

# Structural change in Europe's gas markets: three scenarios for the development of the European gas market to 2020<sup>☆</sup>

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## Abstract

Against the background of the European Union's gas Directive, and the emergence of new players and markets in Europe's gas sector, this paper explores how company actions could shape the future for the gas industry. Starting with an examination of company strategies this paper develops three scenarios for the future: a "Gradual Transformation" scenario where a single European gas market develops that is essentially oligopolistic in nature; a "Vertical Integration" scenario, where upstream and downstream gas companies merge to form a vertically integrated gas supplier; and a "Pull the Plug" scenario, where the current market structure decomposes into a competitive market. These scenarios are examined in terms of their impact on gas prices, demand and the distribution of gas rent along the supply chain. The paper highlights the fact that the EU's gas Directive is not sufficient for the introduction of competition into Europe's gas markets, but that company actions will be the key determinant, and they may favour alternative market structures. © 2000 Elsevier Science Ltd. All rights reserved.

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## 1. Introduction

Although liberalisation of Europe's energy markets has been a common theme for the past ten years or more, it is only now that the gas industry is being opened up to competition. The European Union's gas Directive is paving the way for a third of the EU's natural gas market to be opened to competition, but even before the Directive comes into force there is a momentum developing for structural changes to Europe's gas industry.<sup>1</sup> New players and new markets have emerged onto the European stage, from power generation companies and the development of gas-fired generation, to upstream gas

companies keen to explore downstream opportunities. Existing companies are having to rise to the challenges posed by these new players and new markets and are themselves part of the process of change. Mergers and acquisitions, vertical and horizontal integration, new marketing approaches and alliances with other energy providers are all part of today's gas industry. This is already a different world from just a few years ago, but what of the future? Where are these various pressures for change taking the European gas industry?

This paper explores how these forces for change contain the genesis for radically different market structures, and the key drivers in their development. Three alternative scenarios are constructed, but all are predicated on company actions driving the changes, rather than regulatory and legislative changes forcing through the changes. In this sense continental Europe does not follow the "Anglo-Saxon" model towards liberalisation, as we believe there is less political will in the rest of Europe for the tough regulatory approach adopted in the US and UK. In most European countries, the energy industry is still viewed as strategically important, and although the policy agenda has widened, issues such as security of supply remain and have been supplemented by environmental

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<sup>1</sup> See e.g. Estrada *et al.* (1995) for a historical outline of the European gas industry. See also Stoppard (1996) who focuses on structural changes in the market.

concerns that mean energy is not simply an adjunct to economic competitiveness. That is not to say that competition is not a factor in Europe's future gas markets, but it is more likely that pressure will come from companies and not be imposed by governments. Regulatory action is, therefore, not in the vanguard of change, but reacting to market pressure.

Starting with an examination of company strategies this paper develops three scenarios for the future: A Gradual Transformation scenario where a single European gas market develops that is essentially oligopolistic in nature; a Vertical Integration scenario, where upstream and downstream gas companies merge to form a vertically integrated gas supplier; and a Pull the Plug scenario, where the current market structure decomposes into a competitive market. These scenarios are examined in terms of their impact on gas prices, demand and the distribution of gas rent along the supply chain.

## 2. Current structure and pressures for change

The European gas industry has developed rapidly over the past thirty years, with natural gas now accounting for 20% of Western Europe's primary energy fuel mix, compared to 5% in 1970.<sup>2</sup> The capital intensive nature of the gas industry, with large up-front investments in pipelines, compression stations, storage facilities, network construction and gas-field production, have led to a market structure that not only seeks to spread the risk along the gas chain and over time, but also to balance the market power between producers and consumers.

Gas supply companies have been able to pool consumer demand by acquiring supply concessions or monopoly distribution rights to a particular region/country. This has enabled these supply companies to sign long-term contracts (10–20 yr) that have reduced the uncertainties for the gas producers concerning the volume of gas they can sell. The reduction in market risk and pooling of potential consumers have encouraged the development of the required gas infrastructure and has increased the bargaining position of the gas supply company in its negotiations with the gas producers.

The producers for their part have tended to take on the price risk, by adjusting the price that they sell the gas in line with the price of competing fuels (mainly oil products). This has meant that supply companies have been able to maintain the price of gas at a level that is competitive with competing fuels, while minimising the impact on operating margins of price variations. Monopoly gas supply companies have been subject to government/regulatory control to ensure that all the benefits of the monopolist are not completely captured in higher profits

for the company, but are also reflected in consumer prices.

This pattern of development has ensured that gas has entered the European energy market at competitive prices, while spreading and reducing the risks associated with the high capital costs along the gas chain. This model is suitable for newly developing gas markets where there is no, or limited, gas infrastructure, but it has been questioned in the context of a mature market, where the initial investments have long been amortised and where existing gas supply companies face virtually no volume risk, at least by historical standards. In this context, the main risk is associated with the price the producer's receive for their gas.

However, the factors that supported this market structure are shifting, and primarily because the economics are changing. Pressures are coming from a number of different sources including the fact that:

- The distribution of market risks have shifted as Europe's gas industry has matured, which has reduced the volume risk while the price risk remains. As a result, there is currently more of a price risk than a volume risk.<sup>3</sup>
- Gas rent has shifted downstream as wholesale gas prices have fallen on the back of lower oil prices, while downstream margins have been maintained encouraging gas producers to chase the gas rent down the chain (International Energy Agency, 1998).
- Technological changes have opened a new market for natural gas in base-load power generation, while information technology developments have created new opportunities for gas trading and marketing — BTU vendors and Super Utilities are bundling services together to offer complete energy supply options or retail options to consumers. These new companies are exploiting complementarities between energy markets and other utility services as well as supply-side synergies to offer least cost options to consumers and challenge existing supply structures (Ellis *et al.*, 1999).
- New players have entered the gas sector and have attempted to contract for their gas supplies directly with producers circumventing traditional gas suppliers;<sup>4</sup>
- Privatisation, mergers and acquisitions are changing the ownership and way companies view the gas sector, as well as focusing on maximising company values (Ellis *et al.*, 1999).
- Changes in national and super national energy policies have reduced the emphasis on security of supply and boosted the importance of competitiveness and

<sup>3</sup> A common held industry view articulated by the International Energy Agency (1998) amongst others.

