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The state and progress of the gas to power programme in South Africa



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Scan this QR code with your smart phone or mobile device to read online. **Background:** The Integrated Resource Plan (IRP) is a plan that strives to ensure energy security and directs the goals of South Africa's energy governance. The IRP recognises G2P as an alternative energy source that has the potential to motivate and promote sustainable energy and clean energy, diversify the energy mix and minimise the amount of carbon footprint left behind.

Aim: The focus of this research is to describe current developments in South Africa towards implementing the G2P.

Setting: The research presented in this article investigates a national policy programme in the energy sector in South Africa.

Methods: This research is based on a secondary qualitative approach. Unobtrusive research techniques are used to analyse secondary data and authoritative literature sources.

Results: The findings of this article indicate that there are a few problems that are preventing South Africa from having a successful implementation of the G2P. Among them are the monopoly that exists in the energy industry and the lack of clarity on the path that the present policy direction on G2P would take.

Conclusion: The government has made significant headway in the implementation of the G2P by implementing a policy framework, developing institutional structures and delegating roles and duties to various key actors.

Contribution: This research seeks to update information on the progress and developments towards the implementation of the gas to power programme in South Africa. This will help stimulate debate and further research on areas that researchers and policymakers still need to consider within this research area.

Keywords: integrated resource plan; energy mix; energy sector; natural gas; procurement.

Introduction

South Africa's increasing reliance on fossil fuels means that the country needs a reliable and affordable energy supply, and natural gas offers both benefits (Shell 2012:1). Furthermore, natural gas is acknowledged as a potential alternative to coal in the 2012 National Development Plan (NDP) (National Planning Commission [NPC] 2012). Because South Africa's national electrical infrastructure lacks the capacity to function within appropriate operating buffers, sustainable energy is very important there. Overusing ageing power plants has also led to load shedding and other disruptions. The energy monopoly by Eskom Holdings SOC Pty Ltd has harmed interests and possibilities for investment in the energy sector, and the absence of capital and investment to build additional generation capacity is the primary cause of this (Public Servant Association 2015:2). South Africa's electricity industry is grappling with several complex problems. Eskom, the national company that provides more than 90% of the country's energy, frequently experiences load shedding or even load reduction because of its inability to keep up with demand (Eskom 2021). Existing Eskom coal-fired power facilities, the majority of which will be decommissioned in the next decades, are also the main source to South Africa's greenhouse gas (GHG) emissions that contribute to climate change (Department of Forestry, Fisheries, and the Environment 2021). Eskom has tremendous debt and no obvious way out of its financial dilemma. As a result, Eskom is especially susceptible to undertaking any initiatives that expose it to needless financial risk. There is, therefore, a pressing requirement for new utility-scale electricity generators and supporting infrastructure that is low in carbon emissions, costs and risks; however, the precise makeup of optimal energy investments is a matter of heated debate, political manoeuvring and industry lobbying.

Gas-to-power is a need in South Africa because of the country's significant interest in the field. The Department of Mineral Resources and Energy's (DMRE 2019) Integrated Resource Plan (IRP) for electrical infrastructure development calls for 3000 MW of gas by 2030. However, there are several signs that suggest a significantly larger gas-to-power industry is planned despite this official allocation (Halsey, Bridle & Geddes 2022). Firstly, for appetisers, as of March 2022, there are proposals for gas-to-power projects with a combined capacity of at least 14000 MW, which is equal to 36% of Eskom's nominal coal fleet capacity or 2.8 times the utility's current wind and solar capacity in operation (Halsey et al. 2022). For example, constructing 9500 MW of onshore gas plants near three ports, coupled with liquified natural gas (LNG) import facilities and pipelines, might cost more than ZAR184 billion (\$12.1bn). It is unclear how this number of possible projects fits into existing national power sector planning considering the present situation of gas-to-power legislation. Secondly, the Minister of Mineral Resources and Energy is given authority (including the ability to make capacity determinations) to steer the development of gas-to-power infrastructure under the proposed Gas Amendment Bill, which aims to 'unlock investment into the gas sector and facilitate the development of gas infrastructure' (Mantashe 2021). Gwede Mantashe, the current Minister, has said that 'increasing the generation from gas' is one reason why the IRP must be revised (Steyn 2022). The President of the Republic of South Africa (RSA) has called gas a 'game changer' (Ramaphosa 2019), suggesting that a large gas-to-power sector is planned beyond the existing IRP 2019.

Because the NDP of 2012 and the IRP of 2019 highlight these challenges as crucial to South Africa's energy growth, they are also of larger significance (DMRE 2019). Although the goals and rules for making efficient use of G2P energy technologies are outlined in both the NDP of 2012 and the IRP of 2019, very little is known about the specific obstacles to putting these plans into action. To improve the lives of its citizens, both in urban and rural areas, South Africa has set a lofty target of increasing power availability to nearly 90% of the whole population by the year 2030 (DMRE 2019). Renewable energy programmes in development now will provide the remaining 10%. Because of the impending retirement of over 11000 MW of capacity, South Africa would see a demand increase of over 40000 MW by the year 2030 (Mkhize 2020). Therefore, South Africa must expand its investment in renewable sources of energy by more than 20000 MW to meet the 2030 objective (Mkhize 2020). According to Halsey et al. (2022), a state power provider in South Africa's inability to keep up with demand for electricity has a significant influence on the country's economy and the social well-being of its population.

This context suggests that starting a gas-to-power industry from scratch would need substantial expenditures in gas supply infrastructure and power facilities. Thus, there is a need to conduct studies on this research area as well as their progress and development thereof. In the context of South Africa, however, there are few studies and industry reports that have emphasised the research focus of G2P, the development and progress of this initiative (DMRE 2022; Merven et al. 2017; Mills, Wells & Gyasie-Hayford 2021; Mkhize 2020). Based on this assumption, the research topic at hand is the lack of information available concerning G2P in the South African context, especially as it relates to the execution of the IRP's energy programme.

