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Pricing of wholesale gas in the Netherlands

A FINAL REPORT PREPARED FOR NMA (PUBLIC VERSION)

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Pricing of wholesale gas in the Netherlands

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Executive summary

The Netherlands Competition Authority (NMa) is charged with the enforcement of the Dutch Competition Act. In response to complaints received, the NMa is considering the prices charged by GasTerra for gas supply and gas flexibility services over the period 2001 to 2007.

To help with its analysis, NMa has asked Frontier to develop an estimate of (hypothetical) competitive benchmark prices for the products and services delivered by GasTerra for the periods 2001 to 2007 and to explore whether or not the observed prices charged by GasTerra exceed the estimated benchmark prices.

We apply two different approaches to constructing a hypothetical competitive benchmark:

- Benchmark A: supply costs of **hypothetical new entrants** into the gas market.
- Benchmark B: supply and demand in a **hypothetical market** that is structurally comparable to the Dutch market.

The first approach focuses on the costs of supplying the different customer types by a potential competitor. Since the costs vary according to competitor, we apply this approach to three different hypothetical entrants that procure gas and flexibility services from different sources.

The second approach focuses on the macro perspective. We develop a model of the supply and demand situation in the Netherlands assuming a hypothetically competitive market.

A comparison of GasTerra's prices with the hypothetical competitive price benchmarks estimated on the basis of both approaches reveals that GasTerra's prices do not unambiguously exceed all benchmarks for the cost of supply to a particular type of customer in any given year. However, the areas of greatest concern of possible high prices relative to the benchmarks are:

- GasTerra's price to supply large-scale industrial users in the period 2003 to 2004; and
- to a lesser extent GasTerra's price to supply small scale end users in 2007.

1 Introduction

The Netherlands Competition Authority (NMa) is charged with the enforcement of the Dutch Competition Act. In response to complaints received, the NMa is considering the prices charged by GasTerra for gas supply and gas flexibility services over the period 2001 to 2007.

To help with its analysis, NMa has asked Frontier to develop an estimate of (hypothetical) competitive benchmark prices for the products and services delivered by GasTerra for the periods 2001 to 2007 and to compare the benchmark prices to the prices charged by GasTerra for equivalent products and services. In particular, NMa has asked Frontier to explore whether or not the observed prices charged by GasTerra exceed the estimated benchmark prices.

This document is Frontier's Final Report for the study. The intention of this report is to present the results of the price comparison and to discuss the underpinning analysis in order to provide NMa with solid ground to assess the situation.

1.1 CONTEXT OF THE STUDY

1.1.1 Competition context

The focus of Frontier's study is to develop an estimate of hypothetical competitive benchmark prices for products and services delivered by GasTerra and to compare the benchmark prices to the prices charged by GasTerra for equivalent products and services. Therefore, Frontier's analysis could form only part of a potential abuse investigation, i.e. contributing to a verification of the competitiveness of prices, and could not in its own right be used to draw a conclusion regarding abuse.

Frontier has not been asked by NMa to define relevant markets, analyse market dominance or advise as to whether or not GasTerra has abused a (hypothetically) dominant position in one or more markets as part of this study.

1.1.2 Economic context

A competitive benchmark price should reflect economic value. There is widespread agreement by applied economists and in the economic literature that the principle of economic value should be established by reference to an estimate of the marginal cost of supplying a good or service.[1] In the context of this study, this could, for example, be the (marginal) cost of the marginal supplier of gas to end-consumers, so that the cost of supply of the marginal supplier becomes relevant to a measure of the competitive price.

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1 We use the term "supplying" rather than "producing" since the marginal cost could, for example, be driven by the willingness to pay of demand or the opportunity cost of demand not met.

Over time consumers should not pay more than the total costs of supplying the given product to consumers and as such that neither the industry nor individual players should enjoy super-normal returns. This means that prices over long time-spans should not exceed long term average industry costs where such costs reflect an appropriate return on capital (taking into account an appropriate risk premium for debt and equity).

In the case of the gas industry with high fixed costs, the relevant benchmark for competitiveness is therefore an expectation that the marginal player recovers its (long run) marginal or average costs rather than short run marginal costs as the latter would be too low.

The marginal cost (and therefore the competitive benchmark price) should take account of opportunity costs and scarcity rents. It is therefore possible for the competitive benchmark price to exceed the directly incurred short run variable cost of the marginal producer and it is also possible, in the short run, for the benchmark price to exceed the long run marginal or average cost of the marginal producer.

For this study, we base the benchmark prices on the costs of alternative sources of wholesale gas, flexibility services and transportation – the key inputs to the supply of gas to end users.

In Annexe 2, we present a more extensive discussion of the underlying logic for developing a hypothetical competitive benchmark price.

1.1.3 Gas market context

When developing competitive benchmark prices for the gas and flexibility services provided by GasTerra to its customers, it is important that we compare like with like. The benchmark prices should apply to products that are similar to those provided by GasTerra, e.g. a similar bundle of gas and flexibility services. In addition, it is important that the benchmark prices be determined for delivery at the same location and broadly with the same conditions as for delivery by GasTerra.

GasTerra sells gas and flexibility services to large end users that are directly connected to the high pressure transmission network and to retail suppliers who serve customers connected to the low pressure distribution networks. Flexibility services are needed to meet predictable and unpredictable variations in gas demand over some period of time, e.g. a year, week or day.[2] For this reason the quantity of flexibility services required to meet the demand for gas by end users varies according to the type of end user – small end users such as households typically require more flexibility services relative to their annual demand than a large industrial end user.

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2 Frontier (2008) provides a further description of how flexibility services can be defined and different ways in which flexibility services can be measured.

GasTerra provides customers with a bundle of gas and flexibility services at a single price although the price varies by customer type, for example, to reflect different flexibility needs. The focus of our analysis is therefore on the price for a bundle of gas and flexibility services.

In Section 3, we provide more details about the two approaches we apply to developing competitive price benchmarks.

1.2 STRUCTURE OF THE REPORT

This document is the Final Report for the study, which contains Frontier's views as to the level of benchmark prices for gas and gas flexibility services over the period 2001 to 2007 relative to the prices GasTerra has charged for equivalent services over the same period. The remainder of this document is set out as follows:

- Section 2 provides an overview of aspects of the Dutch gas industry relevant to this study.
- Section 3 sets out our approach to defining possible hypothetical competitive benchmark prices including a description of the choice of benchmark components.
- Section 4 sets out the quantitative results of the price comparison and describes qualitative aspects that are relevant to the interpretation of results.
- Section 5 sets out our conclusions as to the benchmark price comparison. We note that we do not draw a conclusion as to whether GasTerra's prices were excessive in a formal competition sense.

Annexe 1 sets out details of our quantitative analysis and Annexe 2 presents the underlying economic logic for developing a hypothetical competitive benchmark price.

2 Overview of the Dutch gas industry

In this section we provide a brief overview of the Dutch gas sector, focussing on those aspects with specific relevance to this study:

- production;
- transportation;
- storage;
- trading; and
- retail supply.

Gas production

The Dutch natural gas industry has been operating since the discovery of the Groningen field in 1959. Over time, production from Groningen has declined in favour of gas production from other, smaller, fields. Groningen remains the single largest source of Dutch gas production with a 50% share of Dutch production in 2006.[3] In addition, Groningen contains the bulk of Dutch developed gas reserves, with 947 bcm[4] (or 81%) out of a total of 1163 bcm for the country as at 1 January 2007.[5]

GasTerra is contracted to take 100% of the output from the Groningen field. Additionally, GasTerra is obliged to offer to take all gas produced from the small fields (i.e. the production fields other than Groningen which produce mainly H-gas).[6] At the same time producers have the option to sell their gas to other shippers.[7] Nevertheless, GasTerra takes approximately 85 % of the small fields' production.[8]

Gas from Groningen consists of low calorific gas (L-gas).[9] H-gas is imported and both H-gas and L-gas are exported. Overall, the Netherlands is a net gas exporter. In addition, there is a net flow of gas from the H-gas to the L-gas system, which was approximately 25 bcm in 2006.[10] Table 1 sets out the Dutch gas supply and demand balance for 2006.

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3 See TNO (2007), p.32.

4 Gas volumes are in units of Groningen equivalent (Geq) volumes, i.e. 35.17 MJ/m^3.

5 If undeveloped gas fields were included, the total share of Groningen would decrease to 75%, i.e. 1046 bcm out of a total of 1398 bcm. Source: TNO (2007), p.13.

6 In this report we allocate all Dutch L-gas production from smaller fields to Groningen. The category "small fields" in turn includes only Dutch H-gas production.

7 Rules in Respect of the Transmission and Supply of Gas (Gas Act), Section 54.

8 Calculation based on NMa/Dte (2007) and information from GasTerra's website (www.gasterra.nl).

9 Several different qualities of gas are conveyed in GTS' network. Low calorific gas comprises L-gas, G-gas and G+-gas (collectively referred to as L-gas). High calorific gas comprises H-gas.

10 NMa/DTe (2007), p.32.

	H-gas (bcm Geq)	L-gas (bcm Geq)	Total (bcm Geq)
Imports	23.3	-	23.3
Production	39.1	35.6	74.7
Quality conversion (from H-gas)	-	25.1	-
Total supply	62.4	60.7	98.0
Indigenous consumption	12.7	29.6	42.3
Exports	24.6	30.4	55.0
Quality conversion (to L-gas)	25.1	-	-
Total consumption	62.4	60.0	97.3

Table 1: Dutch gas balance, 2006

Source: NMa/DTe (2007)

Note: figures may not add due to rounding, differences between storage levels at the start and end of the period, losses etc

Gas transportation

GTS, the gas system operator, operates two high-pressure gas transportation systems in the Netherlands: an L-gas system and an H-gas system. These systems run in parallel, as illustrated in Figure 1, and are connected by 17 blending/nitrogen stations and two air separation units.[11] Blending and nitrogen injection allow conversion from H-gas to L-gas, but not in the opposite direction.

All of the local distribution companies, which serve smaller customers, are connected to the L-gas system. Large customers take gas directly from either the L-gas or H-gas system. Since small customers tend to have higher variation in demand than large customers, the L-gas system has more variable demand than the H-gas system.

The GTS system is connected to gas systems in Belgium and Germany, to the Danish system though the offshore pipeline, Nogat, and to the Norwegian offshore network through Emden, Germany. In addition, the BBL pipeline, which allows flows from the GTS system to the UK, began commercial operations in December 2006.

11 In addition, Delta has a single gas blending facility that is dedicated to serving the Delta distribution network, an L-gas network. We understand from GTS that one nitrogen plant is at an industrial site but may be used for quality conversion.

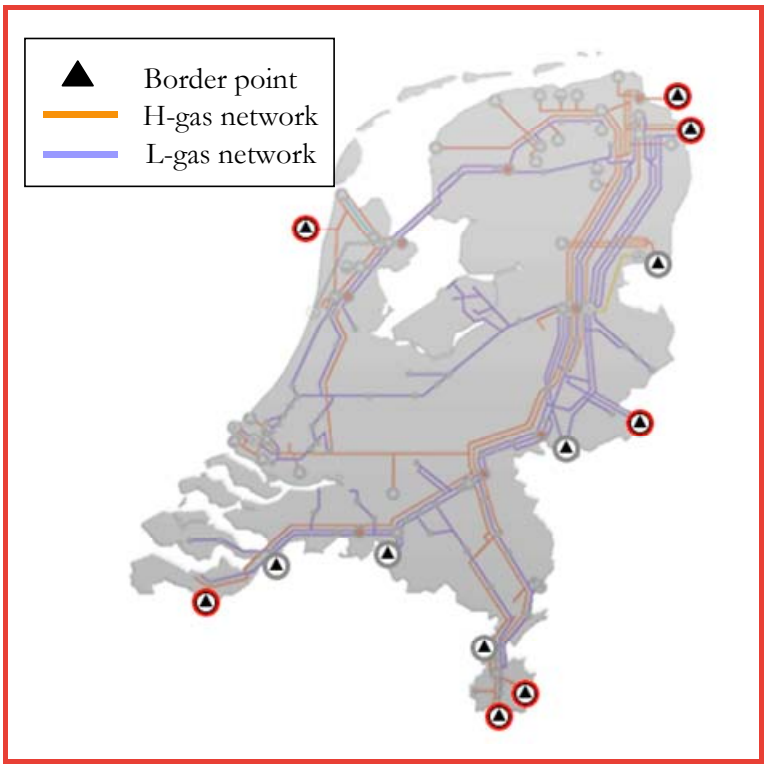

Figure 1: GTS high pressure Dutch gas transportation network

Source: GTS

There is also a small regional H-gas gas network operated by Zebra in the Netherlands. This network provides gas from the Bacton-Zeebrugge Interconnector via the Zelzate Zebra entry point (capacity 16.8 mcm/d in 2006)[12] to customers in the south west of the Netherlands. This network is currently not directly connected to the GTS system.[13] For this reason, we do not consider the Zebra system further as part of this study.

Gas storage

The Netherlands has relatively limited storage, with aggregate working gas volume representing about 6% of annual demand. The limited quantity of storage is due to Groningen meeting the bulk of flexibility requirements on the Dutch gas system. The characteristics of the storage facilities located in the Netherlands are summarised in Table 2.[14]

12 Source: www.gte.be.

13 We understand that a limited number of customers are connected to both the GTS and Zebra systems but that switching between the Zebra and GTS systems is not straightforward due to differences in gas quality.

14 All capacities and volumes are expressed in Groningen equivalent. Therefore all H-gas data is multiplied by 1.18, based on the differences in Wobbe-index (51.6 vs. 43.8 MJ/m³). See DTe (2004), p.4.

Location	Gas quality	Type of storage	Owner	Production capacity [mcm/h Geq]	Working gas [mcm Geq]
Grijpskerk	H-gas	depleted field	NAM	2.70	1770
Norg	L-gas	depleted field	NAM	2.13	3000
Alkmaar	L-gas	depleted field	BP[15] a.o.	1.50	500
Maasvlakte	L-gas	LNG	Gasunie	1.30	72
Kalle (GER)	H-gas	aquifer	RWE	0.47	254
Epe (GER)	L-gas	salt cavern	Essent	0.40	186

Table 2: Storages connected to GTS as of 2006

Source: Companies' websites.

Some underground storage facilities located in Germany are directly connected to the GTS system. Other sources of flexibility are connected to a gas network adjacent to the GTS network and can therefore deliver flexibility services to the GTS systems to the extent allowed by the lesser of (i) the flexibility capacity of the facility itself and (ii) the capacity of the border point between the GTS system and the neighbouring system.