<sup>4</sup> See Estrada *et al.*, 1995 and Radetzki (1990, 1999) amongst others.

<sup>2</sup> Source: IEA energy balances.

environmental issues, which have questioned the monopoly position of many of Europe's gas supply companies. The EU gas Directive, as well as national legislation, is opening up the European gas market and leading to competition between existing national supply companies, foreign supply companies and new entrants;<sup>5</sup>

- Supply availability exceeds European demand — major pipeline developments are occurring across Western Europe based on long-term contracts. However, in the short-term these pipelines have spare capacity that could be utilised to bring existing spare production capacity to Europe from the UK and Russia, the latter's annual surplus production capacity is put at 70 BCM<sup>6</sup> (15% of Europe's total annual demand, around two-thirds of Russia's current exports to Europe);<sup>7</sup>
- The development of a European spot gas market facilitated by the Bacton–Zeebrugge interconnector offers the potential of an alternative price setting mechanism to the current long-term take-or-pay contracts — the current gas bubble could emerge on a European spot market.<sup>8</sup>

It can be seen, therefore, that the EU gas liberalisation process, and other government action designed to open up the gas markets to increased competition, is just one of the pressures being brought to bear on the current market structure. The majority of the pressures stem from company actions initiated by other market developments, independent of initiatives to liberalise the gas industry.

### 3. Company actions lead policy makers

It could be argued that at the heart of the EU's gas liberalisation process is the belief that legislative action will alter the structure of the industry changing company behaviour and the overall performance/competitiveness of the industry — a structure-conduct-performance model for instituting change in the gas sector (the SCP model, Bain (1956)). The EU believes that the introduction of third-party access (TPA) will change the structure of the industry by lowering the barriers to entry, enabling new gas supply companies to enter the industry. This will change the way the existing companies do business, and in theory lead to a much more efficient and competitive market structure.

The EU is not alone in this approach to market reform, with both the US and the UK engaged in, what has

turned out to be, a long series of regulatory changes as policy makers have tried to create the conditions for competition to reign. This unfolding regulatory process continues today in both the US and UK. The fact that there has been a series of regulations indicates that, to a certain extent, legislators have found it difficult to legislate for a competitive market. This not only questions the emphasis on policies to change market structures, but suggests that if the EU follows the UK and US path, then the current gas Directive will be only the first in a series of legislative measures.

However, there are reasons to believe that continental Europe will be less keen to embark on the legislative road, and that the SCP model behind this approach is misplaced. At the heart of our view of gas market developments is the belief that the balance of power between governments and companies is fundamentally different in continental Europe, compared to the UK and the US where there is more of a tradition of government regulation of the market. In continental Europe, government influence has been exercised through the boardroom and government ministries rather than a regulatory body. It is, in our opinion, unlikely that the continental European governments will willingly undertake a more pro-active regulatory role, and the balance of power will increasingly rest with the actors in the market; privatisation is also reducing the power of ministers.

To a certain extent we can see the continental European governments adopting a Schumpeterian (Schumpeter, 1954) view of market developments. Namely that the profitability and relative market security under monopoly and oligopoly are important enabling conditions for companies to undertake risky and high cost investments, such as development of a gas network, and are necessary and acceptable conditions. Competition is not completely lacking in this model, but is manifest in a different manner than that described in neoclassical economic theory.

Competition occurs in the Schumpeterian world through the mere threat that other companies may offer lower prices and take consumers away from an incumbent supplier (i.e. a form of Bertrand competition, Bertrand *et al.* (1883)). As a result, the monopoly company prices its product to prevent new market entrants, which may be closer to the intersection of its average cost and average revenue than its marginal cost and marginal revenue, and therefore closer to a neoclassical competitive price than a monopoly price. Under these conditions there is less of a requirement for governments to intercede in the market, so long as there are no long-term<sup>9</sup> barriers to entry — to do so would impose economic

<sup>5</sup> See Stern (1998) amongst others.

<sup>6</sup> Based on estimates from Cedigaz (News Report 7/8/98)

<sup>7</sup> See Odell (1997) and Stern (1998) amongst others.

<sup>8</sup> Various authors have made this point, including articles in European Gas Matters and the FT Gas Report.

<sup>9</sup> Long-term is used in the economic sense where fixed costs become variable (i.e. the time-frame for investments), which in the gas market are the economic life of the infrastructure — approximately 10–20 yrs.

costs on the industry. It may be questionable whether it can be assumed that there are no long-term barriers to entry, although the EU single market programme should help ensure that condition is met.

What is important, is to understand the dynamics involved in the development of a particular market structure. This means that, unlike the SCP model, we need to place the firm at the centre of our analysis, to see how it seeks to mould its market environment and how it competes against other firms. By understanding the collective behaviour of firms we can see how government policies may attempt to change that behaviour to achieve a given policy objective. Attempting to implement changes to the structure without changing the behaviour of the firms is likely to fail precisely because the firms' will attempt to thwart such changes.

In the context of the European gas industry we can see that there are very good economic reasons supporting the current market structure — large up front capital costs, networks that constitute a major economic investment, the interdependence of upstream and downstream risks and a balance of market power between consumers and producers — that represent strong forces against change. Simply allowing TPA will not diminish or remove those forces, since TPA does not remove their economic rationale. Incumbent companies will continue to operate in a manner that largely supports the current structure and therefore limits the impact of the legislative reforms. All that the EU directive has achieved is to open the door for change within the current market structure, it does not mean that the industry will willingly enter. For change to occur new actors will need to take advantage of the opportunity opened up by the EU legislation and enter the gas market. These new players may have a different set of conducts and performances that challenge the existing structure,<sup>10</sup> but this is by no means certain.

#### 4. Company strategies and alternative market scenarios

##### 4.1. Pro-active versus defensive strategies

When considering the actions of the various market players and their strategies, we need to bear in mind that company strategies are primarily driven by the need to reduce risks and uncertainties and to maximise their potential. This fundamental behaviour provides the motive to reduce costs, maximise profits and enhance the company's value. In addition, companies' strategies are also formed by the need for defensive and proactive

objectives, formulated in the face of competition, market opportunities and changes in the regulatory regime.

