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There is no "World Price" for natural gas

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Gas pricing can be a complex and controversial subject

method and proposed this method to traditional supplier like Algeria and Russia.

This method according to the LNG project cost probably creates some difficulty for Middle-East new players.

(D) "USA" LNG price formula:

This formula linked quoted Henry Hub prices.

$$P = B \times HH +/\_ A$$

B rate of variation with the gas price

HH Quoted Henry Hub price at agree date

A Intercept

According to pervious explanations:

What buyer wants in the future?

1. Price flexibility and net back pricing formula specially in U.S and Western Europe.
2. Short term contracts
3. More flexibility for delivered quantity
4. Minimum Take or Pay

What seller wants in the future?

1. Minimum floor price equal to project unit cost
2. Long term contract
3. Less flexibility for deliver quantity
4. Maximum Take or Pay
5. Buyer guarantee

In above-mentioned:

What happened if Buyer and Seller have been in cooperation:

1. Will be adjusted net back price formula and considered some clauses like Production Sharing in contracts
2. Mid-term contracts
3. Rational flexibility for deliver quantity and Take or Pay percentage
4. Dual guarantee for Natural gas buying and selling

What happened if Buyer and Seller have not been in cooperation:

1. Buyer must be seek new gas supplier or new energy sources
2. Increase probability for gas union establishment for protecting of gas supplier situation.

(I) Conclusion-

Pricing is an art and a precise activity.

Pricing needs enough time for thinking about different elements for making index and needs deep study.

Gradually the status of gas increase in consumer's energy basket and this is good reason to see in the near future price transparency for this commodity and I believe the relation between Crude oil and other Fuels index will decrease.

Probably the Net Back calculation pricing has been a good way for getting transparency but at present could not be an effective help for new suppliers.

For the Middle East Grass root LNG and Gas Projects the Cost

compensation is the first aim and this is logical way for project economy.

Goals of Gas Pricing Policies are to ensure efficiency of resource allocation.

Characteristics of Natural Gas as different from liquid crude's and fuels imply its pricing policy for satisfaction of specific target beside consideration of social equity.

Economic Level of Gas Pricing should be followed to encourage gas exploration and development. Especially it is an effective way for energy conservation.

We can summarized Key issues as follows:

1-The changes in gas market will happen and create new concept in gas business:

i- Short and mid term contract

ii- More flexibility for destination and pricing formula in gas contracts

iii- Independency vis-a-vis crude oil

2- Improvement for international project needs more cooperation between gas producer and gas consumer.

3- with regards to liberalization in market there are some possibility for establishment of gas union in gas supplier countries for pricing protection.

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The new Indonesian slope is about 15.45, which results in delivered LNG prices being above crude parity until crude oil reaches a price of around $ 53 per barrel.

In the early 1990, however, there was an honestly and strongly broadcast view by sellers that CIF LNG prices would have to rise by a dollar or more above the $3.30/MMBTU to $3.50/MMBTU range that was considered "standard" in order to make new high cost projects viable. At the time, there were fewer potential new projects than there are today, and much emphasis was given to the very high cost Natuna project in Indonesia. Japanese buyers were particularly concerned about this trend and made a significant planning switch away from new LNG-fired generating plants towards coal-fired generating plants. Japanese buyers made it clear to the supplying community that such high LNG prices were not realistic. In the light of LNG's actual value for new power stations, higher prices might have not been such a problem for power buyers had they not had a fear that even one new supply at a significantly higher price would generate demands from existing suppliers to have a similar pricing. The prospect of sharp ratcheting up of all LNG prices for the sake of one extra supply was too alarming
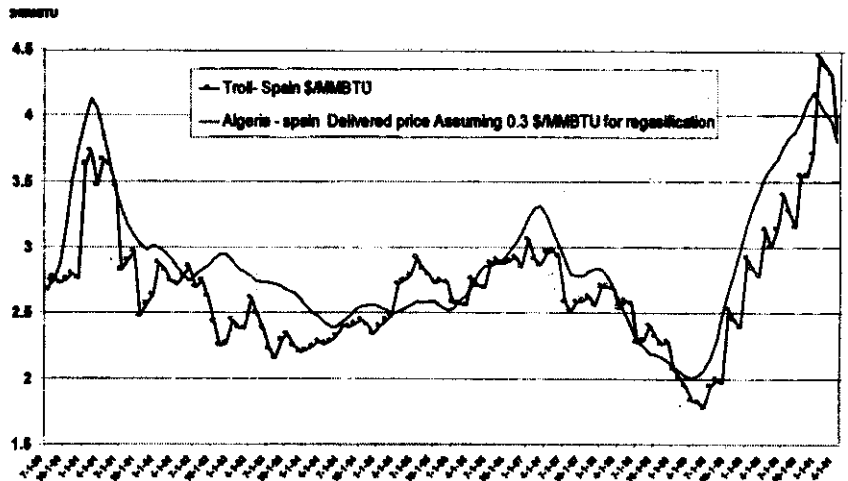
(B) "Indonesia" LNG Price formula:

Price indexed partly to inflation element and typically 90% related to oil and 10% related to inflation.

