

STRUCTURAL REQUIREMENTS FOR THE SUCCESSFUL DEREGULATION OF GAS ENERGY PRICES IN SOUTH AFRICA

4th Annual Competition and Economic Development (ACER) Conference

Johannesburg, South Africa, 19-20 July

Louise du Plessis¹

Abstract

Economic theory dictates that markets are most efficient when prices are based on the free interaction of both demand and supply factors in a market. To this end, NERSA's strategic direction in its regulation of the piped gas industry is to regulate in a manner that will eventually move the industry to a "gas to gas" competition state, whereby gas energy prices are determined by the competitive market forces of supply and demand for piped gas. However, in order for such competitive price setting mechanism to work, firms must have the ability to enter and expand in the market, without significant barriers preventing them from doing so.

This article highlights the remaining barriers to enter into and expand within the South African piped gas industry, and how these act as structural challenges that hinder the otherwise efficient mechanism of the determination of prices by competitive market forces of supply and demand.

Finally, we provide an overview of NERSA's regulatory approach to enable the establishment of conditions for effective competition in the piped gas industry, most obviously through facilitating entry and expansion into the sector, the much needed infrastructure investment required to do so, as well as ensuring that such investment would be efficient, and lead to competitive gas prices.

¹ Louise du Plessis is a senior manager at the National Energy Regulator of South Africa

1. INTRODUCTION

A number of countries with more mature gas sectors have liberalised their gas industries, and with that deregulated their gas energy prices.² With gas energy price deregulation, gas trading hubs have started to emerge, and gas energy prices all over the world are increasingly based on / linked to prices that are discovered on these gas exchanges. Prices discovered on these gas exchanges are particularly efficient, as they are based on the interaction of demand and supply factors in the markets they serve.³

The National Energy Regulator of South Africa's ("NERSA") strategic direction in its regulation of the natural gas industry is to regulate in a manner that will eventually move the industry to a "gas to gas" competition state, whereby gas energy prices are determined by the competitive market forces of supply and demand for natural gas. However, in order for such a competitive price setting mechanism to work, firms must have the ability to enter and expand in the market, without significant barriers preventing them from doing so.⁴ In markets with high and non-transitory barriers to entry, such as those prevalent in industries with natural monopoly characteristics, this process of free interaction of demand and supply is severely distorted, leading to significant economic inefficiencies in the form of monopoly prices and lower than efficient levels of output.⁵

This paper highlights some of the key barriers to enter into and expand within the South African natural gas industry, and how these act as structural challenges that hinder the otherwise efficient mechanism of the determination of prices by competitive market forces of supply and demand.

We also consider the key structural criteria to be met before markets are ripe for deregulation, as demonstrated by international best practice, and draw from key regulatory lessons learnt by both developed countries such as the US, UK and EU, as well as from the leading developing countries in the world, namely China, India, Russia and Brazil, in respect of their approaches to grow and mature the gas industries of their countries.

² Refer to section 2 below for examples of countries that have liberalised their gas sectors and deregulated prices of gas (the molecule) supplied to domestic customers.

³ See Xunpeng, 2016, for detailed information regarding the development of these trading hubs, the types of hubs that have emerged, and the performance of trading hubs around the world.

⁴ See, e.g., Motta, M and de Streel, A "Exploitative and Exclusionary Excessive Prices in EU Law" in Ehlermann, D and Atanasiu, I (eds.), *What Is an Abuse of a Dominant Position?*, Oxford: Hart Publishing, 2006, p.91 at p.108 ("[E]xploitative practices are self-correcting because excessive prices will attract new entrants") in Geradin, 2007

⁵ Du Plessis, L. & Blignaut, L. 2009. Staying safe – dominant firms' pricing decisions in industries where high prices do not attract entry. Third Annual Competition Commission, Competition Tribunal and Mandela Institute Conference on Competition Law, Economics and Policy in South Africa.

Finally, and drawing from international experience, we provide an overview of some of the government policies and regulations that are currently in place, and projects that are underway to enable the establishment of conditions for effective competition in the piped gas industry, most obviously by addressing the key barriers to enter into and expand within the South African natural gas industry.

2. REVIEW OF THE REGULATION OF GAS ENERGY PRICES IN SELECTED DEVELOPED COUNTRIES

2.1 Overview

Historically, gas energy prices in many developed countries were regulated, primarily due to the significant barriers to competition in these industries. These barriers included initial limitations in sources of gas supply and the vertical integration of suppliers of gas and pipeline infrastructure operators who had the ability to use their degree of vertical integration in the sector to keep competitors out of the market.⁶

Over the past 20 - 30 years, a number of these countries' gas industries have since matured, and they have subsequently moved to deregulate their gas energy prices. However, as illustrated in the case of the countries with the most mature gas markets below (i.e. the United States ("US"), United Kingdom ("UK"), and the European Union ("EU")), such deregulation only occurred once the key barriers to competition in these sectors have been removed.

2.2 Deregulation of gas energy prices in the US

The US gas market is the most mature gas market in the world. Here, gas energy prices were regulated since the 1940s⁷. However, artificially low energy price ceilings that were set by the US' Federal Power Commission ("FPC") in the 1950s had a number of outcomes in the market, coming to bear in the late 60s and 70s. Specifically, because the set rates for natural gas were below the market value of that gas, demand surged, but there was little incentive for natural gas producers to devote the money required to explore for and produce natural gas reserves leading to significant gas shortages in the 1970s.⁸ A gradual process of the deregulation of gas energy prices were eventually completed in the 1990s.⁹

⁶ OECD, 2000

⁷ At the time, gas energy prices were only subject to federal oversight if the selling producer and the purchasing pipeline were affiliated companies. The FPC contended that if the natural gas producer and pipeline were unaffiliated, natural market forces existed that would keep wellhead prices competitive. However, this changed in the 1950s, when the energy prices of all natural gas sold into interstate pipelines were subject to regulation.

⁸ MacAvoy and Pindyck, 1974

⁹ MacAvoy and Pindyck, 1974, Brown 2014 and Lund, 2017

As part of the gradual deregulation process, natural gas pipeline companies were required to split-off any non-regulated merchant (sales) functions from their regulated transportation functions. The vertical unbundling of gas contract pricing and transportation contract pricing meant that monopoly infrastructure providers / operators (whose activities remained regulated on an *ex ante* basis) could no longer use their degree of vertical integration in the sector to keep competitors out, thus removing one of the key barriers for competitors to enter into and supply customers with gas.¹⁰ This vertical unbundling process was preceded by a third party access (“TPA”) regime, whereby access to gas infrastructure to transport piped gas on a non-discriminatory basis was mandatory and regulated.

In addition, it is worth noting that even though the US experienced gas shortages in the 1970s, the situation reversed itself in the 1980s. At the time of the deregulation of US gas energy prices, the country already had access to numerous sources of gas supplies. These included the country’s own production of gas, supplies from within the North American region that were transported within the region through pipelines, as well as liquefied natural gas (LNG) imports through a number of LNG terminals that were constructed during the periods of gas shortages in the 1970s.¹¹

It is therefore clear from the above that, before the complete deregulation of gas energy prices in the US, two key barriers to entry and expansion into the market for the supply of gas to traders and end users were first removed. Specifically, sufficient sources of gas supply were first developed and diversified, followed by the vertical unbundling of gas contract and transportation contract pricing.

Moreover, the US’ entire gas liberalisation process, the opening up of its markets, and eventual deregulation of the gas energy price took over 30 years, having started in the late 1960s, and being completed in the late 1990s. This illustrates that, even in a developed economy such as the US, liberalisation of gas markets and the deregulation of gas energy prices is a gradual process, which requires time to complete.

