

Gas Market Liberalisation In Europe: Outlook for Gas Prices and Trade

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Introduction

After the energy markets have been liberalised in the USA and UK, the European electricity and gas market is also changing at a fast pace. Particularly the gas market is rapidly transforming into a competitive market. Despite the fact that forecasting is particularly difficult in a period of transformation, the ambition of this paper is to picture the driving forces behind this process of liberalisation of the European gas markets and thereafter provide a brief analysis of the expected developments of gas prices and trade in the next decade. More in particular we will focus with our tentative projections for gas prices and trade on eight major gas consuming EU Member States, namely Belgium, Austria, France, Germany, Italy, Netherlands, Spain and UK, which we consider to be mature and eligible for establishing a competitive gas market.

The structure of the paper is as follows. First, we discuss the driving forces for more competition in Europe in the last ten years. Next we sketch briefly our expectations regarding two of the main drivers, of which the development is vital for the manner in which competition will be shaped. Then we give a brief overview of some analysis with our model concerning different competitive regimes. Finally we give a brief outlook of the expected changes in gas prices and trade in the coming years for the EU Member States.

Driving Factors For Competition

Demand

After a period of moderate growth in the 1980's the demand for natural gas within the European Union has risen substantially over the past decade. Natural gas demand is said to be 'booming' all over Europe. The all-around optimism is fed by several economic and political developments. The main factors that have been restraining the use of natural gas are either no longer present or will be lifted within the foreseeable future. In 1990 the European Union removed its earlier ban on burning natural gas to generate electricity. Since 1985, natural gas prices have decreased. Until 2000 the fall in oil prices combined with the depreciation of the US\$ has resulted in considerably lower end user gas prices within all European countries. The low sulphur and carbon content of natural gas

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compared with other fossil fuels makes it an attractive fuel from an environmental perspective. In the 90's, in the UK, the availability of highly efficient Combined Cycle Gas Turbines (CCGT) and the liberalisation of the UK electricity market have stimulated the use of gas in the power sector. It seems likely that the ongoing liberalisation of the continental European electricity market will have a similar effect on the demand for CCGT and, hence, for natural gas. The question for demand growth is; will the CCGT capacity also increase at a similar pace in the other continental European countries such as France, Germany and Italy.

Supply

Until recent years, the ownership structure on the supply side of the European gas market can be characterised as an extremely complex oligopoly. In order to limit market risk, the search for and exploration of (new) gas fields is often executed in joint ventures with other gas companies. Although the management of a single gas field usually rests with one company, all partners in the joint venture are entitled to a part of the profit (loss) of the field. Additionally, many upstream (exploration and production of natural gas) companies have extensive interests in the downstream part of the market. The ownership structure of individual transmission companies can be very complex as well. For example, a consortium of four so-called 'pools' owns Germany's Ruhrgas. Behind each of these pools stands a consortium of upstream gas companies, some of which have shares in more than one pool. In fact, so far the upstream market is the most competitive part of the natural gas chain. About twenty major companies are involved in the supply, exploration and production of natural gas for supply to the eight major consumer countries in the EU. Taking a look at each of the countries separately, we obtain a somewhat different picture. In some countries, one company or a consortium of companies holds a dominant market share. Moreover, many of the companies do not compete with each other because of geographically separated markets. Seven out of the twenty companies listed are active only, or mainly, in the United Kingdom, whereas the two largest companies, Gazprom and Sonatrach, only compete with each other in Italy so far. However, the changes in market volume and market share in recent years also illustrate the growing importance of non-EU producers, which is expected to become stronger in the near future.

Transmission

Until 1999 the downstream part of the EU gas market (transmission and distribution) shows a completely different picture than the upstream part. In nearly every country, the transmission market was and at present for some countries still is almost completely dominated by one company supplying virtually the entire market. The only exception next to the UK is the German gas market where the share of the largest transmission company, Ruhrgas, is limited to around 69 per cent. A reasonably competitive upstream market exists together with a nearly (third parties have in principle access to these grids) monopolistic downstream market. Hence, the conclusion seems warranted that any problems with market power will be mainly confined to the downstream market. However, the situation in the market for natural gas is more complicated than this simple analysis suggests. First, a number of the companies active in production and import of natural

