NATIONAL ENERGY REGULATOR

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DISCUSSION DOCUMENT – PHASE 1 OF THE REVIEW OF THE METHODOLOGY TO APPROVE MAXIMUM PRICES OF PIPED-GAS IN SOUTH AFRICA

1. INTRODUCTION

1.1. This document seeks to facilitate discussion among stakeholders to establish the adequacy of the Methodology to Approve Maximum Prices of Piped-Gas in South Africa (‘the Methodology’). NERSA is undertaking a project to assess the effectiveness, efficiency and appropriateness of the Methodology. The main objective of the project is to find out whether there is a need to review the Methodology, the extent to which the Methodology has met the objectives of the Gas Act, 2001 (Act No. 48 of 2001)(‘the Gas Act’) and benchmarking the Methodology against other gas pricing methodologies of other jurisdictions.

1.2. This discussion document poses questions that are directed to stakeholders to comment on the appropriateness of the Methodology and its ability to meet the objectives of the Gas Act as contemplated in the 2011 Methodology (i.e. facilitation of growth of the gas industry; determination of prices that imitate outcomes of competitive markets etc.). It then presents an opportunity for stakeholders to suggest alternative methodologies or improvements to the current Methodology that NERSA may adopt to enhance the efficient pricing of gas.

1.3. Section 6 of the Methodology compels the Energy Regulator to consult with regulated entities, on an ongoing basis, regarding its adequacy and its ability to meet its objectives. The Energy Regulator is expected to solicit feedback from regulated entities on aspects of the Methodology that are either working well or that need amendment. As such, through section 6 of the Methodology, the Energy Regulator was given the mandate to review the Methodology within five years of implementation.

1.4. This discussion document is phase 1 of 3 towards the review of the Methodology and is structured as follows. First, it presents the mechanism of the gas pricing formula. Second, it presents the theoretical underpinnings of the Methodology once again for stakeholders to understand the orientation of the Methodology prior to its approval in 2011. Third, it presents overall theoretical frameworks, gas pricing mechanisms in other jurisdictions and a survey of international gas pricing formulae with associated outcomes for benchmarking purposes. Fourth, a list of reviewable aspects are outlined with recommendable enhancements or adjustments in the current Methodology and concerns that have been raised by stakeholders since its inception. Questions are presented at the end of each section for all stakeholders to respond for further consideration in phases 2 and 3 of this project.

2. LEGISLATIVE FRAMEWORK

2.1. The Energy Regulator is mandated in terms of the National Energy Regulator Act, 2004 (Act No. 40 of 2004) (‘NERSA Act’) to regulate the electricity, piped-gas and petroleum pipeline industries in terms of the Electricity Regulation Act, 2006 (Act No. 4 of 2006), the Gas Act and the Petroleum Pipelines Act, 2003 (Act No. 60 of 2003).

2.2. NERSA derives its mandate regarding piped-gas maximum prices from the Gas Act. According to the Gas Act, the ‘Energy Regulator must regulate prices in terms of section 21(1) (p), in the prescribed manner’. Section 21(1)(p) prescribes that the Energy Regulator may impose licence conditions within the following framework of requirements and limitations: ‘maximum prices for distributors, and all classes of consumers must be approved by the Gas Regulator where there is inadequate competition as contemplated in Chapters 2 and 3 of the Competition Act, 1998 (Act No. 89 of 1998)’.

2.3. In line with this legal requirement, NERSA has developed a Methodology to Approve Maximum Prices of Piped-Gas in South Africa (‘the Methodology’). Approving maximum prices and the use of this Methodology is contingent on

NERSA determining that 'there is inadequate competition as contemplated in Chapters 2 and 3 of the Competition Act, 1998' as stipulated in section 21(1)(p) of the Gas Act.

2.4. The requirements of the Methodology is further informed by the 'Price Regulation and Procedures Principles' prescribed in the Piped-Gas Regulations, promulgated in terms of the Gas Act of 2001, gazette No.29792 of 20 April 2007 ('the Regulations').

2.5. Sub-regulation 4 (4) prescribes that the maximum prices determined by NERSA must enable the licensee to:

a) recover all efficient and prudently incurred investment and operation costs; and
b) make a profit commensurate with risk.

2.6. The above requirements of the Gas Act are key to defining the scope of the Methodology.

3. THE METHODOLOGY, THE GAS PRICE FORMULA & HISTORICAL OUTCOMES

3.1. The Methodology provides two approaches to approving maximum prices for gas molecules, namely; the use of Energy Price Indicators and Pass-through (or cost-build up) to determine the gas energy (GE) price.

3.2. The pass-through approach requires a cost-based price build-up, including at the least the cost of the procured or produced gas, and any transportation or regasification costs, to justify the price for gas energy applied for.

3.3. In terms of the Price Indicators approach, the maximum price of gas (at the point of its first entry into the transmission/distribution system) is referenced to price indicators of identified relevant energy sources as detailed below.

3.4. The maximum prices of piped-gas proposed by an applicant or licensee shall be reviewed for purposes of approval by the Energy Regulator based on the following formula:

$$\mathbf{GE} = \boldsymbol{w_1}\,\mathbf{CL} + \boldsymbol{w_2}\,\boldsymbol{DE} + \boldsymbol{w_3}\,\mathbf{EL} + \boldsymbol{w_4}\,\mathbf{HFO} + \boldsymbol{w_5}\,\mathbf{LPG}$$

where:

GE = Maximum price for gas energy (ZAR/GJ) at the point of its first entry into the piped-gas transmission/distribution system;

CL = indicator of equivalent price of coal;

DE = indicator of equivalent price of diesel;

EL = indicator of equivalent price of electricity;

HFO = indicator of equivalent price of heavy fuel oil;

LPG = indicator of equivalent price of liquefied petroleum gas;

$\mathbf{w_n}$= weighting of the 'nth' indicator in the basket (where, $w_1+w_2+w_3+w_4+w_5$ =100%);

3.5. The formula above is used exclusively for the maximum price of gas energy and does not include trade margins, distribution tariffs, transmission tariffs, storage tariffs and levies.

3.6. Once the maximum price of gas is arrived at, all other charges (tariffs and levies) mentioned above shall be included to arrive at the 'total gas charges' to be invoiced by a licensee.

3.7. Table 1 below shows the evolution of the gas energy price, on a quarterly basis. The GE has been fluctuating between R117.69/GJ and R141.45/GJ over the period from 2013 to 2017.

