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Cluster 2Economic Impact Assessment: Tetra4 (Pty) Ltd Cluster 2 Expansion

CLUSTER 2ASSESSMENT OF THE ECONOMIC NEED AND DESIRABILITY FOR TETRA4'S CLUSTER 2 EXPANSION FOR ENVIRONMENTAL AUTHORISATION PURPOSES

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1 CONTENT

Acronyms

CAGR
Compound Annual Growth Rate, 22, 25
CNG
Compressed Natural Gas, 5
COP
Conference of Parties, 11, 36
ECIA
Economic Impact Assessment, 41
EIA
Environmental Management Programme, 7, 8
GDP
Gross Domestic Product, 12, 14, 15, 16, 17, 18, 19, 29, 38, 39, 40, 43, 53, 60
GGP
Gross Geographical Product, 2, 12, 43, 50, 51, 53, 68, 78, 88, 98, 99
GHG
Greenhouse Gases, 11, 13, 23, 34, 36, 37
GTL
Gas-to-Liquids, 31
IDP
Integrated Development Plan, 48, 50
IRP
Integrated Resource Plan, 11
LED
Local Economic Development, 48, 60
LNG
Liquefied Petroleum Gas, 5, 7, 11
MRI
Magnetic Resonance Imaging, 21
MW
Megawhatt, 11
NDP
National Development Plan, 9
OECD
Organisation for Economic Cooperation and Development, 56
PIC
Public Investment Commission, 14
SARB
South African Reserve Bank, 38
SLP
Social and Labour Plan, 59, 108
VAT
Value Added Tax, 58, 59

2 DECLARATION OF INDEPENDENCE BY SG MULLER T/A STRATEGY4GOOD ('S4G")

The following report has been compiled by SG Muller t/a Strategy4Good. Strategy4Good endeavoured to record the economic need and desirability aspects independently and faithfully, and hereby declares they have no commercial interest in the proposed development. Although the applicant is ultimately responsible for paying Strategy4Good's fees, Strategy4Good is contracted to Environmental Impact Management Services (EIMS), which is an independent Environmental Assessment Practitioner, thus ensuring that the applicant is in no position to effect any undue influence on Strategy4Good's findings.

Where Strategy4Good reports on the findings of other sources or specialists, or where S4G restates the Applicant's own views, it is clearly stated.

S4G is a specialist strategy and economic development consultant and has undertaken in excess of fifty economic impact assessments in support of obtaining licenses to operate in the minerals and petroleum sectors. The author, SG Muller, holds a B Admin MBA from the University of Stellenbosch and had undertaken numerous independent socio-economic impact assessments during his career.

SG Muller

3 BACKGROUND TO THE PROJECT

Renergen is an emerging producer of helium and liquefied natural gas (LNG), with existing production and sales of compressed natural gas (CNG). Tetra4 (Pty) Ltd ("Tetra4"), is a wholly owned subsidiary of Renergen Ltd ("Renergen"), a company listed on various stock exchanges. Renergen's major asset is Tetra4, and the latter is the only holder of an onshore petroleum production right in South Africa. Tetra4 is also the first helium developer with proven reserves in SA.[1]

The Group focus on the commercialisation of the Virginia Gas Project, which is comprised of an executed and granted production right for 187 000 hectares of gas-fields across Welkom, Virginia and Theunissen in the Free State. It is understood that he source of the Virginia Gas Project's methane is primarily microbial, originating from deep within the Witwatersrand Supergroup. The methane find is remarkable as the resource had been in existence for millions of years and lay undiscovered deep within Earth's crust (the methane is released because of bacteria in the water). This means that Tetra4's methane is largely biogenic and, as such, could be regarded as a continuous regenerative resource (i.e. renewable).

The above-mentioned resource is being developed in phases and Tetra4 had already completed Cluster 1, which comprised of an investment thus far of just under R1 billion (referred to as cluster 1).

[1] https://www.renergen.co.za/renergen-rockets-as-it-reports-sevenfold-jump-in-proved-helium-reserves/#:~:text=The%20gas%20group%20said%20on,much%20as%2018%25%20to%20R41.

To view its recent activities, as reported by Renergen dated 30 September 2021, see the below inset from its quarterly report.

Figure 1: Update of Renergen Group Activities to September 2021

Note 1: Source https://www.renergen.co.za/asx-quarterly-activity-report-september-2021/

Tetra4 is in the process of developing the gas field using the existing wells – known as the Cluster 1 project – in conjunction with a drilling programme for future wells. Construction of the Cluster 1 gas gathering pipeline is now underway and due to be completed shortly while the LNG and LHe processing facility is currently being commissioned.

It is Tetra4's objective to expand its existing production capabilities through the implementation of the Cluster 2 LNG/LHe processing facility. The overall project consists of two main components namely, gas gathering, and the LNG/LHe process plant.

IN THIS ASSESSMENT WE TREATED THE LIQUIFIED NATURAL GAS "PRODUCT" ECONOMICALLY AS PART OF THE NATURAL GAS SECTOR IN ORDER TO PUT THE PRODUCT IN A WIDER ECONOMIC PERSPECTIVE, AND WE FOLLOWED THE SAME PRINCIPLE WITH THE "LIQUIFIED HELIUM" PRODUCT – BY GROUPING IT UNDER HELIUM.

As is commonly known liquified gasses can be degassed, and thus by liquifying natural gas Renergen makes it possible to enter the global LNG market. Natural gas in liquid form is compressed almost 600 times, enhancing the economic viability of transportation of this commodity.

4 LEGISLATIVE AND POLICY BACKGROUND

4.1 REGULATORY ENVIRONMENT PERTAINING TO IMPACT ASSESSMENTS

4.1.1 SUSTAINABILITY REGULATIONS

The following sets of South African Government regulations give context to the economic impact assessment.

a. First, as part of the Environmental Impact Assessment (EIA) /Environmental Management Programme (EMPr) process, an alternative economic land use analysis needs to be undertaken to determine whether a proposed development in the energy sector is to the net benefit of the economy. The requirement of this analysis is encapsulated in Regulation 50(c)[2], which has two distinct components - the first being a straight analysis of the economic value of land between a mining or gas production project and the predominant alternative land-use; and the second being an opinion

[2] Guideline For The Compilation Of An Environmental Impact Assessment And An Environmental Management Programme To Be Submitted With Applications For A Mining Right In Terms Of The Mineral And Petroleum Resources Development Act, 2002, (Act No. 28 Of 2002) (The Act)". Regulation 50.

on the sustainable development quality of the project relative to the alternative land-use;

b. Second, the Guideline On Need And Desirability In Terms Of The Environmental Impact Assessment (EIA) Regulations, Notice 819 of 2014, provides a number of key economic aspects that an EIA has to cover in order to illustrate the need and desirability of a proposed development;
c. Third, National Environmental Management Act (NEMA – Act No. 107 of 1998) itself specifies in its Preamble that "*sustainable development requires the integration of social, economic and environmental factors in the planning, implementation and evaluation of decisions to ensure that development serves present and future generations".* It furthermore states that *"the social, economic and environmental impacts of activities, including disadvantages and benefits must be considered assessed and evaluated, and decisions must be appropriate in the light of such consideration and assessment*.

4.1.2 GAS ACT, 2001

The objectives of the amended Gas Act of 2001 strongly support the development of gas projects such as that of Tetra4. The objectives are to:

- Provide for the promotion of the orderly development of the gas industry;
- Enhance the national regulatory framework;
- Promote broad-based black economic empowerment;
- Provide for socio-economic and environmentally sustainable development;
- Provide for new developments and changing technologies in the gas sector;
- Facilitate gas infrastructure development and investment;
- Provide for cooperation between the private and public sectors in the gas industry;
- Strengthen enforcement and improve compliance;
- And to provide for matters connected therewith.

4.1.3 GAS MASTER PLAN

Adding to the above sustainability regulatory section, the Gas Master Plan for SA is an important consideration and a short paragraph that indicates its relevance to SA is given below.

The SA Government has published a Gas Master Plan in December 2021 for comments from the public. The background to the Master Plan is the following (quoted directly from the plan): "The National

Development Plan (NDP) envisions that by 2030 South Africa will have an energy sector that promotes economic growth and development through adequate investment in energy infrastructure. At just 2.6% of the country's total energy mix, South Africa's natural gas market is small, but with all its inherent benefits, it has the potential to completely change the economy by stimulating economic growth and development, stability, and job creation. The meaningful addition of natural gas to the country's energy mix will rejuvenate an overburdened, out-dated energy infrastructure and reduce cyclical energy shortfalls. Perhaps even more importantly, it will stimulate the economy by allowing business and industry to lower their energy and operational spend while also creating significant numbers of new jobs and skills development opportunities. Considering that nearly 90% of South Africa's existing natural gas demand is supplied by a single entity, namely Sasol Gas, the associated economic and employment risks of limited supply options, development and sourcing of alternative natural gas resources are high. It is imperative to ensure economic and employment stability within the natural gas sector by introducing more suppliers. Southern Africa's gas potential has been revealed by major discoveries that, when developed, widen options for greater regional energy trade. South Africa's unconventional gas potential remains to be quantified but raises the prospect of possible domestic production in the longer term. Globally the natural gas industry has moved into a supply surplus, favouring a larger role for gas as a clean fossil fuel in many countries' energy policies. A challenge in developing the gas sector is to bring gas demand and supply on stream at the same time and spread geographically to stimulate broader localized demand through South Africa. Without such localized gas demand, it is difficult to develop distributed gas supply and without such distributed gas supply it is difficult to develop localized gas demand. One way of breaking this impasse is to create significant "anchor" gas demand through the development of a gas-to-power programme. In pursuit of adding generating capacity, lowering carbon emissions, enhancing energy security and supporting industrial development, South Africa has taken the first steps in a gas-to-power programme to be executed under the Integrated Resource Plan 2019, aiming to increase the national energy mix natural gas contribution from 2.6% to 15.7% by 2030."

4.1.4 REGULATORY CONCLUSION

As with any large-scale development that triggers an Environmental Impact Assessment, Tetra4 must comply with a broad scope of laws and regulations. The above short paragraphs were not intended to do justice to all the regulations, but is stated here as acknowledgement that this report need to comply with these regulations.

In the case of this report the critical issues from a compliance perspective are the following:

a) Stating the positives of the economic development to juxtapose the potential harmful impacts on society and the environment.
b) Stating whether current economic interests may be negatively impacted.
c) Stating whether the current land-use is not better economically as it stands.

5 NEED AND DESIRABILITY SECTION

As shown in the section immediately preceding, a need and desirability assessment is required for the Tetra4 expansion.

5.1 EXECUTIVE SUMMARY

Renergen is Tetra4's holding company and the group is an emerging helium and domestic natural gas producer. Renergen holds the rights to natural gas fields in the Free State, South Africa, and it is important to note that these gas fields have unusually high helium concentrations.

The necessity for this economic need and desirability assessment is triggered by Tetra4's proposed Cluster 2 expansion in terms of South Africa's regulatory requirements to obtain an environmental authorisation for the planned activities. Tetra4's Cluster 2 expansion is the result of the company desiring to expand its existing helium and methane gas production and beneficiation within its existing Production Right area.

The probable and proven natural gas reserves as put forward by Renergen is of significant volumes, and thus the proposed expansion could be viewed as one of the more strategic investments in South Africa at present from an energy perspective. It certainly has the potential of being one of the largest business expansions in the Matjhabeng Municipality in recent years.

Table 1: Renergen Resources and Reserves

In Billion Cubic Feet		Mar-19	Sep-21	% Change	
Methane Proven	Phase - 1P	40.8	215.1	***427%***	BCF
	Phase - 2P	**138.9**	**407.0**	***193%***	
	Phase - 3P	284.2	600.1	***111%***	
Helium Proven	Phase - 1P	1.0	7.2	***610%***	BCF
	Phase - 2P	**3.4**	**13.6**	***298%***	
	Phase - 3P	6.9	20.0	***192%***	

Source 1: Tetra4 provided information

Theoretically, if 600 billion cubic feet of gas (see phase 3P above) is converted over 100 years to electricity it could cover SA's current installed capacity of approximately 60 Gwh with ease. However, this is theoretically only as the process of conversion poses its own challenges.

The key positive findings in favour of the need and desirability of Tetra4's expansion are the following:

1. **Domestically sourced gas.** The value of an own sourced gas plant cannot be over-emphasized. The biggest criticism of most nascent gas projects aiming to alleviate South Africa's electricity crises is that the input costs (thus imported gas) may be exorbitantly expensive and is an obvious inflationary risk to SA. In the case of the Tetra4 development the gas is captured from local geological sources thus avoiding the disadvantage of being a price-taker. However, cognisance is taken that gas may well be sold at international commodity prices, but a locally sourced gas can give SA the flexibility around pricing.
2. **The establishment of a self-sufficient helium industry in SA.** As is known SA imports all its helium, and therefore this development could result in the establishment of a self-sustaining helium industry in the country which have several benefits, one of which is the considerable foreign exchange savings, the other becoming a major exporter of helium. This is significant considering that helium is a scarce resource and whilst the gas' demand continues to rise, it's global supply could be under threat. (See sections below for discussion on the demand and supply for Helium).
3. **The contribution to a more competitive natural gas sector in SA.** It is discussed in the sections below that for historic reasons the gas sector in SA is small and uncompetitive. Based on the consideration that the establishment of a gas sector in SA is viewed by many as a necessary step to meet SA's COP 26 GHG emissions reductions, then it follows that Tetra4's expansion ought to be seen as very needed and desirable. (Natural gas is a better energy source than coal due to gas' lower CO_2 emission rates). There is every reason to believe that with Tetra4's methane resources and reserves, it could be a significant contributor to the competitiveness in SA's natural gas sector.
4. **Potential for cleaner power generation.** The LNG to be processed by Tetra4 could also be used as a source of power generation in South Africa. The significance of this is that the Government of South Africa in the various versions of its integrated resource planning has made it clear that natural gas as a source of power generation is highly desirable. In particular, the various IRP documents highlight the necessity of generating almost 6000 MW of the national grid from gas technologies soon. The discovery of the gas fields in the Free State, and the subsequent exploitation thereof by Tetra4 could therefore be seen as opportune for the SA economy.

5. **Significant positive economic impacts.** Econometrically, there is no doubt that Cluster 2 will contribute significant additions to GDP and employment in the local economy. Cluster 2's GDP contributions from the Tetra4 expansion after multipliers are potentially up to 13% relative to the Matjhabeng GGP, and employment is nearly 5.8% of that base. (Note that these ratios are *relative to* Matjhabeng because much of these benefits will leak out of the local economy). Captured as an addition *within* the Matjhabeng economy it is likely to be 6.9% of GGP and 1.5% of current employment.

   In addition to the aforementioned, Tetra4 is planning on investing approximately R13 billion in South Africa over its Cluster 2 investment period of 2 years. After considering the potential leakages through exports of the Cluster 2 investment, and adding in investment multipliers, it is estimated that the project's investment amount relative to Matjhabeng' total gross geographic fixed capital formation (new investment plus depreciation) would amount to 57%. This is a significant increase, and its positive impact cannot be overstated.

   A further positive economic aspect is that of the contribution to SA's current account in its balance of payments. The significance of this aspect is that without earning hard-currency through exports South Africa would not be able to import goods and services without depleting its foreign exchange resources. South Africa over the last 10 years has had a negative current account of approximately R127 billion per annum on average. Therefore, the estimated turnover of R6 billion per annum of Tetra4 could contribute strongly to the current account of the country given that most of this turnover would either be exports or import substitution.

6. Furthermore, **the likelihood of future expansions** remains, and these increases will add further value to the economy.

The argument against, or perhaps in the neutral category is the following:

Detractors of prioritising natural gas over "green" renewable energy point out two arguments against natural gas over green energy:

1. Natural gas still emits CO_2, and hence the problem of mostly eradicating greenhouse gas emissions globally remains unresolved[3] if natural gas continues to be a source of energy.
2. In addition to this, natural gas is composed of 70-90% methane, a potent greenhouse gas and major contributor to global warming. The argument is put forward that 2-3% of methane escapes during processing, transmission, and distribution. These fugitive emissions add to global warming.

Proponents of cleaner energy in South Africa have vociferously proposed that the country bypasses natural gas developments in its entirety and concentrates only on renewables like solar, wind and hydro. (It must be noted that helium is NOT((a GHG because if anything, it will cool the earth's atmosphere, and due to its lightweight properties, it escapes into space and does not trap heat in the atmosphere.)

Despite the above concerns, the overall conclusion based on this assessment is that the economic need and desirability of Tetra4's expansion is significantly high. The main reasons are: 1) The establishment of an onshore natural gas and helium processing facility, 2) the urgent need to replace coal as a source of energy in SA, and 3) the significant economic benefits proposed.

5.2 ASSESSMENT OF THE ECONOMIC NEED AND DESIRABILITY OF TETRA4 EXPANSION

5.2.1 LIMITATIONS AND ASSUMPTIONS OF ECONOMIC IMPACT ASSESSMENTS

Prior to stating the findings of this economic assessment, several limitations and assumptions to the statistics presented below in Table 2 below need to be mentioned:

a. Although Tetra4's Cluster 1 production is in progress (thus there is direct evidence that the enterprise is operational and viable), the Cluster 2 economic impact is based on an intent, namely Tetra4's intent to generate the output and employment as is discussed below. The

Pounds of CO2 emitted per million British thermal units (Btu) of energy for various fuels

Coal (anthracite)	228.6
Coal (bituminous)	205.7
Diesel fuel and heating oil	161.3
Gasoline (without ethanol)	157.2
Propane	139.0
Natural gas	117.0

Source: eia.gov

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eventuation of these benefits is reliant on an economically viable Tetra4, an assumption that is made in this report.

b. As a sub-section of the economic viability, it is assumed that Tetra4 will be fully funded for its Cluster 2 project. (News of the PIC willing to invest R1billion has surfaced in April 2022, which is a vote of confidence by the PIC in the Tetra4 expansion.)
c. Accepting of the above assumption, the next limitation is the ratios and multipliers used in the economic valuation. Although care was taken to use acceptable economic science, there is always a risk that some of the estimates may not eventuate in practice, and hence that the actualised economic and employment benefits may be much less. This is a limitation over which no assessment has control but needs to be mentioned.
d. A further important limitation is that multipliers on a national level are different compared to a municipal level. This is due to the "leakages" from a local economy, for example income earned by a mine is often distributed to a region outside the enterprise's' municipality, or procurement if from outside the region, or salaries and wages are not always spent in a local economy. For this reason the direct impact is used as a barometer of impacts on the local economy and when multipliers were included those ratios were stated as *relative to* the local economy. However, despite this limitation the economy-wide benefits compared to the local base is instructive as it allows a competent authority a better perspective of the total local and national benefits relative to the local base.
e. The gas multipliers for a well-established gas driven economy will be different to that of SA and for this reason, where possible, multipliers were adjusted to assume a more mature gas industry in SA.
f. The economic impacts are calculated on the supply side of the economy in an optimal year. Thus, GDP is calculated as the sum of salaries and wages, depreciation and gross operating profit for the optimal year.
g. For a long-term project such as Tetra4 the net present value of economic benefits could also have been used, but it has been shown that using the optimal year methodology (which we use), is equally correct, and easier to understand for the lay reader.
h. The investment of the project is used separately as year 1 and 2 increases in GDP.
i. As the world had experienced, outlier events such as the impact of Covid-19 are not included in this assessment.

5.3 FACTORS IN FAVOUR OF THE ECONOMIC NEED AND DESIRABILITY

5.3.1 POSITIVE ECONOMIC IMPACTS

This section outlines the positive economic impacts of Cluster 2 based on an analysis of the potential economic output of the expansion.

5.3.1.1 Assessment of the economic data in Table 2 below

The economic impact is based on the optimum production year principle, which is one specific year. In this regard, we selected 6 years from today, namely 2028. The basis for selection is that in that year Tetra4 will be in full production as is anticipated in the Cluster 2 expansion.

Table 2: Economic impact assessment basis of assessment

Phase 2		Row #
Assume steady state date	2028 Total	
Daily Volume - 1000 Standard Cubic Feet	44 000	1
Yearly Volume - 1000 Standard Cubic Feet - 265 workdays	9 900 000	2
US Dollar Price per 1000scf	#N/A	3
Turnover in US Dollars (incl maint days) pa	360 000 000	4
Rand:USD Exchange (2028)	18.4	5
Turnover in Rand pa - Rand million	6 641	6
% GDP:Turnover - Estmated natural gas	55%	7
GDP (Economic Value Added by Tetra 4) pa Rand Million	3 653	8
Add GDP Multiplier	1.87	9
National GDP Addition - R Million	6 822	10
Estimated Direct Employment	1 218	11
Employment Multiplier	3.80	12
Total Employment	4 623	13
GGP Matjhabeng - 2028 Est (Rand Million)	53 221	14
% relative to GGP including mulitpliers	12.8%	15
Estimated Employment in Matjhabeng	80 211	16
% Additional employment relative to Matjhabeng	5.8%	17
New Investment over 2 years (Rounded off) - Rand Million	13 000	18
Deduct for imports (Equipment, Fabrication and Installation)	6 500	19
Annualise (Above investment over two years)	3 250	20
Estimated national investment multiplier	1.87	21
New investment after leakage and added multipliers per annum	6 078	22
Average investment in Matjabeng per annum	10 644	23
% New Investment relative to Matjabeng Economy pa	57%	24
Average Current Account last 10 years	(127 176)	25
Tetra4 potential Mitigation to Current Account	6000	26
Tetra4 potential Mitigation to Current Account %	5%	27

Source 2: OWN CALCULATIONS

Please note that the mix of LNG to Helium may change from time to time depending on demand. The current mix of the resource is circa 4% Helium and 96% Methane/LNG.

