
European gas markets have grown to a very large size, and further substantial expansion is envisaged for the coming decades. The paper explores the preconditions and modes for the future expansion of the gas market. It juxtaposes the 'policy driven' model for gas market growth versus the 'do-nothing' model, and concludes that the latter will predominate, supplemented by policy elements to assure supply security and the full environmental benefits of gas. Developments in the UK are unlikely to be a model for the rest of Europe. The gas market on the continent has already been transformed in some measure along the 'do-nothing' model path, with tendencies towards vertical integration, international corporate alliances and the emergence of new agents who accentuate the competitive pressures, and reduce the powers of former monopolies.

Les marchés du gaz en Europe ont pris une très grande ampleur et on prévoit qu'ils vont encore connaître une croissance importante durant les prochaines décennies. L'étude explore les conditions préalables et les modes de l'expansion future du marché du gaz. Elle juxtapose le modèle 'régi par une politique' visant à une croissance du marché du gaz et le modèle du 'Ne rien faire.' Elle conclut que ce dernier prédominera, accompagné d'éléments de politique pour garantir la sécurité de l'approvisionnement et tous les avantages environnementaux du gaz. Les développements en G-B. ne serviront vraisemblablement pas de modèle au reste de l'Europe. Dans une certaine mesure, le marché du gaz sur le continent s'est déjà transformé en s'engageant dans la voie du modèle du 'Ne rien faire.' Cette transformation s'accompagne de plusieurs tendances: intégration verticale, alliances d'entreprises internationales et émergence de nouveaux agents qui accentuent les pressions dues à la concurrence et qui réduisent le pouvoir des anciens monopoles.

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The Transformation of the European Gas Market

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Introduction

Natural gas in Europe represents an industry expected to experience substantial demand growth during the coming two decades. It is however uncertain how this demand potential will affect the organizational structure of the gas industry. Is the European gas industry 'mature' enough in terms of infrastructure? If so, can politicians justify the transition of this industry towards gas-to-gas competition at the transmission and distribution levels? Or is it just intrinsic to gas trade that operations must be controlled by monopolies? Parallel to the public debate that this issue has aroused, gas producers and transmission companies have begun to position themselves for the new type of market which is gradually emerging in Europe. Indeed, existing national gas monopolists in core producing and consuming countries are transforming into the dominating 'integrated Majors' of the pan-European gas trade.

The purpose of this paper¹ is then to review the driving forces that will be shaping European gas industry developments, and to propose an interpretation of the organizational

1/ A more extensive analysis of the arguments presented in this paper and further statistics can be found in Estrada et al. (1995).

structure that could characterize this market some fifteen years from today. To do so this paper discusses a) the background situation justifying present expectations on gas demand growth; b) the possible consequences of gas market deregulation as compared to those that would result from maintaining the organizational status quo; and c) the emerging trends in the organization of the European natural gas industry.

1. The Background

Since the beginning of this decade natural gas has been referred to in European energy policy debates as a fuel deserving a higher share in energy markets. Environmentalists have even qualified natural gas as the fuel required to revivify Europe's greying energy sector. Although this tune sounds familiar today, the political sentiment in Europe was radically different only some seven years ago. Several historical circumstances explain why gas currently enjoys a 'window of opportunity' in European energy markets. Four of these circumstances can help us to draw the main rough features of the overall background picture.

First was the expression of political desire to stop the growth of - and in some cases to diminish the reliance on - Europe's traditional energy supply sources. It began with oil after the price shocks of the seventies, and it was followed by nuclear electricity after the accident at Chernobyl. Finally, also during the eighties, political scepticism reached the domestic coal industry. This happened after recognition of the fact that the excessive costs of domestic coal, its low calorific value and its high sulphur content could hardly satisfy the economic prerequisites of technical progress and market competition. Thus, natural gas was left as the remaining supply option still neutral to public opinion. In other words, the natural gas industry benefited from both its competitive economic structure and its anonymous position in the European energy sector.

Second, gas gained the status of being an environmentally benign fuel for power generation almost simultaneously as politicians recognised that the electricity sector was in

need of major reorganization. Note in this respect that in 1989 the EC removed the 'gas burn' Directive of 1975 which limited the use of gas in the power sector. The building consensus was that, rather than expansion, what the European electricity sector required was consolidation and efficiency improvements. Most European governments considered that the modernization of this sector could be delegated to the market, partially or totally. In the countries where authorities carried out this type of reform, investors soon discovered that gas-based combined-cycle power generation (CCGT) is a flexible and very energy-efficient technology. The rapid spread of CCGT plants in the USA and the UK during the last five years has awakened the investors' interest for gas-based electricity in other countries. Thus, gas-based power generation is today the new 'bench marking' reference for the electricity sector.

Third, by the end of the eighties the pipeline networks of Europe's core gas consuming countries had reached a respectable level of geographical coverage and multinational interconnection. Pipelines could now be extended to smaller communities or to countries at the periphery of core markets. The expansion of secondary distribution networks should enable middle-size consumers to benefit from the economic advantages of combined heat and power systems (CHP). Besides generating electricity for own consumption, end-users could finance part of their investments in modern gas-based equipment by selling their heat and electricity surpluses to the market. The very basis for a new type of energy market, where consumers participate as commercial actors, could now be envisaged. Thus, the debates on deregulation of gas and electricity transportation were of interest to many micro-economic oriented entrepreneurial minds. However, the market actors whose economic interests were at stake, namely the gas and electricity monopolies, soon mobilised to try to convince national and European politicians about the disadvantages of changing the structure of the energy sector. Nevertheless, in the memorable debates that followed, natural gas was handled as the fuel that could ignite

an energy market revolution across Europe.

Fourth, the fall of the Berlin Wall in 1989 symbolised democratic freedom to the populations of former centrally planned countries. However, on the other side of the fence, the same event was perceived as the opening of market clusters from west to east. The modernity of western energy and environmental values could now be exported to countries still living in the darkness of the coal era. The European Energy Charter Treaty, then under preliminary negotiations, was soon interpreted in the OECD as an instrument providing the legal framework for western companies to fetch oil and gas in Siberia. The former USSR was no longer an enemy and Europe should benefit from the Russian transition to market economics. Europe's gas imports could now increase, preferably if mediated by western companies. Thus, gas became the symbol of concrete efforts to achieve East-West integration. The gas industry would also provide the economic means to promote western trade and investments with the European East.

In short, the apparently sudden interest in natural gas seemed to coincide with the emergence of an enthusiastic West Europe. Political concerns were being placed on competitiveness, economic integration, environmental sustainability and reconciliation with the East. Gas fitted well into this picture of renewal because it represented a cleaner fuel upon which to base the future development of the European electricity sector. The high energy efficiency of gas-based equipment and its relatively low investment requirements reinforced the views of Europoliticians about the advantages of energy market liberalization within the Community. National gas and electricity monopolies could now be removed. Thus, gas could also facilitate the process towards the formation of the Single Market while achieving important political goals such as energy supply diversification and compliance with air pollution abatement targets (mainly for SO_x, NO_x and CO₂). Furthermore, the expansion of the gas industry could involve Eastern Europe where gas demand would increase in pace with the region's transition to market economics. Increasingly large volumes of Siberian

gas would then be required in Central/ Western Europe. Additional field and pipeline developments could be carried out with the technical and economic participation of western energy companies. The Energy Charter Treaty would provide the legal framework to facilitate the formation of a pan-European gas market.