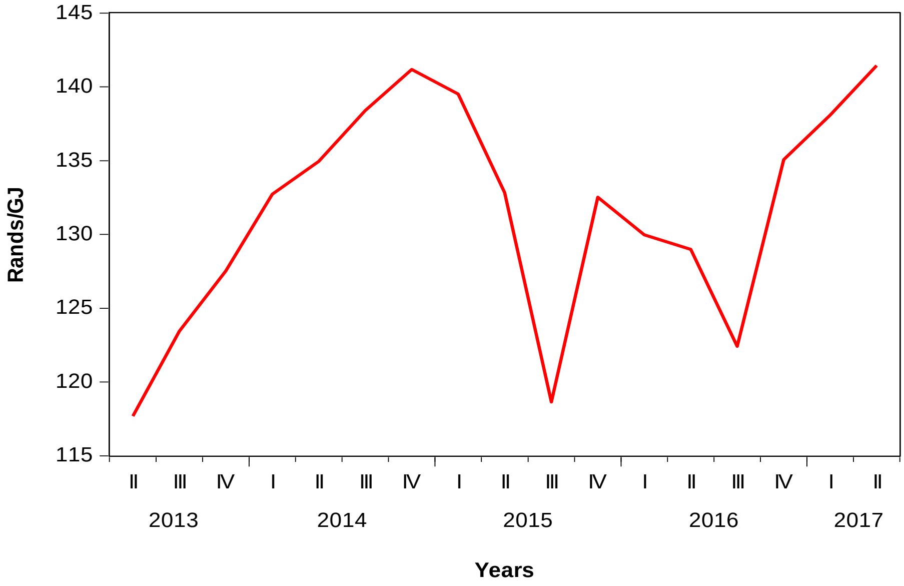
Table 1: The Gas Energy Price Evolution, 2013-2017

Quarters	NERSA GE (R/GJ)
2013Q2	117,69
2013Q3	123,44
2013Q4	127,53
2014Q1	132,73
2014Q2	134,44
2014Q3	138,29
2014Q4	141,12
2015Q1	139,48
2015Q2	133,21
2015Q3	118,61
2015Q4	132,52
2016Q1	130,08
2016Q2	129,28
2016Q3	122,50
2016Q4	135,28
2017Q1	138,00
2017Q2	141,38

Source: NERSA (2017)

3.8. Figure 1 below is a graphical presentation of the GE price movement.

Figure 1: The Gas Energy (GE) Price trend in South Africa, 2013Q2 to 2016Q4



3.9. Notably, the GE price has fluctuated significantly over the reference period, with sharp declines in July 2015 and July 2016 respectively. Figure 1 illustrates that the GE price rose consistently for the second quarter of 2013 from R117.69/GJ, driven mainly by escalating prices of crude oil, hence the diesel price, heavy fuel oil (HFO) and exchange rate turbulence.

3.10. The GE price increased from R134.95/GJ to R138.40/GJ in the second to third quarters of 2014. The GE price further increased to R141.18/GJ in the fourth quarter of 2014. This translated to a 5% increase in the Sasol GE price from the date of its first implementation of the maximum GE price to the end of 2014. The increase was mainly due to the increase in the price of electricity, diesel and LPG in the first and second quarters of 2014.

3.11. In the first quarter of 2015, the GE price was R139.52/GJ. The GE price decreased from R139.52/GJ to R132.83/GJ in the second quarter of 2015. It further decreased from R132.83/GJ to R118.65/GJ in the third quarter of 2015. This sharp decrease of about 16% in the GE price was due to a decrease in the price of HFO, and consequently the price of diesel and LPG. Diesel has a significant weight in the basket of alternatives formula used to calculate the maximum price. Hence, a decrease in the diesel price had a considerable impact on the final maximum GE price.

3.12. In the third and fourth quarters of 2015, the GE price increased by 12% to R132.52/GJ. This sharp increase in the GE price was mainly a result of an increase in the price of electricity and diesel.

3.13. In the first half of 2016, the GE price slightly decreased again by 3% from R129.97 to R128.98 and continued to further decrease by 5.09% in the second quarter of 2016. The decrease in the GE price in this period was due to a decrease in the prices of electricity and diesel. The GE price increased by 10.33% from R122.42/GJ in the previous quarter ended 30 September 2016 to R135.07 in the quarter ending 31 December 2016.

3.14. The increase in the GE price of 10.33% in the last quarter of 2016 was due to the increase in the price of electricity and diesel in the second quarter of 2016 (as Sasol Gas' adjustment mechanism uses information from that period to escalate the GE in the last quarter of 2016).

3.15. From 31 December 2016 to 31 March 2017, the GE price increased by 2.23% from R135.07/GJ in the quarter ended 31 December 2016 to R138.08/GJ in the quarter ending 31 March 2017. The increase in the GE price is attributed to the increase in prices of thermal coal, diesel and electricity. For the second quarter of 2017 ending 30 June, the GE price stands at 141.45/GJ pronouncing a 2.44% increase from the R138.08/GJ of the first quarter. Electricity and diesel prices are once again the main drivers of such an increase.

3.16. Section 4 below is an account of the identified areas of improvement, the current prescriptions of such aspects (if any) in the Methodology, challenges or gaps regarding such and suggestions for possible inclusion.

4. AREAS OF IMPROVEMENT IDENTIFIED IN THE METHODOLOGY

Data Sources for Weights of Energy Indicators and Associated Prices

4.1. NERSA concedes that there is need to review the sources of data used to determine the relative weights of each energy indicator as well as the sources of data for relevant energy indicator prices in the basket of alternative fuels. As provided in the above formula, the price of gas is determined by referencing it to the following energy price indicators: coal, heavy fuel oil, diesel, liquefied petroleum gas and electricity.

Data Sources for Weights

4.2. In the Methodology, the weights are obtained from the respective contributions of each energy source to the total consumption basket as gazetted by the 'Digest of South African Energy Statistics' – Energy Balances and Energy Digest.

4.3. It has been noted that there may be a double counting potential with respect to the manner in which coal is accounted for in the basket. Coal used in electricity production and diesel processing, if any, has to be excluded.

4.4. NERSA is proposing that strictly primary sources of energy ought to be considered and that secondary sources be disregarded in the determination of weights. The expectation is that such a revision will change the composition of weights and improve the GE price.

4.5. In addition, NERSA has noted that the official source of such weights, the 2008 Energy Digest, is outdated. Since this bulletin is published by the Department of Energy (DoE), NERSA had chosen it as a compulsory source of information for the calculation of weights because it is accessible to all stakeholders at no cost. More so, the use of such a source would ensure transparency and consistency. However, the fact that the DoE takes long to publish a new bulletin, makes the Energy Digest an inefficient source of information for weights and that would lead to the use of obsolete information in the GE price calculations. As a result, the GE price calculated using obsolete information is in all probability an inefficient price reflecting a biased economic value of gas.

4.6. There are alternative sources of energy statistics that stakeholders may use and some of them are private sources accessible at a cost. Examples of such private sources include the Quantec Research, Bloomberg etc. NERSA is appealing to all stakeholders to put forward information leading to the identification of a possible alternative source that may give reliable data and preferably a public source for transparency and consistency purposes.

4.7. NERSA therefore recommends the:

   a) removal of coal used in electricity and diesel production; and
   b) consideration of proposed alternative source that the Energy Regulator may use to determine the weights of the alternative source of energy used to determine the price of GE.

<u>Questions to stakeholders</u>

1a) What are your views regarding the removal of coal used in the production of electricity and diesel?

b) What are the possible alternative sources of information that NERSA may use to calculate weights?

Data Sources for the Prices of Energy Indicators in the Basket

4.8. The **price of coal** is sourced from the International Monetary Fund (IMF), actual market prices for non-fuel and fuel commodities (Richards Bay Terminal, thermal coal-free-on-board price). Stakeholders have raised concerns over the authenticity of coal prices. They have argued that the price series used for coal reflects the price of higher-grade export coal, which is more expensive than the coal used for energy by local users. More so, such an export price for higher-grade coal includes transport charges. Hence, the price series substantially overstate the opportunity cost of the price of natural gas as reflected through the price of exported coal as an energy substitute.

4.9. The basic **price of diesel** is quoted in SA cents/litre converted to Rands/GJ sourced from the DoE website, available as a monthly time series. The price of diesel is BFP for diesel and is also a wholesale price that does not include a margin for trading.

