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# Liberalization of the European Gas Market

Are oil-linked gas contracts on their way out?

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### Abstract

The European market for natural gas is in turmoil: The European Commission has passed various legislative reforms to achieve a liberalized European-wide integrated market and national regulatory acts seek to put an end to the traditional contracts which use oil-indexation. Several hubs have come into existence throughout Europe, where natural gas is traded and currently, oil-indexed contracts co-exist next to spot-priced gas in Europe. In the past two years, events of vast importance have been influencing the market further: Because of the recession and structural changes, demand for natural gas is driven down, while additional supply in the form of liquefied natural gas (LNG) and shale gas is glutting the world-wide market, causing in turn the spot- and futures prices of natural gas to deteriorate. At the same time, the oil price is recovering from its steep fall, making oil-indexed gas much more expensive than spot-priced gas, which outrages consumers and politicians and opens the door for exploiting arbitrage opportunities. Countries such as the Russian Federation, which traditionally provide Europe with natural gas, are in favor of oil-indexation, or as alternative a cartel organization, which could manipulate gas prices with production cuts. Currently, within GECF, there is no consensus on a common strategy to keep prices on a high level, and the massive gas oversupply on the market limits the market power of the organization further. Additionally to these events, the end uses of the fuels oil and gas are increasingly decoupling, and different production forms separate their economic ties further. It will become harder to remain with the historic system of linking the gas price to the oil price, as market conditions and economic rationales are clearly in favor of switching to pricing gas on a gas-to-gas competition basis. Until the oil-indexed gas contracts, which are still in use, will have expired, there will be a co-existence between the two pricing regimes in Europe. On the long-term view however, this contract form is bound to be dying out.

## Acknowledgment

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## Abbreviations

ACQ	annual contract quantity
AP	basic energy rate (from German: Arbeitspreis)
APX	Amsterdam Power Exchange
bcma	billion cubic meters per annum
BGH	Bundesgerichtshof (German for Federal High Court of Justice)
Ct	cents
d	day
e.g.	for example (from Latin: exempli gratia)
EIA	Energy Information Administration
GEFCF	Gas Exporting Countries Forum

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HFO	heavy fuel oil
i.e.	that is (from Latin: id est)
ICE	IntercontinentalExchange
IEA	International Energy Agency
kWh	kilowatt hour
LFO	light fuel oil
LNG	liquefied natural gas
LP	demand charge (from German: Leistungspreis)
LTGEC	long-term gas export contract
mt	million tons
Mtoe	mega tons of oil equivalents
NBP	National Balance Point
NYMEX	New York Mercantile Exchange
OECD	Organization for Economic Co-operation and Development
OPEC	Organization of Petroleum Exporting Countries
OTC	over the counter
ToP	take or pay
TPA	Third party access
TTF	Title Transfer Facility
UK	United Kingdom
USA	United States of America
ZEE	Zeebrugge Platform

## 1 Introduction

The gas market on Continental Europe is undergoing major changes: Due to various passages of the European Commission, the individual national markets should form a single, deregulated pan-European market, where prices are formed according to the fundamental market mechanisms, i.e. supply and demand on one or more trading hubs, while the traditional oil-indexed contracts should be on their way out. However, these regulatory changes are only one side of the coin: Further drivers and recent events, such as the global recession or the production of shale gas influence global gas markets and therefore the European market for natural gas. The goal of this paper is to analyze the European market for natural gas, to

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identify the key players and drivers of the market and to discuss their impact on a movement away from the traditional oil-indexation in European gas contracts.

In a first, introductory part, key facts about natural gas are given and an overview of the development of natural gas consumption in general is presented.

In the second part, the historical developments of the Continental European gas market are outlined and it is explained, how the oil-indexed, long-term contracts for natural gas have evolved according to the Groningen model, and how the oil-indexation has proceeded from the 1960s up until now and examples of some standard contractual clauses or procedures are outlined. In a further step, the liberalization attempts and the goals of the European Commission are briefly discussed. Furthermore, an overview on physical and virtual trading hubs in Europe is given, and it is described, how these market places are developing.

In the subsequent main part of the paper, the key forces, events and market players on the European gas market are described and it will be explained, how they are interlinked: First of all, the possibility of a natural relationship between the oil price and the natural gas price will be discussed. In a further step, a close look on the global economy is taken and it will be analyzed, how the economic recession, unconventional gas production methods and increased trades of LNG are impacting the natural gas market. Afterwards, there follows a discussion, on how arbitrage opportunities between different pricing regimes arise and what consequences they have on the gas market. In a next section, the oil-indexed prices are compared to the spot traded gas price and their differences are outlined. The sequel examines how the different events have increased pressure on the system. In a next step, the market power and the goals and strategies of the gas exporting countries are discussed.

In the final chapter of the paper, the findings will be summarized and as a conclusion, a prognosis about the development of pricing mechanisms in the European market is given.

## 2 Key Facts about Natural Gas

Natural gas is a combustible fossil fuel and one of the main energy sources besides oil and coal. It is often found as a by-product of oil exploration. Natural gas is formed primarily of methane, but it can also include other heavier hydrocarbons such as ethane, propane, butane and pentane, and also water. (Krauss, 2010; NaturalGas.org, 2010; Energy Charter Secretariat, 2007, p. 59)

The chart below shows the usual composition of natural gas, before the refining process:

**Table 1: Typical Composition of Natural Gas**

Gas	Structural Formula	Proportion
Methane	CH <sub>4</sub>	70-90%
Ethane	C <sub>2</sub> H <sub>6</sub>	0-20%
Propane	C <sub>3</sub> H <sub>8</sub>	
Butane	C <sub>4</sub> H <sub>10</sub>	
Carbon Dioxide	CO <sub>2</sub>	0-8%
Oxygen	O <sub>2</sub>	0-0.2%
Nitrogen	N <sub>2</sub>	0-5%
Hydrogen sulphide	H <sub>2</sub> S	0-5%
Rare gases	A, He, Ne, Xe	traces

Source: NaturalGas.org (2010)

Natural gas is mainly used for heating, but it is increasingly becoming a source for the generation of electricity, it is necessary for many industrial processes and used as a chemical raw material. During the course of the last century, natural gas has gained a major role in the supply of energy around the world and it has become an important, internationally traded commodity. In the past however, natural gas hardly ever attracted headlines and interest like oil did, but according to Krauss (2010), the beginning of a gas era is in sight, where gas builds a bridge between the currently common fossil fuels and the alternative renewable energy sources of tomorrow. (Krauss, 2010; Rügge, 1995, p. 46)

A further characteristic of natural gas is, that it has in none of its fields of application, neither an economical nor a technological monopoly as it can always be substituted by oil, coal, electricity from alternative energy sources; one speaks therefore of a competition between energy substitutes (Rügge, 1995, p. 46).

The main advantages of natural gas are that it is a comparatively efficient fuel and that this fuel type is cleaner in the burning process than other fossil fuels, i.e. oil and coal are, because less greenhouse gases are being emitted when burning gas (Banks, 2007, p. 181). Furthermore, the International Energy Agency [IEA] states, as cited in Banks (2007, pp. 51, 173-174), that natural gas is an abundant resource. Large amounts are available for example in Russia, where a considerable share of the reserves of the world are located or in the Middle East with around 40% of the proven global gas reserves. The available proven quantities suffice the current needs for gas easily. A recent study of booz&co. (2010) even suggests, that at least during the up-coming five to seven years, there will be a significant worldwide oversupply of natural gas. (Holz, von Hirschhausen & Kemfert, 2008, p. 769; booz&co., 2010)

However, despite its current abundance, like oil and coal, natural gas is a limited fossil fuel, and the reserves are concentrated on a few geographical areas in the world. Even though views on the peak of exploitation of natural gas differ, a lot of estimations forecast that the natural gas production will peak at some point within the next 20 to 30 years. Estimates of Europe's Energy Portal (2010) suggest that the reserves of natural gas will be exhausted by the year 2068; in comparison, the estimation for the date of exhaustion of oil is the year 2046. However, these numbers have to be regarded cautiously, as new, cheaper production technologies allow for exploitation of novel sources, such as exploitation from shale gas. (Banks, 2007, pp. 171, 185)

Besides its named advantages, i.e. efficiency, cleanness, and abundance, there are some serious disadvantages of natural gas, which have to be taken into consideration as well. The main drawback of natural gas lies in the enormous and risky investments, which have to be undertaken for the development of production and distribution infrastructure, i.e. gas pipelines and gas storage facilities, or



infrastructure for producing and distributing LNG. Moreover, especially in the case of cross-border pipelines, there are often very few market players, leading to a much bigger investment risk than for cases with many market players. Long-term contracts are a powerful instrument in order to help to share the risk between these few market players. Because of these high costs involved with establishing the infrastructure, the gas markets remained for a long time regionally concentrated and it was not until after the Second World War that gas could be marketed on a wider, international scale. Nevertheless, even today, the markets for natural gas remain regional and there is no single world market for natural gas, like it is in the case of oil. (Energy Charter Secretariat, 2007, pp. 43-44, 59)

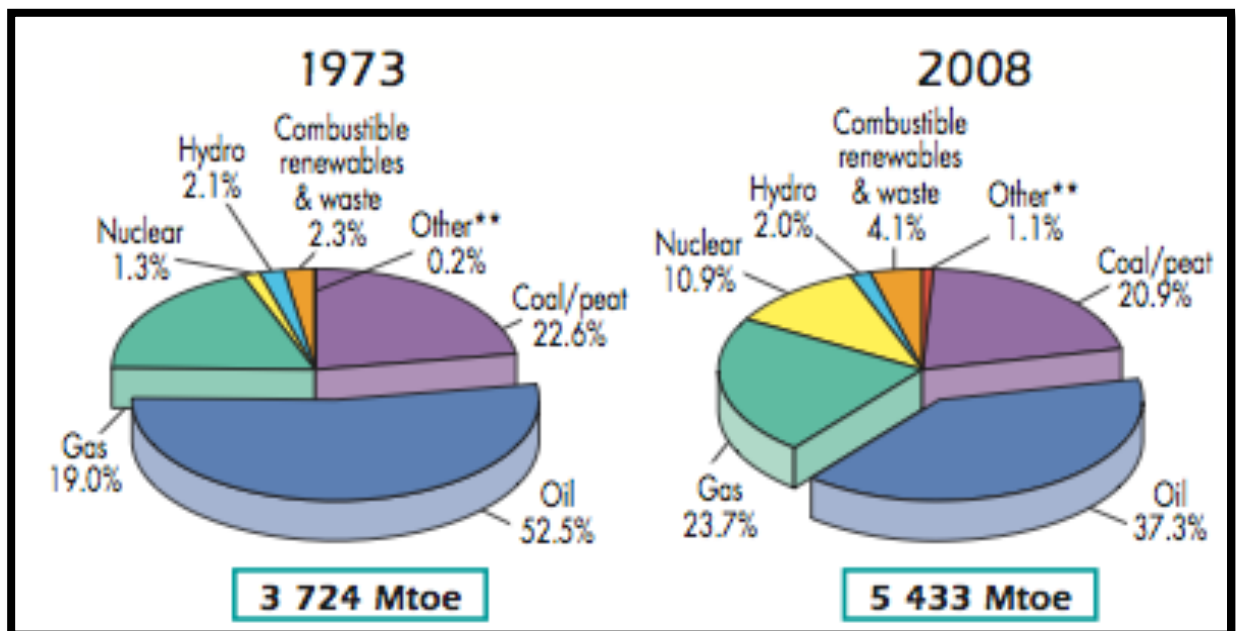
An alternative to transporting natural gas via pipelines to the customers is the transportation of natural gas in form of LNG, where liquefied gas is carried with special ships between the continents. Upon the arrival at its destination, the LNG is transported to storage tanks and is later re-gasified, so that it can then enter the local distribution network. However, this transportation mode is only more profitable than pipelines, if the commodity is transported over very far distances, because the investments, which are required to construct a LNG supply chain, are considerably high and can reach US-\$ five billion for a LNG project with a capacity of nine billion cubic meters per annum (bcma). (Rogers, 2010, p. 3)

The Economist (11 February 2006, as cited in Banks, 2007, p. 48) calculated, that only for distances, which exceed 3000 kilometers, the transportation as LNG is more cost efficient than using the traditional pipelines. Furthermore, the liquefaction and de-liquefaction processes involved in LNG are extremely energy consuming, thus reducing the total energy efficiency of the commodity. Additionally, the political debates need to be mentioned, which arise, when the establishments of new terminals for LNG are in planning because of their risks such as explosions and fireballs (Banks, 2007, p. 58; 177-178). Regardless of the high investments required, LNG is a major component of the overall, global natural gas markets, among other reasons because of its obvious advantage over the pipeline infrastructure - its much greater flexibility in transport.