Gas trading

Parties may trade gas at the Title Transfer Facility (TTF), the virtual trading point of the Netherlands, in order to manage their individual gas balances and portfolios. Contracts traded on TTF are defined using a day as the basic unit of time, with a flat delivery profile within the day.[16]

The traded volumes on TTF in 2006 accounted for 6.5% of the yearly gas supply (demand plus exports) and the churn rate was 11.3, which means that each gas unit was re-traded about 11 times. The bulk of traded volume were H-gas; liquid trading of L-gas does not exist, for example, only 2% of the total traded volumes on TTF relate to the three L-gas qualities (G, G+ and L). Although trading has increased over time, it remains low compared to more mature trading markets like Britain's NBP or Henry Hub in the US.

Most of the trading at TTF has focussed on forward contracts. In this segment, TTF is the second most important marketplace for gas in Europe, after NBP. TTF may therefore become a gas price benchmark for northwest continental Europe. This is in part due to a lack of a representative German virtual trading point, and the tendency for Zeebrugge to more reflect the gas price situation of the British market.

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15 In 2007, the Abu Dhabi National Energy Company (TAQA) acquired BP's Dutch upstream business including the share in Alkmaar.

16 Within day contracts, with an hour as the basic unit of time, may also be traded on TTF. In practice, within day contracts are rarely traded.

Gas retail supply

Since 1 July 2004, all gas market consumers have been free to choose their gas retail supplier. The 11 gas network operators in the Netherlands are currently legally unbundled from upstream supply and retail supply activities and, according to the Law on the Independence of Network Operators, from 2011 they must also be economically unbundled from these activities.

According to the Dutch Office of Energy regulation (Energiekamer or EK[17]), as at 1 July 2007 the three large gas retail suppliers together had a market share of approximately 80% in the small-consumer segment with the other 17 independent retailers each having a market share of less than 5%. At the time of full liberalisation, the market share of the three largest gas retail suppliers in the small-consumer segment was about 86%. The switching rate of small consumers is around 0.5% per month, with 6.8% of consumers switching gas supplier between July 2006 and June 2007.

GasTerra [✂] sells to very large end users that are directly connected to the high pressure national gas transportation network and to retail companies. [✂]. Retailers sell to both large and small end users that are directly connected to a regional gas distribution network and sometimes also sell to very large end users that are directly connected to the high pressure national gas transportation network.

17 EK was formerly named Directie Toezicht Energie (DTe).

3 Approach to defining benchmark prices

In this section we provide an overview of the approaches we apply to deriving hypothetical competitive benchmark prices for sales of gas and flexibility services to different customer types. As a result of our preliminary investigations, two methods have been chosen to apply quantitatively.

3.1 BROAD APPROACH

The underlying logic of our analysis is to compare:

- the actual prices observed for the services in question as charged by GasTerra; against
- a benchmark that represents hypothetical competitive prices.

In our study, we undertake the comparison of observed prices against benchmark prices. However, we have not been asked as part of this study to formally attempt to establish abuse or to advise as to when prices can be considered non-competitive.

This analysis is repeated for the following customers of GasTerra and covers the period from 2001 to 2007:

- small scale end-users supplied through retailers; and
- large scale end-users supplied through retailers or directly by GasTerra.

3.2 BENCHMARKS APPLIED

We apply two different approaches to constructing a competitive benchmark:

- Benchmark A: supply costs of **hypothetical new entrants** into the gas market.
- Benchmark B: supply and demand in a **hypothetical market** that is structurally comparable to the Dutch market.

The first approach focuses on the costs of supplying the different customer types by a potential competitor. Since the costs vary according to competitor, we apply this approach to three different hypothetical entrants that procure gas and flexibility services from different sources.

The second approach focuses on the macro perspective. We develop a model of the supply and demand situation in the Netherlands assuming a hypothetically competitive market. We briefly describe each approach below and provide more details in Annexe 1.

We also considered a possible third approach to estimating a hypothetical competitive benchmark. We discarded this approach as being impractical but describe it in this section for completeness.

3.2.1 Benchmark A: Supply costs of hypothetical new entrants into the gas market

With this approach, a hypothetical price benchmark is established equal to the costs that suppliers from other product or geographic markets would be able to supply the relevant Dutch markets with gas and flexibility services. In an assumed competitive market those supply costs would determine the minimum price at which an entrant is able to supply to the market without making a loss.

The supply costs for gas and flexibility services delivered to the Dutch markets would therefore include the cost of commodity gas, the cost of procuring flexibility and the cost of transportation to the Dutch market at a location comparable to that of the observed prices for GasTerra's sales of gas and flexibility services.[18]

We apply this option to a number of hypothetical competitors that source gas in the Netherlands and from the neighbouring countries of Germany and Belgium. Annexe 1 describes the specific choice of competitors, where flexibility is procured and the transportation paths for delivery to the Netherlands.

This approach is likely to lead to a relatively high benchmark price as it presumes that the prices used for sourcing gas and flexibility services in constructing the benchmark are themselves competitive, when they may not be.

3.2.2 Benchmark B: Supply and demand in a hypothetical market

Whereas Benchmark A focuses on the position of individual competitors and their practical procurement options, the second approach takes a market-wide approach. With Benchmark B, we model the market as if it were perfectly competitive. In such a market, prices are set at that level where demand (representing the willingness to pay for gas) and supply (representing the marginal costs to deliver the gas to the market) are in equilibrium. In general these basic economic models work with the assumption that demand falls with increasing prices whereas supply increases with increasing prices.[19]

A further development of this simple market model is the concept of merit order curves, which is often used in energy market modelling.[20] Merit order models also apply the concept of demand and supply curves (see Figure 2). For a short term horizon (or ex-post analysis) demand is often represented by a vertical curve (or line) due to the common assumption that in the short run demand is inflexible. On the supply side all possible suppliers are sorted in ascending order

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18 Additional costs would be incurred in cases where additional services must be procured in order to supply the customer, e.g. the costs of quality conversion if the customer uses L-gas and the new entrant has only access to H-gas.

19 A more detailed description of the basic market model can be found in several economic text books, e.g. Samuelson/Nordhaus (2004).

20 Merit order curves are often used for modelling electricity markets, e.g. Kreuzberg (2001), and are becoming more common for gas market modelling, e.g. Seeliger (2006).

according to their marginal costs. The supply costs of the last supplier who is needed to meet the (fixed) demand determines the benchmark competitive price.

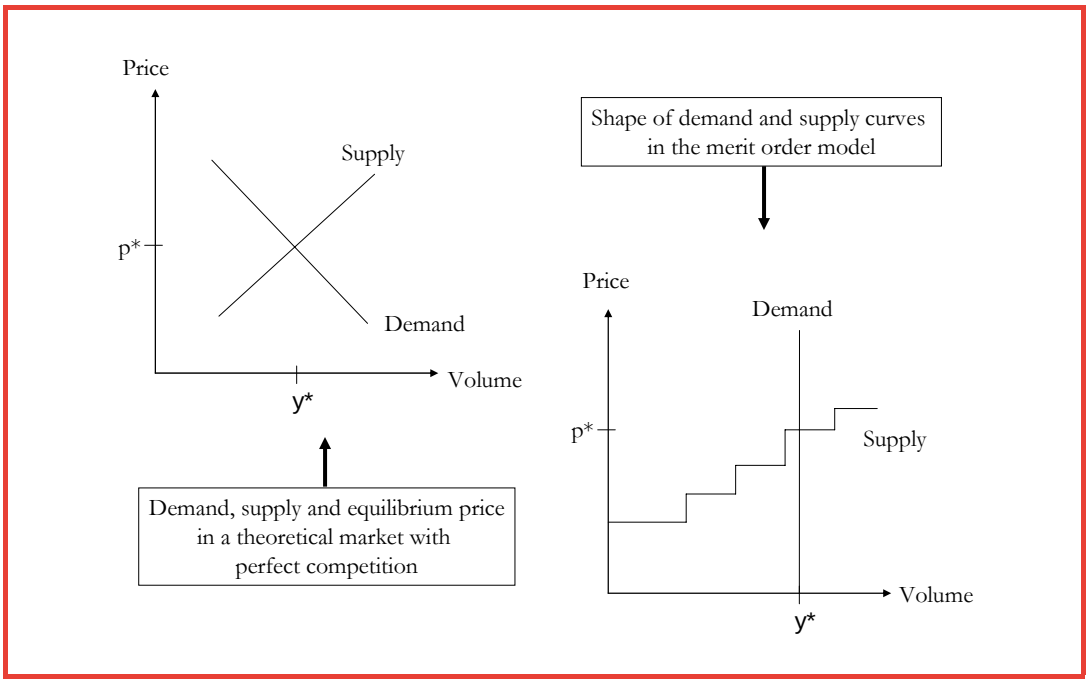

Figure 2: Supply and demand in a merit order model

Source: Frontier

When comparing the benchmark prices resulting from the supply and demand model with prices charged by GasTerra, adjustments are necessary to ensure the benchmark and observed prices represent the same product.

Prices resulting from the merit order model represent a wholesale price for commodity gas, e.g. for delivery at TTF of a flat product (i.e. base load delivery of gas for a year). In contrast GasTerra's prices represent structured gas (i.e. shaped to match the profile of demand) delivered near to the customer, e.g. at the city gate. Therefore, additional costs must be added to the price determined by the merit order model to take account of the cost of structuring the gas and delivering it to the consumer. We describe the additional costs applied in chapter 4.2 and provide further details in Annexe 1.

As with Benchmark A, this approach presumes that the prices used for sourcing gas from outside the Netherlands are themselves competitive when they may not be. Again, this could result in our benchmark overstating the true competitive price level if sources of gas from outside the Netherlands are the marginal providers of gas to the Dutch market.

3.2.3 Prices in a comparable market

We considered and discarded the use of a third approach to estimating a benchmark price, described here.

In theory, observed prices in a competitive and structurally comparable market could be analysed and used as a benchmark for the Dutch markets for wholesale gas and flexibility services. For example, prices in the Belgian, British or German markets might be considered as such a benchmark. Figure 3 and Figure 4 shows average prices for households and industrial customers in these countries and in the Netherlands as published by Eurostat.[21]

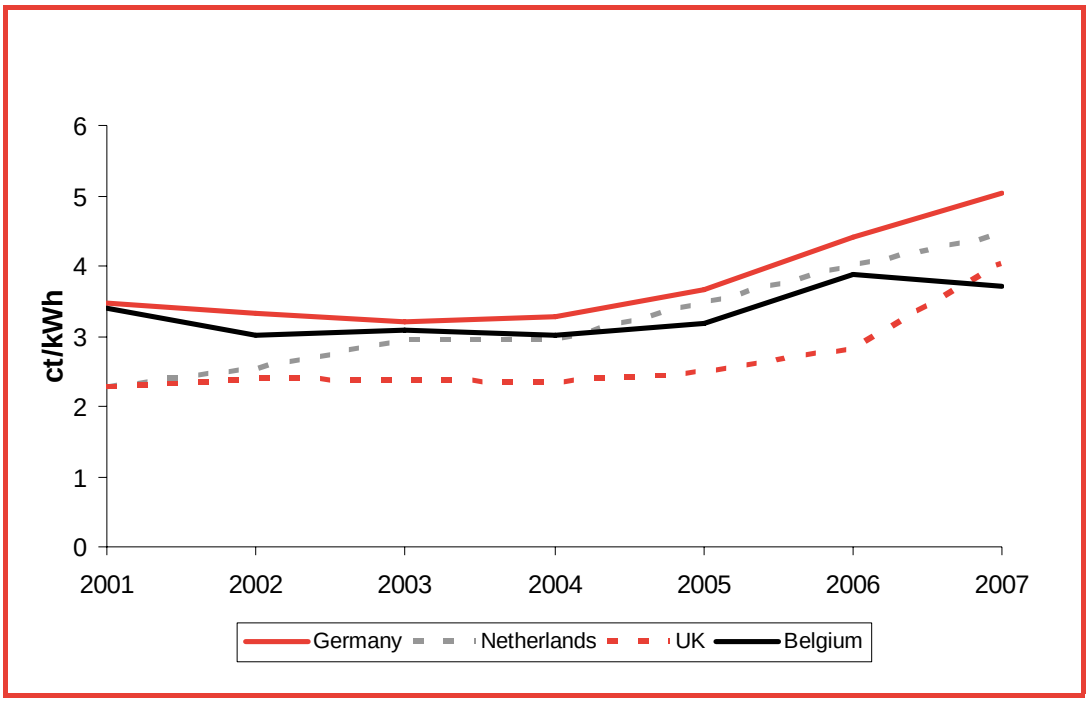

Figure 3: Average prices for households (without taxes)

Source: Eurostat

[21] For industrial customers Eurostat does not provide a complete data series over the period 2001 to 2007. Where data is missing, e.g. for the Netherlands in 2002/2003, we use price indications published by commercial services such as GasStrategies and Argus Petroleum as a proxy.

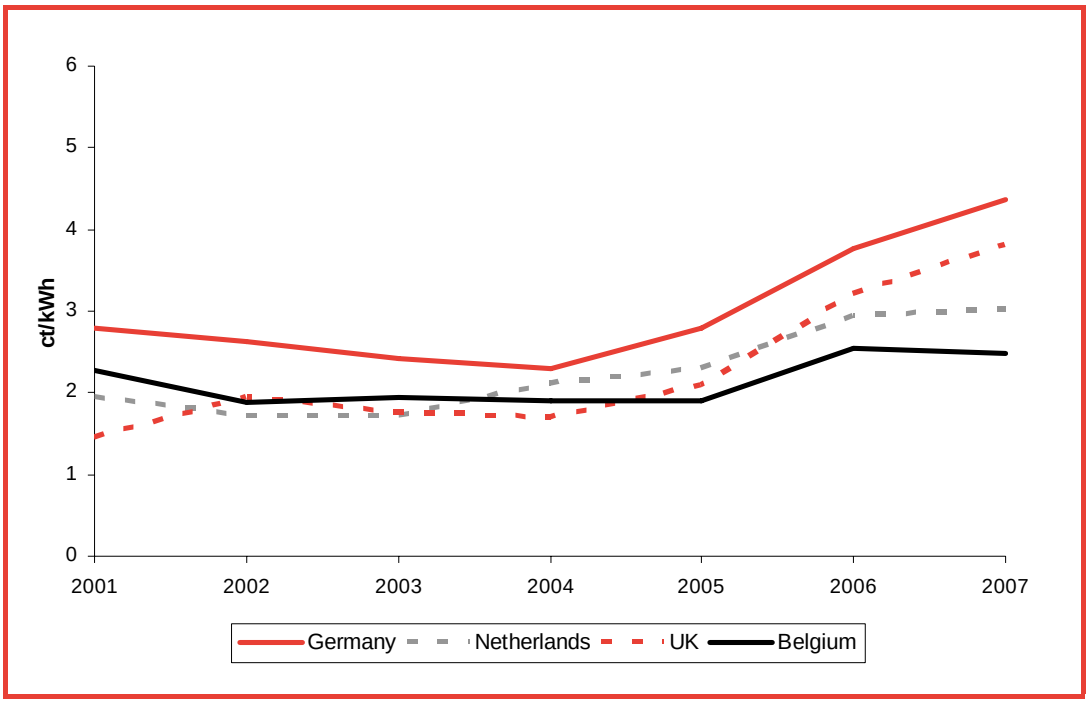

Figure 4: Average prices for industry (without taxes)

Source: Eurostat, GasStrategies, Argus

Cross country comparisons of prices can deliver useful insights if certain conditions are fulfilled:

- First, it is important that same methodology underlies the published average prices across countries and across time. For example, the data should refer to the same kind of customer with the same annual demand and also with the same (or similar) consumption profile.
- Second, prices need to have been adjusted to take account of cost differentials between the compared markets for gas transportation, gas production/imports and the procurement of flexibility services.
- Third, the prices observed in the comparator countries are the result of a competitive process.