Defensive objectives may be to preserve market share and power as well as prevent competitors entering another company's market. Proactive objectives are to try and acquire market share, increase the company's market value and its profitability. In any situation there are a combination of defensive and proactive actions taking place as companies compete. The strategic decisions taken by the market players will reflect the balance between their need to take defensive and proactive actions. Determining the balance between players is the key to the market changes. Can the major downstream players accommodate the aspirations of upstream companies to move down the gas chain, or will the actions of the upstream players undermine the existing downstream companies and the structures built around them? Can existing supply companies meet the needs of a new set of gas consumers, or do new marketing techniques herald their demise?

The type of pro-active and defensive actions that can be undertaken by firms are:

- Erecting barriers to entry — where existing companies seek to prevent other companies entering their industry by raising the entry costs or preventing them gaining access to their customers. TPA is an attempt to reduce the barrier to entry posed by the large cost of licensing and building a gas pipeline. However, there are other techniques for raising the barriers to entry that may partly offset TPA, including the terms of access to a company's pipeline (e.g. hourly balancing and minimum contract lengths), cumulative discounts and contract extensions, as well as the transportation tariffs themselves.
- Horizontal integration — where companies form joint ventures or acquire companies performing similar tasks in adjacent markets (for example, Germany's Ruhrgas moving into gas supply in Central Europe);
- Unbundling/demerger — where companies choose to specialise in one segment of the gas chain;
- Mergers & acquisitions — where companies expand into a new market by merging or acquiring an existing company already operating in that market. This has the advantage of overcoming some of the barriers to entry that may have stood in the way of a simple entry into the new market. However, an increase in merger and acquisition activity could lead to companies placing greater importance on the company value, possibly to the detriment of employees and consumers (reduced wages and benefits for employees, higher prices for consumers);
- Lateral integration — where a company seeks to diversify into an adjacent industry where it feels it has a comparative advantage and where there are links in

<sup>10</sup> This is already occurring in the UK with the development of base-load gas-fired power generation, which is creating a new market and introducing a new set of gas consumers who are challenging the existing supply structure.

demand and supply between the two industries (e.g. power generation, or electricity retailing);

- Vertical integration — where one company seeks to control the entire gas chain and allocate risks and returns within one company.

We have already noted that these actions tend not to be mutually exclusive and an individual company strategy may involve one or more of these actions. Drawing together a number of common strategies will enable us to develop alternative scenarios for the market as a whole. We have put together three scenarios that emerge from the company strategies.<sup>11</sup>

#### 4.2. *Gradual Transformation scenario*

In this scenario the major existing players, to a large extent, manage to contain the emerging competitive tendencies in the gas market and stabilise the structure of a small number of large transmission companies. One of the key assumptions behind this scenario is that competition is largely limited to the existing T & D companies. New companies wishing to enter the market are prevented from doing so by the economies of scale required to compete with the existing players — the large up front capital costs that are only marginally diminished by TPA — and limited access to additional supplies. Gas producers are unwilling to jeopardise existing gas contracts by providing gas to the competitors of the existing T&D companies who the producers are currently supplying.

The possibility of producers displacing existing contracts with new supplies at possibly lower prices is further reduced if producers perceive that there is little room for additional gas demand beyond that already contracted. In addition, existing T&D companies can be expected to erect further barriers to trade to protect their existing consumer base and their existing capital investments. Companies wishing to enter the market may be left with the prospect of fighting for TPA in the courts or building their own pipeline network: both are time consuming and expensive.

Overcoming the barriers to trade and accessing the market can, however, be achieved by acquiring an existing T&D company. This is as true for new companies wishing to enter the market as it is for existing companies wishing to restrict the number of competitors or to expand into a new market. This appetite for mergers and acquisitions could also be encouraged by the possible privatisation of some of the publicly owned T&D companies. Privatisation could provide a relatively easy way

for new or existing companies to enter new markets without leading to a significant increase in the number of T&D companies or a change in the market structure.

Adopting the mergers and acquisitions route to company expansion will result in greater emphasis being placed on the market value of the T&D companies. This could have a quite profound impact on the balance of interests between consumers, owners and employees, and therefore on prices, margins and the distribution of gas rent. Dividend payments will tend to have a higher priority than salaries or consumer prices. The threat of a merger or acquisition could be sufficient to refocus a company on maximising company value by raising its profitability. Efforts would be expected to be made to reduce each company's costs, to eliminate x-inefficiencies and seek better terms for wholesale gas supplies, as well as seeking to maximise their producer surplus at the expense of consumers. The gas producers may be willing to offer better terms to gas supplies if the new contracts involve the T&D companies taking on more of the price risk. Meanwhile, the T&D companies may try to exploit their captive market in order to compensate for any revenue losses suffered in the eligible market: we could see a widening of the gap between prices in the eligible market segment and those in the captive market.

A widening of the price differential between the eligible and captive market segments could lead to calls for greater regulation of the industry to stop exploitation of captive markets. However, if this process occurs in a period of low or falling wholesale gas prices then the fact that the captive market segment does not fully reflect the change in the wholesale price may be politically acceptable. In other words if consumers do not feel they are being exploited, because they are paying low or falling gas prices, then there will be less concern that the T&D companies are earning increasingly larger margins on sales to this segment of the market. Conversely, where there are rising wholesale prices then it may be more difficult for the T&D companies to exploit their captive markets without risking government action.

#### 4.3. *Vertical Integration Scenario*

In this scenario the winning strategy is for companies to control the entire gas chain and to seek vertical integration. The upstream pressure for companies to gain access to downstream rents and exercise greater control in a changing market environment, is matched by downstream companies wishing to gain access to upstream reserves, thus ensuring their future supplies and limiting those available for potential downstream competitors.