¹⁰ Ibid

¹¹ During the period of shortages in the 1970s, a number of LNG receiving terminals were commissioned in the US, located in Everett, Massachusetts (commissioned in 1971), Cove Point, Maryland (commissioned in 1978), Elba Island, Georgia (commissioned in 1978), Lake Charles, Louisiana (commissioned in 1981). The Cove Point and Elba Island terminals were initially mothballed during periods of oversupply in the 1980s, and were reactivated in 2003 and 2001 respectively. After the deregulation of gas energy prices in the 1990s, more terminals were built / expanded, further increasing the country’s capacity to import LNG.

2.3 Deregulation of gas energy prices in the UK

The natural gas market in UK is the second most competitive and matured market in the world, after the US. The country started a gradual process of privatising and opening up the sector to competition in the mid 1980s. The process started with the privatisation of British Gas, the publicly owned, vertically integrated transporter and supplier of natural gas in the United Kingdom, in 1986. This was followed by a process of the gradual deregulation of gas energy prices in the 1990s, which process was eventually completed in the early 2000s, thus bringing the total duration of its liberalisation and gas energy deregulation processes to around 25 years.¹²

Similar to the US, the deregulation of gas energy prices only occurred once the UK had access to sufficient sources of natural gas, and once the vertical separation of British Gas' gas supply and pipeline transportation activities had been completed. To this end, the country's domestic gas production had risen to the point where the UK became a net exporter of gas in 1997. Moreover, by that time the country also had access to a number of other sources of gas, including LNG imported from Africa via the Canvey Island terminal.¹³

Initially at the time of privatisation, the vertically integrated operations of British Gas was not unbundled. Because British Gas controlled the entire pipeline system and held long-term gas supply contracts with producers, it was able to retain a *de facto* monopoly in the wholesale and contract gas markets and control entry by independent gas suppliers. Complaints about the company's market power prompted the gas regulator in the early 1980s to require British Gas to build "Chinese walls" separating its gas supply and pipeline transportation businesses. The intention was to increase independent suppliers' access to natural gas from producers and to level the playing field for suppliers contracting for pipeline transportation. British Gas eventually sought a more permanent structural change and in 1996, and it decided to split its assets into two companies: Centrica, a gas production, sales, and supply business, and BG plc, a transportation and storage business. This separation, or "demerger," of British Gas was completed in 1997, i.e. before the deregulation process was completed in the early 2000s.¹⁴

The failure of the British government to restructure the industry in this manner earlier, (i.e. at the time of British Gas' privatisation in 1986) has been widely criticized on the basis that the industry's flawed structure at the time resulted in frequent regulatory interventions in the

¹² Parliamentary Group for Energy Studies, 2012

¹³ Ibid

¹⁴ Parliamentary Group for Energy Studies, 2012 and Juris 1998

markets and disputes between the gas regulator and British Gas. This increased the regulatory risk and cost of capital for British Gas, which saw a big drop in the market value of its assets.¹⁵

2.4 Deregulation of gas energy prices in the EU

The level of maturity and competitiveness of gas markets in the EU vary significantly as between its member states. The region started a gradual process of privatising, opening up the sector to competition and the gradual deregulation of the gas energy price in the 1990s. The process started with a series of EU Directives, which aimed to remove monopolies in the sector and partially opening up the market to competition by starting to allow users (initially only large users) to choose their suppliers. However, already at that early stage of the deregulation process, the EU identified the risk that vertically integrated firms in the gas sector could use their monopoly positions over the transmission networks in order to stifle the emergence of competition at the supply level of the gas value chain. Rules were established to mitigate that risk, including the introduction of a TPA regime and some unbundling provisions to ensure that vertically integrated operators would not discriminate against new entrants or create other entry barriers.¹⁶¹⁷

The unbundling process was a slow one that was initially met with some resistance in some member countries. Today, most EU member countries have to some degree unbundled the ownership of vertically integrated operators in their gas markets. Many EU member countries have also made a concomitant move to gradually deregulate gas energy prices to non-household customers, with energy prices to non-household customers in many member countries now being subject to *ex post* regulation by their respective competition authorities only.¹⁸

In addition to the vertical unbundling of ownership of operators in the gas sector, the deregulation of gas energy prices in EU member countries also appears to be closely related to the relevant member country's security of gas supply and diversity in its sources of gas supply. Specifically, although the EU still imports more than half of its energy needs (mainly from Russia) it has made significant progress in diversifying its gas sources, routes and suppliers of energy. New interconnections and LNG terminals have improved the security of gas supply over the past few years. This development and diversification of sources of gas

¹⁵ Juris, 1998

¹⁶ Other important areas covered by the third package, but which are of less relevance for the purposes of this note include establishment of the Agency for the Cooperation of Energy Regulators (ACER), cross-border cooperation between transmission system operators and the creation of European Networks for Transmission System Operators, and increased transparency in retail markets to benefit consumers.

¹⁷ Correljé, A. Curr, 2016;

¹⁸ Getting the deal through, 2017

supply have facilitated competition in the gas sectors of most EU member countries by removing gas supply as key barrier to entry and expansion in the sector, and creating workable competition that, together with the vertical unbundling measures discussed above, facilitated the deregulation of gas energy prices to non-household customers in these countries.¹⁹

Nevertheless, some constraints remain. In 2017, two member states could still not fully substitute for the disruption of their most important gas source, indicating some remaining security of supply issues.²⁰ These include Bulgaria and Portugal. Incidentally, and as discussed in further detail below, these two countries also still regulate gas energy prices charged to all, or certain portions of their gas end user customer segments, as the basic requirements for competitiveness and free market conditions are not met, at least insofar as some end user customer groups are concerned.

In this regard, Bulgaria is amongst the few remaining EU member countries that still regulate non-household gas energy prices, in spite of the fact that the country has already put measures in place to make the sector more competitive, including measures to achieve a degree of vertical separation between suppliers of gas and gas transmission operators.²¹

Similarly, although Portugal has made significant progress in maturing its gas industry, and although prices to most of its natural gas customers have been set freely since 2010, prices of certain customers are still regulated. In this regard, there are still suppliers of last resort who are obliged to supply household consumers (with an annual consumption lower than 10,000 cubic metres) until the end of 2020 and, after that, to supply economically vulnerable consumers as defined by law. Suppliers of last resort are also obliged to supply consumers whose supplier has been prevented from exercising its activity, and also consumers who do not have the possibility of choosing a supplier because there is no supplier in their region.²² The liberalised portion of the natural gas market in Portugal (i.e. the portion where customers are free to choose their supplier and where prices are set freely) already has a large relative weight in Portugal, but there are still a significant number of domestic consumers who remain in the regulated portion of the market, accounting for nearly 35% of customers in the natural gas sector.²³

¹⁹ Ibid

²⁰ Getting the deal through, 2017

²¹ Bulgaria has unbundled its gas sector using the Independent Transmission Operator (“ITO”) model. Under this model, energy companies retain ownership of their transmission networks, but the transmission subsidiaries are legally independent companies operating under their own brand name, under a strictly autonomous management and under stringent regulatory control. Investment decisions are made jointly by the parent company and the regulatory authority.

²² As per the recent Ministerial Order No. 144/2017

²³ GLI, 2018

Based on the experience of EU member countries, and particularly that of Bulgaria, it is therefore clear that countries have been reluctant to deregulate gas energy prices until such time as both a degree of vertical unbundling of suppliers and network operators have been achieved *and* sufficient levels and sources of supply of gas have been developed. Moreover, the experience of Portugal has highlighted the need to continue to protect customers that remain vulnerable and who do not have sufficient natural gas supply options.

