SIMAT Arbeitspapiere
Herausgeber: Prof. Dr. Michael Klotz

SIMAT AP 05-13-023

The price-link in the German natural gas market

The development of the oil price-link and alternative price mechanisms

Stefan J. Saatmann

Fachhochschule Stralsund
SIMAT Stralsund Information Management Team

Januar 2013

ISSN 1868-064X

Saatmann, Stefan J.: The price-link in the German natural gas market – The development of the oil price-link and alternative price mechanisms. In: SIMAT Arbeitspapiere. Hrsg. von Michael Klotz. Stralsund: FH Stralsund, SIMAT Stralsund Information Management Team, 2013 (SIMAT AP, 5 (2013), 23), ISSN 1868-064X

Download über URN vom Server der Deutschen Nationalbibliothek:
http://nbn-resolving.de/urn:nbn:de:0226-simat05130239

Impressum

Fachhochschule Stralsund
SIMAT Stralsund Information Management Team
Zur Schwedenschanze 15
18435 Stralsund
www.fh-stralsund.de
www.simat.fh-stralsund.de

Herausgeber

Prof. Dr. Michael Klotz
Fachbereich Wirtschaft
Zur Schwedenschanze 15
18435 Stralsund
E-Mail: michael.klotz@fh-stralsund.de

Autor

Stefan Saatmann, M.Sc. ist Energieökonom und absolvierte den Doppelmasterstudiengang „International Energy Economics and Business Administration“ der Universität Leipzig und des MGIMO Moskau. Derzeit arbeitet er in der deutschen Energiewirtschaft und veröffentlicht zu energiewirtschaftlichen Themen in der SIMAT-Arbeitspapierreihe.

The price-link in the German natural gas market

The development of the oil price-link and alternative price mechanisms

Stefan J. Saatmann[1]

Summary: This SIMAT Working Paper deals with an intensively discussed topic in the German natural gas economy: The price-link in natural gas contracts. Because of opposite price developments of the energy commodities such as oil, coal or natural gas, the traditionally used oil price-link is facing a reset. Shifting market dynamics in supply and demand of natural gas are the fundamental reason for that and led to intensive debate between the contract partners.

Content

[1] Stefan J. Saatmann, M.Sc., stefan@saatmann.net

Schlüsselwörter: competition – gas market – Germany – natural gas – natural gas pricing mechanisms – oil

JEL-Klassifikation: L11, L95, L98

Preamble of the editor

The energy turnaround in Germany is widely discussed these days. This comes in different dimensions and not only renewable energies are part of that long term transformation process. The following working paper broaches the issue of the price-link in natural gas contracts. It includes within the row of working papers dealing with energy economics (see working paper No. 16).

The content decribes the natural gas market in Germany and illustrates the contractual price-links. Changes in supply and demand as well as market regulation developments stenghten natural gas as an independent commodity. They create an environment in which natural gas pricing comes from liquid markets as instead off following other commodity prices. With this background the economic arguments and alternatives of the price-linked natural gas pricing are discussed.

Now, a limited working paper does not claim to provide the energy economic complexity of the natural gas market. In this respect the paper limits to key facts and figures. The objective of the working paper is to present circumstances and relationships in a comprehensible manner – especially for those readers who do not deal with daily energy industry issues.

From the limitations of the presentation is also clear that not all perspectives are equally considered and executed. This can and should give cause for debate and amendment. The author is available for this purpose under the said communication channels.

Prof. Dr. Michael Klotz

Figures

Tables

Abbreviations

ACER	Agency for the Cooperation of Energy Regulators
AG	Aktiengesellschaft (joint-stock company)
AGEB	Arbeitsgemeinschaft Energiebilanzen e.V. (Working Group on Energy Balances)
Bcm	Billion cubic meters
BDEW	Bundesverband der Energie- und Wasserwirtschaft e.V. (Federal Association of the German Energy and Water Industry)
BMWi	Bundesministerium für Wirtschaft und Technologie (Federal Ministry of Economics and Technology)
bn	Billion
BNetzA	Bundesnetzagentur (Federal Network Agency for Electricity, Gas, Telecommunications, Post and Railway)
BP	beyond petroleum
CIA	Central Intelligence Agency
CO2	carbon dioxide
dpa	Deutsche Presse Agentur (German Press Agency)
DVGW	Deutscher Verein des Gas- und Wasserfaches e.V. (German Technical and Scientific Association for Gas and Water)
EEG	Gesetz für den Vorrang von Erneuerbarer Energien (Renewable Energy Act)
EEX	European Energy Exchange
EGIX	European Gas Index
EnWG	Energiewirtschaftsgesetz (Energy Industry Act)
EPEX	European Power Exchange
EU	European Union
EUR	Euro
EWG	Europäische Wirtschaftsgemeinschaft (European Economic Community)
GasNZV	Gasnetzzugangsverordnung (Gas Network Access Regulation)
GDF SUEZ	Gas de France SUEZ
GDP	Gross domestic product
GECF	Gas Exporting Country Forum
GTL	Gas-to-Liquids
GWB	Gesetz gegen Wettbewerbsbestimmungen (Act Against Restraints of Competition)
H-gas	High calorific gas
hl	hectoliter
IEA	International Energy Agency
km	kilometer
kWh	Kilowatt hour
kWh/kg	Kilowatt hour per kilogram

LCOE	Levelized Cost of Electricity
L-gas	Low calorific gas
LNG	Liquefied Natural Gas
m3	cubic meter
M	Million
MWh	Megawatt hour
NBP	National Balancing Point
NCG	Net Connect Germany
OPEC	Organization of the Petroleum Exporting Countries
OTC	Over-the-counter
PJ	Petajoule
R/P	Reserves to production ratio
RWE	Rheinisch-Westfälisches Elektrizitätswerk Aktiengesellschaft
t	ton
TTF	Title Transfer Facility
UK	United Kingdom
UNCTAD	United Nations Conference on Trade and Development
UWG	Gesetz gegen unlauteren Wettbewerb (Act Against Unfair Competition)
Vol. %	Volume per cent

Symbols

§	Paragraph
C	Constant (energy conversion factor)
P	Price
P*	Market equilibrium price
Q	Quantity
Q*	Market equilibrium quantity
RP	Reference Price
T	Tariff payed by the buyer
T0	Basic Tariff
WF	Weighting Factor

1 Introduction

The natural gas market in Germany is in motion. Excellent gas availability[2], stagnating demand and continuous progress in the liberalisation of this market create challenging conditions for Germany's gas industry. This development has found expression in opposite price movements of imported crude oil, oil price-linked natural gas and hub-based natural gas prices in the period from 2008 to 2010. The line chart in figure 1 shows that until the middle of 2008 prices of oil and gas were very similar. However, toward the second half of 2008 a gap started to open with oil prices rapidly rebounding, whereas contract prices stagnated and spot market prices fell sharply. All of these shifting market dynamics have challenged the implemented price-link pricing mechanism with oil commoditiy products as the leading commodity in long-term gas delivery contracts and have therefore led to intensive debate between contract partners and also within the gas economy.[3]

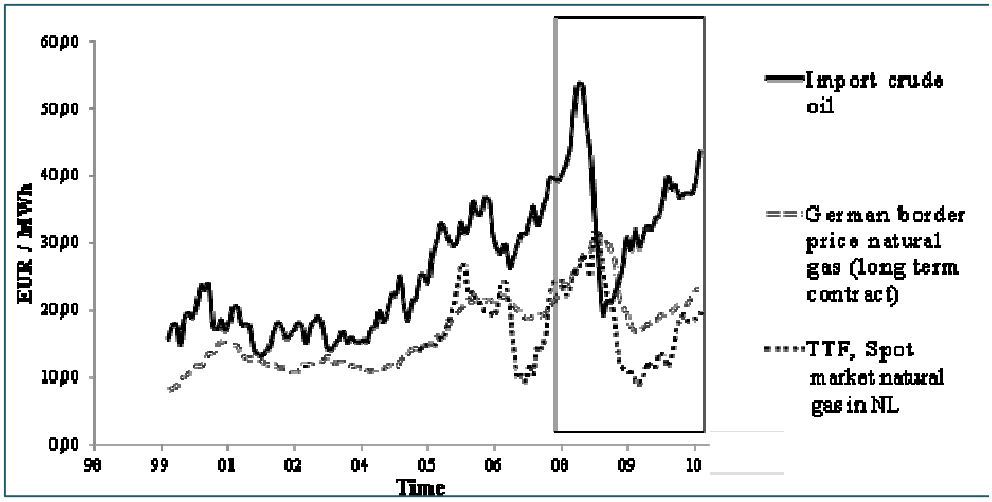

Figure 1
Price development of internationally traded energy products[4]

The price-link is a price setting mechanism, simply transferring the price of a commodity[5] with a certain time delay towards the price of natural gas.

[2] Cf. *Auer, Nguyen* Gasschwemme, 2010.
[3] Starting in the summer of 2010 E.ON Ruhrgas turned to the public, convinced of the necessity to adjust pricing mechanisms in the long-term gas delivery contracts with their international partners.
[4] Source: Own figure; Data from *Statistik der Kohlenwirtschaft e.V.* Energiepreise, 2011.
[5] This can be e.g. crude oil, oil products e.g. light heating oil, heavy oil, or statistical prices such as the German oil import price. Furthermore hard coal or power are also possible depending on the contractual purpose varifying from heating or power production.

This principle of competition oriented pricing can be used in every contract and is technically transferred into a price-formula. It is an industry-internal agreement and is still applied in gas delivery contracts by the entire value chain of the German natural gas economy. However, the gas market dynamics forced a transformation within the contract pricing between natural gas producers and importers. Two main directions are apparent within this process and debate. On the one side the producers tend to remain supporters of the ancien oil price-link, emphasizing its successful historical expansion and their need for investment security. In fact this demonstrates that they are under pressure to develop price setting mechanisms in order to maintain and protect their profit interests. On the other side the importers need to restructure their business model and to regain their profitability, in order to secure their business sustainability. They tend not only towards attaining lower gas prices, but towards establishing new contractual price setting mechanisms. This contrast serves as a basis for the economic analysis of the price-link, trying to find economic arguments favouring or opposing the usage of an oil price-linked price setting or of alternatives.

1.1 Objective and methodology

1.1.1. Goal and crucial questions

Key issues

Object of investigation is an economic analysis of the price-link in long-term contracts between foreign gas producers and German gas importers. This is a key issue in the German natural gas market due to changing market dynamics. Therefore the following crucial questions are being established as:

- What are the current developments in the German natural gas market and what is the role of natural gas in German energy policy?
- What are the economic arguments on the micro- and macroeconomic level of the instrument of price-linked gas pricing?
- What are alternative pricing mechanisms in long-term natural gas import contracts?

1.1.2. Applied methods

This working paper is based on literary and document analysis as well as an assessment of secondary statistical material, which entails an evaluation of published literary and statistical material. Furthermore the master thesis

includes observations using market analysis and expert interviews, enhancing the discussion of the results and the conclusion of the work. However the interviews have not been carried out in a uniformly structured way, as would be the case if the goal were to acquire sound scientific evidence. Nevertheless, this exchange of views has significantly enriched the process of research on this subject and has broadened the perspective of the author.

1.2 Structure of the working paper

The first chapter formulates the introduction, the objective and the crucial questions of this working paper "The price-link in the German natural gas market". The second chapter elaborates on the specifics of natural gas usage, the natural gas market in Germany and the role of natural gas within German energy policy. In this context the focus is upon the previous mainly used oil price-link, describing the historical development, the usage in long-term supply contracts as dominating price mechanism and the design of the specific pricing formula.

The normative basis for evaluating the price-link is given in chapter three, summarizing the underlying economic competition theory. Furthermore theoretical models of the competition policies and theoretical restraints are brought in line with the development of competition in the German natural gas market. The objective is to give an economic perspective of the natural gas market and in particular of the price-link itself.

Chapter four analyses economic consequences of the price-link using the normative understanding of chapter three. The economic assessment illustrates the economic arguments and consequences for competition, market power and pice formation. The fifth chapter discusses possible pricing alternatives briefly. It completes the economic analysis of chapter four and the perspective of the work. This working paper concludes with a summary and a discussion of the results found.

2 Natural gas and the German natural gas market

There are a variety of characteristics of the primary energy resource natural gas. The following chapter illustrates selected characteristics, the German natural gas market and the role of natural gas within German energy policy, ensuring a structured introduction of the analysis carried out in this working paper. In this context, fundamental economic aspects, the regulatory frame-

work, supply and demand of natural gas with a particular focus on the oil price-link are described. A brief systematic description of current developments in the natural gas market concludes this chapter.

2.1 Natural gas usage: specifics of a primary energy source

Technical aspects of natural gas

Natural gas is a non-renewable primary energy resource located in the earth's crust.[6] It is extracted from natural gas reservoirs, from porous rocks and from oil or coal mixed reservoirs. Natural gas results from a complex chemical process in which biological deposits have been decayed under high pressure and at high temperatures. Methane is the main component of natural gas and its energy content is the reason for extraction. Internationally there is the distinction between high and low calorific gas (H- and L-gas), meaning a methane content between 99 Vol. % – 87 Vol. % and 87 Vol. % – 80.1 Vol. %.[7] As a result of this variation in methane percentage, the energy content varies following the *Wobbe* index between H-gas and L-gas with 13.1–13.63 kWh/kg and 10.66–11.26 kWh/kg.[8] This characteristic is considered in the German gas market by the possibility of trading H- and L-gas quality. Another technical point of differentiation is the way in which gas is exploited. Therefore the classification differs between conventional and unconventional natural gas. Conventional gas is natural gas that can be extracted with conventional recovery techniques for instance free natural gas in reservoirs. Unconventional gas can only be extracted by using further technologies such as horizontal drilling or hydraulic fracturing, because the gas does not flow towards the production wellbore in sufficient quantity without further technical measures.[9] Further research has been undertaken to also extract gas from methane hydrates, mud volcanoes in the seabed[10] and from shale layers. These improved technologies increase supply in the global natural gas market, creating new markets and affecting gas economy structures, which have been using price-links and especially oil price-links as a pricing mechanism. The third specific characteristic to mention in this context is the multifunctional usage and storability of natural gas. It is used in Germany for power generation, heat generation and as fuel for mobility.[11]

---

[6] Cf. *Federal Institute for Geosciences and Natural Resources* Energy Resources, 2009.
[7] Cf. *Stadtwerke Norden* Natural gas, 2011.
[8] Cf. *DVGW* Gasbeschaffenheit, 2008.
[9] Cf. *Federal Insitute for Geosciences and Natural Resources* Energy Resources, 2009.
[10] Cf. *RWE* Energiewelt von morgen, 2011.
[11] Cf. *BDEW* Energiemarkt Deutschland, 2010.

Therefore, natural gas is in competition with several other primary energy sources and the storability enhances the flexibility in usage and creates the possibility of peak demand control. The gas economy needs to find competitive price setting mechanisms to retrieve this potential.

Strucual specifics of natural gas

Apart from technical there are also structural specifics of natural gas affecting the gas economy. First, there is the regional separation of production and consumption, resulting in an international network of the industry. About 70 % of the world natural gas reserves are located in the "*strategic ellipse*"[12] between North Western Siberia and the Persian Gulf, whereas 52 % of the natural gas is consumed outside of these gas exporting countries.[13] This fact is supplemented by differences in political systems of the exporting and consuming countries. When talking of price negotiations there is also a difference in the perception of price building mechanisms resulting from different economic systems in place. This is expressed in the fact of having private companies from consuming countries negotiating with state owned companies from exporting countries in an oligopolistic supply structure. Second, natural gas needs large upstream investments and expertise to set up and run either grid transportation or LNG processing infrastructure. From an economic perspective the transportation grid is a natural monopoly, factor specific and inflexible in usage.[14] These circumstances cause the need of investors to find reliable and competitive pricing mechanisms in order to avoid sunk costs, because of stranded infrastructure projects having become obsolete. Third, natural gas is the cleanest fossil fuel in terms of CO_2-emissions emitted per unit of energy output.[15] This characteristic has been put forward in the recent years and can lead to an improved public perception of natural gas.

Natural gas: a scarce and homogen good

The last part of the specifics deals with two classifications of natural gas, having an impact on the price building and thus having an impact on the application of price-links. From an economic point of view usable natural gas is first of all a scarce good, because it has to be produced by human activity. This explains pricing needs and market based mechanisms to value such production.[16] Furthermore natural gas is classified as a homogenous

[12] Cf. *Böhme* Energy Relations, 2011.
[13] Cf. *CIA* Natural gas consumption 2010, 2011.
[14] Cf. *Lochner, Bothe* Gas, 2007.
[15] Cf. *EIA* Carbon dioxide, 2011.
[16] Cf. *Welfens* Wirtschaftspolitik, 2005.

good due to international standards of a minimum content of methane.[17] This simplifies international trade and simultaneously increases the importance of the price and therefore the price setting mechanism as other distinguishing characteristics are missing. However, biological gas production changes this situation. Although it is still standardised methane, consumers start to differentiate and are partly willing to use methane produced on biological basis, because of environmental aspects or regional value added.[18]

2.2 Key issues of the German natual gas market

Phases in the development oft he German natural gas market

The lifecycle approach offers a concept for describing dynamic developments of products or markets over time using defined phases.[19] Applying this concept to the German natural gas market, the starting phase would have been in the mid-1960s, followed by the growing and the maturity phases between 1970 and 1998 and resulting in the relaunch phase since the beginning of the liberalisation in 1998. During that time natural gas usage has established itself as a reliable energy source in Germany and achieved 21.8 % share of primary energy consumption in 2010, which puts it at the second place behind mineral oil with 34.5 %.[20]

What do these numbers and this development signify? The following section tries to find answers. The description of the German natural gas market includes the economic fundamentals, the regulatory regime, the market supply and demand side as well as the current developments. In particular the mainly used oil price-link will be defined and reasons for implementation are discussed in preparation for the economic analysis following in chapter four.