Given these requirements, it is difficult to directly compare retail prices across countries.

In the case of this study, we discard the use of an international retail price comparison as unlikely to provide additional information to the other two benchmark approaches we apply for two reasons.

Firstly, available data on international retail prices, mainly sourced from Eurostat, is not very robust for several reasons:

- Eurostat does not distinguish between market based prices and prices that are set by administrative mechanisms. This reduces the usefulness of Eurostat prices for an international comparison of *competitive* retail prices.

- It is questionable whether the standard customers as defined by Eurostat are representative of typical customers in all countries. As a consequence of ongoing criticism (e.g. which arose in several competition cases), Eurostat was forced to change its methodology in 2007.[22]
- Even if published retail prices are adjusted by taxes, other administrative or regulated cost components will still remain in the prices (e.g. transport tariffs or concession fees). Any useful benchmark retail price comparison would need to correctly adjust for these components.

Secondly a more fundamental argument suggests that it will be impractical to use a retail price comparison as a benchmark for GasTerra's prices. National gas sectors have developed very differently from each other in the past. Therefore, retail prices may not be directly comparable across countries without adjustments to take account of structural differences.[23]

3.3 ISSUES WITH APPLYING THE BENCHMARKS

In this section we describe some issues that must be considered when constructing appropriate benchmarks. As described previously, we assess the relativity of GasTerra's prices to the prices of a (hypothetical) competitive benchmark, priced at the same point in time when these players would have been faced with the same general cost and demand conditions as GasTerra.

3.3.1 Appropriate cost

Where cost information enters into the consideration of competitive benchmark prices, there are questions of:

- whether it is more appropriate to estimate short term variable costs or long term variable costs or even long term variable or average costs of the facility in question; and
- over which time frame should costs be considered.

22 See ec.europa.eu/eurostat.

23 For example, with respect to the energy balance the Dutch gas sector has a unique position. Gas is the most important primary energy source in the Netherlands with a very high penetration in nearly all market segments. In total, four different gas qualities exist (which is not the case in any other country). Also, the Netherlands is the only net gas exporting country in North Western Europe and is characterised by a high share of international gas flows in its gas balance. In addition, there are differences in the energy policies of the Netherlands and other countries. The small fields policy and the construction of the "gas roundabout" (which follows the "gas building"), with the increasing importance of TTF as trading and delivery point, are illustrative of Dutch specific gas policies.

To be conservative, it would seem more appropriate to use a measure of long term costs, in particular including the relevant capital costs. In this way, if GasTerra's prices were to exceed this benchmark, then this could be deemed as evidence of the occurrence of supernormal profits. Similarly, in terms of the time frame, it needs to be considered that GasTerra, when setting prices to end-consumers for – typically one or two years – it is more likely to set prices reflective of such contract durations, also anticipating future gas price developments and the gas flexibility capacity situation. We therefore use long term contract prices for gas and gas flexibility, covering the time periods in question.

As a more concrete example of how this affects our analysis, consider a potential competitor who sources his gas from the traded market. The retail price will be related to the traded market price – the question is to which traded market price. The trader may procure gas through a portfolio of contracts of different durations and different lead times to delivery. For example, if the trader is selling gas through retail contracts with a one year duration, it would be reasonable to expect that the retail price of gas would be related to the forward price for gas, for delivery in the year, traded several months ahead of the start of delivery. In this case we would use the forward price of gas as one component of our price benchmark.

3.3.2 Comparable product and location

The benchmark price must be for a product that is comparable to the retail products sold by GasTerra. Therefore, the benchmark must be constructed for a customer similar to that served by GasTerra (e.g. similar consumption shape).

The gas used to contrast the benchmark must also be delivered at a similar location to the location of GasTerra's sales. For example, in the case of large scale end users, we understand this to be an exit point on GTS' H-gas network and in the case of small scale end users we understand this to be an exit point on GTS' L-gas system. Since GasTerra's prices are for an average user, we take an average exit charge when calculating the benchmark price.

3.3.3 Availability and quality of data

The validity of the model results depends on the availability and robustness of the input data. Good quality data is required on the key drivers of the levels of the benchmarks; the border or trading hub prices for commodity gas and tariffs for gas transport and storage services.

Most of the required data for gas procurement costs is available from relaiable public sources. For examples, German average border gas prices are published on a monthly basis by an authority called BAFA (Bundesamt für Wirtschaft und Ausfuhrkontrolle), which is part of the German Ministry of Economics. Trading hub prices (e.g. the Zeebrugge hub and TTF) for gas are published on a daily basis by brokers (e.g. Spectron or ICAP) and exchanges (e.g. Endex or APX). In some cases, e.g. for the Netherlands, no official price index for imported gas exists and we therefore have to use either confidential data provided by NMa or estimate the price using reasonable approximations.

While the data situation for the price of gas sources is good, less information is publicly available for some historic regulated or negotiated tariffs for transport, storage or quality conversion. For 2007 all tariffs are known as they are published on the internet and for 2006 good data can still be found in public sources. However, prices and tariffs for the time period before 2006 are in general not available. Some data was provided by the NMa but in some cases (e.g. German storage tariffs) no valid data was available to us.

We describe in Annexe 1 the data used in our analysis and the source of those data.

In order to make the analysis more robust, we consulted with some industry participants to gain additional insight into market conditions with a particular focus on the early years of the analysis period.

Approach to defining benchmark prices

4 Quantitative analysis

In this section we set out the main parameters and the results of our quantitative analysis for the two approaches to estimating the competitive benchmark price introduced in section 3.

4.1 BENCHMARK A: SUPPLY COSTS OF HYPOTHETICAL NEW ENTRANTS TO THE MARKET

4.1.1 Framework for the analysis

We construct a competitive benchmark price for gas supply to two different customer types by three hypothetical competitors with differing strategies for procuring gas and flexibility services in order to supply the customers over the period 2001-2007. In the following we give an overview of the parameters and assumptions used to construct the competitive benchmark prices under this approach. Further details are presented in Annexe 1.

Customer types

We focus our analysis on two model customers:

- ***Small scale end-users served through retailers***. Here the competitor delivers gas to a "typical" medium-sized city at the off-take point from the transmission system to a local distribution company. The gas quality is assumed to be G+-gas.
- ***Large scale end-users***. Here the competitor delivers gas to an average cluster of industrial customers.[24] In contrast to small scale end-users, the shape of demand of the large scale end-user is relatively flat and most of the gas supplied is H-gas.[25]

Hypothetical competitors

We assume three different groups of suppliers that could be seen as hypothetical competitors of GasTerra:

- A major wholesale and import company in a country neighbouring the Netherlands with access to large import contracts and several transport and storage facilities. When setting the parameters for this hypothetical

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24 The parameters of the cluster of industrial customers were chosen to be consistent with a portfolio of industrial customers which represents GasTerra's average sales structure. This includes industrial customers supplied directly by GasTerra and those supplied via retailers. Based on historic sales data, we estimate the share of directly supplied customers ("very large scale" end-users) to be [✂] and the share of large-scale customers supplied via retailers to be [✂] of GasTerra's sales volumes for use by industrial end-users. Approximately [✂] of the volumes supplied via retailers to large-scale customers ([✂] of GasTerra's total sales for use by industrial customers) are sales for use by greenhouse farmers. All industrial customer shares are relatively constant throughout the years assessed.

25 In contrast to other large-scale customers, greenhouse farmers typically use G+-gas.

competitor, we used major German gas players like E.ON Ruhrgas or Wingas as role models.

- An international trading company that uses wholesale marketplaces for their gas sourcing. A good example for this type of company is a UK based trading company without access to physical production.
- A Dutch new entrant (to the relevant market segment) that uses a mix of indigenous and foreign gas supplies and infrastructure options to source gas and flexibility services (e.g. Essent and Nuon).

A more detailed description of the hypothetical competitors is given in Annexe 1. We also discuss the rationale for focusing on these three hypothetical competitors and for leaving aside other potential hypothetical competitors such as foreign regional distribution companies.

Time horizon

Since the benchmark prices have to be constructed over the period 2001 to 2007, we need to make assumptions about how the Dutch and surrounding gas sectors have developed over this time and, in particular, whether it would have been possible for our three different types of competitors to access the gas, flexibility and infrastructure required to supply the two customer types.

Not all of our hypothetical competitors could have delivered gas to Dutch customers throughout all periods. This ability depended on the availability of sources for gas procurement, access to flexibility services and the opening of the gas retail supply market to competition by consumer type.

In general, we assume that it was in theory possible for all potential competitors to supply gas to large-scale users throughout the period of analysis (2001 to 2007). For small-scale users in some cases we find that this wasn't possible for some suppliers in some years. We discuss this issue in more detail in Annexe 1.

4.1.2 Results of the analysis

Overview

A comparison of GasTerra's prices to a hypothetical competitive benchmark estimated on the basis of the supply costs of a hypothetical entrant shows that GasTerra's prices do not unambiguously exceed all benchmarks for the cost of supply to a particular type of customer in a given year.

Table 3 shows the percentage mark-up (or discount) required to get from the benchmark price to GasTerra's price. Colour coding is used to help identify the relative levels of GasTerra's price and the various benchmarks.

GasTerra's prices to supply large-scale industrial users are:

- in line with or below at least one of the benchmark prices in the periods 2001 to 2002 and 2005 to 2007; and
- higher than all three benchmarks during the period 2003 to 2004.

GasTerra's prices to supply small-scale end users through retailers are:

- in line with or below at least one of the benchmark prices in the period 2005 to 2007; and
- higher than the benchmark constructed for a major German gas company in 2004.[26]

The price benchmarks and GasTerra's supply prices are set out in Table 4 for each year and for supply to each type of customer in the Netherlands.

It is difficult to identify any strong trends in the results of the comparison of GasTerra's prices to the benchmarks comparison. A weak trend is that over time GasTerra's prices have tended to become lower relative to the price benchmarks.[27] This weak trend may have been due to the outcome of the liberalization processes that has progressively taken place in the Netherlands and neighbouring countries over time. The improved conditions for third party access and the opening of the wholesale and retail segments of the gas market to competition could be expected to have increased competitive pressure on the incumbent gas supplier (GasTerra).

It is important to caveat the results due to data quality for the earlier years of the analysis. In particular, the benchmark comparison for the years 2001 to 2005 should be treated with some caution because data on transportation and storage tariffs is not robust for these periods. For large customers any uncertainty will have only a small potential impact on the level of the benchmark price although the impact is potentially larger for small customers. The direction of any bias is not certain.

In addition, we note that the results present an average estimate for a particular end user group and therefore do not reflect the consumption profiles and storage needs (which affect the benchmark price level) of an individual large customer that procures its gas directly from GasTerra. Therefore, the appropriate benchmark price for an individual consumer may be either higher or lower than the price we estimate for the end user group to which it belongs.

A further caveat of the results is required due to the question of whether the costs of the hypothetical entrants are themselves derived on the basis of competitive market outcomes (with respect to those elements of cost not subject to price regulation). For example, if the BAFA, Zeebrugge and / or Dutch import prices did not reflect competitive markets, the price benchmarks we have constructed may overstate the competitive benchmark price.

As a result of these caveats, the benchmark should be treated as a good approximation rather than the exact prices that could have existed if the hypothetical entrants had been active in the market.

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26 The major German gas company was the only appropriate benchmark for supply to small scale end users in 2004.

27 GasTerra's prices tend to be lower relative to those of the competitors for the period 2005 to 2007 compared to the period 2001 to 2004. This observation applies only for large scale customers as it was not possible to construct a benchmark price for small customers in the period 2001 to 2004.

Sensitivity analysis shows that the results of the benchmark comparison are robust to errors in our estimated transport and storage tariffs because these costs comprise only a small proportion of total gas supply costs. Comparing the absolute price difference between the competitive benchmark price and GasTerra's price with the sum of transport and storage tariffs shows that any error in our estimated transport and storage tariffs would need to be large to change the results of our analysis. For example, only in 1 out of 20 cases the ratio of the absolute price difference between the competitive benchmark price and GasTerra's price to the sum of transport and storage tariffs is below 10%. For example, in 2007 the price difference for small-scale users between the UK trader and GasTerra is [✂] €/MWh and the sum of transport and storage tariffs is [✂] €/MWh. This means that the actual transport and storage tariffs would need to be at least [✂] €/MWh or 6% below our estimate to change the result, i.e. that GasTerra has prices below that particular competitive benchmark. However, in the case of most of the benchmarks applied, the ratio is much higher than 10% and therefore, a much greater error in estimated transport and storage costs would be required to affect the results. For example, when comparing GasTerra prices to the benchmark derived from the German incumbent, ratios of between 24% and 101% result. This means that for some benchmarks a doubling of estimated transport and storage tariffs would not change the result.

In contrast, the cost of commodity gas comprises a far greater proportion of total gas supply costs. This means that a relatively small under or over estimate of the procurement costs of a competitor could have an impact on the results of the benchmark comparison. However, relevant commodity gas prices are published and, in particular, for competitor 1 (German incumbent) and competitor 2 (UK trader) the published prices are reliable.

More details of the sensitivity analysis are included in Annexe 1.

