

Natural Gas Pricing and Price Review Challenges: Preparing for a More Competitive Global Market

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ABSTRACT

Natural gas infrastructure is growing and global LNG volumes are set to expand substantially. This results in more trade between different regions of the world and emergence of a more competitive and relatively more integrated global gas market. In addition, several key markets are currently undergoing structural reform with the aim of opening them to competition. In line with these changes in the global market, gas pricing methods also need to be adapted. This paper discusses the challenges of natural gas pricing and price review in this new market environment. Firstly, the current structure of the global and regional gas markets is analyzed. Secondly, challenges in natural gas pricing and price review are discussed, and in this context oil-indexation and hub-indexation are analyzed in detail. Thirdly, the recommended framework for pricing and price review in the more competitive global market are presented. The pricing mechanism and price review framework should be tailored to the characteristics of the gas market and the stages of growth and maturity of the market.

1. Introduction

While the need for sustainable energy supply is becoming more pressing, air pollution and global climate change issues associated with fossil fuels are also becoming increasingly serious. Although renewable energy will play an important role in this regard, however, renewable energies alone may not be sufficient to solve these problems (Dickel, 2018; Trainer, 2010).

In this context, natural gas, as a type of clean energy, is going to have a major role in the global energy system (BP plc, 2019, p. 79) and world natural gas consumption is continuing to expand, both in absolute numbers and as a proportion of the total energy supply mix (BP plc, 2019, p. 78). Natural gas has several characteristics that

have made it a very promising and highly attractive fuel. Firstly, it has relatively low cost and is currently more economical than many other alternatives (Kan et al., 2020), while there is sufficient global proven reserve to meet projected demand for the year 2040 and well beyond (Esen & Oral, 2016). Secondly, it is an efficient clean-burning fuel and has low pollutant content. Numerous urban air quality studies have provided scientific evidence to support the effectiveness of substituting natural gas for other fossil fuels, particularly coal (Mao et al., 2005; Ren et al., 2017; Shen, 2015; Yurtseven et al., 2018). Thirdly, it has the lowest CO₂ intensity among all fossil fuels (Dong et al., 2018) and many policy analysts see an important role for it in the transition to a low-carbon future (Brown et al., 2009; Mac Kinnon et al., 2018; Moniz et al., 2011). Fourthly,

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Natural gas is complementary to renewable energies owing to its flexibility and gas-fired electricity generation can be useful for maintaining the momentary balance between electricity supply and demand (Vandewalle, 2014), which is a serious challenge in the countries with a high share of electricity from fluctuating renewable sources (Ebrahimi, 2020, p. 1).

As natural gas is going to have a major role in the global energy system, the global natural gas market is undergoing major changes. Natural gas infrastructure is growing and global LNG volumes are set to expand substantially. This results in more trade between different regions of the world and emergence of a more competitive and relatively more integrated global gas market. In addition, several key markets are currently undergoing structural reform with the aim of opening them to competition.

In line with these changes in the global market, gas pricing methods also need to be adapted and several studies have been conducted in this context. Stern (2014) analyzed international gas pricing in Europe and Asia and addressed the fact that although the fundamentals of the gas market had changed, pricing methods had not changed accordingly. This created problems for the parties of the long-term contracts most of them were indexed to oil prices and could not reflect the new gas market situation. Zhang et al. (2018a) discussed whether hub-indexation is preferable to oil indexation and concluded that although oil indexation is simple and effective, but hub pricing can better reflect fundamentals of the market and is a better choice for both policy makers and practitioners. Hulshof et al. (2016) analyzed the Dutch gas hub and concluded that natural gas prices at hubs can be observed as prices resulting from gas-to-gas competition. Holland et al. (2012) considered the necessity of price review provisions in the long-term gas contracts and whether this necessity will continue in the future market environment. Ason (2019) studied the Asian LNG market and argued that, due to the market reform, price reviews in this region is likely to increase in the coming years and presented some recommendations in this regard. Anway and von Mehren (2019) provided an overview of the history of natural gas pricing disputes, as the world's highest-value commercial disputes, resulted from the gas market evolution. They concluded that, as changes in the gas market continue and the market environment becomes more competitive, disputes over changing pricing mechanisms will continue, and like what happened in Europe, these disputes are likely to arise in some other parts of the world, especially in Asia. Zhang et al.

(2018b) investigated the causes of higher gas prices in Asia than elsewhere and concluded that this is more likely due to common oil-indexation pricing mechanism and recommended that this price gap can be eliminated by developing gas hubs and transition from oil-indexation to hub-indexation.

Although effective efforts have been made in this regard, there are still questions that need to be answered. For each specific market structure, which gas pricing method is more effective? Where to use the hub-indexation method? What are the specifications of an ideal gas hub that can be a pricing reference? If the oil-indexation is chosen, what approach should be taken to avoid a significant difference between the contract price and market realities? In the more competitive market conditions, what should be the characteristics of the price review condition? What should be the conditions for activating this price review? Is there a need for price review for hub-indexation? The present paper attempts to answer these questions.

2. Global Natural Gas Market Environment

The global natural gas market is undergoing major changes and a more competitive and relatively more integrated global gas market is forming. This chapter discusses the characteristics of the global gas market and challenges in natural gas pricing and price review.

2.1. Natural Gas Transportation

Natural gas is currently transported to markets and destinations mainly via two long-established technologies. About two thirds of gas traded internationally is transported by pipeline and the remaining one thirds is traded as liquefied natural gas (LNG). Over the last decades, LNG trade volume has grown faster than pipeline and in recent years the rates have converged slightly and both technologies now compete head-to-head. However, pipeline transportation still dominates the market, accounting for about two thirds of total trade and 54% of Inter-regional trade (BP, 2019, p. 38).