Methodology

The research design is qualitative and conceptual in nature. Jaakkola (2020:19) states that multiple ideas, literature streams and theories that perform different functions are commonly used in conceptual papers. These papers provide empirical insights because they expand upon and test preexisting ideas and notions (Jaakkola 2020:19). This study fits the criteria for a 'typology article'. An academic typology study, as stated by Jaakkola (2020:23), categorises different conceptual variations into different categories. A better knowledge of a phenomena or concept may be gained through reading a typology paper, which identifies and explains the defining characteristics of the many forms. A conceptual typology article presents:

[*A*] mode of reasoning that involves investigating a large number of particular examples, concepts, or instances in order to infer patterns from the data acquired in order to construct a conceptual category. (Auriacombe 2017:8)

Non-obtrusive research techniques include things such as existing observation and the critical analysis of materials such as documents, websites and academic journals (O'Brien 2011). For this study, secondary data and literature sources were analysed using covert research methods such as, content analysis and document analysis. With the goal of promoting objective, in-depth examination of concepts and situations, this was conducted (Auriacombe 2017:1). It was emphasised that qualitative data are incredibly useful for translating the meaning of a phenomenon into terms that can be understood as a reflection of other occurrences (Maxwell 2012:13). The procedures that were followed to carry out a documentary analysis, determine the criteria for inclusion and exclusion, select the appropriate search keywords and examine the sources to determine whether they were relevant. Based on these key search words, appropriate sources were chosen for further investigation. During the search for pertinent papers, the terms Natural Gas, LNG-2-Power, IRP, South Africa, Africa, Electricity, Integrated Energy Plan (IEP) and Gas Bill were chosen as search criteria. To locate the most relevant sources of information, the search procedure was carried out using specific inclusion and exclusion criteria as the foundation. The review of the paper consisted the following stages: firstly, finding relevant sources in accordance to the key words and terms (such as gas to power, energy development, integrated resource plan, and South Africa), thereafter, the found sources were scruitnised for relevance through considering their titles, abstracts and introductions. lastly, the relevant sources were analysed and included in the review of literature in this study.

To identify the initial list of sources, a search was conducted across six different online databases using the pertinent keywords. The search considered titles, primary concepts, abstracts and entire texts, and it did not restrict itself to a certain publishing year. The following online databases -Google, Google Scholar, Elviser, ResearchGate, ScienceDirect and Government websites - were utilised for this research. During the first phase of the research project, a total of 127 sources of information, such as publications and internet web pages, were uncovered. Only 62 of these met the exclusion and inclusion criteria for sources of information. This study, in its entirety, reviewed the following works of literature as part of the project: published and unpublished research reports on public policy, policy implementation and G2P; unpublished lectures, documented interviews, institutional and organisational periodic reports, and docudrama; Science Direct and News24 articles from academic journals and reference works and docudrama.

Table 1 indicates the initial list of sources generated through the first review.

Purpose and contribution of the study

The purpose of this study is to highlight and provide clarity on the developments surrounding the energy project that is currently being implemented, namely the G2P independent power programme in South Africa. As mentioned earlier, there are limited studies that focus on this research area especially in the South African context and from an importer's perspective. Another reason for the research is the substantial ambiguity surrounding South Africa's urgency, commitment and success on the G2P front. Despite being part of the 2019 IRP, the government and stakeholders are unsure if this energy programme's criteria, such as the request for quotation (RFQ) that was meant to be issued in November 2016, would be implemented. As such, the purpose of the research is to offer a snapshot of where G2P stands in South Africa now. This study's overarching goals are to (firstly) produce a status report on the current state of the G2P independent power procurement, and (secondly), contribute to the scant studies that exist on this research area, which is particularly scant in the South African context and other countries that import or seek to import LNG. Lastly, the study seeks to stimulate debate about crucial elements needed for the development of the G2P independent power procurement programme in the African region. To the scant studies that exist on this research area, which is particularly scant in the South African context and other countries that import LNG in Africa, and to stimulate debate about the other crucial elements needed for the development of the G2P independent power procurement programme in the African region.

Rationale for the Gas to Power programme

One of the major challenges in South Africa is ensuring the reliable and sustainable distribution of power to the public (Nel 2017:2–3). Concerns about route dependency, limited

TABLE 1: List of sources collected and reviewed for literature purposes.

Database	Type of document	Number of articles	Filtered by key concept/ title	Total number of relevant documents used	Type of source used	Total number of sources used
Google	All	55	Natural Gas, IRP, LNG-2-Power, South Africa, Electricity, IEP, Gas Bill	55	Conference papers, research reports, industry reports, books, Other internet sources	12
Google Scholar	Journal, Relevant Websites	24	Progress, G2P, Electricity, IRP, South Africa	24	Journal Articles	11
ScienceDirect	Journal Articles	1	Natural Gas, IRP, LNG-2-Power, South Africa, Electricity, IEP, Gas Bill	1	Journal Articles	0
Edward Elgar	Book	1	LNG, Natural Gas, Electricity, Africa	1	Peer-reviewed Book	1
Elviser	Journal Articles	7	Natural Gas, IRP, LNG-2-Power, South Africa, Electricity, IEP, Gas Bill	5	Journal Articles	1
ResearchGate	Journal Articles	4	LNG-to-Power, South Africa, electricity	4	Journal articles	0
United States Energy Information Administration	Industry Report and Analysis	1	LNG, Natural Gas, Africa/Global South	1	Industry Report	1
Simens	Industry Scoping Reports	1	LNG, Natural Gas, Africa	1	Industry Report	1
BP	Industry Reports	2	LNG, Natural Gas, Africa	2	Industry Reports	2
Shell	Industry Reports	2	Natural Gas, IRP, LNG-2-Power, South Africa, Electricity	2	Industry Reports	2
International Gas Union	Industry Reports	2	Natural Gas, IRP, LNG-2-Power, South Africa, Electricity	2	Industry Reports	2
Standard Bank	Industry Reports	2	Natural Gas, IRP, LNG-2-Power, South Africa, Electricity	2	Industry Reports	2
Government	Information Memorandum and request for proposals	21	Natural Gas, IRP, LNG-2-Power, South Africa, Electricity	21	Institutional reports, plans and Information memorandums	10
Government	Laws	4	Natural Gas, LNG, Electricity, South Africa	4	Legislative framework	4
Government	Policies	2	Natural Gas, LNG, Electricity, South Africa	2	Policy framework	2
Total	-	127	-	127	Articles	51

IRP, integrated resource plan; IEP, integrated energy plan; LNG, liquified natural gas.

resources, poor governance and a lack of private investment all contribute to these limitations. These issues must be fixed immediately. In addition to these, Nel (2017:2-3) identifies three other major problems that prevent a steady and sustainable power supply. Here is a rundown of them: to begin, the nation is stuck in 'dirty' technology and still relies on coal-fired power generation because of historical, social, political and economic issues. A highly centralised power grid that impedes progress in alternate power-generating technologies is also a contributing factor. People's reluctance to adopt new technologies is shown by the 'not in my backyard' phenomena. To overcome these obstacles, it is important to have a wide variety of 'clean' energy sources. The South African government has indicated its intention to do this with programmes like the G2P Independent Power Producer Procurement Program (IPPPP). This energy initiative will support in accomplishing the clean energy target, which is one of the United Nations' (UN) universal Sustainable Development Goals for 2030. This target was included in the list of Sustainable Development Goals because of the favourable environmental benefits it will have (SDGs).