Before discussing why the structure of the European gas industry is not evolving in line with this specific vision conceived during the early 1990s, we need to make a short detour to review how key framework variables have actually developed during the last four years. Our discussion will focus on the 'driving forces' and the 'moving actors' presently changing the structure of the European gas industry. We question whether the gas industry can really shoulder 25% to 30% of Europe's energy requirements by the year 2010. How will this demand potential transform the structure of the European gas industry? How can pending gas supply security concerns be addressed? Who will control the European gas industry?

2. Recent and Present Market Structures

Initial Optimism

The West European gas market, as generically denoted, is highly concentrated in six countries (Germany, UK, Italy, Netherlands, France and Belgium) each having a distinctive regulatory and organizational framework. Their combined gas use represents 90% of total consumption in Western Europe.

The present situation in Europe is that in each gas-consuming country gas markets are basically administered by one monopolistic or commercially dominant gas transmission company, with close links to its national government. Excluding the UK whose energy sector has been radically reorganised since the late 1980s, in all other European countries the dominant gas company performs the tasks of securing gas supplies, planning and operating the services required by the market and underwriting the expansion of pipeline networks.

Moreover, although about half of the gas consumed in Continental Europe is produced outside the country of consumption, each country represents a distinct protected market, or as is the case for Germany where a few minor transmission companies exist, by regional demarcation areas. However, the national gas markets of many European countries have now grown to the point where transition towards a new stage of development, characterized by integration between neighbouring countries, can become possible. Current forecasts indicate an extraordinary growth in natural gas demand, from 272 BCM in 1992 to 360-470 BCM in 2010 in Western Europe, and from 58 BCM to 80-105 BCM in Eastern Europe (Table 1).

This consensus view started to build up by the end of the eighties, although at that time markets had been growing quite slowly for some years. Until 1988 the conventional wisdom was that small but constant increases in gas demand in Western Europe were to come from additional customers in the household/commercial sector and from the gradual development of new markets in Scandinavia, the Iberian peninsula, Greece, Turkey and Yugoslavia. Given the apparent saturation of core markets, producers were approaching potential customers in non-traditional regions, even when high transportation costs could leave little room for profits. Observers characterized this period as a gas buyer's market (Estrada et al. 1988).

By 1991 the lukewarm prospect of future gas demand was gone. Gas consumption was again on the increase pushed by the surge in oil prices during the Middle East war. However, behind the renewed optimism was the importance environmental regulations had been gaining on the EC agenda and their potential impact on gas demand. More concretely, the EC had passed directives regulating CO, NO_x and SO₂ emissions from major combustion plants (EC 1988; EC 1991). Furthermore, the EC Commission was pushing hard to introduce an energy and CO₂ tax building up to the equivalent of \$10/boe by the year 2000 (EC 1992).

But the Commission was not only function-

Table 1: Typical ranges in gas demand forecasts (BCM)

	1988	1992	2010		
			1988*	1991	1992/93
Western Europe	235	272	244-342	450-500	360-470
Eastern Europe	76	58	na	150-220	80-105
Total	311	330	na	500-720	440-575

*In 1988 forecasts did not include East Germany. West European gas consumption that year was 225 BCM.

Source: Estrada et al. (1995).

ing as a 'moving actor' raising the EC's environmental standards. Its aim was also to establish a more competitive framework for energy markets in the Community. The removal of national gas and electricity monopolies and opening for free market access to their grids (third party access or 'TPA'), was seen as a condition for improving the Community's economic and environmental efficiency (EC, 1991a). Other proposals to create competition in the gas and electricity sectors were: the integration of national transmission networks, publishing the prices paid by industry, and disaggregation of company accounts making clear their actual transmission and distribution costs. The last point was regarded as an additional condition to secure 'transit and price transparency' in energy markets, which would then reduce the need for excessive supervision, and facilitate EU's intervention in cases of abuse of market dominance. Similar energy trade principles were proposed for Eastern Europe and the FSU through the European Energy Charter.

The Loss Of Political Momentum

The Commission had thus taken the leadership role to restructure the EC, and its relations with other European neighbours, to form a renewed economic block. Political, economic and social reforms were systematically being proposed to form a European Union. However, for most member states the schedule for the proposed reforms was too swift. Few countries were prepared to commit themselves to these goals. The debilitation of European

economies in 1992 and 1993 was the short term expression of deeper structural problems, most notably the weakening of Germany, currency flotation, high budgetary deficits and difficult GATT negotiations. Solutions to national issues, particularly unemployment, were pressing. Reactions to the proposed EC reforms meant that the role of the Commission in policy making was given a lower status compared to decisions taken at the local and national levels.

The general change in perception of the potential for transformation of the European economic structure also meant a change in the assumptions underlying the high gas demand expectations of 1991. There was also disenchantment with progress in restructuring achieved by Eastern European countries, and their weak financial capacity, to justify a rapid buildup of gas markets. In the EC the political focusing on unemployment also meant that proposals for stricter environmental regulations and increased liberalization in energy markets were placed at a lower priority level. Industry, southern member states and the UK argued against the energy and carbon tax proposal and managed to freeze it. National electricity and gas monopolies fiercely argued against further deregulation attempts by the Commission and obtained the support of their governments.

Other basic factors affecting the gas sector were also changing. The most striking was the decline of oil prices and the building consensus in oil companies that prices under \$18/bbl should be expected for the foreseeable future. Meanwhile fuel oil has been regaining much of its lost competitiveness in the traditional high value segments for natural gas, effectively setting a ceiling for gas price increases.

3. Possible Consequences of Gas Market Deregulation

The initial enthusiasm to promote gas in the energy sector started to recede as the European economic and political environment turned cloudy. The focus on gas moved towards the negative aspects of market deregulation and, thereby, to the risks attached to increasing re-

liance on imported gas reinforced by the fact that 45% of the forecast 2010 demand in Europe has not yet been contracted (Table 2). Three issues deserve especial attention.

The first is the fear for the collateral effects of increasing the market share of gas in the power sector. The second is the arguments put forward by the gas industry in its campaign against deregulation. The third is the latent concern about future cost developments in the gas sector.

Gas and Electricity Monopolists – Complementarity and Mutual Fears

At least 50% of the forecasted growth in European gas demand between 1992 and 2010 is expected to take place in the power sector. Thus, one of the most decisive debates ahead for the gas industry is the liberalization of the electricity sector. However, there are numerous uncertainties about future developments in the power sector. The main questions are long term electricity demand and how it will be covered. The latter also involves the uncertainty about how future regulations on CO₂ and SO₂ emissions will influence the competitive position of the different fuels available for power generation.

Concerning electricity demand, EU forecasts show that the rate of growth in electricity consumption of 3.1 %/year taking place between 1985 and 1990 is expected to grow by 2%/year between 1995 and 2000 and 1.6%/year for 2000 to 2005 (*Petroleum Economist*, 1993). Given this long term flattening of electricity requirements, the key problem for the sector is not so much the expansion of generating capacity as the choice of generating technologies. Actually European utilities are aware of the advantages of promoting a higher degree of efficiency among consumers (demand-side management) rather than investing in additional capacity.