RED – GasTerra price exceed the benchmark price for more than 10%

YELLOW - GasTerra price exceed the benchmark price for less than 10%

GREEN - GasTerra price are lower, than benchmark price

Prices (€/MWh)*	2001	2002	2003	2004	2005	2006	2007
German major company							
Small-scale end-users through retailers	n/a	n/a	n/a	8.0%	10.8%	5.7%	23.9%
Large-scale end-users	-21.9%	-4.6%	13.5%	9.2%	-11.8%	-7.4%	4.2%
Trading company							
Small-scale end-users through retailers	n/a	n/a	n/a	n/a	n/a	-3.7%	-1.0%
Large-scale end-users	4.5%	33.8%	34.0%	13.1%	-2.7%	-17.1%	-19.6%
Dutch newcomer							
Small-scale end-users through retailers	n/a	n/a	n/a	n/a	-3.4%	-10.8%	4.5%
Large-scale end-users	-25.1%	-7.5%	8.7%	8.3%	-12.5%	-14.5%	-3.0%

Table 3: Percentage mark-up of GasTerra prices over benchmark prices (2001-2007)

Source: Frontier

Prices (€/MWh)	2001	2002	2003	2004	2005	2006	2007
GasTerra							
Small-scale end-users through retailers	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
Large-scale end-users	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
German major company							
Small-scale end-users through retailers	n/a	n/a	n/a	[✂]	[✂]	[✂]	[✂]
Large-scale end-users	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
Trading company							
Small-scale end-users through retailers	n/a	n/a	n/a	n/a	n/a	[✂]	[✂]
Large-scale end-users	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]
Dutch newcomer							
Small-scale end-users through retailers	n/a	n/a	n/a	n/a	[✂]	[✂]	[✂]
Large-scale end-users	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]	[✂]

Table 4: Benchmark and GasTerra prices (2001-2007)

Source: Frontier

Quantitative analysis

Further discussion of results

For the period of 2001 to 2004 the results of our analysis suggest that Gasterra's prices to supply large-scale industrial users exceeded the benchmark of a trading company and for the period 2003 to 2004 also exceeded the benchmarks of a major German company and a Dutch newcomer. We suggest two possible explanations for this outcome:

- In the early years of gas sector liberalisation (which coincides with the early years of our analysis) it was difficult for new entrants to supply large customers reducing the competitive pressures on the incumbent. As the liberalization of the Dutch gas sector progressed conditions improved for new entrants to supply large customers and competitive pressures increased. This hypothesis is reinforced by, for example, the reduction in the (positive) margin over time between GasTerra's prices and the benchmark of a UK trading company (see Figure 5).
- Data caveats concerning transportation and storage tariffs for the early period of the analysis (2001 to 2004) could potentially affect the estimated benchmarks. The unavailability of factual data on prices for transportation and storage relates to the rapidly changing regulations over the course of gas sector liberalization processes in Europe. In addition, transparency requirements for transport and storage operators have been issues throughout the market oriented reforms. If, for example, we had underestimated the true transportation and storage costs faced by a hypothetical entrant during the period 2001 to 2004, we would have underestimated the benchmark price.

During the period 2005 to 2007 GasTerra's prices were generally similar to or below the benchmark prices for potential competitors for supply to both types of end users. One exception to this generalisation is the significant margin between GasTerra's prices and the benchmark constructed for a major German player for small scale end users in 2007.

In 2007, GasTerra's price for supplying large-scale customers is only moderately above the benchmark constructed for a major German player. However, compared to the two years before 2007 a change can be observed since in 2005 and 2006 GasTerra's prices for supplying large-scale customers were significantly below the benchmark constructed for a major German player.

The higher margin for GasTerra's price relative to that of a major German player compared to the low (or negative) margins for the other benchmarks in 2007 (for supply to either large scale or small scale end users) is the result of the price of gas in long-term contracts being below the price of gas in the traded market in this year. The major German player sources (or is assumed to source) gas through long term contracts whereas the trading company sources gas from the traded market. There may be some basis for arguing that the traded market prices reflect the opportunity cost of gas and that they should therefore be used to construct the competitive benchmark. However, with low levels of liquidity until recently in the traded market relative to total demand it could be argued that the traded market only represents the opportunity cost of gas for small volumes.

A more specific explanation for the high margin of Gasterra's small scale supply price (and also the change from a negative to a positive margin for supply to large-scale end users) in 2007 compared to a major German player relates to the pricing methodology used by GasTerra.[28] The increase in GasTerra's large-scale and small scale supply price from 2006 to 2007 (as shown in Figure 5 and Figure 6 respectively) is in line with the change in the benchmark that relies on market formed prices over that period (i.e. the benchmark constructed for a UK trader) rather than the change in the benchmarks that relies on prices in long-term contracts (German major or Dutch newcomer). This outcome could be the result of introducing a direct linkage between the gas price in wholesale markets to gas market outcomes. However, the same effect could be achieved through decoupling gas prices from crude oil prices through the changes in the indexation mechanism that is common in long term wholesale gas supply contracts.

It is difficult to draw conclusions from price observations in only 2 years about whether there has been a move by GasTerra to price its retail supplies according to gas market outcomes. Observations over longer time period will be necessary to understand whether there has been a structural change to pricing.[29]

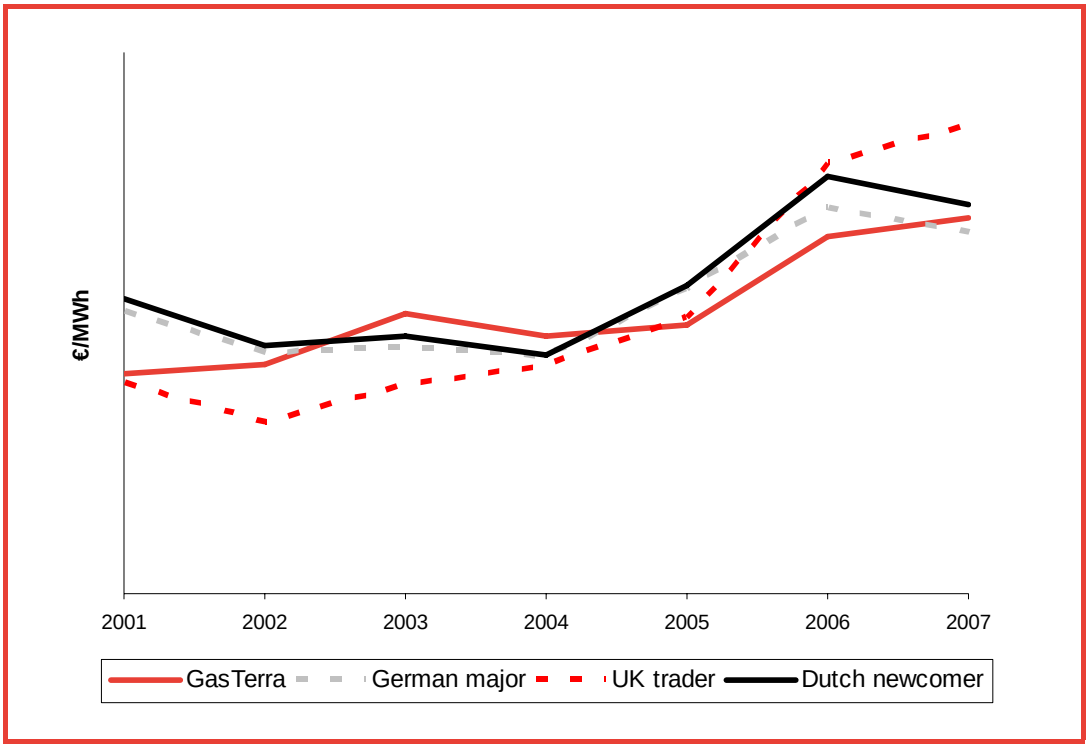

Figure 5: Benchmark prices for large-scale end-users [prices removed for reasons of confidentiality]

Source: Frontier, GasTerra

28 GasTerra announced in 2006 that its 2007 supply price levels would be adjusted to be more in line with TTF price levels than previously.

29 It will be interesting to see whether GasTerra's pricing would revert to long term contract prices in the event TTF prices fall significantly below long-term contract prices.

GasTerra prices are generally closely aligned with the benchmark prices constructed for supply to small scale end-users throughout the period of analysis, as illustrated by Figure 6. However, as noted previously an exception to this generalisation is the benchmark constructed for a German gas major in 2007.

It is important to mention that the benchmark prices for small scale users are quite sensitive to the assumptions about the shape of gas required, storage costs and transportation tariffs, since these cost components contribute a significant (approximately 20-35%) share of the final price. Assumptions about the shape of gas required are important because they affect both the storage requirements and transportation requirements. We necessarily use approximations for storage and transportation tariffs for the 2004 to 2006. Therefore, the benchmark prices constructed for this period should be viewed as a good approximation to the prices able to be offered by the hypothetical entrants considered.

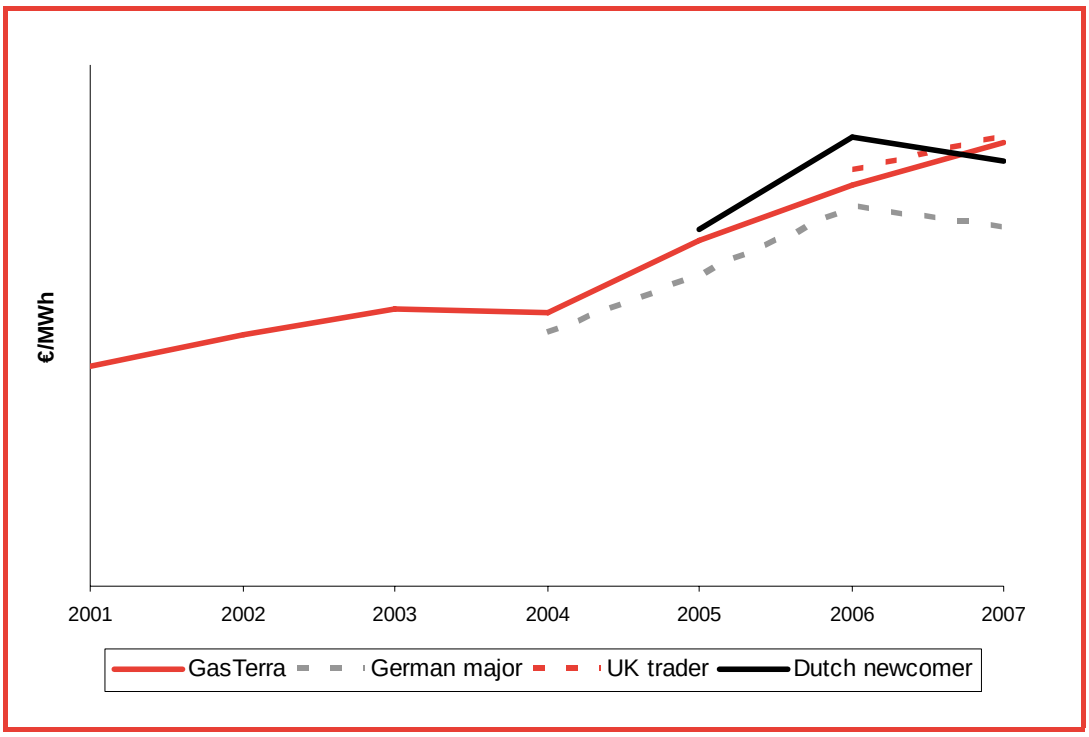

Figure 6: Benchmark prices for small scale end-users through retailers [prices removed for reasons of confidentiality]

Source: Frontier, GasTerra

4.2 BENCHMARK B: SUPPLY AND DEMAND IN AN HYPOTHETICAL MARKET

We focus with this benchmark on the most recent years 2005 to 2007 as these years provide the greatest concerns about excessive pricing. In addition, for these years the available data is sufficiently robust to provide a reasonable benchmark price.

4.2.1 Framework for the analysis

We construct a hypothetical competitive benchmark price for gas supply to two different customer types by over the period 2005 to 2007. The benchmark is constructed by considering the gas supply and demand situation in the Netherlands over each year to estimate the cost of the marginal supplier of gas. We then add a margin to this cost where the margin is based on the costs of procuring flexibility services, transportation and quality conversion to arrive at the benchmark prices for supply to large end users and small end users.

The reader is referred to Annexe 1 for a more detailed description of this benchmark approach and the underlying data used.

4.2.2 Overview of results

A comparison of GasTerra's prices to a competitive benchmark estimated on the basis of a merit order analysis shows greatest concern with GasTerra's prices in 2007. Table 5 and Table 6 show the results of this benchmark comparison for supply to large scale end users and to small scale end users respectively.

GasTerra's prices to supply large-scale industrial users are:

- below the benchmark prices in 2005 and 2006; and
- 6% above the benchmark price in 2007.

GasTerra's prices to supply small-scale end users through retailers are:

- 8% and 4% above the benchmark price in 2005 and 2006 respectively; and
- 21% higher than the benchmark price in 2007.

The increase in the margin between GasTerra's prices and the benchmark prices for 2007 for both types of end users might reflect GasTerra's shift to focus more on TTF prices than on border prices as the relevant benchmark for the value of gas when setting supply prices. This possible change in GasTerra's pricing policy has been discussed in the section above regarding Benchmark A.

The negative margin in 2005 and 2006 for large scale end users may also in part be explained by GasTerra's pricing policy. In the earlier years of the study GasTerra may have chosen to offer a relatively lower price in those market segments for which it faced stronger competition (e.g. for supply to large scale end users) and a relatively higher price in those segments for which it faced weaker competition (i.e. supply to retailers). It seems unlikely that the negative margin could solely be the result of any possible overestimate of the benchmark price since GasTerra's supply prices were below the cross border import price for sourcing gas. The recent policy shift to use TTF prices as the benchmark for setting supply tariffs means that GasTerra may find it difficult to defend future sales to large consumes at prices below average border prices.[30]

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30 In a regime where gas prices are related to oil prices through indexation formulae there is more freedom for gas price setting for importing companies. In general, supply prices below average

	2005	2006	2007
GasTerra price (€/MWh)	[✂]	[✂]	[✂]
Benchmark price (€/MWh)	[✂]	[✂]	[✂]
Difference (% of benchmark)	-10%	-5%	6%

Table 5: Merit order based benchmark comparison for large-scale end users

Source: Frontier

	2005	2006	2007
GasTerra price (€/MWh)	[✂]	[✂]	[✂]
Benchmark price (€/MWh)	[✂]	[✂]	[✂]
Difference (% of benchmark)	8%	4%	21%

Table 6: Merit order based benchmark comparison for small scale end users

Source: Frontier

We describe the analysis undertaken for each year in more detail, below.

4.2.3 Analysis for 2007

In 2007 total inflow capacities (which consists of import and production capacities described in Annexe 1) for the Dutch gas market was about 115 BCM/a. This exceeded demand which was about 97 BCM/a.