$P = P0 \times (R1 \times REP/REP0 + R2 \times RP1/RP0)$

P0: Base price in certain date
REP: Indonesian realized Export price in $/bbl 1-3 months in which the price is calculated

FIGURE 3- Europe: LNG prices versus pipe gas prices

REP0: base Indonesia realized export price
RP1:Agree inflation index
RP0: Base inflation index
R1 & R2: Weighting applied
A: Intercept

(C) "European " LNG Price formula:

In Europe LNG is a diversification energy: LNG has to compete with pipe gas from Norway and Russia.

* As pipe gas, LNG is indexed on Oil products, coal, and inflation.

* Consequence of pipe gas competition : prices are lower than in Asia

* Before the EU directive for gas markets deregulation, LNG was imported by large monopolies (GdF, ENAGAS...) under classical pricing terms.

* Since the EU directive many new players are trying to enter the LNG business in Europe.

* Power Utilities, or Gas Commercialisation companies targeting to sell to eligible customers.

* Purchase smaller volumes: approx 1 Bcm

* They do not control their market

and have few suppliers, and are not prepared to carry the entire price risk. They negotiate different price terms to share the market price risk with sellers:

In this type of formula basket of indices: e.g. Brent, fuel oil , gas oil, inflation and coal and indexation is based on average - great stability ,but there are lags to market.

The price reviews periodic.

Two type of formula applied in Europe:

First one is Multiplicative model:

$P = P0 \times (R1 \times A/A0 + R2 \times B/B0 + R3 \times C/C0 + ...)$

The second one is Additive model:

$P = P0 + R1 \times A/A0 + R2 \times B/B0 + R3 \times C/C0 + ...$
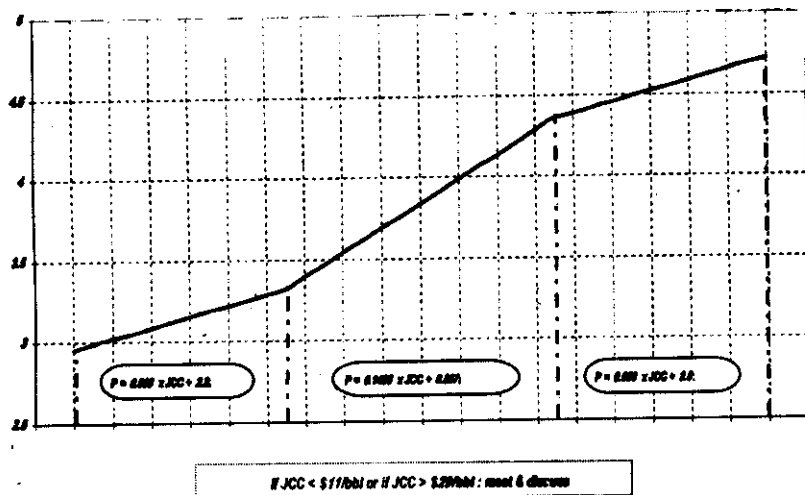
P0 Base price I certain date
A,B,C Moving average prices of oil products or other agreed indices
A0,B0, C0 Base price for the above
R1,R2,R3 Weightings applied to each the above

According to new changes in European market , the European costumers seek net back calculation

Price reviews applicable only to (and S.

(Vi) Sellers are only exposed to a typical Crude price risk for LNG in Asia.

At present in Asian Pacific region according to new changes in market the consumers specially Japan look for new pricing formula with high flexibility. Characteristics of this methodology are:

Contract extensions for shorter duration

* Indonesian contracts have been extended, respectively for 11, 8 et 5 years

* Extension of Malaysia-I contract currently under negotiation, with a part of the volumes on a short-term basis (3 to 5 years).

Preference for FOB contracts

* Indonesian contracts have long been the "FOB exception"

* Gas companies show a definite interest and have ordered tankers

* Part of Malaysia-I extension volumes being negotiated on a FOB basis

Operational tolerance, free destination

* Decrease of Take-or-Pay

obligation through annual reduction entitlement

* Price incentives for optional volumes

* Case by case relaxation of destination clause allowing cargo resale

Referencing importance of Japan LNG market I would like to explain more about it.