The interesting aspect about gas is that it offers national electric utilities a wide scope of technical, economic and environmental flexibility to achieve adaptation. Its disadvantages are first, that national electricity companies already have large generating capacity based on

Table 2: European Gas Balance Year 2010 (BCM)

	1991	2010		
	Actual	Low	Consensus	High
Demand				
Small users	119	153	173	183
Industry	92	106	122	132
Power gen.	42	92	127	143
Other	14	13	13	14
West Europe	267	364	435	472
East Europe	66	81	92	103
Total	333	445	527	575
Contracted supply	348	288	288	288
Supply gap	-15	157	239	287

other energy carriers, which they will try to use for as long as possible, and second, that major utilities do not have the required confidence in gas as a reliable long term source of supply. This second point is treated below. It should be underlined, however, that the arguments against the use of gas lack important nuances: a) it is a seldom mentioned fact that interfuel competition effectively limits gas prices to end-users; b) even if the relative price of gas increased by 50% from its 1995 level, it would still be competitive against coal in combined cycle plants; and c) one of the main purposes of deregulation is to promote competition between gas suppliers putting an additional brake on price increases. Another purpose is to remove the monopoly profits of transmission companies. Hence gas prices to end-users could actually decline, as has been the case in Britain.

It can thus be argued that the apparent rejection of gas by established electric utilities on the Continent also reflects a defensive attitude to change. The risk consists in the potential for an escalation in deregulatory measures triggered off by the fast multiplication of small scale gas-based power generation units in private hands. One can ultimately say that without liberalization in the electricity sector, gas could end up being used merely as a fuel complementing a system based on other energy solutions like clean coal technologies or a renewed nuclear industry.

The picture changes radically when the electricity sector is deregulated to allow the

participation of independent power producers. For example, in the UK, the privatization of the electricity sector and the reinforcement of the TPA system for gas and electricity was followed by a rush of established utilities and independent power producers to build gas-based combined cycle plants. Besides capital costs being low, CCGT plants can be installed at short lead times and extra units can easily be added in accordance with demand developments. They also offer enormous flexibility to manage daily electricity demand fluctuations. The economic advantages of gas-based technologies to generate electricity are so substantial that reluctant governments on the Continent are striving to accommodate independent power generators in the system, simultaneously endeavouring to preserve the stability offered by public service utilities. Germany for instance, is moving towards a system of tenders to build power stations in response to demand while gradually dismantling regional monopoly rights and structuring a limited TPA system.

It can thus be held that also dominant gas companies on the Continent fear that deregulation of electricity markets could force a similar deregulation in gas markets. As shown below, gas companies argue that any major deregulation in this sector will undermine the reliability of a gas market that currently functions efficiently.

The pressure not only concerns the reliability of additional gas supplies but also the flexibility of deliveries required by power producers. One of the characteristics of CCGT equipment is that it takes only minutes from start to full capacity functioning of a unit. This equipment is thus normally used to meet daily peak electricity demands. Should the number of CCGT units be high, such fluctuations in gas requirements can only be met by major storage capacity or many highly flexible interruptible customers elsewhere in the system. Prices to the different groups of customers need to be balanced. This system can hardly function if it is based on rigid tariffs. Thus, the optimization of the system soon translates into a 'spot' pricing market within the organization of a monopolistic gas transmission company. To make

this system acceptable, full transparency in price formation would be required for all actors involved. To execute this at the national level would probably prove very extensive, intricate and thus costly. A gas monopolist would be likely to prefer a situation with few but large electric utilities where gas is used as base load. In short, we may assume that the fear felt by established gas and electricity utilities of market deregulation is mutual and complementary.

The Campaign Against the Deregulation of Gas Markets

Given the reluctance of Member States to endorse the Commission's initial proposal (EC 1991a) for the liberalization of gas and electricity markets (the 'Transit Directive'), a new approach was proposed in 1991 in which TPA would be introduced in three stages. The first of these stages confirms the consensus already reached at the level of Member States where transit agreements, freely negotiated between the involved parties, are restricted to an exclusive list of national gas pipeline companies. The second, intended for implementation by 1993 but still pending agreement, proposes the introduction of the TPA system for consumers with annual demands above 25 million m³ (e.g., power generators and large industries) or distribution companies representing at least 1% of the market in a Member State. The scope for extending the TPA to consumers with lower consumption levels during the third stage, planned for 1996, would depend on the evaluation of the second stage. The merits, or rather the perceived disadvantages of the TPA system have been the subject of numerous gas industry conferences, books, consultant reports, etc. The arguments can be summarised as follows:

- Degradation of services, as companies no longer have the 'public service obligation' to supply all customers;
- Expensive reforms because transmission companies would have to renegotiate their long term contracts with distribution companies and producers. This could lead to costly litigation;

- Transfer of power to exporters because without monopolies on the purchasing side the consuming countries would be deprived of mechanisms to determine the required diversity in gas imports to achieve security of supply. Producers would then have the market power to raise prices;
- Investment declines because, as uncertainty in supplies and markets increases, so does the cost of capital;
- More expensive gas since the scope for competition between pipelines is limited (the proponents of this view insist that gas transmission is a 'natural monopoly'); and
- Bureaucracy. The system would require cumbersome and costly regulatory supervision.

These arguments, some of them speculative (fall of investments) or weakly consistent (lower security but higher competition), reflect that the overriding scepticism to the TPA system is due to Europe's dependency on a handful of monopolies or quasi-monopolies from gas exporting countries. This would contrast most sharply with the UK or North America where, due to their large gas reserves and multiplicity of producers, TPA represents an efficient form of organization despite its weaknesses such as strong price volatility. This difference in the structure of gas supplies is an important background against which to understand why the merits of TPA in the US or the UK are usually dismissed as irrelevant for the Continent.

The Cost of Future Gas Supply

The key issue that arises in the overall deregulation debate is whether sufficient volumes of natural gas at competitive prices will be available to justify the expected increase in gas demand, e.g., to the levels assumed by the highest demand forecasts. It is true that gas producers will normally invoke the argument of higher future costs to secure better prices and conditions for their projects. However, present assumptions on the future cost of 'marginal' projects should be open to discussion. In order to get an idea of what is likely to be the price of gas at different levels of delivered supplies

into Europe (regardless of final destination), we can build a tentative 'gas supply curve' for the year 2010. To do so we can assume a *ceteris paribus* situation where only the price of gas increases, while all other energy market factors remain unchanged.

The elements to build a long-term supply curve are presented in Table 3. With this information, one can build a first curve defined by the marginal cost of the last unit of supply, another by the weighted average cost of an additional tranche of gas supplies, and the third by the weighted average cost of all supplies. In economic theory the last two lines are often dismissed as 'irrelevant' in a traditional supply-demand analysis. However, the assumption that present cost estimates of 'marginal' projects will be representative for the future gas price developments should be open to discussion. According to economic theory the price at the intersection between the supply and demand curves is defined by the cost of the last unit of output. Thus, one can hardly propose an alternative way of analyzing future gas prices without simultaneously challenging basic economic principles. Our aims, however, are less ambitious. We simply intend to highlight the following considerations:

- There are many intermediate points between the cost of already contracted supplies and the assumed cost of 'new generation' gas projects;
- In the long term the gas supply/cost curve seldom increases by steep jumps in an irregular staircase. It normally grows smoothly towards the most expensive projects;
- All experience from oil markets shows that assumed future 'marginal' costs are only reference points constantly challenging geologists, engineers and entrepreneurs to bring projects down to a cost level close to the prevailing market average; and
- Some financial subsidization is always involved in the investments required to expand capacity. This is because companies value infrastructure in place as having a strategic market value, in addition to the fact that its economic life is longer than its pay-back period. However, the way and extent subsidization is involved changes with structural

transformations in the organization of markets.

