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Principles of gas pricing and their impact on the market for gas cars in Germany

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Abstract:

As for any other fuels used for transport or heating, the gas price for final users could be split into three major components: the wholesale price for the resource (including far distance transport by ship or pipeline), taxes and finally a assorted group of mainly smaller price drivers (such as local transport, storage, marketing costs or retail margins).

This paper focuses on the gas wholesale price component. It will be demonstrated that due to the traditional pricing system in Germany (net-back pricing based on oil-indexation or "Anlegbarkeit") gas prices have been higher than necessary – at least when assuming a competitive supply and demand based pricing system (like in the US or the UK). Based on the linear optimisation model MAGELAN a hypothetic competitive market price for Germany will be simulated for the period 2000 to 2011 and compared with the actual prices for German gas imports based on the net-back principle.

The paper ends with a section discussing the impact of the traditional pricing systems for the German gas market in general and the situation of gas cars in special. It will be discussed that price regime is only one limiting factor for further development and that massive efforts by the gas industry are needed to push gas cars in Germany.

JEL Classification: Q41, Q47, C61

Keywords: Oil and gas prices, natural resources, transport, energy market modelling

1 Introduction

Gas cars are in principle an environmental friendly and economic efficient alternative to oil cars. Given this, it takes no wonder that gas cars are common in many countries around the world. However, gas car sales are only marginal in Germany so far, and no real dynamic could be observed in recent years.¹

Reasons for this are very diverse and cover a wide range of arguments such as technical, safety or economic aspects. It is not subject of this paper to weight those factors or even to discuss if the arguments are right or wrong. But clearly, prices are always one of the most important decision factors for customers - and gas cars are obviously no exception from this. However, fuel prices for gas cars are not an argument against this technology, as the fuel itself is quite competitive to gasoline or diesel car. And even if gas cars themselves are sold with a premium to diesel or gasoline cars, still gas could be an alternative for many drivers.²

One reason, why gas cars haven't found a market position in Germany (and many other European countries) so far, could be that (potential) consumers are not convinced that gas cars are economically attractive today – and even if they do so, they may assume that this will not stay in the future. The key argument for this might be that most consumers have made experience with massive price increases in the heating sector - and have been frustrated by rather dubious (from their perspective) justifications from their suppliers. Especially in 2008/2009 a sharp decline in gas wholesale prices as well as oil prices could be observed by every customer – but this does not prevent suppliers from further large-scale price increases still justified with “increasing prices due to oil-indexation”. Even if this argument might have some reasoning in the “old gas world” thinking of some gas suppliers, the gas industry failed to translate this to their customers³ (and to the Bundeskartellamt, by the way).⁴

In this paper it will be demonstrated that the unspecified feeling of gas customers to be “ripped off” is quantitatively provable. Based on a short overview over the principles of gas pricing in section 2⁵ a gas market model will be introduced in section 3. This model will provide gas prices based on long run marginal costs of production and transport. In addition, transit fees and other costs are included - so that these prices could be interpreted as competitive price benchmarks at a wholesale trading point (like NCG or Gaspool in Germany). Section 4 presents some selected results from the model. These (hypothetical) competition prices will be compared to the actual prices in Germany for the last decade. The paper ends with an outlook to the further development of the German gas market in general and gas cars in special (section 5).

¹ In 2012 more than 17mio natural gas vehicles (NGV) were registered worldwide. Most gas cars are used in Iran and Pakistan (each more than 3mio). Italy is market leader in Europe (approx. 750.000), whereas gas cars in Germany are still below 100.000. See NGV Journal (2013).

² IEA (2010) summarises various economic, ecological and political aspects of natural gas cars.

³ Marketing studies show a declining trend of the image of the gas industry and that an increasing number of customers lose confidence in their supplier. See e.g. Energate (2013).

⁴ Numerous price abuse cases were opened from 2008 by the German cartel office. Most cases were settled in the following years with a repayment to the customers. See Bundeskartellamt (2013).

⁵ Readers with some knowledge about gas markets might skip this section without scruple as it will not provide anything new to them.