LNG was originally priced in Japan (1969-1973) on what amounted to a cost plus basis, even though such pricing did not render LNG visibly competitive with other fuels. Prices in the early Japanese LNG contracts were fixed, unindexed prices. When oil prices rose, however, the Japanese buyers allowed LNG prices to rise as well, although they were not contractually obliged to do so. It therefore remained attractive to develop new LNG supplies and producer governments remained content with the pricing of exported gas reserves. For a long period of time, LNG-delivered prices were essentially at thermal parity with crude oil prices. When oil prices fell in 1966, the newer LNG projects, particularly the Australian project, which had been constructed in the expectation of CIF (cost, insurance, freight i.e. a delivered

price) LNG prices of around $7/MMBTU, were put in some difficulty (although none was threatened with collapse). After several years of discussion, Japanese LNG buyers generally began to accept that LNG should be priced at a premium (initially around 10%) over thermal parity with crude oil prices.

The contract prices that were entered into following the drop in oil prices in the late 1980s and early 1990s, although not all expressed exactly in this form, can be reduced to the following simplified formula:

$$P = 14.85 \, JCC + A$$

Where P is the price in US cents/MMBTU and JCC (or the "Japan Crude Cocktail" which represents the weighted average delivered price of the top 20 crude's by volume imported into Japan) is in dollars per barrel.

The level of 'A' varied from contract to contract, with newer projects farther from the LNG buyers having slightly higher prices. Malaysia's a was 77 cents (though the new MLNG Dua secured both an 'a' and an additional B). Australia's 76.8, Abu Dhabi's 698, and Indonesia's (CIF) 59 (although Indonesia always had a different formula, similar to Qatar gas and Ras Laffan). Brunei and Alaska were 14.65 JCC + 61 and 57, respectively. This was the state of play in late 1992.

The effect of this standard formula is to give an increasing premium over crude parity at lower oil prices and a diminishing one at higher oil prices. At around $30/barrel (depending on a) the formula results in LNG prices that are at parity with crude oil prices. Indonesia has subsequently achieved steeper slopes, moving the crossover point to higher levels on new contracts..

The greater the slope, the more upside with high crude prices and, conversely, the more downside with low crude prices.

distribution.

(iv) It is delectable commodity so depletion premium has to be included in the opportunity cost.

In developing countries which is owner of large gas reserves, there are many differences between domestic and international gas pricing policy and I believe the liberalization in gas markets like EU and US is not good solution to the confliction and only consider customer side.

With regards to new changes in gas market it is necessary to consider some adjusted clauses in gas contracts like Profit Sharing.

International gas pricing need international cooperation between Buyer and Seller and this is the concept of commercial issue in international gas industry.

In South East Asia and especially Japanese case, sellers were also concerned about the impact of the escalating cost of LNG and tackled cost problems vigorously. Today there is considerably more realism about what prices will be acceptable for new LNG contracts, and engineers, contractors, and technologies have essentially risen to the cost challenges so that now there

are several new supply sources prepared to offer LNG to the markets at no more than a modest premium to current price terms. However, because investors in some projects are clearly concerned about maintaining adequate cash flows during periods of low oil prices, new LNG projects have departed from traditional pricing formulae by incorporating protections from low oil prices through floor prices and "S" curves (which exchange reduced downside risk for a loss of some upside opportunity).

Generally, LNG purchasers' unwillingness to pay excessive premier has dovetailed with the increased competition between projects that has emerged over the last three years. However, we do expect buyers to accept the reality that some projects will need revenue protection.

2- Gas and LNG Pricing formula and international trade

What is the LNG or Gas price drivers?

(A) Natural gas supply and demand balance

(B) Infrastructure and market size

(C) Alternative competing fuels:

(D) Competing source of gas

(E) Seller's need guarantee of off-take and payment

(F) Feed gas supply and cost

(G) Destination characters

(H) Need for bank ability

Of course there are many other elements that could have effect on pricing formula but I will try to introduce some important elements.

Above elements are good tools for negotiators for decision-making.

According to these elements the primary shape of the pricing formula will be recognized.

We can classify pricing formula in different regions:

(A) "Traditional" mode of price that applies in Japan and other Asian Pacific countries. The structure of this formula is:

$$P = B \times JCC + A$$

B: the real variation with the crude price (the Slope)

JCC: Japan Crude Cocktail in \$/bbl 1-3 months before the month in which the price is calculated

A: Intercept

**-In Asia LNG is substitution energy for crude oil or oil products**

(i) Contracts are signed for large volumes, by important single buyers (Kogas, TEPCO...) or groups of buyers

(ii) Those buyers are monopolies on their market. Their main objective is to secure volumes. They are prepared to carry most of the price risk.