2.5 Conclusion: deregulation of gas energy prices in selected developed countries

A key lesson learnt from the experiences of the US, UK and EU is that the processes and degree of development required before the liberalisation of their gas industries, and eventual deregulation of their gas energy prices necessarily take time to complete. In the US, this process took about 30 years, and in the UK around 25 years. The process took about 20 years in the EU, although in some EU member countries this process is still ongoing.

It appears that countries have only fully deregulated gas energy prices to end user customers once two key barriers to entry and expansion into the sector have been removed such that the “*structural conditions [of the markets] are more compatible with a normal functioning of competition*”.²⁴

These key barriers include (i) vertical integration of suppliers and transmission network operators; and (ii) limited sources of gas supply. The reluctance of countries to deregulate gas energy prices before these barriers have been removed (e.g. Bulgaria) is most obviously due to the inefficient outcomes that are associated with the premature deregulation of these energy prices which include monopoly pricing practices and inefficient volume reductions (allocative inefficiencies) that are harmful to customers.²⁵

The risks and unintended consequences of the premature deregulation of gas sectors were formally recognised in the EU’s Directives, which were issued to guide the liberalisation, integration and reform of its member countries’ gas sectors. In this regard, the preamble to the EU’s First Directive in this regard (“the First Directive”) noted *inter alia* that the internal EU natural gas market needs to be established gradually in order to take account, amongst other things, the different market structures and levels of development of the economies amongst its member states, and that special provisions would be required for markets and investments in areas which have not yet reached a developed stage.²⁶

²⁴ Motta, 2004

²⁵ Mondliwa and Roberts, 2013

²⁶ EU directive 98/30/EC, 1998, at para 2

Article 26 of the First Directive goes further to outline some of the parameters to be considered in the granting of derogation to some member states in respect of certain key initiatives contained in the Directive to reform their gas sectors. In this regard, member states with any one of the following characteristics would be derogated, for a certain period of time, from certain elements of the directive:²⁷

- Member states not directly connected to the interconnected system of any other member state and having only one main external supplier (i.e. a supplier with a market share of more than 75%);
- Member states whose gas sectors qualify as emerging (i.e. where the first commercial supply of its long-term natural gas supply was made less than 10 years earlier) and which, as a result of the implementation of the Directive, would experience substantial problems;
- Where the implementation of the Directive would cause substantial problems in a geographically limited area of a member state, in particular concerning the development of the transmission infrastructure, and where there is a need to encourage investment in such infrastructure.²⁸

Another lesson from the experiences of the US, UK and EU, as outlined above, is that in all of these countries, elements of the gas supply chain that still exhibit a lack of workable competition (e.g. transmission pipeline construction and operations, as well as supplies to certain vulnerable customers, in the case of Portugal) are still regulated. This is further evidence of the reluctance of countries to deregulate elements of the gas sector where significant barriers to entry and expansion, and a lack of workable competition are still present.

Having established these lessons from the deregulation in the mature gas industries in the developed world, it is useful to also consider the experiences of countries with natural gas industries that are still very much in their developing stages as compared to those in the US, UK and EU, and whose socioeconomic challenges and degree of development of their economies in general are more comparable to that of South Africa. In this regard, the section below outlines the experiences faced by South Africa's counterparts in the cooperative coalition of developing BRICS countries, namely Brazil, Russia, India and China (collectively

²⁷ EU directive 98/30/EC, 1998, article 26.

²⁸ In this regard, the Directive notes that a derogation may be granted only if no gas infrastructure has been established in this area, or has been so established for less than 10 years.

referred to hereinafter as “the BRIC countries”) in the development of their natural gas sectors.²⁹

3. REVIEW OF THE REGULATION OF GAS ENERGY PRICES IN BRAZIL, RUSSIA, INDIA AND CHINA

The natural gas industries of the BRIC countries differ in structure and degree of maturity, mostly as a result of their varying degrees of domestic gas reserves and production levels, export capabilities and import needs, as well as the way in which natural gas usage in each country has evolved compared to alternative sources of energy (see table 1 below).

However, the natural gas sectors of each of these countries also have a number of factors in common. First, similar to South Africa, Brazil, Russia, India and China are all regarded as emerging economies, at similar stages of economic development and with similar socio-economic challenges. Their natural gas industries have therefore evolved, and continues to evolve within this similar context, and with similar broader developmental objectives in mind. Moreover, as is illustrated in table 1 below, the key policy objectives and directions for each of these countries are focused on security of supply of energy, with investment in and the development of their natural gas sectors key in achieving such security. Government policies, driven by environmental considerations (and global commitments in this regard) as well as rich (and some cases, significantly untapped) gas endowments, are now focused on increasing natural gas consumption in their countries in a meaningful way.

The gas industries of each of these countries are also remain concentrated at most levels of the supply chain, with a significant degree of vertical integration across those levels still prevalent. Thus, and in line with the lessons learnt from gas reforms in developed countries (discussed in the previous section) as regards the market structures more conducive to gas price deregulation, all of these countries still regulate gas energy prices, and they all also have non-discriminatory TPA regulations in place, although vertical unbundling is currently being discussed and/or implemented in most of these countries (see table 1 below).

Another significant common policy stance amongst the BRIC countries has been associated with the domestic pricing of natural gas – specifically the historical use of price controls to protect households and to prevent rising energy prices from feeding into general inflationary pressures, together with efforts to reform these price controls over time.

²⁹ BRICS is the acronym for an association of five major emerging national economies: Brazil, Russia, India, China and South Africa. Originally the first four were grouped as "BRIC", before the induction of South Africa in 2010.

The BRIC countries have since moved towards regulating prices with reference to so called market based pricing methodologies, and some divergence in the drivers of their respective price methodologies (see table 1 below), along with the challenges experienced by their regulators in determining these methodologies, point to the fact that it is often not an easy task to establish a logical market-oriented basis for price formation.

For example, prompted by *inter alia* significant declines in domestic gas production levels observed from 2011, which raised questions as to whether India's upstream pricing regime was effective in terms of incentivising exploration and production, the Indian government appointed the Rangarajan Committee to review *inter alia* the upstream system of gas pricing, and to make recommendations for reform.³⁰³¹ The Rangarajan Committee subsequently published its recommendations in December 2012, and they were approved by the government in June 2013. Based on these recommendations, the price of gas to domestic producers from 1 April 2014 was to be set on the basis of the 12 month trailing average of two components, namely:

- the volume weighted average of netback prices to producers at the exporting country wellhead (for all Indian LNG imports), and,
- the volume weighted average prices of gas traded in three major markets – US Henry Hub, UK National Balancing Point and the netback price of Japan Customs-cleared Crude (JCC).³²

The Rangarajan Committee's recommendations were predicated on a "*conscious move away from below-cost pricing and cost-of-service pricing*".³³ The recommendations also rejected a continuation of oil price indexation, on the basis that gas did not substitute for oil in India's two largest gas consuming sectors, namely fertilisers and power. The formula appeared to be based partly on elements of opportunity cost. Specifically, the first component of the formula described above was linked to import parity pricing, based on what domestic producers would receive for their products in the international market. The second component of the formula was meant to represent the returns that global gas players get from their investments.³⁴

³⁰ The Rangarajan Committee was also appointed to review the upstream fiscal regime, following a 2012 report published by India's National Auditor alleging that large amounts of revenue had potentially been lost to the exchequer due to ad hoc extensions and policy relaxations granted by the upstream regulator to exploration companies.