2 Background: Principles of gas pricing

In general, two different pricing mechanisms for gas are common. The first approach is the so-called netback pricing where the price for gas is defined by other prices, mainly those from substitutes like fuel oil. In the second way the gas price is simply the result of supply and demand acting on free markets.⁶

The netback principle (or “Anlegbarkeitsprinzip” in German) is a top down approach, where the price for gas is derived from other energy sources. The price reflects substitution relationships between gas and comparable fuels like gasoil, fuel oil or, less common, coal and electricity. If fixed cost components like taxes or regulated tariffs along the value chain are subtracted, a margin for the producer remains. Depending on the substitute price, this margin could be higher or lower and in some situations also negative. The price is set by a formula which is fixed in very complex long-term contract. The formula (as well as other parts of the contract) is subject of regular renegotiations to guarantee that the formula still reflects the actual market development and allows a margin sharing of the two contract parties along the value chain. The netback principle was first introduced by Gasunie (now GasTerra), the Dutch gas export monopoly in the late 1960s and was adopted soon by other suppliers (with various modifications). Also the import companies arrange a comparable formula and contract system in their downstream markets.⁷

Market prices cover in principle the same cost components as netback prices (see Figure 1). However, the price mechanism works bottom-up so that cost components of gas itself are the drivers of the gas price – and not prices of other fuels.⁸ Beside the fixed and regulated components production costs have significant impact on the prices. As the marginal supplier defines the price and the supply/demand balance is changing along the year, gas prices are very volatile.⁹

⁶ Austvik (2003), Lohmann (2006) and IEA (2008) provide comprehensive overviews over both pricing regimes and their historic and economic background.

⁷ Gas contracts are usually confidential and only limited details are known to the market. EU (2007) provides an (anonymous) overview over the most relevant parameters of European gas supply contracts.

⁸ What makes it even more complicated is a time lag in the formulas. So the gas prices in, say, January 2013 is defined by fuel oil prices between April and September 2012.

⁹ Nevertheless, market prices are on average below formula prices. In the last 15 years market based prices in the UK was only in 3 years higher than the oil-indexed average border price in Germany.

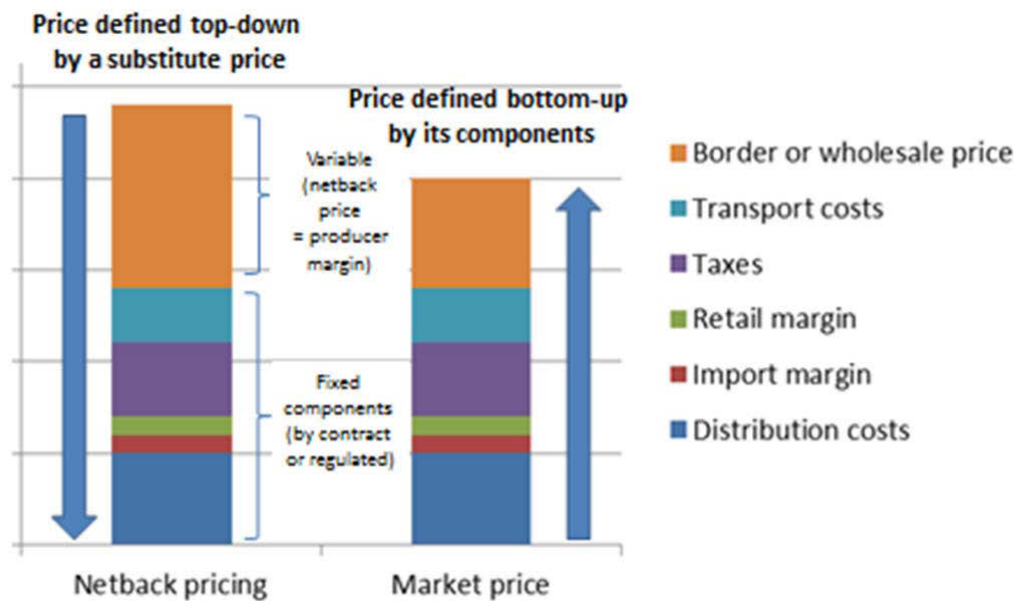


Figure 1: Pricing mechanisms for gas

“Real” gas prices have been introduced first in the US in the late 1970s, followed by the UK a decade later. Both are role models for the EU liberalisation starting in 2000. But still netback pricing plays an important role even in markets with advanced gas trading places (like Belgium, the Netherlands and to a lesser extent also Germany). And large parts of Eastern and Southern Europe are still dominated by netback pricing with only limited (e.g. Italy, Spain) or no market activity at all (e.g. all new EU member states).¹⁰