A vertically integrated company may enjoy additional economies of scale over existing companies, due to the fact that it is able to internalise the risks and spread them more efficiently along the gas chain (Spengler, 1950). Essentially, one large vertically integrated company

<sup>11</sup> In determining the market impact of these strategies we draw on the works of Cournot (1838), Golombek *et al.* (1995, 1996), Philips (1998), Schmalensee (1982), Spengler (1950), Sutton (1991) and Sweezy (1939).

holds price and volume risks, and it is assumed that the sum of the two risks is less than their individual parts (i.e. holding the price risk can help offset the volume risk). In addition, a vertically integrated company may be better positioned to take advantage of arbitrage opportunities between markets and to exploit its knowledge of the complete gas chain.

Vertical integration, under this scenario, can be expected to extend down to sales of gas to the power sector and large industrial users, it may even extend into the small industrial, commercial and residential sectors. However, it is quite likely that local distribution companies (LDCs) will remain to serve the small gas consumers. This will be especially true if the vertically integrated company is able to acquire most of the rent from sales to the small gas consumers due to its role as the main, or sole, source of supplies to the LDC.

In theory, this vertically integrated structure need not be any more concentrated than today's. However, in practice it is likely to be so, unless gas producers like Gazprom and Sonatrach are broken up into a number of production companies. This seems unlikely from today's perspective. Gas supplies to Europe are expected to be produced from a concentrated group of companies, centred on Gazprom, Sonatrach, Shell/Exxon and Statoil, which together are expected to account for around three-quarters of Europe's gas production by 2020.<sup>12</sup> It is likely that any integration of these companies downstream will involve a number of existing T&D companies such that a more concentrated market structure emerges.

Overall, the balance of interest will largely lie with owners (and possibly employees) at the expense of consumers. In other words, where possible, the vertically integrated company will attempt to exploit any monopoly power it has. This should lead to higher margins on end-use sales, including sales to LDCs. The vertically integrated company may have greater incentives to cut costs, since all the benefits in terms of profits will accrue to the company. Nevertheless, certain consumers may gain relative to today's market structure as the lower cost structure should lead to higher output and lower prices if the vertically integrated company seeks to maximise profits and if the current T&D company is a profit maximising monopoly.

#### 4.4. *Pull-the-Plug scenario*

In this scenario we assume that efforts to erect barriers to entry and restrict new entrants are not the successful strategies. New companies are able to enter the market, but their success rests on being able to offer lower prices to consumers. Given that there are monopoly

profits currently being earned, there appears to be room for new companies to offer price cuts but this begs the question where will the gas supplies come from given that existing long-term contracts cover today's gas requirements?

As we noted earlier, there is currently an excess supply availability that could be tapped into, but in the short-to-medium term any new gas would displace existing long-term contracted volumes. It could be that a single gas producer displaces gas sales from one set of T&D companies and shift it to another with no net volume gain. Alternatively, competition between gas producers could encourage one producer to increase sales in the belief that they will displace another producer's supplies. The displaced volumes will either have to be absorbed by the gas producers or made available, possibly via a spot market, at lower prices.

Whatever the mechanism, this scenario requires the gas bubble to be brought to market. Initially those low cost supplies could be the UK gas bubble arriving at Zeebrugge, but subsequently it would be Russia's gas bubble. It is the arrival of the Russian gas bubble that poses the serious threat to the existing long-term contract market. Therefore, the actions of Gazprom are decisive in determining the outcome of this scenario.

It is one thing to have low cost gas, but it is quite another to equate it with end-use markets. Existing T&D companies, tied to long-term contract gas, are likely to be resistant to allowing competitors to use their pipelines to deliver gas to their customers at lower prices. In this scenario, eligible and would-be eligible customers along with new supply companies have to argue strongly for more transparency and easier access to these low cost sources of gas. Recourse to the courts or the regulatory authorities will be necessary to ensure real access and ultimately it may require greater government involvement to ensure that lower wholesale gas prices are passed through to consumers and competition between distribution companies is brought about.

Competition could ensure that the price customers are charged for their gas reflects the marginal cost of supply. This competitive market means that companies are forced to compete on prices and to that extent consumers' interests increase relative to those of owners and employees (i.e. relative to dividends and salaries). However, a proliferation of downstream companies supplying gas could lead to a shift in the balance of market power towards the producers who are able to exploit this power to capture some of the benefits accruing to consumers.

This scenario leads to a much more competitive market environment, but to achieving it requires greater regulatory control. In other words, regulated TPA needs to be introduced, where there is an integrated transmission and distribution company, to ensure equal access to

<sup>12</sup> Econ estimates.

the transmission network. Essentially the monopoly transmission (high pressure and low pressure) component of the gas chain has to be isolated from the potentially competitive supply and production components. The monopoly component then needs to be regulated to ensure it does not exploit its position, whether it operates as part of a T&D company or as an independent unbundled entity in its own right. Although there is currently little political will to intervene in continental Europe's gas markets, in the medium term this may change. This scenario requires that greater regulatory controls are introduced after 2005 to enable consumers to gain access to low-cost gas supplies.

#### 4.5. Scenario Comparisons

The different scenarios have radically different market structures, but each emerges from company strategies that are present in today's gas market and are initially independent of government action, beyond the introduction of TPA. To that extent they are policy neutral, although they produce results that are more or less favourable for policy makers.

The Gradual Transformation scenario maintains the existing market structure, but the behaviour of companies is radically different as they balance the need to preserve their traditional consumer base with the desire to take advantage of new market opportunities. In this scenario, the adage that "he who owns the consumer controls the market" is true, while the balance between upstream and downstream companies is more-or-less maintained — control of upstream reserves is less significant, however, in a period of excess supply availability. In the Vertical Integration scenario control of customers is not sufficient to guarantee success, but must be joined by control of supplies. This greater control from the well-head to burner tip lowers the risk premium on investments and should lead to lower costs, although primarily to the benefit of the company and less so to consumers. The Pull-the-Plug scenario leads to the most competitive downstream market structure, but in the long-term market power shifts towards the producers (i.e. by about 2010). Nevertheless, prices, costs and margins are expected to be the lowest of all the scenarios, even in the long term, due to the intense competitive pressure experienced in the short term.

