

The Ties between Natural Gas and Oil Prices

On the European continent, the price of natural gas is still tied directly and to a great extent to the price of competing energies, especially heavy fuel oil and home heating oil. In other words, the gas market is linked to the oil market. Under the effect of deregulation, this model is likely to change in the future, making a shift like that which took place on the American market in the past.

In the natural gas sector, one question keeps cropping up: **Will there continue to be a link between the gas and oil prices?** First of all, let us note that this question mainly concerns the continental European and Asian markets. Since the deregulation of the gas markets in the United States and the United Kingdom, the reference price for natural gas has been based on short-term prices (spot prices at the Henry Hub or the NBP) and on standardized quotes at marketplaces like the Nymex (United States) or the IPE (United Kingdom): these prices reflect the supply/demand equilibrium on the market.

However, even on these deregulated markets, there is a connection with the price of crude. The price of gas is influenced directly by using formulas based on the price of petroleum products, or indirectly, like in the United States. Two questions arise: **Will direct price indexation formulas eventually be dropped? What kind of link persists in a deregulated market?**

Formulas Used to Compute the Gas Price in Europe and Asia

The mid-1950s marked the beginning of long-distance gas exchange transactions, especially in the United States and Europe. The development of a grid enabled Europe to import natural gas from Russia, Algeria, Norway and the Netherlands. At the same time, liquid natural gas (LNG) exchanges were implemented in Asia to supply power plants in Japan that had previously burned oil. As for North America today, Canada will soon be supplying the United States.

To ensure the longevity of these exchanges, which require very heavy capital expenditure worth billions of dollars, it was of paramount importance to find an instrument that would reassure both buyer and seller, and the long-term contract did just that. Its key characteristics are: a term of 20 to 25 years, a buyer obligation to "Take and Pay" for a minimum quantity ("Take or Pay" clause), a seller

obligation to supply the gas and a price indexed on competing energies.

The purpose of having a price indexed on heavy fuel or home heating oil or directly on crude oil (Algeria or Asian LNG contracts) is to protect market share. In the absence of a separate market for natural gas, which must compete across the board with petroleum products, this type of procurement formula yields a price that is in line with competing energies; this price practically guarantees that natural gas will find sales outlets. Transport investment can be amortized without any serious risk of a decline in deliveries. Such formulas and contracts are still used on European and Asian markets.

The price is computed on a net-back basis: the transport and distribution costs are subtracted from the average price of competing energies on the final market. The result corresponds to the maximum purchase price that the gas distributor is prepared to pay the producer. Through conventional indexation, natural gas is tied to competing energies over time.

Example of a gas pricing formula:

- Europe: $P = P_o + A \times (G - G_o) + B \times (F - F_o)$
- Asia: $P = P_o + A \times (B - B_o)$

where:

$P (P_o)$ = Monthly price at which gas is purchased from the producer (index o : initial date of contract implementation).

$G / F / B$ = Average price over 3, 6 or 9 months for heating fuel G , heavy fuel F , petroleum B . (Using an average limits oil price increases or decreases).

A / B : Energy equivalence coefficients.

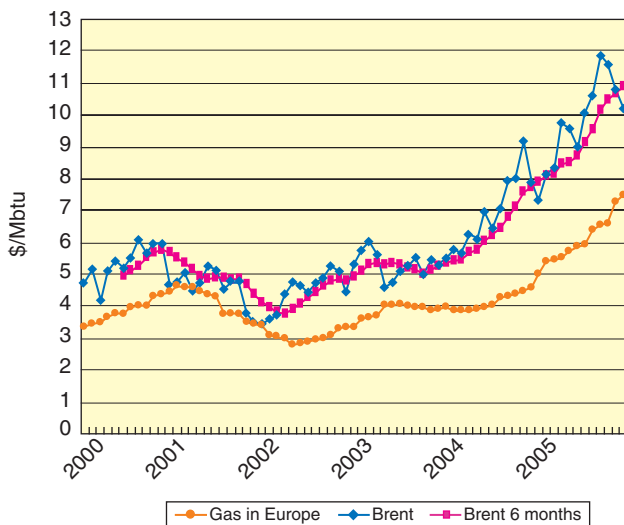
In Europe, natural gas is usually indexed on fuel oils (heavy oil and home heating oil), because it competes mainly in the industrial and commercial sectors. In Asia, it is indexed on

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crude oil, which was the energy used at most electric power plants in the 1970s.