The key findings are outlined below.

- In row 8 in Table 2 above we show that in an optimal year for Cluster 2, Tetra4 could add an additional R3.65 billion to the local economy. Including multipliers, this additional GDP could increase to R6.8 billion. Relative to the Matjhabeng economy, this is a 13% addition to GDP. Subject to economic multiplier leakage, this is a significant additional amount to the local economy.

- Row 11 shows that an additional 1 218 jobs could be created, and after multipliers this could amount to 4 623 jobs throughout the country. Relative to the local economy, this is an addition of just over 5% and needs to be considered as a significantly positive impact.
- The employment multiplier is higher than the GDP multiplier because the gas and helium industry is capital intensive, meaning its cost per job created is high, and as the cost per job in downstream industries are lower, thus the multiplier is in favour of job-creation downstream. In simple terms this means that one job created by Tetra4 has the potential of creating almost 4x as many formal jobs.
- A further factor is that the project could save SA R6.6 billion in foreign exchange per annum – foreign exchange earnings in a stable currency are important for a country as it is an indication of wealth – the more stable currency a country possesses, the higher the quality of its financial standing in the world which results in better trading relations and less expensive cost of capital.

Cognisant of the assumptions and limitations, there cannot be any doubt that the Cluster 2 Expansion can only be significantly positive from an economic perspective, thus the perspective of quantitative economics benefits.

5.3.1.2 EXPLANATION OF NOTES IN ABOVE TABLE

1. The estimated volume of processing per day is shown in the first row. This information is sourced from a presentation made by Renergen and the link is included in the graphic below.

Source 3: https://www.renergen.co.za/virginia-gas-project-reserves-resources-update/

2. This row was simply multiplying the day's output by the days of the year, after making provision for break-downs and maintenance days, to result in the annual volumes. This is obviously done as an economic analysis is done on an annual basis.
3. The prices for methane and helium in 2028 is conservative as these are today's prices as indicated by Tetra4 presentations. The prices used were US Dollar Price per 1000 scf of 15 and 250 for LNG and helium respectively.
4. This is simply volume x unit prices.
5. In this row we project the rand to weaken by 3% per annum against the US Dollar. The basis is simply the expected inflation differential between SA and the United States (even though at the time of writing this report there seems to be an aberration in inflation rates due to Covid's impacts.)
6. In this row we simply state the potential Rand Turnover in 2028.
7. This row is the estimated percentage of GDP to Turnover. The GDP of an enterprise (on the supply side) is in short, the sum of EBITDA and Salaries and Wages. Why is GDP the equivalent of EBITDA and Salaries and Wages? This is because procurement from an external enterprise, be that electricity or insurance services, is recorded as income to that third party and if

included in a GDP total it would amount to double counting in an economy. For a large economy, of which SA is one, a GDP:Turnover statistic is stable over years due to the inherent structure of such an economy. Because Tetra4 is not in full production it would be difficult to estimate its "GDP" (note a company's "GDP" is also very similar to its Economic Value Add). Thus, using historical GDP:Turnover[4] ratios would yield good enough results to evaluate this project's economic need and desirability. However, because SA does not a well-established natural gas sector (this sector is combined with the electricity sector in SA's economic data), we relied on our own calculations[5] to determine a GDP:Turnover ratio appropriate for this assessment. (We combined data from the United States of America and South Africa.) We concluded that a 55% GDP:Turnover ratio is an acceptable ratio for the purposes of this assessment.

8. This row returns the potential GDP produced by Tetra4 to be added to the SA economy.
9. This row adds an estimated multiplier to the direct increase in GDP produced by Tetra4. The multiplier works on the basis that as the GDP in an industry increases, there will be knock-on demand from other sectors (e.g. Tetra4 will procure goods and services), which leads to an indirect increase in GDP. The additional salaries and wages then earned throughout the economy will result in increased consumption in the economy, and hence what is termed an "induced" impact is put into effect. Together the direct, indirect and induced impacts are the economic-wide impacts. We concluded that a 1.87 is an acceptable GDP multiplier for the purpose of this economic need and desirability study.[i]
10. This row is the product of the GDP multiplier and the direct GDP added by Tetra4.
11. This row is the estimated number of direct jobs that could be created by Tetra4. We estimated the number of jobs by dividing the additional GDP with a GDP per employee in the gas sector. This resulted in an average number of jobs created. Working with estimated number of employees based on industry averages is preferred to employment estimates by Tetra4 for the simple reason that when working with a steady state mining statistic, it is best to work with industry averages rather than projected actual numbers due to a potential mismatch between a specific project estimate and tried and tested estimates based on a larger economic structure. Over the long term, individual enterprises have a strong tendency to approximate

[4] Please note that in economics the term "Gross Output" is a proxy for "Turnover" and although these two economic quantalities are slightly different, we use the economic GDP:Gross Output as a proxy for GDP:Turnover.

[5] We used the published multipliers in South Africa for the electricity and gas sector. It turned out that the GDP:Turnover ratio in the SA Gas and Electricity Sector is very similar to the ratio of the Gas Sector in the USA. Perhaps this is coincidence.

industry averages. From an evaluation perspective, using these average statistics tend to result in a better assessment.

12. This row shows the employment multiplier and the same principles outlined in row 9 are applicable here.
13. This is the product of the direct employment and employment multiplier.
14. This is this report's own estimate of Matjhabeng's GDP in 2028.
15. The result in this row is the division between the increased GDP of the project and the Matjhabeng GDP.
16. Estimated employment in Matjhabeng in 2028.
17. The division between the potential additional employment generated and the Matjhabeng employment.
18. This row shows the estimated investment amount of Cluster 2 that is being planned for the expansion.
19. This row shows the estimated investment after a 50% reduction for potential imports of equipment and services during the investment phase.
20. This row shows the Tetra4 local investment divided by two as the investment will take place over two years.
21. This row shows the estimated national investment multiplier.
22. This row is the product of the net local investment and the national investment multiplier.
23. This row shows the average gross domestic fixed investment of the local economy based on our own estimate as derived from national averages from the SA Reserve Bank. Using National statistics, we estimate that at present the gross domestic fixed investment (read gross investment) for the local economy amounts to R10 billion.
24. This row simply shows the division between rows 22 and 23.
25. This row shows the *average* amount of SA's Current Account – this amounted to a negative average of R127 billion for the last 10 years.
26. This row shows the potential foreign exchange earnings that could be generated by Tetra4 during optimal processing.
27. This row shows the potential mitigation that could result because of the Tetra4 expansion.

5.3.2 THE DEMAND FOR HELIUM

The demand for a product or service is defined as a consumer's desire to purchase goods and services and willingness to pay a price for such goods or services. The processing of helium is a high priority for Tetra4 and the demand for this gas is important for the assessment of this expansion. Assuming the

reader of this report may well not be an scientist or engineer, the below definition of helium is tendered.

5.3.2.1 What is helium?

Helium is the second most abundant element in the universe after hydrogen. It is a colourless and odourless inert[6] gas that has unique properties.

5.3.2.2 What makes helium so unique?

Of all the elements, helium is the most stable; it will not burn or react with other elements. Helium has the lowest melting and boiling points. It exists as a gas, except under extreme conditions. At temperatures near *absolute* zero, helium is a liquid; most materials are solid when cooled to such low temperatures. Helium is therefore one of the most important cooling agents on the planet.

5.3.2.3 Where does helium come from?

Helium is a non-renewable natural resource that is most recovered from natural gas deposits. Thus, helium is mostly a by-product of natural gas fields. It is important to note that helium is found in recoverable quantities in only a few locations around the world, many of which are being depleted.

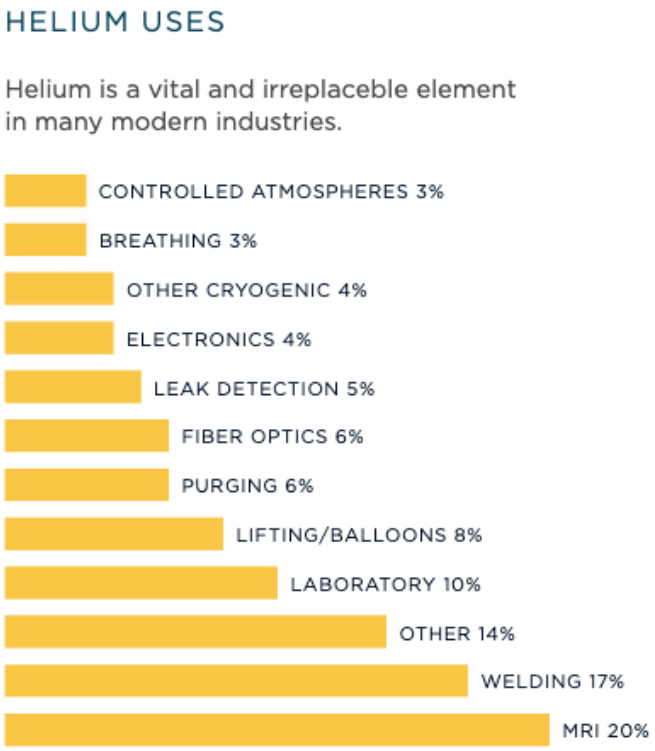
In the gas fields of Virginia in the Free State, the source of helium for this study is indicated as being unique given the *high* helium content in the gas field. This makes this development a potential "game changer" in the helium industry in that Tetra4 could produce helium as its prime product, with methane potentially being a by-product. This is a different strategy to how helium is currently recovered worldwide. The uniqueness of this situation is that as pressure increases on reducing gas production worldwide, helium production will also decline. However, in the case of Tetra4, as said, this status quo is reversed, meaning that the Virginia Gas fields may well become a significant strategic helium resource in the world.

5.3.2.4 What is helium used for, and why is it a strategic natural resource?

Perhaps the most familiar use of helium is as a safe, non-flammable gas to fill party and parade balloons. However, helium is a critical component in many fields, including scientific research, medical technology, high-tech manufacturing, space exploration, and national defence.

[6] An inert gas is a gas that does not undergo chemical reactions under a set of given conditions. The noble gases often do not react with many substances and were historically referred to as the inert gases. Inert gases are used generally to avoid unwanted chemical reactions degrading a sample. These undesirable chemical reactions are often oxidation and hydrolysis reactions with the oxygen and moisture in air. The term inert gas is context-dependent because several of the noble gases can be made to react under certain conditions.

Figure 2: Uses of helium



As can be seen in the graph to the left, the largest use of helium is in magnetic resonance imaging (MRI). Liquid helium is the ideal temperature to maintain superconducting magnets in MRI's and help them work at their full potential. The ideal temperature for the highest resolution images is 4,15 Kelvin, which is -269 degrees Celsius. Using liquid helium for MRI machines will ensure the best imaging results and safety.

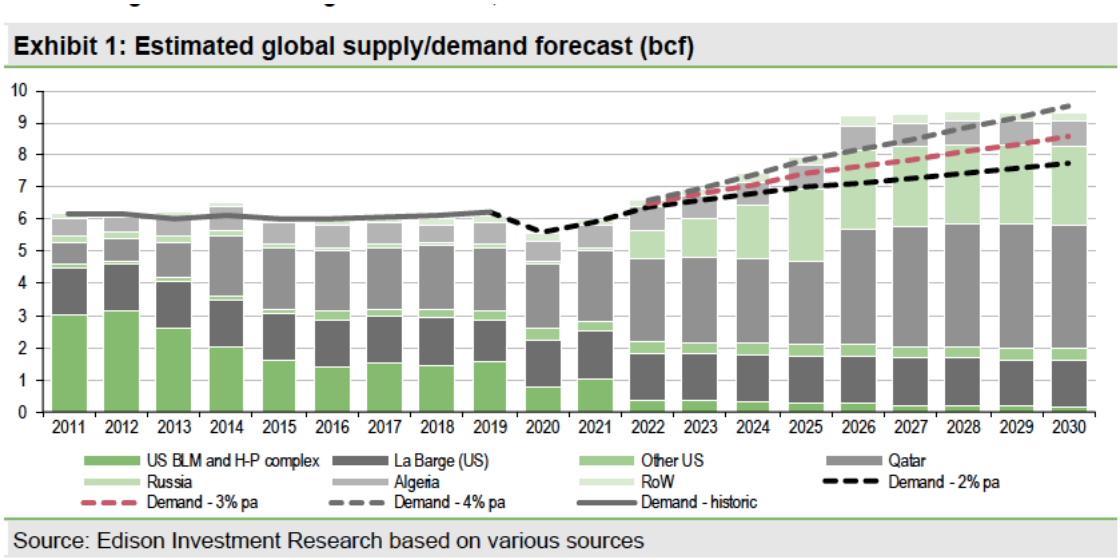
Other uses of helium, in no particular order, is as an inert-gas for welding metals such as aluminium; in rocket propulsion (to pressurize fuel tanks, especially those for liquid hydrogen, because only helium is still a gas at liquid-hydrogen temperature); in meteorology (as a lifting gas for instrument-carrying balloons); in cryogenics (as a coolant because liquid helium is the coldest substance); and in high-pressure breathing operations (mixed with oxygen, as in scuba diving and caisson work, especially because of its low solubility in the bloodstream).

When looking at the future uses of helium, there is overwhelming evidence that this element with its rare properties will continue to be in demand. Research is showing that helium is increasingly used in the health industry, and as a coolant in the military and rocket industries. In addition, helium is targeted as a coolant in the potential new nuclear energy generators using fusion, as opposed to fission. In addition, increasing consumption of helium in the electronics and semiconductor industry is expected.

5.3.2.5 Demand predictions for Helium

The importance of the demand for helium is that an economic need and desirability would be low if a sufficient demand now, or in the future, could not be established. In this regard, all indications are that the demand for helium is strong and sustainable, thus contributing strongly to the economic need and desirability of this expansion.

Figure 3: Global Demand and Supply of helium – Billion Cubic Feet



Note 2: Source Edison Investment Research

The above graph was sourced from the Edison Research Group as published on Renergen's website. It shows a possible slight oversupply of helium in next few years, but thereafter demand is likely to outstrip supply (all things being equal).

A few independent forecasts for the global growth in demand for helium are mentioned below:

- Energy Industry Review, an energy magazine in Europe, predicts a 4% CAGR between 2019 and 2027.
- Mordor Intelligence, an independent research company, also predicted growth at 4% CAGR between 2021 and 2026.
- Global Newswire, an independent market analyst reporting on listed investments, predicts the growth to be 4.5% to 2030.
- Various other sources put the growth rate of helium much higher than the three sources above - at between 5-11% CAGR based on the continued increase in scientific and technological innovation.

The conclusion about the demand for helium is that every source on the internet that we scanned predicts a healthy growth in the demand for helium. It can therefore be concluded that helium is in strong demand globally, which is a positive factor for the economic need and desirability of the Tetra4 expansion.

5.3.3 THE DEMAND FOR NATURAL GAS IN THE ECONOMY[ii]

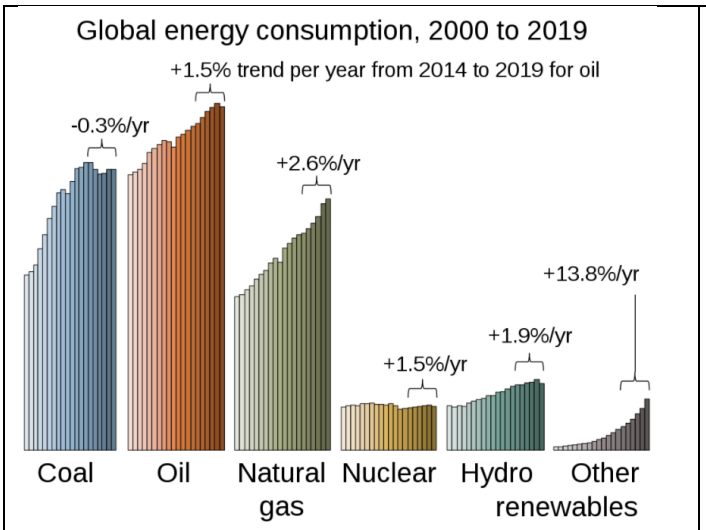
In this and the section below, the need for natural gas is discussed. Note that natural gas is largely composed of methane, and the gas fields under discussion yields methane as its primary gas. Thus, in discussing natural gas, a discussion of methane is implicit.

The self-evident nature of the need for natural gas is stated in the list of items below (not an exhaustive list):

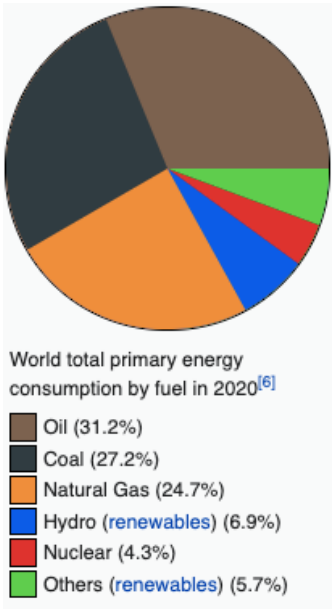
- The electric power sector uses natural gas to generate electricity. For example, natural gas accounted for 40% of U.S. electricity generation in 2020, as opposed to 3% in SA.
- The industrial sector uses natural gas as a fuel for heating, as a feedstock to produce chemicals, fertilizer and hydrogen, and many other applications.
- The residential sector uses natural gas for heating, cooking and other applications.
- The commercial sector needs natural gas to heat buildings and water, to operate refrigeration and cooling equipment, to cook, to dry clothes, and to provide outdoor lighting. Some consumers in the commercial sector also use natural gas as a fuel in combined heat and power systems.
- The transportation sector uses natural gas as a fuel to operate compressors that move natural gas through pipelines and as a vehicle fuel in the form of compressed natural gas and liquefied natural gas.

In the insets following below, we show some statistics and trends on the growth and demand for natural gas. At the end of this section, and at the end of the report the contradiction in the use of natural gas ought to be clear – it's regarded as a bridging source of energy by most responsible governments today because it emits less GHG's than coal, but its long-term usage will continue to be under pressure as it remains a fossil fuel.

Figure 4: Global Energy Composition and Growth

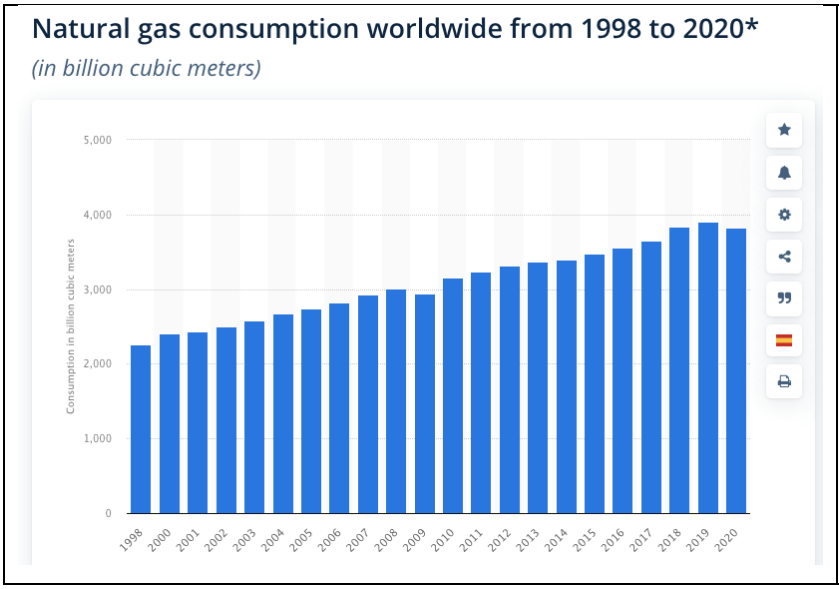


The figure to the left shows that natural gas is growing second only to renewables (2.6%), and it makes up, as can be seen below 24.7% of energy consumption globally.