Natural gas use is undeniably a defining feature of sustainable energy. Natural gas will offer energy stability, diversity and security (Coetzee 2019:21). The NDP's 2012 platform likewise supports a low-carbon economy transition that does not compromise the country's or its citizens' social and economic status. The Paris Agreement, which sought to reduce the average global temperature by two degrees Celsius by the year 2100, was approved by South Africa along with several other countries throughout the world. This plan states that South Africa must become 'globally competitive in the use of innovative technology for the design, production, and development of state-of-the-art nuclear energy systems' (NPC 2012:65). This means that South Africa needs a more varied energy mix. To combine several energy sources in a single industry is one definition of energy diversification. Therefore, the G2P IPPPP has been designated by the Department of Energy (DoE 2016a:13) as a cornerstone for the expansion of South Africa's gas industry beyond its original scope. According to the NDP, natural gas is one of South Africa's most promising potential energy sources, providing an enticing alternative for meeting the country's energy demands (NPC 2012). According to Wolpe and Reddy (2015:2), South Africa is among the top 12 countries responsible for global CO2 emissions. Coal is available, and the country's electricity-generating and energy-intensive industrial and mining sectors are contributing factors.

South Africa's energy mix is unsustainable because of its reliance on coal. Wolpe and Reddy (2015:1) earlier mentioned that South Africa is the 12th greatest CO_2 emitter worldwide. To further lessen South Africa's carbon impact, both the NDP (2012) and the IRP (2019) advocate cutting back on less-clean energy sources. The *National Climate Change Response White Paper* is only one of various measures South Africa has taken over the years to lower its carbon levy. It has been argued

whether these strategies are adequate to bring about a reduction in the country's carbon footprint.

Everyone in South Africa has the right to 'an environment that is not harmful to their health or well-being', according to Section 24(a) of the country's constitution. Moreover, according to Section 24(b), everyone has the right to live in a protected environment whose sustainable use is in line with future demands. This may be achieved by the implementation of legislation that reduces pollution, encourages conservation and fosters a safe, ecologically sustainable society. The South African government has committed to reducing carbon emissions, and the IRP of 2010 is a plan document to make that happen. It is a significant effort to reduce South Africa's reliance on coal while simultaneously increasing its use of renewable energy. Kusile and Medupi, the two largest power plants ever built in Africa, are now being equipped to generate more than 9.6 GW of power. In addition to the newly approved IPPPPs by the government cabinet, South Africa also constructed the water-pumped-storage hydro system in Ingula.

A major factor in reaching this objective is the growth of the G2P initiative. This is because LNG is a dependable, clean and green source of energy.

Policy context for the Gas to Power in South Africa

South Africa's energy industry is supported by a legislative and regulatory framework that is both large and complicated. The citizens of South Africa have the right to demand transparency and accountability from their government according to the country's ground-breaking legal framework. These regulations greatly improve transparency, accountability and their overall contribution to clean governance, which is defined as the just and equitable distribution of power from honest, reliable and economically beneficial institutions. A regulatory framework for the LNG project is as important as any other government endeavour in making sure that societal needs are satisfied. Investment in the gas industry is emphasised in Chapter 1 of the Gas Act. In addition, the Gas Act hopes to promote reliable gas transportation that allows for efficient regasification. When declaring that the goals of the Employment Equity Act (No. 55 of 1998) and the growth of competitive gas markets must be encouraged for skills development throughout the gas sector, this Act considers South Africa's broader socioeconomic problems. The Gas Act does not specifically name LNG as a source of energy, but it does address the socioeconomic inequalities that present in South Africa. Thus, as was said previously, it is imperative that the LNG project be conducted in a way that fosters the growth of relevant skills and the creation of new employment opportunities. Therefore, converting to LNG should enhance the efficiency with which society generates power and serve as a long-term investment in the progress of society.

Like the Gas Act of 2001, the Gas Amendment Bill (DoE 2013b) fails to include third-party access (TPA), despite its critical role in facilitating the LNG programme's rollout. Despite the lack of energy in law, the Gas Amendment Bill's contents are important to this research because they detail crucial elements like TPA that will be required for future gas deployment. The TPA states of economically non-dependent situations that they 'must have a legally enforceable right to access and utilise diverse energy network facilities held by third parties' (Kotlowski 2006:102). Including TPA in the LNG programme and in the policy to govern the programme's execution is crucial, as it might threaten the current pricing regime in the market, which is why 'imports from neighbouring sources within the Southern African Development Community (SADC) area' are encouraged by the LNG programme in South Africa (DoE 2016b:13). The programme also hopes to 'establish the framework for LNG import, storage, and regasification facilities to be put in place that may be made available for use by third parties', and TPA can contribute to this aim (DoE 2016b:13).

In contrast, this Bill refers to LNG and makes it clear that specific permissions are necessary for the establishment, operation and trade of LNG facilities. The Bill, which has not yet been signed into law, does not provide adequate guidelines for this proposal. Even nevertheless, the study's recommendations for regulating the rollout of the G2P programme need the restrictions imposed by this Bill. To emphasise the importance of permits for LNG facilities and trade, certain clauses are included. The National Energy Regulator of South Africa (NERSA) uses the parameters provided by the Gas Regulator Levies Act to determine the administrative and other costs connected with levies on natural gas. The Act also requires a review of the effectiveness, efficiency and cost-effectiveness of gas levies to be conducted by the Minister of Energy (now known as the Minister of Mineral Resources and Energy) per section 6. The Gas Regulator Levies Act, like the Gas Act, does not address LNG or its programme by name, but it does elaborate on the premise that gas levies should be practical, efficient and reasonably priced. Given that this Act is only generally applicable to 'gas' and not LNG or G2P specifically, it is only used as a model for a strategy to regulate the G2P initiative. In Chapter 1 of the National Energy Regulator Act, it is stated that a national energy regulator would be created (RSA 2004:4). The national regulator oversees regulating the electric, gas, and oil pipeline sectors. A national regulator is mandated by the National Energy Regulator Act (RSA 2004:4) to fulfil the responsibilities of the Petroleum Pipelines Regulatory Authority under section 4 of the Petroleum Pipelines Act and the Gas Regulator under section 4 of the Gas Act.