As previously mentioned, natural gas makes an important contribution to the international energy supply, which the following numbers will demonstrate: The

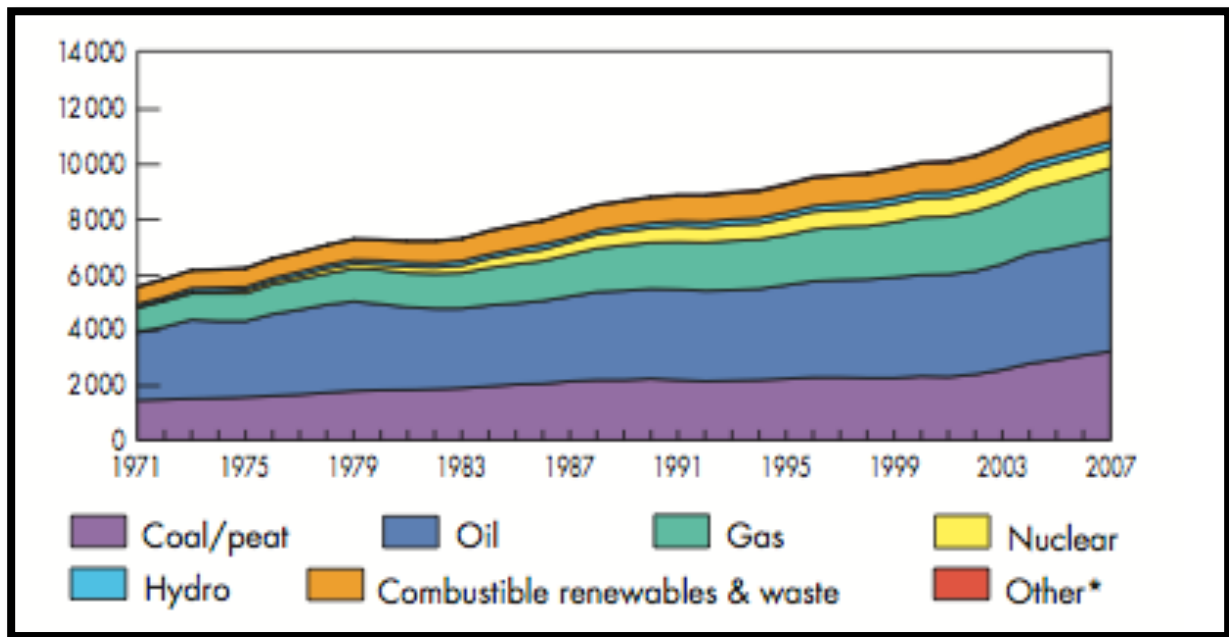
share of gas of the world's total supply of primary energy has steadily increased from 16 percent in 1973 to 20.9 percent in 2007 (IEA, 2009, p. 6). The IEA (cited in Banks, 2007, p. 49) assumes, that this figure will rise to at least 26 percent by 2020. In spite of the long-term trend of a continuous increase of consumption of natural gas, during the period of recession in the years 2008 and 2009, its demand has collapsed dramatically in all regions of the world for the first time since the 1960s, resulting in a tremendous oversupply (Oushoorn, Schlaak & Waterlander, 2010, p. 2).

**Figure 1: 1973 and 2008 Fuel Shares of Total Primary Energy (excluding Electricity Trade)**



Source: IEA (2009)

**Figure 2: Evolution of World Total Primary Energy Supply by Fuel (in Mtoe)**



Source: IEA (2009)

### 3 The European Gas Market

In Europe, just like in the rest of the world, the consumption of natural gas has steadily increased – with the demand drop during the recession period after the financial crisis as exception to the over-all long-term trend. The increase of the consumption has been accompanied – with the exception of Norway - with a continuous decrease of domestic production, because production limits have been reached. This drop of domestic production is especially severe in the UK. Because of this decreased European production, imports have become increasingly important to allay Europe's hunger for natural gas: Already in the 1980s, pipeline-imports became essential for Europe, and by 2008 they accounted for 39 percent of Europe's overall supply of natural gas (not including Norway), while LNG imports amounted to ten percent. The imports into Europe originate mainly from Russia, Algeria, Norway, Libya, Iran and Azerbaijan, where the markets are usually controlled by state-owned monopolistic companies, such as the Russian Gazprom, Qatargas from Qatar, Statoil from Norway and the Algerian company Sonatrach. (Rogers, 2010, p. 14; Waterlander, Oushoorn, Sarraf & Schlaak, 2009, p. 8)

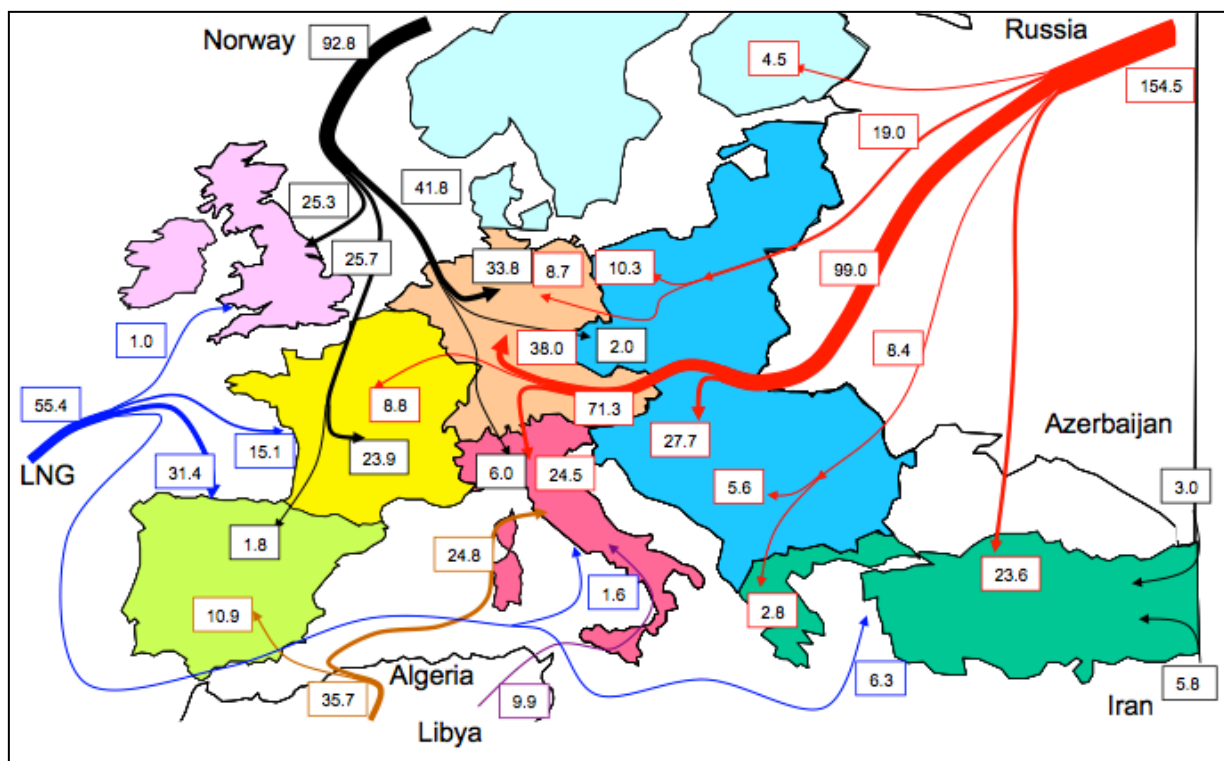
Furthermore, considerable investments into the development of LNG receiving infrastructure have been made since 2005, to add LNG imports from the Atlantic Basin, the Middle East, Qatar, and Nigeria to the supply of natural gas for Europe

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(Bloom & Patel, 2008, p. 1). It is estimated, that by 2030, the share of imported natural gas in the European Union will amount to as high as 80 percent (Solanko, 2010, p. 1).

The chart below presents the supply network in Europe by showing the pipeline and LNG imports into Europe. The graph illustrates clearly the concentration on the import countries Russia, Norway and Algeria, while LNG imports are gaining remarkable importance as well.

**Figure 3: Pipeline and LNG Imports into Europe in 2008**



Source: BP 2009. Gas and LNG Trade Flow Data (cited in Rogers (2010))

## 4 Gas Pricing

Even though oil and gas are both very important commodities in the energy supply, the markets and therefore the pricing mechanisms and contracts for these two commodities differ to a remarkable extent. Unlike in the case of oil, where we have one single global market, the story looks completely different for natural gas: The pricing and contractual systems for natural gas have developed differently in different geographical regions; and even today there is not an integrated, single world market for natural gas, but we find tremendous differences in gas contracts in

the different regions of the world.

In North America, where the liberalization of natural gas markets started about 20 years ago, and in the United Kingdom (UK), the liberalization progresses in the markets for natural gas are very advanced. One reason for this sophisticated development in these areas is, that natural gas is a domestic resource both in the United States of America (USA) as well as in the UK. Attributes of these highly developed markets for natural gas are their great liquidity and the pricing mechanisms, where well-established spot and futures markets for natural gas on established exchanges as well as a wide range of individualized over-the-counter (OTC) contracts are the forces behind the gas price. A further characteristic of these markets is the much shorter contract durations compared with the traditional continental European contracts for gas of around eight to fifteen years. (Energy Charter Secretariat, 2007, p. 99; Banks, 2007, p. 53; Neumann & von Hirschhausen, 2004, p. 177)

However, despite their advantages, deregulated commodity markets usually exhibit extensive price volatilities, i.e. a very high price risk both for industrial customers as well as for energy suppliers (Bayern LB, n.d., p. 1).

### 4.1 Groningen Model

In Continental Europe, the historical roots for the local pricing mechanisms of natural gas and the long-term contracts lie in the discoveries of the super-size Groningen field, which belongs to the Netherlands as well as the gas fields in the North Sea and the subsequent attempts of the governments to design a model, which would enable the countries to achieve the highest possible total revenues from natural gas sales.

In 1958, when the world's largest gas field at that time was discovered, the Dutch government tried to develop together with the petroleum companies Esso and Shell a concept, which would generate the maximum revenue for the Netherlands in the long-term and would also make natural gas an attractive and competitive alternative to other energy resources, for the potential customers in an energy market which was dominated by oil. To generate an attractive rent in the long-term, the government, Shell and Esso decided against pricing the commodity on its low production cost or pricing according to supply and demand on the market, but

instead established the so-called “market value approach” or “netback market approach”, which links the gas price to the prices for its energy substitution products, i.e. oil, and to a lesser extent, coal. The focus of oil in the replacement formula is reasonable in the sense that oil is an extremely liquid commodity, where traders can efficiently hedge their exposures with derivative instruments, thus linking the gas prices to the oil price, links natural gas to a highly liquid market. (Konoplyanik, 2010, pp. 6-7; Energy Charter Secretariat, 2007, p. 147)

The basic pricing formula used gasoil (light fuel oil or heating oil (LFO)) with a weight of 60 percent and residual fuel oil (heavy fuel oil (HFO)) with a weight of 40 percent, but these weightings were subject to changes and now the weighting usually depends on the type of end-users, i.e. industrial or residential users and the geographical origin of the contracts. Because of complaints by the buyers of natural gas, who felt that this concept with its strong focus on oil and oil products neglected different feasible fuel alternatives such as coal or electricity, these contracts began to change, and with time they started to include a wide range of other energy indices upon the oil index. (Konoplyanik, 2010, pp. 7-9; Melling, 2010, pp. 21-22)

To give an example about a common pricing technique and typical contractual elements, the formulas in a German contract will be shown: The typical contractual structure used by the national gas distribution companies includes so-called demand charges, basic energy rates, as well as a surcharge, which is being imposed when oil prices fall below a certain threshold to avoid a too strong decrease of the basic energy rate: According to Möller, Niehörster and Waschulewski (2005, p. 459) the demand charges and the basic energy rates are often calculated by using the following pricing formulas:

- Demand charge  $LP := LP_0 + 0.01575 * (L - L_0)$  [Ct/kWh/d]

$LP_0$  (demand charge, from German: Leistungspreis) is the basic demand charge at the beginning of the time period,  $L$  is a defined monthly charge, which is used as a basis for adjusting the demand charge to the general price development, while  $L_0$  is the basic rate at the beginning of the time period.