The cost structures of LNG and pipeline transportation are different. Typically, the cost of pipeline transportation increases linearly with distance, while the cost of LNG is high for short distances and relatively low for long distances. Generally, gas pipeline is the preferred option for short distances and LNG is the optimal choice for long distances, particularly those crossing oceans. There is a break-even point below which pipeline transportation is the preferred option and



after which LNG is the choice. The exact break-even point varies from project to project and depends on the volume of gas to be transported and various technical, geographical, legal and other factors. Different authors have reported different values for this break-even point, most of them between 3000 and 5000 kilometers (El Hachemi Mazighi, 2003, p. 7; Mokhatab et al., 2014, p. 2; Ulvestad & Overland, 2012, p. 3).

2.2. Natural Gas Consumption and Production

In recent years, before coronavirus crisis, natural gas has grown at one of its fastest rates for over three decades, accounting for over 40% of the growth in primary energy. In 2018, natural gas consumption of the world rose by 5.3%, the fastest rates of growth since 1984, and reached 3309 Million tones oil equivalent (BP, 2019, p. 35). The share of natural gas in the energy mix increased to 24%, and therefore the gap between natural gas and coal narrowed to 3% (BP, 2019, p. 11). In addition, the inter-regional natural gas trade has experienced considerable growth too, driven mainly by continuing the expansion in LNG. This growth has led to development of new markets and emergence of numerous new trading routes. This has changed the shape of the natural gas markets.

The growth of natural gas is expected to continue and this source of energy is going to have a major role in the global energy system, supported by growing demand and the wide availability of natural gas. Growth in natural gas demand is driven by industry and the power sector and it is anticipated that by 2040, nearly all of the net growth in industrial demand will be covered by natural gas and electricity (BP plc, 2019, p. 31). Coal to gas switching plays an important role in this growth.

2.3. Global Market Structure

Currently, due to the limitations in the transportation, natural gas does not have a global market and natural gas markets around the world have not been integrated into a single market. The development of such a global natural gas market is limited by geography and efficient trade between different regions is impossible. This has divided the global gas trade into three main regional markets: The North American market, the European market and the Asian market. Each of these has its own characteristics and price formation mechanisms.

Geography and infrastructure greatly influence the structure of each regional natural gas market. Consider a pipeline which connects a single producer to a single buyer. In this case, price is determined by negotiations between the two parties. The seller requires a price that

covers the capital and operating costs, compensates the risks and makes as much as possible profit. The buyer wants a price that maximizes the profit which is the difference between total revenue and total costs, including capital and operating costs, costs of risks and cost of natural gas. The bargaining power of the parties is affected by the ability to substitute natural gas with alternative fuels, the price of alternative fuels, the structure of the downstream market, and many other factors. Now consider another case, where there are various sources of supply and demand and many gas sellers and buyers participate in the market. In this case, there is a pure gas to gas competition and the price is influenced by supply and demand. In practice, most of the natural gas markets are somewhere intermediate between these two extreme cases.

In North America, having developed interconnected infrastructure, there is a gas to gas competition so that prices are generally reflects the supply and demand dynamics (Ishwaran et al., 2017, p. 362) and are affected by economic factors (Ji et al., 2014). North America's gas market is characterized by well-developed pipeline networks and gas storage systems, large numbers of buyers and sellers competing in a liberal market environment, easily accessible Infrastructure and sufficient liquidity. This can be useful for the parties to perceive their future financial situation and manage the risks.

In Europe, there are multiple natural gas markets with varying degrees of gas to gas competition. In northwestern Europe, where natural gas infrastructure is acceptably interconnected, there is a high degree of competition and thus the gas-to-gas competition is the dominant price mechanism (Hulshof et al., 2016). Northwestern European natural gas markets are strongly correlated with North American gas markets (Zajdler, 2012) and both affect each other. In other parts of Europe, long-term gas sales contracts play an important role and natural gas prices in these contracts are more or less linked to oil products, because oil and gas are substitutes in many processes. However, this linkage is gradually becoming weaker and market pricing is becoming widespread (Hulshof et al., 2016).

In Asia, national monopolies and state-owned enterprises play key roles in the natural gas markets and gas markets are controlled by a small number of larger buyers and sellers. Natural gas market liquidity is low and gas is often sold under long-term contracts with prices linked to the oil price (Ishwaran et al., 2017, p. 362). However, Asia's natural gas market is undergoing

reform and is gradually moving towards maturity with gas infrastructure continue to expand.

Currently, these regional markets are separated by transport limitations and differing market structures, however, it is expected that this regional market will come closer to each other and will be more integrated in the future. At a global level, natural gas infrastructure is growing and global LNG volumes are set to expand substantially (BP plc, 2019, p. 99). This will result in more trade between different regions of the world and a more competitive and relatively more integrated global gas market.

2.4. Gas Market Evolutions and Emergence of Disputes

Currently, in some parts of the world gas pricing is based on gas on gas competition and the supply and demand equilibrium, but in other regions gas prices are determined based on long-term pricing relationships, such as oil indexation. In the past, however, the share of the oil indexation method was much higher, and in most parts of the world the price of natural gas was a function of the price of oil or other fossil fuels. The most important reason for this type of pricing was that, mainly due to the limitations mentioned in the previous section, it was not possible to determine the gas price based on the market mechanism. In such cases, the price of gas was usually considered as a function of other alternative energy carriers, especially oil. This type of pricing was economically reasonable to some extent, because in many cases oil and gas are interchangeable, and if there is a significant price difference between them, it is possible to use one instead of the other.