gas are working closely together. The main motive is that it allows cost savings and reduces risk. Horizontal integration also reduces the number of competitors in the market and, hence, reduces competition. Second, many of the upstream companies have interests in downstream companies. This vertical integration reduces risk and increases value added for a company, it also allows the upstream firm to 'shift' the battlefield to the less competitive downstream market and, hence, to evade competition. Furthermore, the fall in natural gas prices since the mid-eighties has been fully absorbed by cost reductions, which are particularly realised by the producers, while at the same time, the profits of the transmission companies have remained almost unaffected. Since the new companies Gazprom, Sonatrach and GFU (a Norwegian Joint Gas Negotiations Committee composed of Statoil, Norsk Hydro and Saga) have virtually no downstream interests, they have been hit much harder by the fall in natural gas prices between 1986 and 1995 than other companies with downstream activities (v. Oostvoorn and Boots, 1999).

EU Gas Directive

Until 1990, the issue of gas market liberalisation did not feature significantly on the policy agenda of the European Commission. Its concerns were primarily focused on issues of security of supply. The gas industry was allowed to operate according to the individual wishes of each Member State. Perhaps because of the strategic importance of energy supply, no serious attempts were made to establish a free market in either gas or electricity, in spite of the EU objective of the establishment of a free market for other goods and services. However, in the 90's the European Commission reconsidered its position and adopted two important EU Directives, one on electricity (1996) and another on the gas market (1998); this to enhance the efficiency and lower the energy prices of these markets.

The EU Gas Directive aims at creating a fully competitive market in natural gas through common basic rules for transmission, distribution, supply and storage. Central to this aim is the requirement to open up the transmission network and storage facilities (third party access), so that eligible customers can buy gas directly from any/each producer if they wish. The Directive establishes minimal degrees of market opening. The initial gas market opening covers all power generators and all other consumers of more than 25 million cubic metres/year and a minimum of 20% of each national market. Finally the EC threshold for market opening is 33%, but due to reciprocity we foresee that several EU countries will end up with a 100% opening before 2005. The market opening rises to 15 million cubic metres/year and 28% of the market after five years of the Directive taking effect in 2000; and to 5 million cubic metres/year and 33% after ten years. The Directive also allows new entrants to build pipelines, etc. Clearly the Directive is a key driving factor for pushing competition in the gas markets in a majority of continental EU Member States and other European countries. It is rather important that there is free TPA, in order to ensure that accessibility on equal basis is guaranteed for all eligible companies. This process will be completed for the whole of Europe, if the CEECs that are candidate members also adopt and implement the EU Gas Directive in order to comply with the *acquis communautaire*.

In summary, over the past years the following factors have

been driving the EU gas markets towards more competition:

- growing gas share in energy demand and diversification of gas supplies and imports,
- emergence of large non-EU suppliers and overcapacity in gas supplies to the EU consumer markets,
- changing role of governments in the economy, and consequently their intervention in the gas markets, from players to regulators,
- two important events, one the opening up of the German gas market by Wingas and Gazprom and second the liberalisation of the UK gas market and construction of the Interconnector between UK and Belgium,
- implementation of the EU Gas Directive to accomplish an internal market for gas for all Member States.

Key Drivers For The Future

In order to present a tentative outlook for gas prices and trade first we briefly discuss the main drivers in the next years. In our view and looking at the experiences elsewhere, i.e., UK and USA, the most relevant factors for growing and shaping competition in the European gas markets in the next decade are:

- implementation of the EU Gas Directive in the Member States,
- behaviour and responses of companies in the gas market inside and outside the EU.

EU Gas Directive Implementation

The future developments of the EU gas markets, the implementation of the Directive raises several questions. How will the different Member States implement the Gas Directive and at what pace? Given the large differences between Member States with respect to available domestic gas production, dependency on imports and other economic and political features, differences in the implementation can be expected. Will the implementation of the Directive indeed lead to an internal market for gas in the EU or in other words, will the Directive be implemented by all Member States beyond its minimal requirements? And will this lead to sufficient investments in gas transmission grids and thus an enlargement of the European gas network, which is sufficiently capable to allow for emergence of full competition in the European gas market. How will the Member States and how will the Commission react to mergers or vertical integration of companies and to requests for derogations and violations of what is expected by the Gas Directive?