2.2.1 Economic basic data

Economic attributes of the natural gas industry in Germany

The table below indicates several attributes illustrating the economic fundamentals of the gas economy in Germany in the years 1999 and 2009. It starts with the capital investment remaining stable and reaching three bn EUR in 2009. The principal reason among others for that are the expansion and the maintenance of the pipeline network from 355.711 km in 1999 to 445.000

[17] Cf. *Wöhe, Döring* Betriebswirtschaftslehre, 2008.
[18] Cf. *Agentur für Erneuerbare Energien* Wertschöpfung einer Biogasanlage, 2009.
[19] Cf. *Wied-Nebbeling* Preistheorie, 2004.
[20] This means 83,6 bn m^3 or 876 bn kWh have been used in Germany. Cf. *AG Energiebilanzen* Energiebilanz Deutschland 2009, 2011.

km in 2009. Furthermore the table shows a steady decrease of the exploited gas volume in Germany from 206.1 bn kWh in 1999 to 142 bn kWh in 2009. This decrease comes with an increase of imports from 812.4 bn kWh in 1999 to 916 bn kWh in 2009. This characteristic of imports exceeding indigenous production shaped the structure of the natural gas market in Germany persistently within the value chain and the organisational expertise necessary to execute transnational natural gas transportation.[21] All those developments run in parallel to a stagnating demand reaching natural gas sales of 911 bn kWh in 1999 and 885 bn kWh in 2009.

Attribute	Dimension and Unit	1999	2009
Capital investment	Billion EUR	2,6	3,0
Length of the pipe network	km	355.711	445.000
Exploited natural gas in Germany	Billion kWh	206.1	142
Imported natural gas	Billion kWh	812.4	916
Natural gas sales	Billion kWh	911	885

Table 1: Economic basic data of the natural gas industry in Germany[22]

Value chain

As market liberalisation has shaped the natural gas market, trade has become important in the value chain in continental Europe. This has been a significant development since liberalisation and origination of liquid gas hubs emerged in the near past and created the necessary market conditions. The value chain nowadays consists of the steps of exploration, transportation, trade, storage, sales and distribution to the end consumer.[23] Processing natural gas e. g. cleaning or changing pressure for transportation reasons is always included in the physical movement of gas.[24]

The value chain is in reference to the business areas of the companies involved in that branch. That is why the German natural gas market divides into three main levels as:

[21] Cf. *Stäck* Gasmarkt, 2008.
[22] Source: Own table; Data from *E.ON AG* Branchenreport Erdgas, 2010 & *BDEW* Energiemarkt Deutschland, 2010.
[23] Liquid gas hubs are wholesale markets with big sales volumes, good conditions to exercise trades due to numerous traders, a variety of products offered and minimum transaction costs.
[24] Cf. *Spicker* OTC-Handel, 2006.

1. Domestic production or import of natural gas (upstream),
2. Transmission of natural gas (midstream),
3. Distribution of natural gas to the end consumer (downstream).[25]

The first level determines the origin of the natural gas. It can either be domestically produced or imported. The second level of transmission and distribution is handled by about 700 regional companies. The interfaces to end consumers are the regional distributing gas companies partly offering also power and heat. They usually serve households, commerce, industry or power plants. Direct trade is also partly done and the new possibility of buying and selling gas from gas traders is supplementing this system. The following figure 2 provides an overview of this structure.[26]

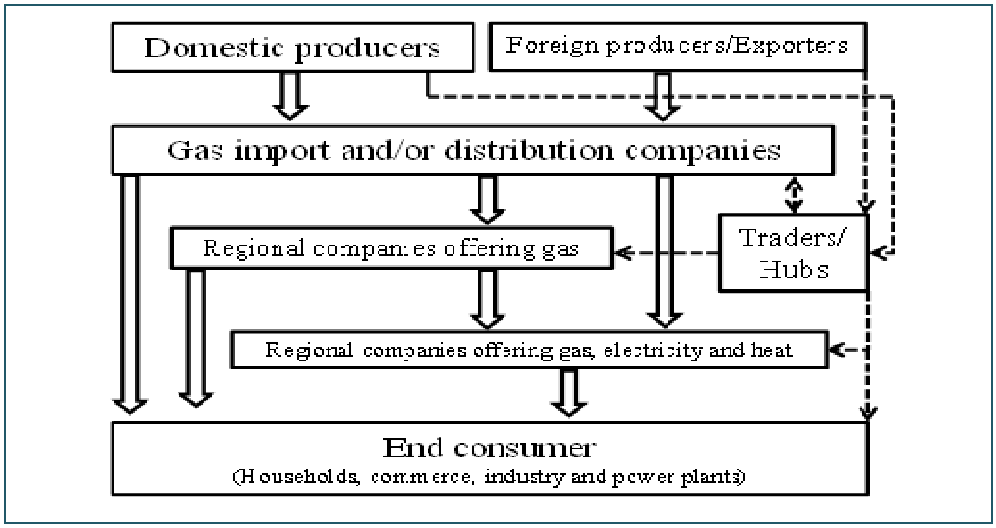

Figure 2
Structure of the German natural gas industry[27]

In addition the gas economy has a complex structure of the involved stakeholders and institutions e.g. utility companies, network operators, gas customers, investors, government agencies, municipalities, employees and non-governmental organisations. Different interest groups need to be addressed and public acceptance needs to be achieved for construction and operation of necessary infrastructure.[28] This underlines the situation that long-term investments specific to the gas economy for instance in production facilities or pipeline infrastructure depend on several partners agreeing upon. How-

[25] Cf. *Schiffer* Energiemarkt Deutschland, 2005.
[26] Cf. *E.ON AG* Erdgas, 2010.
[27] Source: Own figure; According to *Schiffer* Energiemarkt Deutschland, 2005.
[28] The E.ON AG is managing Stakeholder Dialog as part of their Corporate Responsibility Strategy.

ever, as there is a complex structure of the gas economy and a lot of different stakeholders partly with international background, different interests need to be addressed. That is why contracts and the regulatory regime play a significant role in this branch.

2.2.2 Regulatory Regime

Since the recent two decades the European and the German gas markets are in the centre of discussions and measures focusing on market liberalisation. This creates continuous changes in the regulatory framework.[29] Before that period, the focus was upon energy security by ensuring adequate supply. This part dealing with the regulatory regime doesn't claim to be all-embracing, because it deals with the described structure on the surface and leaves regulatory frameworks e.g. subsidies for Biogas, energy taxes, accompanying regulations and emissions trading aside.[30]

Legeslative basis

The regulatory framework consists of international, European and national legislation levels and regulatory institutions accompanying regulation. In Germany, the European energy related directives are implemented into the Energy Industry Act (Energiewirtschaftsgesetz). Supportive regulation e.g. the Gasnetzzugangsverordnung (GasNZV)[31] deals with details in the specific execution of the Energy Industry Act. International agreements e.g. for climate protection such as Kyoto Protocol serve as a framework for European and German regulation.[32] Furthermore an independent regulatory authority the "*Federal Network Agency for Electricity, Gas, Telecommunications, Post and Railway*" (Bundesnetzagentur – BNetzA) controls actions and competition within the gas and also other grid based markets.[33] In addition, German economic policy monitors developments within the gas economy using independent competition authorities such as the "*Monopolies Commission*"[34] and the "*Federal Cartel Authority*"[35]. On the European level the Agency for the cooperation of Energy Regulators (ACER) assists

[29] Cf. *Nötzold* Energiepolitik, 2011.
[30] For more information especially on German energy regulation see Pricewaterhouse Coopers AG Entflechtung und Regulierung (unbundling and regulation), 2008.
[31] The names of the GasNZV in English language is: Gas Grid Access Regulation. It deals with the non- discriminatory third party access to the gas grid in connection with § 20 Section 1 Energy Industry Act.
[32] Cf. *Konstantin* Energiewirtschaft, 2009.
[33] Cf. *Kurth* Energiewirtschaft, 2010.
[34] see www.monopolkomission.de.
[35] see www.bundeskartellamt.de.

national regulatory authorities in exercising regulatory tasks for the creation of an internal energy market since 2010.[36]

Features of competition in the natural gas market

Appendix I provides an overview of the legislative regulation starting from the beginning of the energy market liberalisation relevant for natural gas in 1998. In this figure it becomes obvious that the EU is the key driver in the liberalisation process shaping the German gas market. Especially with the amendment of the energy industry act in 2005 a process of reorganization of the gas market has been started.[37] Formerly separated market levels are now open to resolve monopolistic structures and to introduce competition. The goal is to reduce market entry barriers, create transparency and to implement market processes within the complete value chain. The four main features to achieve that competition are:

- Free choice of utilities,
- Unbundling of gas production, gas grid, gas trade and gas distribution (vertical disintegration) on the legal, operational, informational and accounting level,
- Third party access to the gas grid,
- Independent regulator monitoring gas market.[38]

Goal of the regulation

This creates a structural and institutional framework that allows a better integration of the European gas economy. However, growing competition and market based mechanisms in the gas economy are more likely to be developed, if the structural framework holds and government failures are avoided.[39] The costs and benefits of regulation are hard to define, but the manner in which liberalisation is to be achieved is by applying more regulation. However, this regulation does not have direct influence on the price and does not prohibit the application of different types of price-links. Nevertheless it aims at market prices, to be formed by supply and demand of the respective energy resource.

2.2.3 Supply and demand: new entrants and stagnating demand

Supply and demand are the two main market determinants of the price. Price-links to other commodities are not directly affected by price signals

[36] Cf. *European Commission* Agency for the Cooperation of Energy Regulators, 2012.
[37] See the Civil Code Book 1 General Section. I 2005, p. 1970 et seqq.
[38] Cf. *Konstantin* Energiewirtschaft, 2009.
[39] Cf. *Helm* Energy policy, 2011.

due to changes in supply or demand of natural gas. However, an investigation of these two factors is necessary, because natural gas market based pricing is becoming increasingly important and is forces back price-links mechanisms.

Supply sources

An aggregated level is chosen to describe the German natural gas supply and demand. A differentiation in terms of seasons and German regions is not undertaken. Germany tries to diversify the supply sources for natural gas, because of the low indigenous reserve to production ratio (R/P)[40] of 6.5[41] and the high dependency on imports (see 2.2.1). In 2010, national production covered 16 % of the supply.[42] The largest supplier however was Russia with 31 % followed by Norway with 28 % and the Netherlands with 19 %. The remaining 6 % came from Denmark and the United Kingdom (UK).[43] As those numbers imply, the procurement market between producers and gas import companies has the structure of an oligopolistic market. There are three quasi-governmentally controlled producers with Gazprom, Statoil and Gasunie and some other multinational oil companies such as Royal Dutch Shell, BP, Total or ExxonMobil. In the future the supply situation will remain oligopolistic, but will further improve, due to the second Nord Stream pipeline being finished in 2012.[44] This fact and the current global oversupply in natural gas due to unconventional natural gas production,[45] result in liquid gas hubs, making it harder for global producers such as the Gas Exporting Country Forum (GECF)[46] to manage prices in the market.[47]

Excursus: Biogas in the German gas supply

A specific circumstance in the German gas market is the increasing role of Biogas[48] in gas supply.[49] On average Biogas consists of methane (45-70%) as well as of carbon dioxide (25-50%), hydrogen sulphide, ammonium and

[40] The R/P ratio is the number of years for which the current level of production of any energy and mineral can be sustained by its proved reserves. For more information see *Feygin, Satkin* Reserves to Production Ratio, 2003.
[41] Cf. *BP* Statistical Review of World Energy June 2011, 2011.
[42] Cf. Ibid.
[43] Cf. *BDEW* Energiemarkt Deutschland, 2010.
[44] Every Nord Stream pipeline is able to transport 27,5 bcm per anum. Cf. *Nord Stream* European Energy Security, 2011.
[45] Cf. *IEA* Energy Outlook 2011, 2011.
[46] Member states are: Algeria, Bolivia, Egypt, Equatorial Guinea, Islamic Republic of Iran, Kazakhstan (observer status), Libya, Netherlands (observer status), Nigeria, Norway (observer status), Qatar, Russian Federation, Trinidad and Tobago, Venezuela.
[47] Cf. *Erdmann*, *Zweifel* Energieökonomik, 2008.
[48] Bio-natural-gas is the preferred gas-industry term for upgraded biogas, but the scientific terminology biomethane.
[49] Cf. *Biogaspartner* 2011 a.

condensed water.[50] It is produced from biological material and afterwards processed and upgraded for injection in the natural gas grid. The figure 3 indicates the development of Biogas in Germany. Only within 2010 the quantity of fed in stations has more than doubled achieving 66 stations, meaning a surplus of 450 % compared to 2008. The capacity took the same development reaching 250 Mm^3 in 2010, increasing 415 % compared to 2008. Regulatory support of the production of Biogas is the main reason for this development and further growth can be expected in this gas supply segment.[51]

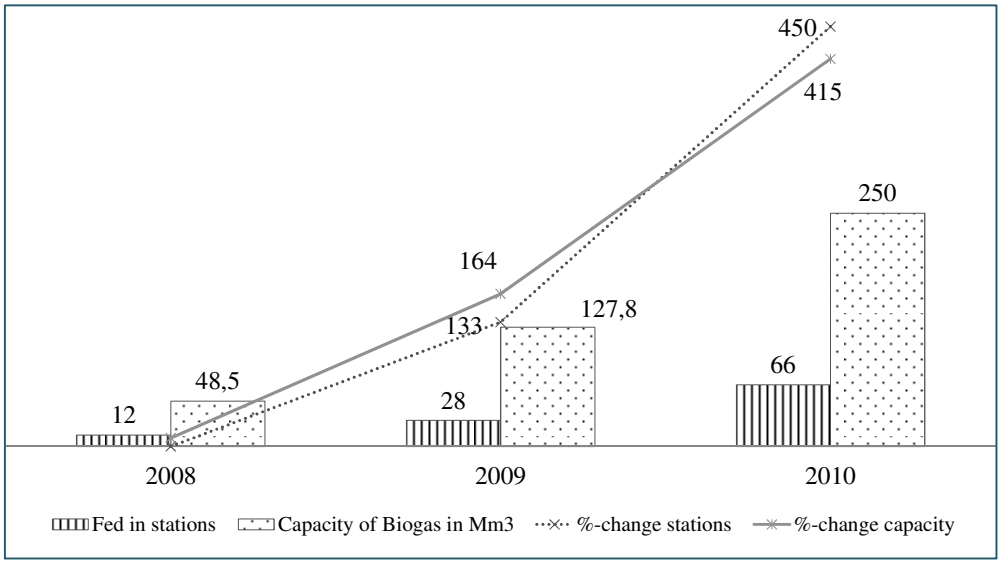

Figure 3
Development of Biogas in Germany[52]

Security of supply

The variables affecting an economical and secure supply of natural gas are diverse[53]: political stability, storage capacity of gas to secure elastic supply, technical know-how in extraction, processing and transport of natural gas, investments in infrastructure[54], a legal framework and other exogenous trends in the penetration of gas. This creates a multi-dimensional environment for investors to manage economic decisions and impacts on prices.

Demand of natural gas in Germany

In Germany the demand for natural gas is stagnating. Increasing use of natural gas for power production and in the traffic sector[55] cannot compensate a

[50] Cf. *Biogaspartner* 2011 b.
[51] Cf. *Fraunhofer* Biogaseinspeisung, 2009.
[52] Source: Own figure; Data from *BDEW* Energiemarkt Deutschland, 2010.
[53] Cf. *Oushoorn*, *Schlaak*, *Waterlander* Gas Markets, 2010.
[54] In this context infrastructure means: pipelines, LNG (re)gasification facilities and storage facilities.
[55] The amount of natural gas sales in the traffic sector grew from 239.9 bn kWh in 2000 to 2500 bn kWh in 2009, but remains low (Cf. *BDEW* Gaswirtschaft, 2010).

declining residential usage of gas heating systems in newly built houses[56] and increasing energy efficiency. Furthermore energy intensive industries try to diversify energy supply meaning a full use of all energy resources and continue to increase energy efficiency.[57] However, German natural gas demand driver's e.g. economic activity in boom and bust periods and climate happenings such as warm winters, due to significant importance of residential and district heating natural gas demand, also have a cyclical character and thus are exposed to very high uncertainties regarding their development.[58] Most of the 885 bn kWh of natural gas consumed by the industry sector with 325 bn kWh, followed by households consuming 286 bn kWh. Commerce and power plants together consumed 223.5 bn kWh, whereas distance heating and traffic shared 50.5 bn kWh of the natural gas sales.[59]

Complexity of variables affecting supply and demand

The variables affecting demand of natural gas are also various: climate and temperature, technological progress improving energy efficiency, inventory of energy-consuming capital assets, demographic development or the business cycle and other exogenous trends in the affection of gas. Due to this complex environment of supply and demand variables and the difficulty in predicting which variables will be decisive, investors want to reduce risk. That is why long term contracts have been established dominated with oil price-linked price settings. The next chapter provides an overview of the definition, describes the historic development of the oil price-link, a practical example of a price-link formula and a comparison between oil and gas as an example of price-linkage to another commodity.