## 5. Market implications

### 5.1. Modelling approach

The scenarios may give rise to widely different outcomes as regards prices, quantities and revenues along the gas chain. We have illustrated the possible outcomes by utilising a numerical model of the European gas

market (see Econ, 1997B). End-user prices of gas are generated by sector and country-specific mark-ups over border prices, which vary between scenarios. The model describes gas demand and transport tariffs in Germany, France, the Netherlands and Belgium in some detail (5 demand sectors) while the rest of Continental and UK gas demands are given an aggregate treatment.<sup>13</sup>

The price sensitivity of demand varies across country, sector and time, e.g. entailing little short run but quite substantial long run price effects on demand. There are small price effects in countries where gas has already penetrated the energy sector and stronger effects in countries where there seems to be a noticeable growth potential for the market share of gas (Germany and France). The effects are in general assumed to be larger in energy-intensive industry than in the service sector.

The scenarios differ from each other and the present situation in the mechanisms governing the level of prices and margins, and the effects of different outcomes on income distribution. We outline the quantitative differences between the scenarios by looking at border prices, downstream costs and margins, and the outcome in the form of end user prices, gas demand and profits.

### 5.2. Border prices

The mechanisms determining border prices will differ considerably between the scenarios. Up until now, long-term (up to 25 yr) contracts between national monopolies in production and transmission have been negotiated. Each contract has generally consisted of a base price and an indexation clause where changes in oil, coal or consumer prices automatically trigger changes in the gas price. In addition, the contracts include re-negotiations clauses if the underlying market conditions change significantly.

Under the Gradual Transformation scenario, the existing long-term gas contracts will continue into the future, with gas prices reflecting changes in oil and coal prices. Gas prices for power generation will be priced according to the "indifference principle", i.e. the gas price is set so as to make the buyer more or less indifferent to choosing a coal fired plant. Other gas sales are priced according to the costs of using oil products as energy source; the market value principle. Since gas for power will increase its share of total gas demand, there will in the long run be an increasing discrepancy between average gas and oil prices. A spot market could develop as a mechanism for pricing swing gas, and this component could be removed from the long-term gas contract. In this situation, long-term contracts would set the

<sup>13</sup> Model structure and elasticities draw on earlier work by Econ (1990, 1997A) and others (Atkinson and Manning, 1995; Brubakk *et al.*, 1995).

base-load gas price, while a spot market would price swing gas.

Border prices will also reflect the underlying cost of bringing new gas resources to the European market. We expect that new fields will come from more remote sources and at potentially higher costs than today's supplies. However, at the same time we can expect that the cost of bringing those new supplies to market will fall relative to today's calculations, such that they partially off-set the higher cost of developing more marginal fields (Stern, 1998). We also assume that the "effort" to reduce costs in the scenarios is inversely related to the price of gas. In other words, that effort to reduce costs fall as prices rise and rise as prices fall. The level of effort employed to reduce costs is related to desire to try and preserve or enhance the long-run profitability of the company. This means that lower border prices under a scenario where the gas bubble is brought to market will encourage greater efforts to cut costs to try and preserve the level of profitability of production. As a result, costs may be lower than if the bubble had not been brought to the market.

In the Vertical Integration scenario, tax considerations play an important role for pricing of deliveries within the company — so-called transfer pricing, as is common for multinational corporations. There are strong grounds for believing that integrated companies will try to exploit differences in company taxation between their different host countries, and that they will seek to concentrate profits in countries with low company taxes. If company taxes turn out to be low in Russia, one way of minimising taxes is for the downstream layers of the chain to pay a high border price and impose low consumer tariffs; in other words shift the profits upstream into the low tax country. This produces small taxable surpluses in the

high taxed downstream markets and large taxable surpluses in the low taxed upstream markets. However, other considerations than taxes may be important for the companies' choice over where to place their profits. The border prices shown for this scenario do not attempt to account for possible tax avoidance, but are intended to reflect cost changes and shifts in market power along the gas chain.

The Pull-the-Plug scenario unfolds as a consequence of Russia launching a large fraction of her excess supply into the European gas market. In a relatively short time, this undermines the existing contracts between producers and wholesale buyers, and the border price is determined in a short-run equilibrium between a given (and now rapidly increased) supply and the aggregate demand curve. Since the gas bubble is so large (we assume it to be 40 BCM) buyers seek ways of extricating themselves from their obligations under existing contracts — through contract re-openers and re-negotiation clauses — and instead rely on the spot market. However, since both sellers and buyers of gas may find it in their interests to enter into contracts specifying prices and quantities for some time into the future, we may see a gradual increase in forward contracts after the initial price reductions have materialised. But the time horizon for these contracts will be much shorter compared to the existing Take-or-Pay contracts. In this scenario the basic price determination mechanism is based on the intersection of the short-run supply and demand curve. Prices for contractual deliveries some months or a few years into the future will be linked to this short-run gas price, in similar manner to today's crude oil market.

The assumptions on gas costs and margins are shown in Fig. 1. The border price is the sum of costs and margin, where costs are wellhead prices plus normal rate of return

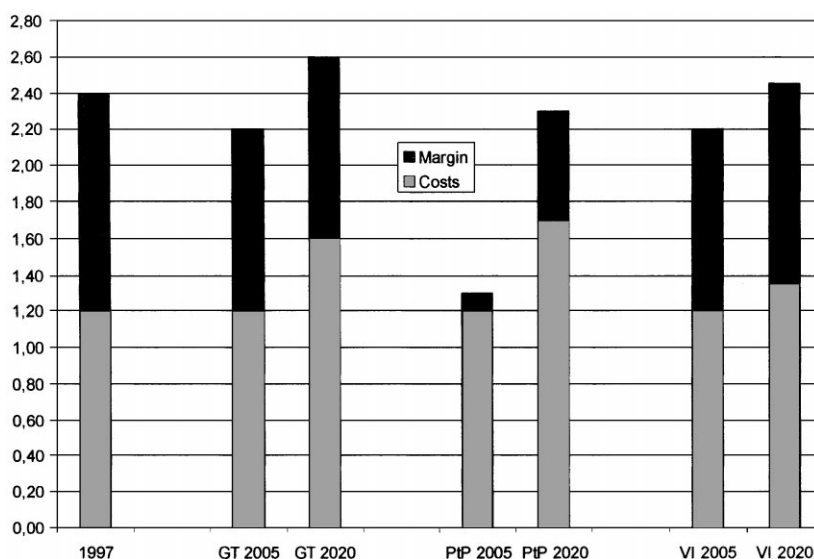


Fig. 1. Upstream costs and margins; border price of gas (USD 97/mBtu).



on transportation to the border. The margin is the difference between border prices and the costs.