Below we sketch an optimistic outlook with respect the accomplishment of fully competitive gas markets. This implies a close approximation of the 'full competition' status of the gas market, in at least eight mature Member States before the year 2008. Meaning that for these mature gas markets in the EU the objectives of the EU Directive, namely establishment of an internal gas market, are completely fulfilled in 2008.

We conclude that in order to bring about a fully liberalised gas market in the EU and thereby harvesting the expected benefits, such as a more efficient gas industry and gas price reductions for all customers, the following market conditions must prevail in 2008:

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European Gas Market Liberalisation (continued from page 5)

- Harmonisation of the implementation of the Gas Directive in all EU Member States beyond the bottom-line requirements. This implies among other things an effective and thus legal unbundling of accounts and separation of management of the different functions of the gas market such as trade, network transmission, storage, etc. Otherwise large vertically integrated and/or national gas companies will continue to dominate the gas markets in the EU. However, the companies involved in unbundling will on the short run face higher exploitation costs so the industry will have a smaller margin as the prices fall. Furthermore, it implies a 100% opening up of the market instead of 33%.
- Effective and non-discriminatory access to the entire network and particularly its auxiliary functions such as storage facilities and services. This can only be attained by regulated TPA for the entire network.
- Establishment of a strongly empowered regulation authorities at the EU and Member State level, which have to co-ordinate with each other and the Commission their pro-active regulatory work in order to be really effective in facilitating trade and non-discriminatory access of all parties involved.
- Minimise derogations for mature markets, particularly for take-or-pay contracts, public service obligations and capacity reasons.
- Close monitoring of events and market developments by policy makers at both EU and Member State level.
- Sufficient and timely extension of pipelines, network, hubs and other trading (storage!) facilities and emergence of spot and future trading at the interconnections (hubs on geographical optimal locations).

Above we sketched an optimistic view of the future. However, there are a few market developments that can easily undermine this optimistic view. This mainly concerns the degree of market opening and company behaviour, particularly in the downstream gas market. In reality, the progress and process of implementing the Gas Directive is currently diverse among the different Member States. Some of the Member States opt for a more restricted opening up of markets and thereby limit the scope for switching suppliers by customers in the next years. We observe a different pace, progress and direction of implementation of the Directive in several Member States. For example, it seems doubtful that France, Belgium and Italy will be completely (100%) opened up in 2008 like the UK today. Consequently, the share of eligible customers (potentially) able to switch suppliers differs strongly among the Member States. Probably the French government sticks to the 33% opening in their new regulation. In Italy the new law is strongly in favour of the incumbent gas company ENI, which maintains its near monopoly on storage and national supplies and in Belgium Distrigaz will also maintain its dominant position.

Clearly one of the most relevant parts regarding the implementation of the Directive for pushing competition and downward pressure on gas prices in the Member States and thus Europe-wide, is the Directive principle of non-discriminatory (in economic terms) access to all transmission

pipelines in Europe by suppliers, traders and distribution companies. Thus for the gas prices to customers, it is also important how some key elements of open access in the Member States are realised. Particularly important for non-discriminatory access is:

- What type of TPA, negotiated or regulated, will be implemented and in what way,
- The costs of access to the pipelines and auxiliary services,
- What methods and schemes for calculation and determining the tariffs and pricing of the services will be applied?

Concluding, at the moment, the outlook for the implementation of the Directive leads to the tentative conclusion that:

- a majority of countries opt for negotiated TPA, and unfortunately some are adopting it in a weak form,
- costs of access to transmission networks differ among countries,
- tariff schemes also differ between the network operators of the Member States,
- harmonisation of access conditions between the Member States is still lacking,
- several Member States are planning (by law) a 100% opening up, but others such as France stick to a minimum obligation of 33%.

Clearly the lack of harmonisation poses a great threat to cross-the-border trade and, therefore, the establishment of competitive European gas markets.