From the beginning of the third millennium, the factors that necessitated the connection between the price of gas and oil began to fade. As described in the previous sections, with the growth of gas consumption and the development of LNG, as well as the reforms in world gas markets, competitive regional gas markets were gradually formed and developed, and in many places the possibility of determining gas prices according to Market mechanism was provided. In addition, specific uses for each of oil and gas were formed and developed, and the ability to replace oil and gas with each other was reduced to some extent.

Therefore, the correlation between gas and oil prices gradually decreased and their price began to separate. Another important factor that played a role in this separation was the development of hydraulic fracturing technologies and horizontal drilling, which led to a

significant increase in the production and supply of shale gas and other types of natural gas. Other factors such as rapid changes and fluctuations in oil and coal prices, heavy investments for replacing pollutant fuels with natural gas, the Fukushima nuclear accident in Japan and the decline in nuclear energy demand, contributed to the development of gas markets and reduction of the correlation between gas and oil prices.

In this context, when prices in gas markets were somewhat independent of oil prices, many long-term gas contracts were still tied to oil prices and did not reflect the realities of the gas market. This caused challenges and disputes in the gas market, and gradually the number of requests made by one of the parties to long-term gas contracts for price adjustment increased so that many pricing disputes were referred to arbitral Tribunals.

These disputes can be classified into two groups. The first group is disputes in which the arbitral tribunal maintained the pricing mechanism agreed in the contract and made changes to the base price or its coefficients. This was mainly due to the importance of maintaining the contractual agreement of the parties and, as far as possible, to respect their agreement as a legal principle. In addition, sometimes there is basically no effective alternative that can replace the existing price relationship. For example, there may not yet been a competitive gas market as a reference.

The second group is disputes in which the arbitral tribunal has concluded that the existing pricing mechanism is no longer effective and may not comply with some of the conditions set out in the price review clause, or it may disrupt the contract's economic equilibrium, or it may subject one of the parties to hardship, and therefore it should be replaced by a newly established pricing mechanism. In such cases, the competence of the arbitrator for changing the price mechanism is an interpretation of parties' intent to maintain the contract's economic equilibrium. (Oloumi Yazdi, 2018)

In the history of natural gas pricing disputes, 2008 may be called a turning point. Since 2008, demand for natural gas was declined due to the global financial crisis, while by then there had been heavy investment in increasing gas production and transport capacity. Therefore, there was a rise in supply and a fall in the market demand. These circumstances, along with the liberalization of gas markets in many regions, led to a decrease in gas prices in consumer markets. As a result, many gas buyers who had to buy gas at a price tied to the oil price and sell it in the target market with these new



circumstances, requested a price review, and a wave of price review requests emerged.

2.5. Price Review Cases

Due to the confidentiality of the arbitral proceedings, the content and results of gas price disputes are rarely known, but analysis of the few existing cases can illustrate some important aspects of sources and root causes of these disputes and can be useful in moving toward the more competitive gas market. One of the famous pricing disputes is the dispute between Esso Exploration & Production UK Limited (Esso) v Electricity Supply Board (ESB) under a long-term 15-year gas sales agreement. In this contract, the price review clause made it possible to request a price adjustment if the gas prices fall too far out of line with market prices (Esso Exploration & Prod UK Ltd v Elec Supply Bd, 2004).

In 2002, Esso requested for a price review and based its request on the price of short-term supplies. ESB rejected the request and claimed that the request for a price review is invalid because the method used by Esso in calculating the price of natural gas in the market is basically incorrect and Esso's application must be based on prices actually paid for gas to be supplied under long-term contracts. Esso stated since long-term gas contracts are confidential, there is no clear evidence of prices being paid for long-term gas supplies and it has no choice but to determine the price of gas by other computational methods, including use of the price of short-term gas sales contracts. Finally, the court rejected the price review request, stating that the method used by Esso could not prove that the price difference has exceeded the allowable amount (Baily & Lidgate, 2014, p. 145).

An important root cause of this dispute was that the conditions for activating the price review process were not determined in a transparent and effective manner. This is why Esso could not provide an acceptable method for determining the price of gas in the market.

The most important and well-known gas price review case is the Atlantic LNG case, which was published in 2008 after an arbitral award was challenged in a New York court. This case is one of the most important disputes that the arbitral tribunal has replaced the contract pricing mechanism with a new one, and since then many arbitral tribunals have followed the same procedure.

Atlantic LNG of Trinidad and Tobago and Gas Natural Aproveisionamientos SDG of Spain (GNA) signed a long-term gas contract in 1995, in which GNA

was permitted to transport LNG either to Spain or to New England. The contract also included a price review clause according to which if the economic circumstances, beyond the control of the parties, have substantially changed and the pricing mechanism of the contract does not reflect the value of gas in the end user market, either party can submit a request for price review and in case of disagreement, the case will be referred to arbitration. (Gas Natural Aproveisionamientos, SDG, S.A. v. Atlantic LNG Company of Trinidad and, 2008).

After reduction of the natural gas price in the target market, due to the liberalization of the Spanish gas market, gradual formation of gas on gas competitions and economic factors, GNA decided to sell gas at a higher price in New England. Shortly afterwards, due to this new circumstances, Atlantic LNG requested a gas price review and increase.

In the Final Award, accepting that the requirements for a price review had been met, the tribunal established a new two-part relationship for gas pricing. In the first part, the price of gas sold in the Spanish market will continue to be determined by the same pricing mechanism in the contract with changes in the base price. In the second part, a "New England Market Adjuster" was introduced to determine the price of gas sold in New England, provided that this relationship is used when the share of gas sold to New England is more than a certain amount (Gas Natural Aproveisionamientos, SDG, S.A. v. Atlantic LNG Company of Trinidad and, 2008).