The gas source with the lowest short run costs of supply is Groningen followed by Small Fields production. The next cheapest origin of gas in the merit order is imported gas via Germany. Capacities of these three sources would have been enough to satisfy demand in this theoretical environment, which means that gas imports via Germany was the marginal supply. It is worth noting that the marginal cost of the supplier required to meet average demand will tend to be

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border prices for one group of customers (e.g. large industry or power plants) would be offset by higher prices for another group of customers (e.g. households). With a system that relates prices to the gas prices observed on a transparent hub (and in particular if the hub is also the delivery point), commodity prices above the hub price would be difficult to establish since customers and competitors would be able to observe the price discrepancy and undercut it.

below the demand weighted average marginal cost of daily varying demand.[31] Therefore, this methodology will tend to be a low estimate of the competitive benchmark (assuming competitive gas sourcing).

Other import options, which were used in reality, are more expensive than the marginal supplier. This is shown in Figure 7, where the red line illustrates the merit order curve based on capacity to supply. The black line in contrast shows which sources contributed to the supply of gas actually delivered in 2007. The merit order model highlights that some capacities of low cost sources were not used to supply the market in 2007, which led to imports from more expensive sources being required.[32]

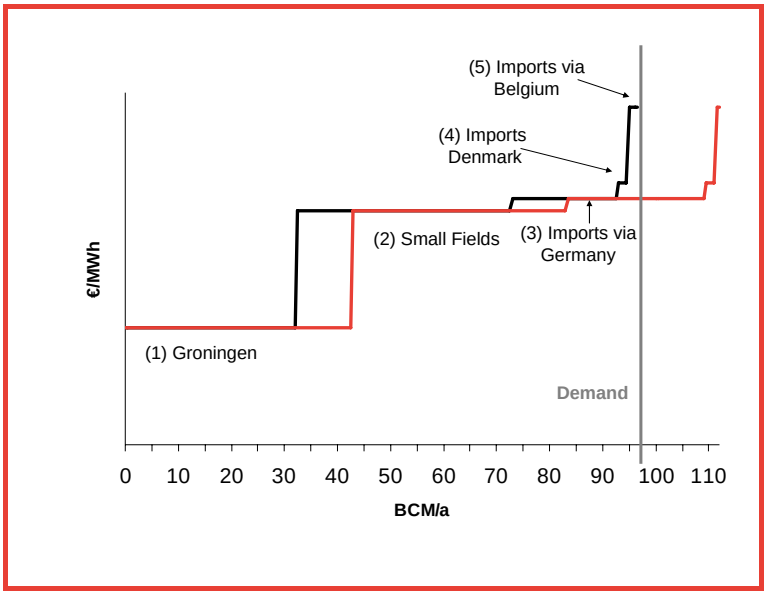

Figure 7: Merit order curve for 2007 [costs/prices removed for reasons of confidentiality]

Source: Frontier

Imports via Germany are the most expensive source required to satisfy demand in the model for 2007. The supply costs of these imports are [✂] €/MWh, consisting of the price for commodity gas and the transport cost of delivery to the Netherlands. After adding mark-ups to the marginal supplier's cost related to the procurement of flexibility services and transportation for large-scale and small-scale customers and quality conversion and the peak demand tariff for

31 In energy markets the marginal cost of supply typically increases at a faster rate than it decreases for a unit change to quantity supplied. In this case, the marginal cost of meeting the average quantity demanded will be lower than the average of the marginal costs of meeting each individual level of quantity demanded. For example, consider a market where the marginal cost of supplying different quantities of gas is as follows: €10/MWh for 20 bcm/year, €15/MWh for 25 bcm/year and €25/MWh for 30 bcm/year. The marginal cost of meeting the average quantity demanded (25 bcm/year) is €15/MWh. However, the average of the marginal costs of meeting each level of demand individually is €16.67/MWh.

32 We base our analysis on the merit order derived from capacity to supply rather than the actual supply. This is because the actual supply of gas to the Netherlands may (for example) have been affected by non-competitive actions of players with market power. If we based our analysis on actual supply, we would tend to overstate the competitive price benchmark based on the marginal cost of supply if capacity to supply had been withheld from the market. For example, the latest Gasmonitor reports a gap between allocated and used import capacity (see NMa/DTe (2007)). However, if we were to apply the actually used import capacity to our analysis, we would tend to overstate the competitive price benchmark.

small-scale customers, we derive the benchmark prices for those representative customer groups (see Figure 8):

- [✂] €/MWh for large-scale; and
- [✂] €/MWh for small-scale end-users.[33]

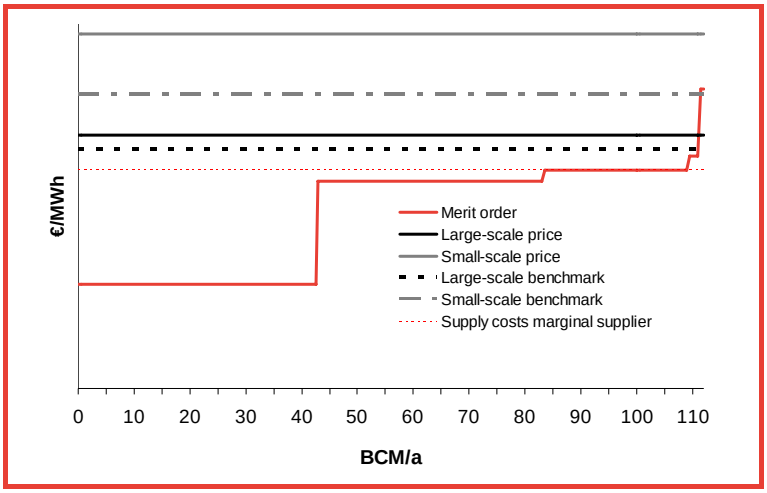

Figure 8: Benchmark prices based on merit order curve for 2007 [costs/prices removed for reasons of confidentiality]

Source: Frontier

Comparing these benchmarks with reported prices from GasTerra, a significant difference could be observed especially for small-scale end-users. In absolute terms GasTerra's prices exceed the benchmark for small-scale end-users by [✂] €/MWh, i.e. 20.5%. The margin by which GasTerra's prices exceed the benchmark for large-scale end-users is lower, at [✂] €/MWh, i.e. 6%.

4.2.4 Analysis for 2006

The merit order curve for 2006 shows a similar shape to the one for 2007, which means that the merit order of suppliers is unchanged. As demand for 2006 is also comparable to 2007 (98 BCM/a) again imports via Germany are marginal supplier.

Due to higher gas procurement costs, represented by the average German border price index plus transport tariffs to the GTS system, the marginal supply costs which are relevant for calculating the benchmark price are also higher in 2006 than in 2007: [✂] €/MWh in 2006 compared to about [✂] €/MWh in 2007 (Figure 8).

[33] Further details about the different components of the mark-ups are provided in Annexe 1.

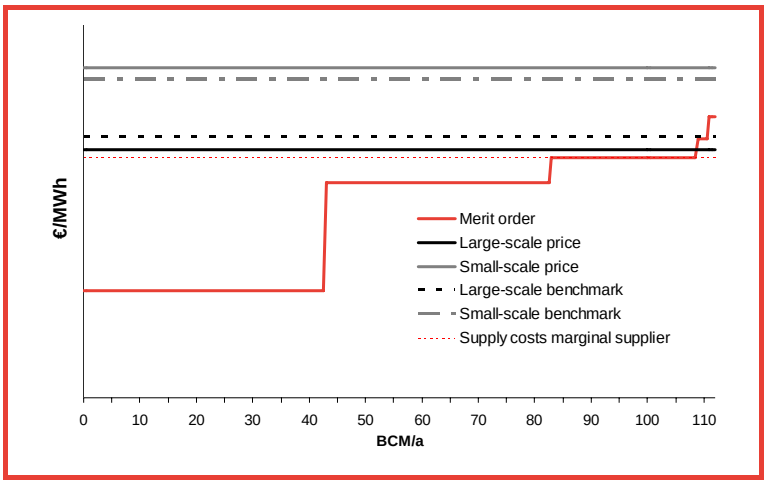

Figure 9: Benchmark prices based on merit order curve for 2006 [costs/prices removed for reasons of confidentiality]

Source: Frontier

After adding mark-ups for large-scale and small-scale customers to the marginal supplier's cost, we derive the benchmark prices for those representative customer groups:

- [✂] €/MWh for large-scale end-users; and
- [✂] €/MWh for small-scale end-users.

GasTerra prices were [✂] €/MWh below the benchmark price for large scale end-users, i.e. 5% lower in 2006 compared to 6% higher in 2007.

GasTerra prices were [✂] €/MWh above the benchmark price for small scale end-users, i.e. 4% higher in 2006 compared to 20.5% in 2007.

4.2.5 Analysis for 2005

Whereas merit order curves are more or less identical for 2007 and 2006, we observe a different shape for 2005. Due to comparable low British (which means Zeebrugge) gas prices and also very low average Dutch import prices (which we assume as a proxy for the price of Danish imports, see Annexe 1 for more details), these imports are cheaper than those via Germany. However, given that the British and Danish import routes have only limited capacities, again imports via Germany are the marginal supply (see Figure 10).

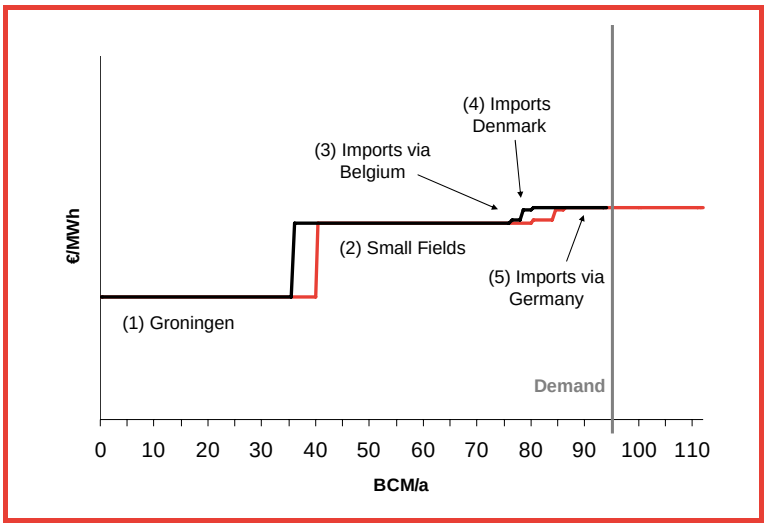

Figure 10: Merit order curve for 2005 [costs/prices removed for reasons of confidentiality]

Source: Frontier

After adding mark-ups for large-scale and small-scale customers to the marginal supplier's cost, we derive the benchmark prices for those representative customer groups:

- [✂] €/MWh for large-scale end-users; and
- [✂] €/MWh for small-scale end-users.

As with 2006, GasTerra's prices were below the benchmark price for large-scale end-users. In this case GasTerra's prices were [✂] €/MWh below the benchmark price, i.e. 10% lower. It is interesting to note that not only were GasTerra's prices below the benchmark price but they were very close to the marginal suppliers' costs ([✂] €/MWh), which includes no costs related to structuring or domestic transportation.

GasTerra prices were [✂] €/MWh above the benchmark price for small scale end-users, i.e. 8% higher.

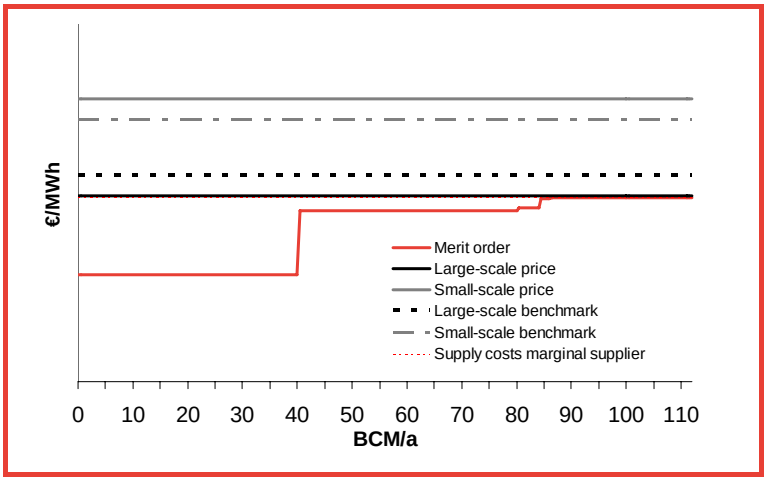

Figure 11: Benchmark prices for 2005 based on merit order curve [costs/prices removed for reasons of confidentiality]

Source: Frontier

5 Conclusions

A comparison of GasTerra's prices to the hypothetical competitive benchmarks estimated on the basis of the supply costs of a hypothetical entrant and on the basis of merit order analysis shows that GasTerra's prices do not unambiguously exceed all benchmarks for the cost of supply to a particular type of customer in any given year.

The areas of greatest concern of high prices are:

- GasTerra's price to supply large-scale industrial users in the period 2003 to 2004 since the price exceeds all measures of the benchmark level; and
- to a lesser extent GasTerra's price to supply small scale end users in 2007 since the price exceeds some but not all measures of the benchmark level.

With Benchmark A, GasTerra's prices to supply large-scale industrial users are:

- in line with or below at least one of the benchmark prices in the periods 2001 to 2002 and 2005 to 2007; and
- higher than all three benchmarks during the period 2003 to 2004.

GasTerra's prices to supply small-scale end users through retailers are:

- in line with or below at least one of the benchmark prices in the period 2005 to 2007; and
- higher than the benchmark constructed for a major German gas company in 2004.

With Benchmark B (merit order analysis) GasTerra's prices to supply large-scale industrial users are:

- below the benchmark prices in 2005 and 2006; and
- 6% above the benchmark price in 2007.

GasTerra's prices to supply small-scale end users through retailers are:

- 7% and 4.5% above the benchmark price in 2005 and 2006 respectively; and
- 21% higher than the benchmark price in 2007.

The general relative increase in the margin between GasTerra's prices and the benchmark prices for 2007 for both types of end users we believe is likely to reflect GasTerra's shift to focus more on TTF prices than on border prices as the relevant benchmark for the value of gas when setting supply prices. If GasTerra were to change its pricing policy from year to year such that it chose the higher of TTF prices and prices from long term contracts as a benchmark for setting retail supply prices, GasTerra's pricing may warrant further investigation. However, we note that it may be possible to justify setting supply prices on the

basis of the higher of TTF prices and long term contract prices if the higher of the two prices was the marginal supply of gas in a merit order analysis.[34]

To facilitate future analysis of the pricing of wholesale gas in the Netherlands, NMa may wish to extend its market monitor to include the costs of transportation and storage facilities in the countries surrounding the Netherlands. In this way a permanent record of costs that potentially affect the price of wholesale gas in the Netherlands could be established.