³¹ Sen, 2015, at pages 11 and 12

³² Sen, 2015, at pages 11 and 12

³³ Rangarajan Committee, 2012 in Sen 2015

³⁴ Rangarajan Committee (2012) in Sen, 2015, at page 12

However, India's Election Commission directed the government in March 2014 to postpone the implementation of the Rangarajan Committee's recommendations until after the country's general elections had been completed in April 2014. This was on the basis that new policy changes in the run up to the elections would have violated India's Election Code of Conduct. The new government that took office in June 2014 subsequently instituted a fresh review of gas pricing and postponed the decision until October 2014, when it published its decision on gas pricing reform.³⁵

The new formula to be implemented was based on the Rangarajan formula, but with two price benchmarks removed from the formula. The first related to the volume weighted average of netback prices to producers at the exporting country wellhead (for Indian LNG imports), and the second to the volume weighted average producers' netback price of gas in Japan. Instead, the Alberta (gas) reference price weighted by the volume of Canadian gas consumption, and the Russian domestic gas price weighted by the total annual volume of natural gas consumed in Russia were introduced in the formula. Based on this formula, the price of domestic gas was set at \$5.05/MMBtu as from 1 November 2014, thus an increase from the previous levels of US\$ 4.2 per mmbtu, but still significantly lower than the price of \$8.40/MMBtu that would have prevailed under the Rangarajan formula.³⁶

The revised formula has been criticised for being focused on the managing of the price level of gas, rather than establishing a logical market-oriented basis for price formation, and that it therefore does not reflect the supply and demand dynamics of India's gas market.³⁷ The Indian Oil Ministry appears to have recognised this, and announced in 2018 its intentions to set up a domestic gas trading hub, although the configuration and model of such a hub is yet to be finalised. The trading platform would aimed at helping discover market prices for domestic, as well as imported LNG, and if successful, could be key to growing India's gas market.³⁸ However, experience from developed countries have shown that, to establish and effective gas trading hub, a number of requirements need to be met. These include *inter alia* sufficient network capacity and non-discriminatory access to networks, a competitive number of market participants, and the involvement of financial institutions.³⁹⁴⁰ Whether or not India's gas sector has evolved sufficiently to support and effective gas trading hub, particularly against the

³⁵ Sen, 2015, at page 13

³⁶ Sen 2015, at page 13 - 15

³⁷ Sen, 2015, pages 15 - 17

³⁸ The Hindu Business Line, 2018

³⁹ Xunpeng, 2016

⁴⁰ Apart from capital investments that will be recouped by operational revenue, if a gas trading platform is established, a link between natural gas markets and financial institutions is needed to reduce counterparty risk and to provide a long term clear price signal.

background of the levels of concentration and vertical integration in the sector, therefore remains to be established.

A key lesson from the gas reforms and pricing policies of the BRIC countries is therefore that establishing a logical market-oriented basis for price formation is a complex and difficult task. One size does not fit all, and each country's regulated pricing methodology should be formed with its own natural gas sector's particular requirements, development goals and demand and supply characteristics in mind.

Table 1: Key characteristics, policy directions and regulatory pillars driving the development in the natural gas industries of Russia, China, India and Brazil

	Russia	China	India	Brazil
Proven reserves and consumption	<ul style="list-style-type: none"> Proven reserves: 1234,9 trillion cubic feet, 18% of world total Consumption: 424,8 cubic metres in 2017, 11,6% of world total. Natural gas 52% of total energy mix Large exporter of natural gas 	<ul style="list-style-type: none"> Proven reserves: 193,5 trillion cubic feet, 2,8% of world total Consumption: 246,4 cubic metres in 2017, 6,6% of world total. Gas 6% of total energy mix Net importer of natural gas 	<ul style="list-style-type: none"> Proven reserves: 43,8 trillion cubic feet, 0,6% of world total Consumption: 54,2 cubic metres in 2017, 1,5% of world total. Gas 6% of total energy mix Net importer of natural gas 	<ul style="list-style-type: none"> Proven reserves: 13,5 trillion cubic feet, 0,2% of world total Consumption: 38,3 cubic metres in 2017, 1% of world total. Gas 12% of total energy mix Net importer of natural gas
Strategic focus of sector	<ul style="list-style-type: none"> Ensuring optimal development of domestic gas sector, Russian economy as a whole Preserving competitive position as an exporter to European and Asian gas markets. 	<ul style="list-style-type: none"> Growing demand, driven by environmental goals and deployment of cleaner energy in China's economic reform plan. Develop indigenous production to meet demand, improve security of supply, secure more favourably priced supply than imported gas and reduce import dependence 	<ul style="list-style-type: none"> Raise the share of natural gas in the country's energy mix (to meet environmental goals) Develop indigenous production to meet growing demand, improve security of supply, reduce import dependence 	<ul style="list-style-type: none"> Energy security and raising share of gas in country's energy mix main objective Investment in exploration and production to stimulate domestic production, meet growing demand, improve security of supply
Structure of market	<ul style="list-style-type: none"> Gazprom (formerly the Soviet Ministry of Gas Industry) still largest gas producer in Russia, supplies about 75% of domestic gas demand, remains dominant in all segments of the domestic gas value chain. 	<ul style="list-style-type: none"> Upstream, midstream and downstream sectors still dominated by NOCs: China National Petroleum Corporation ("CNPC"), China Petrochemical Corporation (Sinopec) and China National Offshore Oil Corporation ("CNOOC"). About 75% of China's natural gas is produced by 	Upstream supply Dominated by State Oil companies ONGC and Oil India Limited. Pipeline system dominated by GAIL and Reliance Gas Transportation Infrastructure Limited ("RGITIL"). Other players like Assam Gas Company and Gujarat State Petronet Limited have pipeline assets that service regional demand centre.	Dominated by Petrobras in the production, transportation and supply of natural gas.

	Russia	China	India	Brazil
		CNPC, which is also the biggest owner and operator of transmission pipelines (with about 90% share).		
Domestic gas energy pricing				
• <i>Regulated? (Y/N)</i>	Yes	Yes	Yes	Yes (at city level)
• <i>Current methodology</i>	<ul style="list-style-type: none"> Parity with oil-linked export price (netted back to Russia) charged by Gazprom to EU customers. 	<ul style="list-style-type: none"> Uniform price, linked to alternative competing energy sources (imported oil products, discounted to ensure price advantage for natural gas rather than coal. Prices for shale gas, coalbed methane, coal-to-gas, and LNG imports sold at the terminal for local distribution negotiated between producer and the buyer, not subject to regulation (US Energy Information Administration, 2015a). Price reform followed concerns of fragmented pricing and cost-plus approaches with reference to domestically produced gas that were not conducive to LNG imports. 	<ul style="list-style-type: none"> Linked to hub-based prices of natural gas in competitive markets Price reform followed concerns that energy prices not at levels conducive for increased gas exploration and production 	Since 2002, gas energy prices freely negotiated, but in practice oil prices have remained a key price marker for gas, with gas prices often linked to, or based upon, oil prices throughout the gas sector, including at regulated city level
• <i>Previous methodology</i>	Prior to 2006: below cost of production	Prior to 2011: cost-plus approach, complex mixture of	Prior to 2010, sold to final consumers at 'administered'	Prior to 2002, gas energy prices determined by Federal Government by setting maximum

	Russia	China	India	Brazil
		agreements for different gas sources and end users	prices far lower than the costs of production.	gas prices as a percentage of fuel oil prices (for imported gas, this was 85% in 1994 and 98% in 1999).
Access to infrastructure	Regulated by TPA, transportation tariff also regulated	Regulated by TPA, transportation tariff also regulated. Vertical unbundling measures currently under debate.	Regulated by TPA, transportation tariff also regulated. Vertical unbundling measures currently under debate.	Regulated by TPA, and Petrobras carrying out major divestiture plans, includes divestments of some of its upstream midstream and downstream assets.