2.2.4 The oil price-link: neuralgic point in contractual relations

Definition

The oil price-link as other price-links transfers the price in this case of oil[60] with a certain time delay towards the price of natural gas. This principle is called "*Anlegbarkeitsprinzip*"[61] (principle of competition oriented pricing) and can be used in every contract. It simply means that the value of natural gas is not determined by supply and demand of natural gas, but by orientation towards other energy commodities such as oil. By definition the link is

[56] The share of the gas heating facilities in newly built houses fell from 72.1% in 1996 to 50.4% in 2010 (Cf. *Herminghaus* gas heating facilities, 2011).
[57] Cf. *IHS CERA* European Gas Country Profile, 2010.
[58] Cf. *BP* Statistical review 2010, 2011.
[59] *BDEW* Energiemarkt Deutschland, 2010.
[60] This can be crude oil, oil products e.g. light heating oil, heavy oil or statistical prices such as the German oil import price.
[61] *Neuhaus* Erdgasvermarktung, 2006.

"*a contractual scheme, which allows the modification of a contract price*"[62]. Usually this mechanism is put into contracts by a certain formula and as a contract clause is consequently a major part of the negotiations.

Historical development

As the natural gas market in Germany was established in the mid-1960s, investments into infrastructure building processes needed to be undertaken across national borders. In consequence, natural gas producers were faced with the price risk, meaning that the price for the natural gas needed to cover all production costs in this long-term investment cycle (>10 years). Whereas importers were faced with the risk of selling the volume of natural gas, meaning that they had to find solvent end consumers and flexibility tools e.g. storage facilities for managing the volume on a long-term basis. This elasticity needed to be taken into the long-term contracts to have calculation bases, regarding the fact that there was little experience for long-term transnational investments. Both sides were seeking price stability and wanted to impede substitution of natural gas primarily in the heating market, meaning oil is a substitution for gas, because gas can be processed to become oil-equivalent (gas to liquid, GTL). Furthermore, most of the companies were also engaged in the oil economy acting not to endanger sales volumes and price reduction of oil.[63] In consequence, the oil price-link as a principle of competition oriented pricing has been the predominant pricing principle at that time. With natural gas achieving 21.8% of German primary energy consumption today, one can say that this was a successful development. However, there have been crises in using this principle. The two oil crises in 1973 and 1979/80 challenged the price setting and accelerated the development of alternatives. In chapter five these alternatives will be described among others things.

Long term contracts: Usage of oil price-link as dominating price mechanism

Traditionally long-term contracts mostly endure between 15 to 30 years and have been closed by German gas transmission companies with producers of natural gas on the basis of private (common) law.[64] This reflects the international and private sector characteristics of the gas economy.[65] They build the main basis for the international over-the-counter (OTC) trading. Those contracts are called take-or-pay contracts, because of the commitment of the buyer to take a defined minimum amount of the natural gas over a long

[62] *Topp* HEL-Bindung, 2010.
[63] *National Petroleum Council* Gas to Liquids, 2007.
[64] The contract duration of natural gas deliveries form transmission companies to regional gas companies are usually one to five years.
[65] Cf. *Riemer, Kästner, Kießling* Energie in 60 Minuten, 2011.

period of time.[66] If the buyer takes less volume than agreed upon within the contract, he must still make payments with respect to the lower limit.[67] This lower limit is usually at 90 % in gas import contracts, but varies according to contractual agreements.[68] However, these long-term contracts and the take-or-pay clause reflect the long-term investment cycle of natural gas. From an economic perspective this also represents a market exit barrier, as the buyers are not able to flexibly adjust their gas supply with changes in demand. The contracts will hold and leaving it can lead to economic and reputational loss. It is a contrast of economic interests, creating a managerial challenge.

The exact parameters are part of every contract due to the agenda of the contract parties. However, the price formula is usually reviewed every three to five years, meaning a limited opportunity to make fundamental changes.

The price-link pricing formula: A practical example

The price-link pricing formula is an industry standard applied in the up- and downstream market levels within the German gas economy. This means that producers and importers use it within their long-term contracts, as well as local utilities and traders mostly use it in mid- and short-term contracts. The pricing formula is part of the private business contracts between those parties, meaning that it is an issue of private law in which the state in principle has no right to intervene directly. The legal foundation is the freedom of contract stated in the "*Personal freedoms*"[69] of § 2 (1) Basic Law of the Federal Republic of Germany: "*Every person shall have the right to free development of his personality insofar as he does not violate the rights of others or offend against the constitutional order or the moral law.*"[70] However, in recent times the oil price-link usage came under legal pressure due to German court decisions. On the 24th of march of 2010 the German Federal Court (Bundesgerichtshof) precipitated a court ruling by declaring that the oil price-link is a violation of § 307 "*Test of reasonableness of contents*"[71] Civil Code (Bürgerliches Gesetzbuch), which was also confirmed in September of 2010 by the German Federal Constitutional Court (Bundesverfassungsgericht).[72] In consequence an increase of gas prices due

[66] Cf. *Erdmann, Zweifel* Energieökonomik, 2008.
[67] Cf. *Pechtl* Preispolitik, 2005.
[68] Cf. *Wood Mackenzie* Take-or-Pay, 2011.
[69] Basic Law of the Federal Republic of Germany I. Basic Rights Article 2.
[70] Basic Law of the Federal Republic of Germany I. Basic Rights Article 2 (1).
[71] Civil Code Book 2 Law of Obligations Division 2 Drafting contractual obligations by means of standard business terms Section 307.
[72] Cf. *Stürmlinger* Ölpreisbindung, 2010.

to more expensive commodities such as oil or other is an "*unreasonably disadvantage*[73]" for the end consumer and not conforming to German law. However, this legal dispute proceeds on the German downstream level and creates no internationally binding basis for the upstream segment. In such a case, contractual disputes between producer and importer are negotiated before international independent arbitral courts e.g. in Stockholm (Sweden).

The structure of this formula follows a certain pattern, the content of which can be adjusted separately. The following figure 4 shows a simplified construction of such a price formula:

$$T = T_0 + \sum_{i=1}^{n} WF_1 \times C_1 \times RP_1 + \ldots + WF_n \times C_n \times RP_n$$

Figure 4
Schematic price – link formula[74]

Factors of the formula

where:

- T = Tariff paid by the buyer
- T_0 = Basic Tariff
- WF = Weighting factor
- C = Constant (energy conversion factor)
- RP = Reference Price

The formula calculates the tariff paid by the buyer of the natural gas valid for a certain defined time period. It consists of the basic tariff, which is agreed upon by the contract parties. This is added to the sum of the calculation of the reference prices multiplied with their energy conversion factors and the weighting factor. The reference price is an average price consisting of average monthly prices of a chosen energy commodity, standing in substitutive competition with natural gas as for instance light fuel oil. The energy conversion factor takes into account the conversion of the selected commodity prices to the gas price. The weighting factor considers the chosen importance of that energy commodity. As a condition of this formula the sum of all weighting factors must add up to one. Appendix II includes a simplified practical example of natural gas price calculations using the oil price-link.[75]

[73] Civil Code Book 2 Law of Obligations Division 2 Drafting contractual obligations by means of standard business terms Section 307 (1) Sentence 1.
[74] Source: Own figure.
[75] For a precise explanation of the formula see *Specht* Gasbeschaffung, 2001.

Time dimension of the formula

The formula in the gas delivery contract will be used in a time mechanism. Prices generally rearrange quarterly according to the contractual formula and agreement with duration of three months. This time mechanism may for instance follow the schemes of 6/3/3, 3/3/3 or 3/1/3.[76] The first number defines the length of the reference period taken as a basis to calculate the reference price, the second number states the time delay, with which the calculation of this reference price starts and the third number terms the coming duration of the price validity.

Other variables in the price-link formula

In the international gas contracts several price formulas for example the "*Continental European Gas Pricing Formula*"[77] or the "*Ashkhabad pricing formula*"[78] are possible. This reflects regional features in the energy infrastructure and gas substitution competition. Furthermore variables such as inflation and exchange rates can also be part of the formula in import contracts.[79]

Comparison of oil and natural gas characteristics

As the oil price-link connects the price setting of oil and natural gas the questions occur: What are the differences of these products and is the connection justified? In general, the interdependency of the fossil fuel markets is based upon usage substitution. The following table gives an overview of three differences between oil and gas by choosing the attributes of usage, substitution and P/R ratio in 2010.

Table 2
Comparison of selected attributes between oil and natural gas [80]

Attribute	Oil	Natural gas
Usage in Germany	Traffic, rarely power and heat production; 33.4% in primary energy consumption in 2010	Power and heat production and rarely traffic; 21.8% in primary energy consumption in 2010
Substitution	Mostly no substitution in traffic sector	Yes, in every use substitution with oil or coal
R/P ratio in 2010	46.2 years	58.6 years

Consequences of the oil price-link

Oil is mainly used for traffic purposes as fuel in cars, aeroplanes and ships and nowadays is rarely used for power and heat production. Natural gas is used for power and heat production outweighing usage for traffic, even

[76] Cf. *Lechwerke AG* Gas-ABC, 2012.
[77] Cf. *Frisch* Gas Pricing Problems, 2010.
[78] Cf. *Mitjajew* Gasstreit Russland – Ukraine, 2009.
[79] Cf. *Hedge, Fjeldstad* Natural Gas Contracts, 2010.
[80] Source: Own table; Data from the *BP* Statistical Review of World Energy 2011, 2011; *AG Energiebilanzen* Energiebilanz Deutschland 2010, 2011.

though the number of gas stations for mobility purposes is rising. These different usage patterns lead to several substitution possibilities, meaning a negative effect for the price-linkage as the markets of fuel application differ. As there are several other resources for power and heat production as for instance nuclear energy, renewable energy or coal, this is not yet the case for traffic exercised by cars, air planes and ships. However, the oil price reflects scarcity because of market based price settings and global liquid markets. Based on different R/P ratios, this adds up to a price distortion of oil price-linked natural gas, because oil and natural gas supply fundamentals differ. Oil with 46.2 years R/P ratio in 2010 is much scarcer than natural gas with its 58.6 years R/P ratio in 2010. This is at odds with the fact that oil shares 11.6 % more in primary energy consumption. An effect of these different attributes is the price decoupling of oil and gas products observable in Germany in the period from 2008 to 2010. Because of the strong price increase of oil products in the recent years, natural gas also became more expensive. However, since oil prices began to rise again in mid-2009 imported natural gas prices in Germany in contrast stagnated (see figure 5).

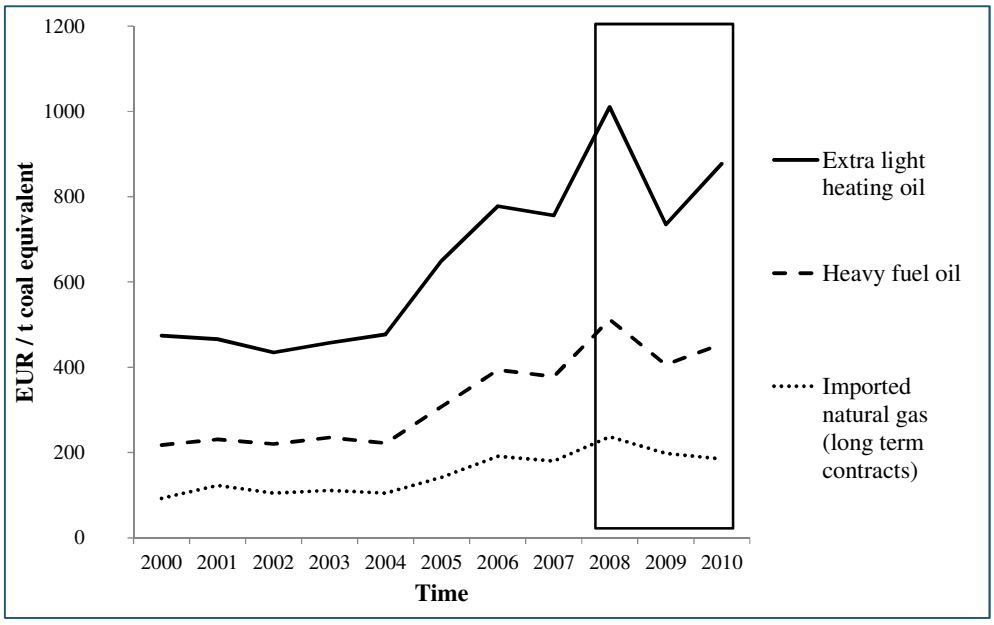

Figure 5
Prices of oil products and imported natural gas in Germany[81]

As a result of liberalisation mostly new natural gas distribution companies entered the market. Without sticking to price-links in long term contractual relations, they simply buy natural gas from liquid hubs such as Title Trans-

[81] Nach *Bundesnetzagentur 2011-a*, Stand 3. Feb. 2011.

fer Facility (TTF) in the netherlands or from the European Energy Exchange (EEX) in Leipzig and gain a price advantage. This puts the established gas industry in Germany under pressure to renegotiate their price mechanisms.

2.2.5 Current developments: challenges for the gas industry in Germany

Current developments take place in the technical, economical and legal area of the gas economy inducing different implications in the different world regions. The following selection of current developments is based on the attribute of affecting the oil price-linked long-term contracts in the German gas economy.

Trends in the global market

In general, natural gas is in the process of commoditisation, becoming a good that is traded on a global market.[82] Changes in supply, demand or improved technologies in one part of the world, start to affect the other parts. This follows the global integration of production, pricing and consumption of natural gas caused for instance by improved transportation technologies such as LNG.[83] These trading and arbitrary possibilities have also led to more natural gas volumes available at the European gas hubs. Furthermore a current global oversupply of natural gas due to the production of unconventional gas by using hydraulic fracturing increases the resource base. All these developments reinforce the debate on the oil price-link, because the spot market prices are currently cheaper and the gas availability is good. This oversupply of gas is accompanied by stronger production coordination by GECF trying to regain negotiating power.[84] However, what is currently happening in the global gas market is a transformation reaction and risk reallocation because of changing market fundamentals.

Trends in the German market

New opportunities for storing electrical energy are needed due to the increasing share of renewable power production in the energy mix. The storage of methane in the existing natural gas grid offers a method and capacity for this, as it can shift peak production to high demand with low production. This technology is called "*Power to Gas*" [85] and is currently under development. A future usage of such gas capacities has different price building factors than the substitution to oil. If the oil price-link is enforceable in

[82] Cf. *Auer, Nguyen* Gasschwemme, 2010.
[83] Cf. *IEA* Supply options, 2003.
[84] Cf. *Lichtschläger, Ellersdorfer* Gasmarktmodell, 2010.
[85] For more information about this innovation see the strategy platform of the German Energy Agency www.powertogas.info.

connection with such "*renewable methane*"[86] remains a question for the customers to answer. However the support of such alternative gas production has the purpose of diversifying gas supply and therefore to lower natural gas imports.

Another topic is the discussion about hydraulic fracturing for the extraction of natural gas from unconventional resources and possible related environmental hazards.[87] To what extent these projects will be enforceable against citizen protests remains open. However, the efforts to create a positive public atmosphere concerning infrastructure projects have increased in the recent decade.[88] The issue of stakeholder dialogue is therefore playing an increasingly important role for gas companies.

Another remarkable development is the continuous regulatory change such as for example the formation of only two market areas *NetConnect Germany*[89] and *Gaspool* since the 1st of October 2011. These two market areas simplify gas trading in Germany and found new conditions for the future development of deep and liquid hubs. It is to be believed that the regulatory changes as for instance the entry-exit model for the transport contracts have supported the development of the traded hubs. However, further standardization and regulation is necessary, because for example L-gas is still used in northwest Germany. [90]

2.3 German energy policy and the role of natural gas

Political analysis

Political analysis can be conducted in three parts of policy, polity and politics. This concept hides the multidimensional analysis of policy. Politics marks the political process by different actors trying to convey the design of public policy with their own influence. Polity refers to the institutions involved in the design process of public policy. Policy analysis focuses on the political content of public policy, in the form of laws, regulations, party programs and individual decisions. This section deals with the policy analysis of energy policy in Germany and will emphasize arguments for and against natural gas as part of the energy mix.[91]

---

[86] *Krause, Müller-Syring* Erdgasnetz, 2010.
[87] Cf. *Focht* Gasbohrungen, 2011.
[88] Cf. *dpa* Energiewende, 2011.
[89] The hub *NetConnectGermany* was founded in 2006, the hub *Gaspool* in 2004.
[90] Cf. *Focht* Gasnetz, 2011.
[91] Cf. *Schneider, Janning* Politikfeldanalyse, 2006.

German energy policy

German energy policy[92] moves toward three main goals: energy security, environmental compatibility and economic efficiency.[93] However, every applied primary energy source has its own weaknesses, resulting in the impossibility of fulfilling all energy policy goals completely. Therefore the legislator tries to create an energy policy that realizes a well-balanced energy mix using different kinds of energy resources. Within this process, arguments of every energy resource are discussed. Concentrating on natural gas within this work, the following table is a list of possible arguments within the German energy policy concerning natural gas.

Table 3
Main arguments of natural gas in the political dicussion[94]

Energy policy goal	Arguments favouring natural gas	Arguments opposing natural gas	Practical energy policy goal
Energy security (reliable)	Non-fluctuating use; storage capacity; positive R/P ratio	High import dependency	Diversification of import sources; avoidance of market power
Environmental compatibility (environmentally sound)	Cleanest fossil-fuel concerning CO2-emission	External costs of exploration	Stimulation environmental friendly technologies
Economic efficiency (affordable)	Cost advantage because of emission advantage towards other fossil fuels; fast start capability; high energy efficiency in gas and steam power plants	Oil price indexation creates higher prices; rising prices will increase LCOE[95]	Competition, Efficiency

This means that characteristics of natural gas are put in the context of their impact towards the energy policy goals and policy outcome. It is not meant

[92] In addition there is also an European energy policy in the development. Based upon article 194 of the Treaty of the functioning of the European Union the following goals are taken as a basis: to ensure the functioning of the energy markets, ensure security of energy supply within the Union, promote energy efficiency and renewable energies and promote interconnection of the markets. In comparison to the German energy policy goals, these goals must serve a broader spectrum, because they should take the interests of 27 different energy mixes of the Member States into account. This is now formulated in the EU Energy Roadmap 2050 (see http://ec.europa.eu/energy/energy2020/roadmap/doc/com_2011_8852_en.pdf) For deeper insights see *Geden, Dröge* Integration of the European energy markets, 2010 and *Helm* Energy policy, 2002.
[93] Cf. *Kästner, Kießling* Energie in 60 Minuten, 2009.
[94] Source: Own table.
[95] LCOE Levelised Cost of Energy.

to be an all-encompassing embracing table, but it illustrates that there are many chains of reasoning concerning this classification of natural gas. The first column includes the German energy policy goals. The second and third columns list arguments for and against the usage of natural gas respectively in the context of the energy policy goal. The fourth column contains the practical energy policy goals and lists treatment recommendations.