The results presented in Table 3 show different levels of potential volumes available for European consumption in 2010, and corresponding prices. The first level for example is defined by 'firm' supplies (i.e., contracted import supplies plus production from domestic fields in East and West Europe having been accepted for development by the authorities). The reader will note for example that the 'firm' gas production in the UK by the year 2010 falls to 23 BCM in accordance to existing estimates made by authorities and oil companies on the future gas production from currently producing fields and from fields already accepted for development. The same logic applies to all countries in Europe. We can thus assume that 288 BCM can be delivered into energy markets with oil prices as low as \$18/bbl (in real 1993 US\$) and the same price correlations between oil and gas prices that prevailed in 1991. The reason for this assumption is that since the 1986 fall in oil prices, oil companies test the robustness of their investments by ensuring that projects remain profitable at \$16/bbl.

The next level, here called 'plateau' supplies, represents the plateau deliveries for all presently signed gas import contracts. It has been normal practice to renew these contracts before expiry, though it is not a rule. We can thus assume that an additional 103 BCM of gas could be delivered into Europe at the price level that prevailed in 1991 when the price of oil was particularly high (\$20.5/bbl in constant 1993 US\$). The price of a total of 391 BCM would be between \$2.8/mm BTU, which is the weighted average of 'firm' and 'plateau' supplies, and the marginal price of these additional volumes which is \$3.1/mm BTU.

The subsequent level, here called 'full capacity' supplies, could be at the estimated cost of planned 'new generation' projects. We include only those projects whose investments are already being made or that are regarded by acknowledged sources as being highly probable. We will assume the cost from each of these sources to be the average of available estimates for these projects. The table shows that a possible price for a total of 495 BCM would be

Table 3: European Gas 'Supply Curve' for the Year 2010 (Volumes in BCM. Prices in \$/mmBTU – constant 1993 US\$)

	Firm		Plateau				Full capacity				Ultimate			
	Vol.	\$	Add. vol.	\$	Cumulative	\$	Add. vol.	\$	Cumulative	\$	Add. vol.	\$	Cumulative	\$
Accumulated total	288	2.7			391	2.8			495	2.9			704	3.2
Total			103	3.1			105	3.2			210	4.1		
Production in non-exporting countries	54	2.7			54	2.7			54	2.7	29	5.0	82	3.5
UK	23	2.6			23	2.6	5	3.2	28	2.7	51	3.8	78	3.4
Netherlands	62	2.7			62	2.7	14	3.2	76	2.8	4	3.8	80	2.9
Norway	62	2.8	9	3.1	71	2.8	2	3.1	74	2.8	6	3.3	80	2.8
Russia	37	2.4	84	3.1	121	2.9	53	3.2	175	3.0	36	4.0	210	3.2
Other FSU											20	4.8	20	4.8
Algeria	44	3.0	9	3.0	53	3.0	28	3.3	81	3.1	19	3.5	100	3.2
Nigeria	5	3.4			5	3.4	1	3.4	6	3.4	6	3.5	11	3.5
Libya	2	3.2			2	3.2	2	3.2	4	3.2	4	3.5	7	3.3
Iran											20	4.4	20	4.4
Qatar/M.East LNG											10	3.9	10	3.9
Casual LNG											5	4.3	5	4.3

Prices represent averages for gas delivered into Europe (including regasification costs for LNG). Prices are anticipations based on today's estimates of supply projects, including a normal return on invested capital. According to *World Gas Report* (1994), the average price of gas supplies in Western Europe was \$2.42/mm BTU in July 1994. Volume decimals are rounded to closest unit.

Background sources: CEDIGAZ (1993); IEA (1991); IEA (1993); IEA (1994); Prior (1994); proprietary consultants reports by Arthur D. Little (1991); Purvin & Gertz (1992 and 1994); and WEFA Energy (1992); and gas trade magazines.

found between two levels. The lowest is the composite price of \$2.9/mm BTU obtained from the weighted average of the cost of all possible supplies. The highest is at \$3.4/mm BTU defined by the most expensive gas in our list of projects. The 'middle of the road' price would be the weighted average *marginal* cost of this additional gas at \$3.2/mm BTU. As we can see, the total supplies at this point are almost equal to the expected 'consensus' gas demand in Europe.

The last level here called 'ultimate' supplies, can be placed at the level that oil industry officials have declared to be the 'maximum' volume their countries could deliver into European markets by the year 2010. This list includes gas export projects reported by industry magazines as being 'under consideration.' Thus, it includes projects that are highly uncertain and whose cost estimates vary substantially depending on assumed volumes and export routes. Here again the possible price for a total of 704 BCM could be found between \$3.2/mm BTU, which is the weighted average of all supplies, and \$5.0/mm BTU, which is the most expensive gas in our list of projects. The

'middle of the road' price would be the weighted average *marginal* cost of this additional gas at \$4.1/mm BTU. However, it should be noted that the total of 'ultimate' supply volumes is well in excess of the 575 BCM of East and West European gas demand assumed in the most optimistic forecasts (see Table 2).

The question here is whether or not a floor above \$3.2/mm BTU for gas prices should anyhow be assumed once the 495 BCM maximum level of 'plateau' supplies has been reached. The answer will depend on whether gas demand by the year 2010 is a peak volume or just a point in an expanding gas market. Such a discussion will be further elaborated below. Meanwhile it should be underlined that the price list presented in Table 3 shows that there is a \$1.7/mm BTU difference between the cheapest and the most expensive of these 'new generation' projects. Thus, the \$4.1/mm BTU weighted average cost of additional 'ultimate' gas supplies could be indicative of the direction European gas import prices could be heading sometime after the year 2010 if demand remains above the consensus 527

BCM/year indicated in Table 2. Supporting this view is the fact that the initial estimates for gas reserves 'originally in place' tend to be adjusted upwards as the geology of the field or gas province is better understood after the start of production. In many cases the cost of a marginal output increase in a producing field will be lower than its current average cost of production. Another factor reducing costs is that exploration and production technologies are in constant development, thus rendering new projects less onerous than industry expectations.

Finally, investment decisions always carry an element of 'strategy,' i.e., the 'synergy' value that the companies involved see in developing a project in order to mark their presence in a market. This translates into a form of cross-subsidization between projects, as for example, developing first the oil reserves of a marginal field and then to use the infrastructure in place to launch a nearby gas project. A 'strategic' element of importance to governments and companies alike, is the fact that once all investments in infrastructure have been made, gas projects tend to become cash cows with performing lifetimes substantially longer than their pay-back period.