4.10. The **price of electricity** is the average Eskom tariff approved by the Energy Regulator, in cents per KWh, converted to R/GJ and is accessible to all stakeholders through the NERSA website. Electricity prices considered have been disputed as not comparable to the energy price because they include distribution, transmission and trading margins as well as a premium for capital investment. As a result, stakeholders have indicated that the price of electricity overstates the opportunity cost of switching to natural gas by industrial customers. Thus, such bias has led to upward pressures on the GE price as such electricity prices have increased considerably in the past.

4.11. Regarding the **price of HFO**, it has become apparent that the Department of Energy has discontinued its publication. The price of HFO is obtained through the United Kingdom's Department of Energy and Climate Change, which publishes this data on a quarterly basis, based on information from the International Energy Agency and Eurostat, among others, converted to R/GJ. The reflection of the HFO price in US$, sourced from IMF, has been considered by stakeholders as inappropriate as it is based on an export parity. Furthermore, stakeholders indicated that there is no evidence that such a price is a wholesale price and that it does not include trading margins and distribution tariffs. There is a possibility that the HFO price is transmitting distortions of a comparable external market to the domestic gas market.

4.12. The **price of LPG** is the maximum refinery gate price (MRGP) obtained from the DoE website, converted to R/GJ. The applicable conversion density factor is 0.54. According to the Methodology, the DoE website must be used as a source for LPG prices. In 2011, when NERSA approved the Methodology, the DOE published the LPG price under **Petrol Price Archives – Historical Prices-LPG** and this LPG price used a density conversion factor of 0.54 to convert the MRGP of LPG from c/kg to c/ltr. The DoE has since changed the conversion factor used on this table from 0.54 to 0.555.

4.13. It has been noted that failure to utilise wholesale prices of energy sources, particularly for electricity and coal, leads to circularity problems where inefficient electricity prices are feeding into the maximum gas energy price. This has compromised the objective of regulating the gas industry of South Africa with a goal to mimic a competitive price.

4.14. NERSA therefore recommends:

a) the adoption of domestic prices of coal published by DMR instead of sourcing the price externally from the IMF;

b) an alternative source of HFO prices such as Bloomberg; and

c) the adoption of 0.555 as the LPG density conversion factor.

Questions to stakeholders

2a). What alternative sources of energy statistics can be used in the determination of prices of coal and HFO?

b) Do you recommend the use of 0.555 as the LPG density conversion factor?

c) What possible impact does that change have on the GE price?

Gas Energy Price Adjustment Formula

4.15. Section 2.3.1 of the Methodology states that an applicant (licensee) must indicate the frequency of the desired price adjustment to be approved by the Energy Regulator.

4.16. The Methodology, through section 2.3.1 leaves it to the discretion of the licensee to specify the form and frequency of price adjustments. However, it does not spell out the price adjustment formula that licensees should adopt for both short-term and long-term contracts.

4.17. Three challenges have been identified so far. First, the Methodology does not spell out the price adjustment formula. Second, the Methodology is misconstrued for giving reference to the price adjustment through section 3.4 that is alluding to the frequency of price review. Third, a further gap is that section 3.4 does not ensure consistency and equal treatment of licensees by leaving price review decisions solely to the discretion of licensees.

4.18. NERSA therefore proposes the inclusion of a section in the Methodology that specifically talks to the price adjustment formula as was proposed historically during the design stages of the Methodology. For instance, the formula below may be adopted to adjust prices over a period of 12 months using the appropriate adjustment factors for each energy source in the basket and price changes for each respective energy source over the period in question.

$$\boxed{GE_1 = G_0 + (f_1 \text{ x change in coal price} + f_2 \text{ x change in diesel} + f_3 \text{ x change in electricity price} + f_4 \text{ x change in HFO price} + f_5 \text{ x change in LPG price})}$$

4.19. The ***f*** are the price adjustment factors that are determined either through the respective correlations of each energy source in the basket against piped-gas price movements in a comparable market. However, this can only be the case if stakeholders believe that the price adjustment factor cannot be maintained in the formula as redundant and kept constant with a value of 1, as was previously agreed.

4.20. At present, the GE is adjusted using the same formula used to determine it. The only contentious issue is the frequency of adjustment, which is at the discretion of the licensee. The experience gained so far in doing so is that quarterly adjustments or any other higher frequency adjustments have a tendency of causing volatility and turbulence in the GE movement with time. On the other, adjustment of the GE with a low frequency has less turbulence and volatility in GE movement, especially if done annually. Annual GE adjustments tend to smoothen the trend in the GE movement over time.

Questions to Stakeholders

3. Propose a method to adjust the GE price and indicate the impact of the proposed price adjustment formula on various stakeholders in the gas value chain.

Alignment of the Elements or the Trading Margin Formulae to the Tariff Guidelines

4.21. According to section 3.7 of the Methodology, the following formula will be used to determine the allowable revenue for trading services provided to:

a) transmission customers of a trading licensee;
b) distribution customers of a trading licensee; and
c) customers as trading margin.

Allowable Revenue $_{(transmission)}$ =

{Approved Trader Operating Expenses +

((Approved Transmission Trader Costs of Sales + Approved Transmission Trading RAB + Working Capital)* Margin) + T ± C

4.22. The Methodology, through section 3.6.1 stipulates that the regulatory asset base of a trader is a horizontal summation of the trading-specific piped-gas network assets and the general plant used for piped-gas trading. As such, it is still aligned to the old Tariff Guidelines of 2009. It is proposed that the RAB formula be adjusted to include allowable funds used during construction (AFUDC), net working capital and depreciation. Therefore, the formula; RAB = V+AFUDC-d+w becomes applicable as it applies to the 2017 Guidelines for Monitoring and Approving Piped-Gas Transmission and Storage Tariffs in South Africa (‘The 2017 Tariff Guidelines’).

4.23. The general formula to determine allowable revenue is proposed to be as follows:

Allowable Revenue = (RAB x WACC) + E + T + D ± C

AR = Allowable Revenue

RAB = Regulatory Asset Base at the beginning of the period

WACC = Effective Weighted Average Cost of Capital (in nominal terms)

E = Efficient operating and maintenance Expenses

T = Tax expense

D = Depreciation for the period under review.

C = "Clawback/giveback" factor to correct for differences between actual variable values and the assumptions thereof used in the price calculations. This factor is typically applied with a 1 year lag in order for the licensee to submit the audited actual values for assumed values.

4.24. The formula to determine Regulatory Asset Base (RAB) is proposed to be as follows:

RAB = (PPE + AFUDC + Cost of Sales + W)

RAB = Regulatory Asset Base at the beginning of the period

PPE = Property Plant and Equipment at the beginning of the period without inflation indexation.

AFUDC = Allowable funds used during construction relate to WACC return capitalised to the PPE during construction period.

Cost of Sales = Actual direct costs relating to the purchase or production of a good that is sold to a customer.

W = Working capital balance capped at 45 days.

4.25. NERSA proposes the amendment of the Methodology with respect to section 4.4.2 (general provisions) of the 2017 Tariff Guidelines, which indicate the treatment of assets in the RAB and excludability conditions of some, inclusion of assets and specified categories of assets into RAB after they have been commissioned, capitalisation of extraordinary costs, category of costs excluded and tax approach. This is applicable to piped-gas and CNG licensees alike.

4.26. NERSA proposes the adjustment of the CAPM model in the WACC calculations to include risk premia as prescribed in the 2017 Tariff Guidelines, alignment with respect to the net working capital formula and the arithmetic computation of MRP over a 30-year period. Clawback rules will be included for alignment purposes into the 2017 Tariff Guidelines in line with the inclusion of a correction factor proposed in section 17 below.