Source: Author, based on information contained in BP, 2018, Aolin and Qing, 2015; Baleroni, 2017, Braga, 2017, EIA, 2016, Export.gov, 2016; Gomes, 2014, Henderson, 2013, Paltsev and Zhang, 2015; Sen and Jain, 2011; Sen, 2015; and Yafimava, 2015

4. SOUTH AFRICA'S NATURAL GAS SECTOR: STRUCTURE, BARRIERS AND DEGREE OF READINESS FOR DEREGULATION

4.1 Overview

South Africa's natural gas industry is characterised by vertical integration, as publicly listed Sasol Ltd is part owner of the upstream natural gas supplies into South Africa, the majority owner of the only cross-border gas importation pipeline (through its subsidiary, Sasol Gas), who is also the sole owner of many transmission pipelines and all of the distribution pipelines. Although different transmission operators exist, two of these (i.e. Sasol Gas and Transnet Pipelines) own one pipeline each that are geographically separate, and effectively do not compete with each other.⁴¹ Distribution pipelines exist in several of the country's provinces, but are all owned and operated by the same distributor, namely Sasol Gas.⁴²

At the downstream level of the sector, natural gas is sold to end user customers by gas traders. Although a number of traders have entered and commenced trading activities at this level of the market (bringing the total to 10).⁴³ Sasol Gas also remains irrefutably dominant at this level of the sector, with it still accounting for more than 80% of natural gas sales to end user customers in South Africa.⁴⁴ This structure, along with the lack of significant growth (relative to Sasol Gas) of new players that have entered the industry over the past 13 years is indicative of certain barriers to entry that exists in the South African gas supply chain.⁴⁵

The two key features of the gas industry that serve as barriers for new firms to enter into, or for existing firms to expand their operations within the sector include first, (and arguably the most important) the limited sources of natural gas supply available to South Africa, and second, access to capital intensive network infrastructure. The latter is exacerbated by the degree of Sasol Gas' vertical integration across all levels of the gas supply chain, and its monopoly or irrefutably dominant position at each of those levels.⁴⁶

These are discussed further in the sub-sections below.

⁴¹ NERSA, 2016

⁴² Ibid

⁴³ South Africa currently has 10 licensed gas traders, namely Sasol Gas, Spring Lights Gas (Pty) Ltd, Virtual Gas Network (Pty) Ltd, NGV Gas (Pty) Ltd, Novo Energy (Pty) Ltd, Reatile Gastrade (Pty) Ltd, Tetra 4 (Pty) Ltd, SL-CNG (Pty) Ltd, Evraz Ltd and Columbus Stainless (Pty) Ltd.

⁴⁴ Ibid

⁴⁵ See, for example, NERSA (2016) and Granville and Irvine (2015), 'The impact of regulation on competition in telecommunications and piped gas', The African Journal of Information and Communication, Issue 14, 2015

⁴⁶ NERSA, 2012; NERSA, 2016; Granville and Irvine, 2015

4.2 Limited sources of gas supply

The most significant constraint to new entry in the South African natural gas industry is the lack of access to alternative sources and upstream suppliers of gas. Proven domestic gas reserves are small in South Africa. Domestic shale gas reserves are unproven and may many years to become commercially viable. Existing and potential domestic landfill gas and coal bed methane developments are unlikely to supply large volumes of gas at this stage.⁴⁷

Currently, South Africa's only source of natural gas supplies that are available for third party use is the gas extracted in Mozambique, imported into South Africa by Sasol Gas, as well as some (limited) volumes of synthetic gas manufactured by Sasol Synfuels at its Secunda plant.⁴⁸ Sasol Gas has recently confirmed that all gas supplies available to it from Mozambique, and from its domestic operations, have now been fully committed to customers through long term contracts, and that it is unable to supply additional contractual volumes of gas from Mozambique to any customers.⁴⁹ This effectively means that there is now an overall limit on the gas supplies available in the short to medium term into South Africa.

Another potential source of supply is through LNG imports from other sources of gas internationally. However, such imports would require the erection of capital intensive fixed or floating storage and regasification facilities, as well as access to pipeline infrastructure to distribute such gas to customers. There are currently no firm plans or commitments for such facilities to be erected in South Africa. Given the time required to erect such facilities, it is clear that LNG imports, as an additional source of gas supply to South Africa is unlikely to become available in the short to medium term.⁵⁰

These supply constraints place a significant limit on the degree of competition between Sasol Gas and other traders for the supply of gas to end users, and the general development potential of the sector, at least until more supply becomes available.

4.3 Access to capital intensive network infrastructure as a barrier to entry and expansion

Another impediment for firms to enter into and grow in the South African gas sector is access to Sasol Gas' transmission and distribution pipeline network infrastructure, which infrastructure cannot be easily duplicated by a competitor.⁵¹ This is because the capital costs

⁴⁷ NERSA, 2016

⁴⁸ NERSA, 2016

⁴⁹ Sasol Gas' non-confidential submissions to NERSA during the public hearings relating to the multi-year trading margin application from Sasol Gas for the periods 01 July 2017 to 30 June 2018 and 01 July 2018 to 30 June 2019, held at NERSA's offices in Pretoria on 7 September 2017

⁵⁰ Ibid

⁵¹ NERSA, 2012; NERSA, 2016; Granville and Irvine, 2015

associated with the construction of such pipeline infrastructure is significant, and exhibits natural monopoly characteristics, as the average total costs of supplying the service decline with volume, over the entire range of demand, leading to significant barriers for new entrants to enter into the market. In such a context, it is more efficient to have one pipeline that satisfies all customer demand.⁵²

Access to Sasol Gas' existing transmission and distribution pipeline networks is therefore an important consideration in facilitating new entry at the other levels of the gas value chain, as new entrants would require such facilities to transport gas to their customers. Since Sasol Gas is vertically integrated throughout all levels of the South African gas industry, it does not have an incentive to provide its competitors with fair access to such networks. Specifically, the problem with this degree of vertical integration was enunciated in merger cases such as the seminal United States Brown Shoe case,⁵³ and was summarised by Pereira (2003) as follows:

"The multiplication of the presence of a company throughout a number of markets along the value chain of the product concomitantly multiplies the possibilities for such a company to foreclose one or more of the corresponding markets where the company possesses market power. In these circumstances, vertical integration may in itself raise barriers to entry".⁵⁴ [own emphasis added]

If left unregulated, Sasol Gas would likely be able to achieve the foreclosure referred to above in a number of ways. First, it would likely be able to outright refuse to supply a competitor, or a potential competitor with gas. Second, it would likely be able to refuse to give a competitor or potential competitor access to its transmission and distribution pipeline facilities. Third, it would likely be able to charge its competitors or potential competitors exploitative prices/tariffs for the gas energy or use of its transmission and distribution facilities. The latter strategy will have the effect of raising the costs of Sasol Gas' competitors or potential competitors, and effectively "squeezing" their margins, thus impacting on the competitor or potential competitor's ability to compete with Sasol Gas on an equal footing.⁵⁵

⁵² Makhholm, J. 2013. The Political Economy of Pipelines: A Century of Comparative Institutional Development. University of Chicago Press.

⁵³ 370 U.S. 294, (1962) at 325.