Source: 1: https://en.wikipedia.org/wiki/World_energy_supply_and_consumption#/media/File:Global_Energy_Consumption.svg

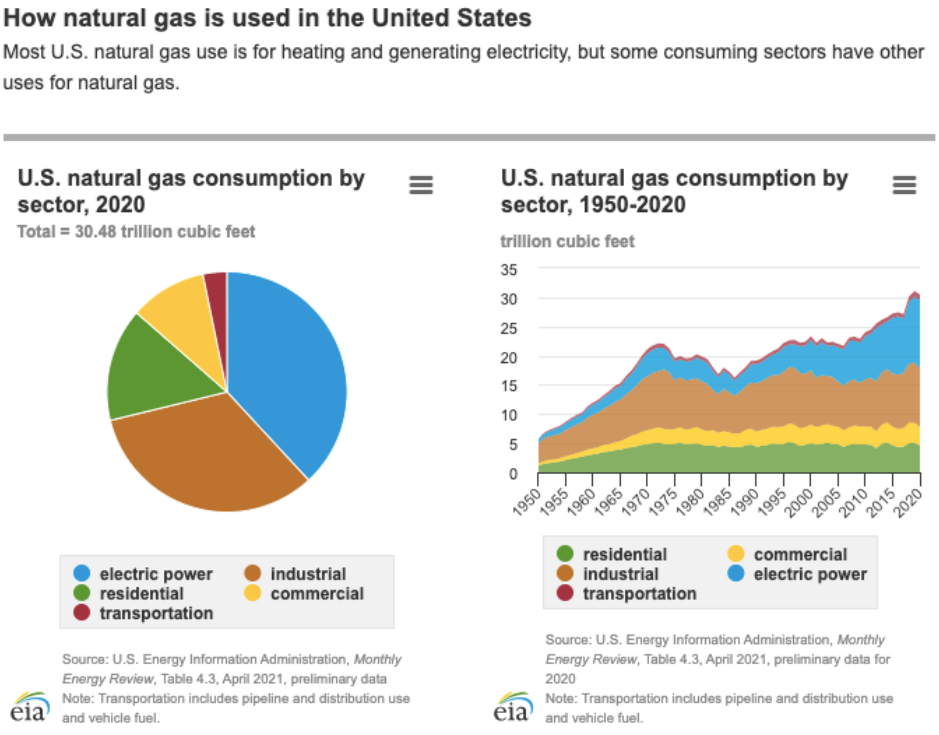
Figure 5: 2.4% CAGR in Natural Gas Consumption



The figure to the left shows the growth in natural gas usage globally. The trend is continually upward, and as indicated above, at 2.6% by volume annually.

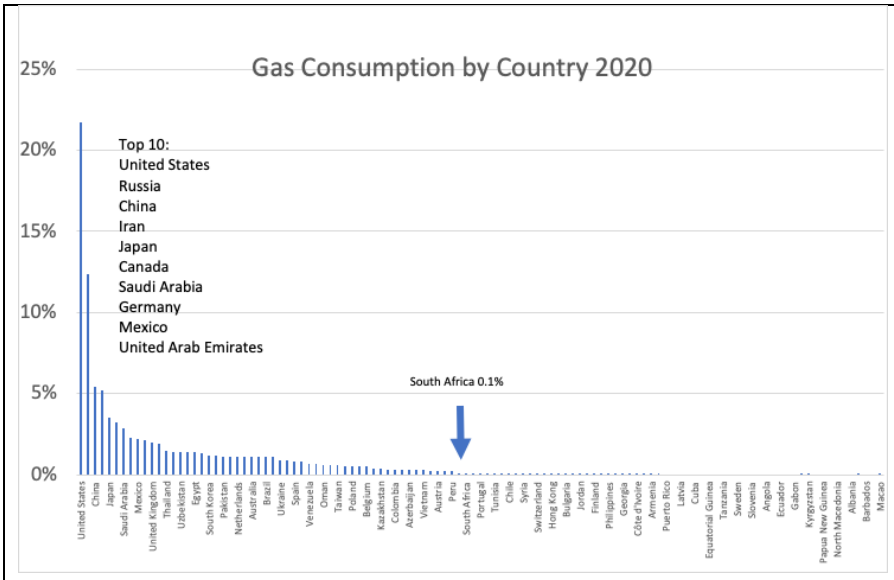
Source: 2 https://www.statista.com/statistics/282717/global-natural-gas-consumption/

Figure 6: Graphic illustration of the use of natural gas by one country, USA



Note 3: https://www.eia.gov/energyexplained/natural-gas/use-of-natural-gas.php

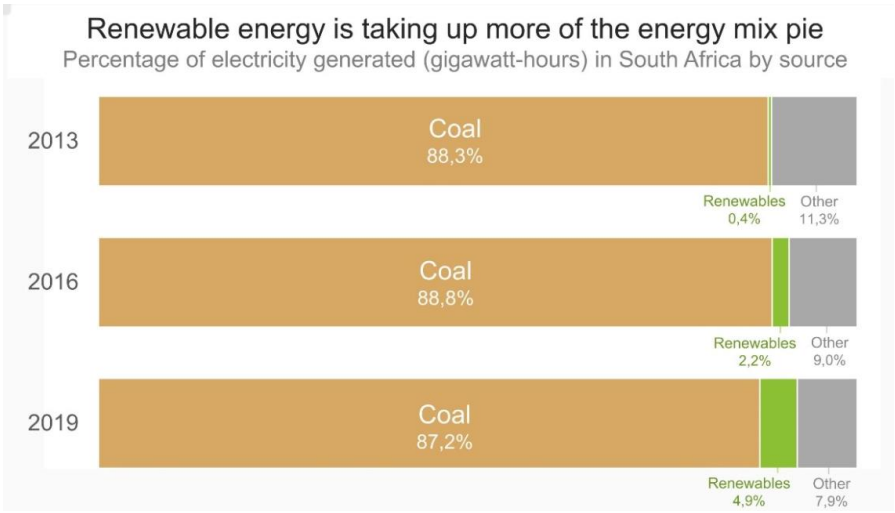
Figure 7: Gas Consumption in South Africa



As could be expected, South Africa makes up a small market for gas consumption globally.

Source: 3: https://www.worldometers.info/gas/gas-consumption-by-country/

Figure 8: Electricity generation sources in SA - Gas is under "Other".

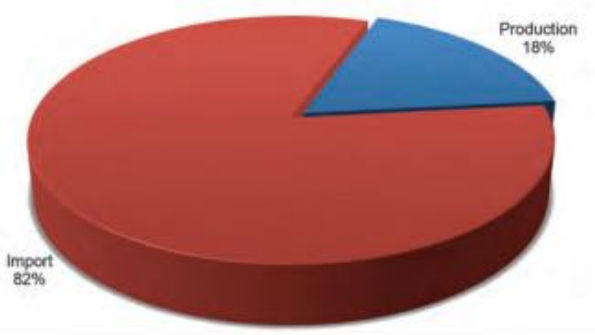


Source 4: StatsSA

South Africa is slowly moving away from coal. In 1996, 96% of the country's electricity was generated from coal. Today this proportion is decreasing towards 85%. Given the pressure coal is under, this shift is likely to continue.

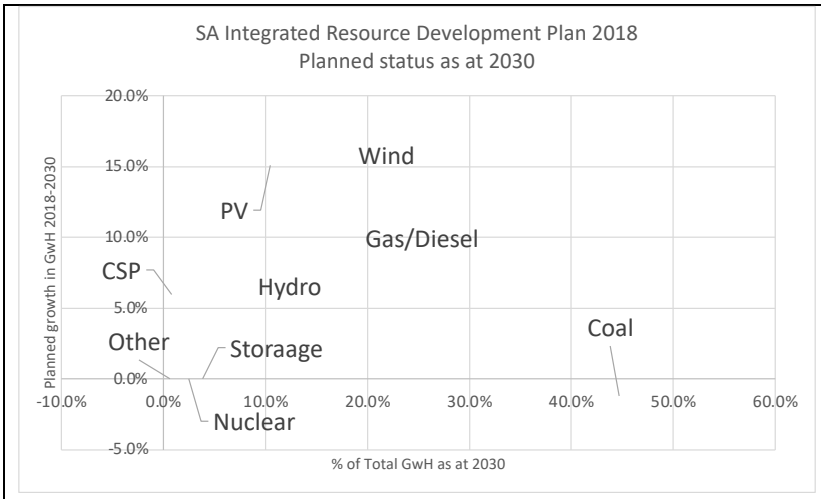
Gas comprised only 3% of SA's electricity generation.

Figure 9: Production and Imports of Natural Gas in South Africa



Source 5: http://www.energy.gov.za/files/media/explained/2019-South-African-Energy-Sector-Report.pdf SA Dept of Energy Balances in a 2019 Report

As is probably expected, the majority of SA's natural gas is imported.



Source 6: Source SA Integrated Resource Plan 2018 for 2030

Estimated gas use by 2030 in SA. Note that natural gas had moved from 5% to 15% of the mix.

5.3.3.1 Conclusion on demand for natural gas in the world and South Africa

From the above it can be concluded that at present gas still plays a significant role in the production of energy in the world. We showed above that gas makes up 25% of the world's electricity production. In addition, the growth in the demand for gas seems stable.

In South Africa, natural gas plays a relatively small part in contributing to electricity generation. Gas is not regarded as a cleaner energy than "green energy" sources, for example solar, water and wind, but is undoubtedly "cleaner" than coal. As a "bridging" source of energy, there is sufficient cause to rate gas as economically needed and desirable, however, this statement is subject to the views of more qualified scientists and engineers. As an economist, one would favour gas processing in SA in the short and medium term, however, it is very likely that at some future point targets will be set to reduce gas production (note not helium) in the same manner as targets are being set to reduce coal production today.

5.3.4 A SUSTAINABLE AND COMPETITIVE LOCAL GAS AND HELIUM INDUSTRY IN SA IS NEEDED

A further factor in favour of Tetra4's expansion application is the potential for the development of a sustainable and competitive gas and helium industry in South Africa.

5.3.4.1 Why is a competitive gas and/or helium industry important for South Africa?

To answer the above question, one must visit the study of economic comparative advantages and the importance of innovation and productivity for an economy. When a country has a comparative

advantage economically, such as gold for example historically in SA, that advantage creates economic wealth that then translates into a better quality of life for that country's citizens. Since the advent of the use of oil and gas worldwide, SA has had a comparative disadvantage as it did not possess those natural resources. That meant SA had to (and still does) import most of its oil and gas, which meant that foreign reserves had to be used to pay for such imports. That in itself not only resulted in a decrease in GDP, it also caused a reduction in the country's foreign reserves.

It can be argued that even though SA had been blessed with significant mineral resources, the lack of oil and gas had been the country's Achilles heel. The historic increase in the cost of gas and oil and weakening of the SA Rand had brought about a persistent "imported" inflation to the SA economy for many decades, and unless SA creates its own less expensive and clean energy, the country will remain less economically competitive than it could be.

Ironically, the commodity that SA has in abundance, coal, is today considered as an undesirable commodity because of its effect on warming the earth. Thus, SA faces ominous comparative disadvantages in the generation of future energy - the lack of natural gas, the small amount of energy that can be produced from green energy in the foreseeable future, and the undesirable nature of coal as an energy source.

There is thus a strong case to be made for a much stronger natural gas industry in South Africa.

5.3.4.2 How will the Tetra4 expansion assist with an increase in the Gas and Helium Sector competitiveness?

To answer this question, the competitiveness framework developed by Michael Porter, an eminent economist and strategy consultant, can be applied. We describe his competitiveness framework below and in each section we highlight how Tetra4 can potentially enhance the SA natural gas and helium industry.

An important note, as had been indicated in many sections in this assessment, SA historically did not have a helium producer, and to that extent the advent of Tetra4's helium production is in fact the establishment of a helium industry in this country. Thus, starting from a zero base for helium, one could therefore argue that the need and desirability of the advent of a helium sector in SA is beyond significantly high.

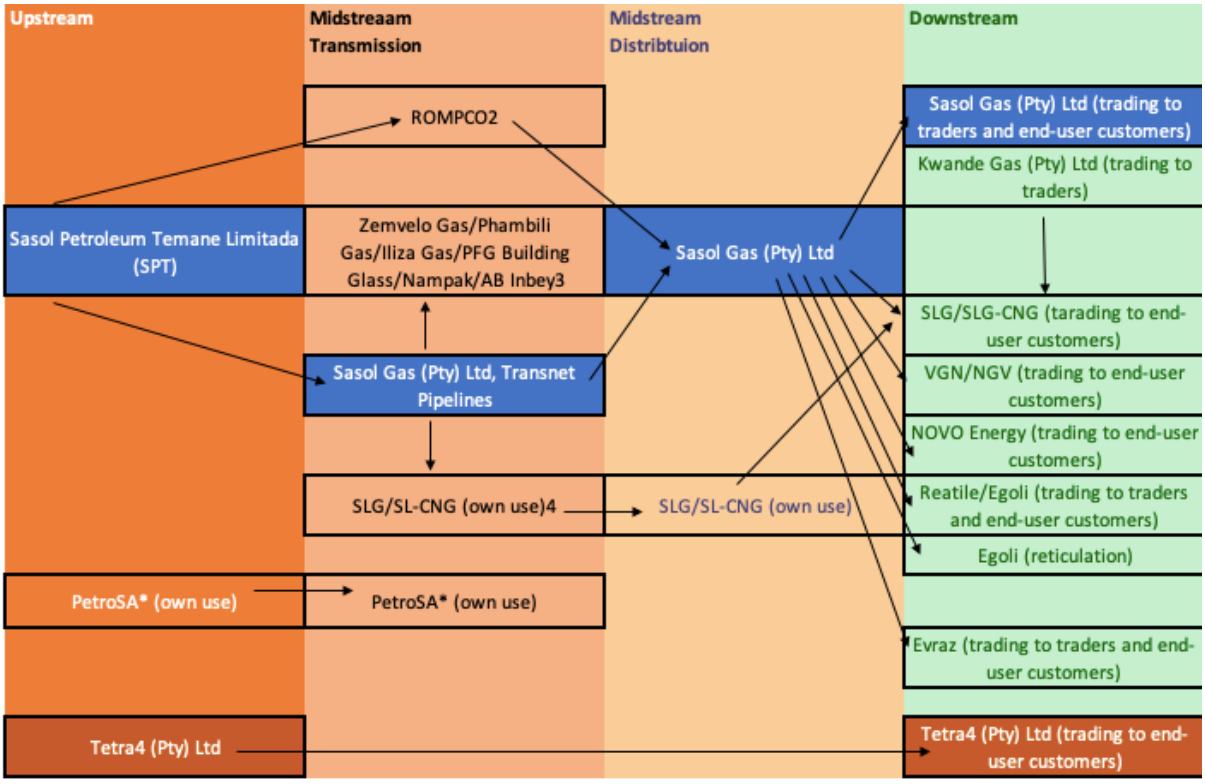
For the reason above, thus accepting that the competitiveness of the helium industry starts from a zero base and hence the establishment of this industry has a high economic need and desirability, we elaborate below only on the increase in competitiveness of the gas sector in SA.

5.3.4.3 *Explaining the structure of the SA gas sector*

Prior to discussing how Renergen could increase the competitiveness in the SA natural gas sector, a quick overview of the SA gas sector is provided.

The inset below gives a snapshot of the natural gas sector in SA. As indicated below, the supply chain of the piped-gas industry is broadly categorised into three levels, namely upstream, mid-stream and downstream. The upstream level of the piped-gas industry includes gas exploration and production activities. The midstream level comprises transmission and distribution of gas, while the downstream level consists of gas reticulation and trading activities.

Figure 10: SA Natural Gas Sector



Source 7: Nersa 25 February 2021 Report

Based on the above figure, it can be gleaned that Sasol Gas is the dominant gas enterprise in South Africa. From this figure it plays a major role in production, transmission and distribution. Because there are not that many rivals, even in the downstream activities, it follows logically that there can't be lots of rivalry in this sector. It follows further, by mere inference that the SA natural gas sector may not be as efficient a sector as in countries with robust competition.

Prior to Tetra4, there were only two suppliers of gas. The first is Sasol Gas that imports natural gas from the Pande and Temane gas fields in Mozambique to Secunda via the transmission pipeline owned by the Republic of Mozambique Pipeline Investing Company (ROMPCO). (This is a joint venture

company comprised of the South African Gas Development Company (Pty) Ltd, and Companhia Mocambicana de Gasoduto S.A.R.L, nominated by their respective governments as the designated shareholders, with a 25% shareholding each. The third shareholder, Sasol Gas Holdings (Pty) Ltd, has a 50% shareholding.) The transmission pipeline is 865 kilometres long with a 26-inch diameter, and a capacity of 147 million Gigajoules per annum.

Sasol Synfuels, which is a coal-based synthetic fuels manufacturing facility, produces methane-rich gas in its plant in Secunda. Synthetic gas is produced through coal gasification and natural gas reforming through the utilisation of Sasol's proprietary technologies.

The other supplier, PetroSA, is a state-owned entity, owned by the Central Energy Fund, and was the only producer of indigenous natural gas. Its offshore producing gas field is in the Bredasdorp basin, and provides feedstock for PetroSA's Gas-to-Liquids (GTL) plant. It produces for its own exclusive use. However, this field is close to being depleted, and further developments of the field have been undertaken to supply feedstock for the GTL plant. In 2011, PetroSA was granted approval to explore additional gas reserves of the coast of Mossel Bay, in which drilling activities have been ongoing.

Sasol Gas is the only supplier of piped-gas in South Africa, given that PetroSA is not a supplier of piped-gas as it uses its production for its GTL plant.

There are two transmission pipeline operators in South Africa – Sasol Gas which owns and operates the gas transmission facilities in the Gauteng, Mpumalanga and Free State Provinces and Transnet Pipelines which owns and operates a gas transmission pipeline, known as the 'Lily' pipeline, from Secunda in Mpumalanga to Durban South in KwaZulu-Natal.

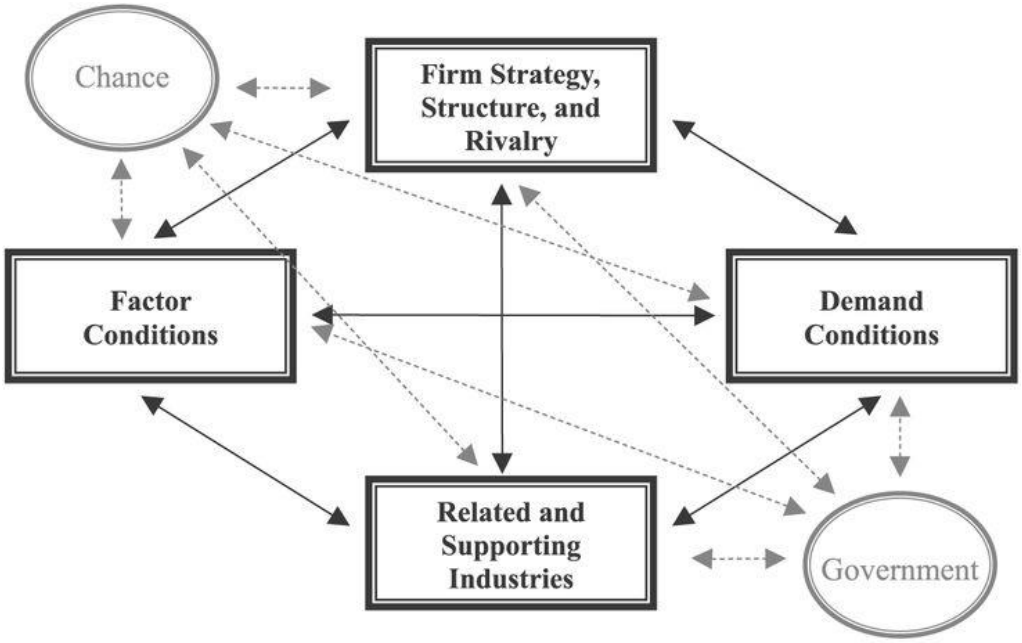
The transmission pipelines owned by Sasol Gas in the Gauteng/Mpumalanga/Free State Provinces have a combined length of approximately 903 kilometres, and a compressor station exists in Komatipoort, Mpumalanga, which facilitates the natural gas delivery from Mozambique into South Africa. These compressor stations are fuelled by the natural gas from the pipelines.

The 'Lily' pipeline is approximately 600 kilometres long, and transports a portion of the methane rich gas from Sasol's Secunda plant to KwaZulu-Natal. The Transnet pipeline extends to Newcastle, Richards Bay and Durban South.

From the above brief overview of the gas sector in SA, the need and desirability of a further gas supplier to increase the competitiveness of the SA gas sector is undoubted. In this regard the economic need and desirability of the Tetra4 expansion becomes even more evident.

To elaborate further on the significance of a competitive gas sector in SA, and why Tetra4 is needed and desirable, the country and industry competitiveness framework of Michael Porter is applied in the section below.

5.3.5 COUNTRY AND INDUSTRY ECONOMIC COMPETITIVENESS



Source: Porter (1990)

Country and industry competitiveness can be described using the following aspects as outlined by Michael Porter in his book *The Competitive Advantage of Nations*.

- Factor conditions – this is the degree of development in a country's basic production factors in a particular industry, being entrepreneurial, labour, physical, intellectual, land and infrastructure, and capital factors.
    - With respect to factor conditions, Tetra4 thus far has shown itself to be entrepreneurial and able to conjoint labour, land and capital to spearhead a new and significant enterprise in the natural gas industry. There is an equally strong argument that the enterprise could prioritise helium over natural gas. However, on the assumption that it equally wants to focus on methane, the project is needed and desirable as it will add greatly to the development of SA's factor conditions.