Oil and coal price assumptions as well as assumptions on overall economic activity, are common for all scenarios. Real coal prices decline gradually from 40 \$/tonne in 1997 to 30 \$ towards 2020 (1995 prices). The real oil price forecast is based on a gradual increase in annual average prices towards 20 \$/bbl after 2010 (1995 prices).

In the Gradual Transformation scenario, upstream costs are 15% higher in 2020 than in 2005. The relatively low border price in 2005 is due to low oil and coal prices, an effect that is partly reversed towards 2020. The indexation clauses push border prices upwards again, but the price increase is followed by cost increases of the same magnitude leaving upstream margins unchanged.

In the Vertical Integration scenario, the integrated operations will help to reduce market risks and upstream costs below those in the Gradual Transformation and Pull-the-Plug scenarios. Under our assumptions, upstream costs are around 25% lower than under Gradual Transformation in 2020. However, since the competitive pressure between the vertically integrated companies is much lower than in the two other scenarios, upstream margins are higher. Although, it is our contention that the cost savings in this scenario may be sufficient to produce a border price slightly below that in the Gradual Transformation scenario.

The rapidly increasing gas supply between 2000 and 2005 depresses border prices in the Pull-the-Plug scenario. Since gas demand is relatively inelastic in the short run, necessary price reductions must be large for demand to absorb the increased supply of 40 BCM. In our simulations, the price reduction has to be nearly 50% to obtain short-run market clearing. Upstream margins virtually disappear in the short run in this scenario.

The transition to a competitive market will increase market risks, which means that higher returns will be required to entice longer-term investment into the upstream gas sector. This will be considered as higher capital costs. However, low border prices during the gas bubble years must be expected to induce greater effort to cut production costs. As a result, wellhead and international transport costs may be lower than under the Gradual Transformation scenario. The lower costs from improved modes of operation are expected to be smaller than the cost increases from higher risk premia so that costs in 2020 are higher than in Gradual Transformation. Upstream margins are virtually eradicated in 2005 by the low prices unleashed by the gas bubble. Even though we envisage fierce competition between the producers, margins rise slightly in the following years, although they remain lower than in the Gradual Transformation scenario.

In the Pull-the-Plug scenario, gas prices are at each point in time determined by the intersection of the short-run demand curve and the prevailing short-run marginal supply curve (where there is a capacity constraint, the short-run marginal supply curve will increase sharply as it approaches the constraint leading to the marginal supply curve moving vertically along the capacity constraint). As demand gradually grows and prices rise, some investors undertake capacity increases based on expectations about prices in the long run and development costs. If demand increases more rapidly than capacity, we could see periods with high prices and vice versa if supply increases faster than demand.

### 5.3. Downstream costs and prices

Downstream costs and margins constitute a major part of end user prices, in particular for smaller

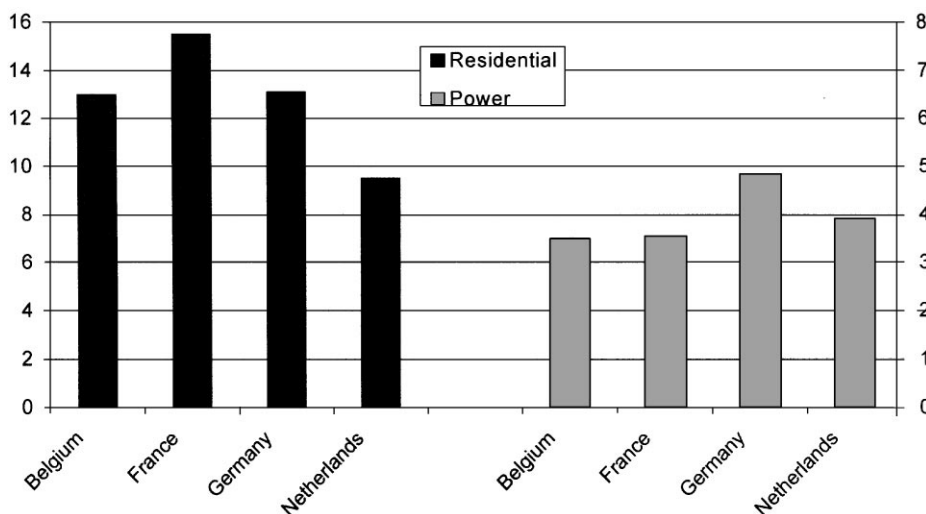


Fig. 2. Residential and power sector gas prices, 1997 (USD 97/mBtu).

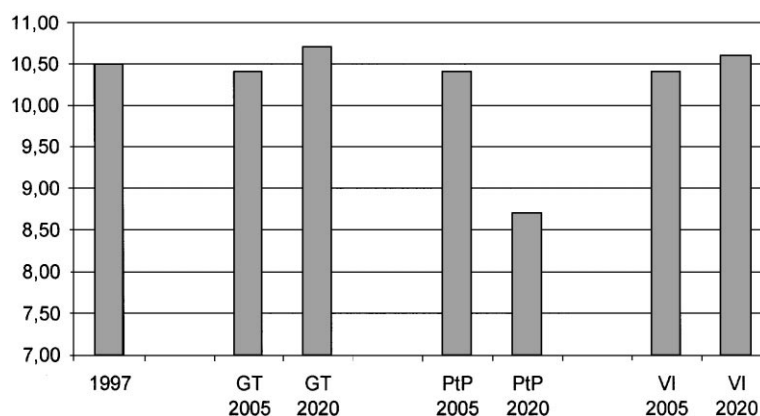


Fig. 3. Indicative end user prices, residential (USD 97/mBtu).