4.27. NERSA proposes the amendment of the Methodology with respect to section 4.4.4 (general provisions) of the 2017 Tariff Guidelines, which indicates the treatment of assets in the RAB and excludability conditions of some, inclusion of assets and specified categories of assets into RAB after they have been commissioned, capitalisation of extraordinary costs, category of costs excluded and tax approach. This is applicable to piped-gas and CNG licensees alike.

4.28. NERSA proposes the adjustment of the CAPM model in the WACC calculations to include risk premia as prescribed in the 2017 Tariff Guidelines, alignment with respect to the net working capital formula and the arithmetic computation of MRP over a 30-year period. Clawback rules will be included for alignment purposes to the 2017 Tariff Guidelines in line with the inclusion of a correction factor proposed in section 17 below.

Question to Stakeholders 4. What other issues regarding the trading margin formulae require alignment to the 2017 Tariff Guidelines?

Problem of Choice between the Indicators Approach and the Pass Through Approach

4.29. The current Methodology is flexible in terms of the choice between the Energy Indicators approach and the Pass-through approach in the determination of the gas energy price. As a result, applicants or licensees in the gas value chain are at liberty to motivate for their choice between the two approaches.

4.30. NERSA is of the view that the Price Indicators approach should be utilised by importers of Gas to determine the economic value of the gas molecule at the beginning of the value chain or at point of its first entry into the transmission/distribution system. Since the value of gas molecule, once determined at the point of entry from outside South Africa, is the same irrespective of the location of the licensee in the country. The GE of all other traders/resellers of gas must be based on the negotiated cost of gas from the suppliers of gas who are at the point of entry into the transmission/distribution system.

4.31. Hence, traders, domestic producers of gas and LNG importers should compulsorily use the pass-through approach in determining their total charge of gas.

4.32. The rationale behind this proposal is that there is no need for them to recalculate the unit price of the gas molecule that has already been established at the at the point of its first entry into the transmission/distribution system by importers of natural gas into the South African market. Traders should then add trading margins, transmission and distribution tariffs to the known, pre-determined gas molecule price to arrive at the total charge of gas in the market. Therefore all resellers of gas, including CNG traders sourcing their gas from suppliers who are at the point of first entry into the transmission/distribution are expected to use the pass-through approach under all circumstances.

4.33. The above implies that the GE will be determined using the pass-through approach and that the reseller/trader will apply for a trading margin based on the requirements of the Tariff Guidelines.

4.34. NERSA therefore recommends an amendment of the entire of section 3.5 of the Methodology that has been allowing licensees to make a choice between the indicators approach and the pass-through approach regardless of their circumstances.

Questions to Stakeholders

5a) In your view, who is eligible to use the indicators approach? Who is expected to use the pass-through approach in GE calculations instead of the price indicators approach? Why or why not?

b) Provide a working definition of the point of first entry of gas into the transmission/distribution system.

Monitoring Procedure for Approved Maximum Prices

4.35. Section 2.3.1 of the Methodology states that NERSA will monitor prices to assess the impact and to verify if the prices comply with the requirements of the Gas Act and the Regulations. However, it does not spell out the information that will be required for monitoring purposes.

4.36. NERSA proposes the submission of invoices, proofs of trading margins and itemised billing on an annual basis as per the dictates of the section 17(c) of the Piped-Gas Regulations.

4.37. In addition, licensees will be asked to motivate for the impact of their approved maximum price on their profitability and other business circumstances as well as its impact on other stakeholders.

Application for Distinguishing Features

4.38. According to section 22(1) of the Gas Act, licensees may not discriminate between customers or classes of customers regarding access, tariffs, prices, conditions or service except for objectively justifiable and identifiable differences regarding such matters as quantity, transmission distance, length of contract, load profile, interruptible supply or other distinguishing feature approved by the Gas Regulator.

4.39. It can be concluded from the above section 22(1) of the Gas Act that, Licensees may determine actual prices on normal commercial consideration, as long as it does not discriminate between customers or classes of customers except for objectively justifiable and identifiable differences.

4.40. Furthermore, licensees may determine a maximum price applicable to all customers from which discounts will be applied. The application of discounts may not discriminate between customers or classes of customers except for objectively justifiable and identifiable differences stated in section 22(1).

4.41. While it is therefore expected that within any given licensed area, the gas energy value (GE) will be the same for all customer classes, there may be reasons why NERSA may choose to permit some differentiation in maximum price between customers or classes of customers.

4.42. Section 22 of the Gas Act, provides examples of price discrimination, which may be allowed by NERSA. However, examples cited in section 22 of the Gas Act all relate to characteristics of supply. Therefore, section 22 of the Gas Act, permits licensees to apply (with NERSA approval) for other distinguishing features which are not listed in section 22 of the Gas Act.

4.43. Below are some of the economic grounds which NERSA may consider as acceptable reasons for price discrimination:

a) to address transitional issues, whereas price changes (price ‘shocks’) are greater for some customer classes than others;
b) where some customer classes take a greater exposure to price volatility in their pricing arrangements;
c) makes only reasonable allowance for differences in cost, or likely cost, of manufacture, distribution, sale, promotion or delivery resulting from the differing places to which, methods by which, or quantities in which, goods or services are supplied to different purchasers; and
d) promote development of competitive markets for gas and gas services.

4.44. Against this background, there is need to include a section in the Methodology that presents an outline of the distinguishing features in terms of section 22 of the Gas Act including those that may be considered for approval by the Regulator.

4.45. NERSA recommends that:

4.45.1. A new section be included in the Methodology to deal with NERSA’s interpretation of section 22 of the Gas Act.

4.45.2. Applicants (licensees) be required to provide the following information as part of the application of the distinguishing features:

a) Impact of the proposed features to customers.
b) Reasons why it may be necessary for licensees to provide proposed price discrimination.
c) Economic justification of the proposed distinguishing feature.

Questions to Stakeholders

6a). Is NERSA’s interpretation of section 22 of the Gas Act appropriate? What other interpretations should be considered?

b) Besides the principles set out in section 22 of the Gas Act, are there any other criteria for evaluating applications for distinguishing features that the Energy Regulator must consider?

c) What other distinguishing features do stakeholders consider as relevant that the Regulator may need to consider and approve and that are not explicitly stated in the Gas Act of 2001? What is the potential impact of such distinguishing features on other stakeholders, particularly customers?

The Effect of Price Shocks Driven by Exchange Rate Movements

4.46. Stakeholders raised a concern that the current methodology may have the implication of increasing the gas price due to the fact that it is linked to the prices of energy indicators that are influenced by movements in the exchange rates. Furthermore, stakeholders raise a concern that the price of electricity, which carries a significant weight in the basket of alternatives, has been experiencing significant increases over the past years, which has the impact of increasing pricing above the notionally competitive level.

4.47. Furthermore, some stakeholders believe that licensees/applicants propose prices at (or about) the maximum price. While this may happen in practice, NERSA considers that not all licensees will opt to price their customers at maximum price, as they will be vying for competitive advantage, or will be seeking to prevent the loss of customers to alternatives.