Because in this case, the arbitration authority disrupted the agreed pricing formula of the parties and established a new relationship, it can be considered as a turning point in natural gas pricing disputes. An important aspect of this award is that the tribunal decided to change the indexation formula while neither party had requested it and therefore this gave rise to doubts that the arbitral award was ultra-petita (Gas Natural Aproveisionamientos, SDG, S.A. v. Atlantic LNG Company of Trinidad and, 2008; Lorefice, 2017, p. 211). In the context of procedural law, ultra-petita is a decision which contains things out of claimant's request and the tribunal has exceeded its jurisdiction (Lew et al., 2003, p. 714).

In this case, several factors can be considered as the roots of the dispute. A primary factor is that the contract pricing mechanism did not directly reflect the price of gas in the target market and was based on a base price and adjustment coefficients related to the price of oil products. This factor is often seen in many other similar cases in that period which was not effective in reflecting

the gas market reform. Another factor is that although the contract stated that GNA could export gas to New England in addition to Spain, but the pricing formula was tied to the European energy market, because the parties expected that the LNG would be consumed in Spain (MCNAIR CHAMBERS, 2013, p. 6).

There are other cases in which the tribunals have used various approaches to adopt the long-term pricing mechanism with a more competitive and more liquid gas market environment. In *RWE v Gazprom* case, the tribunal introduced a new element of indexation to spot gas prices, while the contract original pricing mechanism was based on oil indexation (Sparling et al., 2016). In *Edison v Eni* case, the tribunal changed the pricing mechanism from oil indexation to spot gas indexation (Sparling et al., 2016).

3. Analysis of Current Long-Term Pricing and Price Review Methods

This chapter comprehensively discusses the methods of gas pricing and price review from different points of view, and each of these methods is analyzed in detail.

3.1. Natural Gas Pricing Methods

At the beginning of this section, the common natural gas pricing methods are introduced. Gas pricing methods are categorized in various ways and various names.

International Gas Union (IGU) categorizes pricing methods as: (IGU, 2019, p. 11)

- Oil Price Escalation (OPE): The price of gas is connected to the price of oil through a base price and a coefficient of adjustment or escalation. Sometimes the price of coal or electricity or a basket of other fossil products may be used instead of oil.
- Gas-on-Gas Competition (GOG): The price of gas is determined according to the market mechanism and based on interplay of supply and demand. Gas can be sold in both physical and non-physical markets, and over various periods.
- Bilateral Monopoly (BIM): The price is determined through bilateral negotiations between a large seller and a large buyer, usually single dominant companies.
- Netback from Final Product (NET): The price paid to the gas seller is a function of the price that the buyer earns from selling his final product. This method can be used when the gas is used for a specific consumption, for example in petrochemicals.

- Regulation methods: The price is determined by a regulatory authority. This regulation can be for social and political purposes (Regulation: Social and Political or RSP), or as a subsidy to the population by receiving only the cost of service (Regulation: Cost of Service or RCS) or as a more significant subsidy to the population (Regulation: Below Cost or RBC).

In recent years, GOG method has received more interest. Its share of global pipeline gas exports has increased from about 25% in 2005 to about 60% in 2018 (IGU, 2019, p. 14) and its share of global LNG exports has also increased from about 15% to about 35% (IGU, 2019, p. 15).

In each of the regional markets, depending on the market structure, the prevalence of pricing methods is different. In the European gas market, the share of the OPE method has decreased from 78% in 2005 to 24% in 2018 and instead the share of the GOG method has increased from 15% to 76% in the same period (IGU, 2019, p. 56). This trend is in line with changes in the structure of the European gas market and increasing gas-to-gas competition. Unlike in Europe, oil-based pricing is still so important in Asia to the extent that it has even been associated with a share increase, from 35% to 67% in the same period (IGU, 2019, p. 61).

GOG method itself has various forms, however, herein after, when we refer to Gas on Gas competition pricing method, we mean pricing mechanism in which the gas price is indexed to the price of a gas market or hub and we call it “Hub-Indexation”. Also, hereinafter, the oil price escalation pricing method is referred to as “Oil-indexation”.

3.2. Pricing Methods in the New Market Environment and the Potential of Dispute in Them

Oil-indexation and hub-indexation are two main pricing mechanisms in the new international natural gas markets environment. Other methods are currently rarely used in market-based pricing and are often used in governmental or monopoly pricing. This section describes these two pricing mechanisms and analyses the potential for dispute in them.

a. Oil-indexation

The simplest form of the oil-indexation pricing relationship is as follows:

$$P = \alpha \times P_{\text{crude oil}} + \beta$$



Where, P is the price per million BTU of natural gas, α is the linkage slope, P_{-} (crude oil) is the price of a barrel of crude oil and β is the constant of the equation in terms of price per million BTU.

Since this relationship connects the price of gas to oil in a linear and direct way, it makes the parties vulnerable to price fluctuations in the oil market. For this reason, S-Curve formulas were introduced in which a floor price is considered for the gas price so that the gas price does not fall below the production cost and a ceiling is considered accordingly to reduce the risk of the buyer. These floors and ceilings can be either in fixed numbers or in the form of linear relationships that have a slight slope.

There are more complex forms of this relationship, for example, α and β can take different values for different price ranges, or instead of using the price of crude oil alone as a reference, the price of a basket of oil products or other energy carriers can be used.

The main problem with this method is that crude oil price does not accurately reflect the reality of the gas market. In addition, as explained, sometimes divergences are observed between natural gas and oil prices and each of them takes a different trend, which can be, and has been, controversial.

b. Hub-indexation

In a hub-indexation pricing mechanism, the price of the traded gas will be directly related to the price of gas in a gas hub, plus or minus a number that can be constant or a function of the price. This plus or minus usually depends on the characteristics of the base hub and its relationship to the point of consumption. The main advantage of this pricing method is that the prices are competitive and reflect the real price of gas, not oil, in the market. Therefore, the probability that the price of gas traded in the contract will differ significantly from the price of gas in the consumer market will be less.

