (2014). Key factors for assessing climate benefits of natural gas versus coal electricity generation. Environmental Research Letters, 9.
[14] Howarth, R. W. (2015). Methane emissions and climatic warming risk from hydraulic fracturing and shale gas development: implications for policy. Energy and Emission Control Technologies, 3, 45-54

has seriously underestimated the importance of methane emissions in general and from shale gas.

vi. In a paper published by Turner et.al (2016)[15] in which both satellite retrievals and surface observations were used to determine that methane emissions in the United States increased by more than 30 percent over the previous twelve years. The findings contradict the 10 percent decline reported by the EPA and suggest that the United States could be responsible for 30-60 percent of the global spike in atmospheric methane.

vii. The CSIR (2016)[16] report on Shale Development in the Central Karoo was compiled for the Strategic Environmental Assessment into the potential impacts of introducing shale gas extraction in the Karoo. Drawing from many of the studies cited above, the assessment concluded that leaks amounting to a few percent can offset the benefit that accrues from the higher energy yield per unit CO_2 emitted when gas is used in the place of coal. The GHG no benefit threshold occurs at between 1.9 to 3.2% leakage under the gas production scenarios assumed in the study.

viii. In an analysis of methane leaks from the U.S. oil and gas supply chain, Alvarez et al (2018)[17] found that natural gas is just as damaging as coal for the climate over a 20-year period. This study combined terrestrial measurements of leaks at selected facilities (bottom-up methods) with data collected from the atmosphere via aircraft (top-down methods). Based on the results, the authors estimated that 2.3 percent of all the natural gas extracted in the United States escapes into the air. This estimated level of leakage was 60 percent higher than the EPA's estimate of 1.4 percent.

xii. In a study conducted by Jackson et al (2019)[18] the growing dependency on fossil fuels around the globe was examined. They determined that the ongoing natural gas boom isserving a major barrier to rapid decarbonization. Natural gas is the fastest growing fossil

[15] Turner, A. J., Jacob, D. J., Benmergui, J., Wofsy, S. C., Maasakkers, J. D., Butz, A., . . . Biraud, S. C. (2016). A large increase in U.S. methane emissions over the past decade inferred from satellite data and surface observations. Geophysical Research Letters, 43.

[16] 18 Scholes, R., Lochner, P., Schreiner, G., Snyman-Van der Walt, L. and de Jager, M. (eds.). 2016. Shale Gas Development in the Central Karoo: A Scientific Assessment of the Opportunities and Risks. CSIR/IU/021MH/EXP/2016/003/A, ISBN 978-0-7988-5631-7

[17] Alvarez, R. A., Zavala-Araiza, D., Lyon, D. R., Allen, D. T., Barkley, Z. R., Brandt, A. R., . . . Hamburg, S. P. (2018). Assessment of methane emissions from the U.S. oil and gas supply chain. Science, 361(6398): 186-18

[18] Jackson, R. B., Friedlingstein, P., Andrew, R. M., Canadell, J. G., Le Quéré, C., & Peter, G. P. (2019). Persistent fossil fuel growth threatens the Paris Agreement and planetary health. Environmental Research Letters, 14.

fuel in the world and has displaced coal as the preferred fossil fuel. The use of natural gas has grown at a rate that the methane emissions from burning it have more than offsetthe decline in carbon dioxide emissions from the reduced use of coal. The result is that carbon dioxide equivalent emissions from fossil fuels grew each year from 2017-2019. The low costs of natural gas, and new methods for transporting it, such as LNG tankers, are keeping the use of fossil fuels high even as renewable energy sources are also growing. As a result, the carbon intensity of global energy production has remained unchanged since 1990. The study calls for *"…accelerated energy efficiency improvements and reduced consumption, rapid deployment of electric vehicles, carbon capture and storage technologies, and a decarbonized electricity grid, with new renewable capacities replacing fossil fuels."*