⁵⁴ Pereira (2003) op cit note 13 at 5.

⁵⁵ Ibid

4.4 Conclusion: Structure, barriers and degree of readiness for deregulation of South Africa's gas energy prices / where we are with reference to best practice

South Africa's natural gas sector is still immature. There are currently key barriers in the sector that prevent the type of competitive entry that is needed to facilitate the free interaction of supply and demand to set gas prices at efficient levels. These include the limited sources of natural gas supply available to South Africa, and access to capital intensive network infrastructure. The latter is exacerbated by the degree of Sasol Gas' vertical integration across all levels of the gas supply chain, and its monopoly or irrefutably dominant position at each of those levels.⁵⁶

These barriers are similar to those experienced by the natural gas sectors of countries that have not yet deregulated their gas energy prices (see sections 2.4 and 3 above), although even compared to those countries, South Africa's sources of natural gas supplies are very limited. This suggests that South Africa's gas sector may still have a long road ahead before it would be viable to deregulate gas energy prices, and not the risk exploitation of customers, exclusion of competitors or potential competitors, or inefficient under or over investment in the sector as a result of the fact that there is no workable competition or prospects therefore over the short to medium term.⁵⁷

Based on international best practice (see sections 2 and 3 above), and in addition to its regulation of gas energy prices, South Africa already has most of the key policy and regulatory requirements in place that are appropriate for a gas industry that is at South Africa's stage of development. These include inter alia regulation of non-discriminatory access to infrastructure through TPA regulations and the approval of transmission tariffs, although regulatory oversight of distribution activities is lacking.

The next section will highlight some of the most important regulations and government policies currently in place, or under way, that will be key in facilitating and enabling the next steps in the eventual establishment of conditions for effective competition in South Africa's natural gas industry.

⁵⁶ NERSA, 2012; NERSA, 2016; Granville and Irvine, 2015

⁵⁷ These refer to inefficiently low demand side investments to switch to gas as an energy source, as well as inefficiently low or high supply side investments. The economic literature is clear that an important prerequisite for efficient supply side investment in an unregulated market is that some degree of competition (or the threat of competition through new entry) needs to be present in the market. To this end, Aghion et al. (2005) developed an inverse U-shaped curve between competition and innovation, which notes that competition may provide firms with incentives to innovate to "escape" from competition in the product market. This implies that, for efficient supply side investment to occur in an unregulated market, there must be some degree of competition, or at least some threat of competition to incentivise such investment.

5. POLICIES AND REGULATIONS TO FACILITATE COMPETITION IN SOUTH AFRICA'S GAS SECTOR

5.1 Overview

A discussion of the most important government regulations and policies that will facilitate and enable the next steps in the eventual establishment of conditions for effective competition in South Africa's natural gas industry must necessarily be focused around the key barriers to entry and expansion in the sector, as outlined in the previous section. In this regard, the sub-sections below set out the key government policies, regulations and initiatives currently in place, or under way, that are aimed at addressing these barriers.

5.2 Government policies to stimulate investment, diversify sources of supply

A key lesson from the BRIC countries assessed in section 3 above is that clear government policies and plans, providing clarity to investors as regards the strategic direction for their respective countries' energy sectors in general, and providing a strategic framework within which investments can take place, often serve as an incentive for the investment required to develop sources of gas supply.

In South Africa, government policies that are likely to contribute significantly to stimulating investment in the natural gas sector and that are likely to serve to address some of South Africa's gas supply constraints include the Integrated Energy Plan ("IEP"), the updated Integrated Resource Plan ("IRP"), and the Gas Utilisation Master Plan ("GUMP") for South Africa. These plans are currently being finalised by the Department of Energy ("DoE"), and Minister of Energy has recently indicated that they will be submitted to Cabinet by August 2018 for approval.⁵⁸

These plans would act as a roadmap for the development of the gas industry within the South African economy. They analyse *inter alia* the potential and opportunity for the development of South Africa's gas economy and sets out a path of how this could be achieved. Some of the main objectives of these plans are to enable the development of indigenous gas resources and to create the opportunity to stimulate the introduction of a portfolio of gas supply options to South African customers.⁵⁹

Another government initiative that is likely to significantly contribute to the development of infrastructure required to access other sources of supply, such as LNG, is the Gas to Power Programme, which could potentially serve to anchor the gas demand required to justify the

⁵⁸ ESI Africa, 2018

⁵⁹ Ibid

development of such infrastructure, whilst at the same time, longer term sustainable demand for gas still develops. The Gas to Power programme was stalled until the completion and publishing of the IEP, IRP, which is now set to be submitted to Cabinet by August 2018 for approval. Moreover, in his May 2018 budget speech, the Minister of Energy also indicated that he has instructed the DoE's IPP Office to resuscitate the Gas to Power Programme and take a lead in engaging with the different stakeholders to take the project forward.⁶⁰

5.3 Pricing as an appropriate signal to investors

An important regulatory tool to facilitate entry and expansion into the gas sector is for NERSA to determine maximum prices of gas that will facilitate the investment required to address South Africa's gas supply concerns (as outlined in section 4 above), whilst at the same time protecting customers from exploitation and price inequity, and competitors and potential competitors from foreclosure. The price must also be non-discriminatory, and it must achieve regulatory certainty and flexibility.

International best practice (particularly in the BRIC countries reviewed in section 3) suggests a move away from historical cost based and below cost based approaches to so-called market based pricing methodologies, based on prices of alternative energy sources, or gas prices as determined on selected gas trading hubs, (see table 1 above).

The review of the experiences of the BRIC countries set out in section 3 above has revealed that it is not an easy task to establish a logical market-oriented methodology for price formation, and that these methodologies may not go unchallenged or without what appear to be valid criticisms. South Africa's maximum pricing methodology ("methodology") developed and implemented by NERSA in 2014 also has challenges that have been well documented,⁶¹ and it seems that a review of the methodology may be appropriate.⁶²

In embarking on such a review, it would be appropriate for NERSA may take guidance from the experiences of BRIC countries, including the various components and drivers of their reformed pricing methodologies, and how effective / ineffective these have been in respect of achieving their goals. However, another key lesson, underpinned by the experiences of the BRIC countries reviewed in section 3 above is that one size does not fit all, and that the price methodology should aim to incorporate supply and demand conditions prevalent in South Africa.

⁶⁰ DoE, 2018

⁶¹ See, for example, Maseti, Gotori and Teljeur, 2018 and PG Group & others v NERSA (150/2017) [2018] ZASCA 56 (10 May 2018)

⁶² After a finding of inadequate competition in the sector is made, per the provisions of S21 of the Gas Act.

5.3 Policies and regulations focused on addressing access to infrastructure constraints

The Gas Act, 2001 (Act No 48 of 2001) ('the Gas Act') makes non-discriminatory TPA to transmission facilities mandatory and regulated and as such, it is legally possible to obtain access to transmission pipelines to transport piped gas which could, in theory, be imported along the existing import route from Mozambique. Alternatively, a gas trader could import LNG and supply the gas in liquefied or compressed form via cryogenic or pressurised containers to its customers. Access to Sasol's distribution network is currently voluntary.⁶³

South Africa's measures to address the potential exclusionary effects of Sasol Gas' vertically integrated position in the gas sector through TPA regulation appear to be in line with international best practice insofar as regulatory tools for countries whose gas sectors are still immature are concerned. As is clear from table 1 above, TPA regulation is still widely used in the BRIC countries (whose gas sectors are more mature than South Africa's gas sector), although some are now discussing or have recently started to implement, vertical unbundling as a measure to address the potential anticompetitive effects of the vertically integrated structures of their respective natural gas industries.