3 Model structure

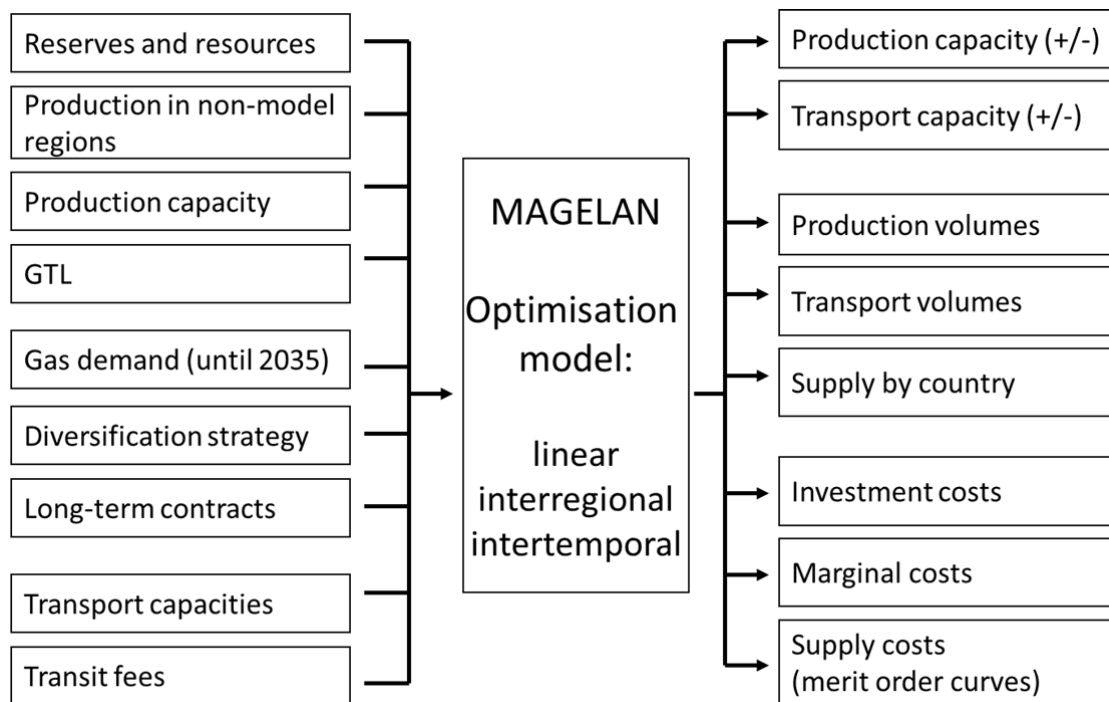
As nearly no competition existed in Germany for long parts of the 1990s, market prices need to be modeled. Those hypothetical prices consist of the same components as discussed in section 2 and are comparable to the market prices.

The underlying model is MAGELAN, a linear optimization model for the world gas market.¹¹ The model is designed as a node-to-node network and covers more than 120 nodes. It has various input parameters like reserve and resource base, demand forecasts, production and transport capacities. All existing and possible production and transport options are characterized by specific cost parameters.¹² Additionally, political and technical constraints are included as well as many other parameters relevant for the gas industry (see Figure 2).

¹⁰ Heather (2012) gives an overview over development of Continental European gas trading hubs.

¹¹ The model was developed at the Institute of Energy Economics at the University of Cologne (Seeliger (2006)). MAGELAN is based on an older Europe specific model approach called EUGAS (Perner (2002)). A newer version of MAGELAN (named COLUMBUS) with different features is currently under development (Hecking/Panke (2012)).

¹² Cost estimations based on Seeliger (2006), Lochner/Richter (2010) and company websites.

Figure 2: Model structure of MAGELAN¹³

The model covers a forecast period until 2034. The model produces a wide range of results. Of specific interest for the topic of this paper are especially the supply costs for Germany. Those costs could be aggregated to a supply curve for gas, starting with the costs of the most competitive supplier and then on in increasing order. The last needed supplier to cover the total demand is the marginal supplier, who determines the market price (in a competitive market). As the costs of all other suppliers are below the costs of the marginal supplier, they are able to realise a producer margin.¹⁴

4 Selected results

Figure 3 illustrates a merit order for Germany in 2011. The Netherlands are the most competitive source followed by domestic production. Russian gas is the most expansive source used in Germany and, on the first view surprising, also the one with the highest market shares. However, given limited resources in most Western European countries, they are not able to increase their production significantly (and even if they could, it is not guaranteed, that these volumes would flow to Germany instead of other markets), which explains the high (and increasing) market presence of Russian gas. Russia is the only supplier with higher transport costs than production costs, which is not surprising given a transport distance of around 5.000km from Western Siberia to Germany.

¹³ See Seeliger (2006).

¹⁴ Merit order models are very common in energy markets. Stöbele et al. (2012) provides an overview over general functions of such models.