However, trading large volumes of gas based on hub prices is not without its challenges. The first challenge is that the gas market, like other markets in the world, may face problems such as speculation, bubbles and market failures, and some believe that the oil market is in a better position in this regard, because it is long established and has advanced infrastructure. The second challenge is the risk of collusion and manipulation of gas prices in the hub. Proponents of oil-based pricing argue that the oil market is so large that it is less possible for prices to be colluded or manipulated (Zhang et al., 2018a). The third challenge is the probability of unfair distribution of the contractual risks. This means that if the buyer takes the

gas with the price directly related to the target market, its risk is reduced, while the seller stills is at risk and may suffer from any reduction in gas prices.

3.3. Long-Term Gas Pricing and Take-or-Pay Provisions

Exploration, production, processing and transmission of natural gas require large investments and return on investment must be ensured. One of the most common measures taken to ensure the return on investment is to enter into a long-term contract and place a take-or-pay condition in it. Under this condition, the buyer undertakes to take a certain volume of gas, and if it does not want to or cannot take this amount of gas, it must pay a large part of its price (Mokhtab et al., 2014, p. 80).

As a result of the take-or-pay condition, the seller and the investor are assured that the purchase of gas and return on investment will continue and the buyer will not refuse to buy in the middle of the way. When the buyer accepts this condition, it actually takes a big risk because the economic conditions and market conditions may change and it will be uneconomical for it to buy gas at the contract price. In such circumstances, the importance of the price review clause emerges and the buyer is assured that, due to this clause, if the economic situation changes, the contract price will be adjusted accordingly. Therefore, the less strict take-or-pay clause, the less need for a strict price review clause.

3.4. Price Review

When the parties to a long-term contract determine the pricing mechanism, they determine it according to the market conditions and their forecast of its future. However, since the future is uncertain and circumstances may change during the term of long-term contract, Suitable provisions should be considered to adjust the price according to the new conditions. For this purpose, the price review provision is usually used so that pricing can be corrected in the event of a significant change in the economic circumstances.

A price review clause usually includes a trigger condition, which determines under what conditions one of the parties can activate the price review process, and it also contains procedural rules and methodology of price review. Procedural rules of price review determine what process must be followed to review the price. For example, if the parties do not agree on a new price within a certain period of time, how should the price review and dispute resolution be referred to the arbitral tribunal and what formal rules should govern the formation of the

tribunal. Methodology of price review determines the conditions, parameters and the main and substantive bases according to which the price review should be done.

The first step is to determine if the trigger condition is met. In this step, the price review requester must prove that the condition of the price review trigger has been met. The clearer and more effective this condition is in the price review clause, the easier it will be to determine its fulfillment. Sometimes there may not be a precise and clear condition for activating the price review in the contract, and only a “significant change in the economic circumstances or gas market” is considered as the price review conditions. In such a situation, first, it must be determined whether a significant change has taken place or not, and second, whether the existing pricing relationship can truly reflect this change or not.

After this step, the pricing relationship should be corrected according to the new situation. In addition, since the will of the parties and their agreement is of fundamental importance, the price adjustment should be in such a way that the parties’ agreement is respected as much as possible.

a. Trigger condition

A trigger can include special conditions to be met or can provide an automatic right to run a review procedure at regular intervals during the life of the contract. Usually price review is activated when the change of circumstances is beyond the control of the parties, significant and unpredictable (MCNAIR CHAMBERS, 2013, p. 3).

In a Periodic trigger, a predefined schedule is considered to review the price and update the pricing relationship, for example each party may have a right to request for price review every 4 years. The advantage of this type of trigger is that it has a simple and predetermined process, thus avoiding disputes over whether the economic situation has changed or no. However, this type of trigger is not directly related to changes in the market and economic circumstances. There may be changes in the market that cannot be responded to quickly, or there may be no change in economic conditions during the period and there is basically no need to review the price in the predetermined schedule.

When a special condition is considered to be met for starting the price review process, this condition can either be described in general terms and the recognition of its instances left to the arbitration authority, or it can

be defined in detail by defining parameters and relationships. Which of these two types is better is an important issue that will be addressed in the next sections?

b. Procedural rules

Before the price review is referred to a third party, it is better for the parties to negotiate and compromise. If so, cost and time are saved and the risk of a significant loss in the arbitration is eliminated for the parties. Thus, the price review clause usually provides a specific time and process for bilateral price negotiation and agreement negotiations, and if no agreement is reached, the issue is referred to a third party to resolve the dispute. This process may be set up in such a way that before referring to the dispute resolution authority, the case is referred to a mediator so that it may be able to reach a compromise between the parties before the dispute is brought to a tribunal. The dispute can be referred to arbitration or expert determination or formal proceedings, however the majority of price review disputes are resolved in arbitration (Baily & Lidgate, 2014, p. 143; MCNAIR CHAMBERS, 2013, p. 4). Why arbitration is preferred is not the subject of this paper but, in summary, arbitration can be relatively fast and flexible, the parties have control over the selection of the arbitrator with an appropriate degree of practical experience, arbitral awards are generally easier to enforce in other nations than court judgments and arbitration proceedings and arbitral awards are confidential.

c. Methodology of price review

The basis of the price review and the substantive principles on which the new pricing relationship should be established is also included in the price review clause, and if there is to be a limit to the application of the new pricing relationship, it is specified. For this, you can use general terms and leave the review authority free to review the price or, instead, restrictions and a framework for price review can be considered.