- Demand conditions - the degree to which national firms create a competitive advantage is dependent on home buyers demanding local firms to innovate and create more advanced products.
    - As an opening remark, the demand conditions for natural gas had historically been poor in SA. One could argue because of the limited usage of natural gas in the SA economy historically, there are not sufficient sophisticated consumers to drive competitiveness. If one compares for example the rivalry and demand conditions of internet data transfer, one will find a large consumer market and many competitors. It is also easy to switch from one supplier to another. Compared to that industry, the gas industry obviously does not have that kind of rivalry and neither does it have that type of consumer sophistication. The reason for this comparison is that for an industry to enhance its competitiveness, it requires many rivals and sophisticated consumers.
    - It is possible that Tetra4's increase in supply of methane may stimulate demand for the product, and this may educate consumers to become more sophisticated, but it is not foreseen that Tetra4 will contribute to a major improvement in gas consumption sophistication in SA in the short to medium future.
- Related and supporting industries – the degree to which these industries assist with important inputs for innovation and internationalisation determines the competitiveness of industries in a country. These industries provide cost-effective inputs, but they also participate in the upgrading process, thus stimulating other companies in the chain to innovate.
    - As a first comment it is important to note that the gas industry is strongly integrated with the electricity generation industry. As showed above, 40% if the United States' electricity is generated by gas and therefore the technology and services that underpin the process of gas-to-powerplant are well established. If Renergen choses to focus on gas-to-power plants then the integration of these two industries in SA are likely to improve the country's gas to power competitiveness.
    - When looking at the related and supporting industries to the natural gas industry, it becomes interesting to note that the finance, insurance, and services industries are the ones that are most inter-related with the natural gas industry (see page 39). The educational and research industries are particularly well integrated with the gas sector in countries with robust gas industries.
    - There is every possibility that Tetra4 would stimulate the supply and sophistication of products and services in related industries, for example more research and education in the natural gas sector, or more technical engineering knowledge and better capital

markets for gas projects. Stimulating the related industries would certainly improve SA's competitiveness in the gas sector.

- Government can influence each of the four determinants of competitiveness. Clearly government can influence the supply conditions of key production factors, demand conditions in the home market, and competition between firms. Government interventions can occur at local, regional, national or multi-national level.
    - All indications are that the current SA Government is gas development positive, and media statements of Government officials indicate that gas is seen as the bridging energy source to achieve sustainable energy supply and reduce GHG emissions in SA.
    - SA furthermore has the Gas Act (Act 48 of 2001) which has as its goal the promotion and orderly development of the piped gas industry.
    - Thus, overlapping the SA Gas Act with that of the Tetra4 expansion plans, where both have as their goal the development of a natural gas sector, every indication is that this determinant ought to improve the competitiveness in the gas sector.
- Chance events are occurrences that are outside of the control of a firm. They are important because they create discontinuities in which some gain competitive positions and other may lose.
    - The significance of chance in the development of the Virginia Gas Fields cannot be under-estimated. The history of the discovery of the gas field is worth reading and is explained on the Renergen website. (www.renergen.co.za)
    - One can argue that it was indeed chance, more than anything else, that brought the opportunity of exploiting a major gas field in a traditionally gold mine and maize pfarm area.
    - Like gold, this is a chance factor that ought to be exploited, all things being equal.
- Role of multinationals – this aspect was added to the Porter model by commentators who indicated that Porter's single home-based diamond approach is incomplete regarding smaller and emerging economies. It is indicated that multinationals make an important contribution to national competitiveness.
    - One of the factors that often short-cuts the increase in competitiveness, is the transfer of technology from international firms. From press statements, it is clear that Tetra4 has aligned itself with numerous multi-nationals that will assist it in achieving operational efficiencies. The benefit of the transfer of technology from leading multi-nationals to an economy such as SA, cannot be underestimated in its value. Over and above chance, one could argue that technology transfer from international

multinationals to Tetra4 are probably the two most important factors in increasing the SA gas sector competitiveness.

- Firm strategy, structure and rivalry is a further determinant of competitiveness. The way in which companies are created, set goals and managed are important for success. The presence of intense rivalry in the home base is also important as it creates pressure to upgrade competitiveness.
    - In can be asserted that that the SA gas sector is one of the sectors with the least rivalry in SA. In the SA gas sector, there are only two producers at present, Sasol and PetroSA - and it cannot be argued that these two companies compete. For that reason, Nersa plays a decisive role in regulating piped gas prices.
    - The entry of Renergen may be a spark that will add to competitiveness in the SA gas sector. For example, if there are sufficient resources, what is to stop Renergen from supplying domestic gas supplies to municipalities for household consumer use?
    - A new entrant to the gas market can only increase competitiveness because competition in an economy drives efficiencies. To this extent, this expansion project could be of great value to the SA economy.

5.3.6 CONCLUSION OF FACTORS IN FAVOUR OF THE NEED AND DESIRABILITY

The above section shows clearly that both the economic quantitative and qualitative factors ought to be considered as positive for the SA economy.

5.4 ARGUMENTS NEUTRAL OR AGAINST THE NATURAL GAS SECTOR'S NEED AND DESIRABILITY

5.4.1 NEGATIVE FACTORS

5.4.1.1 Climate Change Impacts

5.4.1.1.1 Natural gas

In as much as some may consider a discussion of climate change as outside the study of economics, most modern economist would agree that the challenges of climate change today are of such importance that few sciences are unaffected by it, and neither should they be unaffected. There is consensus that global warming is the number one challenge on earth and given that fossil fuels are large contributors to global warming, this topic deserves mentioning, even if as brief as in the few paragraphs below.

The context is that there is more consensus than ever that GHG'es cause global warming. In this regard, SA at COP 26 had pledged to reduce its GHG emissions by reducing its dependence on coal as a source of energy in favour of renewable energy sources. In addition to this, economically, SA runs the risk of being sanctioned by the international community should it persist with an intransigence regarding the use of coal.

Natural gas is therefore seen by many in the country as a "bridging" source of energy because it emits almost 50% less CO_2 than coal. Considering only tailpipe emissions, natural gas is 15-30% cleaner than fuel when it is burned. Thus, if SA converts its coal fired stations to natural gas tomorrow, it will save a considerable amount of GHG emissions.

Thus, based on the above, natural gas is certainly a cleaner energy source than coal, and therefore relative to coal, must be considered as more desirable in this context.

However, detractors of prioritising natural gas over "green" renewable energy point out two particular arguments against natural gas over green energy:

1. Natural gas still emits CO_2, and hence the problem of mostly eradicating greenhouse gas emissions globally remains unresolved[7] if natural gas continues to be a source of electricity.
2. In addition to this, natural gas is composed of 70-90% methane, a potent greenhouse gas and major contributor to global warming. The argument is put forward that 2-3% of methane escapes during processing, transmission and reticulation. These fugitive emissions add to global warming.

Proponents of cleaner energy in South Africa have advocated that the country bypasses natural gas developments in its entirety and concentrate on renewables like solar, wind and water.

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[7]

Pounds of CO2 emitted per million British thermal units (Btu) of energy for various fuels

Coal (anthracite)	228.6
Coal (bituminous)	205.7
Diesel fuel and heating oil	161.3
Gasoline (without ethanol)	157.2
Propane	139.0
Natural gas	117.0

Source: eia.gov

A further interesting observation is that a plethora of gas operators seem to want to enter the SA gas market, and although that could be of major benefit in the reduction of the use of coal, at some future point the debate will intensify regarding the emissions of GHG emissions in the gas industry vs that of other cleaner energy sources.

Economically, common sense does indicate that natural gas offers an interim solution for the climate change target challenges in SA in the short to medium term. In the long term, it is very possible that even natural gas usage becomes an undesirable commodity, as is the case with coal at present. That stated, an economic need and desirability assessment must consider the current generation, and although not discounting future generations, the economics of gas production in SA at present has a strong case.

5.4.1.1.2 Helium

Where the Tetra4 expansion is different from the typical gas producer is in the concentrations of helium in its gas reserves. Whereas an economic cut-off as low as 0.05% helium in natural gas has been proven to be economically viable, Tetra4 has indicated that its helium concentrations are high – between 2-14%. When one considers that helium is NOT a GHG because When the vital use of helium in an economy is furthermore considered, then one has to conclude that the weight of the need and desirability of this project, because of the high helium content, must be rated as high.

As is observed elsewhere in this assessment, because of the pressure on the reduction of gas production, helium may become an ever-scarcer commercially available commodity on earth. Thus, the helium find in the Free State will not only provide in SA's own helium needs, but it also has the potential of contributing significantly to the supply of helium globally.

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6 ECONOMIC IMPACT ASSESSMENT SECTION

6.1 RECEIVING ENVIRONMENT

6.1.1 NATIONAL ECONOMY

The national economy, thus the broader receiving environment, is under much stress and in a receiving environment of this nature it would be commonplace to observe that all desirable economic development would be urgent for SA. In this regard, all things being equal, the Tetra4 expansion ought to be viewed as a significant benefit to the SA economy.

The summary below of the SA economy is based on a PWC document referenced below. Paragraphs in italics are directly quoted from the report.[8] (Our own summary in bold and italics in the notes below.)

- "Statistics South Africa (Stats SA) reported on March 8 that real gross domestic product (GDP) increased by 1.2% q-o-q and 1.8% y-o-y during the fourth quarter of 2021. This was in line with expectations. The latest data indicated that real GDP increased by 4.9% last year following the pandemic-induced 6.4% decline in activity during 2020. This was a healthy bounce-back — and the highest annual growth number since 2007 — due to the base effects from the 2020 recession. Following the 2021 expansion, the South African economy entered 2022 at about 1.7% smaller compared to the end of 2019. However, over the same period, the local population also increased by 2.5% — resulting in a net decline of 4.2% in real GDP per capita during 2020-2021."
    - ***The population of SA keeps becoming poorer, and the outlook for economic growth that could improve average wealth creation per capita is challenging.***
- "Local inflation outlook deteriorates as international commodity prices rise following invasion of Ukraine. Consumer price inflation moderated from 5.9% y-o-y in December 2021 to 5.7% y-o-y in both January and February 2022 — though the latest numbers remained near the top end of the 3%-6% range targeted by the South African Reserve Bank (SARB)."
    - ***A decline in the GDP per capita coupled with high inflation is a breeding ground for social unrest in South Africa.***

[8] https://www.pwc.co.za/en/assets/pdf/economic-outlook/economic-outlook-local-impacts-from-disruptions-in-central-eastern-europe.pdf

- ***A high inflation has the risk of budget over-runs for the Tetra4 expansion. There is a strong possibility of increases in salaries and wages and other input costs into the Tetra4 expansion.***
- ***On the upside increases in commodity prices is positive for the SA economy.***

- "Global shipping costs surge and commodity prices jump as conflict constrains exports. For some years there has been concern about increasing polarisation in society. In our view, polarisation is characterised by a breakdown in the global consensus and a fracturing world, with growing nationalism and populism. In this environment, a new nationalism is taking hold, with many countries prioritising their own interests. As seen in Central and Eastern Europe right now, there could be an accompanied increase in international conflict, insecurity, migration, and tensions in cross-border business. The World Economic Forum (WEF) Global Risks Report 2022 reflected that in 23 out of 124 economies (18.5%) surveyed, interstate conflict was identified by business executives amongst the top five risks that pose a critical threat to their country in the next two years. For Ukrainian business leaders, this factor placed joint third on the list, while it was the number one factor for Russian businesses."

A further useful description of the outlook to the SA economy is the following quoted section from the *African Development Bank*.

- "South Africa's real GDP growth was 0.2% in 2019. The pandemic and the containment measures to curb the spread of the virus further damaged the economy. Real GDP contracted by 8.2% in 2020, the result of a decline in construction, transport and communication, manufacturing, and mining. On the demand side, all components declined, with the largest contraction, 32.4%, recorded in investment. The Reserve Bank of South Africa cut the policy rate by a cumulative 300 basis points in 2020, from 6.5% to 3.5%, to support businesses and households affected by the pandemic. Inflation was estimated to decline to 3.4% in 2020, within the reserve bank target of 3%–6%. The budget deficit was estimated to widen significantly to more than 14% of GDP, mainly due to spending pressures to contain the economic impact of the pandemic. The country will, however, record its first current account surplus in 2020, estimated at about 1% of GDP, because of the high price of the gold it exports, a low bill for fuel imports, and increased agricultural exports. Despite the pandemic, the South African banking sector remains sound, with a capital ratio of 16.3%, which is above the 10% regulatory requirement. Domestic credit to private sector reached $280 billion in November 2020, an increase of 3.5% from December 2019, when it was 139% of GDP. Lingering economic weaknesses prompted the three major credit rating agencies to downgrade South Africa's local and foreign currency credit rating to subinvestment grade. Nevertheless, real private

investment expanded by 33.2% in the third quarter of 2020. Social indicators are likely to remain weak due to the severity of the pandemic and legacy issues of low human development. About 2.6 million people have lost their jobs since March 2020, bringing the unemployment rate to 30.8% in September 2020 from 23.3% in December 2019.

Real GDP growth is projected to rebound to 3.0% in 2021, but the pace of the recovery will slow to 1.6% in 2022 due to continued structural constraints such as unreliable electricity supply and job regulations. The inflation rate is projected at 4.2% in 2021 and is expected to stay within the reserve banks' target range of 3%–6% for 2022. The current account surplus is expected to erode, since a recovery in oil prices could raise the import bill. Public debt could reach more than 90% of GDP in the medium term, with projections that it will stabilize at 95% in 2026. The 2020 Medium Term Budget Policy Statement (MTBPS) in October 2020 projected a significantly larger budget deficit and slower debt consolidation in the medium term. These projections will raise risks due to the high debt-service costs and deteriorating balance sheets of state-owned enterprises and the continued weaknesses of the financial position of municipalities.

The 2020 Medium Term Budget Policy Statement proposed steps to reduce the public service wage bill and investment driven by state-owned companies in order to narrow the fiscal deficit and stabilize the debt-to-GDP ratio over a five-year period. The treasury expects to reduce the wage bill—the major driver of the fiscal deficit—by nearly $1.8 billion through 2023–24. The proposal has already raised the risk of widespread strikes by the 1.3 million public sector workers. Also, calls for debt guaranteed by the government to support higher levels of capital investment will be discouraged. This could push South African Airways into liquidation and the electric utility Eskom to adopt tariffs that reflects its costs, which would be efficient but unpopular. In 2020, the South Africa government committed itself to investment in public utilities through strong private sector participation. South Africa's gross international reserves increased slightly from $52.4 billion at the end of March 2020, covering 6.9 months of imports, to $53.8 billion at the end of November 2020, covering 8.3 months of imports. This progress mainly reflects foreign borrowings received on behalf of the government from multilateral banks, including the African Development Bank, to cope with the pandemic crisis."

- ***The key points from the above are the following:***
  - ***The SA Government will endeavour to reduce its budget deficit through a "right-sizing" of its public sector wages and salaries. The State intends to reduce its debt dramatically and will be looking towards the private sector***

for public-private joint ventures. Tetra4 being in the energy space, may well benefit on levels not anticipated at present.

- ***SA's foreign reserves are healthy which means Tetra4 ought to be able to source international funding as international investors need certainty that they can withdraw funds in hard currency again.***
- ***2.6 million people lost their jobs due to the pandemic and the current unemployment rate is 34%. (Other sources indicate an unemployment rate of 40%.) Socio-economic indicators will continue to decline and hence Tetra4 and its suppliers can expect a disproportionate amount of job applications, which means that it would have to be vigilant on the fairness of its recruitment process.***

6.1.2 *MINNG CITY EDGE ECONOMIES*: MATJHABENG ECONOMY

The project area covers a large part of the Free State gold fields, and hence an understanding of the afore-mentioned economic baseline is important to finalise this Economic Impact Assessment (ECIA). The immediate receptor area is the population of Matjhabeng Municipality, which is one of five local municipalities in Lejweleputswa District in the Free State. The major towns located in Matjhabeng are Allanridge, Hennenman, Odendaalsrus, Ventersburg, Virginia and Welkom.

As is to be expected in any economic observation of Matjhabeng, gold production and the mining industry loom large. The wellbeing of the Matjhabeng economy is therefore interwoven with the state of its mining industry. In the past two decades this industry has unfortunately declined in output, affecting employment especially. Interestingly though, the decline in economic value added (thus the money side of the economy) of the mining industry has not been as severe as that of the job losses in the industry. This can be ascribed to 1) higher commodity process and 2) more mechanisation.

The Matjhabeng economy can be described as a mining city edge economy (a phrase coined by this report). These kinds of economies are pervasive in SA and particularly in Gauteng. Good examples of city edge economies are areas like Rustenburg, Emalahleni and Matjhabeng itself. These economies tend to have S-curve economies – meaning with the advent of mining the local economies grow at an exponential rate, then plateau and inevitably experience long declines. The long declines is an aspect that few have found sustainable solutions for and it is not in the soope of this report to address these wider socio-economic challenges.

Returning to the mining city edge economies the following observations are worth making:

a) Mining edge economies owe their development to the growth of the mining sectors in their economies.
b) They are vulnerable to commodity price declines and ore depletion, and hence these economies often are inextricably linked to the performance of its mining sector.
c) Of all the economic sectors in the edge areas the mining and tertiary sectors tend to be largest given that the one is a propulsive industry and the other is a service sector to mining. The more important economic sector, namely manufacturing, is often underweight in these areas which means that upon mining output declines other propulsive industries do not exist to buffer economic downturns. Thus, these edge economies' fortunes fluctuate alongside the fortunes of the mining industry.
d) This author's experience is that relatively little is being done in the growth and stability periods of the edge economies to counter their inevitable economic decline. "Decline" needs to be qualified though as the base of the edge economies are much larger than the baseline prior to when the mining industry invested. Thus, the declines come from a larger base than the original baseline and even after mine closures these local economies are larger than what they would have been had it not been for the mining sector. Even so, the declines are significantly negatively to edge economies.
e) Moving from the capital markets to the labour markets, these edge economies attract large amounts of in-migrants looking for jobs when mining commences often leading to the oversupply of labour. This then result in large informal settlements which then adds pressure to local governments to provide social services.
f) When mining declines in an edge economy, the legacy footprint that the sector leaves behind is extensive with often very negative visual impacts and unattractive landscapes, resulting in significant obstacles to re-generate a better sense of place.
g) Despite the above negative observations, the edge economies undoubtedly play an important role in economic development of SA as they have comparative advantages that when exploited lead to wealth generation that is to the advantage of the whole country.
h) The challenge is to retain that wealth creation in the local ("mining edge") economies when mine-closure occurs.

Following from the above observations, Renergen's investment in the Matjhabeng economy is considered to be different to a typical mining investment as it is derived that its gas resource has a "life of mine" that could exceed 50 years. An economic generation is 25-30 years which means that Tetra4's operations are likely to span two economic generations. This type of longevity allows local

economies to step up their economies over a long period of time that ought to create stronger buffers against downscaling.

Moving from a discussion of "edge economies" to the local economic receiving area, the graphs below assist in portraying the salient aspects of Matjhabeng.

The total GGP of the Matjhabeng municipality is estimated at R45 billion at present and this can be considered as a large economy by size in South Africa. SA's GDP is just under R5 000 billion rand and although Matjhabeng's economy is only ~1 % of that amount, it needs to be compared to the 0,2% of the average municipality in SA. Thus, Matjhabeng's economy is 5 times larger than the average municipality in SA and hence could be considered as a relatively big economy in the country. The significance of this is that the local area has a reasonable economic base that could sustain itself and as a rule ought to provide in some of Tetra4's supplier and procurement needs.

The graphs below show that the local economy's GDP growth rates had been mostly negative between 2005-2014. As the data for the local economy's performance was not available after 2014, a look at the SA GDP growth rate shows that nationally there were no signs to indicate that the economy was improving. One could therefore assume that the local economy may also *not* have experienced strong growth, albeit that higher commodity prices may have had a positive impact locally in 2021 (that year's statistic not in the graph.)

From the graphs below it can also be seen that the mining industry made up 56% of the local economy in 2014. (Compare this to national mining contribution to GDP of less than 10%). The Government sector, which is not a propulsive industry, is the next biggest economic sector in Matjhabeng.. The critical sector for economic success namely the manufacturing sector is very small in that economy.

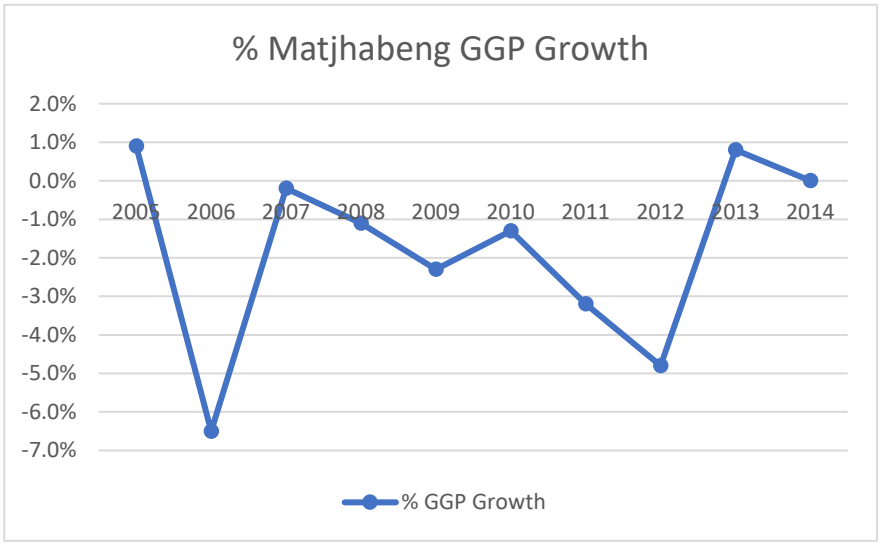
Mining output in the local economy is showing a downward trend at a rate of 1.5% per year. From the graphs below Matjhabeng had been hit hard by declining gold production. Its workforce had been halved since the golden years of the 1990's and this had led to high unemployment rates.