Establishing the rules for a national framework for energy production and supply falls under the purview of the *Electricity Regulation Act* (RSA 2006:6). The following goals are listed in Section 2 of Chapter 1 of this Act (RSA 2006:6):

- Ensure that the interests and needs of present and future electricity consumers and end-users are safeguarded and met, regarding the governance, efficiency, effectiveness, and long-term sustainability of the electricity supply industry within the broader context of economic energy regulation in the Republic to facilitate investment in the electricity supply industry.
- Facilitate investment in the electricity supply industry.
- Facilitate universal access to electricity.
- Promote the use of diverse energy sources and energy efficiency.
- Promote competitiveness and customer and end-user choice.
- Facilitate a fair balance between the interests of customers and end-users, licensees, investors in the electricity supply industry, and the public'.

The Act also specifies licence and registration requirements for the regulation of electricity generation, transmission, distribution, trade, import and export, as well as other relevant topics (RSA 2006:6). The fundamental goals of the DoE are outlined in the *National Energy Act* (No. 34 of 2008). The following are fundamental to the DoE's mandate, as stated in Chapter 1 of this Act (RSA 2008:6):

- 'Ensure reliable energy supply to the Republic.
- Enhance diversity in energy resources and supply.
- Facilitate sound management of energy demand and its conservation.
- Advance energy research and commercialise energyrelated technologies.
- Improve the quality of life of the people of South Africa by facilitating access to energy.
- Guarantee sound planning for energy supply, transportation, and consumption.
- Be considerate of safety, health, and environmental precautions relating to energy.
- Guarantee data collection on energy supply, transportation, and demand thereof.
- Supplying and consuming energy should be within appropriate standards and carried out through specifications of systems and processes.
- Provide for optimal supply, transformation, transportation, storage, and demand of energy that are planned, organised, and implemented in accordance with a balanced consideration of the security of supply, economics, consumer protection, and sustainable development.
- Contribute to the sustainable development of South Africa's economy'.

Several policy directives, national programmes and strategies are in place in addition to the legal framework that supports natural gas in South Africa. The NDP: Vukuzenzele – 2030, the IRP 2019, the IEP, the Medium-Term Strategic Framework (MTSF) 2014–2019 and the Efficient Energy Solutions (EES) of the RSA are among these

policies, programmes and initiatives. For governments to plan for the supply of power effectively, efficiently and economically in their different countries, an IRP is necessary globally (Siemens 2015:1). A portion of the IEP is the IRP. Instead of the energy plan, the national power plan is the focus. The IRP serves both theoretical and practical objectives. The theoretical goal's main objective is to pinpoint necessary investments in the power industry that will guarantee the realisation of national objectives. Finding inexpensive ways to meet the nation's demand for and supply of electricity is the practical goal.

The IRP, also known as the Living Plan, has as its primary goal the provision of a comprehensive and fair assessment of the main elements of an efficient electrical plan that considers both the advantages and disadvantages of its eventual implementation. The following ten elements of a successful electricity blueprint are based not just on South African principles, but also on worldwide viewpoints. According to the DoE (2011:12–19), South Africa has the worst electricity delays in the world, so its IRP includes the following features:

- 'Planning process,
- objectives of the plan,
- · checks on previously implemented plans,
- demand forecast methodology,
- assessment of resource alternatives,
- policy mechanisms to achieve objectives,
- regulatory and institutional frameworks,
- investment financing,
- social and environmental contemplations, and
- enhancement of improvement and expectation of emerging constraints'.

Regarding G2P, this strategy acknowledges G2P technology as an energy alternative to attain energy security and eventually reduce the country's GHG emissions from the 80% that were identified through Intended Nationally Determined Contributions (INDCs) via the United Nations Framework Convention on Climate Change (UNFCCC) in November 2016 (DMRE 2019:8). According to the IRP (DMRE 2019:9), G2P technologies such as Combined Cycle Gas Turbine (CCGT), Combined Cycle Power Plant (CCPP) offer the flexibility needed to supplement renewable energy. The significance and applicability of LNG to the promotion of renewables have been the subject of a larger debate and discussion, which includes the strategy described by the IRP. Aside from this, the IRP makes it obvious that South Africa must import natural gas to meet its energy demands and pursue the use of G2P technology. The IRP (DMRE 2019:9) states that 'the opportunity to pursue gas imports through regional "local" gas resources will allow scaling up within manageable risk levels', although this cannot be guaranteed in the future energy settings. Mozambique has been identified as a potential regional source or supplier for the LNG to South Africa.

The IRP also notes that the Gas Master Plan for the SADC region to be developed and completed before the G2P programme can be fully implemented in South Africa. At an average load factor of 12%, the plan calls for energy generation through the G2P of 1000 MW in 2030 and 2000 MW in 2027. Limitations in transmission, port and environment all contribute to this signal. There is no need for additional gas infrastructure because there is so little demand for it. The IRP (DMRE 2019:49) suggests replacing older diesel-powered power plants (peakers) with newer gas-powered ones. This decision is expected to be a 'zero regret option' because the 'power system requests for bigger gas volumes when there are no constraints enforced' (DMRE 2019:49). South Africa's west and east coastlines are home to the country's diesel-fired power plants. Dedisa (IDZ), Ankerlig (Saldanha Bay), Gourikwa (Mossel Bay) and Avon (outside Durban) are just a few examples (DMRE 2019:13). In accordance with the requirements of the National Energy Act of 2008, the IEP has goals and aims. Considering that the primary goal of the IEP is to fulfil South Africa's long-term energy demands, the DoE should consider both the country's immediate and long-term energy production requirements while formulating the IEP (DoE 2016b:11). In addition, it is important that these requirements be met in a way that is helpful to the people of South Africa in terms of efficiency, economy and effectiveness. The IEP also considers the contribution of energy to the South African economy. The DoE (2013a:6) states that the IEP has eight primary goals targeted at addressing supply bottlenecks and shortfalls, the need to increase energy supply to support economic growth and the provision of clean, cost-effective energy to residents.