On balance, the uptake of TPA to gas pipelines in South Africa has been poor. Even though Sasol Gas does not have an incentive to provide access to its network to competitors / potential competitors,⁶⁴ it is possible that the poor uptake of TPA to its pipelines has largely been a result of the supply constraints currently faced by in the South African gas sector. It is therefore likely that the effectiveness of the current TPA regulations will be tested more fully, once further investments to increase gas supplies into South Africa, have been made.

Another contributing factor to the limited uptake of TPA may also be related to the challenging hybrid regulatory regime currently in place regarding the regulation of the ROMPCO transmission tariff.

Briefly, this relates to the situation where in 2004, when ROMPCO began transporting natural gas into South Africa, the transportation tariff for the initial volumes to be transported into South Africa was set in terms of the "Mozambique Gas Pipeline Agreement" entered into between the Minister of Minerals and Energy, the Minister of Trade and Industry and Sasol Limited at the time. The tariff established for ROMPCO under this agreement (also referred to as the GTA 1 tariff) was based on a base tariff to be adjusted quarterly with South African PPI, and this is still the basis for GTA 1 tariffs to date, without NERSA having oversight of such

⁶³ NERSA, 2016

⁶⁴ As this may threaten its dominant position in respect of other levels of the natural gas supply chain.

tariffs. Subsequent investments in the line happened after the introduction of the Gas Act, and are now regulated by NERSA at cost reflective levels.⁶⁵

As such, a hybrid regulatory regime emerged, whereby a portion of the tariffs paid by South African customers on the ROMPCO line is regulated by the Mozambique Gas Pipeline Agreement and is not related to cost, whereas other portions on the line are regulated in terms of the Gas Act, and are therefore cost reflective. Since the tariffs charged by ROMPCO for GTA 1 volumes, it is possible that this may have led to the over recovery of costs by ROMPCO on the GTA 1 line, and may have served as a deterrent for new entrants wishing to make investments in order to offer natural gas to customers in South Africa, and wanting to use the ROMPCO pipeline to transport the natural gas. In this regard, they would find it more difficult to do so the higher the tariff charged by ROMPCO.⁶⁶

A key regulatory intervention in this regard is that NERSA has initiated processes to amend the ROMPCO's licence to address these issues, and to bring GTA 1 tariffs in line with the objectives of the Gas Act, to ensure efficient tariff setting in respect of all ROMPCO lines servicing South African customers.⁶⁷

In addition to this, and as South Africa's natural gas industry develops further, particularly once some of the abovementioned constraints have been addressed, amendments to the Gas Act to provide NERSA with regulatory oversight over access to distribution networks and their tariffs may become increasingly necessary in order to ensure that this access barrier is also addressed.

6. Conclusion

It is clear that South Africa's natural gas sector is still immature. There key barriers in the sector that prevent the type of competitive entry that is needed before prices can be efficiently determined by the competitive market forces of supply and demand for piped gas. These barriers include the limited sources and suppliers of natural gas available to South Africa, and access to capital intensive network infrastructure. The latter is exacerbated by the degree of Sasol Gas' vertical integration across all levels of the gas supply chain, and its monopoly or irrefutably dominant position at each of those levels.⁶⁸

These barriers are similar to those experienced by the natural gas sectors of countries that have not yet deregulated their gas energy prices, although even compared to these countries,

⁶⁵ NERSA, 2018 and NERSA, 2017

⁶⁶ Ibid

⁶⁷ Ibid

⁶⁸ NERSA, 2012; NERSA, 2016; Granville and Irvine, 2015

South Africa's sources of natural gas supplies are very limited. This suggests that South Africa's gas sector may still have a long road ahead before it would be viable to deregulate gas energy prices, and not the risk exploitation of customers, exclusion of competitors or potential competitors, or inefficient under or over investment in the sector as a result of the fact that there is no workable competition or prospects therefore over the short to medium term.⁶⁹

Based on international best practice (see sections 2 and 3 above), and in addition to its regulation of gas energy prices, South Africa already has most of the key policy and regulatory requirements in place that are appropriate for a gas industry that is at South Africa's stage of development. In this regard, the key regulations and government policies currently in place, or under way, that will be key in facilitating and enabling the next steps in the eventual establishment of conditions for effective competition in South Africa's natural gas industry include various government policies and plans aimed at facilitating investment in the exploration activities and infrastructure required to expand South Africa's sources of gas supply. Regulations and initiatives aimed at attracting and facilitating investment and addressing potential exclusionary practices that may arise as a result of the structure of the South African gas sector are also already in place, underway, or being refined, and these should further facilitate and enable the establishment of conditions for effective competition in the South African gas industry over the longer term.

⁶⁹ Ibid

References

Aghion et al (2005) 'Competition and innovation: An inverted-U relationship.' Quarterly Journal of Economics 120, no. 2: 701-728. '

Aolin and Qing, 2015. "On natural gas pricing reform in China", Natural Gas Industry B, Volume 2, Issue 4, 2015, Pages 374-382.

Baleroni, 2017. "Recent developments in the oil and gas industry in Brazil", Oil and gas law news, available at <http://www.cesconbarrieu.com.br/arquivos/15030717330.pdf>

Braga, 2017. "Brazil's Natural Gas Sector Prepares For New Phase", available at <https://www.epmag.com/brazils-natural-gas-sector-prepares-new-phase-1660771#p=full>

Brown, 2014 'Evolution of Natural Gas markets in United States' Florence School of Regulation

BP, 2018. "BP Statistical Review of World Energy", 67th edition, available at <https://www.bp.com/content/dam/bp/en/corporate/pdf/energy-economics/statistical-review/bp-stats-review-2018-full-report.pdf>

De Streel, A. (2008). The relationship between competition law and sector specific regulation: The case of electronic communications. *Reflets & Perspectives de la Vie Economique*, XLVII(1), 55-72. doi: 10.3917/rpve.471.0055.

DoE, 2018. Media Statement by the Minister of Energy: Jeff Radebe on the 2018/19 Budget Vote of the Department of Energy. Available at <http://www.energy.gov.za/files/media/pr/2018/MediaStatement-by-the-Minister-on-the-2018-19Budget-Vote-of-the-Department-of-Energy-16May2018.pdf>

Du Plessis, L. & Blignaut, L. 2009. Staying safe – dominant firms' pricing decisions in industries where high prices do not attract entry. Third Annual Competition Commission, Competition Tribunal and Mandela Institute Conference on Competition Law, Economics and Policy in South Africa.

EIA, 2016. "Country Analysis Brief: India", available at http://www.ieee.es/Galerias/fichero/OtrasPublicaciones/Internacional/2016/EIA_Country_Analysis_Brief_India_14jun2016.pdf

ESI, 2018. "SA energy minister optimistic about driving sector investment", available at <https://www.esi-africa.com/s-africa-energy-minister-optimistic-on-driving-economic-investment/>

EU directive 98/30/EC, 1998. "Directive 98/30/EC of the European Parliament and of the Council of 22 June 1998 concerning common rules for the internal market in natural gas", Official Journal of the European Communities, L 204/1

Evans, David S & Padilla, Atilano Jorge, 2004. "Excessive Prices: Using Economics to Define Administrable Legal Rules," CEPR Discussion Papers 4626, C.E.P.R. Discussion Papers.