- Basic energy rate  $AP := AP_0 + 0.09098 * (LFO - LFO_0)$  [Ct/kWh]

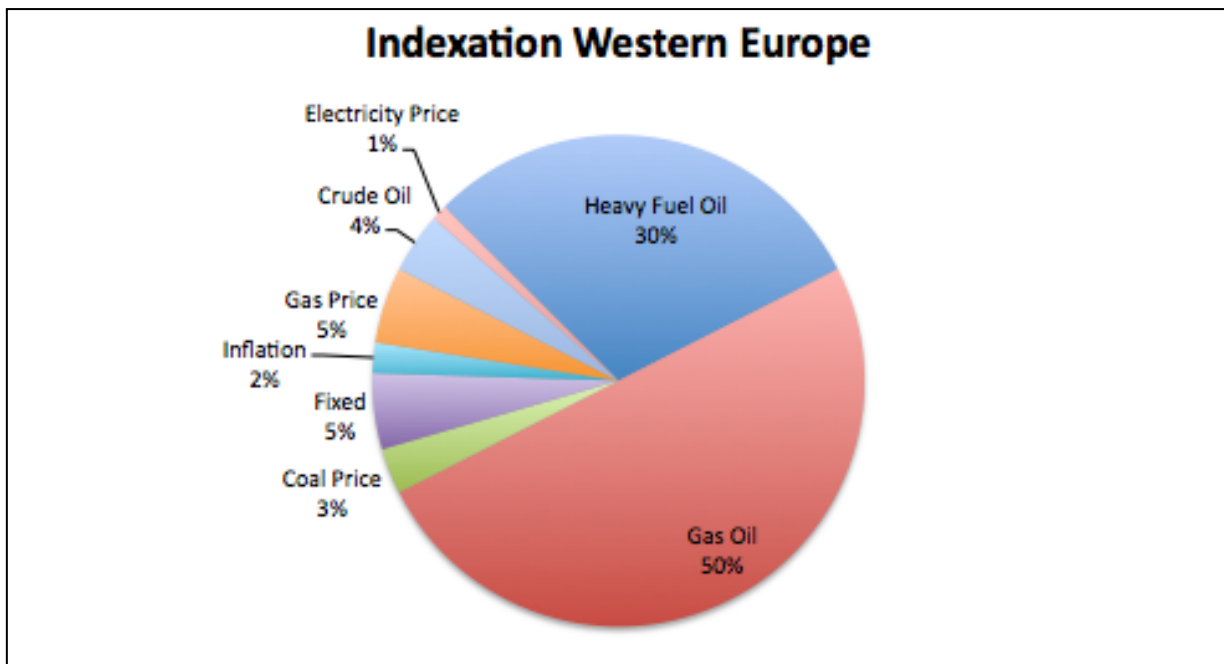
The  $AP$  (basic energy rate, from German Arbeitspreis) is determined as follows:  $LFO$  is the reference price for light fuel oil calculated by the German

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Federal Office for Statistics, which allows for the adjustment of the basic energy rate to the development of the oil price.  $LFO_0$  is here a basis value. The factor 0.09098 determines the slope of the gas price curve depending on the oil price. Typically this factor is identical to the so-called equivalence factor, i.e. the conversion rate of the energy of LFO to the energy value of natural gas.

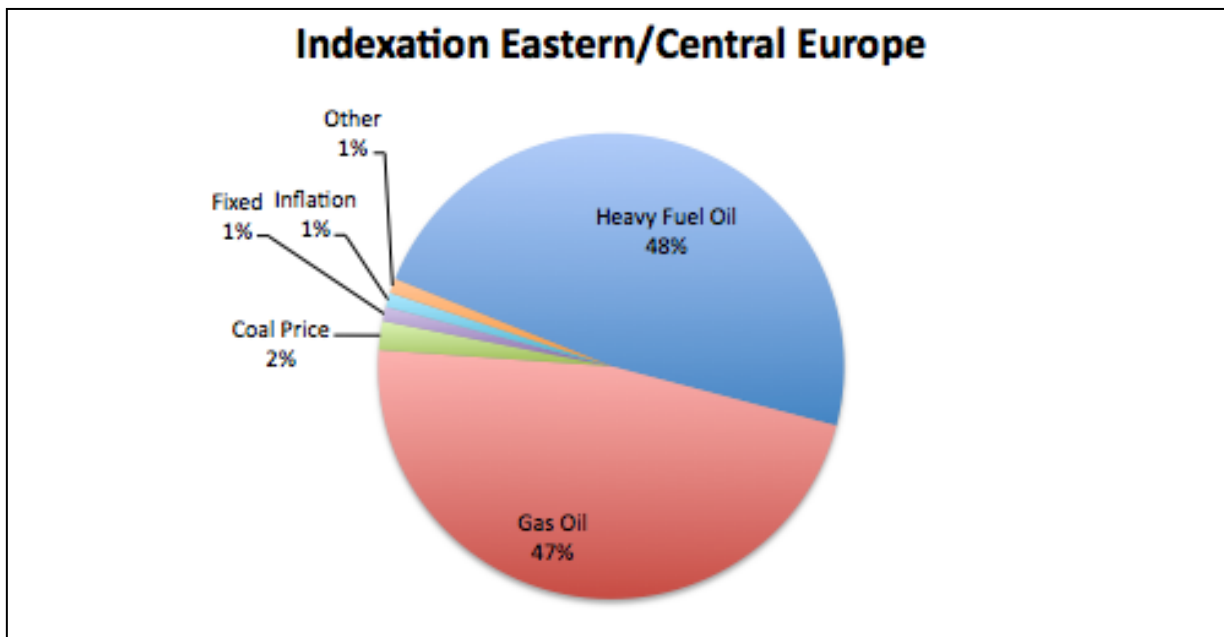
Not only in Germany, but also throughout the continent, linking gas prices to oil prices has persisted up until today: The DG Comp. Energy Sector Inquiry of 2005/2006 (cited in Melling, 2010, p. 26) draws the following picture for the price indexation in Europe:

**Figure 4: Price Indexation used in Western Europe**



Source: Melling (2010)

**Figure 5: Price Indexation used in Central and Eastern Europe**



Source: Melling (2010)

In order to avoid a high volatility of the gas prices and to smoothen its development, it is common to pool the oil quotes of several months; a popular form for the price adjustments is the so-called 6/3/3-settlement, where the mean is calculated with a time lag of three months using the quotes of the past six months and adjusting prices every quarter of the year (Möller, Niehörster & Waschulewski, 2005, pp. 459-460). Regular price reviews in the contracts ensure that gas prices are maintained at a competitive level and thus the marketability of natural gas compared with its alternatives on the fuel market can be secured. (Konoplyanik, 2010, pp. 7-9)

Besides allowing natural gas to become a competitive alternative to other fuels, a further advantage of this concept of binding the gas price to the prices for oil is, that these prices are quoted on energy exchanges; thus, the potential for price manipulations and exploitation of market power by single market players, namely gas exporting companies, can be eliminated. (Stern, 2007, p. 15)

One further key advantage of the Groningen concept is its ability to plan and control cash flows: The enormous size of the Groningen field required considerable investments in the multi-billion dollar range, making a short-term optimization of the investment impossible. Hence, the Groningen concept needed to be of a fashion, which would optimize the huge investments into the infrastructure for this super-size natural gas field in the long run. The long-term nature of the contracts between the



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market players helped to significantly mitigate the investment risk by ensuring lasting and stable cash flows, which aim at matching the duration of the project lifetime. (Konoplyanik, 2010, pp. 7-9)

Konoplyanik (2010, pp. 7-9) summarizes the Groningen model described above with the following three key characteristics and their purposes:

**Table 2: Key Characteristics of the Groningen Model**

Key Characteristic	Purpose
Long-term contract between producer and purchaser	<ul style="list-style-type: none"><li>• Reduction of investment risk (guaranteed pay back of investment in infrastructure)</li></ul>
Linking gas prices to prices for energy substitutes	<ul style="list-style-type: none"><li>• Making natural gas an attractive and competitive alternative to other energy forms</li><li>• Maximizing long-term rent</li></ul>
Regular price reviews within and of the formula	<ul style="list-style-type: none"><li>• Maintaining prices at competitive level</li><li>• Securing marketability of natural gas</li></ul>

Source: Konoplyanik (2010)

Those three key characteristics of the Groningen model have been used on most of Continental Europe up until recently, when the European Union attempted to deregulate the gas market.

Besides the Netherlands, the Dutch Groningen concept of oil-indexing was being adapted by other providers of natural gas, such as by the former USSR and then later the Russian Federation, Algeria and Norway. Because of the lack of spot markets for commodity trading at that time, also LNG contracts were based on the long-term and with oil-indexation. (Melling 2010, pp. 20-21)

Using the oil price as basis to form the price for natural gas has persisted to be the most common pricing technique throughout most member states of the European Union, so that even today the Continental price of such gas contracts follows the oil price with a certain time lag. Furthermore, the delivery contracts on the national as well as on the international level for natural gas are of a long-term nature, with durations of several decades; import contracts for example typically last for thirty

years, while contracts between transmission and distribution companies normally have a duration of twenty years. For LNG contracts for Europe, the story is similar to pipeline supply contracts, where the typical contractual period lasts twenty years. (Möller, Niehörster & Waschulewski, 2005, p. 458; Treeck, 2009, p. 6, Melling, 2010, p. 21)

The above-mentioned long-term contracts between producers and gas distribution companies, as well as between the gas distribution companies and their end-customers typically include a so-called “take-or-pay (ToP) clause”. According to this clause, the consumer agrees to pay for a certain, specified quantity, regardless of the actual usage of this amount; therefore, if only quantities below this ToP-threshold are consumed, severe financial losses will be incurred, as the contractual partner has to pay for the amount of the ToP-quantity in any case. The main reason behind these ToP-clauses is risk management; as such a clause secures the gas sales and can therefore mitigate the financial risk of the high investment costs of exploitation and infrastructure developments. Besides the ToP rule, the contract includes the Annual Contract Quantity (ACQ); according to this ACQ-clause, the supplier is obliged to provide its customer with natural gas according to the threshold upon which renegotiations are foreseen. Furthermore, the contracts include clauses on regular reviews of the pricing. (Rügge, 1995, pp. 41-45)

The Groningen model itself was a success, making it possible for natural gas to become an important, widely used energy source in Continental Europe with a significant share of the primary energies in this previously oil-dominated market and it has been adapted to a certain extent by other markets, for example the Asian market for natural gas (Treeck, 2009, p. 10).

Nevertheless, the mature natural gas market in Europe under this system exhibits major drawbacks compared with the liberalized markets in the USA and in the UK.

Because of the considerably high investment costs into exploitation and transportation infrastructure development such as for example the establishment of pipeline networks, we find here a textbook example of a natural monopoly, where it is most efficient, if a single company serves the whole market instead of many competing companies, because of the large economies of scale, which can be exploited by the monopolistic supplier (Pindyck & Rubinfeld, 2005, p. 362). Indeed, in most countries in Continental Europe, monopolistic market structures were the

typical case, before the different gas directives, and they were either established by the government or backed up by competition law (Treeck, 2009, p. 6).

Treeck (2009, pp. 10-11) identifies the following weaknesses of this monopolistic market structure and the resulting outcomes: Even though there is a natural monopoly in the case of gas market, in this specific case there is apparently not enough incentive for the monopolistic companies to work efficiently: Over-capacities are not being avoided and the standard of customer service quality is comparatively low. For example, according to Möller, Niehörster and Waschulewski (2005, p. 458) gas supply companies have been harshly criticized for exploiting their market power by not relaying decreases in the oil prices to their customers, acting therefore in contradiction to the price adjustment clauses in the contracts. A further weakness of the monopolistic system is, that the described economies of scale are not extensively enough exploited, thus resulting in unnecessary economic costs for the market participants. Treeck (2009, p. 11) reckons, that these market inefficiencies threaten not only the natural gas industry, but that even the competitiveness of other industries in the European Union can be endangered, because the current inefficiencies affect the cost structure of these industries to a great extent.

### **4.2 Liberalization Efforts by the European Union**

Because of the above-mentioned disadvantages of the market structure based on the Groningen model on Continental Europe as well as the import dependency of Europe accompanied with an increasing growth of demand, reforms of the gas market became inevitable. The European Union intended to deregulate the natural gas market on Continental Europe since the 1990s and anticipated to complete this deregulation by 2007. The goal was to increase competition, while insuring the future supply of natural gas into Europe, which becomes increasingly dependent on imports. A deregulated, single internal European natural gas market should be established, similar to the natural gas markets in the USA and the UK, which have been liberalized about 20 years ago.

According to the IEA (2000, p. 11), the major advantages of such a liberalized, competitive market for natural gas are a wider selection of providers, lower end prices for the consumers and a higher standard of customer care with a better service quality. Therefore, the European Commission (2007, p. 4) was expecting great economic benefits arising from this energy market reform in the natural gas

sector: “Well functioning energy markets that ensure secure energy supplies at competitive prices are key for achieving growth and consumer welfare in the European Union.”