The area's population is large with well over 400 000 inhabitants. The population growth rate in Matjhabeng was estimated at 0,5% in the last decade, compared to 1,5% in SA, which indicates that the Gold Fields is not a major in-migration area at present. This can only be ascribed to the area's inability to absorb job-seekers in the economy prompting less people to in-migrate.

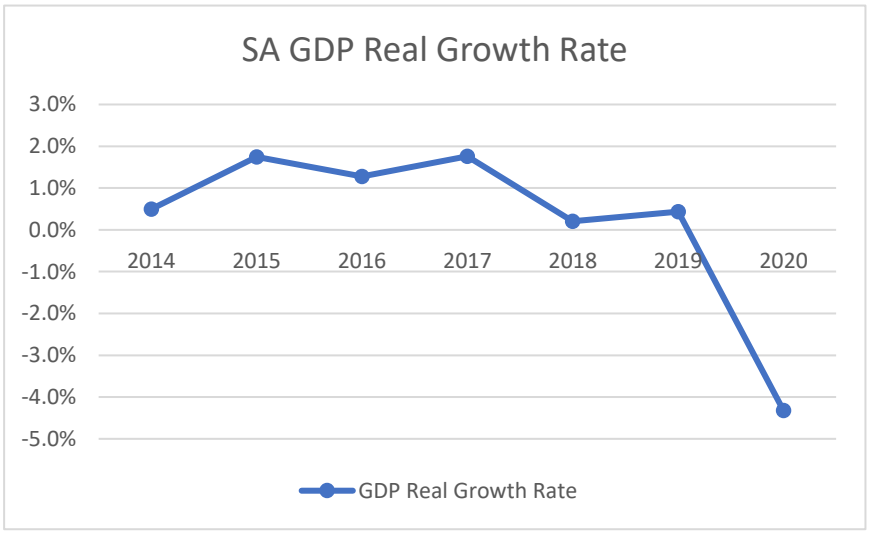
As is the case in the rest of South Africa, the Matjhabeng unemployment rate is high, bordering on 40%.

Due to the urbanised nature of Matjhabeng its Agricultural Sector is small contributing less than 2% to its economy. The agricultural sector in the region is much larger as is expected in the Free State, averaging 5% of GDP.

Figure 11: Key Economic Graphs

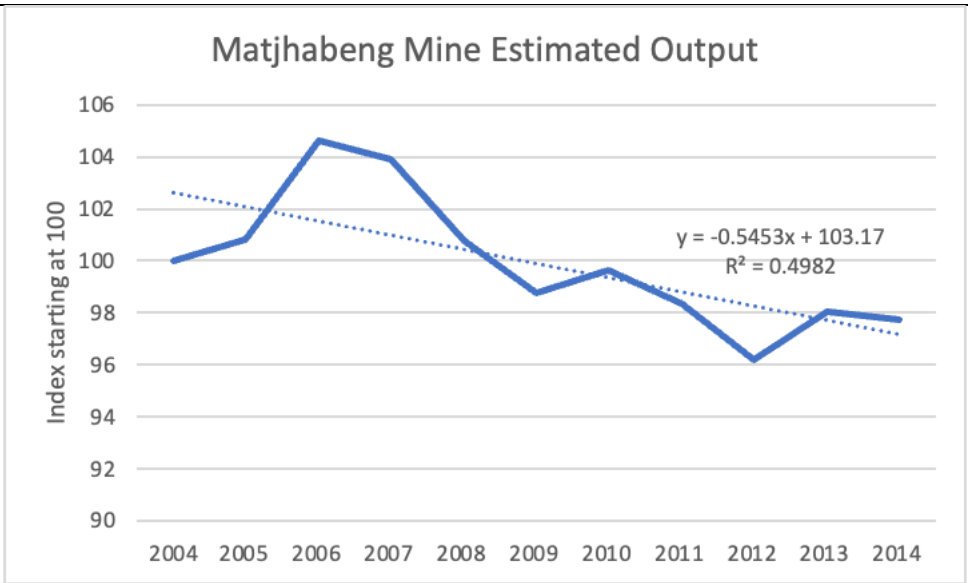


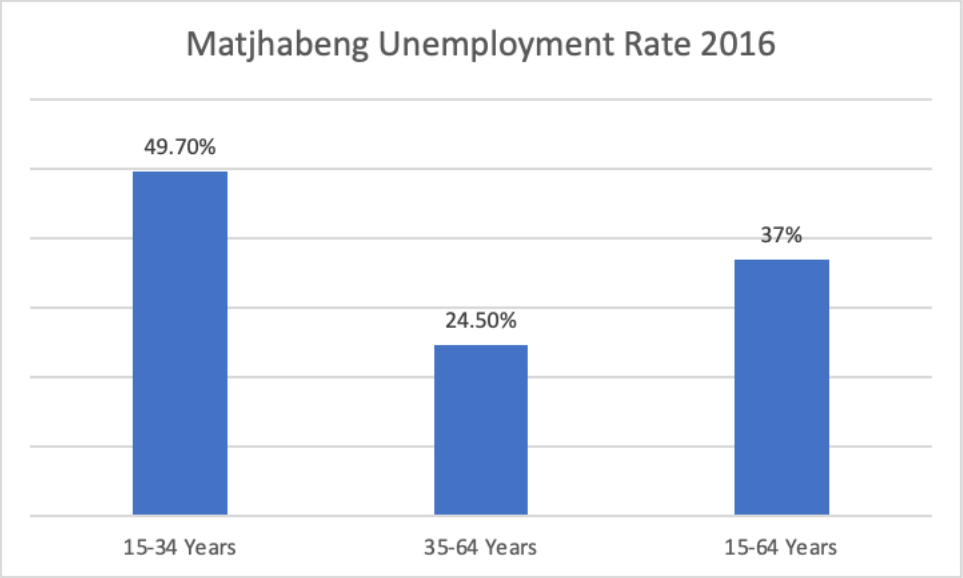
Source 8: Matjhabeng IDP



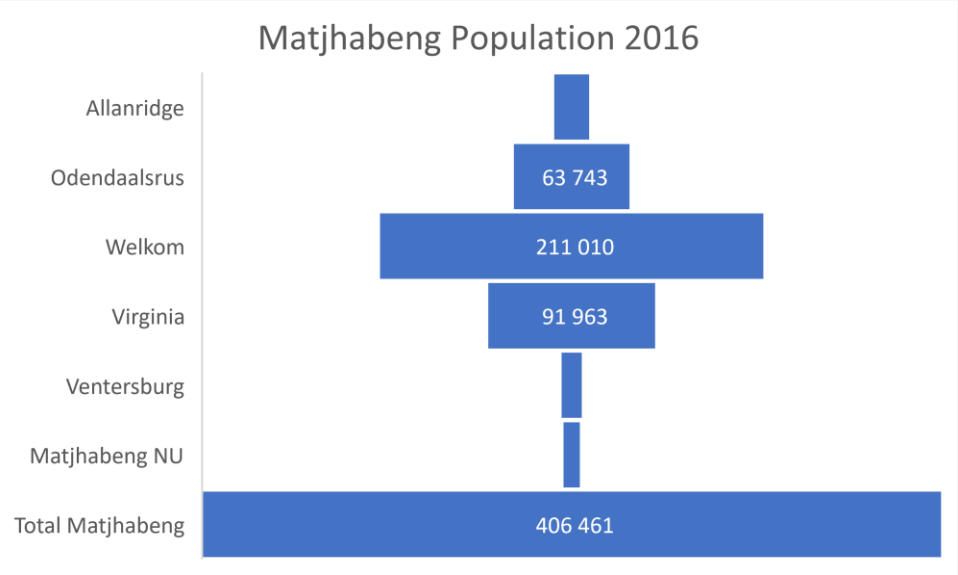
Source 9: Reserve Bank Statistics

Figure 12 :Structure of Matjhabeng economy by economic output 2014





Note 4: Population in 2020 estimated at 430 000 people



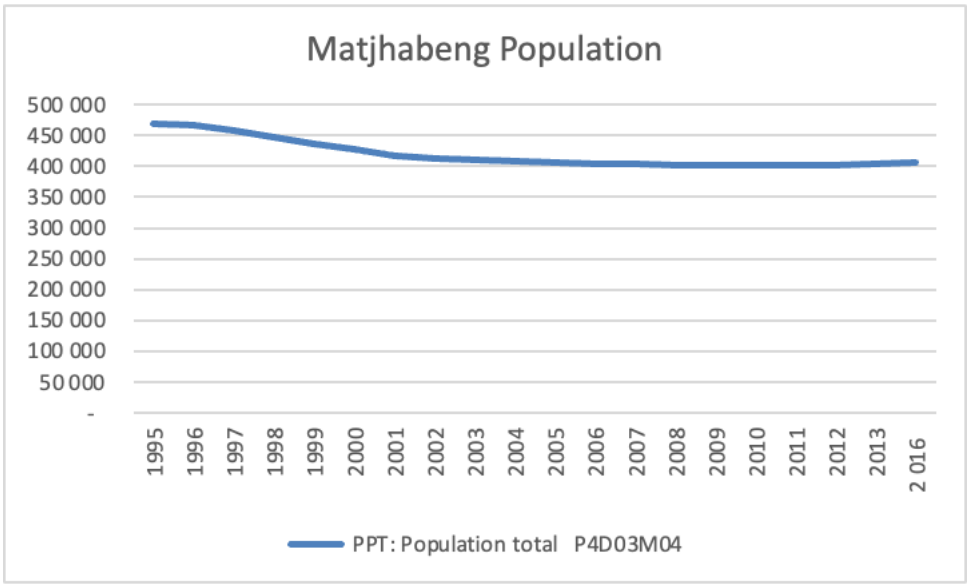
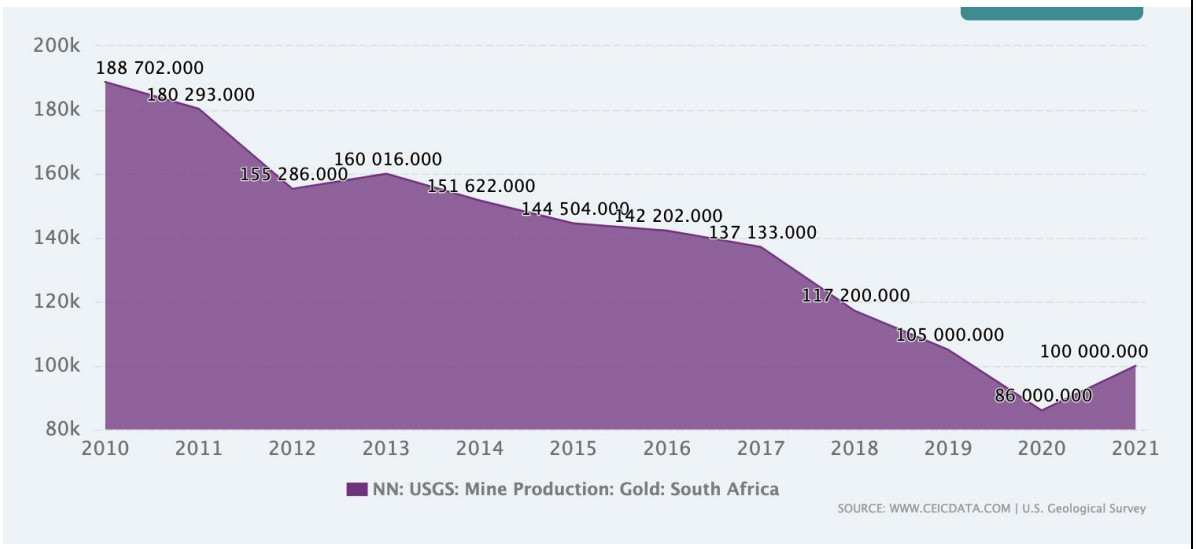
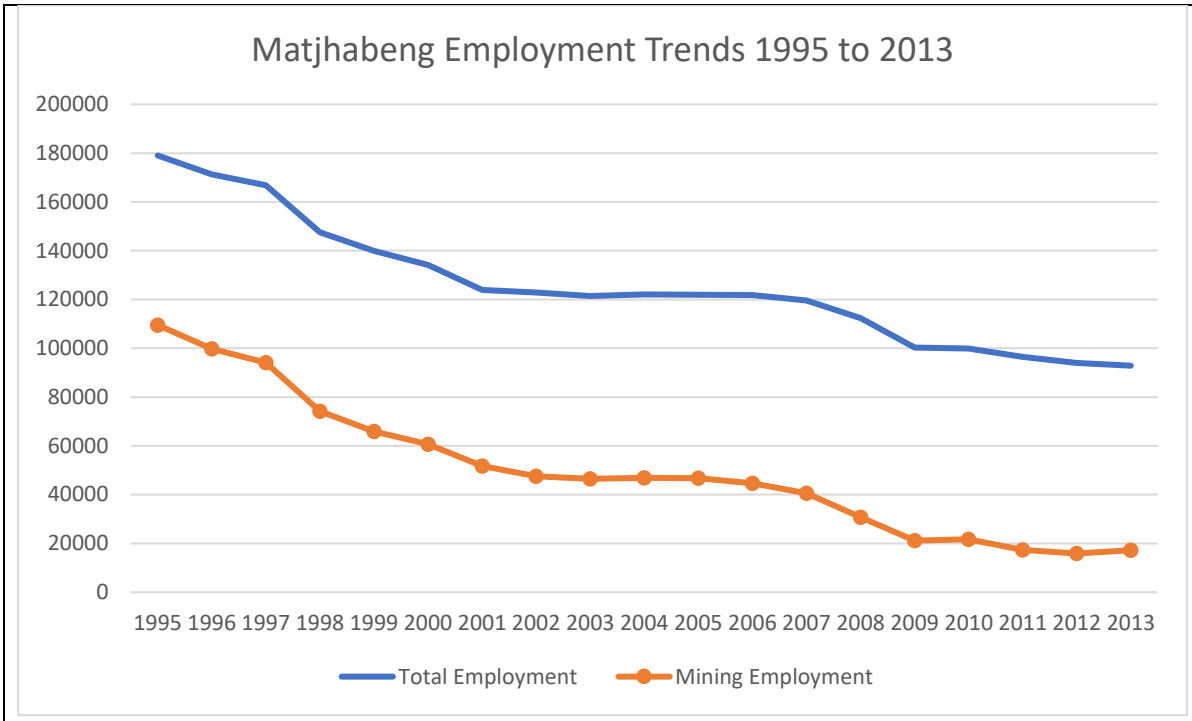


Figure 13: SA Gold Production



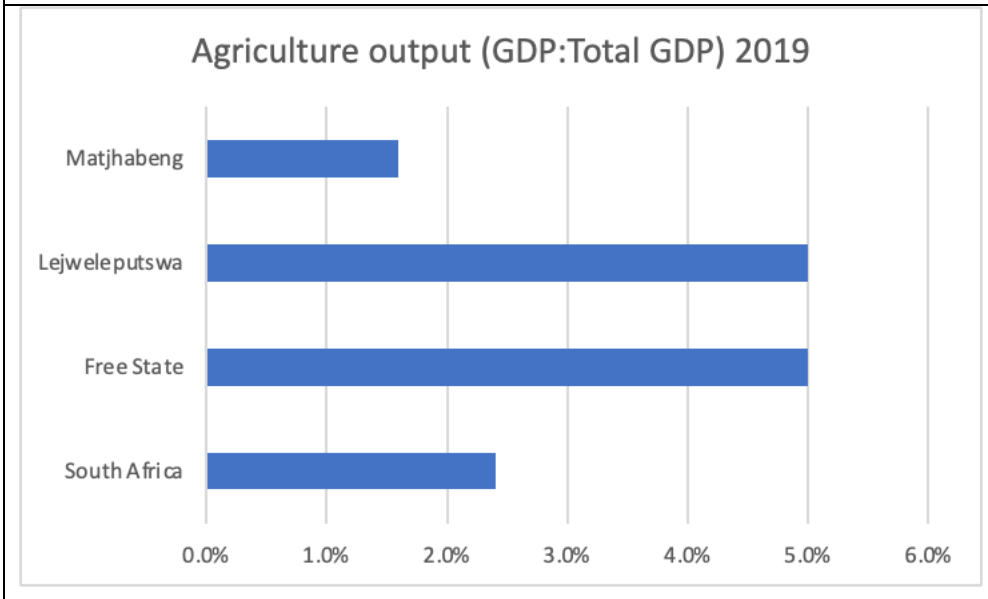
Source 10: Independent Source www.ceicdata.com



Employment	South Africa				Free State				Lejweleputswa				Matjhabeng			
	2009		2019		2009		2019		2009		2019		2009		2019	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Formal sector: Skilled	11987	19%	13866	19%	532	15%	551	16%	105	15%	112	15%	73	16%	82	15%
Formal sector: Semi-Skilled	34614	54%	39915	56%	1875	54%	1921	55%	356	52%	363	50%	242	52%	273	51%
Formal sector: Low Skilled	9178	14%	10033	14%	592	17%	642	18%	122	18%	160	22%	86	19%	123	23%
Informal	8606	13%	7989	11%	480	14%	399	11%	104	15%	91	13%	62	13%	61	11%

Source: Quantec, 2019

Source 11: Matjhabheng LED Report 2019



Source 12: Unless otherwise stated source of information aboce is the Matjhabeng 20/21 Draft IDP

6.1.3 LOCAL ECONOMIC NEWS MATJHABENG

We include two items of local economic news in order to weave more threads into the tapestry of the local economy for the purposes of this report.

05 Sep 2021: https://www.news24.com/news24/SouthAfrica/News/matjhabeng-municipality-rampant-looting-illegal-mining-and-theft-could-wipe-out-ailing-entity-20210905

Matjhabeng municipality: Rampant looting, illegal mining and theft could wipe out ailing municipal infrastructure. Unemployment and Covid-19 have severely affected Matjhabeng municipality. The Free State municipality is dealing with theft and vandalism of its properties and infrastructure. Illegal mining activities and cable theft are on the rise too. Unemployment and closure of businesses in the Free State's mining towns has left one municipality with a burden of problems resting on its shoulders. The Matjhabeng local municipality servicing Allanridge, Odendaalsrus, Welkom, and Virginia, is now grappling with increasing unemployment. Matjhabeng is the Sesotho name for a place where people of different races meet. The area is home to locals and foreigners from Lesotho, Zimbabwe, and Mozambique, who were attracted to the area by the gold mines. The municipality is also battling rampant looting and the destruction of its infrastructure and properties. Among those targeted are municipal buildings and theft of municipal fences, electricity cables, and other valuables. Looting takes place in both towns and in townships. The most ailing towns are Meloding, Virginia, Thabong, and Welkom. Two weeks ago, thieves struck "gold" when they stole electricity cables worth R5 million. Cemeteries are not spared either.

08:11 Sun, 13 Mar 2022 https://www.ofm.co.za/article/centralsa/314016/businesses-community-commits-to-rebuild-matjhabeng-

It is time that the business community starts lending a helping hand to the Matjhabeng Municipality in the Free State. This, according to local businessman, Jakes Jooste, during the the launch of the Matjhabeng Community Forum. The event, hosted by the local business community and the Executive Mayor of Matjhabeng, Thanduxolo Khalipha, was attended by roughly 300 businessmen and women across Matjhabeng. Jooste, in an interview with OFM News, said it's high time the local community gets involved - as it is the only way to rejuvenate local economy. Mayor Khalipa also pledged his support to the initiative, adding Matjhabeng's people must unite to rebuild the city of Welkom Meanwhile, Khalipha confirmed an amount of R1.8 billion has been received from the National Treasury, of which R64 million will be set aside to renew water and sewage treatment around Matjhabeng. Philip van der Merwe tabled their plan and gave the business model they will use to achieve this vision. He also said the benefits of the project include that Matjhabeng will have

clean towns, fewer potholes, security in the residential areas to curb criminal activities, and that the business community will be involved in the Integrated Development Plan of the Municipality.

6.1.4 SUMMARY OF THE LOCAL ECONOMY

6.1.4.1 Strengths of the local economy

The local economy is considered to have the following strong points:

- Matjhabeng has a relatively large GGP compared to other municipalities, which ought to leverage possibilities for further development in the area.
- The road infrastructure from Matjhabeng that connects it to both the Johannesburg markets and Durban ports is of a very high quality, which makes import and export linkages more efficient than for many other municipalities in the country.
- Barring further mine closures, Matjhabeng may be finding a new economic equilibrium which ought to increase business confidence and investment in the area.
- The 2014/15 IDP indicates that the average household income has increased, which ought to contribute to social stability.
- The IDP also states that educational levels in the area have improved substantially, and a better-educated population is crucial for economic development.
- The IDP furthermore states that Matjhabeng has a Human Development Index (HDI) of 0.66, which is one of the highest in the Free State and just above the average SA HDI. However, the country's HDI is still low compared to that of developed countries, and it requires much improvement before Matjhabeng could be a significantly competitive economy.