[34] The results of Benchmark B suggest that the German incumbent may be the most relevant competitor for Benchmark A. However, this would only apply to the extent that production, flexibility and import capacity was sufficient for the *hypothetical* German incumbent competitor used for Benchmark A to actually be the marginal supplier of a bundle of gas and flexibility. For example, capacity constraints may mean that during some periods a more expensive hypothetical supplier than the German incumbent is the most relevant competitor for benchmark A. Future developments to the gas market, e.g. introduction of reverse flow on BBL, a decline in Dutch production, increasing liquidity on TTF etc could also mean that the German incumbent may not be the most relevant competitor for Benchmark A looking forwards.

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Annexe 1: Assumptions for the benchmark approaches

In this Annexe we explain in detail the approach taken to assessing the benchmark prices for both approaches described in Sections 3 and 4.

BENCHMARK A: SUPPLY COSTS OF HYPOTHETICAL NEW ENTRANTS TO THE MARKET

As described in Sections 3 and 4, with this approach a price benchmark is established equal to the price that suppliers from other product or geographic markets would be able to supply the relevant Dutch markets with gas and flexibility services. This price would include the cost of commodity gas, the cost of procuring flexibility and the cost of transportation to the Dutch market at a location comparable to that of the observed prices for GasTerra's sales of gas and flexibility services.

In this section, we describe the types of customers that would be served by the hypothetical competitive entrants, the characteristics of potential entrants and the supply paths that new competitors would use to supply the customers. Also, we explain the choice of timetable for comparisons that describes the periods when various types of customers could be supplied by different potential entrants.

Types of customers

Table 7 portrays the main characteristics relevant for our analysis of the two types of consumers we are considering in our analysis.

	Annual demand, GWh	Peak hour demand, MWh/h	Flat hour demand, MWh/h	Type of gas	Storage requirements, % of annual demand	Storage volume, GWh
Small-scale end-users	900	[✂]	[✂]	G+	[✂]	[✂]
Large-scale end-user customers	1,000	[✂]	[✂]	H/G+	[✂]	[✂]

Table 7: Consumer profiles

Source: Frontier

Small-scale end-users

Small scale end-users receive their gas through a retail company. The gas is delivered from the GTS high pressure transportation network to the city gate where the retailer takes title to the gas. These retail companies add a retail margin to the tariff they receive from GasTerra – or from another shipper (e.g.

the hypothetical new entrant in this case). We construct a benchmark for the price of gas delivered to the city-gate, not to the end user.

We assume a yearly demand for gas of about 900 GWh for the model group of small scale-end users. This represents a medium sized city of about 100,000 to 200,000 inhabitants. However, depending on gas intensity of local industries and competition from other heating systems, the number of city residents could be below or above the mentioned level.

For this customer group, the shape of demand varies significantly throughout the year. We expect a very high peak demand hour in the winter and a low base load demand in the summer. For our analysis we assume that the peak hourly demand of the representative city is [✂] MWh/h. In the summer months the demand falls to [✂] MWh/h.[35]

This demand structure implies a significant need for gas flexibility, e.g. as provided by storage. For the analysis we assume only limited storage possibilities at the local level provided by the city work themselves, e.g. by linepack or small low pressure storages. Therefore the predominant part of the structuring of the gas needs to be done by the shipper. We assume that [✂] GWh ([✂]% of annual demand) of gas needs to be stored in the course of a year by the shipper to provide sufficient flexibility to supplier this type of customer.

Large-scale end-users

Large-scale end-users are the second category of the consumers defined in the analysis. This category represents a portfolio of industrial customers with a collective demand of about 1 TWh/year. [✂] ([✂]%) of these volumes are supplied directly by GasTerra (to "very large-scale" end-users), whereas the remaining volumes are supplied via retailers. The volumes supplied via retailers include a significant share of gas supplied to greenhouse farmers (approximately half of the volumes supplied via retailers or [✂]% of the total supply by GasTerra for use by large-scale customers). In contrast to small-scale customers described above, the large-scale industrial consumer uses mostly H-gas and has a flatter demand profile. However, due to the portfolio including a significant share of greenhouse farmers (who typically use G+-gas), demand is not entirely flat with hourly demand peaking at [✂] MWh/h[36] compared to the average level of [✂] MWh/h.

We assume that [✂] GWh ([✂]% of annual demand) of gas needs to be stored in the course of a year by the shipper to provide sufficient flexibility to supply

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35 The characteristics of customers are based largely on aggregated confidential data from German city works because only limited information about GasTerra's retail contracts are available. However, the characteristics are similar to two load profiles of retail companies which were provided by GasTerra on a confidential basis.

36 If no greenhouse farmers were included in this portfolio, peak hourly demand would be below [✂] MWh/h. Assumptions about flexibility needs were sourced from information provided by GasTerra, load profiles of Dutch and German industrial customers and load profiles of regional distribution companies and city works. We estimate the ratio of peak hourly demand to average demand as 210%. This includes a margin to allow for very short term spikes in demand due to the fact that demand from greenhouse farmers is affected not only by temperature but also by sun intensity (which can be particularly variable).

Annexe 1: Assumptions for the benchmark approaches

this type of customer. The storage needs for this group of large-scale users are very different from one another. Most industrial customers have a relatively flat profile throughout the year, which implies only minor storage needs. In contrast large-scale customers supplied by retailers require greater flexibility.[37]

Definition of competitors

As outlined before we include three different potential categories of suppliers in the analysis. We describe the main parameters in the following section and also discuss why other possible options are not considered.

Major German gas player

Here, we focus on the incumbent companies from the traditional gas world whose business model has existed since the beginning of the natural gas industry. Such a company would buy and sell gas under long term contracts, typically with a price indexed to the price of oil products.

The Netherlands is directly connected to the Belgian and German gas networks. We focus our analysis on potential competitors based in Germany since the network connections to Belgium are not extensive and some of them (i.e. connections from Belgium via the Zebra pipeline) are not linked to the GTS system.

We note that for the analysis even small interconnection capacities might be useful to define a competitive price. However, there are other reasons for leaving a Belgian major aside from further investigations. One point is the limitation of Belgian storage sites, which we found in a previous study to be only available to supply the Belgian market.[38] Another important issue is that Belgium has no indigenous gas production and depends largely on Dutch imports, in particular to meet its flexibility needs. Re-import of Dutch gas to the Netherlands from Belgium is unlikely to provide an effective competitive constraint on GasTerra because the cost of these re-imports would on average be greater than the market price of gas in the Netherlands.

Concerning German companies, we concentrate on those companies that have the following attributes:

- there is a direct connection between their market area and the GTS system;
- there are likely to be good conditions to import gas and/or flexibility into the Netherlands (volumes, prices, flexibility); and

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37 Our assumptions about flexibility needs are based on confidential load profiles provided by GasTerra. We assume a storage need for directly supplied (very) large-scale end-users to be approximately [✂]%. The storage requirements for large-scale customers supplied via retailers (including greenhouse farmers) are estimated at around [✂]%. A sales volume weighted average of these figures results in storage needs of [✂]% for the total large-scale end-user portfolio.

38 See Frontier (2008), p.46.

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- they have access to sufficient storage and pipeline facilities.[39]

We identify the cluster Oude Statenzijl/Bunde as the only relevant border point between Germany and the Netherlands.[40] Several German companies own access to the border point – we exclude some of them for various reasons:

- BEB is excluded from our analysis. Firstly, BEB is aligned to GasTerra due to mutual shareholders (ExxonMobil and Shell). Secondly, BEB was split up during the relevant period (2007). Following the split BEB no longer has access to import contracts or control over German production.
- EWE and RWE are not included in the analysis because they either do not have a sufficient gas portfolio or are not directly connected to Bunde. Additional transportation would be needed within Germany which would reduce dramatically the competitiveness of companies not directly connected to Bunde.
- Wingas is directly connected to Bunde. However, its only storage facility in northern Germany (Rehden), was not been assigned to the market area adjacent to Bunde before October 2007. Therefore, additional transportation fees would be required which would also make Wingas uncompetitive and it is therefore excluded.

We assume that Ruhrgas (in later years E.ON Ruhrgas), the largest German gas company, is easily able to achieve all above mentioned criteria.[41]

UK trading company

A second kind of theoretical competitor is taken into account for the benchmarking. While in the traditional gas world companies buy and sell their gas under long term contracts, trading companies[42] source their gas mainly on wholesale market places. In contrast to the oil indexation of long term gas contracts, prices on gas hubs and virtual market places are settled under the conditions of gas-to-gas competition.

For our analysis we choose the trading hub at Zeebrugge, Belgium, as a representative price benchmark. It has a sufficient liquidity of traded volumes and trading parties and was active throughout the relevant time period of the

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39 It is not necessary that the potential competitor has ownership of the network. Alternatively, a company which has a large portfolio of gas in the relevant market area directly to the GTS system would be able to supply gas to the Netherlands. However, in practice (especially for the first several years in the period 2001 to 2007) this would be unrealistic. Also, the cost of another company delivering gas and flexibility services to the Netherlands would be no lower than that of the incumbent and therefore can be left aside.

40 See www.gte.be.

41 Ruhrgas is closely bonded to GasTerra by long term import contracts, which means it is unlikely in practice that Ruhrgas would compete with GasTerra in the Netherlands. However, for our analysis we want to investigate at which conditions a company like Ruhrgas could *theoretically* deliver gas to Dutch customers.

42 In most cases trading companies are not independent companies, as they are affiliates of major oil, gas or electricity players, e.g. EDF Trading, Gaselys or Gazprom Marketing & Trading. Nevertheless most of them can optimize their portfolio more or less independently from their mother company.

Annexe 1: Assumptions for the benchmark approaches

study, i.e. from 2001 to 2007. Zeebrugge is directly connected to the GTS system. The availability of storage is not relevant in this case since a trader exporting to the Netherlands could structure its gas supply from trading products at the hub. In addition we assume that this company could book capacity of a Dutch storage facility to supply its Dutch customers after TPA was introduced.[43]

Dutch newcomer

At third group of potential competitors is another Dutch gas company other than GasTerra. It might not be necessarily a newly established company but could also be a formally regional company that expands its activities towards new business fields like trading on the Dutch wholesale market, delivering gas to other parts of the country and also to investing in storage or pipeline capacity.[44] In contrast to the two competitor models described above, we assume that the Dutch company uses mainly gas sources and flexibility from inside the Netherlands or close to the Dutch border.

The Dutch newcomer can develop a commodity portfolio out of two sources:[45]

- import contracts (e.g. Russian or Norwegian gas via Germany);
- trading at the TTF (not available for years before 2005).[46]

When considering storage needs, only those facilities are included in the analysis that are either located in the Netherlands or that are directly connected to the GTS system.[47]

Other competitors?

Several other types of theoretical competitors could have been included. However, the three chosen categories seem to represent the most realistic and economic reasonable candidates for entry. Other players were not included for reasons of capacity constraints, exorbitant transport fees or because they are

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43 Due to there being almost no L-gas storage capacity in the Netherlands available to parties other than GasTerra, we assume that the competitor can only use the Netherlands' only H-gas storage, at Grijpskerk. Here third party access is possible, but on for a limited capacity and not for all years of the analysis - especially 2001 to 2004. In this years all of the structure has to be bought at Zeebrugge hub which increases the gas sourcing component, e.g. due to the need of buying more expensive winter gas.

44 Companies like Essent or Nuon are some examples for this category.

45 In theory also a limited access to small field production by other producers than NAM is possible. However, in most of the relevant years of our analysis nearly all gas from those fields was bought by GasTerra or was used by the producers themselves. But even by assuming secure access to one or more fields, production profiles and delivered volumes of most of the small fields are not suitable to build up an end-user supply portfolio.

46 TTF was established as a trading point in January 2003. However, due to limited liquidity in practice the TTF would not have been available as a source for procuring gas prior to 2005.

47 These are Grijpskerk and the two storage sites located in Germany: Kalle (RWE) and Epe (Essent). Since Epe has become available only in the last few years of the study period and also since no tariffs for access to it are made available to the public, we concentrate on Grijpskerk and Kalle.

Annexe 1: Assumptions for the benchmark approaches

more or less represented by one of the types of theoretical competitors already described:

- UK upstream major. There are no direct gas links from the UK to the Netherlands. The interconnector pipeline between Bacton and Zeebrugge can't guarantee a constant physical flow, which is necessary for a supply of end-users, due to its flow being reversed during some periods in the year (especially in the winter).
- Regional companies in Germany. In order to deliver gas from a market area in Germany that is not adjacent to the Dutch border, a theoretical competitor would need to transport its gas from his market area to one adjacent to the Dutch border, described above (or to the BEB network, which was affiliated with GasTerra until 2007). This would incur a transportation charge. Then, he would have the same additional costs as E.ON Ruhrgas for delivery to the Netherlands.
- Russian or other export companies. We assume that such companies won't be able to sell gas to Dutch importers at a significantly lower price than for sales to the German companies. In general, the commodity component of the cost of supplying a Dutch customer should more or less be the same whether the supplier is a German company or another company. Therefore, it does not impact the analysis if we include a German company selling their Russian imports to Dutch customers or include the Russian company selling directly to Dutch importers (or customers).

Definition of theoretical supply paths

The next step is to describe the individual supply paths for each potential new entrant. The supply path should include the source of gas procurement, transport tariffs and a convenient storage if required.

To clarify the approach a sample path is shown below. It illustrates how E.ON Ruhrgas (or a player with a gas portfolio in this market area) might supply gas to Dutch end-users (or to the retail company which does the final distribution and sale to the end user):

- Source of gas: average German procurement costs at the border (BAFA index);[48]
- *plus* entry tariffs for E.ON Ruhrgas system (now EGT, formerly Ruhrgas Nord market area), [49]
- *plus* storage tariffs for E.ON system storage;[50]

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48 BAFA (Federal Office of Economics and Export Control) provides official average gas import costs on an aggregated level on a monthly basis. These prices represent the procurement costs of large importers very well, since they have the greatest impact on this volume weighted price basket.

49 We assume Emden as the relevant entry point.

50 E.ON Ruhrgas offers a so called system storage which is not dedicated to a single storage site but to their total storage portfolio. The storage tariff includes entry and exit fees to/from storage.