Already as early as 1988, the European Union declared the single European energy market as goal, which had to be achieved. For the market for natural gas, three gas directives – the first in 1998, the second in 2003 and the third in 2008 – have been passed by the European Commission. Through these three gas directives - which intent to regulate the whole supply chain from production, over transportation to distribution – competitiveness shall be achieved, while they still ensure the security of the supply in Europe. The main regulatory reforms of these gas directives include third party access (TPA) to transportation network, unbundling, tarification of transport, balancing services and storage, trading and eligibility, provision of an institutional framework, and further important issues such as information access, a clear vision of a liberalized gas market, the harmonization of the different national gas markets in Europe, and lastly the security of the supply of natural gas (IEA, 2000, pp. 14-22):

**Table 3: Goals of the Gas Directives by the European Commission**

Regulatory Reform	Purpose	Forms/Conditions
TPA to transportation network	<ul style="list-style-type: none"><li>• Maximize choice of suppliers</li><li>• Generate competition between suppliers</li><li>• Stimulate liquidity</li></ul>	<ul style="list-style-type: none"><li>• Negotiated TPA</li><li>• Regulated TPA</li></ul>
Unbundling (separation of natural gas services and supply into separate components with individual pricing)	<ul style="list-style-type: none"><li>• Secure non-discriminatory treatment for access-seeking companies</li><li>• Avoid favoritism of vertically-integrated companies of own gas supply business</li><li>• Allocate the costs to the different activities</li></ul>	<ul style="list-style-type: none"><li>• Accounting separation</li><li>• Functional separation</li><li>• Operational separation</li><li>• Divestiture (ownership separation)</li></ul>

## Liberalization of the European Gas Market

of the company		
Tarification of the transport	<ul style="list-style-type: none"> <li>• Cost-reflective pricing of transport access</li> <li>• Pricing must provide effective incentives for investments</li> </ul>	<ul style="list-style-type: none"> <li>• Distance-related tariffs</li> <li>• Postage-stamp tariffs</li> <li>• Capacity-related tariffs</li> <li>• Throughput-related tariffs</li> </ul>
Balancing Services and Storage		
Trading and Eligibility	<ul style="list-style-type: none"> <li>• Liquid market</li> <li>• Competitive market</li> <li>• Efficiency</li> <li>• Security of supply</li> </ul>	<ul style="list-style-type: none"> <li>• Sufficient transportation infrastructure with flexibility services</li> <li>• Broad access to transportation</li> <li>• Eligibility of local distribution companies for TPA</li> <li>• Exposure of local distribution companies to TPA</li> </ul>
Institutional Framework	<ul style="list-style-type: none"> <li>• Application of competition law</li> </ul>	<ul style="list-style-type: none"> <li>• Competition Authorities</li> <li>• Gas regulators</li> </ul>
Information Access	<ul style="list-style-type: none"> <li>• Increase Market Transparency</li> <li>• Reduction of transaction costs</li> </ul>	<ul style="list-style-type: none"> <li>• Encourage good, timely and easily accessible information at earliest stage of market development</li> </ul>
Harmonization of the national markets	<ul style="list-style-type: none"> <li>• Integration of the national gas markets in Europe</li> </ul>	<p>Harmonization in:</p> <ul style="list-style-type: none"> <li>• Energy taxation</li> <li>• Environmental regulation</li> <li>• Technical standards</li> </ul>
Security of supply	<ul style="list-style-type: none"> <li>• Short-term supply</li> </ul>	<ul style="list-style-type: none"> <li>• Operational security</li> </ul>

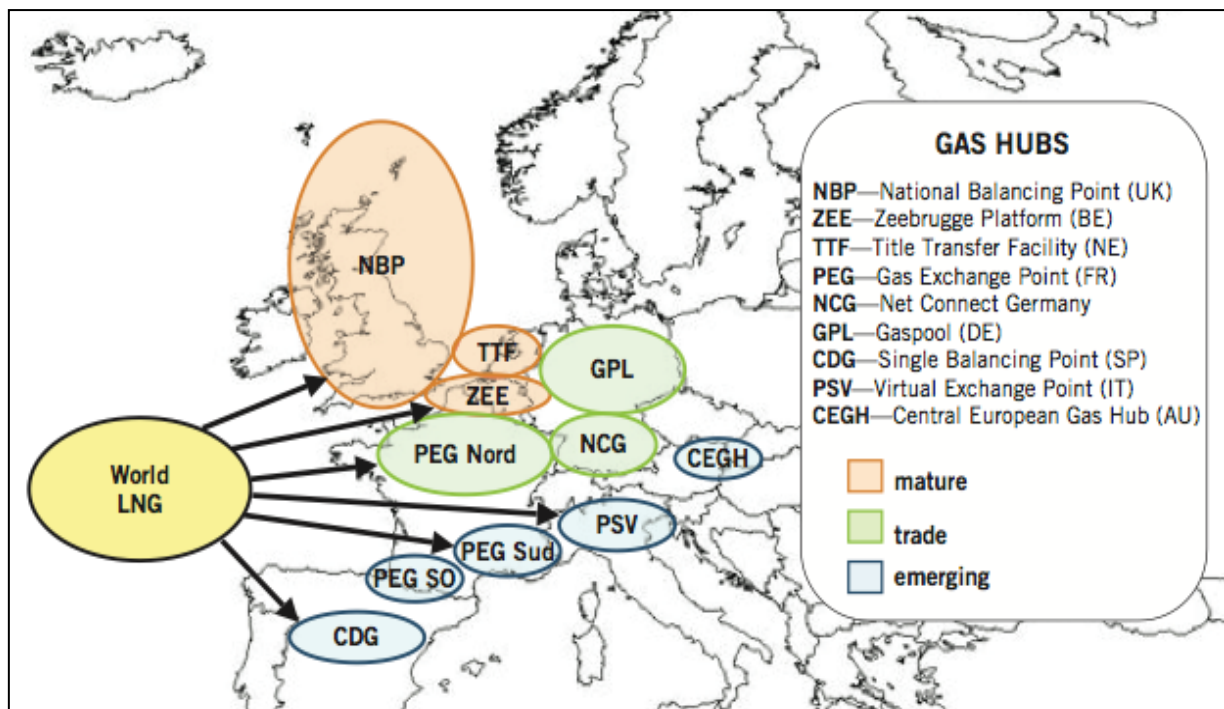
security	standards
• Long-term supply	• Gas supply
security	diversification

Own table; Source of information: IEA (2000)

### 4.3 Hubs

It was expected, that because of the liberalization, one or various trading hubs with increasing liquidity similar to the Henry Hub in Louisiana in the USA would emerge. The Henry Hub is a connection point of a high number of intrastate and interstate gas pipelines and it provides the benchmark for the price formation of natural gas in the whole North American region. Its prices, which are quoted on the New York Mercantile Exchange (NYME) determine the prices for the whole of North America. In Europe, there exist several of such trading hubs – both virtual and physical ones - where the market players have easy access to suppliers and demanders of natural gas. Not only serves a hub as a spot market for natural gas, also longer-term contracts are traded on the hubs. (Stern, 2007, p. 17)

**Figure 6: European Gas Hubs**



Source: (Melling, 2010)

Of the European gas trading hubs, the National Balancing Point (NBP) in the UK, which was developed in the mid 1990s, is the most mature and liquid virtual trading hub, and its prices serve as a benchmark for almost all traded gas in the UK, which is indexed to the prices of this hub. The NBP trades futures contracts on the IntercontinentalExchange (ICE) in Atlanta in the USA and spot contracts on the Dutch Amsterdam Power Exchange (APX). The NBP is connected to Continental Europe by the Interconnector and the Balgzand Bacton Line and because of its liquidity, it influences the continental hubs considerably, more specifically, the continental markets trade usually against the NBP prices: Both Zeebrugge Platform (ZEE) in Belgium and the Title Transfer Facility (TTF) in the Netherlands are therefore highly correlated with the NBP, while the German hubs are linked to the NBP via pricing against the TTF, hence the NBP is the most dominant market for natural gas in Europe. Of the continental hubs, ZEE and TTF are the most important ones, but they lag far behind the NBP in terms of liquidity. Furthermore, substantial progress in gas trading could be achieved in Germany and France: LNG terminals have been connected to major import pipelines in France and in Germany, multiple pipeline networks could be merged under a single trading platform. Additionally, hubs are developing in Austria and Italy. (Melling, 2010, pp. 23-25; Sikorski, 2010, p. 8)

A standard measure for the liquidity of the trading hubs is the so-called churn rate, which is the ratio between traded volumes and delivered volumes. For a hub to be considered to be liquid, a churn rate of at least fifteen has to be achieved. In the USA, the most important hub – the Henry Hub – achieves a churn rate of around one hundred; therefore this hub is decidedly very liquid. The NBP on the other hand has a considerably lower churn rate of around fifteen and is – according to the definition - therefore only just considered to be a liquid market place. Nevertheless, the NBP is the worldwide second most liquid hub for natural gas after the Henry Hub. For the hubs ZEE and TTF, there remains a sizeable catch-up potential to become liquid market places, both – even though classified as mature market places – have churn rates below the threshold of fifteen. In 2010, ZEE had a volatile churn rate with values between three and six, whilst for TTF the churn rate is even lower. (Energy Charter Secretariat, 2007, p. 99; Huberator, 2010; Bloom & Patell, 2008, p. 1)

## 5 Drivers behind the Natural Gas Prices

The liberalization efforts of the European Commission aim at creating an integral, single European market for natural gas, where - like it has been demonstrated in the section on the liberalization attempts - gas-to-gas competition is the key driver for pricing and contracts instead of the traditional inter-fuel competition approach with its focus on oil-indexation. However, participants of the FLAME conference (cited by Stern, 2009) have expressed their doubt, that any time soon, natural gas will be priced competitively in Europe instead of being linked to oil price, there is even widely shared belief, that this practice will never come to an end:

**Table 4: Expected End of Coupling Gas Prices on the Oil Price**

Year of Poll	2004	2005	2008	2009
Before the end of 2010	24%	15%	8.7%	3.8%
Before the end of 2015	36%	15%	22.1%	20.3%
Later than the end of 2015	15%	39%	42.5%	44.3%
Never	24%	31%	28.8%	31.6%

Source: FLAME conferences, cited in Stern (2009)

Nevertheless, there are several recent events of paramount importance, which challenge the paradigm of sticking with oil-indexation greatly.

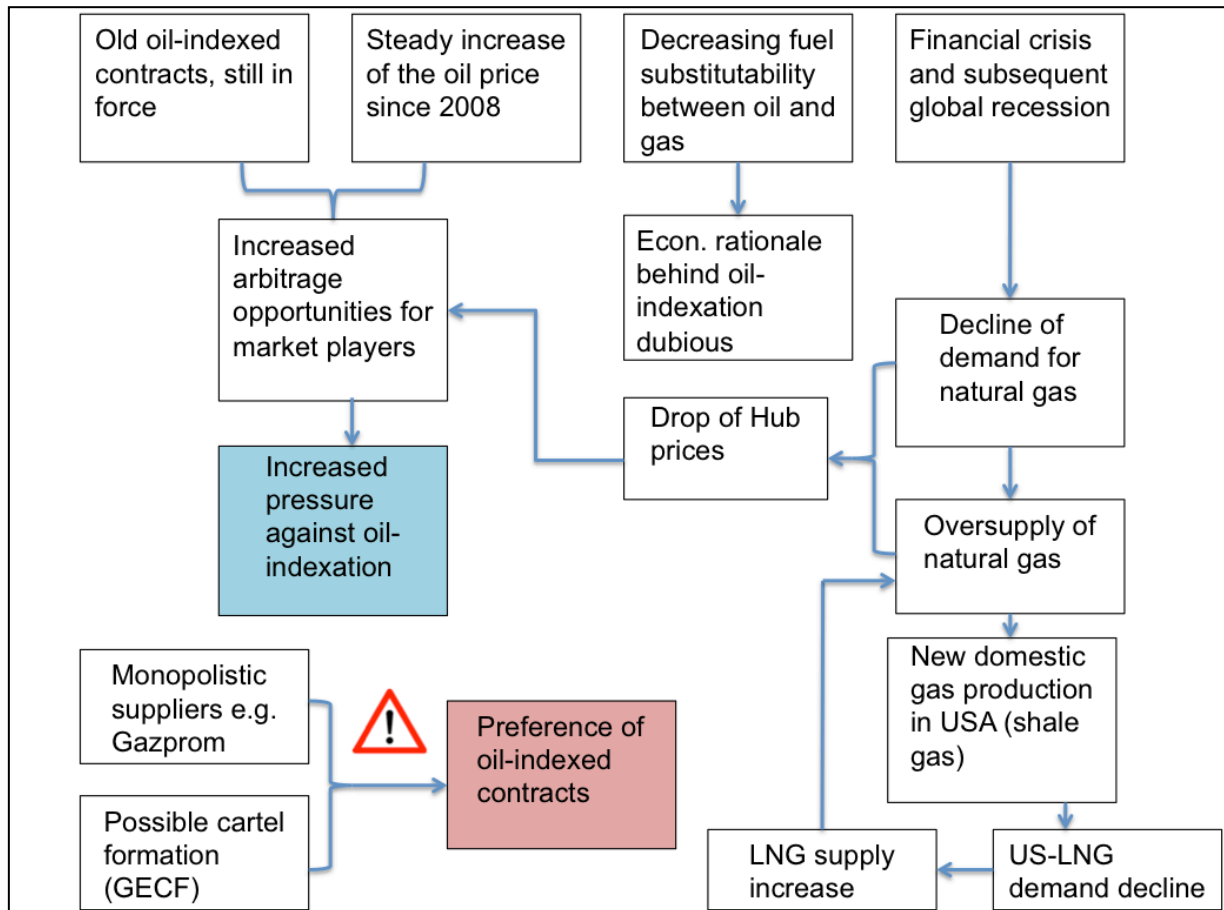
The liberalization process on Continental Europe is highly complex, and focusing merely on the regulatory framework would neglect important aspects. Besides the European Commission and their gas directives, there are miscellaneous further structural drivers and recent events, which have helped or hindered the newest developments of the planned deregulation, and which influence to a considerable extent the pricing mechanisms of natural gas.