4.48. The Energy Regulator recognised the above concern expressed by some stakeholders during the implementation of the current maximum price methodology. As such, proposes the inclusion a glide path parameter to protect the interests of consumers and suppliers from significant price shocks. In line with generally accepted regulatory practices in other jurisdictions, it is deemed appropriate to limit price shocks (either upwards or downwards). This is achieved by limiting the change in approved maximum price from one regulatory period to the next to no more than some proportion of the starting value, as follows:

$$GE_{t,EC} = Min\begin{cases} Max\begin{cases} W_1 f_1 CO + W_2 f_2 HF + W_3 f_3 DI + W_4 f_4 EL + W_5 f_5 LPG \\ GE_{t-1,EC}(1-GP) \end{cases} \\ GE_{t-1,EC}(1+GP) \end{cases}$$

where t is the current time period; EC is the end consumer class; t-1 is the previous time period and GP is the glide path factor lying between 0 and 1. The respective weights of the 5 alternative fuels are depicted through W_i and f_i are the respective price adjustment factors of fuels in the basket. The price adjustment factor may adjust the price either up or down.

4.49. In effect, adjustments to the gas energy price resulting from periodic assessments of the weighted average price of fuel alternatives are limited to the previous period's price plus/minus a glide path margin determined by NERSA.

Questions to Stakeholders

7a) What are your views regarding the inclusion of the parameter to protect the interests of consumers and suppliers from significant price shocks?

b) What other alternative mechanisms can be considered to remove price shocks that may arise due to fluctuations of prices?

5. TYPOLOGIES OF GAS PRICE FORMATION MECHANISM

5.1. The spectrum of natural gas price formation mechanisms embraces at least ***nine*** distinct mechanisms namely:

a) Oil Price Escalation (OPE)
b) Gas-on-Gas Competition (GOG)
c) Bilateral Monopoly (BIM)
d) Netback for Final Product (NET)
e) Regulation: Cost of Service (RCS)
f) Regulation: Social and Political (RSP)
g) Regulation: Below Cost (RBC)
h) No Price (NP)
i) Not Known (NK)

5.2. In the OPE regime, the price is linked through a base price and an escalation clause, to competing fuels, typically crude oil, gas oil and/or fuel oil, coal and electricity prices.

5.3. The GOG regime is based on the interaction of forces of supply and demand forces in the respective gas markets. The GOG characterises trading at hubs such as the Henry hub in the United States and the National Balancing Point (NBP) of the United Kingdom and other hubs particularly in North West Europe. Under this pricing regime, gas is bought through short-term and long-term fixed contracts supported by gas price indices rather than competing fuel indices to determine monthly prices. The GOG regime embraces spot LNG and any pricing linked to hub or spot prices. Typically, bilateral agreements in markets dominated by numerous buyers and sellers reflect a GOG regime.

5.4. The BIM is a price determined through bilateral discussions and agreements between a large seller and a large buyer. The agreements lead to a fixed gas price that usually has a lifespan of up to a year. There may be a written contract in place, but often the arrangement is at Government or state-owned company level. As opposed to the GOG regime, the BIM is between a single dominant buyer or seller, at least, as one party to the transaction (IGU, 2015:7)[1].

5.5. Under the NET, the gas price paid to the supplier is a function of the price paid on the final product on which gas would have been used as an input. This methodology establishes the gas price as the maximum price that the consumers are willing to pay, taking into account prices of substitute fuels. Hence, considering the disposition of the final consumer to pay for gas, the retail price is fixed. From it, by removing the distribution, transportation, storage costs and taxes, as well as the profit margin of the companies involved, the wholesale gas price is obtained. This is mostly relevant in circumstances where gas is a major variable cost in producing the product, for instance, in production processes where gas is used as a feedstock in chemical plants producing ammonia or ethanol.

5.6. The regulation-based pricing regimes are either, RCS; RSP or RBC as defined in paragraph 5.5 above. The RCS is a pricing regime approved by a regulatory authority or a responsible authority such as a government agent, such that it is set to recoup the cost of service and recovery of invested funds inclusive of a reasonable return.

5.7. The RSP regime sets the natural gas price based on social or political factors on an irregular basis as deemed necessary by a responsible authority with the objective of ensuring that escalating costs are recovered or possibly as a revenue boosting strategy. Under the RSP regime, the price is set on an irregular basis, on a socio-political basis in response to the need to cover increasing costs or possibly as a revenue increasing exercise. As such, the RSP is a hybrid between the RCS and RBC.

5.8. The RBC is therefore a price setting approach with an intention to put it below the average cost of producing and transporting the gas as a way by a government to subsidise the trading of gas in the economy.

[1] IGU(2015). News, Views and Knowledge on gas – worldwide: A global review of price formation mechanisms, 2005 – 2014. Wholesale Gas Price Survey – 2015 Edition.

5.9. The NP and NK regimes are meant to provide gas as a ‘free good’ to the populace and industry, strategically to boost output in targeted sectors of the economy. Usually, such gas is a by-product of other production value chains such as oil refinery or coal extraction activities.

5.10. Thus, gas pricing regimes that are functional in international gas markets are a resemblance of the above conceptualised price formation mechanisms or hybrid combinations depending on circumstances in such markets, the extent to which markets are liberalised and government policies.

6. A SURVEY OF GAS PRICING FORMATIONS IN REGIONAL MARKETS

6.1. According to IGU (2017), Africa’s consumption of natural gas constitutes 4% of overall world consumption. From that consumption trend, 48% is RBC priced (as is the case in Egypt, Algeria and Libya). Notably, 2% of price formations is via RSP (as is the case in Equatorial Guinea, Gabon, Morocco and Tanzania). 24% of prices in Africa are via RCS price formation principles (as is the case with pipeline imports from Nigeria to Ghana, Benin and Togo; piped-gas from Mozambique to South Africa). Oil price escalation accounts for 7% of pricing in Africa while 12% of observed prices are determined through GOG. BIM and NET contribute to 4% and 3% of total price formation in Africa respectively.

6.2. In the former Soviet Union, consumption of natural gas accounted for 17% of total world consumption. RCS price formation is dominating at 38% and mainly practised in Russia and Azerbaijan, while RBC accounts for 17% of price formation (and applied in Kazakhstan, Turkmenistan, and Uzbekistan). Russia and Ukraine are using RSP pricing formations constituting 11% of price formation in that region. Approximately 25% of price formation in Russia is GOG to eligible large customer market. Piped-gas imported to Belarus, Moldova, Kyrgyzstan, Kazakhstan, Georgia, Armenia and Tajikistan from Russia is priced via OPE.

6.3. In Latin America, the IGU 2016 Survey results revealed that countries like Brazil, Argentina and Venezuela utilise the OPE pricing mechanism including a proportion of LNG imports into Chile and Argentina. The GOG accounts for 19% of price formation in that region and visible in countries like Colombia, Peru and the Dominican Republic. Some countries like Trinidad and Brazil are using BIM mechanisms (accounting for 4% of total price formation in that region), particularly for piped-gas imports from Bolivia (IGU, 2017:48). Overall RSP, RBC and RCS are contributing 21%, 16% and 5% to price formation in that region.

6.4. Over the period 2005 to 2016, the Asian-Pacific market has not been very dynamic. The OPE is predominantly utilised in Japan, Korea, Taiwan, Singapore, Thailand and Malaysia (and partially in Australia and the Philippines), constituting 64% of price formation in that region. GOD price formation is more prevalent in Japan, Australia and New Zealand. In Indonesia, the BIM is adopted while RSP constitutes pricing 16% and used in Brunei.

6.5. The Asian market where China and India are the dominant players has been dynamic, showing a paradigm shift from regulated pricing regimes to more of OPE. At present, 69% of total price formation in the Asian market is driven by OPE. Pipeline gas imports from Turkmenistan to China are priced through oil indexation. The Chinese Regulator changed from RSP to RCS and the price of natural gas rose to economic levels (IGU, 2017:45). Some pricing reforms took place in India, enhancing more prices to be established through GOG, linking domestic prices of natural gas to a basket of market hub prices. GOG already includes spot LNG in India, China and Pakistan, but these declined in 2016, reducing the GOG percentage to 12%.