6.1.4.2 Weaknesses of the local economy

- As was described in the section on the 'mining edge economies', Matjhabeng is dependent on one propulsive industry, namely mining. With an undiversified economy it is thus vulnerable to the prospects of mining.
- The Matjhabeng municipality itself does not seem to have a strong set of financial statements. Its current liabilities exceed its current assets by a large margin and it has been recording deficits (losses) for the last few years. In addition to this, it also had qualified audits which does not bode well for the financial management of the municipality.
- Other weaknesses are in alignment with what most of SA is experiencing at present:
    - Long term decline in business confidence;
    - Unreliable electricity supply;

- Low growth economic environment;
- Generally low investment environment;
- High unemployment;
- Unplanned urbanisation;
- Crime;
- Apparent government inefficiencies.

Figure 14: SA Long term business confidence

6.1.5 CONCLUSION ON THE LOCAL ECONOMY

Matjhabeng has a relatively large economy compared to that of other SA municipalities, but its GGP has been declining for years. Although the local economy still has a measure of critical mass that could provide continued private consumption expenditure which could sustain it for quite some time, it requires new investments to sustain itself.

The Matjhabeng economy is by all accounts finding a new equilibrium – an economy that is adjusting to declines in mining employment and a stagnating population. The increase in government expenditure and perennial agricultural activities are keeping the municipality's decline in check, but if more mines close down its GGP and formal employment is set to decline more. At present it is not sure what the impact of higher commodity prices are on the local economy.

An investment such as that of Renergen will undoubtedly improve the economic prospects for the local economy.

7 ECONOMIC IMPACTS

7.1 HIGH LEVEL ASSESSMENT RATING

The table below is based on the environmental assessor's impact assessment methodology. An indicators of +25 score means absolutely positive and a -25 means an absolutely negative impact. A zero is in fact a neutral impact and hence any impact above zero is positive.

From the table below most of the significant economic impacts are rated as very positive.

Figure 15: Impact Assessment Rating

No of Impact	Impact Description	Phase	Average of Pre-mitigation ER	Average of Post-mitigation ER
A	GGP Impact	Construction	16.0	16.0
A	GGP Impact	Operation	23.8	23.8
B	Employment Impacts	Construction	13.0	13.0
B	Employment Impacts	Operation	17.0	17.0
C	Forex savings	Construction	(9.8)	(9.8)
C	Forex savings	Operation	18.0	18.0
D	Fiscal Income	Construction	12.0	12.0
D	Fiscal Income	Operation	17.0	17.0
E	Economic development per capita	Construction	15.0	15.0
E	Economic development per capita	Operation	17.0	17.0
F	Country and Industry Competitiveness	Construction	16.0	16.0
F	Country and Industry Competitiveness	Operation	20.0	20.0
G	Black Economic Transformation	Construction	14.0	14.0
G	Black Economic Transformation	Operation	16.0	16.0
H	Alternative Land-use	Construction	8.8	8.8
H	Alternative Land-use	Operation	11.3	11.3
H2	Impact on individual farmland values	Construction	(7.5)	(7.5)
H2	Impact on individual farmland values	Operation	(9.0)	(9.0)
I	Need and Desirability	Construction	15.0	15.0
I	Need and Desirability	Operation	20.0	20.0
Grand Total			**12.2**	**12.2**

Source 13: Own Calculation

7.2 GGP IMPACT

GGP is the acronym for Gross Geographical Product and is the same as GDP, except that the latter is for the country and the former for a province, district or municipality, in this case for Matjhabeng. (GDP, GGP and GVA [Gross Value Added] are often used interchangeably.) For the layman the GDP is the most common economic indicator as it is most reported on. From an impact perspective the GDP or GGP on the demand side is the sum of investments, private consumption expenditure, government expenditure, and net exports. On the flipside, GDP from the supply side is the sum of salaries and wages, gross operating surplus and depreciation. The GDP/GGP statistic, is the quantum that pulls it all together.

We described in paragraph 5.3.1 page 15 in the paragraph headed “Positive economic impacts” how we arrived at the GGP that Tetra4 will be creating.

As described there, assuming an annual *direct* GGP contribution from Tetra4 of R3,6 billion and R6,6 billion after multipliers *(direct, indirect and induce*), the additional GGP relative to the Matjhabeng economy is 6,9% and 12,8% respectively. This ratio is very high given that most economies increase in a boom year by 5%. Relative to the Matjhabeng economy does not mean all the economic benefits will occur within the Matjhabeng economy due to economic leakages. Calculating the exact GGP addition is possibly an exercise in futility as it would be difficult to follow the leakages. The direct increase in GGP is estimated at 6,9% and this is considered as significantly high.

7.2.1 INPUT-OUTPUT STATUS OF GAS IN STRONG GAS PRODUCING ECONOMIES

Given that SA is not a mature gas economy we outline the input and output relationships between gas and other economic sectors based on an “average gas producing hypothetical country” – in the case of this report it is the average input-output relationship of gas within the economies of the United Kingdom, United States of America and Russia. Please note that the extraction of gas is categorized under mining activities in international industry classifications, and the processing of gas falls under the electricity and gas supply sector. For ease of reference we give the economic categorisations of the economic sectors below.

The definitions of industries are based on international standard industrial classifications:

B. Mining and quarrying (***note the extraction of crude oil and natural gas fall under this category).***

05 – Mining of coal and lignite

06 – Extraction of crude petroleum and natural gas

07 – Mining of metal ores

08 – Other mining and quarrying

09 – Mining support service activities

D - Electricity, gas, steam and air conditioning supply ***(note that the manufacture of gas and supply fall in this category).***

35 - Electricity, gas, steam and air conditioning supply

351 - Electric power generation, transmission and distribution

352 - Manufacture of gas; distribution of gaseous fuels through mains

353 - Steam and air conditioning supply.

We also provide further definitions of industries below.

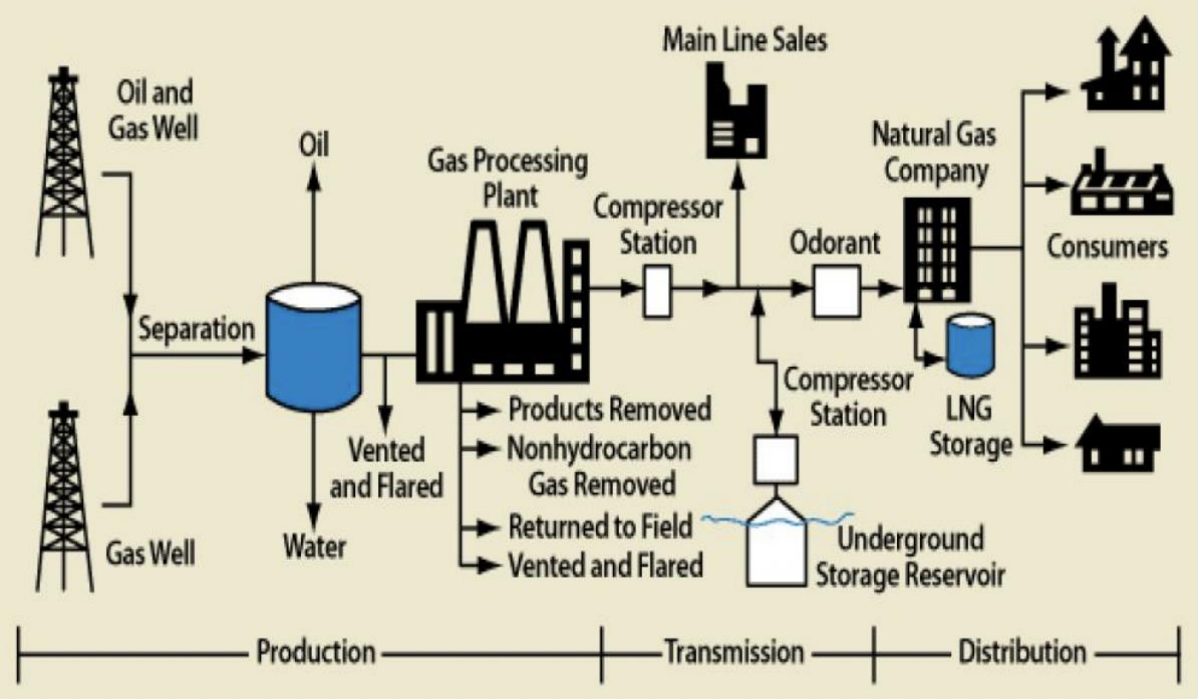
Figure 16: Industrial Classifications of Industries

Division	Group	Class	Description
Division 05			**Mining of coal and lignite**
	051	0510	Mining of hard coal
	052	0520	Mining of lignite
Division 06			**Extraction of crude petroleum and natural gas**
	061	0610	Extraction of crude petroleum
	062	0620	Extraction of natural gas
Division 20			**Manufacture of chemicals and chemical products**
	201		Manufacture of basic chemicals, fertilizers and nitrogen compounds, plastics and synthetic rubber in primary forms
		2011	Manufacture of basic chemicals
		2012	Manufacture of fertilizers and nitrogen compounds
		2013	Manufacture of plastics and synthetic rubber in primary forms
	202		Manufacture of other chemical products
		2021	Manufacture of pesticides and other agrochemical products
		2022	Manufacture of paints, varnishes and similar coatings, printing ink and mastics
		2023	Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations
		2029	Manufacture of other chemical products n.e.c.
	203	2030	Manufacture of man-made fibres
Division 24			**Manufacture of basic metals**
	241	2410	Manufacture of basic iron and steel
	242	2420	Manufacture of basic precious and other non-ferrous metals
	243		Casting of metals
		2431	Casting of iron and steel
		2432	Casting of non-ferrous metals

Division 33		Repair and installation of machinery and equipment
331		Repair of fabricated metal products, machinery and equipment
	3311	Repair of fabricated metal products
	3312	Repair of machinery
	3313	Repair of electronic and optical equipment
	3314	Repair of electrical equipment
	3315	Repair of transport equipment, except motor vehicles
	3319	Repair of other equipment
332	3320	Installation of industrial machinery and equipment

Division 68		Real estate activities
681	6810	Real estate activities with own or leased property
682	6820	Real estate activities on a fee or contract basis

Figure 17: The natural gas supply chain



Source 14: https://apps.dtic.mil/sti/pdfs/AD1080502.pdf

Applying the above to Tetra4 it can be gleaned that it has the potential of establishing a robust gas supply chain in the Free State (and potentially Gauteng). The inset above clearly shows the division between production, transmission and distribution, with the various components comprising those divisions.

From an economics supply chain perspective, the table below shows the relative monetary values from production to consumption. The first observation is that the gas industry obtains most of its inputs, and provides most of its outputs, from and to itself. For example, gas is used to generate electricity at power plants which in itself powers the gas processing plants. After the industry itself, most of the outputs of gas feed into households which indicate that Tetra4 could provide gas to the

wholesale and retail sector should it wish to adopt such a business model. Equally a large amount of gas outputs find its way to the other sectors indicated below, namely wholesale, manufacture and transport. Therefore Tetra4 has many strategic options for the use of its gas.

Table 3 : Input output by major industry to and from Gas Manufacturing Sector based on average of UK, USA and Russian input-output

	Buyers of gas products					
Sellers	Electricity, gas and steam	Wholesale	Manufac-ture and Equipment	Warehousing Transport and Pipelines	Households	Government
Oil and Gas Extraction						
Coal mines						
Wholesale						
Manufacture and Equipment						
Construction						
Warehousing ,Transport and Pipelines						
Finance and Insurance						
Professional Services						
Government						
Electricity, gas and steam						

Note 5: The bars above are indicative of the monetary value in each segment (block). (No monetary values provided as these values are in US Dollars based on the average of the UK, USA and Russia.)

Source 15: OECD Input Output Tables and own calculations

Figure 18: Detailed Input-Output table for average UK<USA and Russian economies

Sum of Avg UK,USA and Russia Row Labels	Column Labels Inputs	Outputs
Agriculture and Fishing	0.2%	0.6%
Basic and Fabricated Metals	0.8%	2.5%
Changes in inventories	0.0%	0.0%
Chemical and Chemical Products	0.5%	1.7%
Coal miinng and oil extraction	18.2%	0.9%
Coke and refined petroleum products	5.7%	0.9%
Construction	3.1%	0.9%
Educationa and Social Services	0.3%	4.7%
Electricity, gas, steam and air conditioning supply	30.9%	16.5%
Exports	0.0%	-0.7%
Finance and insurance	3.5%	0.8%
Gross Fixed Capital Formation	0.0%	0.6%
Hospitality	0.5%	3.1%
Imports	0.0%	0.6%
ITC	1.6%	0.7%
Land transport and transport via pipelines	2.9%	1.0%
Other Manufacturing	1.7%	4.8%
Other mining	0.4%	0.6%
Professional, scientific and technical activities	8.6%	2.4%
Public Administration and Defence	3.3%	1.6%
Publishing and broadcasting	0.2%	0.2%
Real estate activities	1.2%	11.7%
Repain and intallastion of machinery and equipment	0.6%	0.3%
Sales directly to Government	0.0%	0.4%
Sales directly to households	0.0%	34.0%
Taxes to foreign countries	0.0%	0.0%
Taxes to own country	6.1%	0.0%
Transport Equipment	0.1%	0.2%
Warehousing and other transport	2.4%	1.5%
Water and waste management	1.2%	0.4%
Wholesale and retail trade; repair of motor vehicles	6.0%	7.0%
Grand Total	**100.0%**	**100.0%**

7.3 NEW INVESTMENT

New investment is an important catalyst for economic growth and in this regard the planned R13 billion investments of Renergen would be a significant economic contribution to Matjhabeng and SA.

Possibly the best manner to describe the significance of the Renergen investment is to compare it to the average government and private investment quantum's in SA today. To this end, the Nedbank's Capital Expenditure Project Listing[9] for 2021 shows a total of 28 new projects worth R117.7 billion that

[9] https://www.nedbank.co.za/content/dam/nedbank/site-assets/AboutUs/Economics_Unit/Research/EconomicResearch/Nedbank%20Capital%20Expenditure%20Project%20Listing%20July%202021%20Full%20report.pdf

were announced during the first half of that year. (These are large, noteworthy projects.) On an annualised basis, this translates to 56 projects valued at R235.4 billion. Ergo, the average value per project amounts to R4,2 billion. The Renergen investment of nearly R13 billion is much higher than this average and denotes its significance.

7.4 HOUSEHOLD INCOME/ POVERTY ALLEVIATION

Private consumption expenditure and household income are flip-sides to the same main economic driver, namely remuneration of employees. Appreciably, it is understood that private consumption expenditure can exceed household income due to household borrowing, welfare, pension and retirement incomes.

This report's calculations indicate that the addition of 1 218 jobs from Tetra4 and its direct contractors is estimated to amount remuneration of R1,1 billion per annum and this is 3,4% of the current R31,8 billion estimated household income in Matjhabeng. This is a significant increase.

The direct employment at a gas plant will be overweight on skilled employees due to the complexities of gas processing technology. This is to some extent corroborated by the employment profiles in the table immediately below where it can be gleaned that South Africa's Electricity and Gas Sector uses much less semi-and unskilled workers pro-rata to total SA. Therefore, it can be concluded that Tetra4 ought *not* to be viewed as a direct, major employer of semi- and unskilled workers.

However, the above stated, the dependency ratio in South Africa of population to formally employed now stands at 6:1. In Matjhabeng this ratio is 5:1. This means on average that 6 090 local citizens could have an improvement of quality of life because of Tetra4's and it's contractors' direct employment of 1 218. When one considers that economy-wide job creation after multipliers may be as high as 4 600, and multiplying that by the SA 6:1 dependency ratio, then the amount of people that could benefit from the cumulative job creation could be as high as 28 000. Cognisance is taken that there is not always a direct link of financial aid between direct employment and statistical dependents, (e.g. an employee may not have an extended family and even if such and employee did have such a family, that person may not always share income with others.)

Regarding poverty alleviation in general, it can be stated that the SA Government is likely to establish an unemployment welfare payment system to the underprivileged in the country. It is estimated that Tetra4's economic value add may well be R3 billion per annum, thus a total VAT contribution of R450 million could be expected per fiscal year. (R3 billion x 15%). Based on this one could posit that Tetra4's expansion could cover a SA Government social grant of R350 pm for over 100 000 South Africans. Although there is no direct link between government income collections and a particular expenditure

budget item, stating that an economic benefit such as the proposed expansion could cover the social grants of 100 000 citizens in SA is used only to show the significance of such benefits.

Table 4: Employment by skills level

	SA Total		Mining		Electricity and Gas	
IS100: Formal employment by skill: Highly skilled - Toral (Number)		18%		5%		36%
IS200: Formal employment by skill: Skilled - Total (Number)		43%		19%		35%
IS300: Formal employment by skill: Semi- and unskilled (Number)		40%		75%		29%
Grand Total		**100%**		**100%**		**100%**

Source 16: Quantec Data

7.4.1 GOVERNMENT INCOME

In the paragraph above it had been shown that Tetra4 may well add R450 million per annum in an optimal production year to the SA fiscus in net VAT payments alone. (Note that economy wide the amount of increased VAT received by the SA fiscus would be approximately double as input-and output VAT would cancel out.) In addition to this, assuming an average employee income tax rate of 25%, then this tax group may well add an additional R275 million. Corporate tax may well not be paid in the foreseeable future given high depreciation allowances on investments, but after allowances had depleted it is not impossible that Renergen may well pay upwards of R250 million in corporate tax per annum.

At full potential production, total direct and indirect taxes (including SLP and other mandatory contributions), it is not farfetched to estimate that this project's total contribution to the fiscal coffers may well be R1 billion a year.

7.4.2 EXPORTS AND IMPORTS

SA Reserve Bank data shows that SA imports on average R1,2 trillion worth of goods and services and exports on average a very similar amount. In the last 9 years SA's net trade account is positive by R15 billon on average. The significance of these statistics is that Tetra4 is likely to import substitute a total of R6 billion a year at full production, and this is 38% of the average trade surplus of the last 9 years. This is a significant contribution to the trade account of SA.

Table 5: SA Imports and Exports

Year	Imports R million	Exports R million	Trade deficit
2011	896 247	921 530	25 283
2012	1 014 404	967 887	(46 517)
2013	1 179 768	1 097 889	(81 879)
2014	1 260 788	1 198 849	(61 939)
2015	1 282 606	1 225 163	(57 443)
2016	1 318 643	1 340 104	21 461
2017	1 330 275	1 388 381	58 106
2018	1 447 581	1 472 740	25 159
2019	1 502 601	1 532 539	29 938
2020	1 289 107	1 533 645	244 538
Avearge	1 252 202	1 267 873	15 671

Source 17: SA Reserve Bank

7.5 EMPLOYMENT IMPACTS

It is well-known that unemployment in SA is rampant and the causes for such high unemployment are many, which discussion is outside the scope of this report. Gas plants are very capital intensive and as a rule the cost of a job created is high relative to other economic sectors. However, gas plants are propulsive entities, meaning it has strong multiplier effects.

We showed the bases of our employment generation statistics in paragraph 5.3.1 page 15 in the paragraph headed “Positive economic impacts”.

A R3m GDP per employee was used to estimate the number of direct and contractor’s jobs for the Tetra4 expansion which is much higher than South Africa’s GDP per employee of R500k. This shows that the GDP created per direct employee in the Tetra4 expansion is 6x more.

Note we did not use Tetra4’s organogram because of outsourcing and out-contracting difficulties in calculating the correct number.

The estimated direct employment is set at 1 218 and at a multiplier of 3.80 this amounts to total estimated job creation of 4 623 in the national economy. Calculated as relative to the Matjhabeng’s total employment in 2016 of 80 211 employees, it amounts to a 5,8% increase. It is undoubted that this will be a major increase.

It needs to be stressed that a high ration of job creation will be in the highly-skilled category (possibly 40%).

It is important to note that Matjhabeng’s electricity and gas sector employed a total of 539 in 2019 compared to 463 people in 2009. (Matjhabeng LED Plan 2019) The direct employment at Tetra4 and its direct contractors of 1 218 employees is clearly a major increase from the 539 in 2019.

A further analysis worth indicating is shown in the table below. As an introduction, it must be stated that the "bars" below are based on the economic structures of gas economies, not SA. The average of UK, USA and Russian input-output tables were used. This table shows the high employment propulsive impacts of employment creation of a gas plant. Note the high creation of jobs in wholesale and retail (e.g. distribution centres and companies), followed by manufacturing (e.g. manufacturing of gas equipment), professional services, construction and financial services. Pipelines fall under warehousing and other transport and due to the low job requirements for pipelines this sector does not create that many jobs.

This analysis shows that should Tetra4 drive its methane business as hard as its helium business, it could create an eco-system much like high gas economies. Renergen's proven methane resource is estimated at 600 billion cubic feet as in September 2021, which means that over a 100- year period it would have a resource of 6 billion cubic feet per annum, or 0,5 billion cubic feet per month. This report works on an assessment of 40 million cubic feet of gas per month. Thus, using these numbers it can be stated that the life of mine could be more than a 100 years. When considering that it is speculated that the United States has 90 years of gas resources left, it gives an indication of the scope and scale the Tetra4 expansion may achieve in SA.