## Liberalization of the European Gas Market

The following illustration presents graphically in a simplified manner, which forces and recent events significantly influence the European natural gas market and how these drivers are interlinked:

**Figure 7: Forces on the European Gas Market**



Source: Own Illustration

The following sections will give a closer description about the forces in the illustration.

### 5.1 Relationship between Oil and Gas Prices

As described in the section of the Groningen model, an important feature of the long-term natural gas contracts in Continental Europe is the linkage of the gas price to the oil price according to the market value approach.

For a long time, this rationale was a logical one, because these two fuel types were considered competitive alternatives because of their ability to substitute each other. In addition to this explanation, this concept was rational, because natural gas was usually produced as a by-product of the exploitation of oil fields, thus the economics

for the productions of both fuels was vastly similar, which in consequence results in a close correlation of the prices for the two products. (Dietsch, 2010, p. 1)

This pricing approach has lasted until today throughout Continental Europe. However, despite of advantages such as an overall lower volatility of the prices, reduction of the investment risk and increased market stability, these oil-indexed contracts exhibit serious disadvantages and a logical rationale for linking the two prices together does not exist anymore.

Finon (2009) states, that the linking of the gas price with the oil price development is outdated, because the original rationale behind this concept - the competition between oil and gas - is no longer valid: First of all, in the power generation, the dual firing capacity is steadily declining and secondly, mainly because of environmental reasons, oil-based power generation is dying out; oil is nowadays mainly used for transportation, while natural gas is in general utilized by stationary end-users.

Finon (2009) expresses further, that – because the prices are formed according to the market value approach and not according to supply and demand on the market – there is never a market equilibrium reflected by the prices; more precisely, it is estimated, that if the prices would be formed by supply and demand, they would most definitely be lower than oil-indexed prices.

Moreover, it has been observed, that the gas prices of UK spot-trading offer a significant discount over the continental oil-indexed prices; hence the political pressure of moving away from this system sharpens.

However, besides the lack of a contractual linkage of the gas and the oil price in the USA, there is significant econometric evidence, that in the past there was a strong correlation between those prices. More specifically, the evidence suggests, that the gas price was affected by the oil price, while there was no or little influence of the gas price on the oil price. In the 2006 study of the Energy Information Administration (EIA), as cited in Stern (2007, p. 25) it was found, that:

... natural gas and crude oil prices have had a stable relationship, despite periods where they may have appeared to decouple. The statistical evidence also supported the a priori expectation that while oil prices may influence the natural gas price, the impact of natural gas prices on the oil price is negligible.

... oil prices are found to influence the long run development of gas prices but are not influenced by them.

This natural correlation between the two fuels is driven by their long- and short-term substitution opportunities:

As already mentioned above, the exploitation of short-term substitution opportunities between oil and gas was possible, when dual fire capacities were common, but this rationale is becoming increasingly dubious. The customers are unable to react to price changes on the markets on short notice by switching from gas burning to oil burning, because they usually lack the equipment, and if it is at hand, charges or special permissions for emissions for sulphur and nitrogen oxides, which form when burning oil products, represent further obstacles for fuel switching in the short-term and make it economically undesirable. However, fuel switching cannot be completely neglected, because it can become relevant in extreme conditions, like the following example demonstrates: In the harsh winter of 2005 and 2006 in the UK, when prices for natural gas rose to record levels, fuel switching from gas to oil products could be observed. (Stern, 2007, pp. 4-5)

In the long-term view, fuel switching from gas to oil is even less likely than in the short-term, because neither residential, nor industrial, nor business oil fired plants will be built, while the old plants with oil firing capacity are being discharged (Stern, 2007, p. 6).

These results of a diminishing, naturally caused relationship between oil products and the price for natural gas are in line with the findings of Foss' study (2007, cited in Stern, 2007, p. 26) of the US-American market; moreover, she forecasts that in the future power demand and price dynamics will influence the prices for natural gas instead of the oil price dynamics. Additionally to power, natural gas market analysts include weather and inventories as further drivers of the gas price (Dietsch, 2010, p. 1).

### 5.2 Impacts of the Financial Crisis on the Gas Markets

As a result of the financial crisis of 2007 and 2008, the global economy has been hit by a period of severe recession. During the second half of the year 2008, the international demand for natural gas started to decline massively – the first drop in

demand for natural gas ever since the 1960s; and in 2009 and 2010 the downward-direction of demand remained, when the sales of natural gas fell further.

In 2009, the global gas sales dropped by 3.4 percent according to the calculations of Cedigaz (cited by Sethuraman, 2010). Within the countries, which belong to the Organization for Economic Co-operation and Development (OECD), the decline in demand had an average of 3.3 percent in 2009. This demand drop has been especially severe in the European Union, where the demand for natural gas has declined in 2009 by around 6.4 percent in comparison with the demand of 2008, thus falling approximately to the level of consumption of the year 2004. More accurately, when looking at import levels, one could observe, that general pipeline imports into Europe fell by ten percent, while the imports of Russia in particular were driven down even further and decreased by fifteen percent. On the other hand however, there was a steep increase in imports of LNG by 23 percent. (Eurogas, 2010, p. 5; IEA, 2010, pp. 1.3-1.4; Russia Beyond the Headlines, 2010)

This demand drop was driven by the massive cutbacks in industrial sales, which account for around one third of the gas consumption in the European Union, and by declines in the power generation sector. The residential and commercial sectors have already experienced an upward trend again in 2010, but the observed demand increase in those sectors is driven rather by the severe weather conditions in the cold winter than being influenced by the economic cycle, especially in the short-term. It is estimated by Eurogas and by the IEA, that it will take several years until the European gas demand will reach pre-crisis levels again; it is suggested that the levels of consumption of the year 2007 might be achieved in the year 2013 or even later in 2015. (Eurogas, 2010, p. 5; IEA, 2010, pp. 1.3-1.4)

The opinions of other authors stand in contrast to the described suggestion on the development above. According to de Meulemeester (2010, p. 25) for example, the demand decline is more of a structural than of an economic nature, thus demand levels will not necessary speed up after a recovery of the economy. It could be observed, that the demand for natural gas in the whole region of Europe and Eurasia experienced a growth of 15% between the years 2000 and 2007. On a closer inspection however, it becomes clear, that this demand growth is stirred

mainly by the extensive growth of consumption in the countries of the former Soviet Union and in Spain. In Western Europe, i.e. the UK, Ireland, Germany, Belgium France, Luxembourg and Switzerland, de Meulemeester (2010, p. 25) finds after analyzing data of the BP Statistical Review and IEA statistics, that the decrease of consumption has already started after the peak consumption level of 2004 has been reached. De Meulemeester (2010, p. 25) states, that reasons for this structural changes could be the effects of global warming, with generally warmer winters – with the exception of the unusually cold winters of 2005/2006 and 2009/2010 – which result in less demand because less heating is necessary; the effects of the Kyoto protocol and its programs to reduce emissions as well as the globalization processes, which resulted in a delocalization of energy-intensive industries away from Western Europe into the emerging markets. Because of the efforts to emit less greenhouse gases and the accompanying emission taxes, energy markets have been revolutionized in many ways. For example, alternative energy sources such as solar energy or energy from hydraulic power are of increased importance and these sources are becoming progressively competitive, thus also impacting the whole energy mix and possibly reducing gas demand in that way in the future.

Whichever estimation turns out to be true – demand levels are currently way below the record levels before the economic slowdown, and it will take years, if not a decade, until pre-crisis levels will be consumed again.

### **5.3 New Domestic Gas Production in the USA: Shale Gas Revolution**

In the years 2006 and 2007, the USA started their exploitation of unconventional gas resources thanks to new production technologies available, which allow for a much cheaper production. More specifically, shale gas exploitation has been added to the natural gas production and the proven reserves of shale gas in the USA are remarkable. The production of shale gas is already now of vast importance in the USA; the total US-production has grown by impressive 16% since the year 2005 – all of this growth can be accounted for by shale gas production (De Meulemeester, 2010, p. 20). Some analysts even suggest, that the increased usage of this unconventional gas source might result in the USA becoming a self-sufficient producer of natural gas again, or even farther, in the USA becoming an exporter country of natural gas (Waaterlander et al., 2009, p. 7).

Energy tomorrow (2010) defines shale gas as

... natural gas from shale formations, with the shale acting as both the source and the reservoir for the natural gas. Each of these shale gas basins is different and each has a unique set of exploration criteria and operational challenges.

At the moment, shale gas production is concentrated in the USA and in Canada. Before the economic crisis, imports of natural gas in the form of LNG into the USA have been increasingly important, because the traditional exploitation is in steady decline, while demand was continuously growing. The new production methods, with considerably lower costs have created an additional domestic source for natural gas, and the portion of unconventional natural gas in the form of shale gas already amounts to six percent of the US-American market. Together with coalbed methane, this share amounted to 17 percent of the total production of natural gas in the USA, whilst this figure is expected to increase to 35 percent in 2035. However, the real potential of global shale gas resources is yet to be determined and is at the moment uncertain. Nevertheless, the shale gas production already is an important contributor of natural gas in the USA, making them less dependent on gas imports, or even allowing the USA to become some day an exporter of natural gas. (U.S. Energy Information Administration [eia], 2010, pp. 5-6)

For now, production of unconventional gas is concentrated mainly on North America, but small amounts of unconventional gas are being produced in Australia, China and India, and the future outlook is promising, i.e. significant volumes from the Asia/Pacific region could push the gas markets one step further and increase the overall supply significantly. In Europe and in Latin America the case is a little bit different, and it is suggested, that especially in Europe the potential for exploration of such unconventional gas sources is limited, therefore, these sources are unlikely to play a significant role in the future. Nevertheless, Poland, Germany and the Netherlands are potential candidates for shale gas retrieval, and Gasterra, a gas trading company is already planning a project for shale gas production in the Netherlands. (IEA, 2010, p. 1.4; De Meulemeester, 2010, p. 20)

### 5.4 LNG Supplies

As described in the sections above, because of the global recession, the worldwide gas demand has experienced a severe downturn. On the other hand, new production technology has allowed to produce unconventional gas from shale layers and therefore the overall available resources of natural gas and the supply have been increased. Both of these events have impacted the global gas markets strongly. This section will concentrate on increased LNG capacities and new production and receiving infrastructure and the impacts on the international natural gas glut, which can currently be observed.

The USA, which were a major importer of LNG and thus a central market player, have imported less LNG in the past two years, both because of the impacts of the recession and because of the increased domestic production. The LNG Business Review (2010) even states, that the USA have been the least profitable market for LNG during this year: In August, the imports fell drastically and have reached the lowest level since 2007; more specifically, 0.432 mt have been imported, which is 38% lower than the year before. (LNG Business Review, 2010)

Overall, the economic downturn has globally led to lower demand levels, thus, in total, LNG demand has slowed down as well. This demand crunch coincided with an increased supply level of LNG: Numerous projects for LNG plants have begun well before the economy was hit by the recession and some of those new LNG plants – among others in the countries Qatar, Yemen, Indonesia, and Russia - came into service just during the crisis. The report “LNG industry To 2016 – Increasing Gas Supply Challenges Future Growth Prospects” by GBI (cited by PressReleasePoint, 2010) states, that the new LNG plants plus unfinished plants which will go into service during the next years, will contribute to an excessive, world-wide oversupply of natural gas, which will create a so-called buyer market, i.e. a market situation where the market power can be exercised by the buyers of natural gas rather than by the providers.

Since the early 1990s, there is an international trend towards trading LNG on a short-term basis, i.e. with contract durations of up to three years, and also Europe follows this trend and has therefore less long-term LNG supply contracts. Moreover,

the additional supply from new LNG liquefaction plants, which will come into operation in the year 2012, is destined to be traded on short-term basis. (Rogers, 2010, p. 39)

When looking at Europe and LNG consumption, one could observe, that even during the period of the recession in 2009, when the total demand of natural gas in Europe was slowing down, imports of LNG were stepping up by 23 percent to 68 billion cubic meters (Russia Beyond The Headlines, 2010). This import growth of LNG in Europe can be explained by the fact, that Europe made great efforts to diversify its supply sources. Among other reasons, these efforts were also undergone as to ease Europe's dependence from its important yet also unreliable – as it has been proved during the cold winter of 2009, when numerous countries of Europe have been cut off from gas supplies – provider-country, the Russian Federation. In order to implement this diversification, various projects for LNG-receiving terminals, where the LNG can be re-gasified and then subsequently is fed into the pipeline network, have been planned: Besides the existing sixteen LNG re-gasification terminals, 52 further projects for such terminals in Europe are either in planning or already under implementation. (The California Energy Commission, 2010)

Another driver for the growing LNG imports into Europe are price differences between the USA and the European market: In the USA, the prices for futures contracts on the NYME offered a price of US-\$ 5.164 per million British thermal unit, while the ICE in the UK offered for the same amount a price of US-\$ 7.16 (Curren & Zhou, 2010).