When it comes to energy policy, the IEP's objectives and aims are perfectly in sync with those of the *National Energy Act* of 2008. Because of its focus on meeting long-term energy needs, the South African DoE IEP must factor in both current and projected energy use (DoE 2016b:11). As an added requirement, how these requirements are met must be reliable, affordable, productive and ultimately beneficial to the people of South Africa. The economic value of energy to South Africa is considered in the IEP as well.

Important objectives, as stated by the DoE (2013a:6), include:

- 'Ensuring the security of supply,
- reducing the cost of energy,
- increasing access to energy,
- diversifying the supply sources and primary sources of energy,
- reducing emissions from the energy sector,
- encouraging energy efficiency in the economic sphere,
- supporting localisation, technology transfer, and job creation, and
- promoting the conservation of water'.

The National Energy Efficiency Strategy (NEES) is South Africa's first energy plan. The 1998 White Paper on Renewable Energy serves as the source of its mandate (Department of Minerals & Energy [DME] 2003b). This plan offers recommendations for effective energy production and use. TABLE 2: Other legislation and regulations that bear on Gas to Power adoption in South Africa

in South Amea.	
Policies	Brief overview of the law or policy
National Climate Change Response White Paper (2011)	In 2011, this White Paper was officially published. Managing climate change's effects in a way that considers social, economic and environmental resilience is the major focus of this study. The authors of this research also hope that international greenhouse gas (GHG) stability would benefit from South Africa's climate change initiatives (DEA 2011:5).
Industrial Policy Action Plan (IPAP): 2016/17 – 2018/19	Detailed in the Medium-Term Strategic Framework (2014–2019), the IPAP is an essential component of the country's comprehensive transformation. Included in this strategy are the following points of emphasis: public procurement, a strong emphasis on spill-over and labour-intensive sectors, carefully targeted industrial financing and incentives, capitalising on the evaluation of the rand, expanding exports, expanding the automotive industry, instituting gas-based industrialisation and reducing red tape.
9-Point Plan	Established in 2015, the 9-Point Plan was initially introduced by then-president Jacob Zuma. The following are some of the potential drivers of economic growth and job creation in South Africa that this strategy hopes to address: Identifying a solution to the energy crisis; Reviving the agricultural sector and the industries that support it; Enhancing mineral richness through beneficiation; Greater efficiency in carrying out an IPAP with a broader scope; Investment in the private sector is being actively encouraged; The management of workplace tensions; Unlocking the potential of small, medium, and micro firms, cooperatives, townships, and rural enterprises; Increasing funding for research, technology, innovation, and state-owned enterprises (SOEs); Facilitating the expansion of the information and communications technology (ICT) infrastructure; Improving water and sewage systems; Expanding transportation networks and the Operation Phakisa
Piped gas regulations (2007)	The <i>Gas Act</i> of 2001 is being expanded upon by these rules. This suggests an intention to comply with the <i>Gas Act's</i> regulations. Piped gas activities and their market are regulated by these rules, which address issues like distribution criteria, customer eligibility, price regulation principles and procedures, transmission capacity, storage capacity, review of licence conditions, registration data, expropriation procedures, land restoration, administrative consistency, gas specification determination and dispute resolution.
Government's Gas Utilisation Master Plan (GUMP)	A lot of thought and work is going into the creation of this strategy. This document is meant to serve as a guide for creating a gas-based economy. It assesses the prospects for expanding South Africa's gas industry and outlines a strategy for doing so. To achieve its goals, the GUMP will facilitate the development of domestic gas resources and provide a springboard for the introduction of a variety of gas supply choices.

Source: Adapted from Department of Energy (DoE), 2011, Integrated Resource Plan (IRP) for electricity 2010–2030, viewed 13 December 2017, from http://www.energy.gov.a/IRIP/irp%20 files/IRP2010_2030_Final_Report_20110325.pdf; Department of Energy (DoE), 2019b, Natural gos, viewed 07 July 2019, from http://www.energy.gov.a/files/esources/naturalgas/ naturalgas_governance.html; Department of Minerals & Energy (DME), 2007, *Piped gas regulations*, Government Gazette. 29792, pp. 69–95; South African Government, 2019, Ninepoint plan. viewed 11 August 2019, from https://www.gov.za/isues/nine-point-plan

The NEES's main goal was to guarantee a 12% increase in energy efficiency by 2015. However, this objective was not accomplished (Cohen & Winkler 2014:1). It also considers the need to consider the environmental, social and economic pillars of sustainable development to achieve the goal of energy efficiency measures. The NEES's mission is to help make energy accessible to everyone while minimising the harm to the environment and human health that results from energy use. In addition to the legal framework, there are other pertinent legal and regulatory energy frameworks in place that can be used to further regulate and grow G2P in South Africa. Table 2 includes a quick discussion of these.

Figure 1 provides a summary overview of the relevant and applicable legislative and regulatory framework for the energy sector.

Status quo of the Gas to Power programme in South Africa

It is vital to recognise the many efforts that have been made since 2016 despite the delay in implementing the G2P



FIGURE 1: Energy governance in South Africa, with specific reference to gas.



LNG, liquified natural gas; TPA, third-party access; RFQ, request for quotation; RFP, request for proposal.

FIGURE 2: Summary of existing efforts for G2P in South Africa.

initiative in South Africa. The study above classifies these efforts into overarching topics. The first, second and third major topics are the placement of LNG terminals, commercial agreements for South Africa's G2P and essential components of the project, respectively. Some of the details in the third theme are ongoing or look to the future. Figure 2 is a summary of the three components that make up the discussion of current G2P projects in South Africa. These concepts are explained in further detail below.