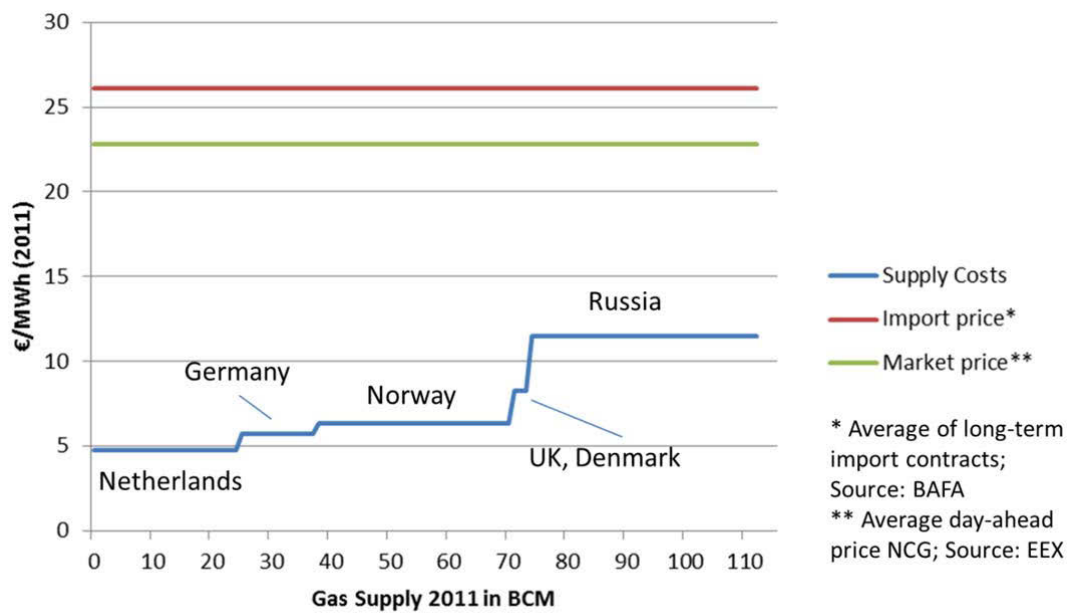


Figure 3: Merit order curve for Germany 2011

When comparing the marginal supply costs of around 11.50 €/MWh with the actual prices, a wide gap could be observed. The average price of oil indexed import contracts was 26.10 €/MWh, meaning approx. 225% of the hypothetical market price.

The actual price on the German gas market (NetConnect Germany) was below the oil-indexed import price but still significant above the hypothetical gas price. One reason for this is that the German market price (as most other market prices) is strongly influenced by oil-indexed volumes, which still dominates the market in some periods of the year.

The high margin for gas suppliers in 2011 is nothing too uncommon in recent years. Especially 2008 show a comparable high surplus over the marginal costs (Figure 4). In general, since 2004 a strong increase is observable, which is quite a contrast to the comparable low margins in the early 2000s (and even slightly negative margins in some years before).¹⁵

This is a remarkable break in the “old gas world” system. The original spirit of long-term oil-indexed gas import contracts was a fair margin sharing among import and export companies. This means that the exporter gets a margin at the border which is in a certain relation to the margin the importer gets in his downstream business. Renegotiations of the price formula guarantee that too high (or negative) margins for one party lead to an amendment of the contract to rebalance the margin sharing.¹⁶

¹⁵ See Seeliger (2006).

¹⁶ See Austvik (2003).