The role of natural gas in the German energy concept

When the German government published the new energy concept on the 28th of September 2010, not much consideration was given to the questions concerning natural gas.[96] This situation changed dramatically in the spring of 2011, because of the nuclear accident in Fukushima Daiichi (Japan) and the following political discussion and subsequent fixing of the nuclear energy phase out until 2022 in the parliament of the Federal Republic of Germany.[97] In addition, 180 individual measures with the title "*The path to the energy of the future - reliable, affordable and environmentally sound*"[98] were adopted by the German government on the 6th of June 2011. Next to increased application of renewable energy production, natural gas has thereby improved its strategic importance within the energy mix. This is due to its flexible usage for power and heat production, the possibility of compensating fluctuating renewable power generation in short time (fast start capability), storability and low CO_2-emissions. As a consequence, natural gas is marked in Germany as the new bridge technology into the *"renewable age"*[99].

2.4 Interim conclusion

The price-link simply means that the price of natural gas is not determined by supply and demand, but by the orientation to competing fuels such as for instance light fuel oil. This is called the principle of competition oriented pricing and is applied as contract formula at all market levels. However, there is no legally or technically binding foundation for applying this link. It is a former market introducing instrument, developed to become an applied industry standard.

---

[96] Only three sources for the term "*Erdgas*" (Natural Gas) in the Energiekonzept (Energy concept). Cf. *Federal Ministry of Economics and Technology et al.* 2010, p. 10, p. 21, p. 24.
[97] Cf. *German Bundestag* Plenarprotokoll 17/117, 2011.
[98] *Federal Ministry for the Environment, Nature Conservation and Nuclear Safety* Energy system, 2011.
[99] Cf. *Wuppertal Institute for Climate, Environment and Energy* Natural Gas, 2010; In addition *Monopolies Commission* Special Report Energy 2011 p. 68.

Changing dynamics of supply and demand in the German natural gas market have shaped the market structure and will continue to do so. Furthermore the regulatory regime supports a competition orientated legal framework to further establish deep and liquid German gas hubs. Because of a favourable natural gas supply situation, even if import volumes by far exceed indigenous production, and stagnating demand, market power has shifted in the buyers (end consumer or regional gas companies) favour. This creates pressure for producers and importers to transform their business models, industry standards and intensified the debate about the price-link mechanism and the oil price link as a price setting mechanism.

3 Competition theory as normative basis for analysing price-links

This is the normative basis from which to evaluate price-links in the gas market. Therefore economic competition theory is used as normative frame and theoretical models of the competition policies are brought in line with the development of competition in the German natural gas market. Additionally, theoretical restraints and market failures are regarded to ensure an enrichment of the normative basis with practical realities. The goal is to give an economic perspective of the natural gas market and in particular of the oil price-link.

3.1 Economic competition theory

3.1.1 Theoretical models of competition: between monopoly and perfect competition

Requirements for competition

The general usage of the term competition implies the desire of two or more groups, organisations or people to achieve a certain objective. This correlates with the condition that the higher the degree of achievement by one party, the lower the level of achievement of the other groups is realised.[100] This concept can be applied to different areas of human society e.g. sports or the cultural level. If it is brought within the context of economic activity, competition is a rivalry of economic units to improve market results.[101] However, this necessitates a number of requirements. These are:

[100] Cf. *Gabler publishing house* Competition, 2011.
[101] Cf. *Schneck* Business Administration, 2007.

- A minimum of two parties either supplying or demanding,
- Existence of markets,
- Antagonistic behaviour,
- Access towards market information,
- A functioning regulatory regime securing freedom of contract etc.[102]

Economic competition theory

These requirements create an environment of competition, finding expression in price- or non-price-parameters such as quantities or quality in service. From an economic view, this has several idealized functions. *Röpcke,* a representative of economic policy, highlights the distribution, control and incentive function.[103] Others, such as *Neumann,* emphasise the establishment of competition as an institutional function, that controls the market based decentralized economy.[104] The overall economic goal to improve the supply of technologically advanced goods and to support innovative behaviour can be assumed behind those functions.[105] However, the different accentuation of the various functions has led to several theoretical competition theories, as competition has been a theme of research and discussion in the past 200 years.[106]

Within an economic context *Adam Smith* and his concept of "*the invisible hand*"[107] can be seen as the starting point of a market-based competition discussion.[108] It started the observation in a static model with given production factors, preferences and technical knowledge and examined the impact of market structures on the level of the supply of goods. Later on, the dynamic competition theory evolved, regarding the feedback effects of the market result on a given market structure (*Schumpeter* and *Hayek*).[109] However, the table below summarizes the main theories and provides their main content and criticism.

---

[102] Cf. *Fritsch* Market failure, 2011.
[103] Cf. *Welfens* Wirtschaftspolitik, 2005.
[104] Cf. *Neumann* Wettbewerbspolitik, 2000.
[105] Cf. *Engelkamp, Sell* Volkswirtschaftslehre, 2011.
[106] For a chronological overview see *Schmidt*, 2005 and *Neumann*, 2000.
[107] First published in his book "*An Inquiry into the Nature and Causes of the Wealth of Nations*" in 1776.
[108] Cf. *Wöhe, Döring* Business Administration, 2008.
[109] Cf. *Klump* Wirtschaftspolitik, 2006.

Competition theory	Represen-tatives	Main content	Criticism
Classical basis	Smith, Mill, Ricardo	System of free competition and markets as the place for price setting	Lack of empirical underpinning
Perfect competition	-	Atomistic market structure with infinite reaction time of market transformation	Unrealistic assumptions e.g. disregarding of market dynamics
Workable competition	Clark, Schum-peter	Dynamic competition in constellation of market structure, market behaviour and market result	Inefficient measurability and vague definition of used terms
Ordoliberalism	Eucken, Röpcke, Rüstow, Böhm	Organization of competition as a tool of economic policy	Incomplete de-finition and usage of the term perfect competition
"Chicago School"	Friedman	Free Market as a principal of federal structure of the state	Social Darwinism

Table 4
Competition theories [110]

Perfect competition vs. monopoly

An in-depth analysis of competitive theories is beyond the framework needed in the context of this thesis. However, for a better delimitation of the requirements necessary for competition the economic literature describes two extreme forms of markets. On the one hand, perfect competition represents the most competitive market, where firms are more likely to be efficient and prices tend to be low. Furthermore each of the market participants has little or no influence on the market price. The model of perfect competition exists on restrictive assumptions such as no market entry and exit barriers, uncertainty and risk. Thus it leads to a greatly simplified representation of reality. On the other hand, a monopoly is the least competitive market, where one company dominates and earns a surplus profit by determining either the output or the price.

However, most markets develop some sort of mixed or partial competition. In this context, *Clark* highlighted the concept of workable competition. He started the discussion to find a normative catalogue consisting of market structure, market behaveiour and market results to evaluate competition.[111] The theoretical basis of the German competition policy is the concept of

[110] The table is not all competition theories embracing. For detailed information see *Bartling* Leitbilder der Wettbewerbspolitik; Cf. *Schwießelmann* Marktprozesse, 2009.
[111] Cf. *The Economist* Economics, 2012.

ordoliberalism and therefore determines the goals of competition policy and the measure of state intervention to achieve these goals. The most notable is the framework of government established by the economic policy to lower restrictions of competition such as cartel formation, violation of the freedom of contracts or to avoid market exit barriers.

3.1.2 Theoretical restrictions of competition theory

Markets as basis of competition

The existence of markets is one of the main requirements for competition. For markets to arise, they also have regulatory framework requirements to arise e.g. guarantee of property rights or transparent regulatory principles.[112] A market in economic terms is the place where supply and demand converges.[113] In this context a place cannot be seen as a territorial area. It is an abstract aggregation of all relations between producers and consumers to enable transactions by making information and opportunities comprehensive, accurate and cheaply available. This information is mainly the price, the quantity and quality of goods as well as other information by seller and buyer.[114]

A special role in this interplay of market factors of supply and demand is the price, because it brings the market into an equilibrium state. [115] The reciprocal relationship of the three market factors of supply, demand and price is the basis of this market-based mechanism. In consequence, changes of one of these factors do result in changes in each of the other two factors.[116] However, price signals do have an important allocation function. They direct the goods to where they create the greatest use and develop their greatest productivity. For this reason prices should reflect the actual cost of production of the product. Only if this condition is satisfied is an efficient allocation possible. Therefore competition seems to be capable of preventing price distortions.[117]

Market failures

Even if the free game of supply and demand can work under competition, the result may not be optimal. The term used in economics to describe such a situation is market failure, meaning the inability of a market to achieve the

[112] Cf. *Knieps* Wettbewerbsökonomie, 2008.
[113] Cf. *Kampmann, Walter* Mikroökonomie, 2010.
[114] Cf. *Rogall* Volkswirtschaftslehre, 2006.
[115] Cf. *Siebert, Lorz* Volkswirtschaftslehre, 2007.
[116] Cf. *Bundeszentrale für politische Bildung* Marktmechanismus, 2012.
[117] Cf. *Weimann* Wirtschaftspolitik, 2006.

allocation of the good efficiently.[118] Theoretical reasons for market failures can be:

- External effects,
- Information deficits (asymmetric information),
- Indivisibleness and market power (missing exclusion principle) and
- Lack of adaptation.[119]

Information as part of the market

These four areas represent violations of the model of perfect competition. In consequence, analysing market failures deals with the implications of reality-departures from this model. The usages of goods result in effects. These effects can be either positive, meaning a benefit for society e.g. site use of gas storage for a better security of supply, or they can be negative, resulting in costs for the society for instance environmental effects of CO_2-emissions of a power plant. The external effects are therefore costs not included in the market price of a good. Transformed to the energy economy those costs can possibly be the eternity costs of coal mining or air pollution. Access to information in transparent, market relevant and suitable ways is the pre-requirement for competition and market mechanisms. Deficits in information can lead to adverse selection[120] and may thus lead to an overall reduction of welfare. Market power can lead to abuse of price or quantity by market participants. Therefore the market share needs to be monitored in order to prevent excessive market concentration. The lack of adaptation can occur in different forms. If we apply this concept to the natural gas market, then the slow reaction towards shifting market factors can be highlighted.

Economic concepts for evaluating market decisions

Apart from these market failures there are also theoretical concepts for evaluating economic decisions. Transaction-cost economics and contract theory are instances of frameworks that have enlarged the perspective of the discussion of market efficiency.[121] Coming back to the important role of information in this market context, there is one circumstance affecting the

[118] The concentration on allocative efficiency leaves questions such as distributive justice aside and engages in a general approach to short. However, in this argumentation of the working paper this is not of significant concern.
[119] *Fritsch* Market failure, 2011.
[120] Adverse selection concerns asymmetric information at the time of the contract conclusion. It is a process in the market which creates suboptimal results. *Ackerlof* established this model in 1970 using the example of the market for used cars. Cf. *Gabler Wirtschaftslexikon* Adverse Selektion, 2012.
[121] Cf. *Gawel* Grundzüge der mikroökonomischen Theorie, 2009.

decision making. Acquiring this market information causes costs, which come on top of the market price. These costs can be:

- Information and search costs,
- Costs of negotiating,
- Costs of monitoring or
- Investments in social capital.[122]

Transactions costs

In fact they are economically valuable and therefore called "*market transactions costs*"[123]. In general, market transaction costs occur during the process of purchase and selling, including pre- and after-sale phases of the transaction such as monitoring the quality of the product. They are a critical dimension for the activity on markets, because costs affect decision making of people or institutions. A general explanation is: The higher the transaction costs, the lower the incentive to execute the transaction ceteris paribus. Institutions in this sense mean markets and organisations as well as social and legal standards, formal or informal rules. *Ronald Coase* in 1937 came up with this concept and developed this theoretical framework.[124] Beside the theoretical analysis of transactional information contract theory is important to mention here in the context of market failures. This theory addresses the question of economic efficiency of contracts. This finds expression in agency theory and the theory of incomplete contracts.[125] Incompleteness refers to the inability to process all available information and to consider all possible future environmental developments. Therefore contracts must be renegotiated in changing business environments and risk management plays an important role.[126]

3.1.3 Competition policy in Germany

Competition policy as the framework of markets

Competition policy seeks to promote market-based mechanisms to prevent market failure and to protect competitive situations in markets.[127] A functioning competition and market system is a pre-requisite for efficient

[122] Cf. *Richter, Furubotn* Institutionenökonomik, 1999; Transaction costs such as corporate or political transaction costs are left aside. Further descriptions see *Richter, Furbotn* Institutionenökonomik, 1999 p. 61 et seqq.
[123] Cf. Ibid.
[124] Cf. *North* Institutional Economics, 1993.
[125] Cf. *Blum, Dudley, Leibbrand, Weiske* Angewandte Institutionenökonomik, 2005.
[126] Cf. *Bannier* Vertragstheorie, 2005.
[127] Cf. *Grüner* Wirtschaftspolitik, 2006.

resource allocation, the sovereignty of the consumer and the limitation of economic power.[128] Another objective of the competition policy is the opening of markets e.g. by reducing Access restrictions, often making it difficult to obtain monopolies or cartels.[129] The social market economy has been the applied economic system in Germany since 1949 and competition has been part of economic policy since then. This system takes the individual freedom in economic decision as a basis, but creates a framework to regulate social security.[130] However, within the recent years there is a trend towards an increase of state actions intervening in economic processes as seen for example with the partial insertion of minimum wages for labour or in energy policy. Nonetheless, polity tries to realise decisions using market-based instruments such as to implement an emission trading scheme[131] or an optional market premium for renewable electricity in the start of 2012.[132] A valuation of the introduction and success of these instruments is to be absent at this point.

Legeslative basis of competition in Germany

The competition policy of the state and all private or state actors, is applied within a regulatory framework. In Germany there are two main antitrust regulations: The Act Against Restraints of Competition (Gesetz gegen Wettbewerbsbeschränkungen – GWB) is monitored by the Federal Ministry of Economics and the Act Against Unfair Competition (Gesetz gegen unlauteren Wettbewerb – UWG) is monitored by the Federal Ministry of Justice. Furthermore there are several stakeholders involved in the process of organizing competition in general: The Monopolies Commission and the Federal Cartel Office. Furthermore there is the Ministerial Approval to allow corporate mergers and the Federal Network Agency for regulatory issues in grid based markets. On the European level the EU competition law from May 2004 and the "*European Merger Regulation*" is monitored by the European Commission.

Competition in the Energy Industry Act

Coming back to the price-link and the natural gas market, competition is not only anchored in the GWB, but also in § 1 (2) of the Energy industry Act. It states: *"The regulation of electricity and gas distribution networks serves the objectives of ensuring an effective and undistorted competition in the*

[128] Cf. *BMWi* Wettbewerbspolitik, 2012.
[129] Cf. *Eucken* Wirtschaftspolitik, 2004.
[130] Cf. *Altmann* Wirtschaftspolitik, 2007.
[131] Cf. *Stiftung Marktwirtschaft* Ressourcen und Energie, 2012.
[132] Cf. BDEW Stromzahlen 2011, 2012; more information about the market premium in § 33g Gesetz für den Vorrang Erneuerbarer Energien (Renewable Energy Act).

supply of electricity and gas…"[133]. This competitive focus is thus a concrete goal and framework of regulation of the gas market and needs some further observation. In anticipation of the economic analysis of chapter four, the coming section analyses the competitive situation in general in the German natural gas market.

3.1.4 Competition in the German natural gas market

The already mentioned opening of markets as an objective of competition policy is especially challenging in network markets. These are essentially characterized by their requiring networks in their provision of services. Therefore one speaks of networks as a "*natural monopoly*", meaning that a replication of the same is generally not economically viable. However, on the network up- and downstream areas, competition is possible. In this case a legislative regulation is necessary as the monopolist needs to be limited in setting his business parameters such as the network transmission fee charged of his competitors. The difficulty is to simultaneously open the market and to organize investment into the infrastructure facilities. The liberalization in the energy sector initiated this process. The Federal Network Agency assumes the role of the network regulator, creating a non-discriminatory network access at fair prices and encouraging competition in the upstream and downstream network areas.

The following section describes the competition on the German gas market using the indicators of the number of transmission customers for market accesse as well as the market structure of the gas supply. Furthermore the section summarizes the development of the grid areas.

Market access

A well-functioning competition characterizes a good and easy market Access. The ratio of transmission customers to gas network operators is therefore a good indicator. Both transmission and distribution system operators in Germany display a clear upward trend in the number of transmission customers, indicating increasing competition. Especially in 2009 the growth rates were high. The number of customers of the transmission system operators grew approximately 60% to an average of 37.8 and the number of customers of the distribution system operators almost tripled from 5.6 to an average of 15.2 (see figure 6).

[133] Energy Industry Act § 1 (2) sentence 1.