Component A: Liquified natural gas terminals location

Three areas for LNG terminals have been determined according to the DoE (2016a:27), that is, Saldanha Bay in the Western Cape, Richards Bay in KwaZulu-Natal and Ngqura (Coega) in the Eastern Cape. The development of the infrastructure to import gas presents opportunities as well as constraints in the selected regions that may import LNG, according to a 2016 Transnet report. Table 3 summarises these prospects and barriers and provides an overview of the prospective terminals. This is crucial because it provides readers with the knowledge regarding the possibilities

TABLE 3: Potential sites for South African lic	quified natural gas terminals	s present several prospects and barriers
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Location	Brief description	Prospects	Barriers	
Richards Bay	 Located at Richards Bay, the major seaport for exports from South Africa. It is a multi-use port that was formerly employed for shipping coal. 	 Access to a leasable region that is quite close to the LNG basin. Furthermore, in the beginning of the project, a Floating Storage Regasification Unit (FSRU) might be employed. 	 Digging out of a wetland area may need to wa until environmental regulations are met. 	
		 Increation, a conventional on-terrain terminal can be employed. 		
		An FSRU can be constructed more quickly and with less money out of pocket.		
Coega/Ngqura	 It is a 115 km² Industrial Development Zone (IDZ) on the eastern coast of South Africa that focuses on exports. It is the ninth new commercial port in South Africa. 	 A relatively brief implementation duration. Minimum maritime infrastructure cost. Exclusive LNG basin. 	 Exclusion zone necessitates the relocation of the current turn circle. Important is the risk evaluation of vessel traffic in this port. The terminal overlaps the port's turning area 	
Saldanha Bay	 Plans are now in the works to import LNG to South Africa. The construction of this port is anticipated to be a challenging undertaking in terms of ensuring its eligibility to join the second phase of the G2P IPPPP in South Africa. The DoE considers that this area is appropriate for development, even though it requires extensive work. 	 Substantial protection for the bay. Reasonable implementation duration. Low safety risk owing to the lack of proximity to other boats. No other operations will be affected. 	 Located near a residential neighbourhood. The operating expenses of an FSRU will be substantial. In the future, transforming this port into a typical landside terminal will be a challenging endeavour. High capital expenditures are required for marine infrastructure. 	

Source: Adapted from Department of Energy (DoE), 2016a, Information memorandum, viewed 03 October 2017, from https://pmg.org.za/files/RNW2426-161129.docx; O'Connor, P., 2014, A preliminary concept for an LNG import terminal for Saldanha Bay, viewed 19 July 2019, from https://scholar.sun.ac.za/handle/10019.1/86230; Transnet, 2016, 30-year long-term planning framework, viewed 02 March 2019, from https://www.transnet.net/BusinessWithUs/LTPF%202017/L

presented by each terminal, which might have been influential when they were chosen.

Component B: Business contracts

Several reports, including one from the Lantau Group (2018), stress the significance of market structure and how it affects commercial agreements and processes for getting LNG offtake for gas-emerging nations, especially importers. According to the Lantau Group (2018:28), the correctness of the commercial arrangements is determined by the amount of competition and decentralisation (or lack thereof) in the electrical business. After considering these considerations and this direction, the South African government and other important players (most of whom are featured in this chapter) have explored two possibilities for the structural arrangement of gas imported for use in power production. Integrated and non-integrated methods are available. It is vital to note that the DoE (2016a:41) claims that a mix of the two techniques might be another option accessible to sponsors and all other engaged stakeholders before digging into what these two approaches signify for the G2P project. If the G2P value chain is not integrated, 'each significant ingredient will be acquired independently' (DoE 2016a:41). Meanwhile, the South African government has recommended an integrated strategy, which is diametrically opposed to the method. Assuming the IPP Office and Eskom would enter into a power purchase agreement (PPA) to facilitate the G2P value chain is fundamental to the integrated strategy's implementation.

South Africa's G2P programme has evaluated a wide range of alternative agreements for this power project (although none of these agreements have been confirmed because the progress of the G2P programme in South Africa is relatively slow). An implementation agreement, a PPA, a transmission agreement, an ancillary services agreement, a port concession agreement, a gas transportation agreement, a gas management services agreement, a gas sales agreement and direct agreements with lenders consistent with the agreements are all part of this package, as detailed in the Information Memorandum (DoE 2016a:45). To emphasise, the DoE has held off issuing a request for proposals (RFPs) for these contracts until the IRP modifications are finalised. Thirdparty access is essential to the smooth running of the G2P programme. One of the main reasons why the G2P programme in South Africa is promoting 'imports from neighbouring sources within the SADC area' is because TPA can undermine the conventional price regime in the market (DoE 2016a:13). And because TPA may 'create the platform for LNG import, storage, and regasification facilities to be put in place that can be made available for use by other parties', it helps accomplish yet another goal of the programme (DoE 2016a:13). Third-party access is the idea that economically separate areas should have a legally enforced right to utilise the energy infrastructure of other businesses (Kotlowski 2006:102).

Figure 3 illustrates the G2P contracting structure in South Africa. The components described make up the proposed framework. A suggested structure for South Africa has an integrated approach as an integral part of its design.

Component C: Essential elements of the project

In addition to the RFQ and RFP, the procurement procedure and schedule (which is crucial to the rollout of the entire programme) are also essential elements of the project. The RFQ kicks off the procurement procedure for the specified ports. The next phase involves sending out requests for proposals. The RFP is the official request for bids from prospective vendors who have already been determined to meet the prerequisite qualifications (DoE 2016a:53; IPP-Gas n.d.:n.p.). It is important to note that, as of the time of this writing, neither of these components of the official procurement process has been provided, even though both



Source: Department of Energy (DoE), 2016a, Information memorandum, viewed 03 October 2017, from https://pmg.org.za/files/RNW2426-161129.docx LNG, liquified natural gas; TNPA, Transnet National Ports Authority; LNG SPA 2, LNG Sale and Purchase Agreement 2; DOE, Department of Energy; PFMA, Public Finance Management Act; PPA, Power Purchase Agreement.

FIGURE 3: Proposed framework for the G2P initiative in South Africa.

the DoE and IPP websites said that an announcement would be made by November 2016. Because a final RFP was expected to be released in August 2017, the schedule outlined in the Information Memorandum is now out of date (DoE 2016a:56). Therefore, the 2019 schedule given by Standard Bank was used for this analysis. As can be seen in Figure 4, this schedule (which includes 7 years for final construction and implementation of the procurement process) was developed with that goal in mind (Makhetha 2019:46). This schedule details the various activities, how long they will take and when they can or should be started and finished. In particular, the schedule demonstrates that the RFQ and RFP are preliminary steps necessary for the G2P project to be initiated. Note that the coronavirus disease 2019 (COVID-19) incident in South Africa may have influenced these estimates. Nonetheless, the schedule might provide a practical perspective on G2P projects the government may be considering.