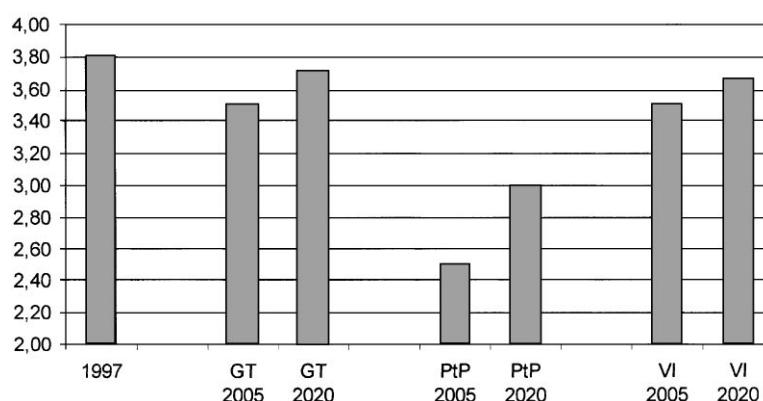


Fig. 4. Indicative end user prices, power sector (USD 97/mBtu).

customers. The changing market structures are assumed to affect costs differently. Fig. 2 shows the actual price levels to the power and residential sectors in Belgium, France, Germany and the Netherlands, while indicative end-user prices are shown in Figs. 3 and 4.

In the Gradual Transformation scenario, the net effect of the pressures to cut costs, raise profitability and levelise prices across countries, will tend to result in transmission and distribution costs being cut over time and margins to large consumers being trimmed. The eligibility of large customers will make margins to large customers converge across countries, with gas prices to large customers declining significantly in countries with high prices. The downstream companies will also try to exploit the captive, low pressure, gas market more intensely. In the low pressure market, the LDCs tend to be restricted in their ability to shop around for gas and they become the captive market of the transmission company covering their region.

In Vertical Integration scenario downstream cost reductions are assumed to be in line or somewhat lower than in Gradual Transformation scenario, as a conse-

quence of larger possibilities for realising economies of scope between traditionally upstream and downstream activities. Since the competitive pressure between different vertically integrated companies is less intense, we assume margins to be slightly higher than in Gradual Transformation scenario. The combined effect of lower border price and lower downstream costs will tend to outweigh the effect of higher margins, according to our analysis. This applies both for deliveries to large industrial customers and small residential ones. The numerical differences in end user prices between Gradual Transformation and Vertical Integration scenarios are negligible, so that the conclusion is that the differences in end user prices may very well be extremely small between these two scenarios.

In the Pull-the-Plug scenario, there are two phases: firstly, large industry users and power companies shop around for their gas leading to reduced margins for sales to these customers; secondly, residential and commercial customers become eligible through effective network regulation. We assume that gas-to-gas competition comes first and that tougher network regulation is only in place

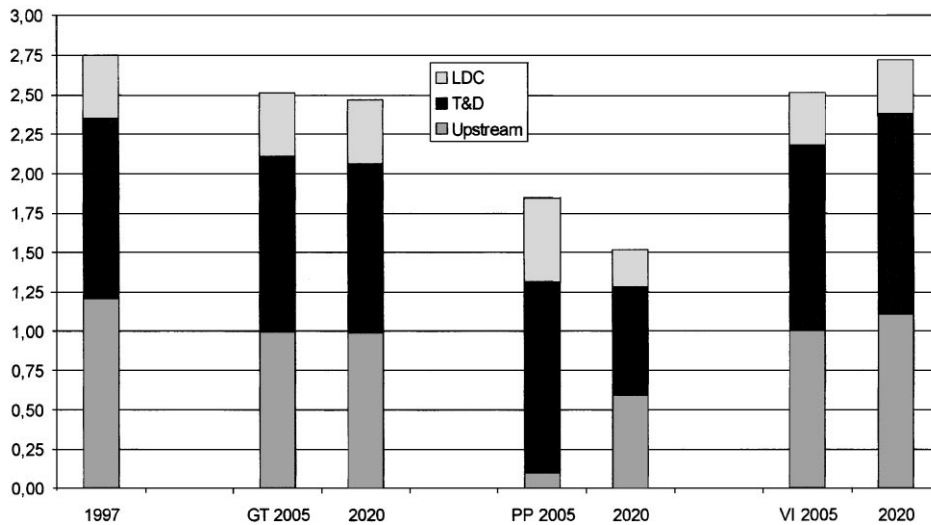


Fig. 5. Indicative average margin by scenario (USD 97/mBtu).

after 2005. The effect is that the drop in wholesale prices is passed on to large users shortly after 2000. The absence of effective regulation of transport networks to low pressure customers means that in the short-term residential prices remain linked to competing fuels, and downstream margins on gas sales to these customers increase as wholesale gas prices tumble.

The Pull-the-Plug scenario may seem very fortunate for gas buyers, except perhaps smaller customers in the short run. One should remember the very conditional nature of this scenario. It is based on the external event of Russia marketing its gas bubble, a successful unbundling of the parts of the downstream sector that are considered as a natural monopoly (the pure transport element) and the parts regarded as competitive (trading, maintenance, etc), and finally the accomplishment of an effective regulation of the natural monopoly elements of the gas chain.

#### 5.4. Margins and rent

To examine the average margins (price above variable costs and normal return on capital) on gas sales along the gas chain we consider the netback value of one BCM of gas. In other words, we need to account for the split in gas sales between high and low pressure markets and their different cost, margin and price structure. If we use the European average of a third of gas sales going into the low pressure market,<sup>14</sup> then the breakdown of margins along the gas chain can be calculated on the netback basis.<sup>15</sup> This is shown in Fig. 5.

According to our calculations, \$2.70 of an average (weighted) end-user market price of around \$6.00 per mBtu could be denoted as the margin in 1997. Out of this margin, LDC's accounted for 15%, T&D's for 42% and upstream players for 43%. The main message is that these shares change only moderately in the Gradual Transformation and Vertical Integration scenarios. In the Pull-the-Plug scenario, however, the share of rent accruing upstream declines substantially in the short run — due to the gas bubble — but then increases such that it too has a similar share by 2020. In fact, it could be argued that the increasing market power of a few large gas producers supplying an increased number of gas supply companies could enable the producers share to rise further in the long run. Nevertheless, the level of the total margin is clearly lowest in the Pull-the-Plug scenario, although the existing transmission companies are exploiting the captive LDC market in the first years after the drop in wholesale prices in 2005.