To make an initial approximation, one can establish a good correlation between the crude price average over 6 months and the monthly price of long-term gas contracts (see Figure 1), which confirms the close tie between the two energies. The following relationships give us an order of magnitude: When the crude price stood at \$20/b (\$3.7/MMBtu), the gas price in Europe approximated \$3/MMBtu (€8.6/MWh, with the dollar at €1.2). When the crude price hit \$60/b (\$11/MMBtu), gas cost about \$7/MMBtu (€20 /MWh). Prices are currently in this range.

Fig. 1 Tie between the price of long-term gas in Europe and the Brent price



Remark: The long-term price of gas is indicative and reflects European averages.

Challenges to These Formulas in Deregulated Markets

Long-term contracts are perfect instruments to meet the needs of emerging gas markets, with their “Take or Pay” clauses (containing a contractual obligation to “Take and Pay” for a minimum quantity) and their prices indexed on competing energies. In the absence of a reference gas price, indexing is used to obtain a price in line with the market, thereby ensuring that gas will find sales outlets.

The market risk is low, enabling the purchaser to make a longer-term commitment and accept the “Take or Pay” clause. Actually, the latter has practically never been implemented, either in Europe or in Asia. The system is perfectly geared to limiting risks and financing transport investment. This type of contract will long continue to be

used in countries developing a gas industry (e.g. China and India today).

Gas market deregulation, undertaken in the mid-1980s in the United States and the United Kingdom, has challenged the long-term contract. To put it schematically, deregulation has two major objectives:

- have one operator manage transport and distribution, since duplicating the network would be an economic absurdity;
- open up gas buying and selling to competition.

This change requires the separation of operator activities, by implementing separate accounts or separate legal entities. There would be the network managers supervised by a regulatory authority (in France, the CRE), on the one hand, and production and marketing companies ruled by market laws, on the other. The consequences of this new organizational set-up are far-reaching.

First of all, long-term visibility is not as good as when there is one operator per region (Germany) or per country (e.g. France or Italy), as in the past. On a competitive market, it is impossible to accurately determine demand for any given operator in 5 years, much less in 10 years. Entering into long-term contracts over a 20-year period becomes a much riskier proposition. Therefore, the first consequence of deregulation is to reduce the buying contract term to less than 10 years compared to 20 to 25 years previously. That’s what happened in the United States and the United Kingdom.

Key differences between monopolistic and deregulated markets

	Monopolistic market	Deregulated market
Term of contract	Most long-term contracts: 20 to 25 years	Short-term (1 month), medium-term (18 months) and long-term contracts (less than 10 years)
Buying	“Take or Pay” clause	“Take or release” clause (US)
Price	Calculated on a net-back basis, indexed on competing energies	Indexed on the spot market price
Transport	Managed by a gas company with a monopoly	Managed by a dedicated transport company; signature of transport contracts (TPA)

TPA: Third-Party Access.

The second major consequence is the emergence of a spot market for natural gas. Spot trading from day to day enables a large number of market players to balance their supplies by

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making short-term exchanges on the market. The creation of a market regulated by the Nymex or the IPE and of standardized contracts (such as futures and options) happens naturally to allow operators to cover their price risk, a basic function of such exchanges.

On a deregulated market, standard contract characteristics are different:

- The term of contract is shorter, with an array of contracts ranging from 1 month, 18 months and over 18 months (United States).
- The “Take or Pay” clause is occasionally replaced by a “Take or Release” clause (allowing resale of excess gas on the spot market).
- The price is set with reference to the gas market, which depends on the supply/demand equilibrium and not on competing energies.
- Gas transport is handled by a dedicated manager (not responsible for commercial operations); its rates are supervised by a regulator.