The estimates of leakage worldwide are in the range 1.5 to 2.3%, but recent literature showing that much of the emission comes from a few "super emitters" locations suggests that the true range may be 2.2 to 4.1 and even as much at 12%[19]. It is therefore beyond speculation that gas does leak from gas infrastructure and installations and must be accounted for when determining the viability of using it as a transition fuel. Failure to do so is tantamount to pursuing a business as usual (BAU) model and externalising the real costs of using gas

4. Gas supply and production

4.1 Domestic gas reserves.

It is critical that the potential of domestic production of gas in South Africa is brought into focus. Statements in the BGMP such *"…as lists, the country has the potential to rank amongst the top 30 countries, provided the initial gas estimates, specifically unconventional natural gas reserves, hold true"*. It is important to note that perusal of the three references, which are all sourced from within the oil and gas industry, not one of them make any such statement or indication of South Africa potentially ranking amongst the thirty top producers worldwide.

[19] Howarth, R. W. (2015). Methane emissions and climatic warming risk from hydraulic fracturing and shale gas development: implications for policy. Energy and Emission Control Technologies, 3, 45-54.

It is useful to differentiate between the concepts of types of reserves. The United States Security and Exchange Commission (SEC)[20] classifies reserves based on the probability that they exist.

Reserves name	*Minimum probability of existence*
Proven reserves	Reasonable certainty or 90%
Probable reserves	50%
Possible reserves	10%

The BGMP makes no effort to differentiate between the status of the reserves in the report and therefore, to provide some clarity, the volumes of domestic gas and reserve status has been tabulated below.

Using the volumes of gas that are presented in figure 4-1 of the BGMP as well as the implied reserve status included but not defined, it has been assumed that a 2P designation means the total of proven and probable reserves and 2C means contingent resources.

Name	*BGMP reserve status*	*BGMP volume (tcf)*	*SEC Reserve Status*	*Adjusted volume (tcf)*
Orange basin	2P	0.54	probable	0.27
Bredasdorp basin	2P	0.02	probable	0.01
Outeniqua basin	2P	4.5	probable	2.25
Durban Zululand	2P	4	probable	2
Witwatersrand	2P	0.13	probable	0.007
CBM	2C	15.1	possible	1.5
Shale gas	2C	13	possible	1.3
Total		37.29		7.34

Of significance is the Draft Report: The SADC Regional Gas Master Plan (RGMP) – Phase One Report[21] that states that South Africa has 0.23tcf of proven reserves and 16tcf of probable reserves. Volumes that are closer to the lower estimations provided in the table above.

[20] Hyne, N.J. (2019). *Non technical guide to petroleum geology, exploration, drilling and production*. 4th Edition. PennWell. Nashville

[21] SADC and DBSA (2021) Draft Report: The SADC Regional Gas Master Plan (RGMP) – Phase One

https://www.dbsa.org/sites/default/files/media/documents/2021-4/SADC%20DBSA%20RGMP%20Phase%201%20Consolidated%20Report.pdf

Perusal of the table above therefore indicated that the total volume of domestic gas is in the order of 7.34tcf, which is less than the volume predicted in the BGMP.

Furthermore, it is important to highlight inaccuracies presented in the BGMP.

i. In section 4.1.2 it is stated that project Ikhwezi in the Bredasdorp basin was expected to yield 0.24 tcf of gas though five wells yet figure 4-1 in the BGMP shows the volume to be 0.02tcf ie. an order of magnitude difference.
ii. Section 4.1.3 in the BGMP states that the Brulpadda project's reserve is estimated at approximately 6tcf of gas and condensate yet figure 4-1 shows a volume of 1.5tcf ie. four times less.
iii. Section 4.1.5 states that The Petroleum Agency's gas-in-place prospective evaluation is estimated at 4 tcf in the Durban Zululand basin and cite a reference 2012 reference from The Petroleum Agency. Substantial exploratory work has been conducted over this basin in the interim period and it is unacceptable that the authors of the BGMP used a reference that is a decade old.
iv. Section 4.1.6 states that the technically recoverable shale gas resource in the Karoo is 30tcf yet figure 4-1 indicates a volume of 13tcf ie. less than half the volume. The estimated volume of 13tcf is borne out by the research conducted by de Kok et. al (2017)[22] and the value of 30tcf constitutes wishful thinking. It is also important to note that research conducted by Geel et.al (2015)[23] indicated that 0 to 23tcf of gas may not be available, with limitedrecoverable quantities due to the thermal regime that the host formations have beensubjected to in their geological history. Figure A-1 South Africa's oil and gas potential shownon page 71 of the GMP bears no resemblance to figure 4-1 and furthermore cannot be verifiedby any reference. By example the potential shale gas volume is given as 209tcf, which is purespeculation and cannot be supported by any scientific measure.
v. In a similar vein, in section 4.1.6.2 in the BGMP, speculative volumes of gas available from Coal Bed Methane (CBM) are provided, none of which are proven, and the resources have not been shown to be recoverable. Due to severe environmental constraints and water usage