Table 6: Indicate direct and indirect employment

Sum of Avg UK,USA and Russia	Direct Employment	Indirect Employmen
Wholesale and retail trade		57%
Manufacturing		51%
Professional, scientific and technical activities		45%
Electricity, gas and steam	100%	35%
Industry Other		25%
Construction		22%
Finance and insurance		19%
Government		13%
Transport		9%
Warehousing and other transport		8%
Other mining		2%
Coke and refined petroleum products		2%
Water and waste management		2%

Source 18: Own Calculations

7.6 FOREX SAVINGS

US Dollar Foreign Reserves of any country (excluding the United States itself), is of paramount importance when measuring a country's financial strength, and for international trading purposes. Tetra4 will likely replace all helium imports and in addition also export helium. In addition to this its

natural gas will result in savings of gas importation. Thus, its entire revenue per annum could be considered as a forex saving for South Africa.

As indicate above, the average net current account balance of SA in the last 10 years amounted to just over R15 billion, thus should the optimal turnover of Tetra4's sales be considered as a forex saving, then the impact could be 38% positive. This is a significant percentage, but it must be borne in mind the numerator is divided by the denominator of net trade, not total exports.

7.7 COUNTRY AND INDUSTRY COMPETITIVENESS

We discuss country and industry competitiveness in the need and desirability section of this report. Please refer to par 5.3.5 on page 33 of this report.

7.8 BLACK ECONOMIC TRANSFORMATION

The Gas Act makes provision for black economic transformation and the provisions thereof is described in the BBBEE Act. This project will need to comply with these provisions which compliance will have an obvious positive impact on economic transformation.

7.9 ALTERNATIVE LAND-USE ANALYSIS / FOOD SECURITY

The likely amount of hectares of directly impacted is set at 7 500 hectares based on a GIS survey undertaken by specialists of the environmental assessor. The stated hectares can be considered as the size of an average farm in the area and hence from a macro-economic viewpoint the Tetra4 development is a significant better land-use for South Africa.

8 FARMLAND VALUES

It is likely that farmland values would be impacted because of establishing wells, pump stations and gas-pipes across a wide area of farmland. For this reason we set as a mitigation, in line with the social impact assessment, that Tetra4 (or it's proxy) needs to negotiate with each individual farmer where there is clear evidence of land value losses (which losses could be a result of either productivity losses or general land value losses).

9 SITE SENSITIVITIES

From an economic perspective, the areas to avoid are productive farmland because this would decrease farming output.

10 SITE CONSTRAINTS

There were no site constraints noted while visiting the site, and there are economically no site constraints to optimising economic output.

10.1 IMPACT RATINGS

1. GGP Impact -					
Impact Name	**GGP Impact**				
Alternative	**0**				
Phase	**Construction**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	1	1	Magnitude of Impact	5	5
Extent of Impact	4	4	Reversibility of Impact	5	5
Duration of Impact	2	2	Probability	4	4
Environmental Risk (Pre-mitigation)					16.00
Mitigation Measures					

Table 7: GDP Impact

Mitigation #	Mitigation Title	Mitigation Description
19	Loss of agricultural land	Ensure that as much of the infrastructure as possible is sited away from agricultural lands. Utilize servitudes, farm roads and any other routes to avoid sensitive areas. Ensure that pipelines are buried at sufficient depth (>1 m minimum) to avoid interference with arable agriculture activities.
23	Influx of people looking for economic opportunities	Communication to stakeholders about the nature and extent of economic opportunities should be undertaken. No unrealistic expectations should be created and the recruitment policy giving preference to local labour should be communicated from the beginning of the project. The local area of influence should be agreed with stakeholders early on in the process.
28	Landowner Consultations	Landowners must be consulted and all reasonable requests complied with. A written landowner agreement should be negotiated and concluded prior to commencement. Should this not be possible, a record should be kept of reasonable negotiations with the land owners.
32	Impacts on land-use	The pipelines will be buried in accordance with the schedule as agreed upon with landowners to minimise disturbance to farming operations [Amendment 2019/05].
40	Loss of farm labour to the Cluster 1 project	If any farm labourers apply for positions at Tetra4 or one of its contractors, Tetra4 or the contractor must ensure that the labourer is aware that the position may only be temporary and what the long term consequences of taking the position are.
41	Potential for conflict between local residents and newcomers about economic opportunities.	Preference for employment should be given to the local community. The recruitment policy must be communicated openly and made available to the public if requested.

51	Potential opportunity for education, skills development, and training	Tetra4 should liaise with local training institutions or service providers to determine whether there are any opportunities to offer internships and practical experience for their students. Tetra4 must ensure that skills development requirements form part of their contracts with sub-consultants as prescribed in the SLP. The skills development requirements and bursaries for local learners as discussed in their Social and Labour Plan (SLP) must be implemented.
94	Interference with existing land uses/livelihoods	Tetra4 must appoint a CLO that deals with the affected landowners throughout the life of the project. If existing activities will be affected negatively Tetra4 must enter into negotiations with the affected parties as soon as reasonably achievable to ensure the affected parties are compensated fairly or can make additional arrangements. Interference with existing livelihoods should be avoided if possible. If any new activities are planned for a property, Tetra4 must consult with the landowner and take reasonable steps to obtain his consent to execute the activity on his/her land. A system to arrange access to properties must be devised and formalised. All reasonable efforts must be taken to obtain agreement on the system with the landowners and it must be formalised. Access must be arranged at least 24 hours prior, except in emergencies, when the landowners should also be informed immediately. If routine access is required, the landowners must be provided with a roster indicating dates and approximate times that access will be required. Tetra4 must compensate the landowners for any damage to property or goods if it was due to behaviour of their contractors. Sub-contractors must be made aware of this and a clause spelling out their liability should be included in their contracts. All contractors should sign a code of conduct as part of their induction process. Induction must explicitly include aspects such as closing gates and littering. Toolbox talks must be designed to include social and environmental aspects. A fining system must be put in place for any transgressions affecting the landowners.

100	Employment opportunities	Contractors should be required to make use of a certain proportion of local labour - it is acknowledged that not all skills will be available locally. Jobs should be advertised in a way that is accessible to all members of society and labour desks (labour registration stations) should be in accessible areas. No unrealistic expectations should be created and the recruitment policy giving preference to local labour should be communicated from the beginning of the project. The local area of influence should be agreed with the stakeholders early on in the process.
106	Secondary economic opportunities e.g. transport, domestic services, catering, etc.	Procurement targets to be in line with the existing Social Labour Plan (SLP). [Amendment 2019/05]

Environmental Risk (Post-mitigation)	16.00
Degree of confidence in impact prediction:	High
Impact Prioritisation	
Cumulative Impacts	1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.	
Degree of potential irreplaceable loss of resources	2
The impact may result in the irreplaceable loss (cannot be replaced or subsitituted) of resources but the value (services and/or functions) of these resources is limited.	
Prioritisation Factor	1.13
Final Significance	18.00

2. Employment Impacts -					
Impact Name	**Employment Impacts**				
Alternative	**0**				
Phase	**Construction**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	1	1	Magnitude of Impact	3	3
Extent of Impact	3	3	Reversibility of Impact	5	5
Duration of Impact	2	2	Probability	4	4
Environmental Risk (Pre-mitigation)					13.00
Mitigation Measures					

Table 8: Employment Impact

Mitigation #	Mitigation Title	Mitigation Description
23	Influx of people looking for economic opportunities	Communication to stakeholders about the nature and extent of economic opportunities should be undertaken. No unrealistic expectations should be created and the recruitment policy giving preference to local labour should be communicated from the beginning of the project. The local area of influence should be agreed with stakeholders early on in the process.
41	Potential for conflict between local residents and newcomers about economic opportunities.	Preference for employment should be given to the local community. The recruitment policy must be communicated openly and made available to the public if requested.
51	Potential opportunity for education, skills development, and training	Tetra4 should liaise with local training institutions or service providers to determine whether there are any opportunities to offer internships and practical experience for their students. Tetra4 must ensure that skills development requirements form part of their contracts with sub-consultants as prescribed in the SLP. The skills development requirements and bursaries for local learners as discussed in their Social and Labour Plan (SLP) must be implemented.
94	Interference with existing land uses/livelihoods	Tetra4 must appoint a CLO that deals with the affected landowners throughout the life of the project. If existing activities will be affected negatively Tetra4 must enter into negotiations with the affected parties as soon as reasonably achievable to ensure the affected parties are compensated fairly or can make additional arrangements. Interference with existing livelihoods should be avoided if possible. If any new activities are planned for a property, Tetra4 must consult with the landowner and take reasonable steps to obtain his consent to execute the activity on his/her land. A system to arrange access to properties

		must be devised and formalised. All reasonable efforts must be taken to obtain agreement on the system with the landowners and it must be formalised. Access must be arranged at least 24 hours prior, except in emergencies, when the landowners should also be informed immediately. If routine access is required, the landowners must be provided with a roster indicating dates and approximate times that access will be required. Tetra4 must compensate the landowners for any damage to property or goods if it was due to behaviour of their contractors. Sub-contractors must be made aware of this and a clause spelling out their liability should be included in their contracts. All contractors should sign a code of conduct as part of their induction process. Induction must explicitly include aspects such as closing gates and littering. Toolbox talks must be designed to include social and environmental aspects. A fining system must be put in place for any transgressions affecting the landowners.
100	Employment opportunities	Contractors should be required to make use of a certain proportion of local labour - it is acknowledged that not all skills will be available locally. Jobs should be advertised in a way that is accessible to all members of society and labour desks (labour registration stations) should be in accessible areas. No unrealistic expectations should be created and the recruitment policy giving preference to local labour should be communicated from the beginning of the project. The local area of influence should be agreed with the stakeholders early on in the process.

Environmental Risk (Post-mitigation)	13.00
Degree of confidence in impact prediction:	High
Impact Prioritisation	
Cumulative Impacts	1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.	
Degree of potential irreplaceable loss of resources	2
The impact may result in the irreplaceable loss (cannot be replaced or subsitituted) of resources but the value (services and/or functions) of these resources is limited.	

Prioritisation Factor	1.13
Final Significance	14.63

3. Forex savings -

Impact Name	**Forex savings**				
Alternative	**0**				
Phase	**Construction**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	1	1
Extent of Impact	5	5	Reversibility of Impact	5	5
Duration of Impact	2	2	Probability	3	3
Environmental Risk (Pre-mitigation)					-9.75
Mitigation Measures					
No mitigation foreseen.					
Environmental Risk (Post-mitigation)					-9.75
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Cumulative Impacts					1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or subsitituted) of resources but the value (services and/or functions) of these resources is limited.					

Prioritisation Factor	1.13
Final Significance	-10.97

4. Fiscal Income -

Impact Name	**Fiscal Income**				
Alternative	**0**				
Phase	**Construction**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	1	1	Magnitude of Impact	1	1
Extent of Impact	5	5	Reversibility of Impact	5	5
Duration of Impact	1	1	Probability	4	4
Environmental Risk (Pre-mitigation)					12.00
Mitigation Measures					
No mitigation foreseen.					
Environmental Risk (Post-mitigation)					12.00
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Cumulative Impacts					1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2

The impact may result in the irreplaceable loss (cannot be replaced or subsitituted) of resources but the value (services and/or functions) of these resources is limited.	
Prioritisation Factor	1.13
Final Significance	13.50

5. Economic development per capita -

Impact Name	**Economic development per capita**				
Alternative	**0**				
Phase	**Construction**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	1	1	Magnitude of Impact	4	4
Extent of Impact	4	4	Reversibility of Impact	5	5
Duration of Impact	2	2	Probability	4	4
Environmental Risk (Pre-mitigation)					15.00
Mitigation Measures					
See Table 7 above.					
Environmental Risk (Post-mitigation)					15.00
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Cumulative Impacts					1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2

The impact may result in the irreplaceable loss (cannot be replaced or subsitituted) of resources but the value (services and/or functions) of these resources is limited.	
Prioritisation Factor	1.13
Final Significance	16.88

6. Country and Industry Competitiveness -

Impact Name	**Country and Industry Competitiveness**				
Alternative	**0**				
Phase	**Construction**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	1	1	Magnitude of Impact	4	4
Extent of Impact	5	5	Reversibility of Impact	5	5
Duration of Impact	2	2	Probability	4	4
Environmental Risk (Pre-mitigation)					16.00
Mitigation Measures					
No mitigation foreseen.					
Environmental Risk (Post-mitigation)					16.00
Degree of confidence in impact prediction:					Medium
Impact Prioritisation					
Cumulative Impacts					1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.					

Degree of potential irreplaceable loss of resources	2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.	
Prioritisation Factor	1.13
Final Significance	18.00

7. Black Economic Transformation -

Impact Name	**Black Economic Transformation**				
Alternative	**0**				
Phase	**Construction**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	1	1	Magnitude of Impact	4	4
Extent of Impact	5	5	Reversibility of Impact	3	3
Duration of Impact	2	2	Probability	4	4
Environmental Risk (Pre-mitigation)					14.00
Mitigation Measures					
No mitigation foreseen.					
Environmental Risk (Post-mitigation)					14.00
Degree of confidence in impact prediction:					Medium
Impact Prioritisation					
Cumulative Impacts					1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.					

Degree of potential irreplaceable loss of resources	2
The impact may result in the irreplaceable loss (cannot be replaced or subsitituted) of resources but the value (services and/or functions) of these resources is limited.	
Prioritisation Factor	1.13
Final Significance	15.75

8. Alternative Land-use -

Impact Name	**Alternative Land-use**				
Alternative	**0**				
Phase	**Construction**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	1	1	Magnitude of Impact	1	1
Extent of Impact	2	2	Reversibility of Impact	2	2
Duration of Impact	2	2	Probability	5	5
Environmental Risk (Pre-mitigation)					8.75
Mitigation Measures					

Table 9: Alternative land-use

Mitigation #	Mitigation Title	Mitigation Description
19	Loss of agricultural land	Ensure that as much of the infrastructure as possible is sited away from agricultural lands. Utilize servitudes, farm roads and any other routes to avoid sensitive areas. Ensure that pipelines are buried at sufficient depth (>1 m minimum) to avoid interference with arable agriculture activities.
28	Landowner Consultations	Landowners must be consulted and all reasonable requests complied with. A written landowner agreement should be negotiated and concluded prior to commencement. Should this not be possible, a record should be kept of reasonable negotiations with the land owners.
32	Impacts on land-use	The pipelines will be buried in accordance with the schedule as agreed upon with landowners to minimise disturbance to farming operations [Amendment 2019/05].
40	Loss of farm labour to the Cluster 1 project	If any farm labourers apply for positions at Tetra4 or one of its contractors, Tetra4 or the contractor must ensure that the labourer is aware that the position may only be temporary and what the long term consequences of taking the position are.
41	Potential for conflict between local residents and newcomers about economic opportunities.	Preference for employment should be given to the local community. The recruitment policy must be communicated openly and made available to the public if requested.
94	Interference with existing land uses/livelihoods	Tetra4 must appoint a CLO that deals with the affected landowners throughout the life of the project. If existing activities will be affected negatively Tetra4 must enter into negotiations with the affected parties as soon as reasonably achievable to ensure the affected parties are compensated fairly or can make additional arrangements. Interference with existing livelihoods should be avoided if possible. If any new

		activities are planned for a property, Tetra4 must consult with the landowner and take reasonable steps to obtain his consent to execute the activity on his/her land. A system to arrange access to properties must be devised and formalised. All reasonable efforts must be taken to obtain agreement on the system with the landowners and it must be formalised. Access must be arranged at least 24 hours prior, except in emergencies, when the landowners should also be informed immediately. If routine access is required, the landowners must be provided with a roster indicating dates and approximate times that access will be required. Tetra4 must compensate the landowners for any damage to property or goods if it was due to behaviour of their contractors. Sub-contractors must be made aware of this and a clause spelling out their liability should be included in their contracts. All contractors should sign a code of conduct as part of their induction process. Induction must explicitly include aspects such as closing gates and littering. Toolbox talks must be designed to include social and environmental aspects. A fining system must be put in place for any transgressions affecting the landowners.	

Environmental Risk (Post-mitigation)	8.75
Degree of confidence in impact prediction:	High
Impact Prioritisation	
Cumulative Impacts	1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.	
Degree of potential irreplaceable loss of resources	2
The impact may result in the irreplaceable loss (cannot be replaced or subsitituted) of resources but the value (services and/or functions) of these resources is limited.	
Prioritisation Factor	1.13
Final Significance	9.84

9. Need and Desirability -					
Impact Name	**Need and Desirability**				
Alternative	**0**				
Phase	**Construction**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	1	1	Magnitude of Impact	5	5
Extent of Impact	4	4	Reversibility of Impact	4	4
Duration of Impact	2	2	Probability	4	4
Environmental Risk (Pre-mitigation)					15.00
Mitigation Measures					
See Table 7 above.					
Environmental Risk (Post-mitigation)					15.00
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Cumulative Impacts					1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or subsitituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.13
Final Significance					16.88

10. Impact on individual farmland values -					
Impact Name	**Impact on individual farmland values**				
Alternative	**0**				
Phase	**Construction**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	3	3
Extent of Impact	3	3	Reversibility of Impact	2	2
Duration of Impact	2	2	Probability	3	3
Environmental Risk (Pre-mitigation)					-7.50
Mitigation Measures					
See Table 9 Above.					
Environmental Risk (Post-mitigation)					-7.50
Degree of confidence in impact prediction:					Low
Impact Prioritisation					
Cumulative Impacts					1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or subsitituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.13
Final Significance					-8.44

11. GGP Impact -					
Impact Name	**GGP Impact**				
Alternative	**0**				
Phase	**Operation**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	1	1	Magnitude of Impact	5	5
Extent of Impact	5	5	Reversibility of Impact	5	5
Duration of Impact	4	4	Probability	5	5
Environmental Risk (Pre-mitigation)					23.75
Mitigation Measures					
See Table 7 above.					
Environmental Risk (Post-mitigation)					23.75
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Cumulative Impacts					3
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/definite that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or subsitituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.38
Final Significance					32.66

12. Employment Impacts -					
Impact Name	**Employment Impacts**				
Alternative	**0**				
Phase	**Operation**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	1	1	Magnitude of Impact	4	4
Extent of Impact	4	4	Reversibility of Impact	5	5
Duration of Impact	4	4	Probability	4	4
Environmental Risk (Pre-mitigation)					17.00
Mitigation Measures					
See Table 8 above.					
Environmental Risk (Post-mitigation)					17.00
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Cumulative Impacts					3
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/definite that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or subsitituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.38
Final Significance					23.38

13. Forex savings -					
Impact Name	**Forex savings**				
Alternative	**0**				
Phase	**Operation**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	1	1	Magnitude of Impact	4	4
Extent of Impact	5	5	Reversibility of Impact	5	5
Duration of Impact	4	4	Probability	4	4
Environmental Risk (Pre-mitigation)					18.00
Mitigation Measures					
No mitigation required.					
Environmental Risk (Post-mitigation)					18.00
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Cumulative Impacts					3
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/definite that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or subsitituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.38
Final Significance					24.75

14. Fiscal Income -

Impact Name	Fiscal Income				
Alternative	0				
Phase	Operation				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	1	1	Magnitude of Impact	3	3
Extent of Impact	5	5	Reversibility of Impact	5	5
Duration of Impact	4	4	Probability	4	4
Environmental Risk (Pre-mitigation)					17.00
Mitigation Measures					
No mitigation required.					
Environmental Risk (Post-mitigation)					17.00
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Cumulative Impacts					3
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/definite that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or subsitituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.38
Final Significance					23.38

15. Economic development per capita -

Impact Name	Economic development per capita				
Alternative	0				
Phase	Operation				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	1	1	Magnitude of Impact	4	4
Extent of Impact	4	4	Reversibility of Impact	5	5
Duration of Impact	4	4	Probability	4	4
Environmental Risk (Pre-mitigation)					17.00
Mitigation Measures					
See Table 7 above.					
Environmental Risk (Post-mitigation)					17.00
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Cumulative Impacts					3
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/definite that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or subsitituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.38
Final Significance					23.38

16. Country and Industry Competitiveness -

Impact Name	Country and Industry Competitiveness				
Alternative	**0**				
Phase	**Operation**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	1	1	Magnitude of Impact	5	5
Extent of Impact	5	5	Reversibility of Impact	5	5
Duration of Impact	5	5	Probability	4	4
Environmental Risk (Pre-mitigation)					20.00
Mitigation Measures					
See Table 7 above.					
Environmental Risk (Post-mitigation)					20.00
Degree of confidence in impact prediction:					Medium
Impact Prioritisation					
Cumulative Impacts					3
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/definite that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or subsitituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.38

Final Significance	27.50

17. Black Economic Transformation -

Impact Name	Black Economic Transformation				
Alternative	0				
Phase	Operation				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	1	1	Magnitude of Impact	4	4
Extent of Impact	5	5	Reversibility of Impact	3	3
Duration of Impact	4	4	Probability	4	4
Environmental Risk (Pre-mitigation)					16.00
Mitigation Measures					
No mitigation required.					
Environmental Risk (Post-mitigation)					16.00
Degree of confidence in impact prediction:					Medium
Impact Prioritisation					
Cumulative Impacts					3
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/definite that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or subsitituted) of resources but the value (services and/or functions) of these resources is limited.					