Contrary to a widespread misconception, the long-term contract does not totally disappear from a market when the spot price becomes the market reference. Long-term contracts are still in use, although now the term of contract is shorter and the price is indexed on the spot market. Relatively long-term transport contracts make it possible to plan future network investment requirements. To a certain extent, they offer the long-term visibility that existed in markets dominated by a single operator.

At any rate, decreased visibility on deregulated markets can be attributed more to the non-existence of a single operator than to the existence of a spot price. Long-term contracts bearing on large volumes (e.g. in Europe) enable effective supply planning. Planning is much harder for producers dealing with many buyers. In a deregulated market, strong price fluctuations make the necessary market adjustments. Price volatility is inherent to a competitive market.

The European Market: Current Situation and Outlook

A dual situation now exists on the European gas market: in Great Britain, the spot market price is the reference whereas on the continent the gas price is directly influenced by petroleum product prices. These two markets are not independent, because the Interconnector, the gas pipeline between Belgium and the UK, creates opportunities for arbitrage.

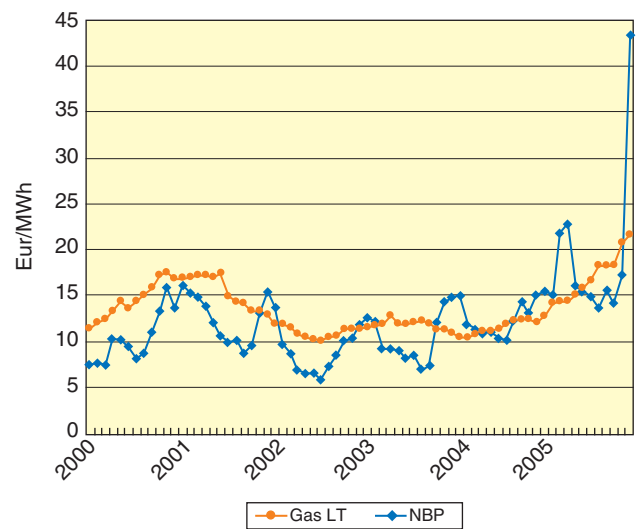
A look at gas price variations since 2000 (see figure 2) shows that the main uptrends and downtrends are common to both

markets. On the other hand, large price differentials have occurred. Roughly speaking, one can distinguish two periods: before 2003 and after 2003.

Before October 2003, the price on the UK market was noticeably lower than the indexed prices of long-term contracts on the continent. The latter served as upper limits to UK prices during tight market periods, especially in winter. The winter of 2003 marked a turning point, with the UK price equivalent to or even higher on average than the prices on the continent.

It's as if the long-term price acted to moderate trends (up or down) in the UK spot price: it served as a ceiling during periods of slack demand on the UK market (before October 2003) and, inversely, as a floor during periods of chronic tension (after 2003). The Interconnector enables two-way gas flows, hence opportunities for arbitrage.

Fig. 2 Spot price (NBP) in the United Kingdom and long-term price on the continent



NBP: National Balancing Point.

The National Balancing Point (NBP) in the UK is no longer Europe's only marketplace. Zeebrugge in Belgium and, to a lesser extent, the Title Transfer Facility (TTF) in the Netherlands are the two largest marketplaces on the European continent. These two markets are linked by the Interconnector, whose two-way flows between the United Kingdom and Belgium keep the spot prices at the NBP and at Zeebrugge in equilibrium for most of the year.

Given this context, the biggest question that arises today is whether this duality is likely to continue in the future. Long-term “Take or Pay” contracts currently represent about 90% of the gas supply in continental Europe. Outside the United Kingdom, the spot price only plays a limited role.

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The spot price will probably become more influential in the future, judging by what has happened on deregulated markets in the past. Whether this occurs quickly or not will depend on the emergence of more intense competition, which in turn depends on gas availabilities on the market and on spot prices.