[22] De Kock MO, Beukes NJ, Adeniyi EO, Cole D, Götz AE, Geel C, et al. Deflating the shale gas potential of South Africa's Main Karoo basin. S Afr J Sci. 2017;113(9/10), Art. #2016-0331, 12 pages. http://dx.doi.org/10.17159/ sajs.2017/20160331

[23] C. Geel, C. De Wit, M., Booth, P., Schulz, H-M., Horsfield, B. (2015). Palaeo-environment, diagenesis and characteristics of Permian black shales in the lower Karoo Supergroup Flanking the Cape Fold belt near Jansenville, Eastern Cape, South Africa: implications for the shale gas potential of the Karoo basin. *South African Journal of Geology*

CBM may be an unrecoverable resource which implies that they have limited or no potential due to economic, technological or environmental limitations.

To contextualise the quantity of domestic gas potentially available it is noted that the Integrated Resource Plan (IRP) 2019, South Africa anticipates generating about 11 930MW (15.7% of total capacity) by means of gas by 2030. Currently the country has insufficient proven gas reserves to provide adequate feedstock for the proposed expansion of gas driven turbines over a reasonable economic life span. The country will therefore be dependent upon imported gas, which undermines the basic principles of the BGMP, namely, energy independence, domestic job creation and universal access to cheap energy.

4.2. Regional gas resources.

Much has been written in the BGMP about the vast reserves of gas in northern Mozambique. Section 4.2.3 provides some insight into the quantities of gas available, the stages of development of the on shore and offshore gas fields, the levels of co-operation that exist between the two countries as well as the potential for job creation. The BGMP does not however, address the very important issue of political instability and insurrection in Cabo Delgado, northern Mozambique. The instability in that province began in 2017, and despite SADC and Rwandan military intervention the insurrection is continuing. Due to these activities Total declared *force majeure* in April 2021, halting all onshore development activities.

It is clearly beyond the scope of the BGMP to provide any detailed insight into the possible future political development in Mozambique, but it is neglectful of the authors to ignore the current situation that may continue or even deteriorate in the future, thus rendering Mozambique as a potentially unreliable supplier of gas.

4.3. Global Gas Reserves and Resources.

Using reports from countries and companies with proved reserves of recoverable oil, natural gas, and coal, an analysis by Heede & Oreskes (2015)[24] showed that full production of these resources would use up 160 percent of the world's estimated remaining carbon budget, designed to restrict

[24] Heede, R., & Oreskes, N. (2015). Potential emissions of CO2 and methane from proved reserves of fossil fuels: An alternative analysis. Global Environmental Change, 36.

anthropogenic climate change to equal to or less than 2°C. However, exploitation of existing proved reserves controlled by the private sector alone will not lead to warming above the 2°C limit if it is not accompanied by exploration for and development of new reserves. Future considerations of fossil fuel use should therefore focus not only on reducing private sector contributions but also on reducing contributions from countries that have historically dominated or currently dominate emissions, and especially nation-states with large undeveloped reserves.