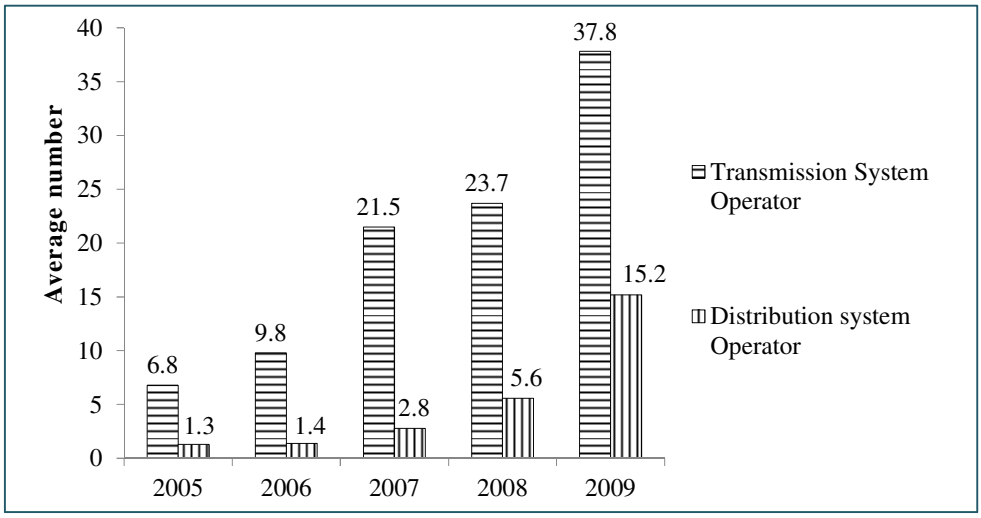

Figure 6
Average number of transmission customers of network operators [134]

Market structure supply side

The number of suppliers has significant impact on the competitive assessment of a market. A number of new providers have entered the German gas market in recent years e.g. GDF SUEZ, Trianel or Nuon.[135] The concentration of the supplier firms therefore is a good indicator to assess the supply structure. The figure 7 on the next page shows the market shares of the five largest companies on total gas sales and on gas imports to Germany. This calculation was performed using the dominant method.[136] Both market segments show a declining trend in their concentration of market shares of the five largest companies. An animated competition can be spoken of in the gas sales segment with 36.90% share of the five largest companies in 2010. In contrast the imported gas segment structure remains oligopolistic with 72.90% in 2010.[137]

Number of market areas

The Federal Network Agency for Electricity, Gas, Telecommunications, Post and Railway aims to form fair and effective competition in the supply of natural gas through a number of initiatives for instance reducing the number of market areas[138]. Since the launch of the Agency in 2005 there has

[134] Source: Own figure; Data from *Federal Network Agency for Electricity, Gas, Telecommunications, Post and Railway* Monitoringbericht 2010, 2010.
[135] Cf. *IHS CERA* European Gas Country Profile, 2011.
[136] The dominant method is the inclusion of the market shares of the dominated company towards the controlling company to 100 %. The shares that are equally 50 % to 50 % distributed respectively are attributed equally.
[137] Cf. *Federal Network Agency for Electricity, Gas, Telecommunications, Post and Railway* Monitoringbericht 2011, 2011.
[138] Market areas in the German natural gas market are virtual for the clearing of the traded quantities of gas.

been significant progress in this initiative as evidenced by a reduction in the number of balancing zones from 14 to eight in October 2008, to six in 2009 and currently two since October 2011.[139] In combination with the two-contract model of entry/exit capacity booking, allowing a non-discriminatory third party Access to the German networks, this is one of the successes of liberalization.[140]

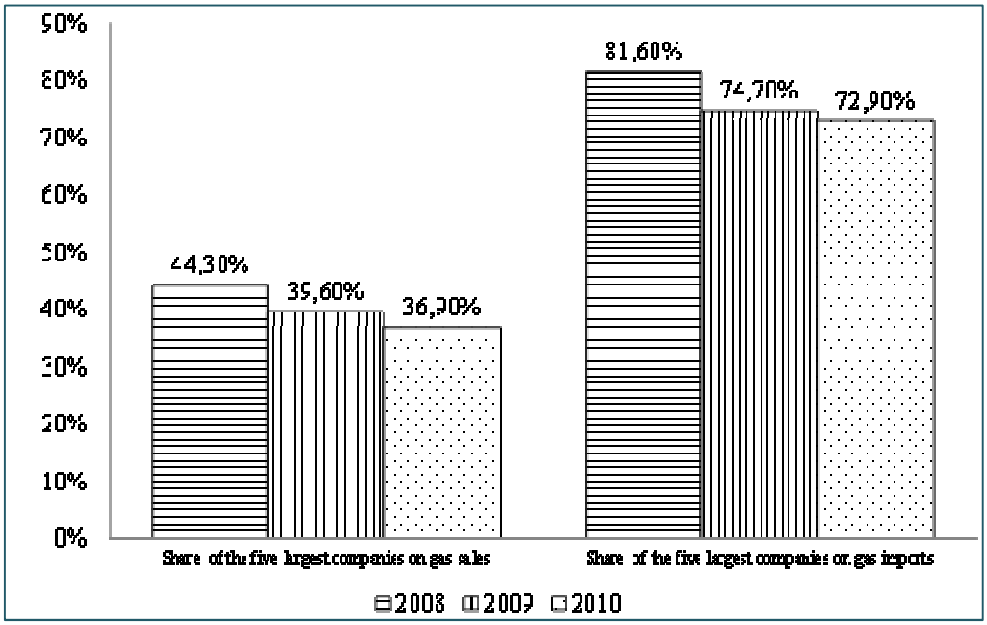

Figure 7
Market share in the German natural gas market [141]

3.2 Interim conclusion

Competition theory provides a framework to establish competitive capabilities. It therefore requires practical implementation within the economic policy and instruments to monitor the markets and the behaviour of market actors. The German system of the Social Market Economy values competition as a central element.

Competition on the German natural gas market has improved due to the liberalisation and regulatory monitoring. Keeping in mind that there are structural restraints such as the natural monopoly of the grid, this is clearly a benefit of the regulation. However, there are oligopolistic structures left in the import market segment, due to long-term oil price-linked contracts and

[139] Cf. *IHS CERA* European Gas Country Profile, 2011.
[140] Cf. *Lohmann* German gas market, 2009.
[141] Source: Own figure; Data from: *Federal Network Agency for Electricity, Gas, Telecommunications, Post and Railway* Monitoringbericht 2011, 2011.

long established economic relations. Furthermore the oil price-link as a price setting instrument partly restrains competition and manifests market shares of import companies. Regulation has to further continue this process of competition building such as the development of deeper and more liquid German gas hubs, as they are one requirement for independent price setting of natural gas.

4 Normative economic analysis of the arguments of the oil price-link in the German natural gas market

The following normative economic analysis tries to unite the concepts of the further chapters. Herein the oil price-link is evaluated in economic terms of competition, market power and price formation in context with the normative understanding of competition provided in chapter three. But before the analysis starts, the economic criteria are explained in detail.

4.1 Economic criteria for the analysis

The chosen criteria for the analysis derived from the previously introduced concepts. There are the transaction costs, asymmetric information and market power as market failures. These criteria are enhanced by the practical difference between OTC-based trading using oil price-linked long-term contracts and hub-based trading of natural gas.

Diverse interests of producer and importer

The analysis attempts to take the position of producers and importers and to match it with the normative assumption of the positive effects the competition. Here one meets the diverse interests of producers and importers, having variable effects on the economic arguments.[142]

The following table presents the established five criteria and their practical indicators for the applied analysis differentiated by the characteristics of long-term contracts using the oil price-link and hub-based trading. They will be partly used in the qualitative argumentation of economic consequences of the oil price-link.

[142] Cf. *Klump* Wirtschaftspolitik, 2006.

Criteria	Long-term contracts using price-links	Hub-based trading
Transactions costs (Information and time)	Individual contracts with bargaining (negotiating, concluding)	Standardised products
Asymmetric information	Low market transparency, price formation after principle of competition oriented pricing	Price and volume transparency, price formation on supply and demand
Market power	Few participants (Oligopoly)	Attract many participants (Polypoly)

Table 5
Economic criteria to evaluate the price-link [143]

4.1.1 The price-link and competition: a limiting factor?

Competition orientated pricing hinders free market price building

The definition of competition was described as rivalry of economic units in the previous chapter. In this context rivalry is equivalent to improving market results. However, the oil price-link as a price setting mechanism follows the principal of competition orientated pricing. The formula applied in the contracts tries to achieve a realistic reproduction of natural gas characteristics for instance using energy conversion factors. However, an independent price setting on the basis of natural gas market factors is not achieved. In consequence the oil price-link suppresses the development of independent natural gas price signals. This represents an information deficit and interferes with the gas-to-oil competition, in particular in markets such as the energy market, where traded products are standardised and the main product traded is the respective energy content. On the other hand however, the pricing principle ensures that natural gas is moving within a price corridor keeping it competitive towards oil products. This reflects the interests of the involved companies, but does not reflect the interest of competitive resource allocation.

Price-link restricts gas-to-gas competition

The gas-to-gas competition is another form of rivalry. As the previous chapter shows, increases of competition in the market environment have been achieved due to the liberalisation. This form of competition crucially depends on the market structure and on the number of competing companies. They particularly require procurement markets that can provide a sufficient gas supply. Because of the price-linked gas contracts and the use of long-term contracts, capacity agreed upon removes gas supply from the free market. This degrades the improvement of free procurement markets.

[143] Source: Own table.

Summing up, the oil price-link restricts a free price formation and suppresses gas-to-oil competition. However, an overall competitive restriction on the use of energy sources to create end products such as heat is not deactivated, as the price setting does not hinder technical progress.

4.1.2 The oil price-link and market power

As mentioned earlier, the import market in Germany remains in an oligopolistic structure, whereas competition has been developing in the other market segments. In consequence the importing companies are not able to exclude competitors from the end consumer market. Together with the minimum take-or-pay contract obligations and spot market prices cheaper than oil price-linked prices, this situation becomes financially unmanageable.[144] However, the import companies do not have sufficient market power to directly pass on their oil price-linked gas procurement prices to their customer without facing the risk of losing them. In this case the established competition measures protect against arbitrary price transmission. Another level of observation is the market power maintaining effect of the price coupling to the oil prices. The oil price-link in combination with the long-term contracts also closes markets by simply absorbing available gas capacity. Therefore the market share of the involved contract partners in the gas import segment is solidified. However, through the long-term contracts on the one hand and the mechanism of adapting to current oil prices on the other hand, an abuse of the oligopolistic market power by the producers is prevented. In this case the oil price-link prevents them from taking advantage of the competitively more advantageous situation e.g. in keeping a stable gas price when e.g. the oil price is falling.[145]

Stakeholders in the natural gas economy

Another point of consideration in this argument is the position of individual stakeholders such as producers, regulators and customers. Since there are only a few countries exporting natural gas, they argue that price-links prevents individual players from manipulating the market price. This argument is supplemented by the fact that a continued high price of commodities provides an extra rent in the gas exporting business. In consequence, producers are in favour of price-links. Regulators consider the usage of price-links as a result of a lack of competition. They argue that a competitive market will lead to a crowding out of the whole price-link

[144] Cf. *Stern* Long term gas contracts, 2009.
[145] Cf. *Schroer* Ölpreisbindung und Marktmacht, 2008.

mechanism. Since they have no legislative power to prevent international companies from using this form of price setting, the solution is to further establish competition and market forces to accomplish and solidify that change. However, the customers are mostly against price-links, as they view it as a monopolistic contractual relationship.[146]

Ambivalent relationship between price-links and market power

Summing up, price-links and market power have an ambivalent relationship, meaning the protection of an abuse of market power on the one side and the manifestation of the market share of producers and importers on the other side. The stakeholders in the gas economy have very different approaches in the assessment of this relationship. Producers are in favour of maintaining price-links, whereas regulators and customers are opposed to pricing links.

4.1.3 The oil price and market price formation

The price as information basis

In a market economy the price is one of the most important components to decide about both production by suppliers and demand for buyers as well as being one of the primary foundations for investment decisions. It reflects condensed information about the production costs, willingness to pay and scarcity of the good as an indicator. Compared to the functions of competition as they are distribution, control and incentive function. The price is the instrument to fulfil these functions. Furthermore the price coordinates the market processes. If we now apply these concepts towards the oil price-link and the market price formation, there will be certain areas of conflict.

Conditions of markte price formation

Traditionally there are two sub-markets in the gas industry (import and distribution markets), which have been increasingly uniting because of the liberalisation. The developments in recent years, such as streamlining of the market areas or regulatory management, have led to improved conditions for a free price formation in the gas market in Germany. This has implications for the pricing, which in the case of hub-based pricing is based on natural gas market fundamentals. Currently the oil price-link and hub-based pricing mechanism exist side by side. *Stern* calls that „*hybrid pricing*“[147]. Most of the companies now have a mixed portfolio of oil price-linked contracts and future market-dependent quantities.

Netback pricing

The current prevailing market price structure is the "netback pricing". Based on various segments the remaining costs of the different levels are extrap-

[146] Cf. *Stern* Gas Contracts, 2007.
[147] *Stern, Rogers* Transition to Hub-Based Gas Pricing, 2011.

olated to the import stage. This system uses the principle of market oriented pricing on every level. *Konstantin* has created the following scheme:

> Competition orientated price at end consumer level
>
> /. Costs for long-distance transport
>
> /. Costs for the distribution
>
> /. Taxes and duties
>
> /. Margin for the import and distribution company
>
> Competition orientated price for the import stage.

This method is also applied to long-term contracts. The arguments favouring that are the ensured profitability and competitiveness of the natural gas price against other competing energy sources. It avoids heavy price fluctuations and stands upon a neutral pricing formation. Therefore it also avoids the lack of transparency in gas supply costs. On a macroeconomic level the consumers should be protected from market power of the few natural gas producers.[148]

Problems of price-link formulas

Now from the application of this method using price-links such as the oil price-link follow several problems. First, the differences in scarcity and the use of energy products oil and gas are not considered (see 2.2.4), leading to low market transparency. In addition, the real natural gas supply costs are generally unknown, as there is a difference between Russian prices and export prices charged by Gazprom. Furthermore the time delay of the price development is difficult to pass on to consumers, because it sometimes leads to gas price increases when oil prices decline. Thereby the gas company's reputation suffers, which is not in the strategic interest of the company. This leads to price distortions with negative consequences. In addition the transaction costs of the individual contract add to this. In contrast standardized products from energy exchanges are easier to acquire, due to lower transaction cost.

Failure in price information

Through the application of the oil price-link, no proper signals of scarcity are sent to market participants. This however is a prerequisite for market processes and a signal for market entry. In the end, wrong incentives for

[148] Cf. *Schroer* Ölpreisbindung und Marktmacht, 2008.

innovation and a systematic investment backlog result from this. The indicator function of the price is not met. As a consequence, this price has a reputation problem, since they are not regarded as market prices. The deficits in information accuracy can lead to adverse selection[149] and may thus lead to a deviation from the macroeconomically optimal amount of natural gas consumption. Inflexible contract constituents and permanent price differences impede the welfare economic efficiency optimum. As the figure 8 below indicates either prices above (P^2) or prices below (P^1) the market equilibrium (P*) causes welfare losses (area ABD).

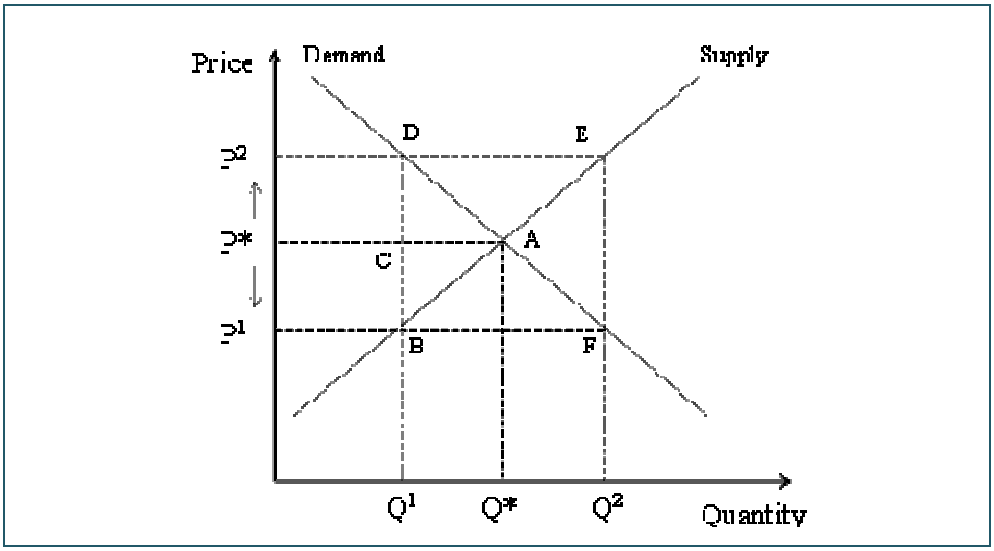

Figure 8
Effects of price distortions on the welfare

Differences in time horizons between stakeholder decisions

A further aspect for the problems with the oil price-link is that the financial markets, political regulation and real investment decisions and realization have different time horizons. Financial markets are very short term oriented and the speed of changes has increased with the development and progress of information technology. In the real gas economy time horizons in projects are generally five to ten years and can achieve 20 years or more taking into account live cycles of utilities. This difference between the time horizons can only be overcome by long-term contracts.[150]

[149] Adverse selection concerns asymmetric information at the time of the contract conclusion. It is a process in the market which creates suboptimal results. *Ackerlof* established this model in 1970 using the example of the market for used cars. Cf. *Gabler Wirtschaftslexikon* Adverse Selektion, 2012.
[150] Cf. *UNCTAD* Commodity markets, 2011.