Annexe 1: Assumptions for the benchmark approaches

- *plus* exit tariffs from the E.ON Ruhrgas system at Bunde;
- *plus* entry tariffs to the GTS system at Oude Statenzijl;
- *plus* quality conversion tariffs to convert H-gas to G+-gas;
- *plus* exit tariffs from the GTS system.[51]

When applying transport and storage tariffs different shapes of the gas has to be considered as imported gas and deliveries to industrial customers are more flat than the profile of households. For deliveries to the large scale end-users consuming H-gas, the costs of quality conversion should not be included (i.e. only the share of gas supplied to greenhouse farmers has to be converted). In the case of small end users, we apply both quality conversion tariff and the cost component "pieklevering" (peak delivery) which is related to the cost of GTS having the responsibility to supply customers at very low temperatures. We do not apply this cost to large scale end users.

The exact price could differ by year, e.g. due to different relevant sources of supply being available, different transport tariffs, the establishment of TTF, etc. Therefore, the ranking of competitors could vary with each year and according to customer type.

In the table below we depict the key elements of the supply path for each hypothetical competitor followed by a more precise description in the next subchapter.

51 For GTS exit tariffs we used an average of the tariff for all local distribution points.

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	Major German gas player	UK trading company	Dutch newcomer
Source of gas	BAFA	Zeebrugge	Dutch import price
Storage tariffs	E.ON system storage	NAM Grijpskerk[52] storage	RWE Kalle storage[53]
Transportation tariffs	Entry Emden Exit Ruhrgas Bunde Entry GTS Oude St. Ruhrgas Exit GTS for industrial/ distributional points	Transit Fluxys Entry GTS Zelzate Fluxys Grijpskerk (storage) exit/entry GTS[54] Exit GTS for industrial/ distributional points	Entry GTS average for border points Kalle (storage) exit/entry GTS (Subnet Northwest)[55] Exit GTS for industrial/ distributional points
Quality conversion and peak delivery tariff	Required for small-scale customers and greenhouses (QC only)	Required for small-scale customers and greenhouses (QC only)	Required for small-scale customers and greenhouses (QC only)

Table 8: Supply path for hypothetical new entrants

Source: Frontier assumptions

Estimation of the costs for new competitors: data description

Three main cost components contribute to the price that could be offered by hypothetical supplier. They are the costs of gas procurement, transportation costs and storage costs. We provide the detailed description of each component for every entrant below.

These costs vary over time, which reflects the changes of transportation and storage tariffs as well as gas procurement prices over time. Unfortunately, the quality of the data on transportation tariffs and storage fees is quite scarce for earlier time periods. Therefore, we have adopted certain assumptions about the dynamics of the tariffs in cases where it was impossible to obtain the factual data.

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52 NAM offers third party access to its storage in Grijpskerk. Two bundled storage services are offered: long term and short term gas storage. We used the fees for a bundle under the long term contract. The bundle is defined in terms of working volume, production and injection capacity.

53 RWE provides storage facilities at Kalle. Similar to Grijpskerk, fees are differentiated according to the term of storage required. We used the fees for the long term contracts, consisting of fees for storage capacities and operating fees that are determined on the basis of electricity prices.

54 We used tariffs published by GTS for exit and entry to NAM Grijpskerk storage.

55 For Kalle exit/entry tariffs we used prices for storage connection entry/exit for subnet northwest, provided by RWE.

Annexe 1: Assumptions for the benchmark approaches

Major German gas player

We assume that the major German gas player procures gas through long-term contracts from Norway or Russia. BAFA prices represent the procurement costs of large importers very well, since they have the greatest impact on this volume weighted price basket.

We conjecture that gas should be transported through the German territory, and we approximate this route by transport from Emden to Bunde. Therefore, the new entrant should pay entry fees at Emden and then exit fees at Bunde.

It is assumed that German player uses the E.ON system storage, and therefore should pay system storage fees that depend on the working volume required and maximum injection and withdrawal rates. Since E.ON provides a "virtual" storage, there are no entry or exit fees involved in using the storage capacity.

However, German company incurs additional costs since the exit fees at Bunde, as well as GTS entry/exit tariffs are applied to shaped gas, as we assume that it delivers the structured product to final customers.

Gas enters the Dutch system at GTS Oude St. Ruhrgas and then is taken off by the retailer/final consumer at the exit point. For entry/exit GTS tariffs we use the tariffs published by GTS. GTS exit tariffs are calculated as average of all distributional points for (separately) G+-gas users and for H-gas users.

In terms of tariff dynamics over time, we conjecture the following changes:

- storage fees are set at the level of fees in 2007 for the period 2001-06 as no data available for previous years;
- entry fees for EON (entry fees for Emden and exit fees for Ruhrgas Bunde) are indexed according to the following schedule in 2001-06:[56]
    - 2006: 117% of 2007 level;
    - 2005: 109% of 2007 level;
    - 2004: 104% of 2007 level;
    - 2001-03: tariffs are preserved on the level of 2004;
- GTS entry/exit tariffs are set at the level of 2007;
- quality conversion and peak delivery tariffs are also set at the level of 2007.

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56 Only data for 2007 is published on the E.ON website. We therefore use reports prepared by ADL on an annual basis for GTS as an indicator of price. As this approach only provides prices at an aggregated average level for the Ruhrgas/EGT system, a minor discrepancy might be possible if Emden tariffs varied significant from this average. See ADL (2007) and also older editions of ADL's report.

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UK trading company

The supply path for the UK company changes over time due to the conditions of storage accessibility etc. The UK trader procures gas at the Zeebrugge trading hub, and the average forward gas prices at Zeebrugge are used as an approximation for procurement costs.

We assume that no storage was available to UK trader before 2005, and thus all flexibility had to be purchased at the market. To reflect potentially high costs associated with providing all flexibility from the market, we add a premium[57] of 7.5%[58] to the Zeebrugge price throughout this period.

The gas is then transported through Belgium to the Dutch border using Fluxys' network. Gas enters the Netherlands at GTS' entry point at Zelzate Fluxys and then is taken off by the retailer/final consumer at the GTS exit point. Fluxys' tariffs consist of a non-distance related component and a distance and diameter[59] related component.

As before, we use official GTS tariffs for GTS exit/entry charges. All these charges are applied to shaped gas and therefore could be quite high compared to the situation when the storage is available.

In 2005-07 we assume that storage capacity at NAM Grijpskerk became available for the UK trader. As a result, the associated charges are modified to reflect a new possibility.

The gas is procured at Zeebrugge, but no premium is embedded. Then gas is transported through Belgium and enters the Dutch system at Zelzate Fluxys. These charges are applied to unshaped gas, which tends to reduce the transportation fee.

The gas then enters the Grijpskerk storage, and appropriate storage charges are applied, together with the exit fee from the GTS network to the storage and the entry fee from storage to the GTS network. It is important to note, that exit fees from the GTS network to storage are applied to flat gas, whereas entry fees from storage to the GTS network are applied to the structured product. Gas is delivered to the final consumer, and GTS exit fees are applied to final structured product.

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57 This mark-up reflects the fact that the price of commodity gas tends to be higher during peak demand periods (for example, in 2005 peak prices were 5 times higher then the average procurement costs based on prices for annual forward contracts although more typically winter prices are twice average prices) and therefore that the gas supplier will pay an average price for procuring gas that is higher than the base load average price of gas.

58 We assume that the potential competitor will source it's flexibility by purchasing in equal parts day-ahead volumes (peak supply) and longer term winter products (e.g. quarterly base load products). Based on price data for the period 2001 to 2007 a mark-up for the first category (peak) of 140% over the price of flat annual commodity gas was estimated. The mark-up over the price of flat annual gas for winter base products was estimated as 15%. On average, such a portfolio results in additional costs for flexibility of approximately 75% over the cost of flat gas. Since flexibility needs are about 10% of yearly gas needs, we apply a mark-up of 7.5% to the total bundle of commodity gas plus flexibility.

59 We use the tariffs for the pipes of diameter of at least 900 mm.

Annexe 1: Assumptions for the benchmark approaches

In terms of tariff dynamics over time, we conjecture the following changes:

- storage fees of Grijpskerk are set at the level of fees in 2007 for the period 2005-06 since no data available for previous years;
- transport tariffs of Fluxys are set at the level of 2007;
- GTS entry/exit tariffs are set at the level of 2007;
- quality conversion and peak delivery tariffs are also set at the level of 2007.

Dutch newcomer

We assume that the Dutch newcomer is able to procure gas from the same import sources as GasTerra does. However, since there are no well established relations between the new entrant and the potential gas supplier, we assume that the price for newcomer is higher than for GasTerra supplies. The premium might also be partially driven by the fact that GasTerra entered gas purchasing agreements much earlier and thus had more favourable conditions to negotiate gas prices. As a result, the assumed gas procurement cost for new entrants is the average imports costs of GasTerra increased by 10%.[60]

We assume that the Dutch company procures gas at the border, and therefore should pay the GTS entry fee. We use the average tariff for border points to reflects this charge and apply it to unshaped gas.

We presuppose that Dutch newcomer can secure some flexibility through the import contract design, but to be able to supply profiled end-users the new entrant has to secure some storage capacity.

Therefore, we assume that gas then enters the Kalle storage via the direct pipe connection between Kalle and the GTS system. The exit fee from the GTS network to Kalle is applied to unshaped gas, and the entry fee from Kalle to the GTS network is applied to profiled gas. Gas then is delivered to final customers and the GTS exit tariffs are applied to shaped gas.

In terms of tariff dynamics over time, we conjecture the following changes:

- storage fees for Kalle are set at the level of fees in 2007 for the period 2001-06 since no data available for previous years;
- GTS entry/exit tariffs are set at the level of 2007;
- quality conversion and peak delivery tariffs are also set at the level of 2007.

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60 Evidence from several gas release auctions show on average a premium of about 10% was paid compared to the average cross border price. As border prices more or less reflect import conditions of major import companies, results from gas release auctions could be interpreted as the willingness to pay by smaller companies.

Annexe 1: Assumptions for the benchmark approaches

Timetable for comparisons

Over the course of the study Frontier Economics has held industry consultations concerned with the real possibility for third-party suppliers to participate on the Dutch market (see chapter 3.3.3). The views of the industry together with the analysis of liberalization of the Dutch market underpin our assumptions about the timing of when each benchmark comparison can be applied.

Table 9 presents our analysis of the timing of when different customers could be served by particular hypothetical entrants. A "+" indicates that it would have been possible for a particular type of entrant to serve a particular customer in a given year.

New entrant	2001	2002	2003	2004	2005	2006	2007
German major company							
Small-scale end-users through retailers	-	-	-	+	+	+	+
Large-scale end-users through retailers	+	+	+	+	+	+	+
UK trading company							
Small-scale end-users through retailers	-	-	-	-	-	+	+
Large-scale end-users through retailers	+	+	+	+	+	+	+
Dutch newcomer							
Small-scale end-users through retailers	-	-	-	-	+	+	+
Large-scale end-users through retailers	+	+	+	+	+	+	+

Table 9: Timetable for comparisons

Source: Frontier assumptions

We assume that in the period 2001-2004 only large industrial users could have been served by a hypothetical entrant company, because during this period retail access was not yet open for non-industrial consumers. All customers with the exception of power plants and large industrial users were supplied by GasTerra. Moreover, since there was only very limited or no TPA for Dutch storages before 2004 and access to cross border capacity was limited, it would have been very difficult for newcomers to build up a portfolio to supply gas to profiled customers.

The major German gas player can serve small scale end-users from 2004 onwards. We assume that as soon as it became possible to supply small scale consumers the major German player would have been able to enter the market. This is explained by the fact that this player can provide the required structure of

Annexe 1: Assumptions for the benchmark approaches

gas through cross-border storage capacity and due to some flexibility embedded in its the long-term contracts.

The UK trading company can deliver gas to small scale customers from 2006 onwards. We assume that although this entrant can secure some flexibility from the market, it needs to have a significant storage in order to supply consumers with a shaped off-take profile. Third party access to storage capacity was in place only from 2005, and we believe that it was realistic for a new entrant to gain access to storage only from 2006. Moreover, it seems that quality conversion capacity was also a constraint for a new comer to supply small-scale end-users.

The Dutch newcomer can only supply gas to small scale consumers from 2005. We believe that the Dutch newcomer could start supplying customers with shaped off-take profile when storage TPA was introduced.

Robustness check

Results of the benchmark analysis depend on several assumptions. Two categories of potentially important assumptions can be identified: transport and storage tariffs and prices for commodity gas. In this robustness check we test the extent to which the assumptions can be changed without changing the results of the analysis, e.g. whether hypothetical over or under estimates of transport and storage tariffs would affect results.

In the robustness check, we calculate two ratios:

- the ratio of the difference between GasTerra prices and competitive benchmark prices to the sum of transport and storage tariffs; and
- the ratio of the difference between GasTerra prices and competitive benchmark prices to the commodity price.

A low absolute value of the ratio indicates that the result is less robust than a high ratio.

Our test indicates that a significant change to estimates of transport and storage tariffs would need to be made before the results of the analysis changed. This is helpful since we have had to estimate historic transport and storage tariffs.

In contrast, a smaller variation in the gas procurement costs would impact the results of the analysis. However, estimates of gas procurement costs are themselves robust as they are mainly based on representative and publicly available data.

In summary, this check confirms that our analysis appears to be robust.

The following tables set out the various ratios calculated as part of the test of robustness for the most relevant benchmark years.

Annexe 1: Assumptions for the benchmark approaches

		2004	2005	2006	2007
GasTerra prices					
Competitor 1	Sourcing (1)				
(German incumbent)	Transport&Storage (2)				
	Other tariffs				
	Total				
	Difference to GasTerra (3)				
	Ratio (3)/(2)	-41%	68%	53%	-29%
	Ratio (3)/(1)	-3%	4%	2%	-1%
Competitor 2	Sourcing (1)				
(UK trader)	Transport&Storage (2)				
	Other tariffs				
	Total				
	Difference to GasTerra (3)				
	Ratio (3)/(2)	-107%	19%	189%	236%
	Ratio (3)/(1)	-8%	1%	8%	9%
Competitor 3	Sourcing (1)				
(Dutch company)	Transport&Storage (2)				
	Other tariffs				
	Total				
	Difference to GasTerra (3)				
	Ratio (3)/(2)	-42%	82%	128%	25%
	Ratio (3)/(1)	-10%	15%	16%	3%

Table 10: Robustness check for large-scale customer benchmark [prices/costs removed for reasons of confidentiality]

Source: Frontier

		2004	2005	2006	2007
GasTerra prices					
Competitor 1	Sourcing (1)				
(German incumbent)	Transport&Storage (2)				
	Other tariffs				
	Total				
	Difference to GasTerra (3)				
	Ratio (3)/(2)	-24%	-39%	-25%	-101%
	Ratio (3)/(1)	-13%	-16%	-8%	-33%
Competitor 2	Sourcing (1)				
(UK trader)	Transport&Storage (2)				
	Other tariffs				
	Total				
	Difference to GasTerra (3)				
	Ratio (3)/(2)			21%	6%
	Ratio (3)/(1)			5%	1%
Competitor 3	Sourcing (1)				
(Dutch company)	Transport&Storage (2)				
	Other tariffs				
	Total				
	Difference to GasTerra (3)				
	Ratio (3)/(2)			39%	-15%
	Ratio (3)/(1)			16%	-7%

Table 11: Robustness check for small-scale customer benchmark [prices/costs removed for reasons of confidentiality]

Source: Frontier

Annexe 1: Assumptions for the benchmark approaches

BENCHMARK B: SUPPLY AND DEMAND IN A HYPOTHETICAL MARKET

As described in Section 3, we construct a merit order curve for the Dutch gas market which consists of capacities and supply costs for all supply sources. When ranked by order or increasing marginal cost, the last source that is needed to meet yearly total demand (consists of domestic demand and exports) is labelled as the marginal supplier. To his marginal supply costs we add several costs that are needed to deliver gas to end-users, e.g. the costs of storage, transportation and where applicable quality conversion and the peak price.