In addition, worldwide proved fossil fuel reserves reported in British Petroleum's Statistical Review of World Energy[25] with CO_2 emission factors from the IPCC yields 3,600Gt of CO_2 emissions. This implies that only one twelfth or 8% of known fossil fuels reserves can be utilised to limit global warming to 1.5°C.

Momentum is growing for energy sectors around the world to decarbonise. As of June 2020,[26], 120 countries, 823 cities and more than 1,000 companies, had committed to achieving net-zero carbon emissions and the structure of South Africa's energy sector will need to evolve rapidly to keep pace with global trends.

5. South Africa's international climate commitments

The BGMP shows an obvious lack of consideration on the effect of greenhouse gas emissions and South Africa's international commitments to the Paris Agreement.

In April 2021 the Department of Environment (DEF) released South Africa's draft NDC[27] submission to UNFCCC for public comment. The country *"…warmly welcomed the IPCC's special report on global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways" and commitment itself to be "…consistently been guided by science and equity".* Within the realms of these noble endeavour's the countries proposed update to the initial INDC submitted in 2016, a PPD emission trajectory is maintained with maximum emissions of 398-510 $MtCO_2eq$ being reached by 2025 and reducing to 398-440Mt CO_2eq by 2030. The upper end of

[25] 28 https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energyeconomics/statistical-review/bp-stats-review-2020-full-report.pdf
[26] Price Waterhouse Cooper (2021) Africa Energy Review. The global race to net zero by 2050 is accelerating. Will Africa realise a just transition or become a stranded asset. www.pwc.co.za/energyreview
[27] https://www.environment.gov.za/mediarelease/creecy_indc2021draftlaunch_climatechangecop26

the target range in 2025 represents a reduction over the NDC (2016) pledge of 17%, and the upper end of the target range in 2030 is a reduction of 28%.

With the current indications that the government intends to adopt gas as a transition fuel it is appropriate to evaluate Souths Africa's INDC against the Paris Agreements target of restricting the planet to an average temperature increase to well below 2 ^{o}C and preferably to 1.5^{o}C. It is envisioned that the decarbonization of the South African economy will focus primarily on the electricity sector in the 2020's and moving the transport sector towards low emission vehicles in the 2030's

Applying the IRP (2019) it is realistic that the country will emit 381Mt CO_2 eq per year (assumed 2.4% fugitive gas emissions) by 2030 from electricity generation only. With all other GHG emitting sectors in the South African economy accounting for 231 $MtCO_2$ eq emissions in 2016, to which no significant amendments have been considered in the draft INDC, it is apparent that the country will be hard pressed to achieve its INDC by 2030. Strong and more decisive policies must be implemented that will divert the country away from the continued use of coal as a source of energy and the realisation that gas cannot be a bridging fuel.