The estimates for single projects published by the media can then be seen as reference points, the economics of which are likely to be improved through better technology, increased use of the infrastructure in place, reduction of lead times, flexible scheduling of the investments, application of moderate discount rates and least possible use of debt-financing. Finally, one must also consider the intervention of governments to promote the development of gas export projects. They often do so by softening amortization rules and taxation, giving preferential treatment to the companies that take risks, providing 'hidden' subsidies, allowing companies to cross-subsidize projects, etc.

4. New Framework Conditions for Gas in Europe

We have seen in the previous section that the future cost of natural gas may not represent a

major constraint for the expansion of natural gas demand in Europe, though it will remain a challenge for the gas industry to ensure the competitiveness of new supply projects. On the other hand, the successful solution to this challenge will greatly depend on the future organization of the gas industry. However, given the gas companies' rejection of the market liberalization model proposed by the European Commission, it is unclear what kind of organization and regulatory regime the gas sector will develop to gain the confidence of a larger customer base than today. What the gas industry proposes is to preserve the organizational status quo. The problem is that the present organization was established some decades ago when Europe needed energy supply diversification and gas was a young industry needing protection. The initial stages involved in establishing gas as an energy alternative have now been accomplished. Moreover, the present organization is becoming an obsolete device to optimize the use of the European gas transmission network. It also fails to provide the reliability that markets and politicians have begun to demand before accepting a higher gas share in the energy system of an increasingly integrated Europe. The issue is not whether the status quo in the organization of the European gas industry will remain. The questions are what will change in it and how. Before exploring these questions in section 5, we can advance three emerging elements that will shape the way the organization of the European gas industry will evolve. One is the need to find a credible solution to the potential risk of disruptions in gas supply. Another is to accommodate the new type of commercial operations that are becoming viable as the European pipeline network expands and integrates. The third is to take account of the ongoing positioning that established and new companies are taking in gas markets.

Security Issues

In Western Europe the main warrantee of the present system concerning the stability of gas supplies is that importers can go to joint action

against an exporter attempting to increase prices unilaterally, or due to technical deficiencies or political reasons is unable to deliver as contracted. This underlying security is based on the fact that major consuming countries have a well diversified portfolio of gas supplies and/or that the share of gas in energy markets is relatively low. Furthermore, exporters have not only made substantial investments in export capacity to European markets; they have also concrete plans for their expansion. Finally, Continental Europe counts on some precautionary measures to tackle supply disruptions, e.g., cutting deliveries to interruptible customers, releasing gas from storage and increasing gas production from the Groningen field. So, the current structural risk of deficient deliverability in the West European gas market is low. The situation in Eastern/Central Europe is different due to that region's unilateral dependency on gas imports from Russia. However, the closer rapprochement of these countries with the EU is now placing them in a new geo-political sphere. Eastern/Central Europe is thus gradually being integrated into the West European 'risk-management' structure of the gas industry.

However, in the future the security issue in European gas markets, assuming no organizational change, will be whether each importer will still be in a position to count on neighbours to threaten any difficult exporter, or whether all importers will be just too dependent on their respective suppliers.

In the past, the negotiating power of gas market actors has swung from a buyer's market (e.g., expansion of production capacity in exporting countries increasing faster than demand) to a seller's market, back and forth, with a buyer's market prevailing most of the time. The expansion of gas markets in Western Europe being supply driven, the signal to launch a new supply project is when the excess capacity of existing projects is about to be 'eaten' by increases in demand. During the last three decades the gas industry has become accustomed to lead times being long between the milestones in a supply project. Such long lead times have made possible the early definition of the companies that will import gas from

each of these projects. Thus it has also given these companies plenty of time to sign long term sales contracts with regional and local distribution companies or to make the required pipeline investments in preparation for the volumes that are scheduled for arrival.

In this sense, the expansion of the West European gas industry has been 'supply driven' and its organizational structure has been linked to the particular way of financing large, capital-intensive supply projects. However, this situation is changing at a fast pace, thereby raising the question whether market liberalization should be used to improve the cooperation between gas importing countries in case of unexpected supply disruptions.

During the last decade, the lead times for new gas deliveries have been shortened in certain regions of Europe. With the infrastructure in place, new producing fields and import schemes from the various supply regions are being structured faster than before. Export contracts no longer specify that deliveries will be linked to reserves from a particular field. Expectations of expanding demand conditions have also created an atmosphere of eagerness-to-invest on the part of large gas consumers, regional distribution companies, gas producers, foreign energy companies and a wide range of money merchants. These market actors are chasing the opportunity to jump ahead of the companies that mediate the gas trade and that still stand for the long term coordination and continuity of the gas industry. These pressures should be motivation enough for governments to consider the implementation of a new regulatory framework for the gas industry.

Given this situation, a case can be made for a system that combines a substantial build-up of supply security measures with the development of a new regulatory regime gradually gravitating towards the liberalization of gas transportation. Some general ideas for such a system are discussed in more detail in Estrada et al 1995. Thus, a system of precautionary gas storage can be established at national levels prior to the liberalization of gas markets. The system can then be expanded to the European level. There is no need for a permanent man-

agerial body in this security system. However, a prerequisite for a multinational security system to function efficiently is that the transmission capacity between Member States is ample enough to avoid bottlenecks in case of emergency.

Network Possibilities

Continental Europe currently enjoys a relatively well integrated gas trunkline network. In practical terms, the gas from one supply source seldom transits a straight line in the transmission system, to be consumed at the opposite extreme of Europe. Once the gas enters the network, the seller is not able to know precisely which buyer receives its gas. The seller is paid for the total gas delivered, for instance by the 'dispatching room' of the receiving pipeline company, which in turn invoices the gas to each individual buyer (e.g., the large gas importing companies). This affords the flexibility to swap gas between buyers. In this way, operations of the whole pipeline network are optimised, while the performance of each contract is maintained. This is important because contracts with the different producers involve distinct price formulae and various ranges for the flexibility of daily and annual supplies. The arrangement ties the gas importing companies very closely to each other.

The future characteristics of the emerging European gas pipeline network are being shaped by the dynamics of a market in expansion, e.g., exporters diversifying their delivery points into Continental Europe; gas companies extending the geographical coverage of their transmission and distribution networks; enlargement of storage capacity and the multiplication of interconnection points between pipeline routes. The system is making it possible to tackle more demanding load management tasks. In short, adding new market participants to the gas network is becoming technically simpler. Regions with deficiencies in gas supply diversification, i.e., countries depending on gas from one supplier, need no longer be perceived as isolated market spots; they are becoming part of a continental whole, and by the new century, part of a pan-Euro-

pean network.

Another characteristic of the emerging system is the formation of subcontinental intersection centres for gas supplies and pipelines, or 'hubs.' The more gas is injected at different delivery points, the greater the number of hubs of different sizes will develop across the network. So far the most relevant hub is the one at Zeebrugge in Belgium where gas from Norway, Algeria, Holland and soon also from Britain will meet. Another 'hub' is around the TAG pipeline in Austria where gas from Russia, Norway and one day also from Algeria, southern FSU republics or Iran could meet. The importance of big and small intersection points is not only that they upgrade the flexibility of the system to redirect gas flows but also, that they can function as reference points for the fixation of market prices from different producers, and for the establishment of standard transport tariffs between hubs.