6.6. In Europe, markets are characterised by the duality between oil-linked gas prices and spot prices in continental hubs driven by the NBP spot price. Notably, imported price is priced under OPE, the transition to a gas-on-gas competition price is taking place gradually. Current statistics reflect that 66%

of gas prices are driven by GOG while OPE price formations account for at least 30%. Regulated pricing regimes are very scarce with a contribution of about 4% of the entire gas price formation process in Europe. OPE is still pronounced on piped-gas imported into Europe in almost every European country except in the UK, Netherlands, Denmark, Croatia, Sweden, Austria and Ireland. Some LNG imports into Spain, France, Portugal, Greece, Turkey and Italy are also priced via OPE. RCS price formation is scarce and still visible in countries like Romania, Poland, Hungary and Croatia.

6.7. World over, GOG is the more prominent price formation mechanism with the largest share at 44%, dominating in North America, Europe and the former Soviet Union. It is adopted in 52 countries, in one form or the other, and in all regions. OPE has a share of 20% in price formations in the world and used in about 61 countries, in all regions and almost in every European country. The regulated categories constitute 31% of total price formation, RCS in 18 countries (mainly Russia, China, Egypt, Algeria) while 23 countries are using RSP (such as Iran, Saudi Arabia, United Arab Emirates, Oman, Indonesia, Malaysia and Argentina). RBC is adopted in 14 countries, mainly in the former Soviet Union (Turkmenistan, Uzbekistan, Kazakhstan) and in Venezuela, among others (IGU, 2017).

6.8. With respect to price formation mechanisms for pipeline imports into the European Market, 68% was priced through GOG in 2016, while OPE accounted for 32%. LNG imports are mainly priced via OPE with a contribution just above 75% while approximately 23% of LNG imports are priced through GOG. A survey conducted by IGU in 2016 reveals that there has been a paradigm shift, as price formation in 2005 was driven by OPE at 91% with only 7% GOG and in 2016, GOG is taking the lead at 44%.

7. BENCHMARKING OF THE GAS PRICING METHODOLOGY

7.1. In this section, the gas pricing formula and its methodological orientation in South Africa is discussed and compared against formulae/methodologies that have been cited so far from various jurisdictions. This has been done to share current and historical formulae adopted in other countries in their circumstances. Hence, such an exposition is meant to provoke debate among stakeholders towards the development of an agreeable gas pricing formula for South Africa.

The 'Basket of Alternatives' Approach (Indicators approach)

7.2. In the Methodology, the formula for calculating the maximum price of gas at the point of its first entry into the transmission or distribution system is reference to the price indicators of alternative energy sources.

$$\mathbf{GE} = w_1\mathbf{CL} + w_2\mathbf{DE} + w_3\mathbf{EL} + w_4\mathbf{HFO} + w_5\mathbf{LPG}$$

7.3. In the above formula, CL, DE, EL, HFO and LPG are the indicators of equivalent prices of coal, diesel, electricity, heavy fuel oil and LPG respectively. Parameters w_1 to w_5 are the respective weights of each indicator in the basket of alternatives, summing to 100%. The GE is the maximum price of gas energy (ZAR/GJ) at the point of its first entry into the piped-gas transmission or distribution system, before trade margins, distribution tariffs, transmission tariffs, storage tariffs and levies.

7.4. Stakeholders who have supported the basket of alternative markets, have argued that using prices of alternative fuels to determine the maximum price of gas in South Africa is a reasonable yardstick. Roberts & Hawthorne (2014) refer to this as 'Yard competition' as it benchmarks the gas price against prices of products in a comparable industry.

7.5. The weights for the South African basket of energy of alternatives is as shown in Table 1 below.

Table 1: The Weights of Energy Sources as at 2008

The Energy Basket for South Africa and their weights in the GE formula	
Energy source	Weight (%)
Coal	37
Diesel	24
HFO	1
LPG	1
Electricity	37
Total	100%

7.6. As reported by Miyamoto & Ishiguro (2016)[2], the weighting factors for India and China in 2015 were as presented in Table 2 below.

Table 2: Competing Energy Sources in India and China with their respective weights in the NMV pricing formulae

Competing energies	**India**	**China**
Coal	0.576	0.580
Oil	0.366	0.282
Electric power	0.058	0.138

Source: Miyamoto & Ishiguro (2016)

[2] Miyamoto, A & Ishiguro, C (2016). A New Paradigm for Natural Gas Pricing in Asia : A Perspective on Market Value, Oxford Institute for Energy Studies

7.7. Notably, the energy alternatives used in South Africa, India and China are different, although the treatment of Coal and Electricity as substitutes of natural gas is similar. The energy consumption compositions of these three countries is fundamentally different, hence the weight differentials in the natural gas formulae. Further debate on the interrogation of weights in the basket of alternatives formula may be necessary, taking into consideration that electricity prices in South Africa are inefficient and that there is a possibility of duplicating coal and diesel in the production of electricity.

7.8. There are several methodologies used by regulators to mitigate the abuse of market power and allocative inefficiency. Approaches adopted include the Netback Market Value (NMV) approach, the cost-plus approach, the benchmarking approach and the price-cap regulation approach. As a result, there are notable advantages and disadvantages of each approach that have to be discussed through active engagements by all market participants of the gas industry of South Africa and other interested stakeholders.

The Netback Market Value Approach

7.9. The NMV approach entails the indexation of gas prices to prices of alternative fuels in a specific market. Miyamoto & Ishiguro (2009) posits that the NMV of natural gas in a country can be expressed as:

$NMV = \sum (WF_i P_i) - C$; such that $WF = NGS(CES)$

Where NMV is the market value of natural gas in a country; WF_i is a weighting factor for a particular competing fuel based on consumption of natural gas by sector and competing fuel's share; P is the retail price of the competing fuel in question in their respective consumption segment; and C is the domestic cost of supply of natural gas (including terminal to transportation and distribution cost, etc). The component WF_i is a product of the segment's share in the total natural gas consumption (NGS) and the market shares of competing energies in a consumption segment (CES).

7.10. In the NGS component, the main segments are power generation use in the energy conversion sector and industrial use, commercial use, residential use, and feedstock use in the final consumption sector. However, the segments were created according to the actual state of consumption of natural gas in each economy. As such, the total shares of all segments must sum to 100% with possibilities of treating low markets shares as a single aggregate in circumstances where identified segments are numerous.

7.11. The CES component caters for the market shares of competing energies in a consumption segment. It is computed by identifying the competitors to natural gas and using the ratio of this competing energy to the total supply (excluding natural gas) of competing energies. Alternative energy sources that do not compete with natural gas are excluded.

7.12. In Asia, the netback market value of natural gas is then presented as the summation of NMVs of all economies multiplied by the market share of each country in the total natural gas consumption of all economies in the region. It is calculated as:

$$NMV(All) = \sum NMV_i(S_i)$$

In the equation above, S_i is the market share of a country in the total gas consumption of countries considered in the region.