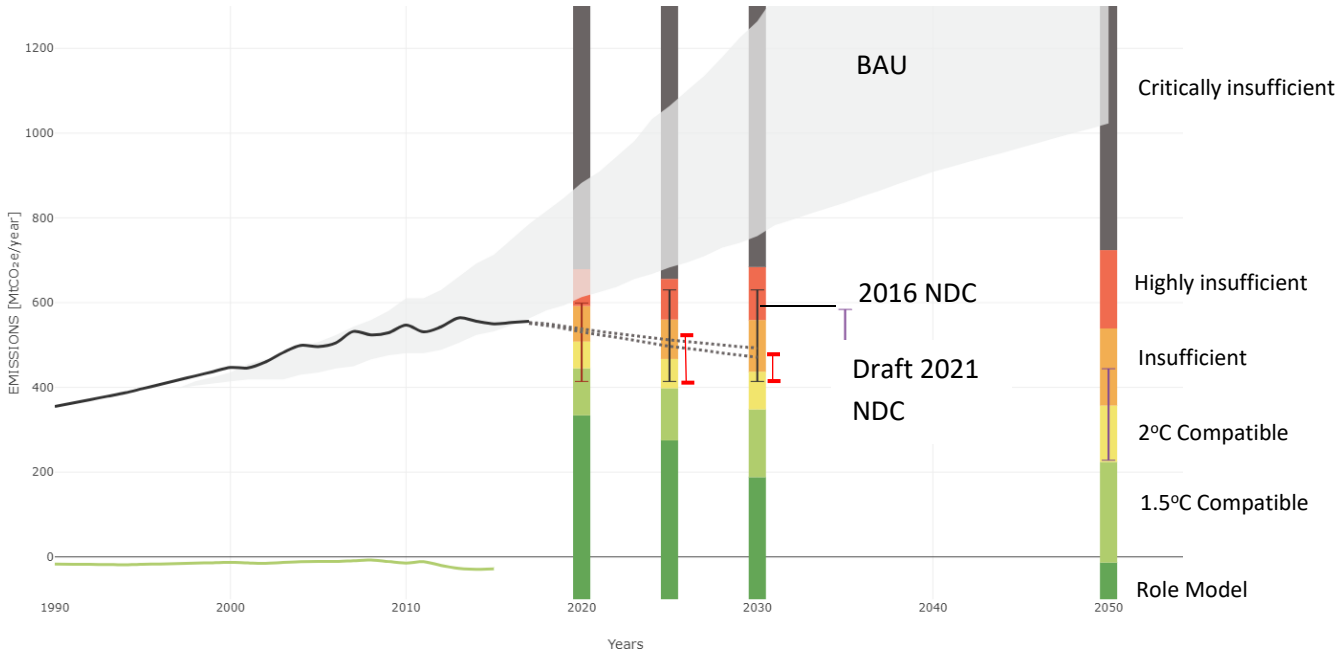

Figure 1. South Africa's emissions trajectory based on 2016 INDC and 2021 draft INDC. (adapted from Climate Action Tracker)[28]

[28] https://climateactiontracker.org/countries/south-africa/

6. Integrated Energy Plan (IEP)

Akom et.al (2021)[29] expressed the opinion that the IEP must include an exhaustive investigation into the gains as well as inadequacies of the entire energy scheme and is therefore intended not only to ensure that the required energy is supplied, but also that the multi-sectorial influences are investigated and dealt with methodically. Accordingly, it is vital to consider the broader objectives of the country and outside influences that typify all sectors in the energy planning process. The intended purpose of an IEP is to provide a roadmap of the future energy landscape for South Africa to guide future energy infrastructure investments and policy development. The IEP analyses current energy consumption trends within different sectors of the economy (i.e., agriculture, commerce, industry, residential and transport) and uses this to project future energy requirements, based on different scenarios.

Currently South Africa does not have an IEP. This document should be produced and updated on an annual basis to take into account relevant recent developments.

7. Alternative energy

The Base Case Gas Master Plan is a flawed document that has been created with the single-minded focus of creating a gas industry in South Africa. Clearly the terms of reference under which the authors of the document were compelled to work were restrictive, thus limiting the scope of the work to consider alternative sources of energy. It is for this reason that the immediate requirements for an updated and inclusive IEP is critical, thereby compelling the DMRE to include all viable alternative energy sources not only for the generation of electricity y also for all sectors of the economy.

Many peer reviewed studies have shown that 100% RE systems are viable, and it is appropriate to quote verbatim from a study conducted in South Africa by Brown et. al (2018

[29] Akom, K., Shongwe, T. and Joseph, M.K. (2021). South Africa's integrated energy planning framework, 2015–2050. *Journal of Energy in Southern Africa* 32(1): 68–82

"We have shown here that all the issues can be addressed at low economic cost. Worst-case, conservative technology choices (such as dispatchable capacity for the peak load, grid expansion and synchronous compensators for ancillary services) are not only technically feasible, but also have costs which are a magnitude smaller than the total system costs. More cost-effective solutions that use variable renewable generators intelligently are also available. The viability of these solutions justifies the focus of many studies on reducing the main costs of bulk energy generation.

As a result, we conclude that the 100% renewable energy scenarios proposed in the literature are not just feasible, but also viable. As we demonstrated in Section 4.4, 100% renewable systems that meet the energy needs of all citizens at all times are cost-competitive with fossil fuel- based systems, even before externalities such as global warming, water usage and environmental pollution are taken into account.