This is a quite new development in Europe enabling the market to handle the gas injected into the network as a politically and commercially neutral bulk of 'domestic' gas. The emerging continental pipeline network can be envisaged as a unitary system because of its high degree of integration. The expansion of the system will in itself release market forces seeking business opportunities anywhere in Europe. In the emerging framework, the separation of gas market regions by country boundaries is becoming a cumbersome organizational device.

Transformation of Market Actors

During the 1990s a quiet and almost invisible streamlining of gas transmission companies has characterised the gas business in continental Europe. One can identify many examples of preparedness to change the ownership structure and investments policy of continental gas companies. This is happening in spite of the strong opposition that transmission companies have expressed against market liberalization and the backing they have received from their governments. The following list of examples is not exhaustive simply because this is an area in constant change. However, this list demon-

strates the strategic positioning currently taking place in the European gas business. Some of the strategies have a clearly defensive character as for example in Belgium where the government is afraid of losing control over its very profitable gas industry. However, even in the cases of defensive moves one can sense a lively market where investors may be perceiving new business opportunities.

PRIVATIZATIONS

- After the unification of Germany, VNG, the national gas company of East Germany was privatised through the strategic sale of shares to various oil and gas companies. Ruhrgas was granted 35% of the company's shares as a measure to secure the integration of VNG into the West European gas network.
- In Portugal the recent establishment of the gas industry involved a government-led process of parallel negotiations with competing European investment groups to choose operators and share owners of the infrastructure.
- In France, plans for the privatization of Gaz de France envisage the exchange of company stocks against the stocks of friendly oil or gas companies ('cross-participation') such as Elf.
- Snam of Italy and ÖMV of Austria are continuously referred to as candidates for partial or total privatization.
- In Central Europe the gas companies of Hungary, the Czech Republic and Poland are in the process of being privatised.

RESHAPING THE OWNERSHIP STRUCTURE OF NATIONAL GAS COMPANIES

- Distrigaz of Belgium. 50% of the company's shares were transferred from Société Nationale d'Investissement to the national electricity utility Tractable. The purpose of this move was to strengthen the economic position of the company in a wider international framework while maintaining national control.
- Gas Natural of Spain. The company is currently a private monopoly with indirect state participation through the oil company Repsol (In 1995 the state holds 40.5% of Repsol, the

rest being in private hands. The government plans to sell half of its Repsol share holding).

EMERGENCE OF NEW GAS TRANSMISSION/DISTRIBUTION COMPANIES

- In Germany Wingas was established in 1989 (then called Wintershall gas). The company has two major transmission pipelines (Stegal and Midal), both of which function on TPA basis.
- In France the Compagnie Générale des Eaux and the Lyonnaise des Eaux - Dumez (water and services companies owning most of the 13 independent gas distribution companies that exist in France) have expressed intentions of rebuilding their district heating networks to distribute natural gas and to explore the possibilities of importing gas directly. Elf Aquitaine plans to strengthen its operations in European gas distribution through its newly formed subsidiary Elfgaz.

DOWNSTREAM VENTURES BETWEEN EXPORTING AND IMPORTING COMPANIES

- The Gazprom model (Russia). Besides a 35% share in Wingas (gas marketing in Germany) and 50% share in WIEH (gas marketing in Europe), Gazprom has established joint ventures and fully owned marketing companies in Poland, Hungary, Romania, Slovenia, Italy, France, Greece, Austria and Finland. Although Gazprom's main intention with its foreign subsidiaries is to market Russian gas, they are also regarded as investments in their own right.
- Statoil (Norway) owns 5% of VNG (Germany).
- A 25-75 Norwegian-German joint venture between Statoil/ Norsk Hydro (Norway) and Ruhrgas/BEB (Germany) was signed in October 1994 to establish a pipeline company, Netra GmbH, that will transport gas in the former East Germany with supplies starting from the Etzel storage in Northwest Germany.

VENTURES BETWEEN GAS AND ELECTRICITY COMPANIES

- Statoil, Norsk Hydro and Statkraft of Norway have established a company, 'Naturkraft' which is to promote power generation projects in Norway and abroad.
- In Austria the Federal Electricity Authority Verbundgesellschaft has bought 32.15 % in the regional gas company Kärntner Elektrizitäts AG.

UPSTREAM JOINT VENTURES

- Algeria. Most European oil companies operate in Algeria. The issue of whether they will be allowed to export gas independently or as a joint venture with Sonatrach is under discussion (e.g., BP).
- FSU. Most European oil companies operate in Russia and southern FSU republics. Gas exports to Western Europe are central to their investment projects.
- Nigeria. Shell, Elf and Agip are shareholders in an LNG export project to Europe.
- Qatar. Italian and French oil and gas companies have been involved in the financing and development of an LNG scheme with gas from the North Field for exports to Europe.
- Libya. Many European oil and gas companies are involved in the potential development of gas fields for exports to the Continent.
- UK. Continental oil and gas companies (Ruhrgas, Wintershall, Elf, Total, Agip, etc.) have increased their involvement in the development of gas fields and transportation systems.

LARGE CONSUMERS AS IMPORTERS

- The national electricity companies of the Netherlands (SEP) and Belgium (Electrabel) have signed import contracts with Norway.
- The national electricity company of Italy, Enel, has been involved in negotiations to import gas from Algeria, Nigeria, Qatar and Norway. Italian legislation has already incorporated a restricted form of TPA designed to facilitate Enel to cover its gas import requirements. Edison Gas and Siciliana de Gas have

been proposed for inclusion in the list of gas companies eligible for inter-gas-companies' TPA schemes.

- In 1989 the chemical giant BASF took the initiative to establish its own gas transmission company, Wingas (see above). An important share of the gas transported by Wingas is delivered to BASF's different plants in Germany.
- Following the recommendations of a Ministry White Paper on the gas and electricity sectors (Mandil report), the French industry will soon be allowed to negotiate gas import contracts.

DIVERSIFICATION OF INVESTMENTS OUTSIDE EUROPE

- BP and Ruhrgas. Foreign investments form part of these companies' core strategy. Interesting in this respect are investments made in US gas transmission companies.
- In the above mentioned Mandil report it is stressed that Gaz de France must pursue a strategy of internationalization.

In addition to this list, the striking multiplicity of 'new actors' in the UK since 1990 should also be noted. These include:

NEW GAS MARKETING COMPANIES

- 35 shippers are active in the commercial and industrial markets

NEW PIPELINE COMPANIES

- Kinetica (a joint venture of Conoco and PowerGen).
- Inter-connector (BG 40%, Elf, Gazprom and Conoco 10% each, and National Power, Ruhrgas Distrigaz and Amerada Hess 5% each).

EMERGENCE OF 'NON-TRADITIONAL' ACTORS IN THE GAS BUSINESS

- ICI, Dow Chemical
- American gas giants (e.g., Enron and Tenneco)
- Marketing companies with direct links to up-

stream production (e.g., Mobil Gas and Alliance Gas, Agas, Quadrant, United Gas)

- Electricity companies trading gas, such as PowerGen and National Power.
- Trading companies (e.g., Accord Gas, IGTL, Phibro, Morgan Stanley)

5. Gas Markets Towards the XXIst Century

The European gas industry is about to enter a period of significant organizational changes. The driving forces behind this situation are many. Some are the result of the 'life-cycle' evolution of the gas industry. Examples of this are the fact that the infrastructure in place is now ample and well amortized, and that new market actors are already testing business opportunities that challenge the position of monopolists. Other driving forces, 'external' to the gas industry are emerging. Examples are the economic integration of the European Union, the uplifting of environmental care as a political priority, the intensifying economic exchanges between West and East Europe and the successful introduction of combined cycle equipment in the power sector. The 'synergy' of these driving forces has created favourable conditions for the future growth of European gas. However, the gas industry has so far failed to convince markets and politicians that it will manage to deliver a reliable and competitive fuel for many decades ahead. It has also failed to convince that the benefits of gas will be equitably distributed between producers, transporters and consumers.