One of these restrictions is the application of the baseball arbitration method, in which each party submits its proposal for the modification of the pricing relationship, and the arbitral tribunal must choose one of the two proposals (Moses, 2017, p. 18; Trenor & Holloway, 2016, p. 43). The advantage of this method is that the arbitration award is limited and it eliminates the possibility of issuing unexpected awards with which neither party is satisfied. However, it also has the disadvantage that it reduces the flexibility, discretion and efficiency of the arbitral tribunal to issue a fair award,



and also reduces the possibility of providing creative solutions. Although, the parties will probably try to make their proposal more acceptable and reasonable to have more chance to be selected.

Another limitation that can be applied is high-low arbitration, in which the parties agree on a "price range" within which the final award must fall and if the tribunal's award exceeds this range it is automatically adjusted to be within the range (Trenor & Holloway, 2016, p. 43). This method both preserves the flexibility and discretion of the arbitral tribunal to some extent and limits the award within the agreed range of the parties.

An example can better explain the high-low price review. Suppose in a gas pricing dispute, Company A believes that it should receive 300 million Euros from Company B for a certain period of time, but Company B believes that it should not pay and only accepts payment of up to 25 million Euros. The parties enter into negotiations before entering the arbitration to agree on a price range for the final award. One of the options for the agreement could be to set the same 25 and 300 million Euros as the minimum and maximum, to at least prevent unexpected awards. Another option would be for Company A to accept a higher minimum in exchange for Company B to accept a lower maximum. In this case, for example, the parties agree on the minimum and maximum of 75 and 200 million Euros, and in exchange for lowering their expectations, reduce the risk of larger losses in final award. Obviously, such negotiations will be successful if the parties show rational and positive behaviour, and if one of the parties wants to insist on too high or too low prices without reasonable foundation, the chance of agreement is reduced.

d. Price review for hub-indexation

As described so far, price review process basically applies to oil-indexation pricing mechanism and it is relevant when indirect pricing methods, such as oil-based pricing, are used. But the question that can be asked here is whether there is no need for a price review clause for hub-indexation where the price of gas is taken directly from the market? The authors of this article believe that the price review clause cannot be ruled out altogether for hub-indexation. Firstly, due to the large investment required by the gas facilities, in some cases, there may be still a concern about the continuation of gas sales, so provisions may be necessary to make it possible to correct the price in the presence of significant changes in economic circumstances. Secondly, there is no guarantee that the price of the hub used as a pricing reference will always reflect the actual price of gas in the

target market. This is more likely when the target market is different from the hub used as reference for pricing, and the greater the distance between the two markets, the greater this likelihood. In any case, there is always the possibility of change in the existing markets or the creation of new ones.

Therefore, depending on the circumstances, it may be necessary to include a price review clause for hub-indexation, unless the risk of the parties is otherwise covered.

4. Recommended Structure for Pricing and Price Review in the More Competitive Global Market

This chapter presents the recommended structure for pricing and price review in the more competitive global market and explains how the pricing mechanism and price review framework should be tailored to the characteristics of the gas market.

4.1. Best Pricing Method

This section addresses the fact that basically no single gas pricing method can be introduced as the best pricing method, and the pricing framework should be tailored to the characteristics of the gas market and the stages of growth and maturity of the market.

As described in section 2, in some regions of the world there are highly competitive gas markets with developed facilities and advanced technical, commercial, and legal infrastructure in which prices are determined competitively based on supply and demand. In other regions, competitive gas markets do not exist and there is no choice but to use the price of alternative fuels. Depending on the market structure, the appropriate pricing method can be selected. As detailed in the previous sections, oil or other energy carriers are not a perfect alternative to natural gas, and oil-indexation gas pricing can be potentially controversial. Therefore, as a general principle, it is preferred, if possible, to price gas directly instead of indirectly through oil-indexation.

In most pricing dispute cases, the lack of proper response of the oil-indexation to the changes in the gas market has been one of the most important causes of the dispute. However, it should be noted that hub-indexation pricing also has its own limitations, the situation may be such that hub-indexation is not possible or preferable. In any case, whichever pricing method is chosen, one of the most important things that must be considered in pricing is to pay attention to the project economics and return on investment. For this purpose, it is necessary to carefully

assess the project economics and, if necessary, determine the minimum and maximum acceptable gas price.

4.2. Hub-Indexation Pricing

The important question is: where is it appropriate to use the hub-based pricing method? The main factor is the existence of a gas hub that reflects the price in the target region. In addition, given the challenges and limitations that this method faces (explained in section 3.2.2), the reference hub should have a developed infrastructure. This means that the hub must be developed in terms of technical infrastructure and industrial facilities and must be large enough to be liquid and competitive and non-exclusive. It must also be developed in terms of commercial and legal infrastructure, and have strong anti-monopoly, anti-money laundering, anti-collusion and anti-price manipulation rules.

The volume of exchanges in the reference hub is another important factor. The hub should be large enough so that collusion, manipulation and anticompetitive behavior will not be a concern. Another factor is the distance of the reference hub from the production and consumption facilities. The closer the reference hub is, the better it can reflect the value of gas in the region. If the reference hub is far from the final point of use, it cannot reflect prices in the target market, and also if it is too far from the production facilities, other concerns may appear. Due to this, where the distance between the place of production and consumption is large, for example intercontinental, choosing a reference hub can be challenging. This

challenge can be one of the reasons why hub-indexation is not as common as oil-indexation in long-distance LNG exports, as explained in Section 3.1.

4.3. Oil-Indexation Pricing

If the conditions for discovering the market price of gas are not provided, the main option is to calculate the gas price from an index of alternative fuels. Accordingly, oil or a basket of oil products are usually the best options for this purpose. This section discusses what components to consider in oil-indexation pricing.

One of the most important factors in oil-indexation is the selection of an index that has the most relevance and connection with the traded gas.