Prioritisation Factor	1.38
Final Significance	22.00

18. Alternative Land-use -

Impact Name	**Alternative Land-use**				
Alternative	**0**				
Phase	**Operation**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	1	1	Magnitude of Impact	1	1
Extent of Impact	2	2	Reversibility of Impact	2	2
Duration of Impact	4	4	Probability	5	5
Environmental Risk (Pre-mitigation)					11.25
Mitigation Measures					
See Table 9 above.					
Environmental Risk (Post-mitigation)					11.25
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Cumulative Impacts					3
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/definite that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2

The impact may result in the irreplaceable loss (cannot be replaced or subsitituted) of resources but the value (services and/or functions) of these resources is limited.	
Prioritisation Factor	1.38
Final Significance	15.47

19. Need and Desirability -

Impact Name	**Need and Desirability**				
Alternative	**0**				
Phase	**Operation**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	1	1	Magnitude of Impact	5	5
Extent of Impact	5	5	Reversibility of Impact	5	5
Duration of Impact	5	5	Probability	4	4
Environmental Risk (Pre-mitigation)					20.00
Mitigation Measures					
See Table 7 above.					
Environmental Risk (Post-mitigation)					20.00
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Cumulative Impacts					3
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/definite that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2

The impact may result in the irreplaceable loss (cannot be replaced or subsitituted) of resources but the value (services and/or functions) of these resources is limited.	
Prioritisation Factor	1.38
Final Significance	27.50

20. Impact on individual farmland values -

Impact Name	**Impact on individual farmland values**				
Alternative	**0**				
Phase	**Operation**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	3	3
Extent of Impact	3	3	Reversibility of Impact	2	2
Duration of Impact	4	4	Probability	3	3
Environmental Risk (Pre-mitigation)					-9.00
Mitigation Measures					
See Table 9 above.					
Environmental Risk (Post-mitigation)					-9.00
Degree of confidence in impact prediction:					0
Impact Prioritisation					
Cumulative Impacts					3
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/definite that the impact will result in spatial and temporal cumulative change.					

Degree of potential irreplaceable loss of resources	2
The impact may result in the irreplaceable loss (cannot be replaced or subsitituted) of resources but the value (services and/or functions) of these resources is limited.	
Prioritisation Factor	1.38
Final Significance	-12.38

21. GGP Impact -

Impact Name	**GGP Impact**				
Alternative	**0**				
Phase	**Decommissioning**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	4	4
Extent of Impact	4	4	Reversibility of Impact	3	3
Duration of Impact	2	2	Probability	4	4
Environmental Risk (Pre-mitigation)					-13.00
Mitigation Measures					
Comply with downscaling regulations of the DMRE.					
Environmental Risk (Post-mitigation)					-13.00
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Cumulative Impacts					1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.					

Degree of potential irreplaceable loss of resources	1
The impact is unlikely to result in irreplaceable loss of resources.	
Prioritisation Factor	1.00
Final Significance	-13.00

22. Employment Impacts -

Impact Name	**Employment Impacts**				
Alternative	**0**				
Phase	**Decommissioning**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	4	4
Extent of Impact	4	4	Reversibility of Impact	3	3
Duration of Impact	2	2	Probability	4	4
Environmental Risk (Pre-mitigation)					-13.00
Mitigation Measures					
Comply with downscaling regulations of the DMRE.					
Environmental Risk (Post-mitigation)					-13.00
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Cumulative Impacts					1

Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.	
Degree of potential irreplaceable loss of resources	1
The impact is unlikely to result in irreplaceable loss of resources.	
Prioritisation Factor	1.00
Final Significance	-13.00

23. Forex savings -

Impact Name	**Forex savings**				
Alternative	**0**				
Phase	**Decommissioning**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	4	4
Extent of Impact	4	4	Reversibility of Impact	5	5
Duration of Impact	5	5	Probability	5	5
Environmental Risk (Pre-mitigation)					-22.50
Mitigation Measures					
No mitigation required.					
Environmental Risk (Post-mitigation)					-22.50
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Cumulative Impacts					1

Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.	
Degree of potential irreplaceable loss of resources	1
The impact is unlikely to result in irreplaceable loss of resources.	
Prioritisation Factor	1.00
Final Significance	-22.50

24. Fiscal Income -

Impact Name	**Fiscal Income**				
Alternative	**0**				
Phase	**Decommissioning**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	4	4
Extent of Impact	4	4	Reversibility of Impact	5	5
Duration of Impact	5	5	Probability	5	5
Environmental Risk (Pre-mitigation)					-22.50
Mitigation Measures					
No mitigation required.					
Environmental Risk (Post-mitigation)					-22.50
Degree of confidence in impact prediction:					High
Impact Prioritisation					

Cumulative Impacts	1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.	
Degree of potential irreplaceable loss of resources	1
The impact is unlikely to result in irreplaceable loss of resources.	
Prioritisation Factor	1.00
Final Significance	-22.50

25. Economic development per capita -

Impact Name	**Economic development per capita**				
Alternative	**0**				
Phase	**Decommissioning**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	4	4
Extent of Impact	4	4	Reversibility of Impact	3	3
Duration of Impact	2	2	Probability	4	4
Environmental Risk (Pre-mitigation)					-13.00
Mitigation Measures					
Comply with downscaling regulations of the DMRE.					
Environmental Risk (Post-mitigation)					-13.00
Degree of confidence in impact prediction:					High
Impact Prioritisation					

Cumulative Impacts	1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.	
Degree of potential irreplaceable loss of resources	1
The impact is unlikely to result in irreplaceable loss of resources.	
Prioritisation Factor	1.00
Final Significance	-13.00

26. Country and Industry Competitiveness -

Impact Name	**Country and Industry Competitiveness**				
Alternative	**0**				
Phase	**Decommissioning**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	3	3
Extent of Impact	5	5	Reversibility of Impact	5	5
Duration of Impact	5	5	Probability	4	4
Environmental Risk (Pre-mitigation)					-18.00
Mitigation Measures					
Comply with downscaling regulations of the DMRE.					
Environmental Risk (Post-mitigation)					-18.00
Degree of confidence in impact prediction:					Medium

Impact Prioritisation	
Cumulative Impacts	1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.	
Degree of potential irreplaceable loss of resources	1
The impact is unlikely to result in irreplaceable loss of resources.	
Prioritisation Factor	1.00
Final Significance	-18.00

27. Black Economic Transformation -

Impact Name	Black Economic Transformation				
Alternative	0				
Phase	Decommissioning				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	3	3
Extent of Impact	3	3	Reversibility of Impact	5	5
Duration of Impact	5	5	Probability	4	4
Environmental Risk (Pre-mitigation)					-16.00
Mitigation Measures					
Comply with downscaling regulations of the DMRE.					
Environmental Risk (Post-mitigation)					-16.00
Degree of confidence in impact prediction:					Medium

Impact Prioritisation	
Cumulative Impacts	1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.	
Degree of potential irreplaceable loss of resources	1
The impact is unlikely to result in irreplaceable loss of resources.	
Prioritisation Factor	1.00
Final Significance	-16.00

28. Alternative Land-use -

Impact Name	**Alternative Land-use**				
Alternative	**0**				
Phase	**Decommissioning**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	4	4
Extent of Impact	2	2	Reversibility of Impact	4	4
Duration of Impact	2	2	Probability	5	5
Environmental Risk (Pre-mitigation)					-15.00
Mitigation Measures					
Comply with downscaling regulations of the DMRE.					
Environmental Risk (Post-mitigation)					-15.00

Degree of confidence in impact prediction:	High
Impact Prioritisation	
Cumulative Impacts	1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.	
Degree of potential irreplaceable loss of resources	1
The impact is unlikely to result in irreplaceable loss of resources.	
Prioritisation Factor	1.00
Final Significance	-15.00

29. Need and Desirability -

Impact Name	**Need and Desirability**				
Alternative	**0**				
Phase	**Decommissioning**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	5	5
Extent of Impact	4	4	Reversibility of Impact	4	4
Duration of Impact	2	2	Probability	4	4
Environmental Risk (Pre-mitigation)					-15.00
Mitigation Measures					
Comply with downscaling regulations of the DMRE.					
Environmental Risk (Post-mitigation)					-15.00

Degree of confidence in impact prediction:	High
Impact Prioritisation	
Cumulative Impacts	1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.	
Degree of potential irreplaceable loss of resources	1
The impact is unlikely to result in irreplaceable loss of resources.	
Prioritisation Factor	1.00
Final Significance	-15.00

30. Impact on individual farmland values -

Impact Name	**Impact on individual farmland values**				
Alternative	**0**				
Phase	**Decommissioning**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	1	1	Magnitude of Impact	3	3
Extent of Impact	3	3	Reversibility of Impact	3	3
Duration of Impact	2	2	Probability	3	3
Environmental Risk (Pre-mitigation)					8.25
Mitigation Measures					
Comply with downscaling regulations of the DMRE.					

Environmental Risk (Post-mitigation)	8.25
Degree of confidence in impact prediction:	0
Impact Prioritisation	
Cumulative Impacts	1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.	
Degree of potential irreplaceable loss of resources	1
The impact is unlikely to result in irreplaceable loss of resources.	
Prioritisation Factor	1.00
Final Significance	8.25

31. GGP Impact -

Impact Name	**GGP Impact**				
Alternative	**0**				
Phase	**Rehab and closure**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	4	4
Extent of Impact	4	4	Reversibility of Impact	5	5
Duration of Impact	5	5	Probability	5	5
Environmental Risk (Pre-mitigation)					-22.50
Mitigation Measures					
Comply with downscaling regulations of the DMRE.					

Environmental Risk (Post-mitigation)	-22.50
Degree of confidence in impact prediction:	High
Impact Prioritisation	
Cumulative Impacts	1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.	
Degree of potential irreplaceable loss of resources	1
The impact is unlikely to result in irreplaceable loss of resources.	
Prioritisation Factor	1.00
Final Significance	-22.50

32. Employment Impacts -

Impact Name	**Employment Impacts**				
Alternative	**0**				
Phase	**Rehab and closure**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	4	4
Extent of Impact	4	4	Reversibility of Impact	5	5
Duration of Impact	5	5	Probability	5	5
Environmental Risk (Pre-mitigation)					-22.50
Mitigation Measures					

Comply with downscaling regulations of the DMRE.

Environmental Risk (Post-mitigation)	-22.50
Degree of confidence in impact prediction:	High
Impact Prioritisation	
Cumulative Impacts	1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.	
Degree of potential irreplaceable loss of resources	1
The impact is unlikely to result in irreplaceable loss of resources.	
Prioritisation Factor	1.00
Final Significance	-22.50

33. Forex savings -

Impact Name	**Forex savings**				
Alternative	**0**				
Phase	**Rehab and closure**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	4	4
Extent of Impact	4	4	Reversibility of Impact	5	5
Duration of Impact	5	5	Probability	5	5
Environmental Risk (Pre-mitigation)					-22.50

Mitigation Measures	
No mitigation required.	
Environmental Risk (Post-mitigation)	-22.50
Degree of confidence in impact prediction:	High
Impact Prioritisation	
Cumulative Impacts	1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.	
Degree of potential irreplaceable loss of resources	1
The impact is unlikely to result in irreplaceable loss of resources.	
Prioritisation Factor	1.00
Final Significance	-22.50

34. Fiscal Income -

Impact Name	**Fiscal Income**				
Alternative	**0**				
Phase	**Rehab and closure**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	4	4
Extent of Impact	4	4	Reversibility of Impact	5	5
Duration of Impact	5	5	Probability	5	5

Environmental Risk (Pre-mitigation)	-22.50
Mitigation Measures	
No mitigation required.	
Environmental Risk (Post-mitigation)	-22.50
Degree of confidence in impact prediction:	High
Impact Prioritisation	
Cumulative Impacts	1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.	
Degree of potential irreplaceable loss of resources	1
The impact is unlikely to result in irreplaceable loss of resources.	
Prioritisation Factor	1.00
Final Significance	-22.50

35. Economic development per capita -

Impact Name	**Economic development per capita**				
Alternative	**0**				
Phase	**Rehab and closure**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	4	4
Extent of Impact	4	4	Reversibility of Impact	5	5
Duration of Impact	5	5	Probability	5	5

Environmental Risk (Pre-mitigation)	-22.50
Mitigation Measures	
Comply with downscaling regulations of the DMRE.	
Environmental Risk (Post-mitigation)	-22.50
Degree of confidence in impact prediction:	High
Impact Prioritisation	
Cumulative Impacts	1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.	
Degree of potential irreplaceable loss of resources	1
The impact is unlikely to result in irreplaceable loss of resources.	
Prioritisation Factor	1.00
Final Significance	-22.50

36. Country and Industry Competitiveness -

Impact Name	**Country and Industry Competitiveness**				
Alternative	**0**				
Phase	**Rehab and closure**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	3	3
Extent of Impact	5	5	Reversibility of Impact	2	2

Duration of Impact	5	5	Probability	4	4
Environmental Risk (Pre-mitigation)					-15.00
Mitigation Measures					
Comply with downscaling regulations of the DMRE.					
Environmental Risk (Post-mitigation)					-15.00
Degree of confidence in impact prediction:					Medium
Impact Prioritisation					
Cumulative Impacts					1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					1
The impact is unlikely to result in irreplaceable loss of resources.					
Prioritisation Factor					1.00
Final Significance					-15.00

37. Black Economic Transformation -

Impact Name	**Black Economic Transformation**				
Alternative	**0**				
Phase	**Rehab and closure**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	3	3

Extent of Impact	3	3	Reversibility of Impact	5	5
Duration of Impact	5	5	Probability	4	4
Environmental Risk (Pre-mitigation)					-16.00
Mitigation Measures					
Comply with downscaling regulations of the DMRE.					
Environmental Risk (Post-mitigation)					-16.00
Degree of confidence in impact prediction:					Medium
Impact Prioritisation					
Cumulative Impacts					1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					1
The impact is unlikely to result in irreplaceable loss of resources.					
Prioritisation Factor					1.00
Final Significance					-16.00

39. Need and Desirability -

Impact Name	**Need and Desirability**				
Alternative	**0**				
Phase	**Rehab and closure**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**

Nature of Impact	-1	-1	Magnitude of Impact	5	5
Extent of Impact	4	4	Reversibility of Impact	4	4
Duration of Impact	5	5	Probability	4	4
Environmental Risk (Pre-mitigation)					-18.00
Mitigation Measures					
Comply with downscaling regulations of the DMRE.					
Environmental Risk (Post-mitigation)					-18.00
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Cumulative Impacts					1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					1
The impact is unlikely to result in irreplaceable loss of resources.					
Prioritisation Factor					1.00
Final Significance					-18.00

40. Impact on individual farmland values -

Impact Name	**Impact on individual farmland values**				
Alternative	**0**				
Phase	**Rehab and closure**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	1	1	Magnitude of Impact	3	3

Extent of Impact	3	3	Reversibility of Impact	3	3
Duration of Impact	2	2	Probability	3	3
Environmental Risk (Pre-mitigation)					8.25
Mitigation Measures					
Comply with downscaling regulations of the DMRE.					
Environmental Risk (Post-mitigation)					8.25
Degree of confidence in impact prediction:					0
Impact Prioritisation					
Cumulative Impacts					1
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					1
The impact is unlikely to result in irreplaceable loss of resources.					
Prioritisation Factor					1.00
Final Significance					8.25

11 MITIGATION

See the above section for the mitigation measures.

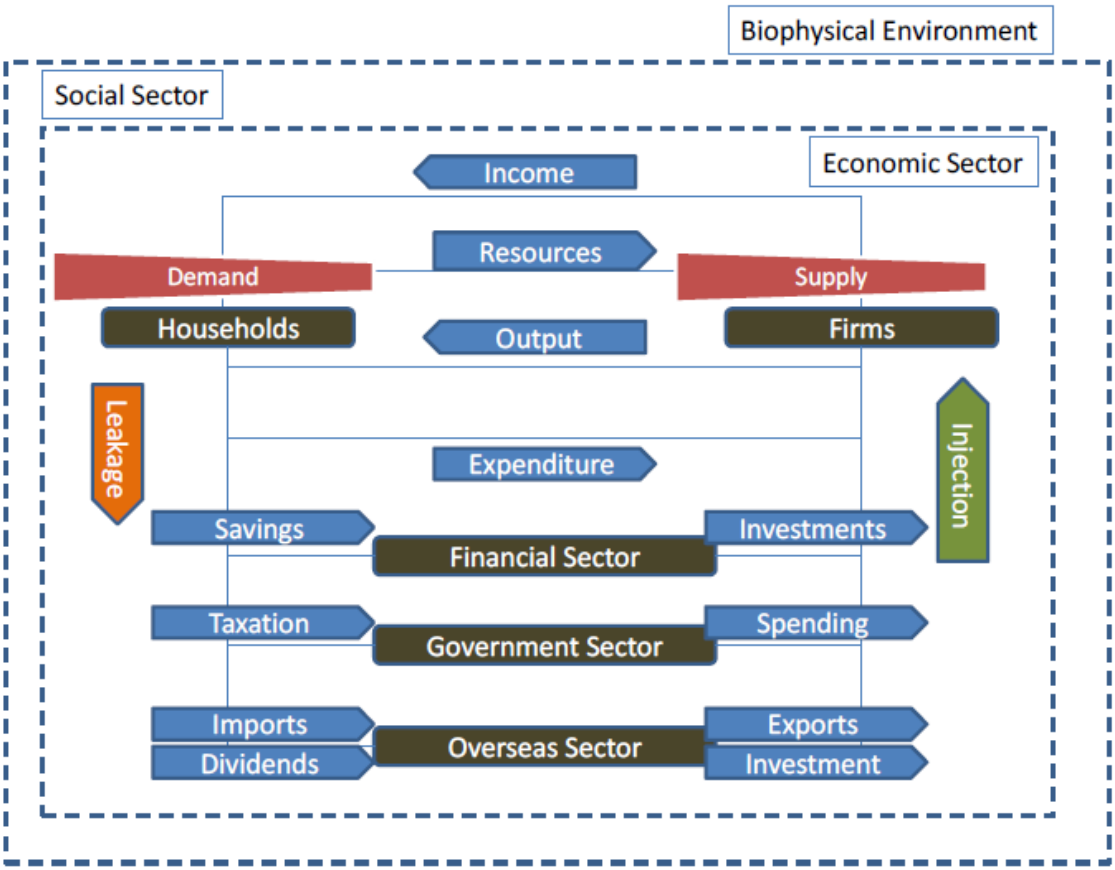
12 ADDENDUM 1

Although this is a relatively old study (2013), it gives a very good example of the structure of multipliers in the USA. Although the multipliers are not in fact calculated in the table below, these ratios are easy to calculate. Suffice to say, this study was undertaken by a reputable organization and its ratios are comparable to this evaluation's own estimates. Keep in mind yet again that the gas sector in SA is slightly under-recorded and SA's gas multipliers are combined with the Electricity Sector.

Sector Description	Employment*	Labor Income ($ million)**	Value Added ($ million)
Direct Impact of the Oil and Natural Gas Industry	**2,590,700**	**$203,591**	**$551,018**
Indirect and Induced Impact on Other Industries	**7,242,600**	**$394,024**	**$658,372**
Operational Impact	***5,854,500***	***$311,777***	***$522,535***
Agriculture	84,700	$2,591	$3,978
Mining	13,700	$1,064	$2,749
Utilities	24,600	$3,256	$12,950
Construction	430,000	$23,762	$25,822
Manufacturing	380,200	$26,826	$46,883
Wholesale and retail trade	777,600	$33,179	$54,430
Transportation and warehousing	228,900	$11,869	$16,159
Information	101,700	$10,432	$20,710
Finance, insurance, real estate, rental and leasing	721,200	$37,435	$144,867
Services	2,829,100	$142,602	$172,764
Other	262,700	$18,761	$21,221
Capital Investment Impact	***1,388,100***	***$82,247***	***$135,837***
Agriculture	17,400	$592	$876
Mining	3,700	$282	$699
Utilities	4,000	$525	$2,165
Construction	20,900	$1,170	$1,390
Manufacturing	221,800	$17,941	$28,886
Wholesale and retail trade	218,000	$11,497	$19,450
Transportation and warehousing	57,600	$3,073	$4,342
Information	35,200	$3,810	$7,950
Finance, insurance, real estate, rental and leasing	155,000	$8,091	$26,553
Services	640,500	$34,270	$42,575
Other	13,900	$997	$953
Total Economic Impact	**9,833,200**	**$597,615**	**$1,209,389**

Source: PwC calculations using the IMPLAN modeling system (2011 database).
Details may not add to totals due to rounding.
* Employment is defined as the number of payroll and self-employed jobs, including part-time jobs.
** Labor income is defined as wages and salaries and benefits as well as proprietors' income.

[i] https://www.api.org/~/media/files/policy/jobs/economic_impacts_ong_2011.pdf


Biophysical Environment
Social Sector
Economic Sector
Income
Resources
Demand
Supply
Households
Output
Firms
Leakage
Injection
Expenditure
Savings
Investments
Financial Sector
Taxation
Spending
Government Sector
Imports
Exports
Dividends
Overseas Sector
Investment