In this section we discuss two alternative roads ahead. One, which we have called the 'policy-driven' model, assumes the intervention of national authorities to deregulate the gas market gradually as the security of the system to tackle supply disruptions is strengthened. Another, here called the 'do-nothing' model, assumes no additional intervention by the authorities on how gas companies and new investors organize their businesses. This model should not be mistaken for the 'deregulated' models that the US or the UK have developed during the last decade. Based on the discussion of these two models, we

point to what we perceive as the likely evolution of the European gas industry during the first decades of the XXIst century.

The Policy-Driven Model

Security measures are one of the prerequisites for strengthening a national gas industry. Another is for regulators and market participants to be gradually acquainted with a new regulatory framework. What the TPA debate has shown is that countries must first develop a new type of organization in the gas sector before they accept opening their borders to competition. However, the interest in liberalization must be initiated at the national level. The process to reach this stage can be divided into stages.

The first step consists in incorporating new rules and to permit actors to be involved at the national level. New actors in the gas transportation business could appear on a marginal basis to finance new investments in infrastructure. The introduction of new rules could be delegated to an 'Independent National Gas Regulatory Agency' whose function would be to ensure that priority be given to projects that increase the flexibility of the system (e.g., hubs, storage) and extend the network towards new consumer regions. All new installations, also infrastructure being refurbished, could then function on Mandatory TPA principles and regulated tariffs. A restricted number of national or regional 'clearing-house' companies could be allowed to buy and sell gas within the country's borders. To achieve this, national pipeline companies must transport and store gas for the 'clearing houses' on stipulated TPA terms.

In the second step, the regulatory body would be given authority to extend import permits. Such permits would depend on the perceived risk of increasing the share of gas from each source in the national portfolio of gas supplies. National pipeline companies would then be obliged to transport and store the gas involved in an imports permit, on a stipulated TPA basis. Once the gas enters the country, it can be traded through 'clearing houses.'

Further liberalization should depend on experience. If the evaluation of results is positive, the merchant and transportation activities of gas companies could gradually be separated into two distinct companies, as existing long term import contracts expire. By then the companies' investments in infrastructure will already have been paid back. Nevertheless, they would retain the ownership of their pipelines and storage facilities. Their merchant role in contrast, would be placed in new companies, to be incorporated as 'clearing-houses' in the new regulatory regime.

At any of the above stages, a government may find it convenient to make a bilateral agreement with a neighbouring country to merge all or certain elements of their national gas markets into one. This would be a natural development for countries sharing the same infrastructure for gas imports. Eventually market and regulatory bridges between countries would be established. A final but central element in this system is the commitment of gas exporters to European markets. The European Union could promote this commitment, by negotiating cooperation schemes with traditional and potential non-EU gas exporters with the purpose of developing gas fields and/or infrastructure intended for European markets. In some cases, as for example with southern FSU countries, the means can be through the involvement of western companies in gas export projects. In others, the measure can be to promote reciprocal investments in the gas sector to strengthen vertical integration. The basis for this type of cooperation is being established through the Energy Charter Treaty which in the long term can become a significant instrument for strengthening the resource base and the reliability of the European gas industry.

In short, the main elements of the new framework would be import permits extended by an independent regulatory office, TPA, controlled transportation tariffs, precautionary stocks and formal security cooperation with other countries.

Security measures and liberalization of gas transportation become more transparent, and thus benefit from stronger political support, when they originate from within each country.

This makes it possible to form an orderly multinational gas market. In the same way, the geo-political reliability of the system is to a large extent the result of vertical integration between producers and consumers.

Once all market elements are in place, the countries having decided to merge their gas markets with other countries will have reached a new organizational platform from which a new era of expansion for the gas industry can take off.

The Evolving 'Do-Nothing' Model

Another way of strengthening the gas sector could be through a probably long but coordinated liberalization process originating from each European country. In this *decentralised* model the 'liberalization' process assumes that once a security structure for the gas sector is in place, market forces can be released but only to the extent that gas market penetration does not endanger the adaptation process that also must take place in other energy sectors. In other words, the European gas market would become a hybrid of national gas markets with different degrees of integration between them, though, in general, at a higher level than at present.

A market development without coordinated liberalization of the gas sector does not necessarily mean that the status quo in the organization of the European gas industry will persist. Structural change can equally well be driven by market forces. However, without a new regulatory framework, it cannot be taken for granted that the European gas industry will adopt a more 'liberal' organization of trade between countries nor that the gas industry will adopt measures to reduce its exposure to supply risk. In a market-driven structural change each country remains an autonomous unit responsible for its own gas security system, actually competing with neighbours for supplies. In this model, regulatory changes are adopted to institutionalise transformations already under development in the marketplace.

The Emerging Market Structure

The importance of market forces in reshaping structure is vividly illustrated by the list at the end of the preceding section of apparently isolated organizational innovations being adopted by market actors since 1989. That list shows that there is an effervescence of strategic investments in the gas sector all over Europe. Companies are positioning themselves in preparation for a more competitive business environment. Even in cases of gas companies where the state is sole shareholder, something that is becoming increasingly uncommon, emphasis is placed on adopting strategies similar to those followed by private enterprises.

Strategic movements are also being influenced by the anticipation of substantial changes in the size and dynamism of the various national gas markets. The most outstanding is the overwhelming expansion of the German gas market, not only in terms of demand but also in terms of pipeline networks, and of the ensuing structural change of the market. Though the gas markets in Italy and the UK will be among the largest in Europe, their peripheral geographical position gives them a peripheral role in the formation of a pan-European gas market. For many years, the rapid changes in the organization of the British gas industry attracted the attention of observers and EC regulators. Many saw the reorganization of the British gas sector as a new fashion that would soon spread over to the Continent: radical curtailment of BG's exclusive rights, mushrooming gas marketing companies and an accelerated demand growth in the power generation sector. In reality a totally different 'fashion' was developing on the Continent.

Since 1989 Germany has become the main scene for the formation of a 'new gas order' in Continental Europe. The initial part of the story is well documented. Russia's Gazprom decided to transfer its custom in Germany, from Ruhrgas to the newly established Wintershall Gas, to develop a new marketing strategy for purposes of obtaining higher economic rent from its gas exports. After some years of hard competition with Ruhrgas, Wingas, as the ven-

ture between Gazprom and Wintershall was later called, managed to become an established gas transmission company in the German market. Eventually Wingas also managed to buy additional long term gas from other sources, primarily from the North Sea where Wintershall has upstream concessions. In 1992/93 Wingas attempted to build an alliance with a small Norwegian oil company, Saga Petroleum, but the deal did not proceed in consequence of opposition from Statoil and Norsk Hydro. In 1994 these two Norwegian companies announced the establishment of a joint venture pipeline company with Ruhrgas and BEB called 'Netra.'