This could be accelerated by a situation in which spot prices tended to be lower than long-term contract prices. Such a situation is likely to develop in 2006/2007 with the arrival of new transport infrastructure (pipeline and LNG) on the UK market.

So there is a very real short-term possibility that the European continent will adopt a spot price for its reference price. To some degree, this happens naturally on deregulated markets and it is hard to believe that Europe will be any different. In this possible future scenario, prices may not fall: this is borne out by current developments on the deregulated US or UK markets. A tight supply situation triggers soaring prices... the supply/demand equilibrium determines the price level.

An Indirect Link with Oil

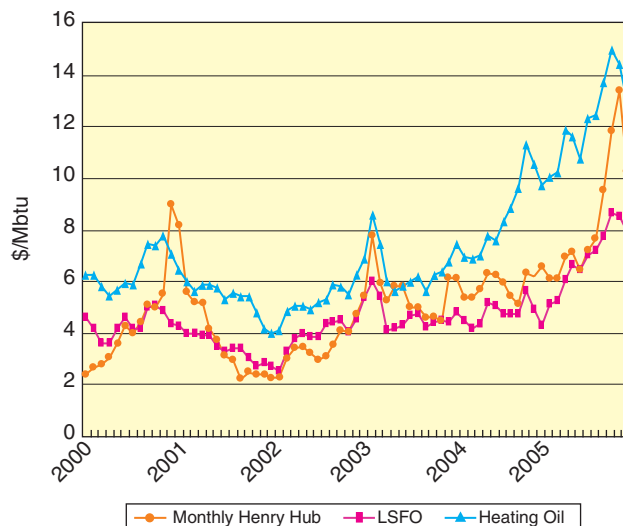
As we have already seen for the United States and the United Kingdom, there already exist natural gas markets with their own price barometer. The US market, where there is no longer interference with indexed prices, merits special attention.

On this market, reference spot prices are quoted at hubs where several pipelines converge, the most prominent being the Henry Hub in Texas. Although gas prices are set independently, a correlation does exist with the oil market. The figure 3 shows that the price trend for natural gas runs parallel to that of petroleum products. However, its monthly prices are more independent and range between an upper limit (the price of home heating oil) and a lower limit (the price of heavy fuel oil).

If the price of gas momentarily deviates from these upper and lower limit values, spring forces (inter-energy replacement) bring it back within the petroleum product price range.

Replacing natural gas with coal (electricity production) or heavy fuel oil (industry) helps avoid excessive price spikes. Inversely, an excessive decrease reaching levels below the heavy fuel oil price will stimulate gas demand and bring the price back into the heating oil/heavy fuel range. In the last few months, there has been price parity between natural gas and WTI crude, due to the shortage of supply caused by Hurricanes Katrina and Rita. If the winter is very cold, this limit would be exceeded before spring forces could exert downwards pressure.

Fig. 3 Spot price (Henry Hub) in the US and price of petroleum products (home heating oil and LS heavy fuel)



Therefore, even on this deregulated market, there is an indirect relationship with the oil market because of the possibilities for replacing one energy with another. Roughly speaking, the heavy fuel price serves as the lower price limit, which can rise in a tight market; here, the gas price comes close to the crude price and can even exceed it for short periods.

By Way of a Conclusion

The price of natural gas on the European market will continue to be directly tied to the price of crude for some time yet, considering the current importance of traditional long-term contracts indexed on the price of petroleum products.

This being said, the importance of hubs where prices are quoted, such as the NBP in Great Britain or Zeebrugge in Belgium, is increasing. There is good reason to think that a gas price will emerge and become the reference price for long-term contracts. Sophisticated indexation formulas (to average spot prices or futures over several months) could be used in addition to or to replace indexations on oil. Indexations on electricity will also come into more frequent use, given the size of its share in European and world gas demand.

Traditional contracts may be used to a lesser extent, but that does not mean that short-term contracts will reign supreme. Long-term contracts can exist even on deregulated markets, especially for the reservation of transport capacity. Nor will crude prices stop having an influence; the interaction between

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energies can be used to regulate excessive temporary price differentials.