Dutch gas demand is fed by several sources of supply. Every one of these sources has a maximum yearly capacity and a cost level at which this source is able to supply to the relevant market. Both could vary amongst the years, so we prepare an analysis for the last three years. For the earlier years (i.e. 2004 and before) the available data required to develop the merit order is not very robust, so the outcome of the analysis might not be very representative. For this reason we do not apply this benchmark approach to the period 2001 to 2004.

The following sources contribute to the merit order in all of the three years:

- Small Fields;
- Groningen;[61]
- imports via Germany representing mainly Russian and Norwegian gas;
- imports via Belgium which are feed by British gas; and
- imports from Denmark via a direct pipeline link in the North Sea.

Capacities of sources

The capacity of supply sources could vary among the years due to the construction of new pipelines or due to technical or political limits on production:

- Small Fields: We assume that their maximum production capacity in 2005, 2006 and 2007 was equal to their actual production in those years. This seems to be plausible as most of the fields are beyond their production peak and therefore not able to increase yearly production.
- Groningen: For 2007 and 2006 we assume the capacity limit to be that set by the 10 year production cap. We furthermore assume an equal distribution of the 425 billion m^3 to the 10 year period, so capacity for Groningen is 42.5 billion m^3/a. For 2005 a 77 billion m^3/a cap on total Dutch production was in place. As described before we assume Small Field production capacity as defined by the annual production, so the

61 We aggregate all Dutch L-gas production in this category.

Annexe 1: Assumptions for the benchmark approaches

difference between this volume and 77 billion m³/a is the yearly production limit for Groningen.

- Imports via Germany: The capacity was 26 billion m³/a in 2005. As no new pipeline was commissioned until 2007, import capacity remains the same for all years covered by the analysis.[62]
- Imports via Belgium: The Zebra-Pipeline is not fully integrated in the GTS system as it only serves a limited market are in the South-West of the Netherlands, capacity which could be used for imports in the GTS system is restricted to 4 billion m³/a.[63]
- Imports from Denmark: Those imports are limited to a single pipeline link between the Dutch and the Danish sector of the North Sea. The capacity is less then 2.5 billion m³/a.[64]

Costs of sources

We outline the methodology of our cost assumptions below – the exact costs we have used by years are shown in Table 12.

- Small Fields: We assume the price offered by GasTerra to the NIP-field producers is an adequate indicator for the supply costs of all Small Field production.
- Groningen: Following public available sources Groningen tends to be the source with the lowest costs. Even if estimations about production costs vary among several publications, the relative position of Groningen is not affected. As Groningen is never the marginal supplier the precise level of cost is not important and we use 10 €/MWh, including entry fees for the GTS system.
- Imports via Germany: We consider the BAFA index as a good approximation to the value of long-term contracted gas flowing via Germany. For the hypothetical market analysis the price has to be adapted by an entry/exit fee for the German gas networks and an entry fee for the GTS system. We estimate costs for a flat profile as the merit order simulates the wholesale market and structuring and flexibility costs are added in a second step.
- Imports via Belgium: Imports from the UK via Belgium are likely to be strongly related to trading prices at the Zeebrugge hub as this hub seems to best represent the value of the gas in the traded market. As for German imports we modify these prices for the merit order by entry/exit fees.

62 See www.gte.be.

63 See www.gte.be and Frontier (2008) for further explanations on Zebra.

64 See www.dong.dk.

Annexe 1: Assumptions for the benchmark approaches

- Imports from Denmark: There is no public available indication for Danish import prices. We assume that they will relate to average Dutch import prices. Due to the lack of official border price publications (like BAFA) or other public information about import prices from long-term contracts (like the published Emden-Troll price in industry newsletters or journals, e.g. the Heren Report, Argus Petroleum or Energate) we use GasTerra's average import costs as an approximation. As Denmark sells its gas to smaller players than GasTerra (e.g. Essent) we adjust the import price upwards by 10%.[65]

2007	Source	Entry/Exit	Supply costs
Groningen	10.00	included	**10.00**
Small Fields		0.25	
Germany	19.98	1.00	**20.98**
Denmark		0.30	
UK	27.72	1.00	**28.72**

2006	Source	Entry/Exit	Supply costs
Groningen	10.00	included	**10.00**
Small Fields		0.25	
Germany	21.30	1.00	**22.30**
Denmark		0.30	
UK	25.20	1.00	**26.20**

2005	Source	Entry/Exit	Supply costs
Groningen	10.00	included	**10.00**
Small Fields		0.25	
Germany	16.25	1.00	**17.25**
Denmark		0.30	
UK	15.33	1.00	**16.33**

Table 12: Cost assumptions for Benchmark B [prices/costs removed for reasons of confidentiality]

Source: Frontier

Mark-ups for benchmark pricing

Prices resulting from the merit order are prices comparable to a flat product, e.g. a year of flat delivery, at the TTF. Therefore these prices only include the procurement costs for the gas and transport tariffs from the point where title to the gas was taken, e.g. at the Dutch or German border or at the wellhead, to the TTF. In contrast to Benchmark A we are not simulating the position of an individual shipper but for the whole market. So the entry/exit fees we assume for Benchmark B are calibrated at a representative value for the whole market rather than at a specific value for a specific transport route.[66] The entry/exit fees might be slightly higher or lower for some shippers but the impact on the overall results will be limited.

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65 This corresponds to the assumptions we made for the procurement costs of the "Dutch newcomer" for Benchmark A.

66 This is different from the approach applied for Benchmark A. With Benchmark A, we simulate the supply situation of an individual supplier (such as E.ON Ruhrgas) applying its typical supply path consisting of actual border points. In contrast, with Benchmark B we use a value that does not relate to one specific exit point but rather represents average cross border transport costs from Germany to the Netherlands.

Annexe 1: Assumptions for the benchmark approaches

We also use average tariffs in applying the mark-ups to the marginal price. We use average tariffs or costs for transport and storage derived from the analysis we undertook for Benchmark A. Again, the costs faced by a specific supplier could be higher or lower than the mark-ups we have applied.

For large-scale end-users we apply the following mark-ups:

- GTS exit fee for industrial points and quality conversion costs for the proportion of gas supplied to greenhouse farmers: 0.40 €/MWh;
- storage costs for structuring and flexibility: 1.50 €/MWh; and
- some specific add-ons for different supply sources. In cases when German imports are the marginal supplier (which was in all years of the analysis) we consider that some flexibility would derive from the contracts. This leads to some higher entry/exit fees as marginal costs in the first step are based on flat supply: 0.10 €/MWh.

The total mark-up for industrial customers is 2.00 €/MWh. We assume that this is valid for 2005 to 2007.

For small-scale end-users we apply the following mark-ups:

- exit GTS for local distribution: 0.90 €/MWh;
- storage costs for structuring and flexibility: 4.00 €/MWh;
- higher entry/exit fees for shaped gas: 1.40 €/MWh;
- the obligatory peak delivery tariff: 0.70 €/MWh; and
- tariffs for quality conversion as the marginal supply source is feed by H-gas and households use G+-gas: 0.30 €/MWh.

The total small-scale end-user mark-up that is applied to the supply costs of the marginal supplier is 7.30 €/MWh for the period 2005 to 2007.

Annexe 1: Assumptions for the benchmark approaches

Annexe 2: Economic logic of competitive price benchmarks

In this Annexe we set out relevant theory relating to the application of competitive price benchmarks with a focus on energy markets.

To assess whether a certain price is competitive, it is not uncommon for competition practitioners to compare prices to *a hypothetical competitive benchmark price*. However, there is no general definition of what constitutes a competitive price – the definition would depend on the industry context, i.e. on the structure of costs as well as on demand factors.

The point of reference for a hypothetical competitive price benchmark is that of *perfect competition where the marginal costs of the marginal supplier determines the price*. All players in the market have the same costs and there is free entry and exit. Price equals the marginal cost as well as the average cost of the industry, which means that no player makes positive *economic profits*, i.e. each player receives a normal economic profit which rewards all factors of production, including capital, at their opportunity cost but no more. However, as this model bears little relation to reality, competition policy should focus on detecting where effective competition, rather than perfect competition, does not work.

Considering the production of homogenous[67] products, there are a number of complications which imply that competitive prices might deviate from the perfect competition paradigm. These complications fall into the following categories:

- high fixed costs relative to the marginal costs of the marginal player;
- opportunity costs or scarcity rents (i.e. where the price may be driven not only by supply but also by the willingness to pay of demand);
- high ex-ante risks of an investment (i.e. capital costs may be high); and
- cyclical demand (i.e. a high or low price observation may be driven by current short term conditions).

We address each complication in turn.

High fixed costs

The marginal player's fixed costs might be so high that marginal cost pricing would not enable him to recover his fixed costs[68]. In this case, competitive benchmark prices need to be set such as to enable the marginal player to recover

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67 For differentiated products, real-world competition is characterised by some sort of pricing power which implies that prices will be above marginal costs, as is the case for example in models of oligopolistic behaviour like monopolistic or Cournot competition. Even where competition is best described by oligopolistic behaviour, the nature of fixed costs could imply that firms make zero (economic) profits and thus be consistent with effective competition; with a competitive price benchmark indicating prices above marginal costs.

68 For this market participant, the marginal cost curve does not cut the average cost curve from below.

(long run) marginal or average costs rather than short run marginal costs as the latter would be too low. Profitability analysis could be used to help identify whether a player is recovering his long run costs.

Opportunity costs or scarcity rents

Many markets are characterised by a temporal inter-dependency which implies that there are opportunity costs to producing in one period rather than the next.[69] One example of such an opportunity cost would be the pricing behaviour of the operator of gas storage who is able to decide when to release gas from storage, implying that he could release gas either today or tomorrow. Suppose the operator were expecting higher prices tomorrow, even if prices today were expected to lie above his marginal, i.e. variable, cost of releasing gas[70], s/he would only produce today if he could expect to be paid tomorrow's higher price. This pricing decision would be efficient since it allows the storage operator to recover his opportunity costs and will help contribute to the recovery of his fixed costs. Therefore, opportunity costs should be included when developing a competitive benchmark price.

In a similar way, an operator may capture scarcity rents when capacity is tight. The theoretical (competitive) equilibrium price when all plants are operating at their full rating is equal to the marginal opportunity cost of avoided consumption. This may greatly exceed the highest directly incurred variable cost of any plant that is running[71].

Through scarcity rent, the plant with the highest marginal cost on the system can recoup some or all of its fixed costs. Such a scarcity rent could therefore be deemed conducive to the effective functioning of the market[72] and should be included when developing a competitive benchmark price.

The implication is that the competitive benchmark should take account of opportunity costs and scarcity rents. It is therefore possible for the competitive benchmark price to exceed the directly incurred short run variable cost of the marginal producer and it is also possible, in the short run, for the benchmark price to exceed the long run marginal or average cost of the marginal producer.

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69 Alternative uses for a resource that don't involve temporal inter-dependency can also create an opportunity cost for use of the resource in the market under investigation.

70 Once gas is in storage, the directly incurred short run cost of its release onto the transportation network is low, e.g. the cost of heating the gas to prevent freezing or condensation when the gas pressure falls as it enters the transportation network.

71 The plant with the highest directly incurred variable cost that is running would not be the marginal plant since it would be operating at full capacity.

72 See, for example, A. Ockenfels, „Marktmachtmessung im deutschen Strommarkt in Theorie und Praxis – Kritische Anmerkungen zur London Economics-Studie", Sonderdruck aus Energiewirtschaftliche Tagesfragen 57. Jg. (2007) Heft 9.

High risks

If there are high ex-ante risks associated with an investment, prices and ex-post returns on capital need to cover average costs including an appropriate return on capital reflecting the ex-ante high risk to investment. In energy markets, where investments risks are incurred with a view of recovering the costs over very long time spans, an adequate risk premium needs to be considered when estimating the long run average cost of the marginal player. The risk premium varies with the type of operation, e.g. gas transport, storage and distribution.

Cyclical demand

Cyclical demand, e.g. demand with a seasonal or multi-annual pattern, might imply that a firm can, at times, recover no fixed costs. Consider a peaking plant in electricity generation that only runs in 30% of all hours in a year and at times only receives its short run marginal costs. For an investment in such a plant to go ahead, there needs to be times when more than its short run marginal costs are recovered. Again, the relevant benchmark for competitiveness is an expectation that the marginal player recovers its long term average costs over the life-time of the investment[73, 74].

Given the practical difficulties in establishing a competitive price benchmark, there is widespread agreement among economists that competition authorities should be concerned only about prices that are significantly above the competitive level for a sustained period and also only if high prices are not eliminated or reduced by competitive forces – for example because of barriers to entry.

CONCLUSION

In conclusion, the NMa's proposed approach for determining a hypothetical competitive benchmark price, basing it on the costs of existing and potential alternative sources of wholesale gas and flexibility services would seem adequate if care is taken to develop an appropriate cost concept.

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73 See, for example, discussed in more detail in P. Joskow, "Capacity payments in imperfect electricity markets: need and design", 2007.

74 It should be noted that some market participants could be vastly more efficient than the marginal player. In such cases, it is important to note that economic theory does not hold that prices are driven down to costs, or economic profits are driven to zero, for all firms in the industry. Rather, economic theory holds that the marginal firm in an industry should earn zero economic profits, so that more efficient firms will by definition earn positive economic profits and less efficient firms will earn negative economic profits. Hence the price of a product should just cover *the average total costs of the marginal firm*, but will be more than the average total costs of the infra-marginal firms.

Annexe 2: Economic logic of competitive price benchmarks

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