The authors claim that a 100% renewable world will require a 'reinvention' of the power system; we have shown here that this claim is exaggerated: only a directed evolution of the current system is required to guarantee affordability reliability and sustainability."

A plethora of studies conducted in Sub Saharan Africa[30] [31] and South Africa[32] [33] have expressed similar conclusions and a small sample is included for ease of access.

At no point in the GMP is the potential competition of renewable energy (RE) considered. As RE technology improves and gains increasing acceptance as a viable utility-based source of energy, the unit costs of electricity have reduced to a point where the International Energy Agency (IEA)[34] made the following announcement in October 2020. *"The world's best solar power schemes now offer the "cheapest…electricity in history" with the technology cheaper than coal and gas in most major countries."*

Of significance to this debate are the job creation opportunities, and economic growth that are associated with the implementation and expansion of RE. The PWC Africa Energy Review (2020)[35] reported that average employment creation across all renewable energy technologies has been found to be four to five times greater than that of conventional energy. Measured in terms of investment, the fossil fuel industry creates 5.3 jobs per US$1 million invest13d, whereas the clean

[30] Ouedraogo NS. Africa energy future: alternative scenarios and their implications for sustainable development strategies. Energy Pol 2017;106:457–71.
[31] Szabó, S., Bódis, K., Huld, T. & Moner-Girona, M. (2013). Sustainable energy planning: Leapfrogging the energy poverty gap in Africa. *Renewable and Sustainable Energy Reviews* 28 500–509
[32] Winkler H. Energy policies for sustainable development in South Africa. Energy Sustain Dev 2007;11:26–34.
[33] Baruah, D.C. & Enweremadu, C.C. (2019). Prospects of decentralized renewable energy to improve energy access: A resource-inventory-based analysis of South Africa. *Renewable and Sustainable Energy Reviews* 103 328–341
[34] https://www.carbonbrief.org/solar-is-now-cheapest-electricity-in-history-confirms-iea
[35] Price Waterhouse Cooper. (2020). Africa oil and gas review 2020. Energising a new tomorrow. https://www.pwc.co.za/en/press-room/africa-oil-and-gas-review-2020.html

energy sector (renewable energy and energy efficiency) creates over three times this amount at 16.7 jobs per US$1m invested.

A similar statement was included in the PWC 2021 Energy Review[36], in which it was reported that employment creation in the green energy sector is also not limited to direct employment and of particular relevance to Africa is the potential boost in non-energy jobs through broader economic activity in rural communities where improved energy access through mini-grids and off-grid solutions will impact economic productivity.

It is an absolute social justice matter that the transition from fossil fuels to RE must be implemented in a just and socially acceptable manner. With the imminent closure of many of South Africa's coal fired power stations as well as the demise of the coal industry, much of the re-skilling and re-employment of the work force will occur organically as people retire and resign. Nobody is saying that the transition will occur over night, but it must begin somewhere.

What is the rationale behind the DMRE's proposal to transition from a coal-based economy to gas, at substantial cost and risk to the economy and environment, and then to implement a second transition from a gas-based economy to RE by 2050 to fulfil South Africa's international climate change commitments?

Taking cognisance of the international trends, rapid technological changes as well as direct and indirect economic benefits of transitioning to RE, it is unnecessary to consider gas as a transition source of fuel.

8. Other shortcomings of the GMP

Having presented some clarity on some of the inadequacies of the BGMP it is appropriate to consider some of the shortcomings of the document.

i. No market research has been conducted to determine the private sector's acceptance of utilising gas as an energy source. Similarly, it has also been assumed that SOE, will also embrace the proposed transition to gas. It is not known how much the potential offtake of

[36] Price Waterhouse Cooper (2021) Africa Energy Review. The global race to net zero by 2050 is accelerating. Will Africa realise a just transition or become a stranded asset. www.pwc.co.za/energyreview

gas would be and at what cost would the offtake be competitively priced with other forms of energy e.g., renewable energy and renewable energy plus storage.