7.13. Energy sources in the Asian market that are competitors of natural gas include coal, oil and electricity. Countries that have adopted this methodology include China, Korea, Taiwan, India and China. In these five countries, coal has the highest share of energy consumption at 50% on average. The share of coal in Taiwan is 78%, 60% in Japan, 45% in Korea and 43% in Korea. In 2016, coal was the main competitor of natural gas in the Asian market. Oil-based energies are the second competitor contributing approximately 40% to the energy basket in the region and then electricity has a contribution of about 10%. Energy usage patterns among the countries are heterogeneous.

The Oil-Indexed Pricing Approach

7.14. Jensen (2012)[3] presents the natural gas pricing formula for oil-indexed pricing regimes in some European countries as:

$$Pn = P_o + MS_{LFO}(PTF_{LFO})(CF_{LFO})[Pn_{LFO} - Po_{LFO}] + MS_{HFO}(PTF_{HFO})(CF_{HFO})[Pn_{HFO} - Po_{HFO}]$$

Where Pn is the current calculated gas price and Po is the base price in $/MMBtu and the respective base prices of product prices of light fuel and heavy fuel oils in $/Tonne. LFO is the light fuel oil while HFO is the heavy fuel oil. Components CF and PTF are appropriate conversion factors of the fuels and the pass-through factors of the two oils as alternative fuel sources. The component MS represents the respective oil market shares of light fuel oil and heavy fuel oil. In square brackets are the price differentials (difference between current and base prices) of light fuel oil and heavy fuel oil. In 2008 Pn was at $13.56/MMBtu before dropping to $6.60/MMBtu in 2009 due to weakening crude oil and gas prices. In April 2012, the European gas price increased to $11.87/MMBtu due to increases in the crude oil price against declining Henry Hub prices.

7.15. According to Demakova (2013), there is no universal price formula for gas in Europe. Numerous gas markets whose pricing mechanisms are based either on gas-on-gas competition or subject to regulation by state authorities have distinct price formulae. Specific equations used to determine the price of gas in each individual gas contract are classified. In general, the gas price is linked to the prices of energy alternatives, usually referred to as a ‘basket of oil products’, i.e. gas oil and fuel oil with different weights, reflecting the peculiarities of the national structure of energy consumption. Other energy sources such as oil, coal, electricity may also be taken into account. As a result, prices may experience significant fluctuations influenced by factors beyond control of any stakeholder, e.g. forecasted demand and supply of

[3] Jensen, J.T(2012). International Natural Gas Pricing – A Challenge To Economic Modelling, A Presentation to the Energy Information Administration, Washington, August 23, 2012.

liquid fuels, activities of speculators (‘raw’ bubble), global macroeconomic conditions, prices of alternative energy sources and technological innovations.

7.16. One of the North East Asian gas pricing formula is linked to the Japanese Customs Cleared price (Japanese Crude Cocktail) in the form:

$$P = C + S(JCC)$$

7.17. Where P is the calculated price in \$/MMBtu; C is a constant expressed in \$/MMBtu and S is the ‘slope’, a dimensionless number applied to JCC in \$/bbl. The inclusion of a constant in the formula ensures that gas prices do not rise proportionally with oil prices as is the case with oil-indexed price regimes in European markets.

7.18. In China, the new pricing regime envisages that the price of natural gas be priced through the value of alternative sources of energy that are close substitutes, i.e. fuel oil used by the industrial sector and LPG used by households for domestic energy consumption. The new formula represents a weighted composite of the imported fuel oil price and the imported LPG price. As presented by Zhang (2016)[4], the new natural gas price from which the ex-plant and retail prices are derived is determined through the formula:

$$\text{Price } (P) = K \times [W_{FO} \times P_{FO} \times (H_{NG}/H_{FO}) + W \times P \times (H_{NG}/H_{LPG})] \times (1+R)$$

The gas price (P) is the city gate price for the incremental volume in Shanghai; K is a constant discount rate to promote gas use and is currently set at 85%. Components, W_{FO} and W_{LPG} are the respective weights for fuel oil and LPG depicting their proportionate contributions to the Chinese energy basket. The P_{FO} and P_{LPG} are the average imported fuel oil and LPG prices respectively. Then H_{NG}, H_{FO} and H_{LPG} are the respective heating values of natural gas, fuel oil and LPG while R is a value-added tax for natural gas.

[4] Zhang, D (2016). The Future of Natural Gas in China: Effects of Pricing Reform and Climate Policy, Massachusetts Institute of Technology

7.19. In India, the KG-D6 Gas pricing formula was established linking the price to the crude oil price as:

Price = 2.5+(**HFSO Price** – 25) x 0.15

The HFSO is the cheapest heavy fuel oil from Singapore and the base gas price is linked to crude oil price. The gas price established through the formulae above is capped at approximately $US4/GJ.

7.20. Another formula applicable to the Free Gas from Raava in India, is priced through a limited competitive tender and the gas price is reviewed quarterly as:

$\textbf{Price}_{(Qtr)} = \textbf{Base Price} \times (\textbf{HFSO Price}_{(last\ 12mnths)} / \textbf{HFSO}\ \text{Price}_{(1998\text{-}2000)})$

7.21. In the above formula, the base price is pegged at $US2.74/MMBtu. The $\text{HFSO}_{(last\ 12mnths)}$ is the average HFSO price for the 12 months preceding the quarter; and $\text{HFSO}_{(1998\text{-}2000)}$ is the average HFSO price from 1998 to 2000 observed as $US86.44/tonne. The price established through the above formula is floating between a minimum of $US2.30/MMBtu and a ceiling of $US3.30/MMBtu through an agreement between stakeholders, namely the Free Gas pricing agreement in India.

7.22. At this stage, NERSA proposes an open engagement with stakeholders as to whether the current basket of alternatives formula is leading to an efficient price.

The Cost Pass-Through Approach

7.23. Theoretically, a gas supplier’s objective is to recover all of its gas procurement costs (consisting of gas purchasing, storage and transportation expenses) due to high risks involved in distribution projects. On the other hand, if there are no incentives to acquire gas efficiently, distributors will not seek to purchase gas cheaply unless they face competition from marketers or from other fuels.

7.24. Milgrom & Roberts (1992)[5] present a simple model where the optimal level of cost pass-through is calculated. The model seeks to calculate an optimal price rule of the form:

$$P(c) = (\overline{P}) + (1-\rho)c$$

7.25. In the above formula, ρ lies between 0 and 1 such that it is considered a parameter that determines the level of cost pass-through. The formula shows that when the regulator minimises the expected payment to the firm subject to the firm obtaining at least some reservation utility level φ_0, the optimal level of cost pass through is given by

$$\rho^* = \frac{1}{1+\gamma\sigma^2}$$

7.26. As such, the parameter γ measures the degree of risk aversion, and σ^2 reflects the amount of cost uncertainty. Therefore the more risk averse the firm is and the more cost uncertainty there is in a project, the more the price should permit pass-through of costs. In extreme scenarios when γ or σ^2 are zero (a reflection of risk neutrality or that there is no cost uncertainty, the component ρ is equal to 1, implying that a pure price cap rule is optimal.

7.27. As presented by Rosellon (1998)[6], the cost pass-through approach has been adopted by gas regulatory authorities in Mexico in the 1990s. This approach was driven by the need to protect captive customers from the market power of a distributor who was selling gas in a niche market without any competition from prospective distributors. Such an approach was also meant to strike a balance between the risks and incentives given to such a distributor.

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[5] Milgrom, P & Roberts, J (1992). Economics, Organisation and Management, Englewood Cliffs, NJ: Prentice Hall.
[6] Rosellon, J (1998). Price and Rate Regulations for the Mexican Natural Gas Industry, *Economica Mexicana, Nueva Epoca*, Vol.VII(2):267-308.