Variables hindering South Africa's gas-to-power implementation

The expansion of South Africa's G2P programme may encounter several potential obstacles. For instance, the nation



Source: Makhetha, D, 2019, *Southern Africa Oil and Gas Outlook*, viewed 20 July 2020 from http://richafricaco.com/wp-content/uploads/2019/06/Southern-Africa-Oil-Gas- Outlook.pdf. RFQ, request for quotation; RFP, request for proposal; PPA, power purchase agreement; SOE, state-owned enterprise; PFMA, Public Finance Management Act.

FIGURE 4: Events leading up to the launch of South Africa's G2P initiative.

has risks associated with commodities prices and currency exchange rates (PwC 2017:11). However, it is important to

emphasise that there is no concrete proof of importing LNG into South Africa currently, thus some of these dangers are speculative and anticipatory. This is not to say that the LNG importation market has been without its share of difficulties. Moreover, this section's significance is backed up by the idea that the government or the authorised spearhead of this G2P plan may guarantee that the programme continues schedule by proactively addressing any obstacles in the process of executing the G2P. South Africa's G2P initiative and efforts to promote investment therein face certain challenges, some of which are discussed below.

Energy industry monopoly

As was previously noted, the electricity industry in South Africa is dominated by a single company. According to Joffe (2012:33–34), one reason why efforts to curb Eskom's monopoly have failed thus far has been that they have focused on supporting the company rather than on addressing its:

[*T*]he policy and regulatory frameworks which are not put in place for private sector participation. Nor, crucially, were electricity tariffs at levels which could have provided private investors with the returns they needed to make investment in this sector attractive. It was recognised that South Africa would need massive new investment in generating capacity to meet growth in demand. However, by the time the government retreated from privatisation and, in late 2004, had given Eskom the mandate to build, it was too late to bring big new baseload power stations on to the grid fast enough to prevent a shortfall in generating capacity. Joffe (2012:33-34)

Eskom is the driving force of South Africa's power sector, and given recent developments, the shift from the existing monopolistic market to a multiple-player system or even a diversified energy mix is likely to be complicated and hazardous. Bringing in new players, paving the road for a more sustainable and cleaner energy supply, tackling climate change and encouraging investment in infrastructure are all areas where South African policymakers are still having trouble because of this problem.

The current Gas to Power policy direction is unclear

Several plans and national policy papers, including the 2010 IRP, the draft revised 2018 IRP, and the IPPPP implemented by the IPP Office, should be recognised as having been prepared and implemented by South Africa. As it is, these initiatives do not seem to contribute to the national drive to create a greener and cleaner electricity sector. For instance, the updated 2018 IRP predicts that South Africa's reliance on coal would fall from 90% to 65% by 2030, while renewables grow in importance to 9% (DoE 2010, 2018).

More importantly, the plan estimates that the private sector will control 30% of South Africa's electricity sector by the year 2030 (DoE 2010:4). However, experts like Joffe (2012:34) say that coal is still expected to be South Africa's principal source of power in the foreseeable future, despite the IRP's 2030 ambitions. Because South Africa does not have the natural gas or water resources that other nations use to provide baseload energy, coal is presently less expensive than any of the alternatives. Also, danger is always present when there is ambiguity. To reduce the potential for harm from this initiative, it is essential to have clarity on the future course of policy for G2P in South Africa. Investors want a thorough analysis of the project's potential dangers. Moreover, 'key components of policy and the regulatory framework for natural gas are, nonetheless, lacking', as stated by the Development Bank of Southern Africa (2016:28), lends credence to this view. Besides, all efforts (including the G2P project) to advance the gas business are exposed to greater danger because of the lack of assurance surrounding the stability of the policy environment.

Furthermore, government policy, legislative and regulatory uncertainty is ranked as ninth in the 2019 top 10 industry risks in South Africa (IRMSA 2019:5). It is, therefore, important to note that policy uncertainty is a key driver of price volatility in the energy market. This is because the rand is weak and sensitive to changes in the market (South African National Energy Association 2019:72). In turn, this dampens the confidence of potential financiers. This obstruction is related to the lack of creativity and the unwillingness to adapt to new circumstances. Because G2P is a ground-breaking initiative in the energy sector, this factor is crucial to its growth in South Africa. Nonetheless, it appears that South Africa still needs to accept change, as reported by the IRMSA's risk report for 2019. This may make it easier for the government to progress the gas business.

The South African Energy Association (SANEA) lists various top uncertainties that may hamper the development of G2P. Policy uncertainty remains an issue as does the development of major programmes of work that involve energy. Finally, uncertainty regarding the availability of innovative market designs and policies to enable renewables integration, secure back-up and storage capacity in natural gas and electricity markets also hinders progress. Table 4 provides a summary of the top uncertainties in the energy sector identified by SANEA.

Efforts should be put in place to overcome the abovementioned uncertainties in the energy sector to ensure the fast-tracking of the implementation of the G2P.

Implications and recommendations

Various implications to further develop the G2P IPP programme in South Africa can be derived from the current study. These implications can be directed at different stakeholders as the study noted that this energy programme requires multiple players. South Africa is relatively equipped to realise the G2P programme as an alternative to the nation's predominately coal-fired power generation, even though not much progress has been made in the country's G2P context.

TABLE 4: Top uncertainties for the South African Energy Sector in 2021.