Company Responses

What are the responses of the different gas companies to the implementation of the Directive by the Member States? For example, can we expect a defensive (i.e., wait and see) or offensive (i.e., take-overs, mergers, etc.) response of the companies? What will be the most significant responses of the gas industry regarding gas pricing and trade and will they seize the new trading opportunities. The main drive for upstream companies is to get more and more engaged with sales in the retail markets, if necessary by becoming vertically integrated companies via mergers or expanding their current activities by forming alliances with downstream transport oriented gas companies. Mergers are a daily topic within the European continent now. Clearly the upstream competition between large producing companies will very probably continue in the next decade and the number of interconnections between regional networks will gradually increase in the future. Furthermore, the role of existing and new supply companies in the upstream market and the role of transmission and trade companies in the downstream market is vital. For example, existing national transmission companies might succeed in holding on to their near monopoly powers and might successfully keep new traders out of the distribution networks. Merges or alliances might also limit competition in upstream and downstream markets. Vertical integration for producers via merging with downstream companies is an attractive option for keeping their profits intact. In any case, increasing downstream competition is crucial for enhancing the scope for downward pressure on gas prices. Furthermore, the

companies involved in unbundling will on the short run face higher exploitation costs, temporarily leading to a smaller margin for these companies as the gas prices will fall.

The above mentioned factors can keep gas prices for consumers above levels attainable in well-functioning competitive markets. However, there are also other cost factors that have a similar or additional impact, i.e.,:

- Take or Pay obligation of gas contracted before 2000 and without adaptation mechanisms,
- Cost of load balancing,
- Investments in expansion of (long distance) transmission, storage, metering and quality conversion facilities.

Particularly in Member States, which are slow or minimally interested to introduce full competition conditions, the required investments in trade facilities and other market functions such as spot and future trade will probably be absent and thus the scope for minimising the above cost factors is minimal. This could result in fragmented 'regions' of competition within Europe, which would lead to an unstable business environment. Consequently there will be certain reservations towards investments in storage and new supply areas. Second and if the gas prices will fall temporarily it will give a rolled back impact on the producers and this will also result in a cut back of investments and large volatility of gas prices.

Generally, liberalisation will lead to pressure on ToP contracts. There will be more short-term contracts and SPOT gas, which results in a short-term-market behaviour of companies. However, if not dealt with properly, i.e., by introducing 'future trade' and other market trade mechanisms, this will finally also result in lower security of supply in these not fully opened up gas markets, less cross border trade, less development in 'fuel of choice' and thus less decreasing gas prices than would otherwise be possible. Of course, this fragmentation of the gas market, which is not intended by the EU, is very harmful for consumers and an efficient evolution of the European gas market.

In summary, we conclude that probably full competition conditions will not be met in three or four of the EU countries, i.e., France, Belgium, Austria and Italy, before 2008, because they are not opened up 100%, thus switching of suppliers is limited and large (national) transmission companies are still able to exercise a 'near' monopolistic behaviour to protect their profit levels.

Analysis of Different Forms of Competition

Clearly, the implementation of the Directive and the company responses are the key drivers for more competition in coming years. However, the precise outcomes of the progressive liberalisation of the EU gas market are, as yet, very uncertain, because the developments of these key drivers are very uncertain and part of a dynamic process in the next five to ten years; a dynamic process, in which both the gas companies and regulatory rules play a key role. To illustrate clearly the importance of these two factors for the changes in gas price and trade patterns ECN has conducted several studies with its gas model GASTALE¹ to examine the effects of

¹ See footnotes at end of text.

different forms of competitive behaviour of downstream transmission (trade) companies. Four alternative assumptions on the market behaviour were analysed. First, we either assume perfect competitive behaviour or oligopolistic behaviour for the traders. Secondly, the border prices are either constrained to be equal across market segments and traders within a country or they are not constrained. The latter situation essentially represents the possibility of price discrimination by the producers. If price discrimination on the border prices is allowed in the model, it means that producers can transfer price decreases from small consumers (households) to large consumers (industries and power generators). Moreover, if producers apply price discrimination, the margin that can be set by traders in an oligopoly on the end-use prices for the small consumers will be reduced considerably. The four alternatives are denoted as case PC-ND, PC-D, O-ND and O-D, see below. PC-ND represents the most competitive downstream case and O-D the least competitive.

	No price discrimination	Price discrimination
Perfect competition	PC-ND	PC-D
Oligopoly	O-ND	O-D

All other things are held equal across these four cases. Upstream producers are assumed to exhibit oligopolistic behaviour. The number of downstream transmission companies is fixed. It is assumed that all consumers, i.e., gas-fired power generators, industrial gas consumers and households, are free to contract for their gas supply. Thus, all consumer markets are assumed eligible (100% market opening).