The PWC Energy Review (2021) reports that although natural gas will enjoy increasing demand and strong pricing in the medium term, Africa is not seen to be a significant supply-side player, with Russia, the US and Qatar seen as the major beneficiaries. These long- term forecasts have not been addressed in the BGMP.

ii. No time timelines from conceptualisation to delivery for the implementation of a gas industry. Typical lead times for the development of a gas-based industry, including production facilities, LNG plants, transport etc may extend from 5 to 15 year compared to other forms of energy such as renewable energy which may become operational within a maximum of two years - and less - from concept to key in hand.

The risk of creating stranded assets is high as can be illustrated by the extension of the Richards Bay Coal Terminal (RBCT) in 2011. Extended at a cost of R1.2 billion[37], to handle 91 million ton of coal per year, the maximum utilisation of the facility was 76.5 million tons in 2017 and is unlikely to achieve these volumes again. A steady decline of coal exports has rendered the Phase 5 expansion of the RBCT redundant and stranded[38]. A similar scenario awaits the proposed development of nascent gas industry in South Africa as international trends away from fossil fuels accelerates.

iii. No concise financing plan is provided in the GMP. As the world transitions to Net Carbon Zero by 2050 international funding for fossil fuel development and infra structure is becoming more difficult to access and more expensive. Private sector funding is unlikely to provide finance for investments that lack a viable and foreseeable return and the national fiscus has more pressing obligations than financing a high-risk fossil fuel investment.

Globally, developed economies are beginning the shift away from fossil fuels by accelerating green policies and investments as 'carbon neutral' and 'net zero' emissions targets have become embedded in national policies and legislation in order to align with

[37] https://www.engineeringnews.co.za/print-version/richards-bay-coal-terminal-expansion-and-coal-line-south-africa-2009-02-06
[38] https://www.news24.com/fin24/Economy/billions-lost-as-coal-exports-hit-multi-decade-lows-20220126

the goals of the Paris Agreement (PWC, 2020[39]; Robertson, 2020[40]; Huxham, et al., 2020[41]; IRENA, 2020[42]). Unlike demand shocks like COVID-19 where prices and consumption may recover, this low carbon transition will bring long-term structural 31 changes, influencing the value of physical and financial assets, tax flows, jobs and skills. These risks are known as 'climate transition risks' (Huxham, et al., 2020).

Developed economies are becoming increasingly energy efficient as the energy intensity of a given unit of GDP has declined in key markets such as Europe and Japan (Robertson, 2020). Furthermore, gas is no longer considered as a transition fuel as grid-scale batteries are now cost competitive with gas, reducing the need for gas for peaking power purposes (Robertson, 2020). According to the IEA, primary energy demand under net zero emission targets falls by 17% between 2019 and 2030, with emission targets likely to fall more substantially by 2050. Huxham, et al (2020) note that as the demand for fossil fuel commodities like coal, oil, and gas decline, so does the demand for related infrastructure, such as ports, rail lines and pipelines. Lower demand is likely to result in lower prices (Huxham, et al., 2020). These long-term structural changes will drive global demand down for oil and gas and negatively impacting export volumes for Africa (SystemIQ[43], 2020; PWC, 2020). As Robertson (2020) states, 'the first rule of business is to listen to your customer.' Thus, developing economies should acknowledge that there is an energy shift underway, and should reconsider their reliance on fossil fuel exports (PWC, 2020).