Improvement of market price formation

However, the current market developments such as third party Access etc. are improving the competition and market price formation. This is the alternative to long term contracts with the oil price-link and the netback system. Hub based pricing is determined by supply and demand. It is already possible to buy at the EEX for six years in advance, with a price made by supply and demand on the stock exchange. One of the main arguments favouring the oil price is that the infrastructure must be financed. This situation has not changed fundamentally, as also nowadays infrastructure needs to be financed. Nevertheless, infrastructure is already established and supports the establishment of market price formation.

Change in culture and competencies within the natural gas industry

Apart from good characteristic there are also problems with the market price formation. For instances the question arises: Can there be a single market price in Europe? On the 27/01/2011 the EEX launched the European Gas Index (EGIX) and since then attempts to form a reference price for natural gas in Germany, spreading its price signals also to the rest of continental Europe. It has been established as a tool to replace other price-link settings, as it is always the price of gas deliveries in the following month. It summarizes this data together from the NCG and Gaspool to generate a virtual German price. The index is published at the end of the trading day in the internet and provides transparency. An important criterion for the reputation and corresponding contractual use of the reference value is the liquidity of the marketplace. It is measured by the churn rate, which is a ratio between traded and physically delivered volumes.[151] Expert opinion is divided concerning what would be a reasonable churn rate. Generally, sufficient liquidity is assumed at a churn rate of 10. The argument of market manipulation is often discussed in this context. The oligopoly in the gas supply remains. However, this argument will naturally diminish with more trading players restricting the potential of manipulation. Another argument is the increased uncertainty about price developments due to expected higher volatility. The smoothing of prices by the oil price-link is a natural feature of this mechanism and a higher degree of volatility cannot be avoided with the increase of market-based price setting. To what extent consumers can become victim to that volatility is not yet clear, as price patterns will find average prices and large industry companies do employ procurement portfolio managers. Apart from that, extremely cold weather can cause a bottleneck situation and lead to peak-prices. These peaks can cause significant

[151] Cf. *European Commission* Energy, 2010.

redistributive effects in favour of the suppliers of gas and at the expense of consumers. In consequence the strategic importance of natural gas storage increases and the procurement of gas will change fundamentally, becoming similar to fund management using trading orientated hedging instruments. This also requires a cultural change within the industry with a need for additional competencies. In addition, the strategic behaviour of the companies needs to adjust. There is a trade-off between a continuing reliance on business partners and active procurement at anonymous markets. Every involved company has to arrange their portfolio.

In contemplation of the argument presented the two pricing options do have their economic authenticity. A further development of free market price formation is likely to happen, due to the promotion of competition in the natural gas market.

Summing up, the key arguments are:

Key arguments in evaluating price-links and markte price formation

- Market fundamentals of natural gas and other commodities differ
- Fundamentals in natural gas should set gas prices to fulfil price function and ensure macroeconomic efficiency
- There should be a single price formation and a reference price in order to enhance transparency
- Increased volatility leads to changing procurement strategies which will need a cultural and know-how change in the industry, but remains manageable

4.2 Interim conclusion

The economic arguments off the oil price-link play an important role for the contractual parties. They have an impact on contract negotiations and strategic decisions for the procurement strategy. In addition, it allows understanding the position of the opposite contract party and to prepare counter-arguments. As pointed out in the analyses there are economic arguments for and against an oil price-link in long-term contracts. The following table provides an overview:

Economic arguments for usage of oil price-link	Economic arguments against usage of oil price-link
– Keeping natural gas prices competitive and therefore add up to be a risk hedge to avoid sunk costs in infrastructure necessities – Risk balance in natural gas importing business model – Avoids abuse of market power due to oil price formation, because it cannot be influenced by either of the contract parties – Avoids price volatility – Avoids weak negotiations power of the producer	– Suppresses independent natural gas price signals, therefore inefficient resource allocation – Natural gas volumes are blocked by contracts and price-link for free market price formation – Maintaining market power of producers and importers – Ignores price affecting differences of oil and gas – Low market transparency, causing reputation suffering – High transaction costs and time delay

Table 6
Economic arguments for and against the usage of the oil price-link [152]

The issue of planning and investment security has to be taken seriously by all stakeholders in the gas industry. The contemplations of price-links do not mean that long-term contracts will not be used in the future. The producers of natural gas and their interests will remain the same or similar. Within their mind-set price-links are an essential safety instrument and are likely to continue to be the industry standard to develop exploration projects. How the German market and European regulators will react on over a long period of time with changing market fundamentals remains to be seen.

5 Alternatives of the oil price-linked pricing

Producers and importers of natural gas must answer the question of how to handle the effects of price-linked long-term contracts with rising market liquidity of natural gas and volatile commodity prices? Existing long-term contracts will remain valid and problems in maintaining the market position represent a growing risk. In the following the author examines three pricing alternatives (hub priced natural gas, power price-link as well as a fixed price clause) and their respective implications for long-term contract parties. Other contractual alternatives such as greater volume flexibility or lower minimum take obligations are not considered in this analysis. Figure 9 below summarizes and categorizes the alternatives considered here, showing

[152] Source: Own table.

which price mechanisms tend to be applied in the market environment of low or high market liquidity and low or high oil price.

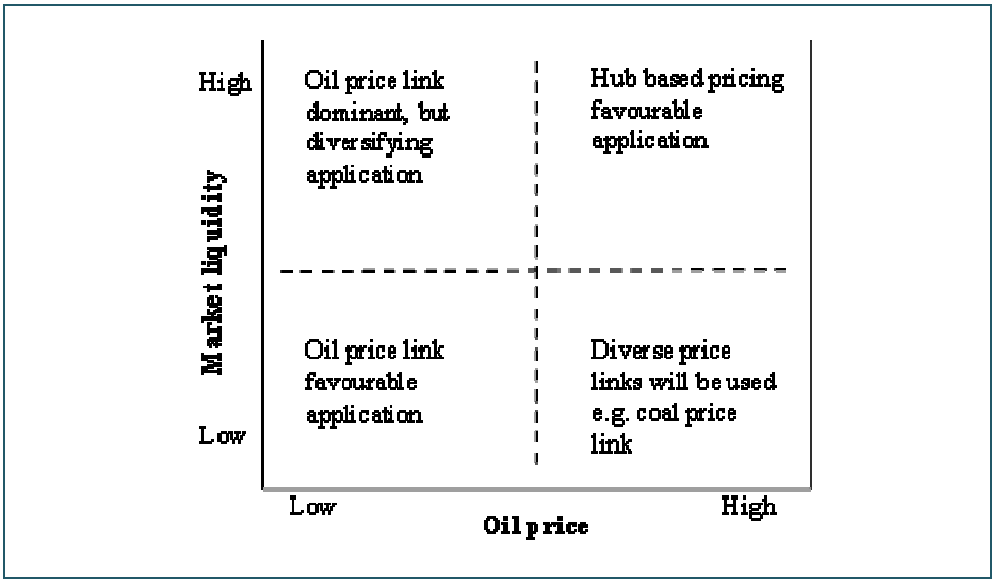

Figure 9
Price mechanism according to the oil price and market liquidity [153]

On the conceptual level there is one important difference between these alternatives. Hub gas prices describe a new pricing mechanism without a definite link to another energy resource, whereas the power price-link is a connection with an energy product and not to an energy resource. Fixed price clauses are generally used in short term contracts.

Conceptual difference between alternatives

5.1 Hub based gas pricing

New gas hubs have developed in Germany and continental Europe within the recent decade. These hubs can be separated into physical and artificial hubs. Physical hubs are pipelines or other infrastructure facilities crossing each other, leading to trade of natural gas. Artificial hubs occur because of grid necessities and define specific market areas. Apart from other requirements (see chapter 3.1 Competition theory), liquid gas hubs are needed to achieve a market based natural gas pricing.

Development of natural gas hubs

This pricing alternative means that the natural gas price is determined due to market fundamentals of supply and demand at the chosen gas hubs. The contractual clause and timely mechanism of an oil price-link changes to become a contract linked to daily natural gas spot market prices. The price

Determinats of the natural gas price

[153] Source: Own figure; Concept of *IEA* Gas Trading in Continental Europe, 2008.

is based on natural gas and leaves direct energy substitutes aside, as hubs do not apply the principles of competition oriented pricing. Furthermore the price risk is no less hedged worse as in comparison to the oil price-link, because both price levels can fall below production costs for natural gas exploration. What runs contrary to the interest of the producer is the increasing risk of energy substitutes gaining market attractiveness, no longer being eliminated by the use of oil price-linked long-term contracts. However, indirect oil price correlation will surely remain, as energy markets are commonly interrelated.

Volatility of gas prices

Daily price changes at the hubs reflect the volatility in natural gas supply and demand. This implies that there will be price volatility, but it will be driven by the market for natural gas instead of oil market developments. Overall, the hub-based pricing best fits the political goal of liberalisation with transparent prices, competition and minimal transaction costs. In practice this means increased gas-to-gas competition between hubs and companies. In this context companies will need to rearrange their respective price risk management. However, there is nothing without opportunity costs, and hub prices can be manipulated either by producers or large scale customers. As *Stern and Rogers* worked out in their study published last year, this was not the case in Europe until then.[154]

Pricing formulas co-exist

As mentioned in chapter two, at the moment both of these pricing mechanisms co-exist. The market will decide which of the formulas functions best. If oil price-linked contracts are more expensive, then demand for hub traded natural gas will grow, creating a price increase toward level of oil price-linked contracts. However, if oil price-linked natural gas contracts are cheaper than gas traded at liquid hubs, the hubs will result in declining prices. As most of the spot gas is imported via long-term contracts and resold on spot markets, a circular reference between both price settings can emerge.[155]

Hub based pricing in the UK

The UK serves as a practical example for hub priced natural gas. Around 60 % (562.8 bn kwh)[156] of the natural gas is sold at the National Balancing Point (NBP) virtual trading point for UK natural gas. It was established in 1996 and is the eldest virtual hub as well as the most liquid wholesale hub

[154] Cf. *Stern, Rogers* Hub-Based Gas Pricing, 2011.
[155] Cf. *IEA* Gas Trading in Continental Europe, 2008.
[156] Cf. *BP* Statistical Review of World Energy June 2011, 2011.

for natural gas in Europe.[157] However long-term oil linked contracts also still exist in the UK and are growing in their impact, as the UK has become a net importer of natural gas since 2004.[158] There is now a competition between these different contract mechanisms. From a strategic perspective, the market participant owning flexibility either in contract relation or due to storage capacities can use both options at a time and realise arbitrage premiums. In the UK, natural gas prices also became more expensive over the recent decade. The following figure 10 shows the average German import price dominated by long-term oil price-linked contracts and the UK NBP hub price. Both natural gas prices increased since 2002. This also shows a price increase in the UK before it became a net importer. As sometimes assumed in the political discussion about oil price-linked gas prices, hub-based pricing is not a guarantee for low natural gas prices. However, this model will transform the German gas market character to become more similar to other commodity markets (commoditisation).

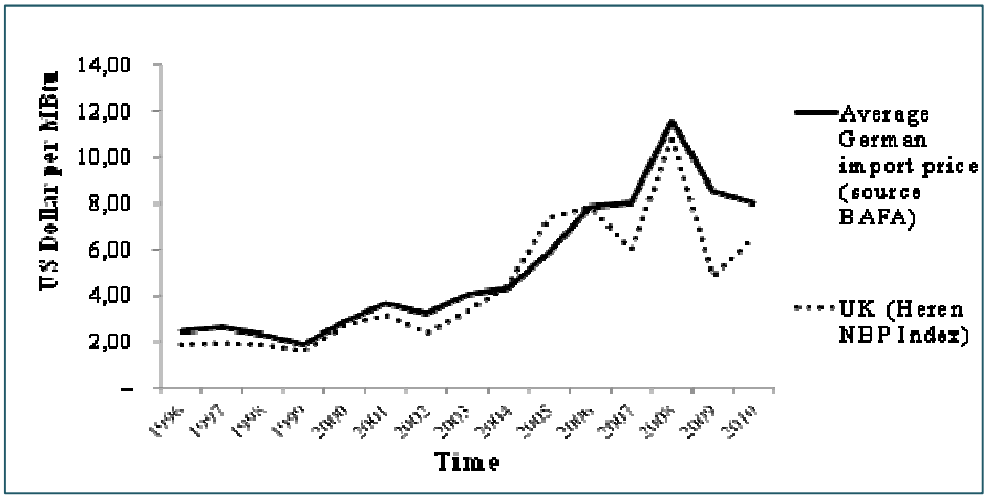

Figure 10
Prices of the spot market and imported natural gas in Germany[159]

5.2 Power price-link

Natural gas in electricity production

The gross electricity generation from natural gas for Germany in 2010 was approximately 573 PJ.[160] The share that natural gas contributed to total electricity generation increased from 7.3 % in the year 2000 to 10.3 % in the

[157] Cf. *IHS CERA* European Gas Hub Tracker, 2011.
[158] Cf. *BDEW* Fakten, 2009.
[159] Source: Own figure; Data from *BP* Statistical Review of World Energy June 2011, 2011.
[160] Cf. *AGEB* Energiebilanz für die BRD 1990-2010, 2011.

year 2010.[161] This confirms the growing trend towards using natural gas for the production of electricity. These facts make a consideration of this alternative pricing mechanism relevant. In the case of a power price-link the natural gas is connected to the price of an energy product. Following this logic this pricing alternative is of interest for gas fuelled power plants.

Electricity price formation in Germany

Two electricity pricings models currently co-exist in Germany. On the one hand you have the model of marginal costs using the Merit-Order at the European Power Exchange (EPEX) in Paris and Leipzig. This exchange based pricing mechanism ranks the marginal costs of the electricity production possibility and matches this order with the demand. The Merit-Order price is regulated by market-based competition. Producers of electricity are constantly attempting to get into the hourly traded volume of electricity e.g. by cost savings or improved efficiency in electricity generation. These savings result in an improved ranking in the Merit-Order and represent an economic incentive. The ranking focuses primarily on fossil-fuelled power plants because of the subsidies flowing to electricity production from renewable energy sources. This is the other pricing model, i.e. state controlled subsidies for renewable electricity. How long these two pricing models will co-exist and whether or not other market designs such as capacity markets will overtake them is part of the current political energy debate in Germany.

The first question to be asked here is which price of electricity would the price of gas have to be linked to? The Merit-Order price-link would put competitive pressure on the contracting parties due to market based price setting. Based on the previous determination, the subsidy price for electricity from renewable energy sources is a politically fixed artificial price and is not exposed to competitive pressure. The price differs according to the various renewable power generation technologies employed and the price development is difficult to predict because of the unclear political situation e.g. after the upcoming German parliamentary elections in 2013. Therefore this option adds high political risk to long-term agreements.

Merit Order

In the following step the author will focus on the Merit-Order pricing model. Gas-fuelled power plants frequently determine the electricity price due to higher marginal electricity generating costs compared to nuclear, lignite and hard coal. The Merit-Order reflects this with generating capacity from natural gas ranked behind them. The point of intersection with the

[161] Ibid.

demanded quantity and therefore the market clearing price at the electricity exchange is often located in this area (see figure 11). However, increased renewable electricity production combined with false price signals coming from the emissions trading scheme can create discouraging investment signals, as gas fired power plants loose operational time.

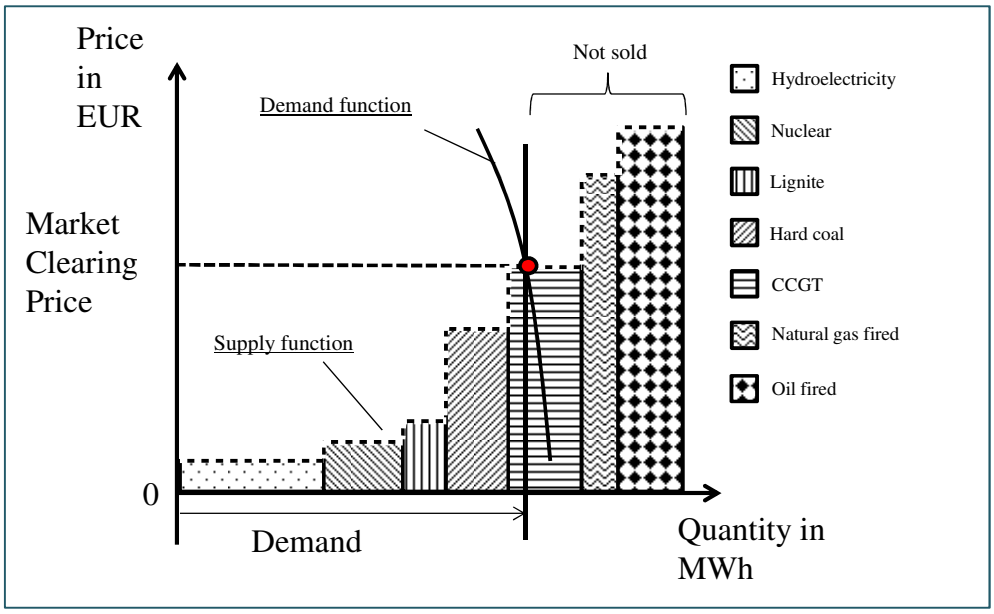

Figure 11
Schematic representation of the Merit Order[162]

Power price-link consequences for natural gas producers

From a gas producer perspective, implementing a power price-link implies taking a long position toward the electricity price in Germany. From a gas power plant operators view a power price-link implies a natural hedge, because rising natural gas prices can lead to higher electricity prices at the energy exchange ceteris paribus. However, more electricity production from renewable resources will lead to less quantity matched at the exchange ceteris paribus. In consequence the negative Merit-Order effect of crowding out gas fired power plants will lead to lower electricity prices and to a loss in operational time ceteris paribus. In this case execution of this price setting in long-term contracts is uneconomical for both contract partners.