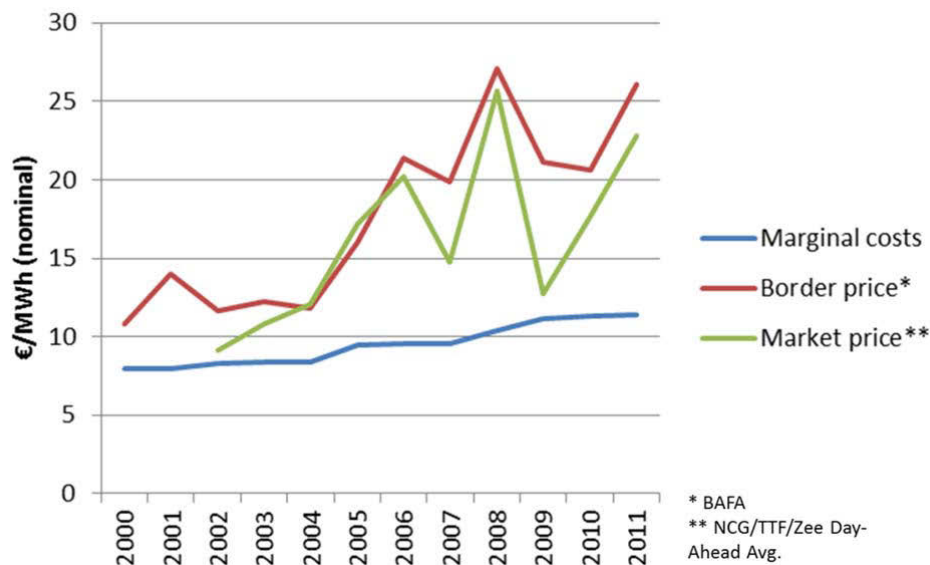


Figure 4: Comparison of hypothetical model prices and actual gas prices in Germany

Figure 4 also illustrates that the high prices increase could not be justified by increasing costs of gas itself but only with increasing costs of oil. Especially in 2009 after the beginning of the financial crisis, oil indexed prices remain high as gas formulas have a time lag and are determined by an average over a longer period. Whereas market prices react immediately, oil-indexed prices could somehow tunnel the oil price decrease beginning in the second half of 2008.

Finally, one could state that the German gas industry wasn't able to negotiate lower prices or get rid of oil-indexation at all. An instrument that was originally implemented to guarantee a fair and sustainable price and margin level, turned into a real problem for the German import companies.¹⁷ As their competitors could source their gas from the market and their (industrial) costumers couldn't (or aren't willing to) pay the high prices, import companies were squeezed in the middle of downstream competition and high priced long-term contract with their suppliers.

5 Outlook for gas cars and (other gas applications)

In contrast to other European countries, German gas demand stagnated since the mid 1990s.¹⁸ With respect to sectoral gas demand forecasts, the future of the gas industry doesn't look too bright. Especially the two main gas consuming sectors have only limited potential for further expansion. In the household sector, gas gets more and more replaced by other sources (such as heating pumps, wood pellets, solar heating etc.) and loses its status as „fuel of choice“ (which gas was in the 1980s and 1990s) in new built houses.¹⁹ Additionally, thermal insulation and

¹⁷ Several attempts were started to reform the price regime but especially Gazprom and Statoil reject these ambitions successfully for a long time. In the meantime, some Norwegian volumes are priced with market price level and even Russian contracts have a (small) fraction of the price formula referring to the German market price. See Energate (2010a) and Energate (2010b).

¹⁸ For statistical data see e.g. IEA (2012), BP (2012) or BDEW (2012).

¹⁹ The share of gas heating systems in new built houses declined from 77% in 2000 to 48% in 2012. See BDEW (2012).

low (or zero) energy housing becomes more and more standard, which reduces the heat energy demand in general (which is not only a gas market issue, of course). Same applies more or less also for industrial demand, where energy efficiency measures and relocation of production sites to other countries are a challenge for the gas industry.

This leaves two very price sensitive segments as only chance for further expansion. Gas-fired power plants were a key driver for gas demand in Europe in the recent years. However, in contrast to countries like the UK or Spain, so far this was not the case in Germany. Reasons could be high prices and structural limitations in the regulated transport sector.

This leaves the mobility sector as potential glimmer of hope. But as gas has to face petrol, diesel and LPG as incumbents and electricity as strong newcomer, gas industry needs to re-think its general market strategy.

Not only, but with special respect to the competition in the car fuel segment fundamental changes are needed, to get the gas demand pushed:

1. Pricing system change: this is needed to uncouple gas from oil prices and reduce overall price level
2. „Aggressive“ product promotion/image improvement: gas industry needs to recapture its formerly good reputation and demonstrate that they are an environmental and consumer friendly alternative to oil
3. Politics: it needs massive lobby and public relation to convince politics and public to shift their mobility strategy away from e- (or hydrogen-)cars to gas cars

As demonstrated in section 4 the price decrease effect is very likely if the gas industry can move away from oil-indexation. After years of blockade and refusal of competition by some gas incumbents a new view on the market seems to awake in those companies.

However, points 2 and 3 are more difficult as in contrast to point 1 they are not realisable by the gas industry alone. From the authors perspective it seems to be rather unrealistic that customers will switch back to gas as “fuel of choice”. And every price increase justified with oil-indexation or other “old world” argument (which is still the case in 2013) will erode confidence base even more.²⁰ And the politics seems to commit themselves to e-cars and a switch back will have impact on their reputation. In addition, it is unlikely that after a possible change of government with an involvement of the Green party fossil fuels will come back on the agenda.

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²⁰ Or, as Germanys most popular newspaper puts as headline on page 1, the “gas rage” will keep on growing.

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