These price differences made it profitable to transport the LNG across the Atlantic Ocean; a practice, which will essentially result in an internationally more integrated gas market, when repeated more and more, where the geographical areas will be connected more tightly. Rogers (2010, p. 51) observes, that

The markets of North America, Europe and Asia which are impacted directly or indirectly by LNG imports, despite their different market-price structures and security of supply concerns, **can be described as having a 'system dynamic'** which is heavily influenced by arbitrage, especially between oil-



indexed European pipeline gas and LNG which has flexibility as to its ultimate destination. Where possible within physical constraints, this arbitrage dynamic will tend to bring about convergence of North American natural gas prices and European Oil Indexed Prices.

The section on arbitrage dynamics, which follows below will demonstrate further, how global arbitrage helps to integrate the different natural gas markets.

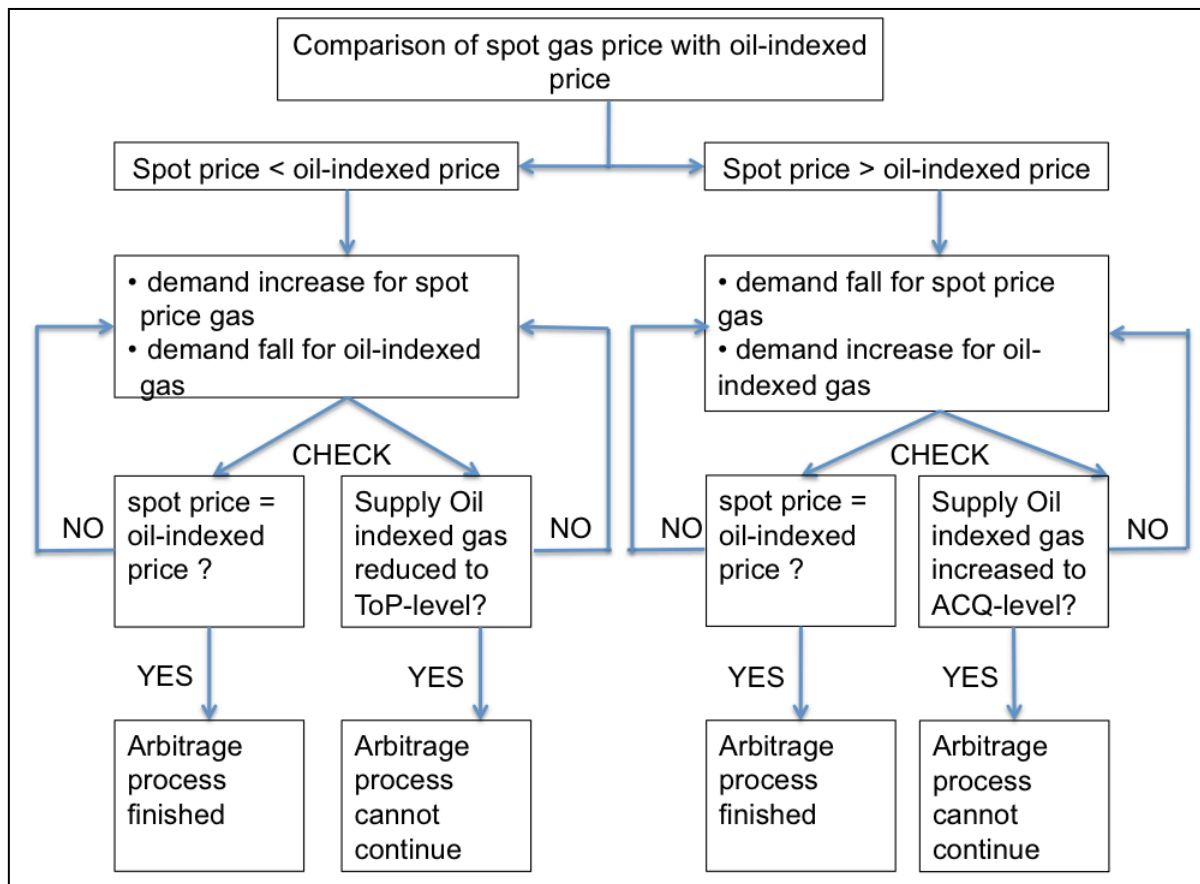
### **5.5 Arbitrage between Oil-Indexed and Spot Traded Gas**

In spite of the liberalization moves of the European Commission and development of spot trading on the above-mentioned hubs, a state of complete liberalization similar to the US markets has yet to be achieved. This part of the paper will look at the co-existence of the two systems, i.e. oil-indexed pricing and market equilibrium prices formed at spot markets.

In 1998, Continental Europe was getting connected to the liberalized UK market by the newly opened Bacton Zeebrugge Interconnector pipeline. A special feature of this pipeline is its ability of switching the flow direction of natural gas: In the time period between 1998 and 2006, a pattern of summer exports from the UK into Europe and winter imports from Europe into the UK could be observed. (Rogers, 2010, p. 21)

This pipeline, which brought the two systems at the ZEE hub together, allowed for market players to exploit arbitrage opportunities, which aroused due to price differences between the two regimes. More specifically, the arbitrage dynamic will occur as it is illustrated by the following flow chart:

**Figure 8: Arbitrage Dynamics: Oil-Indexed and Spot Priced Gas**



Source: Own Illustration (Information about arbitrage dynamics: Rogers (2010))

Rogers (2010, pp. 24-25) explains, that – like it is illustrated by the flow chart above - whenever the spot gas price is lower than the oil-indexed gas price, demand for UK gas will increase, accompanied of course with a fall in demand for oil-indexed gas: The arbitrageur, for example a national distribution company, will purchase the minimum contractual quantity of oil-indexed natural gas, because of the ToP-clauses in the contract between him and his supplier. In addition to this oil-indexed gas, spot-priced gas from the hubs is purchased and delivered to the end-customers. Whenever the contractual ToP-quantity between the distribution company and its end-customers is higher than the ToP-quantity between the distribution company and its supplier, the distribution company can benefit from exploitation of the arbitrage opportunities.

Driven by the market forces supply and demand, this arbitrage game will be continued up to the point, where the NBP price is equal to the oil-indexed price or until the oil-indexed amount of gas has reached the ToP-level – at this point, the arbitrage process is being stopped by the contractual determined minimum gas amounts. In the opposite case, when the spot price is above the oil-indexed price,

traders will buy less UK gas, whilst the demand for oil-indexed gas is being accelerated. Again, this game is being repeated and will come to an end, when either the NBP price equals the oil-indexed gas prices or when the oil-indexed gas amount reaches the ACQ, where again arbitrage opportunities cannot be exploited further. This arbitrage is not only significant for current trading, a lot of it is also undertaken to benefit from potential possibilities in the future: The gas, which is purchased at low prices can be injected into storage salt caverns and taken out and resold, when the hub prices are higher. It is believed, that a considerable extent of the salt cavern storages in Continental Europe are developed because of potential future spot price gas and oil-indexed price arbitrage opportunities. (Rogers, 2010, pp. 24-25)

Keeping in mind, that the international markets for natural gas are being interlinked more tightly than ever, with the sharp increase of LNG and the resulting gas glut - LNG volumes are expected to rise around 50% during the three oncoming years - it becomes evident, that natural gas market trading is taken up to a new level, where traders will be enabled to exploit arbitrage opportunities between LNG supplies and local natural gas markets with their respective regional gas pricing regimes.

This arbitrage between the European oil-indexed natural gas and the international market for natural gas will occur in a similar fashion like the arbitrage between UK spot gas and continental oil-indexed gas as discussed extensively above. For example, whenever the prices for the oil-indexed pipeline gas are higher than the American Henry Hub prices quoted on NYMEX, it is logical for Europe to only pay the minimum ToP-quantity dictated in the contracts and to satisfy the remaining need with LNG imports. Arbitrage opportunities arise again in the case, where the contractual ToP-amounts of the importer/distributor company are lower than the ToP-quantity between this distributor, and its end-consumers, as the arbitrageur can buy cheaper LNG gas and redistribute it for the higher oil-indexed price. The dynamics of supply and demand will proceed in this example analogously as depicted in the chart above, driving the American LNG prices up, until they equal the oil-indexed price level, while the demand for oil-indexed pipeline gas is reduced to ToP-quantities, at which the arbitrage processes are being stopped. In the case, where the American prices are higher than the European long-term oil-indexed

prices, the story is reversed; for further clarifications please refer to the graphic and the dynamics between Bacton and Zeebrugge, as the procedure is similar. (Rogers, 2010, pp. 44-45)

The tighter connection between the international markets due to larger LNG volumes as well as the arbitrage opportunities which already arise only continental in Zeebrugge, where UK gas and continental gas come together should – at least from an economic point of view - result in a price convergence of the different hub prices; and of hub prices and oil-indexed prices.

### 5.6 Comparison of Oil-Indexed Prices versus Spot Prices

The above-discussed circumstances, i.e. demand crunch, increased LNG availability and production growth in the USA represent an introductory textbook example of how the market forces, i.e. supply and demand combined form a market equilibrium:

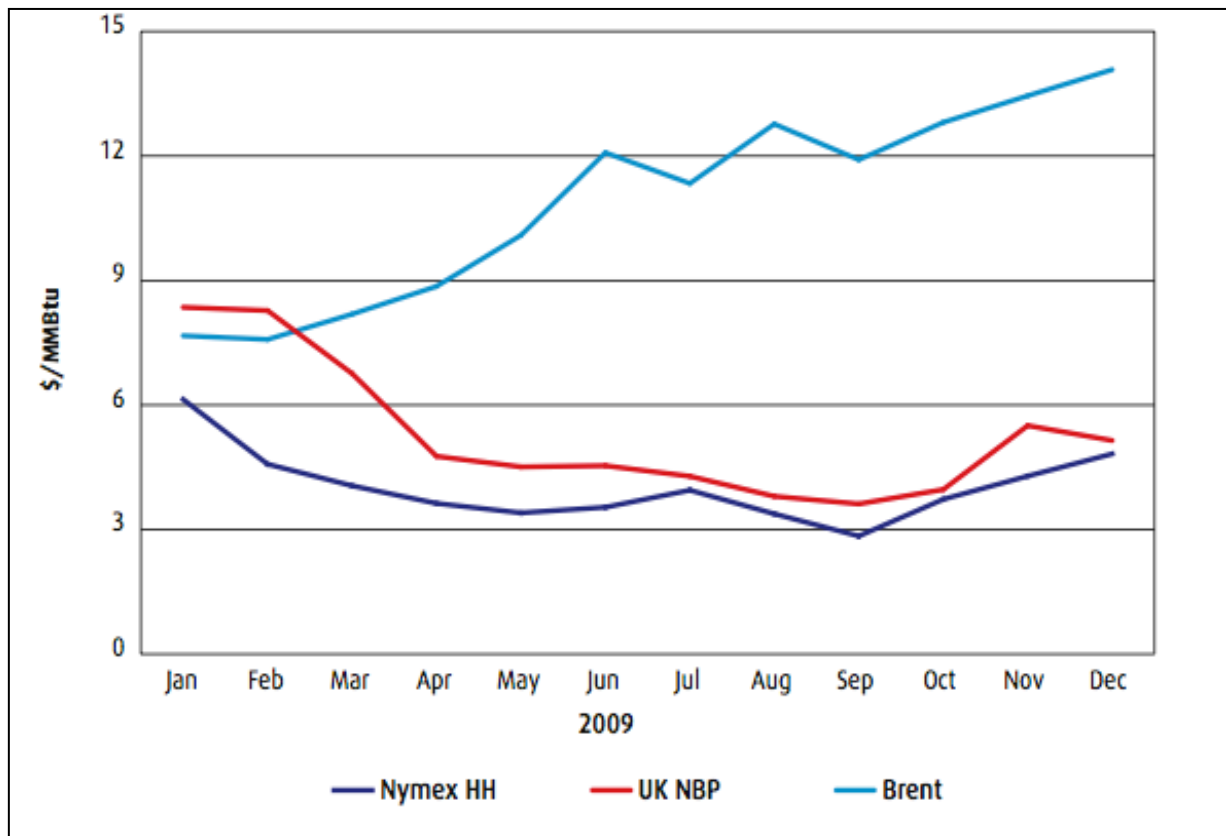
The supply side is globally experiencing gas injections from LNG plants, which are newly in operation and from production of the unconventional shale gas. The USA can increase their own production and therefore, higher amounts of LNG are available for the European market. At the same time, demand is driven down as a result of the economic recession and to a small extent also by structural changes, i.e. the tendency to use more and more alternative energy sources instead of burning fuels.