5.3 Fixed price clauses

Short term contracts

Beyond the other pricing methods, fixed price offers could become an alternative. This model can be applied to fixed natural gas production projects, when cost calculations are reliable. This price setting finds special appli-

[162] Source: Own figure; According to *Von Roon, Huck* Merit Order, 2010.

cability in short term contracts of up to two years with standard products. For long-term contracts this price setting lacks the required flexibility. It will implement a natural gas price either above or beneath hub prices. Contract parties come into the situation of reactive price takers. Furthermore it lacks incentives for producers to reduce their costs. If the estimated cost for the gas exploration project were to rise, then the imported gas price would also rise. Efforts for cost reductions and more efficient gas supply would thus not be rewarded.

Flexibility need in market environment

In the beginnings of the natural gas market this price model made practical sense, because of the lack of experience and competition. In the current market environment, flexibility becomes more important. This stands in contrast to fixed price clauses and therefore becomes practically unattractive. Furthermore the competitive market leads to the interest of cutting costs. This is especially true for a product such as natural gas with little potential for differentiation (see 2.1).

5.4 Interim conclusion

Due to current market developments of cost-increasing oil prices and the development of liquid gas hubs in Germany, the pressure for action on oil price-linked long-term contracts is increasing. For the renegotiation of long-term contractual partners several pricing alternatives are available.

The investigation of the four selected price alternatives with regard to the consequences for producers and importers has shown that there are different interests affected. The applicability of the respective pricing alternatives greatly depends on the particular use of natural gas. There is no one pricing alternative automatically enabling lower end consumer prices. However, a pricing mechanism that reflects the supply and demand fundamentals of that commodity should be regarded as the natural pricing mechanism. Noteworthy in this context is the hub-based price-link. It satisfies this requirement and fits well with the current market environment. An implementation of a price mechanism in the long-term contracts would take into account the supply and demand situation on the selected gas hubs. An equal distribution of the price risk on both contractual partners would result. Whether or not this represents an obstacle to investment in natural gas exploration in the future remains open and should be critically examined.

6 Discussion of the results

6.1 Crucial questions

The conducted analysis has led to the following results concerning the research questions posed at the beginning of the work:

1. What are the current developments in the German natural gas market and what is the role of natural gas in German energy policy?

The current stage of the German gas market is characterised by an over-supply of natural gas, growing liquidity on natural gas hubs and a new structure of the gas industry. The regulatory regime supports a competition oriented legal framework such as the establishment of only two market areas. These developments will support the commoditisation of natural gas. They are accompanied by a stagnating demand, an excess supply and still valid contractual obligations, which forces importers to continue using price-links such as the oil price-link, an end of which is not foreseeable in the near future. Furthermore, several oil and natural gas market fundamentals differ e.g. reserve and consumption levels and an ambivalent political situation for gas adds to that. On the one hand, natural gas is considered a welcome alternative due to its favourable characteristics such as multi-dimensional usage, on the other hand, a clear support of the gas industry is still not forthcoming. This framework creates a difficult environment for long term investments in the up-, mid- or downstream segment.

2. What are the economic arguments for and against the instrument of oil price-linked gas pricing?

There are a variety of arguments on the economic level for and against the instrument of price-links. However, keeping natural gas prices competitive compared to other energy sources and therefore using it as a risk hedge to avoid sunk costs in infrastructure necessities turns out to be very important. This argument for a price-link also represents an important obstacle, as it suppresses independent natural gas price signals, which will result in an inefficient resource allocation. It is up to the viewer to decide how he looks at this argument, and what significance he ascribes to what position.

3. What are alternative pricing mechanisms in long-term natural gas import contracts?

The applicability of the respective pricing alternatives greatly depends on the particular use of natural gas. There are several pricing alternatives such as the hub-based gas pricing, the power price-link as well as fixed price contracts. However, a pricing mechanism that reflects the supply and demand fundamentals of that commodity should be regarded as the natural pricing mechanism. Noteworthy in this context is the hub-based price-link. It satisfies this requirement and fits well with the current market environment and would take into account the supply and demand situation at the selected gas hubs.

6.2 Conclusion

Natural gas will continue its course of increasing commoditisation. This means that prices will be more strongly influenced by the driving forces of supply and demand in the own market. In consequence, the transition away from formal contractual oil product price-linkage is inevitable and has already begun e.g. with hub-based pricing in long-term contracts. However, a close relation to other energy products will remain as the characteristic substitution of energy commodities and worldwide competition for natural gas will become more intensive. Yet, the characteristics of multidimensional usage in diverse markets, lower CO_2-emissions and good resource availability are likely to play out as a comparative advantage for natural gas.

The structural changes in pricing will not happen overnight and the length of this transformation period is uncertain. Nevertheless, the large German import gas companies have to overthink their pricing strategy and to search for new paths to adapt their contracts towards a more spot market orientated natural gas economy in Germany. Old industrial pricing models are unsuitable for the current gas economy environment, even if oligopolistic producer structure is likely to still support this contract structure due to its successful track record. Natural gas has already become a relevant primary energy resource in Germany and the required infrastructure is widely established. Therefore oil price-link pricing mechanisms to hedge risk of infrastructure investment are not useful in the changing market structure. In consequence the logic of the rationale to implement the oil price-link has weakened. However, depending on the market situation, the application of oil prices can become attractive again. In addition to other contractual

content and the procurement strategy, the selection of the price component of gas import contracts will continue to play a strategic role in the future.

German and European actors on the gas market must take joint actions to continue developing an internal gas market. Otherwise the European goal of a functioning of the gas market and a convergence of the wholesale market cannot be achieved, with a fragmentation towards heavily different gas prices being the result thereof. Additionally strategic influence by non-EU contract members could be used to divide European Union energy interests and create what *Helm* calls "*energy nationalism*".[163]

[163] Cf. *Helm* Energy policy, 2011.

Bibliography

Independent writings (Books, Discussion Papers)

Altmann, J. (2007): Wirtschaftspolitik, 8. völlig überarb. Aufl., Stuttgart 2007, p. 22.

Arbeitsgruppe „Politischer Rahmen für Biomethan" des Projektes „Biogaspartner" der Deutschen Energie-Agentur GmbH (2011): Zusammenfassung: Positionspapier zum EEG-Gesetzentwurf vom 6. Juni 2011 mit Schwerpunkt: Regelungen zum Einsatz von Biomethan, Berlin 2011, p. 1 et seqq.

Bannier, C. E. (2005): Vertragstheorie – Eine Einführung mit finanzökonomischen Beispielen und Anwendungen, Heidelberg 2005, p. 179.

Blum, U./Dudley, L./Leibbrand, F./Weiske, A. (2005): Angewandte Institutionenökonomik – Theorie – Modelle – Evidenz, Wiesbaden 2005, p. 58.

Böhme, D. (2011): EU-Russia Energy Relations. What chances for Solutions? Potsdam 2011, p. 34.

Bundesministerium für Wirtschaft und Technologie (ed.) (2010): Energiekonzept – für eine umweltschonende, zuverlässige und bezahlbare Energieversorgung, Berlin 2010.

Bundesnetzagentur für Elektrizität, Gas, Telekommunikation, Post und Eisenbahnen (2011): Monitoringbericht 2010, Bonn 2011. p. 214.

Bundesnetzagentur für Elektrizität, Gas, Telekommunikation, Post und Eisenbahnen (2011): Monitoringbericht 2011, Bonn 2011, p. 210.

Bundesverband der Energie- und Wasserwirtschaft e.V. (2009): Fakten – Warum ist Erdgas sicher? – Fakten, Zahlen und mehr, Berlin 2009, p. 9.

Bundesverband der Energie- und Wasserwirtschaft e.V. (2010): Energiemarkt Deutschland – Zahlen und Fakten zur Gas-, Strom- und Fernwärmeversorgung, Berlin 2010, p. 4, p. 6.

Civil Code Book 1 General Section. I 2005, p. 1970 et seqq.

David, C. (2010): European Gas Country Profile – Germany, IHS CERA (ed.), Massachusetts 2010, p. 2.

Engelkamp P./Sell F. L. (2011): Einführung in die Volkswirtschaftslehre, 5. überarb. u. erw. Aufl., Heidelberg 2011, p. 436.

Erdmann G./Zweifel P. (2008): Energieökonomik – Theorie und Anwendung, Berlin 2008, p. 125.; p. 226.; p. 237.

Eucken, W. (2004): Grundsätze der Wirtschaftspolitik, Edith Eucken und K. Paul Hensel (ed.), 7. Aufl., Tübingen 2004, p. 266.

European Commission (2010) Market Observatory for Energy, Volume 3; Issue: April 2010 – June 2010, Brussels 2010, p. 6.

Fraunhofer-Institut für Umwelt- Sicherheits- und Energietechnik UMSICHT (2009): Verbundprojekt Biogaseinspeisung, Oberhausen 2011, p. 11.

Frisch, M. (2010): Current European Gas Pricing Problems: Solutions Based on Price Review and Price Re-Opener Revisions, in: University of Dundee; Centre for Energy, Petroleum & Mineral Law & Policy International Energy Law and Policy Research Paper Series, No 2010/03, p. 7.

Fritsch, M. (2011): Marktversagen und Wirtschaftspolitik – Mikroökonomische Grundlage staatlichen Handelns, 8. überarb. Aufl., München 2011, p. 13-15.

Gawel, E. (2009): Grundzüge der mikroökonomischen Theorie, Köln 2009, p. 710 et seqq.

Grüner, H. P. (2006): Wirtschaftspolitik – Allokationstheoretische Grundlagen und politisch-ökonomische Analyse, 2. überarb. u. erw. Aufl., Berlin 2006, p. 175.
Hedge, K./Fjeldstad, E. (2010): The future of the European Long-Term Natural Gas Contracts, Oslo 2010, p. 28 et seqq.
Helm, D. (2011): Energy policy and market reform in the UK and Europe, Oxford 2011, p. 10.
Helm, D. (2011): Energy policy and the EMR, Oxford 2011, p. 3.
International Energy Agency (2003): The challenges for further cost reductions for new supply options (Pipeline, LNG, GTL), Tokyo 2003, p. 13.
International Energy Agency (2008)*:* Development of competitive gas trading in continental Europe – How to achieve a workable competition? Paris 2008, p. 41.
International Energy Agency (2011)*:* World Energy Outlook 2011 – Are we entering a golden age of gas? Paris 2011, p. 58
Kampmann, R./Walter, J. (2010): Mikroökonomie – Markt, Wirtschaftsordnung, Wettbewerb, München 2010, p. 37.
Kästner, T./Kießling, A. (2009): Energie in 60 Minuten – Ein Reiseführer durch die Stromwirtschaft, Wiesbaden 2009, p. 9.
Klump, R. (2006): Wirtschaftspolitik – Instrumente, Ziele und Institutionen, München 2006, p. 20.
Knieps, G. (2009): Wettbewerbsökonomie – Regulierungstheorie, Industrieökonomie, Wettbewerbspolitik, 3. aktual. Aufl., Berlin 2009, p. 4.
Konstantin, P. (2009): Praxisbuch Energiewirtschaft – Energieumwandlung, -transport und –beschaffung im liberalisierten Markt, 2. bearb. und aktual. Aufl., Berlin 2009, p. 83.
Lechwerke AG (2012): [Gas-ABC] – Referenzpreis (6/1/3 Regelung), Augsburg 2012, p. 3.
Lochner, S./Bothe, D. (2007): From Russia with Gas – An analysis of the Nord Stream pipeline's impact on the European Gas Transmission System with the TIGER-Model, in: Institute for Energy Economics at the University of Cologne Working Paper, No 07/02, p. 2.
Lohmann, H. (2009): The German Gas Market post 2005: Development of Real Competition, Oxford 2011, p. 9.
National Petroleum Council (2007): Gas to Liquids, Washington 2011, p. 1.
Neuhaus, P. (2006): Herausforderungen an die Erdgasvermarktung – Vertrieb im Spannungsfeld liberalisierter Energiemärkte, Essen 2006, p. 7.
Neumann, M. (2000): Wettbewerbspolitik – Geschichte, Theorie und Praxis, Wiesbaden 2000, p. 5.
North D. C. (1993): The new institutional economics and development, Washington 1993, p. 2.
Nötzold, *A.* (2011): Die Energiepolitik der EU und der VR China – Handlungsempfehlungen zur europäischen Versorgungssicherheit, Wiesbaden 2011, p. 200 et seqq.
Oushoorn, R./Schlaak, T./Waterlander, *O.* (2010): The next Cycle – Gas Markets beyond recession, Amsterdam 2010, p. 3.
Pechtl, *H.* (2005): Preispolitik, Stuttgart 2005, p. 85.
Richter, R./Furubotn, E. G. K. (1999): Neue Institutionsökonomik – Eine Einführung und kritische Würdigung, Tübingen 1999, p. 58.; p. 151 et seqq.

Riemer, G. (ed.), Kästner, T./Kießling, A. (2011): Energie in 60 Minuten – Ein Reiseführer durch die Gaswirtschaft, Wiesbaden 2011, p. 68.
Rogall, H. (2006): Volkswirtschaftslehre für Sozialwissenschaftler – Eine Einführung, Wiesbaden 2006, p. 135.
RWE AG (2011)*:* Neugierig auf die Zukunft? Entdecken Sie die Energiewelt von morgen, Essen 2011, p. 18.
Schiffer, *H.-W.* (2005): Energiemarkt Deutschland, Köln 2005, p. 158.
Schneck, *O.* (2007): Lexikon der Betriebswirtschaft, München 2007, p. 1002.
Schneider, V./Janning, F. (2006): Politikfeldanalyse – Akteure, Diskurse und Netzwerke in der öffentlichen Politik, Wiesbaden 2006, p. 15.
Siebert, H./Lorz, O. (2007): Einführung in die Volkswirtschaftslehre, 15. überarb. Aufl. Stuttgart 2007, p. 53.
Stäck, B. (2008): Die Liberalisierung des deutschen Gasmarktes, Münster 2008, p. 14, p. 31.
Stern, J. (2007): Is There A Rationale for the Continuing Link to Oil Product Prices in Continental European Long-Term Gas Contracts?, Oxford 2007, p. 3.
Stern, J. (2009): Continental European Long-Term Gas Contracts: is a transition away from oil product-linked pricing inevitable and imminent?, Oxford 2012, p. 14.
Stern, J./Rogers, H. (2011): The Transition to Hub-Based Gas Pricing in Continental Europe, Oxford 2011, p. 5, p. 13.
Taamallah, S. (2011): European Gas Hub Tracker, IHS CERA (ed.), Massachusetts 2011, p. 13.
Topp, A. (2010): Ist die HEL-Bindung noch zulässig? Fernwärme und Preisänderung, Köln 2010, p. 13.
Von Roon, S./Huck, M. (2010): Merit Order des Kraftwerkparks, München 2010, p. 3.
Weimann, J. (2006): Wirtschaftspolitik – Allokation und kollektive Entscheidung, 4. überarb. Aufl., Berlin 2006, p. 232.
Welfens, P. (2005): Grundlagen der Wirtschaftspolitik – Institutionen – Marktökonomik-Politikkonzepte, München 2005, p. 469; p. 632.
Wied-Nebbeling, *S.* (2004): Preistheorie und Industrieökonomik, 4. Auflage, Berlin 2004, p. 16 et seqq.
Wöhe, G./Döring, U. (2008): Einführung in die allgemeine Betriebswirtschaftslehre, München 2008, p. 42, p. 415.

Essays from anthologies

Auer, J./Nguyen, T.-L. (2010): Gasschwemme erreicht Europa, in: Deutsche Bank Research, Beiträge zur europäischen Integration – EU-Monitor 75, Frankfurt am Main 2010, p. 4.
Spicker, J. (2006): Formen des OTC-Handels, in: Schwintowski, H.-P. (ed.): Handbuch Energiehandel, Berlin 2006, p. 57.

Journal articles

Feygin, M./Satkin, R. (2003): The Oil Reserves to Production Ratio and Its Proper Interpretation, in: Natural Resources Research, Volume 13 (2004), p. 57-60.
Focht, P. (2011): Flurbereinigung im Gasnetz, in: Energie & Management – Zeitung für den Energiemarkt, No 19/11, p. 9.

Focht, P. (2011): Gasbohrungen auf Prüfstand, in: Energie & Management – Zeitung für den Energiemarkt, No 19/11, p. 17.

Krause, H./Müller-Syring, G. (2010): Das Erdgasnetz als Speicher für regenerative Energie, in: gwf Gas/Erdgas, No 11/2010, p. 722 et seqq.

Lichtschläger, H./Ellersdorfer, I. Gasmarktmodell – Analyse der aktuellen und zukünftigen Entwicklung der internationalen Gasmärkte durch Nutzung komplexer mathematischer Modelle, in: Zeitschrift Kommunalwirtschaft, No 3/2010, p. 157.

Schroer, S. (2008): Gaspreise: Ölpreisbindung und Marktmacht in Wirtschaftsdienst, in: Zeitschrift für Wirtschaftspolitik, No 6/2008, p. 353.

Internet sources

Agentur für Erneuerbare Energien (2009): Regionale Wertschöpfung einer Biogasanlage, http://www.unendlich-viel-energie.de/de/wirtschaft/detailansicht/article/572/regionale-wertschoepfung-durch-biogas.html, Last access: 04/01/2013.

Arbeitsgemeinschaft Energiebilanzen e.V. (2008-2011): Auswertungsbilanzen zur Energiebilanz für die Bundesrepublik Deutschland 1990 bis 2009 und 2011, http://www.ag-energiebilanzen.de/viewpage.php?idpage=139, Last access: 04/01/2013.