Perhaps the “real” question is this: For natural gas, when will there be a **world price** and when will there be a **reference price** on the energy market? Looking to the future, which will bring developments on the Liquefied natural gas (LNG) market and the decline of oil production, perhaps in the ten to thirty years to come, these are legitimate questions.

In the United States, LNG is expected to develop from a relatively marginal source of supply into a major one. Accounting for 2% of US demand in 2003, it will represent over 20% by 2025 (source: DOE). It will have a major impact on the market because the United States will represent 25% of world trade versus 5 to 6% today.

This important change will help fluidize this market, probably creating opportunities for arbitrage with the two other LNG importing regions, i.e. Europe and Asia. If we also consider the arrival of the two Asian giants, India and China, there is every reason to think that an international natural gas market will be set up within the next ten years. Instead of a single world price, there will probably be several strongly correlated regional prices that will interact in the same way that benchmark crudes (Brent in Europe, WTI in the US and Dubai in Asia) do on the oil market.

The second issue, concerning the preeminence of natural gas over oil as the leading energy, is more problematical, given the inertia inherent to historical trends. Nevertheless, it ought to be considered, owing to the changes expected on the energy market.

The production of oil is expected to peak sometime during the next 10 to 30 years. This expectation might lead to an increasing use of oil in the transport sector, its natural outlet. In contrast, the use of natural gas is growing across all sectors — domestic, industrial, electricity production and, albeit to a more moderate extent — transport (NGV, Fischer-Tropsch diesel fuel). There is a legitimate argument in favor of making this energy the market reference.

It may be academic, but this question highlights the complexity characterizing the energy market of the future. The answer, still uncertain with respect to the link between energy prices, will probably become clearer in the next ten years.

Appendix: Long-Term Gas Price Trends

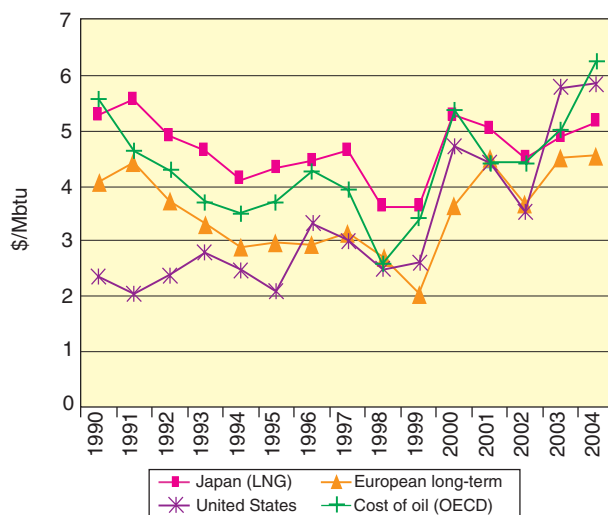
Natural gas prices, expressed in **constant 2004 dollars** for the three largest markets (Europe, Japan and the United States), are currently situated at especially high levels.

From a range of \$2 to 3/MMBtu, the gas price in **Europe** rose to over \$4/MMBtu where it has remained since 2000. It is expected to reach an average of close to \$6 for 2005. The price keeps rising because it is indexed on the price of petroleum products.

In **Asia**, the price, indexed on crude oil, also followed oil market trends. Since 2000, it has hovered around \$5/MMBtu, up from its earlier range of \$4 to 5/MMBtu. It is expected to near \$6 for 2005. As in the past, it remains higher than the European price, but with a lower differential: some Asian formulas limit increases above a given crude price (S curves).

In the **United States**, the year 2000 marked a real turning point that nobody anticipated: the price of gas gradually increased and exceeded \$5/MMBtu, compared to \$2 to 3/MMBtu before that date. It is expected to exceed \$7 for 2005. Market tensions (high demand, impact of the hurricanes) are responsible for this uptrend. 2005 may be an exception, but the basic trend for this market seems to be towards a high price.

Fig. 4 Annual average price of gas on the three key markets



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