When combining these circumstances, the economically logical consequence for the price of natural gas is to fall down, and this is exactly what could be observed on the spot markets.

The circumstances for the oil price however look quite different after a massive fall from its record levels in the year 2008, the oil price is regaining strength again, and in consequence the oil-indexed prices for natural gas are ipso facto climbing up.

The following graph clearly demonstrates, how in the year 2009 the two commodities are developing and it compares the Henry Hub Prices, the UK NBP prices and the development of Brent, a common type of crude oil:

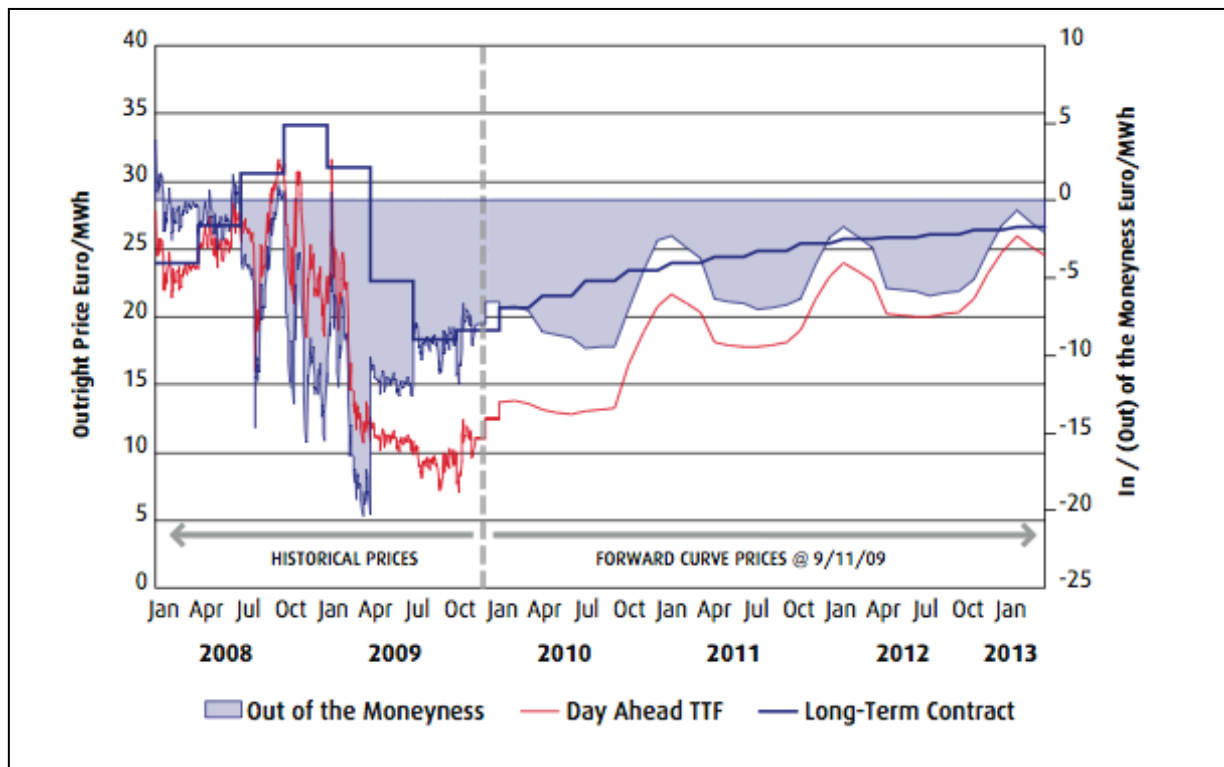
**Figure 9: Divergence of Crude Oil and Traded-Gas Prices in 2009**



Source: Viewpoint Gas Strategies (2009)

For the European consumers of oil-indexed prices, this situation is obviously particularly disturbing: While there is cheap natural gas traded on the hubs, they are obliged to purchase the expensive gas as it is dictated by the ToP-clauses in their contracts. The following chart from Alger (cited in Viewpoint Gas Strategies, 2009, p. 4) depicts the price differences between the two regimes clearly:

**Figure 10: Spot Prices and Long-Term Oil-Indexed Prices**



Source: Alger (cited in Viewpoint Gas Strategies (2009))

### 5.7 Increasing Political Pressure on Oil-Indexing

Given the described events and tendencies on the market for natural gas, the pressure of moving away from the system, which ties the natural gas price to the price of another commodity has intensified: With the oil price diverging from the price for natural gas, customers find it more and more outrageous, that their suppliers benefit from low-priced spot gas, while they – instead of passing these prices along to the end-consumers – charge ever rising prices and cash up in this manner an enormous profit margin. Since the end-uses of the two fuels are decoupling as well, and since with shale gas new sources of natural gas have been found, whose exploration is not tied to the exploration of oil fields, the economic rationale for remaining with this system is collapsing, which leaves little room for explanations in favor for the system. Moreover, consumers have often complained, that the companies exploit the price review clauses, more specifically, it has been claimed, that the practices for such price reviews are highly intransparent and often work in disadvantage for the purchasers.

These unfair circumstances have brought politicians on the scene, who want to fight the continuing of oil-indexation. In August 2010 for example, the German chancellor Angela Merkel required to end the era of oil-indexation and move to a market driven system (Sikorski, 2010, p. 5). According to Merkel (cited by Der Tagespiegel, 2010), the attempts of the energy exchange EEX to develop a gas index would be of great help in order to achieve a transparent market with equilibrium prices.

More important than merely such statements of politicians are of course concrete actions in the form of national acts and legal sentences. Germany can serve here as an example when enforcing such a legal sentence:

In March 2010, the German Federal High Court of Justice (in German Bundesgerichtshof (BGH)) has taken action against unfair practices by passing a leading decision. More specifically, the lawsuits of a consumer protection organization and various private clients have proven to be effective; the decision of the BGH declares that prices for natural gas for private clients are no longer allowed to be immediately linked to the price for heating oil, because according to the BGH, this practice represents an inadequate disadvantage for the private clients. Moreover, it has been found, that the general price drop of natural gas on the spot markets has been to a certain extent passed along to the industrial clients; while for the private clients no such reductions have been granted. The BGH has further criticized, that the review clauses in the contracts are often highly intransparent, as they allow to pass price increases along to their contract partners, while cost cuts within a company are - due to the oil-linked price – not passed along to the final consumers. (SpiegelOnline, 2010; Verbraucherzentrale Hessen 2010)

Lassek (cited in Verbraucherzentrale Hessen, 2010, own translation) so aptly describes the procedures of German provider companies:

..., as especially in the business with end-consumers, the topic of the gas-oil-linking has in the past consistently lead to incomprehensible delays of the pricing. ... One gained the impression, that with increasing oil prices the prices for the end-consumer have increased by the same scale. However, when the oil prices were falling, the gas prices have not been adequately adjusted downwards.

Because of the legal sentence of the BHG, many end-consumers are now entitled for reimbursements (SpiegelOnline, 2010).

This legal sentence is an important signal from the politicians, that oil-indexing is considered to be an unfair practice and that the majority of the consumers are in clear favor of moving to a pricing regime, where gas is priced on trading hubs according to supply and demand. Nevertheless, this is only a national sentence and therefore only legally binding in Germany and not in the whole European Union. Moreover, the sentence only regulates the relationship between the distributing companies and the end-consumer and therefore it does not go down to the root of the problem: The distributing companies normally receive their gas supplies from foreign companies, with which they have themselves long-term delivery contracts with prices, which are linked to the oil price. As long as these contracts will be in force, such legal sentences are of very limited effectiveness. In fact, as it will be described in more detail below, the providing foreign companies are in many cases nation-owned monopolistic companies with great market power and little interest in moving away from their traditional use of the oil price as basis for the price for natural gas. The current market power of these monopolies makes it virtually impossible to enforce legally a change of practice. However instead of legal forces, the changing economic situation and the therefore currently shifting positions of key players on the market probably will be the key variable which will stimulate a change away from oil-indexation.

### 5.8 Market Power of Exporting Countries

The above described events and tendencies on the international natural gas markets in general and on the European market in particular are all in favor of bidding the historical oil-indexed contracts goodbye and move speedily to spot-gas markets, with flexible, short-term contracts; i.e. markets where the forces supply and demand form a market equilibrium, which sets the price for the commodity.

However, there are powerful market players who benefit greatly from the current situation and will set everything in motion to remain with the traditional, oil-indexed contracts regime. It has been mentioned in the introductory chapter that setting up infrastructure for exploration and distribution of natural gas is extremely costly, and if the future cash flows are uncertain because of the absence of long-term supply-



agreements with the buyers, the investment risk is increased. The traditional oil-indexed contracts are an excellent device for mitigating the investment risk by ensuring steady purchased quantities in the future. Besides being a suitable instrument for managing the investment risk, this contract form has recently put the exporting countries in the comfortable situation, where they are receiving a considerable mark-up on their revenues compared with the profit range of the short-term gas, which is priced on the hubs: The oil price could gain strength after its massive fall of 2008, while the hub prices for natural gas are still low; so the oil-indexed gas is getting more pricey, while the spot-prices are cheap. Moreover, these contracts allow for the exporting companies, which are usually owned by the government, to favor the domestic consumption, as it is common, that dumping rates are offered in the home country. The high, oil-indexed rates, which are charged in the countries abroad can compensate for the losses, which are incurred in the domestic market by offering such dumping charges.

Europe's imports are rather concentrated on a few countries, it draws its supplies of natural gas mainly from the Russian Federation, from Norway and from Algeria; of these countries, the lion's share goes to the Russian Federation, which accounts for around 25 percent of the total market share in Europe. Such a market structure puts Europe clearly in the position of a dependent market player, on which market power can be exercised. The Russian Federation, more specifically, its gas exporting company Gazprom has repeatedly declared, that it is in favor of traditional oil-indexation and that measures will be taken, to remain with this system in the oncoming future.

Despite the strong preference of Gazprom of oil-indexed, long-term contracts over short-term gas deliveries, which are priced on hubs, the recent events on the global gas markets force Gazprom and other such companies to rethink their strategy of sticking to oil-indexed gas prices. Many times, Gazprom has been sharply criticized by the European purchasers and by politicians, because of the very low flexibility of the contracts and the outdated pricing formulas. Now, it seems, as if the time has come, that the position of the state-run monopolistic company has weakened substantially: With the massive oversupply of natural gas on the global market, spot prices have decreased tremendously, which in consequence caused European

consumers to only purchase the minimum quantities enforced by the contractual ToP-clauses from the Gazprom company. The remaining need for natural gas has been satisfied by purchasing the much lower priced gas traded on the spot markets, driving therefore the Russian market share far down. These circumstances call for immediate actions on the part of Gazprom. Korchemkin (cited by Doroshev, 2010), analyst with the East European Gas Analysis think-tank states: "Gazprom is unable to sell any more gas under the oil-indexed price formula. Breaking the oil link is the only way to get additional profits from European gas sales." Indeed, in February of 2010, Gazprom made a first, small step away from its position when it agreed with many of its consumers to include an element of European spot market prices in pricing formula. Furthermore, the German energy company E. ON Ruhrgas has reported, to be in negotiation with Gazprom and that the prospect looked bright in that sense, that a large portion of the gas supplies could be purchased on spot trading basis in the future. Also, the French energy group GDF Suez has found agreements with Gazprom for spot market contracts. Nevertheless, it is too early for euphoria in Europe, as the following statement of a Gazprom spokesman (cited by Doroshev, 2010) demonstrates: "The agreements reached do not put into question the fundamental principles -- the system of long-term contracts, the "take-or-pay" principle and the pricing system based on a peg to a basket of oil products." Additionally, Gazprom could again enforce contractual minimum amounts of gas delivered to France and Germany, and should the demanded amounts fall below the defined threshold, Gazprom would as a consequence lower the portion of spot price elements in the pricing formula. (Doroshev, 2010; Danichev, 2010)

Gazprom and the state-owned companies of other countries, which export into Europe and favor oil-indexation even find allies among the importing companies, which distribute the gas. These companies claim, that the paramount advantage of the oil-indexed contracts are their reliability and furthermore, the fact, that the price volatility is much lower than the one of spot-priced gas. In addition, this pricing mechanism forbids strong market players, to exploit their market power and set unfair prices for example by manipulating the prices via production decreases.