Production and transport of gas earn rent in excess of normal rates of return. To determine the overall levels of rent in the industry, we need to account for differences in gas volumes sold and differences in margins per mBtu. From 1995 to 2020 gas demand in Europe doubles in all scenarios. Demand displays the strongest growth in Pull-the-Plug scenario, since prices are lowest. European gas demand increases from 400 BCM to around 780 BCM in 2020, implying an average annual growth of 2.7%. Gas demands in 2020 in the Gradual Transformation and Vertical Integration scenarios are approximately equal, while it is 80 BCM (around 10%) higher in the Pull-the-Plug scenario, as shown in Fig. 6.

Using the demand numbers, we find that overall level of industry profits is higher in the Vertical Integration scenario and lowest in the Pull-the-Plug scenario (\$77 billion versus \$46 billion). In fact, gas demand under the

<sup>14</sup> IEA Statistical data base 1998.

<sup>15</sup> The netback value of 1 BCM of gas is equal to two-thirds times the high pressure price of gas plus a third times the low pressure price. If we do the same for costs then the difference will give the netback margin attributable to different stages along the gas chain.

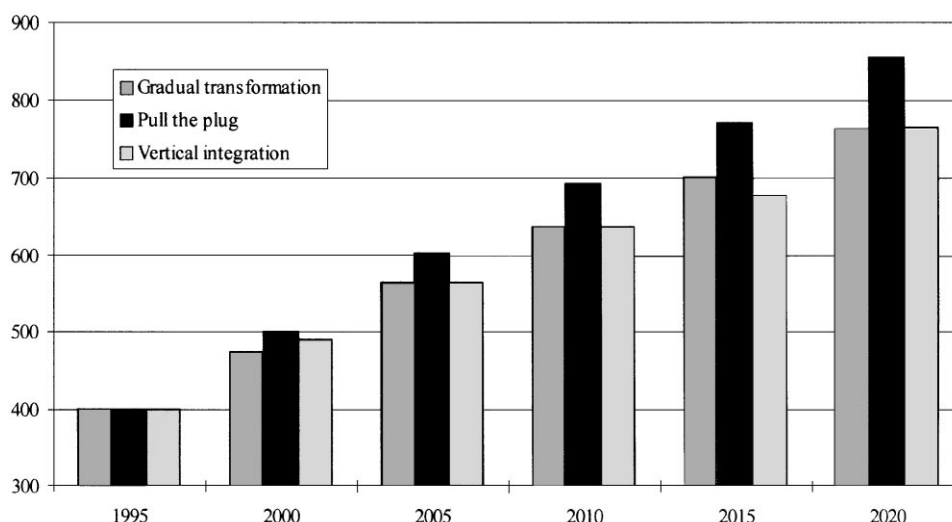


Fig. 6. Gas demand in Europe by scenario, BCM.

Pull-the-Plug scenario would need to be 70% higher than in the Vertical Integration scenario for the two scenarios to have the same overall total profit in 2020 (*ceteris paribus*). This seems to confirm that existing players would prefer the current market structure or further integration, although the total rents in 2020 under the Pull-the-Plug scenario are 15–20% higher than in 1997, suggesting that there are some gains from a more liberalised market.

## 6. Concluding remarks

This paper has highlighted the fact that the EU's gas Directive and TPA is not in itself sufficient for the introduction of competition into Europe's gas markets. All that the EU directive has achieved is to open the door for change within the current market structure, it does not mean that the industry will willingly embrace change. Company actions will be the key determinant and they may favour alternative market structures. Overcoming the barriers to entry posed by the large up front capital costs and the resistance from incumbent companies suggests that the development of a competitive market structure will be difficult to achieve, and instead favour an oligopoly.

Today's gas industry is already very different from just a few years ago. New players and new markets have emerged onto the European stage, all keen to explore new opportunities. Existing companies are having to rise to the challenges posed by these new players and new markets and are themselves part of the process of change. But this is just the transition phase from which new structures will emerge. What that structure looks like will depend on who wins the struggle for change.

Successful company strategies may centre on mergers and alliances as the least cost option for companies to expand or enter the gas market, as well as in "owning the customer" as in our Gradual Transformation scenario, or seeking to control the entire gas chain as presented in the Vertical Integration scenario. Without stronger efforts to separate the monopoly transmission (high pressure and low pressure) component from the potentially competitive supply component, then the development of a competitive market structure will be dependent on producers bringing the gas bubble to Europe's markets and the regulatory authorities helping consumers access these supplies as outlined in the Pull-the-Plug scenario.

One element not discussed in our scenarios is the impact of greater integration of electricity and gas markets. The issue here is the extent of the economies of scope from combined gas and electricity activities. The synergies may be small for sales to large industrial consumers — synergies lie in sales and marketing that constitute a very small part of industrial sales, while there are limited technical synergies in combining gas and electricity that form the major part of industrial sales. Synergies are much greater for sales to residential consumers, where brand names can be more readily exploited and information technology enables greater integration of markets. However, not all residential consumers are eligible to shop around for their gas and electricity supplies, which prevents new companies offering bundling services. Faster and more widespread market opening is required for gas and electricity synergies to be fully exploited.

An examination of the margins under the various scenarios confirms that maintaining an oligopoly or consolidating into vertically integrated companies will yield higher returns than a more competitive market structure.

The incumbent companies have a lot to lose in any move towards greater competition, which will strengthen their resolve to maintain the existing market structure and resist new entrants. Only stronger government intervention could pave the way for greater competition, and only then if it focuses on changing company behaviour such that company actions lead to a more competitive market environment. Competition is unlikely to emerge in supplies to end-users unless access is unrestricted to existing gas networks. How this is to be achieved is open to debate and beyond the scope of this paper, but separation of the monopoly component of the gas chain could be a starting point.

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