(iii) A typical LNG price in Asia:

$$P = 0.1485 * JCC + (+ S$$

(V) -The trend is to decrease the price level in relation to crude. But, buyers do not generally ask sellers to share the downstream market price risk.

FIGURE 1 -PRICE COMPARISON IN THE 3 MAIN LNG MARKETS
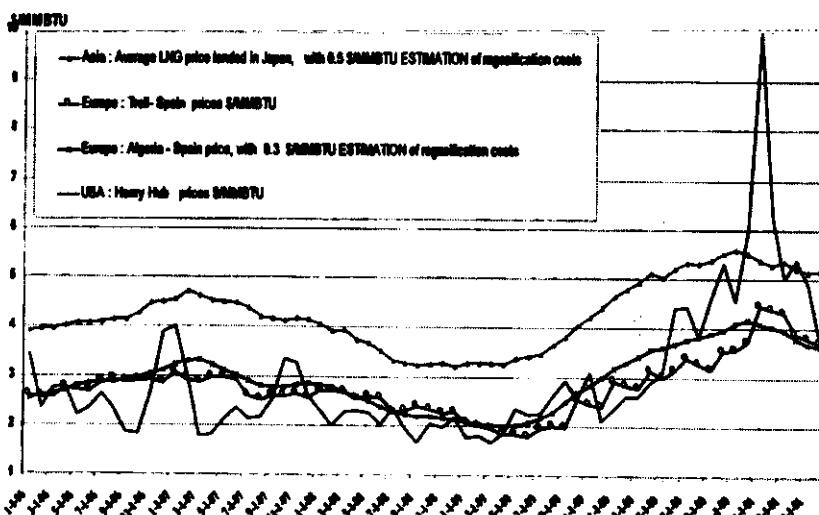
The pricing article in FOB or CIF mode for Gas or LNG sales and purchases agreement is the key issue. When we explain about pricing formula it just means the method for pricing.

I would like to explain more about this subject; really the negotiation factor is next in importance for getting best price.

In negotiation, the pricing formula will be adjusted by seller and buyer and create dual profit. This is the concept of price optimization and must be acceptable to lender for project finance.

More explanation about these topics are as follows:

A- Pricing for Gas or LNG in Integrate Projects -

In this method overall project cost is directly calculated and use difference-pricing formula for calculation. In this method according to final calculation and with regards to net back method feed gas price will be obtained. But the main formula for pricing is defined for final consumers. This is the case with more LNG producers around the word.

B- Pricing for Gas or LNG in non-Integrate Projects-

In some countries like Iran the concept of gas pricing is different. The main factor for creating this situation is relate to contractual concept. NIOC shall consider Buy-Back contracts for Up-stream, and Joint Venture Contract (JVC) for mid-stream.

In this situation we must think for two type pricing formula; the first one is related to feed gas price and will be discussed in Gas Sales and Purchases Agreements (GSPA) and second one is gas or LNG sales price that will be considered in LNG sales and Purchases Agreement (LNGSPA).

Gas pricing can be a complex and controversial subject. Its complexities come from an array of different considerations in gas value chain:

A- In Supply Side:

(i) Setting producer prices high enough to tempt the risk takers into exploration, production, primary treatment (Sweetening) and compensation of project cost.

(ii) Creaming off some of the resource rent for the government and this is the royalty concept.

(iii) Finding equitable transfer prices between gas producers and utilities or LNG or GTL plant.

As explained in above this part is critical point for LNG and GTL projects in Iran.

B-In Demand Side:

(i) Devising complex tariff structures to reward large consumers for shifting off peak.

(ii) Protecting small consumers from monopoly exploitation by the utility.

The whole chain of prices, from the gas explorer to the small consumer, must reflect, and properly distribute, the economic gains from gas development.

How a central authority has set price tool is generally based implicitly or explicitly, on three sets of objectives.

(a) Efficiency of resource allocation, economic efficiency requires that the real cost of energy to the society is reflected in the prices that guide the decisions of producers and consumers of that energy. When this principle is violated, energy consumption can rapidly get out of hand, particularly that of industrial and other large consumers.

(b) The satisfaction of specific financial targets, a financially viable gas utility is one that has the capacity to finance, through its own resources and its ability to service borrowing, the expansion of its operation in line with the development of the market. It is usually possible to devise a set of tariffs

whose structure satisfies efficiency criteria and whose average level meets the financial needs.