Arbeitsgemeinschaft Energiebilanzen e.V. (2011): Energiebilanz für die Bundesrepublik Deutschland 2009, http://www.ag-energiebilanzen.de/viewpage.php?idpage=63, Last access: 03/01/2013.

Basic Law of the Federal Republic of Germany I. Basic Rights Article 2 (1), http://www.gesetze-im-internet.de/englisch_gg/englisch_gg.html#GGengl_000P2, Last access: 03/01/2013

BP (2011): Statistical review of World Energy, http://www.bp.com/liveassets/bp_internet/globalbp/globalbp_uk_english/reports_and_publications/statistical_energy_review_2011/STAGING/local_assets/pdf/statistical_review_of_world_energy_full_report_2011.pdf, Last access: 04/01/2013.

Bundesanstalt für Geowissenschaften und Rohstoffe (Federal Institute for Geosciences and Natural Resources) (2010): Energy Resources 2009, http://www.bgr.bund.de/EN/Themen/Energie/Produkte/energyresources_2009.html, Last access: 04/01/2013.

Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (2011): General information: transformation of our energy system, http://www.bmu.de/english/transformation_of_the_energy_system/general_information/doc/48050.php, Last access: 04/01/2013.

Bundesministerium für Wirtschaft und Technologie (2012): Wettbewerbspolitik, http://www.bmwi.de/DE/Themen/Wirtschaft/Wirtschaftspolitik/wettbewerbspolitik.html, Last access: 04/01/2013.

Bundesverband der Energie- und Wasserwirtschaft e.V. (2010): Sitzung Arbeitsgemeinschaft Energiebilanzen am 16. Dezember 2010 – Entwicklungen in der Gaswirtschaft, http://www.google.com/url?sa=t&source=web&cd=4&ved=0CDsQFjAD&url=http%3A%2F%2Fwww.ag-

energiebilanzen.de%2Fcomponenten%2Fdownload.php%3Ffiledata%3D1292581949.pdf%26filename%3DAGEB_Tagung_Dez_2010_Gas.pdf%26mimetype%3Dapplication%2Fpdf&rct=j&q=erdgasverbrauch%20Deutschland%202010&ei=0WGcTtP8OovLsgb3rtyrDg&usg=AFQjCNHhPccHfpGltn07nyLZ70SMlArhiA, Last access: 04/01/2013.

Bundesverband der Energie- und Wasserwirtschaft e.V. (2011): Wachstum der Erneuerbaren erhöht Handlungsdruck http://www.bdew.de/internet.nsf/id/DE_20120111-PI-Wachstum-der-Erneuerbaren-erhoeht-Handlungsdruck, Last access: 04/01/2013.

Bundeszentrale für politische Bildung (2012): Marktmechanismus – Preismechanismus, http://www.bpb.de/popup/popup_lemmata.html?guid=AFGI6A, Last access: 04/01/2013.

Central Intelligence Agency (2011): World Factbook – Natural Gas Consumption 2010, https://www.cia.gov/library/publications/the-world-factbook/rankorder/2181rank.html, Last access: 04/01/2013.

Civil Code Book 2 Law of Obligations Division 2 Drafting contractual obligations by means of standard business terms Section 307 (1) Sentence 1, http://www.gesetze-im-internet.de/englisch_bgb/englisch_bgb.html#p0924, Last access: 04/01/2013

Deutsche Vereinigung des Gas- und Wasserfaches e. V. (2008): Arbeitsblatt G 260 „Gasbeschaffenheit“, http://www.dvgw.de/regelwerknews-de/archiv-rw-news/dvgw-regelwerknews-nr-608/, Last access: 04/01/2013.

Deutscher Bundestag (2011): Plenarprotokoll 17/117 – stenografischer Bericht, Berlin: 30.06.2011, http://www.bundestag.de/, Last access: 04/01/2013.

dpa/Reuters (2010): Merkel für Ende der Ölpreisbindung, http://www.zeit.de/wirtschaft/2010-08/oel-gas-preis-kopplung-merkel, Last access: 04/01/2013.

E.ON AG (2010): Branchenreport Erdgas, http://www.eon-ruhrgas.com/cps/rde/xbcr/SID-63491921-839D1209/er-corporate/Branchenreport_Erdgas_2010_dt.pdf, Last access: 04/01/2013.

E.ON AG (2012): Stakeholder Dialogs at E.ON, http://www.eon.com/de/nachhaltigkeit/management/stakeholder-management.html, Last access: 04/01/2013.

Energy Industry Act § 1 (2), 2012, in the internet: http://www.gesetze-im-internet.de/bundesrecht/enwg_2005/gesamt.pdf, Last access: 04/01/2013

Energy Industry Act § 61 (1) sentence 1; in the internet: http://www.gesetze-im-internet.de/enwg_2005/__62.html, Last access: 04/01/2013

Etaenergie (2010): Energiewirtschaft – Das Interview mit Matthias Kurth, http://www.etaenergie.com/archive/750967/Energiewirtschaft-Interview-mit-Matthias-Kurth.html, Access: 11/10/2012, Last access: 04/01/2013 File not Found.

European Commission (2011): Agency for the Cooperation of Energy Regulators, http://ec.europa.eu/energy/gas_electricity/acer/acer_en.htm, Last access: 04/01/2013.

Gabler Wirtschaftslexikon (2011): Wettbewerb, http://wirtschaftslexikon.gabler.de/Archiv/9242/wettbewerb-v7.html, Last access: 04/01/2013.

Gabler Wirtschaftslexikon (2012): Adverse Selektion, http://wirtschaftslexikon.gabler.de/Definition/adverse-selection.html, Last access: 04/01/2013.

Gas Exporting Countries Forum (2011): About Us, http://www.gecf.org/aboutus, Last access: 04/01/2013.

Herminghaus, H. (2011): Gasheizungen dominieren den Heizungsmarkt in Deutschland, http://www.umweltbewusst-heizen.de/Heizungsvergleich/Gasheizung/Deutschland/Gasheizung-Oelheizung-Deutschland.html, Last access: 04/01/2013.

Mitjajew, O. (2009): Russland liefert Gas in die Ukraine nach europäischer Preisformel – Neuer Gasstreit Russland – Ukraine, http://de.rian.ru/comments_interviews/20090120/119721259.html, Last access: 04/01/2013.

Nord Stream AG (2011): Nord Stream Pipeline Inaugurated – Major Milestone for European Energy Security, http://www.nord-stream.com/press-info/press-releases/nord-stream-pipeline-inaugurated-major-milestone-for-european-energy-security-388/, Last access: 04/01/2013.

Projekt Biogaspartner der Deutschen Energie-Agentur GmbH (2011): Biogaspartner, http://www.biogaspartner.de, Last access: 04/01/2013.

Schroer, S. (2008): Gaspreise: Ölpreisbindung und Marktmacht, http://www.wirtschaftsdienst.eu/dossiers/dossier.php?dossier=109&PHPSESSID=, Last access: 04/01/2013.

Stadtwerke Norden (editor), (2011): H-Gas oder L-gas?, http://www.stadtwerke-norden.de/service/fahrspass/h-gas-oder-l-gas.html, Last access: 04/01/2013.

Statistik der Kohlenwirtschaft e.V. (2011): Entwicklung ausgewählter Energiepreise, http://www.kohlenstatistik.de, Last access: 04/01/2013.

Stiftung Marktwirtschaft (2012): Energie und Ressourcen, http://www.stiftung-marktwirtschaft.de/wirtschaft/themen/energie-ressourcen.html, Last access: 04/01/2013.

The Economist (2012): Term Competition, http://www.economist.com/economics-a-to-z/c#node-21529803, Last access: 04/01/2013.

U.S. Energy Information Administration (2011): How much carbon dioxide (CO_2) is produced when different fuels are burned?, http://www.eia.gov/tools/faqs/faq.cfm?id=73&t=11, Last access: 04/01/2013.

U.S. Energy Information Administration (2011): International Energy Outlook 2011, http://www.eia.gov/forecasts/ieo/, Last access: 04/01/2013.

Umweltbundesamt (2011): Entwicklung des Primärenergieverbrauchs in Deutschland nach Energieträgern 2010, http://www.umweltbundesamt-daten-zur-umwelt.de/umweltdaten/public/document/downloadImage.do;jsessionid=F52883DAFC303257A3E63B9FC24C4113?ident=20729, Last access: 04/01/2013.

United Nations Conference on Trade and Development (2011): Price Formation in Financialized Commodity Markets - The Role of Information, http://www.unctad.org/Templates/StartPage.asp?intItemID=2068, Last access: 04/01/2013.

Wood Mackenzie (2011): Term Take or Pay, http://www.woodmacresearch.com/cgi-bin/wmprod/portal/energy/overview.jsp?overview_title=glossary#t, Last access: 04/01/2013.

Wuppertal Institute for Climate, Environment and Energy, (2010): Natural Gas: The Bridge into a Renewable Age, http://wupperinst.org/nc/en/projects/details/wi/p/s/pd/307/?cHash=bcad08990e48cacf9082b6da4062a5e7&sword_list[0]=natural&sword_list[1]=gas, Last access: 04/01/2013.

Das Stralsund Information Management Team (SIMAT)

Das von Prof. Dr. Michael Klotz geleitete „Stralsund Information Management Team“ (SIMAT) ist am Fachbereich Wirtschaft der FH Stralsund angesiedelt. Es bündelt akademische Lehre und Forschung, Weiterbildungsangebote und Projekte im Themenbereich des betrieblichen Informationsmanagements. Informationsmanagement richtet sich auf die effektive und effiziente Nutzung der informationellen Ressourcen eines Unternehmens. Diese Zielsetzung wird heute von verschiedenen spezialisierten Fachrichtungen in der Informatik, der Wirtschaftsinformatik und der Betriebswirtschaftslehre verfolgt. Das SIMAT arbeitet insofern interdisziplinär, wobei die inhaltlichen Schwerpunkte in Kompetenzzentren (Competence Center) fokussiert werden.

Im Rahmen des RD&D-Ansatzes (Research, Development and Demonstration) dienen Labore, die mit aktuellen Tools des Informationsmanagements ausgestattet sind, sowohl der fachlichen Arbeit als auch zu Demonstrationszwecken. Eine intensive Kooperation mit ausgewiesenen Expertinnen und Experten sowie mit privatwirtschaftlichen Unternehmen und die Mitarbeit in anwendungsnahen Fachorganisationen gewährleisten eine praxis- und lösungsorientierte Vorgehensweise. Die Zusammenarbeit mit Lehrstühlen anderer Hochschulen, wissenschaftlichen Einrichtungen und eine umfangreiche Publikationstätigkeit stellen sicher, dass sich das SIMAT am State-of-the-Art des Informationsmanagements orientiert und diesen mitprägt. Auf diese Weise sind die Mitarbeiterinnen und Mitarbeiter des SIMAT in der Lage, anspruchsvolle Konzepte und Lösungen zu konzipieren und zu realisieren.

Das SIMAT versteht sich als Mittler zwischen akademischer Forschung und Lehre auf der einen, und der Wirtschaftspraxis auf der anderen Seite. Diese Transferaufgabe, verankert im Landeshochschulgesetz Mecklenburg-Vorpommerns, bildet den Schwerpunkt der Arbeit des SIMAT. Forschung und Lehre werden nicht als Selbstzweck begriffen, sondern führen zu handlungsrelevanten, innovativen Konzepten und Lösungen, die in die Unternehmenspraxis transferiert werden. Die berufliche Weiterbildung bildet hierbei ein wesentliches Element.

Die anwendungsnahe Forschung am SIMAT ist auf eine ökonomische Verwertung hin orientiert. Es sollen Innovationen entwickelt und in Kooperation mit anderen wissenschaftlichen Einrichtungen, Fach-Institutionen und Unternehmen in eine nachhaltige und profitable Praxis umgesetzt werden. Hierzu werden eigene F&E-Projekte auf dem Gebiet des Informationsmanagements und Innovationsprojekte mit Partnern durchgeführt. Zudem hat sich das SIMAT auf die betriebswirtschaftliche Begleitberatung bei IT-nahen Technologieprojekten spezialisiert. Studierenden und wissenschaftlichen Mitarbeiterinnen und Mitarbeitern wird die Möglichkeit eröffnet, an

der Lösung praktischer Problemstellungen zu arbeiten und sich so optimal auf das spätere Berufsleben vorzubereiten.

Die studentischen Mitarbeiterinnen und Mitarbeiter erhalten im SIMAT Einblick in die Arbeitsmethodik sowohl auf wissenschaftlichem als auch auf wirtschaftlichem Gebiet. Aus den Projekten des SIMAT entstehen zahlreiche Abschlussarbeiten, die den Studierenden der FH Stralsund offen stehen. Das SIMAT bietet zudem eine berufliche Perspektive für Studierende, die sich als wissenschaftliche Mitarbeiter in der anwendungsnahen Forschung qualifizieren wollen.

Das SIMAT beteiligt sich zudem an der Diskussion der wissenschaftlichen Gemeinschaft. Hierzu werden regelmäßig Arbeitspapiere veröffentlicht, die den Stand der Arbeit des SIMAT in die Öffentlichkeit tragen und zur Diskussion anregen sollen. Das SIMAT lädt zudem andere Wissenschaftler, aber auch Referenten aus der Praxis als Vortragende ein. Auf diese Weise lernen die SIMAT-Mitarbeiterinnen und -Mitarbeiter sowie andere interessierte Studierende aktuelle Forschungsergebnisse und praktische Fragestellungen aus erster Hand kennen. Erkenntnisse aus diesen Aktivitäten sowie aus den verschiedenen F&E-Projekten werden systematisch in die Lehre überführt, so dass alle Studierenden von der Forschungsarbeit des SIMAT profitieren können.

Zum Zwecke des ökonomischen Transfers verfolgt das SIMAT den RD&D-Ansatz (Research, Development and Demonstration). Hierzu werden Labore als Demonstrationsbereiche unterhalten. In den Laboren werden Produkte und Lösungen von Kooperationspartnern des SIMAT in den Bereichen des Informations-, Projekt- und Prozessmanagements betrieben. Auf dieser technischen Grundlage werden im Rahmen von Projekten durch das SIMAT-Team prototypische Lösungen erarbeitet.

Kontakt

FH Stralsund • SIMAT • Zur Schwedenschanze 15 • 18435 Stralsund
Ansprechpartner: Prof. Dr. Michael Klotz (Wissenschaftlicher Leiter)
☎ +49 (0)3831 45-6946
✉ michael.klotz@fh-stralsund.de
http://simat-stralsund.de

Verzeichnis der SIMAT-Arbeitspapiere

AP	Datum	Autor	Titel
01-09-001	01.2009	M. Klotz	Datenschutz in KMU – Lehren für die IT-Compliance
01-09-002	02.2009	M. Klotz	Von der Informationsgesellschaft zum Informationsarbeiter
01-09-003	09.2009	L. Ramin M. Klotz	Aufgaben und Verantwortlichkeiten von IT-Nutzern anhand von COBIT
01-09-004	10.2009	S. Kubisch	Corporate Governance gemäß BilMoG und SOX
02-10-005	06.2010	M. Klotz	PMBOK-Compliance der Projektmanagement-Software Projektron BCS
02-10-006	07.2010	A. Woltering	Kontinuierliche Verbesserung von Desktop-Services mittels Benchmarking
02-10-007	09.2010	M. Klotz	Grundlagen der Projekt-Compliance
02-10-008	11.2010	I. Karminski	Grundlagen und aktuelle Entwicklungen der digitalen Betriebsprüfung
02-10-009	12.2010	D. Engel/ N. Zdrowomyslaw	Benchmarking-Studie Stralsund 2010
03-11-010	02.2011	E. Tiemeyer	Kennzahlengestütztes IT-Projektcontrolling – Projekt-Scorecards einführen und erfolgreich nutzen
03-11-011	05.2011	M. Klotz	Regelwerke der IT-Compliance – Klassifikation und Übersicht, Teil 1: Rechtliche Regelwerke
03-11-012	06.2011	M. Klotz	Konzeption des persönlichen Informations-managements
03-11-013	08.2011	H. Auerbach/ N. Zdrowomyslaw	9. STeP-Kongress „Region gestalten! Gesundheitswirtschaft und Zukunftsmanagement“
03-11-014	08.2011	M. Klotz	Rollen der Information im Unternehmen
03-11-015	08.2011	Ahlfeldt	eGuides in kulturellen Einrichtungen – deutschsprachiger Museums-Apps
03-11-016	11.2011	S. J. Saatmann / I. Sulk / M. Klotz	Studie zu gewerblichen Strompreisen in Mecklenburg-Vorpommern – Strom als Wettbewerbsfaktor und Gegenstand der Standortvermarktung
04-12-017	02.2012	M. Klotz / I. Sulk / E. Wieck	GDPdU-Konformität von Projektmanagement-software – Exemplarische Konzeption und Umsetzung
04-12-018	07.2012	M. Horn-Vahlefeld	Projektdesign als organisatorischer Rahmen des Projektmanagements
04-12-019	08.2012	M. Klotz / J. Kriegel	ITIL und Datenschutz – Überlegungen für eine Integration des Datenschutzes in die IT-Prozesse nach ITIL
04-12-020	09.2012	M. Klotz	Regelwerke der IT-Compliance – Klassifikation und Übersicht, Teil 1: Rechtliche Regelwerke, 2. Aufl.

04-12-021	10.2012	I. Sulk / M. Klotz	Einsatz von eGuides auf der Marienburg in Malbork (Polen) – Erhebung und Analyse einer Best Practice
04-12-022	12.2012	Witty, M. / C. Kliebisch	Die Versicherungsbranche unter FATCA
05-13-023	01.2013	S. J. Saatmann	The price-link in the natural gas market – The development of the oil price-link and alternative price mechanisms