Export.gov, 2016. *"Global Market Insight: A General Outlook on Brazil's Natural Gas Market"*, available at <http://apps.export.gov/article?id=A-General-Outlook-on-Brazil-s-Natural-Gas-Market>

Geradin, D, 2007. "The Necessary Limits to the Control of "Excessive" Prices by Competition Authorities – A View from Europe," Tilburg University Legal Studies Working Paper. Available at SSRN: <http://ssrn.com/abstract=1022678>

Gerber, DJ "Law and Competition in Twentieth Century Europe: Protecting Prometheus" (Oxford University Press Oxford 1998) in Evans & Padilla, 2004

Getting the deal through, 2017 'Gas regulation 2017' Law Business Research Ltd

Global Legal Insights ("GLI"), 2018. *"Energy 2018: Portugal"*. Available at <https://www.globallegalinsights.com/practice-areas/energy-laws-and-regulations/portugal>

Gomes, 2014. *"Brazil: Country of the future or has its time come for natural gas?"*, Oxford Institute for Energy Studies, OIES Paper: NG 73

Granville and Irvine, 2015. 'The impact of regulation on competition in telecommunications and piped gas', The African Journal of Information and Communication, Issue 14, 2015

Hal R. Varian, "Intermediate Microeconomics, A Modern Approach" (5th W.W. Norton & Company 1999)

Henderson, 2013. *"Evolution in the Russian Gas Market – The Competition for Customers"*, The Oxford Institute for Energy Studies, OIES Paper: NG 73

Juris, 1998, 'Natural Gas Markets in the U.K. Competition, industry structure, and market power of the incumbent, Public Policy for the Private Sector', note no 138, March 1998

Lund 2017, 'U.S. Natural Gas Market Evolution' Harvard Kennedy School Energy Policy Seminar Series, Spring 2017 Monday, April 3, 2017, Consortium for Energy Policy Research

MacAvoy and Pindyck, 1974. 'The economics of the natural gas shortage (1960 – 1980).' *Massachusetts Institute of Technology, Energy Laboratory Report no. MIT-EL 74-011*

Makholm, J. 2013. *The Political Economy of Pipelines: A Century of Comparative Institutional Development*. University of Chicago Press.

Marshall, A *"Principles of Economics"* (Macmillan London 1890) in Evans & Padilla, 2004

Maseti, Gotoro and Teljeur, 2018. *"Price Regulation in a Developing Gas Industry: How South Africa's Innovative Pricing Regime Walks a Regulatory Tightrope"*, World Gas Conference 2018.

Mondliwa and Roberts, 2013. 'Concept paper: Reviewing regulation and regulators in the context of economic development in South Africa', Centre for Competition, Regulation and Economic Development, University of Johannesburg

Motta, M and de Streel, A “*Exploitative and Exclusionary Excessive Prices in EU Law*” in C-Ehlermann, D and Atanasiu, I (eds.), *What Is an Abuse of a Dominant Position?*, Oxford: Hart Publishing, 2006, p.91 at p.108 in Geradin, 2007

NERSA, 2011. ‘*Methodology to approve maximum prices of piped gas in South Africa.*’ Pretoria: National Energy Regulator of South Africa (NERSA). Retrieved from <http://www.nersa.org.za>

NERSA 2012. Determination of the inadequate competition in the piped-gas industry as contemplated in Chapters 2 and 3 of the Competition Act, 1988. Pretoria: National Energy Regulator of South Africa (NERSA). Available at http://www.nersa.org.za/Admin/Document/Editor/file/Piped%20Gas/Consultations/Document/Discussion%20Document_%20Determination%20of%20the%20inadequate%20competition%20in%20the%20piped-gas%20industry.pdf

NERSA 2016. *Determination of the inadequate competition in the piped-gas industry as contemplated in Chapters 2 and 3 of the Competition Act, 1988.* Pretoria: National Energy Regulator of South Africa (NERSA). Available at <http://www.nersa.org.za/Admin/Document/Editor/file/Piped%20Gas/Consultations/Document/An%20assessment%20of%20the%20adequacy%20of%20competition%20in%20the%20South%20African%20piped-gas%20industry.pdf>

NERSA, 2017, ‘*Reasons for decision on Rompco (Pty) Ltd’s application for a multi year tariff*’, available at <http://www.nersa.org.za/Admin/Document/Editor/file/Piped%20Gas/Pricing%20and%20Tariffs/Tariff%20Decisions/Reason%20for%20Decision%20for%20ROMPCO%20tariff%20application%20-%2023%20February%202017.pdf>

NERSA, 2018, “*Consultation document regarding the amendment of the Republic of Mozambique Pipeline Investment Company’s (ROMPCO’s) licence conditions related to its licence to operate its transmission pipeline between Komatipoort and Secunda*” available at <http://www.nersa.org.za/Admin/Document/Editor/file/Piped%20Gas/Licences%20under%20considerations/Consultation%20document%20-%20Amendment%20of%20ROMPCO%20licence%20conditions%20to%20operate%20a%20gas%20transmission%20pipeline%20between%20Komatipoort%20%20and%20Secunda.pdf>

OECD (2000) *Promoting Competition in the Natural Gas Industry*. Policy Roundtable, available at <http://www.oecd.org/regreform/sectors/1920080.pdf>

Ofcom 2015, “*Strategic Review of Digital Communications*”, 2015, page 116, paragraph 11.1 and 11.2.

Paltsev and Zhang, 2015. “*Natural gas pricing reform in China: Getting closer to a market system?*”, Reprint 2015-9, Reprinted with permission from Energy Policy, 86(2015): 43–56

Parliamentary Group for Energy Studies, 2012 ‘*UK Energy Policy 1980 – 2010, A History and Lessons to be Learnt*’ The Institution of Engineering and Technology

Pereira (2003) ‘*Vertical and horizontal integration in the media sector and EU competition law: The ICT and Media Sectors within the EU Policy Framework*’ 7 April 2003 at 5 and 7, OECD Round Table ‘Vertical Mergers 2007’ at 132.

PG Group & others v NERSA (150/2017) [2018] ZASCA 56 (10 May 2018)

Rangarajan Committee, 2012. *Report of the Committee on Production Sharing Contract Mechanism in Petroleum Industry*, Government of India, December 2012. Available at http://eac.gov.in/reports/rep_psc0201.pdf

Schumpeter, JA “*History of Economic Analysis*” (E Boody Schumpeter ed Oxford University Press Oxford 1954) pt III, c 4 in Evans & Padilla, 2004

Sen and Jain, 2011. “*Natural Gas in India: An Analysis of Policy*”, The Oxford Institute for Energy Studies, NG 50

Sen, 2015. “*Gas Pricing Reform in India: Implications for the Indian landscape*”, The Oxford Institute for Energy Studies, OIES Paper: NG 96

The Hindu Business Line, 2018. “*Gas trading hub: A challenge, but doable*”, available at <https://www.thehindubusinessline.com/economy/macro-economy/gas-trading-hub-a-challenge-but-doable/article23638790.ece>

UNECE 2012, *The Impact of Liberalization of Natural Gas Markets in the UNECE region-Efficiency and Security*, available at https://www.unece.org/fileadmin/DAM/energy/se/pdfs/wpgas/pub/ImpactLibNGM_UNECE_EffSec.pdf

Viscusi, K., Harrington, J. and Vernon, J. (2005). *Economics of Regulation and Antitrust*. Third Edition. MIT Press. P.638-639.

Xunpeng, S. 2016. “*Development of Europe’s gas hubs: Implications for East Asia*”, ScienceDirect, Natural Gas Industry B 3 (2016) 357 – 366.

Yafimava, 2015. “*Evolution of gas pipeline regulation in Russia: Third party access, capacity allocation and transportation tariffs*”, The Oxford Institute for Energy Studies, OIES Paper: NG 95