Rank	Uncertainty	Description
1	Activism and civil disobedience	The degree of activity and civil disobedience, such as strikes, and other acts designed to effect political or social change.
2	Appropriate policy and vision	Long-term vision for the nation supported by the approval and execution of the energy sector and associated policies to promote investment certainty, flexibility and agility.
3	Capital markets	Access to financing and the capacity to attract capital for energy infrastructure in South Africa within the setting of a highly politicised market and technological hazards.
4	Climate framework	Acceptance and implementation of international policies addressing adaptation and reduction of greenhouse gas emissions, such as the UNFCCC, leading to an energy transition.
5	Corruption	The extent to which corruption in any portion of the energy value chain or government sectors affects public trust in the energy system.
6	Country-level development	At the national level, the development of significant energy-related work programmes is integrated and linked in a manner that is aimed toward the expansion and flourishing of the country.
7	Decentralised system	New business models that consider emerging industries, technology and services, as well as the pace at which these factors are transforming an energy infrastructure that is more than a century old.
8	Economic growth	The influence that economic development, or the lack thereof, has on the energy markets.
9	Energy affordability	The price levels of energy influence the capacity of the poor to access contemporary sources of energy, as well as on the competitiveness of the nation, which drives economic development.
10	Energy data availability and confidence	The general availability of a dependable and open-book data collection pertaining to energy for the sake of planning and making decisions both short- and long-term.
11	Energy price volatility and uncertainty	Uncertainty caused by the rapid and unexpected fluctuations in the pricing of energy and associated commodities, such as important minerals like lithium and cobalt as well as the cost of coal, oil and gas.
12	Energy-water nexus	Because of the shifting weather patterns and their associated implications on energy production and supply as well as food production, there is increased competition for water resources and the availability of water.
13	Global pandemics	The accelerated spread of contagious human illnesses that are readily transmitted to other continents and are expanding at an alarming rate.
14	Investor confidence	Willingness to invest in South Africa on the part of investors.
15	IoT/Blockchain	The pace at which technologies that enable direct transactions at cheap costs and smart appliances powered by smart contracts and grids, supply chain tracking and labelling are being put into place.
16	Macroeconomic performance	Changes in the exchange rate, as well as a depreciation of the currency, may influence the activities and investments related to the energy sector.
17	Market design and energy governance	The existence of innovative market designs and regulations that make it possible to integrate renewable energy sources, provide reliable back-up power and increase storage capacity in natural gas and electricity markets.
18	Parochial interests and decision making	The degree to which energy participants are motivated by their own self-serving interests, which are not in the best interest of the group but have an influence on the group's capacity to come to a consensus and to make good judgments.
19	Regional geopolitics	The reciprocal nexus between an area's physical characteristics and the political forces that act upon it to form it.
20	Renewable energies	Existence of national policies that actively promote the use of alternative energy sources.
21	Energy storage	The accumulation of energy for utilisation later.
22	Strong grid	Whether the transmission and distribution grids enable the changing market structure and business models or delay the implementation thereof.
23	Sustainable cities	Whether there is substantial thought being given to the delivery of resource-efficient urbanisation at scale, which is connected to the management of waste, water, energy and transportation systems.
24	Talent	The presence of individuals at all levels of the organisation (including those in positions of leadership) who possess the essential knowledge, abilities, credentials and experience for making sound judgements

Source: South African National Energy Association, 2021, Energy risk report 2021/22: Recommendations for decision-makers, viewed 20 February 2022, from https://cdn.ymaws. com/southafricanenergyassociation.site-ym.com/resource/collection/84FAE3E8-C92B-480C-804B-E746D39948D7/SANEA_Energy_Risk_Report_2021-2022.pdf UNFCCC, United Nations Framework Convention on Climate Change. Despite the availability of a variety of resources in the DoE in particular, South Africa needs to take a step towards the G2P programme via the DoE and the IPP Office as a necessary energy alternative. It is therefore necessary for all stakeholders involved, from banks (Standard Bank) to state-owned enterprises (SOEs) such as Transnet to the DoE (otherwise known as the Department of Minerals Resources and Energy) to strategise fast-tracking the implementation of this programme.

The aim of the article was to determine the implementation progress of the G2P. Thus, this article found that (firstly) the identification of location of LNG terminals is important before plans for the infrastructure development can be prepared. Secondly, progress in terms of market structure, including commercial agreements and TPA, is essential in ensuring a pipeline of projects that can deliver on scale. Lastly, key project considerations in terms of the procurements process have been clarified, which is pivotal for determining the appropriate implementation partner to ensure value for money, affordability and risk considerations and successful project development. There are several factors hindering the fast-tracked implementation of the G2P in South Africa. These are, firstly, the prediction of the 2018 IRP for coal dependence to decrease from 90% to 65% is limiting, as this is a marginal decrease and would not address sustainability and demand challenges. Secondly, the IRP predicts that only 30% of the implementation responsibility must be undertaken by the private sector. This is concerning as private partners are essential, especially for capacity and expertise within the G2P projects. Lastly, policy uncertainty remains a concern and it is preventing progress in starting implementation and securing the most suitable partners for implementation. Policy uncertainty could be attributed to resistance to change. The IRMSA and SANEA identified a number of risks in the energy sector, which confirm the abovementioned challenges. The findings mentioned in this study are important both at research and industry level. It is argued that the IRP should be revised to provide a clear indication of the capacity required through LNG for power generation purposes. This plan must also mention how does the implementation of the G2P in South Africa contribute to mitigating the reliance on coal-fired energy. Furthermore, at an executive level of government, the procurement process should be more lucrative for the private sector to engage in developing a pipeline of LNG projects and allowing more than 60% private sector participation in the implementation of LNG.

This research was conceptual in nature, and its primary emphasis was on the progress that has been made with the G2P initiative in South Africa. This study might serve as a baseline for further studies to employ when doing empirical research analysing the implementation process of the G2P. This would be necessary because the IRP is routinely amended depending on the energy status quo. As the G2P policy at national and programme levels was the primary focus of this study, it will also be interesting to learn from future research how different levels of government in South Africa, particularly cities and municipalities, can advance the implementation of G2P to make the country more environmentally sustainable.

Concluding remarks

Natural gas has the potential to transform the South African energy sector. This research was descriptive in nature and focused on providing an overview of developments towards the implementation of the G2P. The unique contribution of this study was that it identified current progress towards the implementation of the G2P in terms of three aspects. The first aspect is the availability and identification of LNG terminal locations, which are Richards Bay, Salhana Bay and Coega. Furthermore, the study found that various commercial agreements that are required for an energy project are continuously being developed. One of these agreements is the PPA which seeks to expand the energy market for those who intend to either transport or produce LNG for power purposes. Another agreement the study referred to is the integrated plan towards funding this energy programme. Lastly, the project currently awaits the release of a few key energy project components, namely the RFQ which is the first step to the procurement process of the identified ports. This step is followed by issuing the RFP. The RFP enables bidders who are identified as prequalified - in the preceding step - to submit formal binding proposals.

Furthermore, another unique contribution of the study was identifying the barriers that contribute to the inefficiency of this project. These stumbling blocks include uncertainty in the current energy policy and plan (such as the IRP and *Gas Act* and the monopolistic nature of the energy sector in South Africa). Overall, the article provided a conceptual analysis of the current developments towards implementing the power independent procurement programme in South Africa.

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The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

Authors' contributions

N.E.M. as the master's student was the main contributor, data collector and author while D.N.-S. served as a supervisor.

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