As the PWC (2020) report notes, this market disruption is taking place against increasingly fragile African economies which depend on fossil fuels for foreign revenue. The market shift has impacted oil and gas companies as evidenced by the large losses, divestments, lay-offs and downscaling that has occurred (PWC, 2020). Companies such as BP, Chevron, Shell, Total and Eni have also written off an estimated R1267 billion in reserve assets whichare now assumed uneconomical (PWC, 2020). The accountants and auditors of major energy firms are beginning to acknowledge the transition, as Total, Repsol, Shell and BP now base their financial statements on price assumptions (at around $55 - $65 per barrel)

[39] PWC, 2020. *Africa Oil and Gas Review - Energising a new tomorrow,* s.l.: PWC.
[40] Robertson, B., 2020. *Flogging a Dead Horse - Why the Gas Industry Can't Stimulate the Economy,* s.l.: Institute for Energy Economics and Financial Analysis.
[41] Huxham, M., Anwar, M. & Nelson, D., 2019. *Understanding the Impact of a Low-Carbon Transition on SA,* s.l.: Climate Policy Initiative.
[42] IRENA, 2018. *Global Energy Transformation: A roadmap to 2050,* Abu Dhabi: International Renewable Energy Agency.
[43] SystemIQ, 2020. *Musina-Makhado Special Economic Zone: An alternative, higher impact model,* London: SystemIQ.

that are more conservative than their peers (Grant, 2020[44]). BP's auditors, Deloitte, explicitly noted in 2019 that its previous impairment prices were not consistent with the Paris goals, and BP subsequently amended its assumptions in the second quarter of 2020 (Grant, 2020). Deloitte (2021)[45] notes that even the industry accelerated its energy transition, with many oil and gas companies announcing net-zero goals at the peak of the pandemic. In fact, supermajors like BP and Shell strengthened their net-zero goals by targeting reductions in oil and gas production and investment by up to 40% over the next decade (Deloitte, 2021).

iv. It is of interest to note that of the seventy references cited in the BGMP, only four are sourced from peer reviewed published journals, the remainder being internal government correspondence, private interviews and memos or oil and gas industry-based articles and reports. Most of the references are inaccurately cited and the documents could not be sourced. This observation illustrates the poor development and construction of the BGMP.

Other applicable gas utilisation studied that have also been commissioned by departments within the South African government have not been included in this GMP. A detailed study[46] was completed by the Department of Energy (DE) in cooperation with the government of Japan in 2017, which outlined, in more detail, the potential of expanding the South African gas industry.

Whilst conduction the Strategic Environmental Assessment for the development of a phased gas pipeline network in South Africa by the CSIR[47], a detailed review of the potential utilisation of gas was included in Appendix 1 of the final SEA report. There is no cognisance of this study included in the GMP.

Similarly, the SADC and DBSA (2021) Draft Report: The SADC Regional Gas Master Plan (RGMP) – Phase One Gas Utilisation Report[48] has not been reviewed and incorporated into the GMP. It does seem to be counterproductive that the South African GMP being developed

[44] Grant, A., 2020. *The Impair State: The Paris Agreement starts to impact oil & gas accounting,* : Carbon Tracker.
[45] Deloitte, 2021. *2021 oil and gas industry outlook,* s.l.: Deloitte.
[46]Department of Energy Republic of South Africa Study on Natural Gas Utilisation Final Report http://open_jicareport.jica.go.jp/pdf/12302097.pdf
[47] Department of Environment, Forestry and Fisheries, 2019. Strategic Environmental Assessment for the Development of a Phased Gas Pipeline Network in South Africa. CSIR Report Number: CSIR/SPLA/EMS/ER/2019/0077/B. ISBN Number: ISBN 978-0-7988-5649-2. Stellenbosch and Durban.
[48] SADC and DBSA (2021) Draft Report: The SADC Regional Gas Master Plan (RGMP) – Phase One https://www.dbsa.org/sites/default/files/media/documents/2021-4/SADC%20DBSA%20RGMP%20Phase%201%20Consolidated%20Report.pdf

does not dove tail with a similar document being developed for the purposes of coordination and cooperation within the SADC region.

It is unexpected that the three studies cited above have not be incorporated into this GMP.

9. Conclusions.

In conclusion, the continued utilisation of gas as a transition fuel as proposed in the BGMP as a policy document emanating from the Department of Minerals and Energy, is incompatible with climate stability and the goal of rapid decarbonization that is required to comply with South Africa's stated climate change commitments.

Therefore, The Green Connection, for the reasons stated above, has no hesitation in rejecting the Base Case Gas Master Plan in its entirety.

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