Sometimes it may not be possible to use the hub-indexation pricing method and an ideal hub, with the characteristics described in section 4.2, may not be found for this purpose, but there may be one or more gas hubs that can be used for adjustment of oil-indexation pricing. In such conditions, a combined method of oil-indexation and hub-indexation can be used. In other words, a hybrid-indexation mechanism, i.e. indexation to both oil-market and gas-hub prices, can be used.

For Instance, consider a case in which the oil-indexation pricing method is used because there is no ideal gas hub to be used as an independent index. In this case, if there is a separation between the oil price and the price of gas in the adjacent hubs, the oil-indexation method cannot reflect the changes in the gas market.

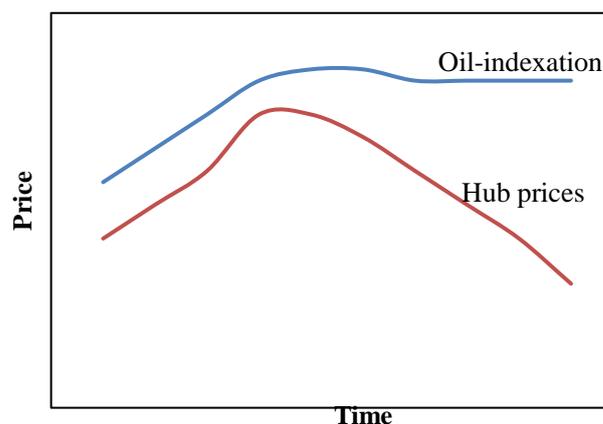


Figure 1. Typical separation between oil-indexation prices and hub prices.

However, if the hybrid-indexation pricing method is used, and the pricing index covers the price of gas in addition to oil, the gap between the oil-indexation and

the price of gas in adjacent markets will be reduced. Figures 1 and 2 show typical examples of these

indexation methods when divergence between oil and gas prices emerges.

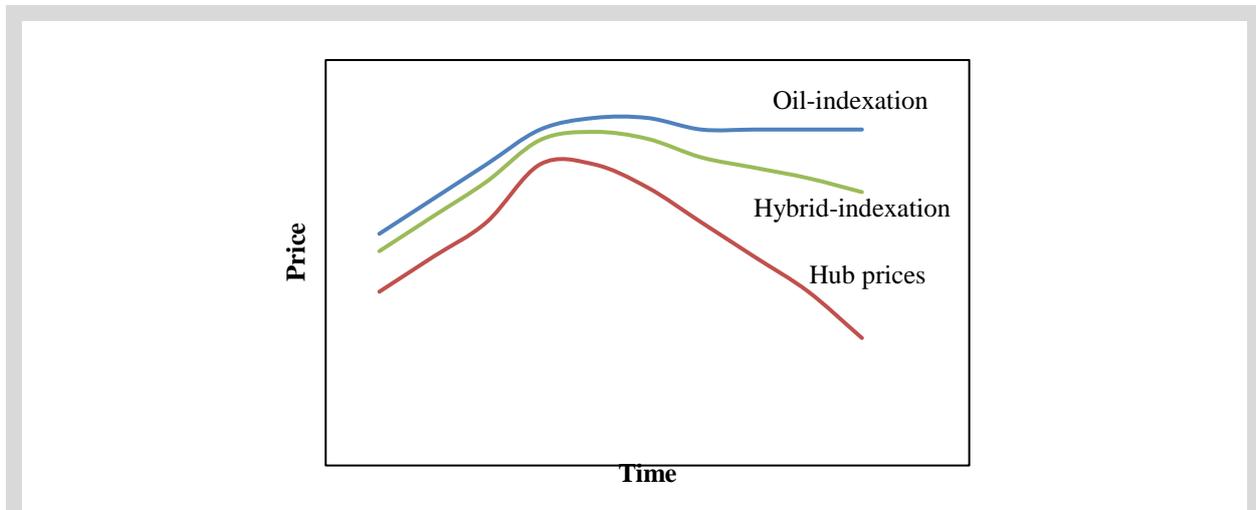


Figure 2. Typical hybrid-indexation prices.

Determining the exact parameters and coefficients of the hybrid-indexation and the share of each element in the total price requires economic analysis, market studies, technical calculations, and complex mathematical optimizations, and should be determined specifically for each case.

Whether the hybrid-indexation is a good choice or not depends on the technical and economic characteristics of the project, the legal considerations, the characteristics of the energy markets in the region and many other factors.

4.4. Price Review Trigger Condition

Have the conditions for activating the price review mechanism been met or not? Potentially, it can be one of the most controversial issues related to gas pricing and price review.

An important question in designing the structure of price review is: does the trigger condition need to be general or should it have specific guidelines? There is not a unique answer to this question, and each of these options has its own applications, but basically it can be said that if a general trigger condition is used, it has the advantage that it can catch as many as possible of the circumstances which may occur in the future. While, if this condition is written in details and with specific guidelines, an unpredictable situation may occur and the price review may not be fair and effective. However, the general trigger makes it difficult for the parties and the arbitral tribunal to determine whether the trigger condition has been satisfied. A general form of trigger

condition usually is such that if "significant changes in the market" or economic conditions occur and these changes are beyond the control and foresight of the parties, the price review process begins.

What can be deduced from a review of gas pricing dispute cases, as well as similar cases in other sectors, is that the main challenge in determining "have there been significant changes in the market?" is, firstly, to precisely determine "the target market" and its characteristics, and secondly, to determine what change should be considered a "significant" or fundamental change in the market.

For instance, as explained in the ESB and Esso case, the basis of the case was that the parties disagreed on whether the price review request was valid and whether the trigger conditions for initiating the price review process had been met. Therefore, if the parties consider a trigger condition for activating the price review, it is necessary to think about the ways to calculate and prove it and, depending on the characteristics of the market, to consider solutions for this purpose. As another instance, in the Atlantic LNG case, it was observed that the components of pricing and price review in each of the target markets were not well defined. Therefore, it can be concluded that it is necessary to precisely determine the target market.