The results in Table 1 show that assumptions regarding the behaviour of downstream transmission traders can have a large effect on prices. An oligopolistic downstream structure results in higher end-use prices than perfect competitive traders' market. In an oligopoly, traders exhibit market power, resulting in prices being higher and quantities of gas sales being lower than with perfect competition, which means that consumption and production in an oligopoly is lower than in a perfect competitive market. Traders make no profit under perfect competition; all profits accrue to the upstream producers. Consequently, total producers' profits are higher in perfect competitive traders' market². In perfect competitive traders' market, the division in market shares between two (or more) traders in the same country (in this case Ruhrgas and Wingas in Germany) is irrelevant as they make no profit (and no losses). In an oligopolistic structure, market share is relevant regarding the optimal solution. As expected, price discrimination results in a wider gap between prices for small consumers (households) and large consumers (industries and power generation).

Thus price discrimination will especially be advantageous for large gas users at the expense of households. As price discrimination is simulated at the country border, the profits of price discrimination solely flow to the upstream producers. Subsequently, the profits of the traders are reduced as the margin they could charge on the end-use prices decreases. In fact, the possible margin on household prices is to a large extent transferred from the traders to the producers. Comparing

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prices in cases O-ND and O-D shows that traders are indeed better off without price discrimination.

Also the case of limited market opening in a small number of selected countries (Austria, Belgium, France and Italy) was analysed. It was assumed that households in those countries will stay captive. For these captive markets the expected 2008 consumption is taken as given (IEA, 1998b). This was compared with a situation of complete opening, assuming that all consumer groups are eligible to choose their natural gas supplier. Here, expected consumption in 2008 is only used to calculate exogenous production.

At the demand side, prices and volumes of natural gas consumption are the important indicators for the effects of market opening. The resulting prices did show that incomplete market opening, compared to the base case of 1995, is advantageous for the consumers that stay captive. The gas price decline for households in Austria, Belgium, France and Italy are substantial in that case. In most cases, prices for industries and power generation increase as a result of market opening. Apparently, initial prices (1995) for large consumers in the countries concerned were too low when compared to the prices for households, due to heavy cross-subsidisation by national transmission companies.

Table 1
Resulting end-use prices (1995 US\$/1000 m³) and profits (1995 10⁶ US\$) for cases PC-ND, PC-D, O-ND and O-D

Country	Sector	Perfect competition		Oligopoly	
		No discr.	Discr.	No discr.	Discr.
		PC-ND	PC-D	O-ND	O-D
Austria	households	190	363	414	500
	industries	178	154	204	192
	generation	176	153	203	191
Belgium	households	139	373	397	510
	industries	127	124	148	141
	generation	125	102	125	108
France	households	195	408	459	562
	industries	183	154	206	188
	generation	180	129	180	151
Germany	households	200	355	332	436
	industries	188	160	198	179
	generation	186	138	183	151
Italy	households	193	540	576	745
	industries	177	183	219	217
	generation	172	136	172	150
Netherlands	households	192	324	372	438
	industries	188	147	194	174
	generation	188	145	193	172
Spain	households	117	366	372	494
	industries	117	125	131	133
	generation	117	111	117	111
UK	households	133	272	292	357
	industries	133	134	155	151
	generation	133	112	133	118
Profits	Producers	34172	56298	22028	33489
	Traders	0	0	29744	12944
	Total	34172	56298	51773	46433

Finally, the impact of changes in the number of traders active in the downstream market was analysed. Assuming an oligopolistic downstream structure, we saw that end-use prices converge to prices corresponding with perfect competition when the number of traders increased. When a large number of traders is active on the same market, the competition

becomes stronger and traders lower their prices in order to retain their market share. Although it is often thought that vertical integration stimulates market power of producers/suppliers and puts the end-consumer into an unfavourable position, the opposite might be true. Given the oligopolistic structure of the upstream industry, it is of great importance to prevent (or abolish) monopolistic structures in the downstream gas market. Tirole already stated 'What is worse than a monopoly? A chain of monopolies'.

In summary, besides the effects of incomplete opening versus complete opening, the results also indicate that the traders behaviour make quite a difference for the end-user's gas price. Price differences compared to the base case are generally stronger in the oligopolistic cases than in the perfect competitive cases. Moreover, price reactions are sometimes opposite; in the perfect competitive cases, prices decline more often. Both conclusions are a logical result of the current institutional structures of the gas markets in most of the Member States. Although these markets are often dominated by a monopoly, the markets are strongly regulated by national authorities, who succeed in maintaining end-use prices close to the marginal cost in the past.