7.28. The Mexican regulatory authority decided to adopt a gas pricing formula that blended the yardstick to pass-through approach and the simple pass-through mechanism, given the formula below:

$$PA_t = \frac{G_t + T_t + A_t}{V_t}$$

7.29. In the formula above, the gas price (acquisition price cap), PA_t, is calculated by adding up all costs identified for pass-through including transportation and storage costs. Hence, G_t, T_t and A_t are the maximum upstream cost that can be passed through, total transportation cost and total storage cost of gas. The summed costs are the divided by total volume, V_t, to establish the gas molecule price.

7.30. This acquisition price cap was constructed using the domestic gas price and the rate of regulations. This was facilitated by the fact that bulk of gas consumed in Mexico is obtained from domestic sources and the price of such gas is capped through evaluation of upstream costs.

Question to stakeholders

8. What are your views regarding the shift from the price indicators approach to a gas-pricing regime based on oil price escalation, cost-pass through or other approaches? Present your arguments with hypothetical illustrations where possible.

7.31. There are competing schools of thought on economic principles, conceptual and theoretical underpinnings that constitute the guiding philosophy within which gas pricing methodologies are developed internationally. As a result, competing arguments have been put forward before the Energy Regulator in support of and against the gas pricing methodology in South Africa.

7.32. The role of incentive regulation is to limit market power and fairly allocate monopolistic rents between monopolistic firms and consumers. The reasons for regulating the price of the product of a monopoly are confirmed in theory and practice that non-regulated monopolies may not have incentives for cost reduction nor for product innovation. Economists have argued that, if a monopoly is left unregulated, it may then set a mark-up between prices and marginal cost with no relation to consumer welfare, thereby creating inefficient resource allocation. The state-of-the-art rationale for regulating a firm with market power is provided by the theory enshrined in economics of regulation. Against this dictum, it should be kept in mind by all players in the South African gas market that while Sasol is a visible monopoly, even small-scale CNG traders are also local monopolies in their respective niche markets. Hence, the regulation of gas prices needs to be a phenomena acceptable by all players as the gas market in South Africa is still far from being competitive due to natural barriers to entry and gas supply constraints, among other factors.

7.33. The behaviour of an unregulated natural, artificial or local monopoly has undesirable consequences on productivity of the entire South African economy. Lack of efficiency in the production and distribution of natural gas has a spiral effect on the macro economy, regional and local economies of South Africa through; (i) immediate effects on industries directly linked to the energy value chain, (ii) increased costs of energy inputs demanded by other firms in different sectors of the economy, and (iii) aggravation of factors that are delaying benefits inclined to deregulation of other sectors. For example, a monopolist may ration supply of gas to the market, causing a nationwide gas distribution and usage patterns that are not close to patterns that would be consistent with productive, technical and allocative efficiency. Therefore, regulatory policy in general seeks to combine; (i) introduction of regulation to prevent a (natural, legal or local) monopolist from arbitrarily manipulating prices and, (ii) the elimination of artificial entry barriers and creation of public information in potentially uncompetitive markets.

7.34. Regulatory methods adopted widely are the pricing based on costs at the wellhead (the pass-through mechanism), comparisons with other fuels’ prices on a netback basis, pricing based on a benchmark such as the price of imported gas at the border.

7.35. International experience has taught that some jurisdictions are pricing natural gas (Wellhead prices) through gas-to-gas competition (the market approach) such as the United States and several other European countries. Negotiations between buyers and sellers determine gas prices in most continental Europe (for instance France and Germany). Contracts are usually with national gas companies such as Statoil (Norway), Sonatrach (Algeria) and Gazprom (Russia).

7.36. In OECD countries, there are two main principles for natural gas pricing. In Germany, the Netherlands, Switzerland, Spain, Sweden and Denmark, gas prices are set according to prices of substitutes or using the cost-based approach reflective of its economic value at the port of entry. In countries like Belgium, France, United Kingdom and Italy a combination of the two principles is utilised. In Japan and the United States, the price of imported gas is established through adding the price at the border to the costs of transportation, distribution and storage. There are two criticisms that have been levelled against such practices. First, benchmarking the gas price against prices substitutes implies that distortions of non-competitive markets to the natural gas markets of those respective countries are transmitted thereby rendering the established price inefficient. Second, the linkage between markets of substitutes and the natural gas market is ignored, thereby disregarding effects driven by either positive or negative externalities.

7.37. In some jurisdictions, such as Mexico, the cost of service approach has been adopted to cascade an incentive-based regulation dispensation. The cost of service regulation implies setting prices equal to average cost so that price setting is the result of equating total revenues to total cost. This mimics break-even pricing, but with indications that economic profits are earned. Theoretically, this kind of price regulation goes along with a restriction on the rate of return on capital to restrain monopoly power. Under this regime, prices remain fixed until some agent (i.e. the regulator, consumers or the firm) formally requests for a modification of the approved maximum price through a public hearing. Criticisms levelled against the cost of service approach are that there is potential for cross subsidization if the firm produces a range of other non-regulated products. Second, rate of return calculations are inherently less than objective, given the vagueness of in determining what is a fair return necessary to attract capital to a business venture and a range of parameters applied. Third, under the cost of service, incentives for cost minimisation are almost non-existent since the complete restitution of costs does not promote monetary expenditures for the improvement of efficiency. Fourth, the cost of service approach has been criticised for lacking a solid theoretical orientation. However, the cost of service approach has notable merits despite its debatable drawbacks, such as its ability to provide certainty and long running commitment to the governing authority, among other advantages.

7.38. In Mexico and other countries, a hybrid of cost of service and price cap regulation has been adopted to enhance a pricing regime that promotes efficiency by providing incentive schemes for cost minimisation. Examples of incentive schemes are benchmarking against prices in other markets, yardstick competition and price caps. A hybrid of price cap regulation and the cost of service approach are applicable in fixed periods (usually four to five years), which incorporates adjustments for inflation and efficiency. Pros and cons are that elements of price cap regulation have been that: (i) low price caps elicit a disincentive for gas producers and procurers as it adversely compromise their profitability, and (ii) high price caps permit monopolists to enjoy abnormal profits at the expense of consumers' welfare.

7.39. The hybrid methodology (price cap regulation and cost of service) implies that the gas molecule price remain fixed and is then adjusted accordingly in line with inflation trends, efficiency and correction factors. This methodology encapsulates merits of both approaches to yield strong advantages that (i) it limits the risks and permits gas traders to earn an appropriate private return,

(ii) it provides incentives for efficient development and operation of gas businesses, (iii) it protects customers from abuses of market power while recognising the firm's need to obtain adequate profits, and (iv) ultimately the blend between cost of service and incentive regulation leads to more efficient gas prices that do not deviate significantly from those of mature markets, such as those of the North American region.

Questions to Stakeholders

9a) Are there any international benchmarks that NERSA ought to consider in the determination of maximum prices of piped-gas in South Africa?

b) Are there any international regulatory pricing examples or experiences that stakeholders would like NERSA to consider?

c) Do you believe that the Methodology has led to efficient gas prices in South Africa? Why or Why not?

d) Is the Methodology appropriate? Why or Why not?

8. CONCLUSION

8.1. Stakeholders are requested to provide comments on this discussion document. Written comments are to be submitted to the Energy Regulator on the following email address: gpt@nersa.org.za or to NERSA offices at Kulawula House, 526 Madiba Street, Acardia, Pretoria by **Friday, 27 October 2017.**