### 5.9 The Gas Exporting Countries Forum

The fear of the importing countries, that a powerful gas cartel could form, is not causeless, as the following paragraphs will demonstrate:

To discuss different gas strategies and matters, various countries have joined the Gas Exporting Countries Forum (GECF) in 2001<sup>1</sup>, which was at the beginning a loose organization but has become of increased importance after 2008. The numbers speak for themselves: According to Dietsch (2009), the member states of the GECF are in control of over 70 percent of the total world-wide reserves of natural gas, 38 percent of all the pipeline trades and 85 percent of the production of LNG. GECF (2010) itself describes its purpose as follows: “The GECF was set up with the objective to increase the level of coordination and strengthen the collaboration between member countries. The forum also seeks to promote dialogue between gas producers and consumers.” So far however, the influence of the GECF is fairly limited, yet the organization’s impact on the gas market in the future should not be underestimated, if a powerful cartel was to emerge. During their meeting in spring 2010 in Algeria, the member countries of GECF agreed to work together towards the common goal of linking the gas prices with the oil price in the long term, but there is no information gone outside, regarding how this goal shall be pursued.

In the year 2007, two major players among natural gas producing countries, Russia and Iran, have raised for the first time the subject of using the GECF to form a cartel, similar to the OPEC in order to manipulate the prices for natural gas via production quotas within the member states. Nasseri and Walters (2008) reported, that in October 2008, the three countries Iran, Qatar and the Russian Federation agreed to form the so-called “gas-troika”, a committee, which seeks common production and exploration between the three countries, a proposition, which was to great concern to the European Union and the USA. Russia however tried to resolve these worries and explained, that the gas-troika would in fact rather concentrate on securing a stable supply of natural gas, than focus on production restrictions. A cooperation would be necessary, because of the extreme costs into exploring and exploiting new fields. (Nasseri & Walters, 2008)

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<sup>1</sup> Member countries: Algeria, Bolivia, Egypt, Equatorial Guinea, Iran, Libya, Nigeria, Qatar, Russian Federation, Trinidad & Tobago, Venezuela. (Observers: Kazakhstan, the Netherlands, Norway)

Despite these words, it only took one year, until the prime minister and former president of the Russian Federation, Wladimir Putin discussed the cartel again. He has great hope and in no way doubts the success of such a venture, he even declared (cited in Dietsch, 2009), at the annual meeting of the GECF in 2009 in Qatar, that “the era of cheap natural gas is coming to an end.” After initial reluctance, the cartel proposal gained popularity when for example Algeria uttered some words of approval to such a cartel, as the currently deteriorating prices for natural gas lower the country’s revenues remarkably and so increase the incentive for the gas exporting countries to work closer together, in order to keep the prices somehow on an acceptable level. Such a cartel solution would incidentally mean, that the exporting countries are moving away from the oil-price binding. Nevertheless, this solution would obviously be in the interest of the exporting countries, as the production quotas and the so manipulated high prices would grant the maximum revenue, the so called cartel profit, to them; logically an undesirable situation for the purchasers of natural gas in Europe and elsewhere. (Dietsch, 2009; Mackenzie, 2010)

So far however, the threat, that such measures will be enforced by the GECF is to a certain extent idle for a number of reasons:

At the moment, the practice of the oil-indexation is still in use, and the long-term nature of the contracts – most of them will expire between the years 2010 and 2025 – forbids due to their contractual clauses, to switch to such a cartel solution before the contracts expire. Also, gas markets are still very regional markets and there is no single worldwide gas market like in the case of oil, because most of the gas is transported by the fixed pipeline network and thus limits the development of an integrated world market. LNG transports, which in turn are much more flexible than pipeline transportation, are still the minority when looking at the total of the global gas transport; yet, this setting is likely to be changed soon, because LNG production is increasing and new projects for production and receiving terminals are in implementation. Additionally, domestic production of shale gas in the USA frees considerable amounts of LNG for the world market. Because of this regionally concentrated gas markets, production restrictions would be ineffective to influence a

world market: As chief strategist of Moscow's Alfa bank, Smith (cited in Nasser & Walters, 2008) so aptly describes it, "gas is still a patchwork of local markets. Any attempts to regulate natural-gas supply in one area of the world has only marginal impact in any other part of the world."

Additionally, important providers of natural gas, for example the USA are not member countries of the GECF. Furthermore, Norway, an important gas supplier for Europe, is only listed as a country with observer status, and not as a full-fledged member country. In order to efficiently work as a cartel, such big players should definitely be part of the organization to exercise the maximum power that is possible. Moreover, if the shale gas production proves effective in other areas of the world, the whole, world-wide market will be re-shuffled, and it might very well be, that new key players emerge, weakening the position of the current key players and consequently the market power of a GECF cartel. Mackenzie (2010) utters reasonable doubt, that even if a consensus over price or production fixing agreements is ever going to be found: It is dubious, that it can be actually be enforced, as even the well-established OPEC is struggling to have all its member states obeying the agreements, and it would be likely, that the situation would look similar for the GECF cartel. Mackenzie (2010) describes further, that the situation of GECF and the planned cartel can be explained by comparing the situation with the prisoner's dilemma, a fundamental principle within the area of game theory: The participating countries have justified reasons to doubt the other countries in pursuing the production cuts, since the prospects of benefiting on the short-term by violating the agreement at the expenses of the other countries, which abide the agreement; so even though the cartel profits, which in the long-term would be far higher than the market revenue, the short-term losses, which are being occurred are preventing the individual members from switching to that system.

Besides the external forces, which weaken the potential of a powerful GECF cartel with effective price manipulations, there are member countries inside, which are not willing to agree with production cuts. Qatar for example, a highly important country on the market for natural gas has put great efforts and investments into building up infrastructure to produce LNG, and these plants just have come into operation

recently. The country is therefore not willing to lower its outputs, in spite of the currently low revenues, which can be obtained on the markets. (Mackenzie, 2010)

All these obstacles presented above give little reason for the purchasers of natural gas to worry about the impacts of GECF or the gas-troika on the global gas market via production restrictions. Smith (cited by Nasser & Walters, 2008) explains, that for the moment the gas-troika is more of a symbolic project than anything else and he even comes to the conclusion, that “the chance of this impacting natural-gas markets over the next ten years is virtually nil.”

Despite the described incidents, which alleviate the position of the market power of the GECF, Dietsch (2009) cautions against underestimating the economic risk of such a cartel: Even though, currently, the power of the GECF is limited and the structure seems somewhat unorganized and a cartel is also unlikely to develop in the near future, a powerful cartel could be formed later: He draws the parallel to the OPEC, which when it was in its initial stage in the 1960s has been belittled, and yet it has become a powerful cartel with tremendous effects on the global economy. Dietsch (2009) reckons, that within the GECF of today slumbers the potential – however limited it may be – of a cartel with similar market power as the OPEC. He therefore advises the politicians to carefully watch and track the developments there, because if such a strong cartel would enter an unprepared market, the economic consequences could be extremely harsh.

To summarize the impacts of the GECF on the markets for natural gas in the future, it needs to be admitted, that there are far too many unknown variables: For example the worldwide production of shale gas and the resulting impacts on the global gas market or the development of the gas markets after the crisis, forbid it to make an informed and realistic assessment of the potential impacts of such a cartel on the global gas markets. Nevertheless, it can be said, that if such an organization would evolve, it is likely that, the organization would do everything, to remain with oil-indexation of the natural gas contracts. As another alternative, this organization would have – if it were able to enforce it among its member states – a great incentive to control the output quantities and in that manner manipulate the price.

## 6 Conclusions

The question, whether oil-indexed pricing of natural gas is on its way out, is highly complex and therefore it cannot be answered at once, but it must be discussed using an analysis of the key factors and their interdependence.

The European gas market is vastly multifaceted, and a high number of key players is participating and thus influencing the market structure. Besides the regulatory reform within the European Union, which has been initiated by the European Commission and paves the way for a liberalized market, there are miscellaneous additional forces and current circumstances within the global economy, which are impacting the market and determine, whether the bell tolls for the historic approach of linking the price for natural gas to the oil price, clearing in that sense the way for a new era, where gas is priced according to market forces.

The following section will briefly summarize the findings from the chapters above, by stating the key players and recapitulating the major past and current events, which influence the pricing game on the natural gas market. Subsequently, it is discussed, whether there is a foreseeable future for the oil-indexed contracts, or whether the days of this system are over.

On the one hand, there are the gas exporting countries, which seek to stick with the oil-indexation, as this system allows for an exact planning and controlling of cash flows, which helps to mitigate the investment risk to a minimum, because minimum ordered quantities are secured by contractual clauses. Besides being a suitable instrument for planning and controlling activities, it has recently put the producing countries in the favorable situation, where they receive far better prices for their commodity than they would earn on the spot markets. These countries have therefore no interest in changing the current system. Important production countries have formed the GECF, an organization, which should help them to follow a common goal by a shared strategy, i.e. sticking with oil-indexation, keeping prices up on a for the organization desirable level and collaborating in the exploration and production of natural gas. The market power of this GECF is currently limited, because of the global downturn in gas demand and the existing vast oversupply of

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natural gas; and potential changes on the gas markets in the near future could limit the market power of the organization even further.

On the other hand, there is a high number of players who seek to come to an end with the traditional approach by pricing natural gas according to supply and demand rather than the outdated pricing against another commodity. The falling gas prices on European and international energy exchanges have even intensified this desire and the pressure against this system is increased.

There are numerous events, which favor the latter position in the gas discussion:

The economic recession has driven down the demand for natural gas and it will take several years – some authors even suggest, up to a decade - until the market will have recovered from this downturn and gas consumption will achieve pre-crisis levels again. In Europe, this demand crunch has been especially severe, and some analysts believe that the slowdown of gas consumption is of a structural nature, and not too much impacted by the crisis, meaning, that even after an economic recovery, the gas demand would remain low and grow little in the future.

Two events of tremendous impact on the markets for natural gas have coincided with the economic crisis and the resulting decrease in consumption of natural gas:

On the one hand, the USA have, thanks to cheaper technological means revolutionized the production of natural gas. The production of the unconventional type of gas – shale gas – has increased the production levels within the North American market considerably. The USA are believed to soon move from a country, which relied despite domestic production on imports, to a country, which is completely independent from imports. In other geographical areas, there are also projects for shale gas production in implementation or in planning, and the full, global future potential of shale gas production, and the resulting impacts on the global gas markets – such as shifting key players and thus shifting market power - are yet to be determined.



On the other hand, there are several new plants for liquefying natural gas to LNG and on the purchasing side, new terminals for LNG receiving have come into operation recently, and therefore the supply of natural gas on the markets has increased. Because of the shale gas revolution, LNG tanks, which were initially intended for the American market, are now looking for other purchasers, increasing the availability of LNG further. Because of its flexibility in transport and due to the fact, that many countries are having or building infrastructure to receive LNG, the new supplies – which are mostly flexible and therefore not bound to specific buyers via long-term contracts – make a significant contribution to the formation of a more integrated global gas market; i.e. it helps to bring the continents closer together, as the transport is not restricted by a fix pipeline network. Nevertheless, it will take time, until a connected world gas market will be established, as today, many regional markets for natural gas exist.

The demand crunch combined with the growing shale gas production in North America and the increased LNG availability have caused a worldwide massive oversupply of natural gas and thus a so-called buyer market, where consequently the prices for natural gas traded on energy exchanges have experienced a continuing fall.

At the same time as the natural gas spot price is declining, the oil price is in steady recovery. This puts the purchasers of oil-indexed gas in the undesirable situation, where they have to buy expensive gas, while there are cheap supplies glutting the market. Moreover, the exploitation of arbitrage opportunities have allowed for some distribution companies to earn massive profits on the expense of their end consumers. These consumers have been outraged by these practices and politicians are criticizing the system as well. In March 2010, the German BGH has with its sentence made a first step away from this system, however the sentence is only of national impact, and the European countries and importers cannot legally do anything to enforce a movement away from oil-indexation when negotiating with their supplier countries.

Currently, because long-term oil-indexed contracts are still in force, there is a co-existence of oil-indexed priced gas and spot-priced gas in Continental Europe, and

the question arises, how the system will change, when these oil-indexed contracts have reached their expiration date.

In conclusion, it can be said, that the recent economic events as well as the new production technologies and LNG plants have a considerable impact on the global gas markets, and help the European gas markets in particular to become more liberalized, probably much faster than without them: The current global oversupply of natural gas has put the European purchasers of natural gas in a position with greater bargaining power: The market share of the traditional oil-indexed gas imports has shrunk to the contractual minimum amount and the remaining need for natural gas can be satisfied by flexible LNG imports. Furthermore, the GECF is not yet a powerful cartel organization, which could impact the global market. Gas supplier companies, such as for example the Russian company Gazprom has in the year 2010 for the first time agreed to include elements of spot traded gas prices, an action which could be interpreted as a first step into the direction of more flexible contracts, maybe even in a direction of gas-to-gas competition. If the circumstances on the global gas markets with the buyer market are to remain for some time, for example because gas demand will remain low or because the global shale gas production is increasing, then the bargaining power of the gas suppliers to Europe will impair further, and it will be increasingly hard for them to stick with the oil-indexation of natural gas prices. To cut to the chase of the matter, it can be said, that at the moment the signs are indicating, that oil-indexing will increasingly be replaced by gas-to-gas competition.

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I declare hereby,

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Ich erkläre hiermit,

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