Another important issue is how long should changes in the market take to allow for a price review? As a rule, short-term changes and fluctuations in the market cannot be a criterion for the possibility of starting the process of

price review, and these changes must be stabilized in the market.

4.5. Procedural Rules of Price Review

As explained, it is best for the parties to negotiate and, if possible, compromise before submitting a review request to the arbitral tribunal. Negotiation and compromise have numerous benefits. Firstly, a mutually beneficial outcome is achieved and the parties' risk of total loss through the arbitration award is eliminated. Secondly, mistrust is not established between them and their business relationship continues based on mutual cooperation. Thirdly, financial and time costs are reduced. Fourthly, the credibility of the parties in the gas industry is maintained. In fact, third parties who may want to enter into a business relationship in the future will be more cautious with the parties who have entered into a business dispute. Therefore, it is preferred to consider an effective process for compromise before referring to the arbitral tribunal.

One of the points that should be considered in this regard is determining the level of direct negotiation. Usually, the higher the level of negotiators, the better, because negotiators will have full discretion in decision-making, and organizational or bureaucratic barriers to compromise will be removed. In addition, top managers are expected to pay more attention to overall benefits of the organization. Therefore, it is recommended that provisions be made for direct negotiations between the parties at the highest executive authority before referring to a third party.

Another important issue to consider is setting a deadline for the parties to negotiate, because without a deadline, a reluctant party may deliberately prolong the process.

Usually, when the negotiations between the parties are not successful, the dispute is sent to the arbitral tribunal. Sometimes mediation is used before sending the case to arbitration. Mediation is one of the mechanisms that can be very effective in the peaceful settlement of pricing disputes. Mediators use a variety of techniques to open or improve dialogue and empathy between the parties to reach an agreement. In natural gas pricing disputes, the use of mediation becomes even more important. Because according to what was described previously, in many cases, it is necessary to give a wide authority to the arbitration tribunal to modify or even change the pricing mechanism, and this extensive competence increases the parties' risk.

If these provisions are not successful, the dispute will be referred to the arbitral tribunal. Since there is often needed to give extensive authority to the arbitral tribunal, choosing the right arbitrator is essential to achieve a reasonable and fair award. The arbitration tribunal must have expertise and experience in reviewing the gas price review and have shown good performance in this field.

4.6. Methodology of Price Review

The competence of the arbitration tribunal and the principles of price review are important issues that should be addressed in the structure of gas price review. Here again, the question is: whether it is better to leave the methodology of price adjustment to the arbitral tribunal, or should it have specific guidelines? Similar to what explained about the trigger condition, the answer is: each of these types has its own application, but in general, given that it is not possible to predict future situation, giving sufficient authority to the arbitral tribunal has the advantage that it covers all possible future situations and conditions that are unpredictable. In any case, it is necessary to have a completely transparent methodology and avoiding any ambiguity and distortion, so that the parties or the arbitration tribunal should not have any problem in interpreting the price review methodology.

One of the important points in designing the structure of price review is to consider a framework and boundaries for price review. Although it is not possible to restrain the arbitral tribunal and impose broad restrictions on it, as it may not be possible to review the price fairly, it may be helpful to include some limitations in this regard, depending on the case. One of the available options is using a high-low arbitration and setting a minimum and maximum for the price. These minimum and maximum can be determined based on the project economics and a reasonable rate of return on investment.

Depending on the case, it can also be clarified whether the arbitral tribunal can completely abandon the pricing relationship and establish a new one, or can only update and modify the coefficients and constants of the existing relationship.

The last issue that is raised in this section and one of the important points that should be considered in the price review framework is that, in many cases, the pricing mechanism is not solely affected by economic conditions and various other factors, like geographical, technical and social factors, are also influential. However, price review clauses usually only deal with



changes in the economic circumstances, and as a result, each party can, after a period of time, submit a price review request, and impose a new price based solely on economic and commercial conditions. Therefore, in such cases, it is necessary to design the price review methodology in such a way that in addition to economic and trade conditions, other components affecting the initial price be taken into consideration. However, explaining these components and determining how each affects the price is a difficult task that requires a great deal of effort, depending on the case.

5. Conclusions

This paper discussed the challenges of natural gas pricing and price review in the more competitive global market. The pricing mechanism and its characteristics should be selected based on the characteristics of the gas market and the stages of growth and maturity of the market, however as a general principle, it is preferred to price gas directly instead of indirectly through oil-indexation, if possible. Hub-indexation can be a good option when an ideal reference gas hub exists that reflects the price in the target region. The reference hub should be developed in terms of technical, commercial and legal infrastructure and it should be large enough to be liquid and competitive so that collusion and manipulation behavior will not be a concern. If the conditions for discovering the market price of gas are not provided, the main option is to use oil-indexation. An important point in this regard is the selection of an index that has the most relevance and connection with the traded gas.

Price review trigger condition, procedural rules and methodology of price review each should be precisely framed. In the trigger condition, it is important to precisely determine "the target market" and its characteristics, and what change should be considered a "significant" or fundamental change in the market. In the procedural rules of price review, it is preferred to consider an effective process for compromise before referring to the arbitral tribunal. In the methodology of price review, it is necessary to have a completely transparent methodology and avoiding any ambiguity and distortion, and to consider a framework and boundaries for price review.

It also should be considered that, in many cases, the pricing mechanism is not solely affected by economic conditions and various other factors, like geographical, technical and social factors, are also influential. In such cases, it is necessary to design the price review methodology in such a way that in addition to economic

and trade conditions, other components affecting the initial price be taken into consideration.

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