(c) Consideration of social welfares, this may be conflicting with previous objectives and may lead to contradictory results. So it is important to review the relative suitability of gas tariffication as a tool to achieve each of the three objectives.

Subsides should be the last recourse to correct the deficiencies of direct income transfer mechanisms and must be rigorously limited in order to safeguard the objective of financial viability.

The overriding criteria for gas pricing should be economic efficiency. The first step in setting or changing gas prices is to determine the economic price of gas in the particular country or region on question the economic price of any good-gas included is determined by the intersection of its aggregate demand and supply curves.

For many goods, that value is simply the price resulting in an open market place through the bargaining of many buyers and sellers. For goods that are traded internationally such as oil or wheat, the economic price in a small country is often determined almost independently of the local demand and supply conditions. Unfortunately there are many reasons why the economic price of gas generally cannot be so easily observed:

(i) It is not a widely traded commodity owing to its high transport costs involved.

(ii) It is not a perfect substitute for all petroleum products, so the fuel oil equivalent price of gas is not always an appropriate short-cut estimate for the economic price of gas.

(iii) In domestic markets for gas, political and economic factors have generally led to price regulation because of monopolistic production and

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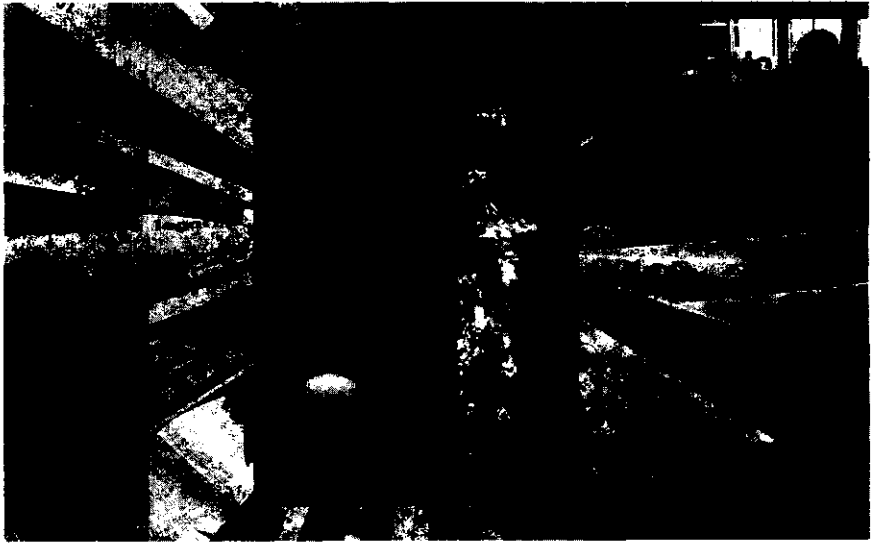
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Introduction

Natural gas occupies an important position in the international energy world, like oil, and other commercial fuels. This situation will create specific status for gas pricing in next decade.

There is no "World Price" for natural gas but we will see gradually the pricing system for LNG has been transparent. Although there must be "An Environmental Premium" attached to gas that is a cleaner fuel than oil or coal, which is excluded from this study, energy planners should include a relative environmental costs and Social benefits of gas in project appraisal.

In most cases in gas supplier developing countries, systems of producer pricing and taxation have been borrowed from the oil industry that becomes an obstacle to gas development.

I believe that making the price formula is an art and different in each country and will become more complicated gradually.

In developed countries structure of pricing formula is very important, it is calculated according to cost of project but in developing countries, economic price of any good like natural gas is determined by the intersection of its aggregate demand and supply curves. This is the concept of the Open Access Market and there is confliction between two different pricing systems.

Framework of gas pricing includes major participants in gas production in upstream side, midstream and distribution among end users in downstream side.

Upstream gas pricing formulas are discussed to develop minimum supply price. Economic downstream gas pricing normally is faced with both social and market forces in developing countries where major gas reserves exist like South Pars in South part of Iran.

Gas tariff system applied in different countries is discussed where three schools can be followed:

1-cost plus,

2-market value

3- price of displaced fuel.

Challenges for bringing gas pricing to economic level are shown and discussed. Finally concept of natural gas planning is illustrated to reach economic and satisfactory prices to all parties concerned.

In this paper, it is tried to introduce following subjects:

1- Pricing Literature for Natural Gas

2- Gas and LNG Pricing formula and international trade

3- Conclusion

1-Pricing Literature for Natural Gas and LNG

There are various methods for calculation of gas pricing in the world. In more countries usually gas or LNG projects are defined integrated and the pricing will be exercised for value chain; in other words according to commodity sales and purchases considered pricing formula clause.