Expectations

Prices Between 2005 - 2008

In summary, under ideal circumstances of achieving full competition the upstream gas market will still be characterised by oligopolistic behaviour of the major gas supply companies on the wholesale market. But oversupplies guarantee probably sufficient competition in the upstream markets in the next ten years. However, in general the gas markets of the eight 'mature' Member States can expect substantial gas price reductions for end-users from liberalisation, in particular if fragmentation of the internal market is avoided and the number of downstream companies is not limited to the incumbent companies. Subsequently, the profits of trade companies will be squeezed in the next years.

In the Member States where we expect a limited market opening, cross border trade and switching of (eligible) customers will be limited, profits will remain relatively high in the transmission part of the gas supply chain to the customer. Consequently it is expected that most of the gas price reductions will be given to industrial and power companies (end users) under competition pressure. However, this will be at the expense of the more smaller customers in these four EU Member States, in order to keep the overall transmission profits constant.

Simulating the emergence of new traders active in the downstream market, challenging the 'former' national near monopoly traders in the other Member States. This will create a downward pressure on consumer prices. Although it is not explicitly analysed here, economic literature (Tirole, 1988) concludes that in the case of both upstream and downstream oligopolies, vertical integration between upstream and downstream might be favourable for the consumers, because vertical integration prevents double marginalisation, i.e., creation of two successive mark-ups, and, therefore, the end-use prices will be lower. At the same time, profits of the vertically integrated company are higher than the sum of profits of the non-integrated companies. This suggests that in the case where monopolistic or oligopolistic competition between

downstream gas companies cannot be prevented, allowing for vertical integration could provide a sensible alternative in Europe.

Changes in the Market Structure

We expect the following changes in trade patterns if gas markets in Europe approach full competition between 2005-2008:

- The share of trade via the pipeline network for transmission will decline and be substituted by volumes of swap deals and other 'paper trade', thereby reducing the transmission costs for consumers. This is because transmission and other auxiliary (storage, quality, etc.) costs are becoming relatively more important in determining the end use gas price in a fully competitive market.
- Consequently EU producers such as Shell, Exxon, Agip/ENI, Winter-shall, etc., which are located closer to their customer markets than most of the non-EU producers, are the 'winners' in the next decade, if attaining a full competition gas market. Their production and trade will increase relatively more than the non-EU producers in the next five or more years.
- Mergers between traditionally upstream competing producers and (national) transmission (trade) and distribution companies can be expected. This trend for vertical integration can lead to price wars at the retail market and thus price reductions and volatility of prices.
- Regions of full competition in Europe will lead to a fragmented 'internal gas market' in Europe and thereby hampering cross border trade and really full competition in the EU.
- The current upstream gas oversupply situation will continue in the next 10 years. However, after about 10 years, more expensive so-called non-EU 'long distance' gas supplies might be necessary to meet the growing EU and CEEC gas demand (assuming reasonable economic growth figures and decoupling of oil and gas prices in Europe). This might lead to small price rises at the EU border and perhaps also too small increases in end user prices. This only holds if the production costs of the EU producers rise even more.
- The relative market positions of Russia and Norway will only gradually change in medium term, in favour of the lowest cost and most reliable producer of these two. Particularly in the EU, Russia's Gazprom will try to expand its market share at the expense of Statoil, if the political situation in Eastern Europe does not change dramatically, and given their strong need for hard currency export revenues. However, changing alliances and development of 'new alliances' between non-EU producers and EU trading companies (vertical integration to reach profitable consumer markets) might change this perspective substantially.
- In the downstream markets, 'product differentiation' will increase. The exact form of this differentiation is still an open question. However, recent mergers of utilities suggest a trend towards the emergence of so-called multi-utilities, which are supplying a package consisting of electricity, gas, water and cable services

to consumers.

Footnotes

¹ The model GASTALE describes the European gas market in terms of two layers of companies that are active on the supply side and consumers that are active on the demand side of the market. It includes sixteen producing companies, a number of transmission companies and three consumer categories per country. It assumes oligopolistic behaviour of supply companies in the wholesale market and can analyse different behaviour of transmission companies in the retail market (Boots, 2000).

² Remember that the producers are assumed to form an oligopoly.

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