The resulting picture is that of two major competing integrated groups in the German market. Under these two groups there are other smaller domestic transmission companies and local gas distributors which in the course of some years will become dependent upon supplies from the 'Ruhrgas group' or from the 'Wingas group.'

Seen in a wider perspective what has happened is that two of Europe's main gas suppliers, Russia and Norway, have now further committed themselves to the German gas market. The consequences of this will not become apparent overnight. However, ten years on, particularly when the UK gradually moves away from her insular gas policy to secure access to less expensive gas from the Continent, the structure of European gas markets will already have been altered. The North Sea will no longer represent the gas province from which to base the expansion of European gas needs, primarily because the cheapest reserves will already have been committed.

For the rest of Europe the emergence of Germany as the centre of the continental gas market gives rise to new opportunities and challenges. Many countries will benefit from the increase of gas in transit throughout Germany. On the other hand, Germany will have a comparative advantage to gain control over the overall management of gas resources injected into continental Europe. To counterbalance excessive German domination, other continental gas companies might try to convince nearby producers to use their receiving

facilities for landing the gas imports. They could do so either by paying higher prices or by offering producers competitive and flexible transportation to other European countries, including Germany. The latter is for example the strategy currently followed by Belgium and France.

Competition for supplies, expansion of the pipeline network and the multiplicity of joint ventures will lead to increased gas traffic and trade along Europe's main transportation routes, as for example the one from Bacton in England via Zeebrugge in Belgium, to Frankfurt and on to Milan. In border regions with intense transit, where gas theoretically moves back and forth simultaneously, the transmission companies of neighbouring countries are bound to increase their cooperation. The alternative would be for domestic companies to be bought up by the neighbouring country's gas companies. In short, it will become increasingly difficult to delineate where one national market ends and another begins.

In any case, the attention will gradually be placed on gas provinces east of Central Europe: Siberia, the southern FSU republics, the Middle East. In the past the launching of major gas import projects was organised through consortia of national transmission companies from the importing countries in continental Western Europe. In the future consortia will be formed by a new brand of 'coalition companies' aiming at vertical integration with producers. Other possible participants could be the 'refurbished' gas companies of Central and Eastern Europe, since gas markets and networks will tend to expand towards Eastern Europe.

There are no indications that the continued evolution of the 'do-nothing' model will lead to the dismantlement of any of the dominant gas companies in Europe. In essence, the investment-driven process is provoking the development of a new organization of the gas industry in Continental northwest Europe on top of the existing structure. This new organization is an economic network of alliances between the major gas companies of different countries. The alliances are forming the new basis for the vertical integration of the gas in-

dustry, and strengthening supply security in the process.

Conclusions

Gas in the Early Decades of the XXIst Century

The models discussed in the preceding section give possibilities for the reader to test his or her own opinions about the future of the gas industry and to propose other interpretations. We for our part consider that the gas market will primarily be driven by market forces but that ingredients of policy-driven models are likely to be implemented.

There is wide political commitment in EU Member States to the adoption of regulatory reforms aimed at converging towards a more integrated energy market. There is also strong consensus about using policy instruments to soften the negative impacts that energy consumption and production have on the environment at all levels, local, regional and global. Finally, there is a great deal of effort devoted to the Energy Charter Treaty as a policy instrument to harmonize the conditions for international trade and investments in the energy sectors of countries with differing economic and political systems. These three elements will in themselves continue to represent an important background for policy initiatives affecting the European gas industry, mainly driven by market forces, in the direction of more closely coordinated development.

The controversy provoked by the Commission's proposals to liberalise gas trade in the Community can be regarded as a symptom of gradual breakup of the organizational structures that have prevailed in the European gas industry since the 1970s. A clear distinction must thus be made between the arguments advanced by Continental gas companies against proposed market liberalization reforms and the long term strategies that the same companies are adopting. Our interpretation is that while companies will continue to defend their preferential positions in domestic gas markets they will also prepare themselves for a new era characterised by internationalization of the gas industry and by the unavoidable

emergence of competitors in their hitherto exclusive market territories. Heavy investments in infrastructure and carefully planned integrated supply systems are the assets that companies will strive to protect, as these assets provide them with a comparative advantage in future competition.

The formation of the Single Market will push the Member States to implement all required measures to remove the exclusive rights of gas companies, to hinder any potential abuse of market dominance, and to open up their gas markets to foreign competitors in the process.

Market forces along with national and EU policies are bringing about a gradual but clear 'cultural change' in the European gas industry, in East and West alike. Daring entrepreneurial attitudes are slowly loosening up the stiff engineering approach that for many decades dominated gas industry behaviour.

The European gas industry has already entered a period of transition towards a new stage of development. The way this transition process develops will determine whether the European gas industry will reach a peak around the year 2010 and then stagnate or decline, or whether it will succeed in establishing a new platform for continued growth well into the early decades of the XXIst century. If the transition process is driven exclusively by politically-inspired regulatory changes, the gas industry could in some years' time risk being defeated by the commercial competition with other energy industries. Obversely, if driven solely by the impulsive strength of market forces, it could well end up as loser in the fight for the political support required to preserve or expand market positions when the time comes for energy diversification choices to be made. Our impression is that the strength of the gas industry will depend on both, but more on the entrepreneurial initiative of producing and transmission companies to innovate, and build new alliances to secure the further vertical integration of the gas industry, than on the commitment of politicians to the environmental and economic advantages that gas can offer.

The question of whether there is a need for

policy to liberalise gas transportation arises when it is realised that a purely market-driven vertical integration may exclude large regions of Europe from the circles formed by coalitions of companies in central markets. In this sense, too, liberalization of gas transportation will be a prerequisite for the expansion of the European gas industry and thereby for its prospects for growth during the XXIst century.

But, What About the Near Future?

In our view, four distinctive regional organizational systems will tend to develop and overlap in Europe just after the turn of the century.

Starting from the West, in the UK, with an already well established domestic 'free market' for energy, companies will be working on gas projects to integrate England with the Continent. Competition for North Sea gas and for gas coming from the diametral extremities of Europe will gradually lead to gas prices in the UK becoming 'less advantageous' compared to other energy carriers. The way to counterbalance this trend will be, through the increased use of financial trading instruments on a European scale, and by strengthening the involvement of UK oil and gas companies in upstream gas projects.

Another distinctive cluster of gas markets will develop in Continental countries along the Atlantic seaboard. The dominant actors will continue to be the national gas companies. The features of this organization are not expected to differ much from their current state, except that a major transport route is likely to develop by connecting gas supplies coming from Algeria into Spain and moving up to Zeebrugge where it can then link with the 'inter-connector' pipeline to the UK. This route could justify additional pipeline connections to the UK, either by using existing infrastructure in the southern part of the North Sea or by building a new 'inter-connector' between France and England. The interesting element here is the overlap of organizational systems and the conditions for the development of a European gas trading area based on gas from the Netherlands, Norway and the UK. Ample installed capacity in pipelines and storage facilities

could form the basis for the establishment of spot and forward markets, and thereby for the development of related financial services especially designed for the gas industry.

A third area is likely to develop in Mediterranean Europe, with some extension to Northern Africa. The main gas ingredient will be supplies from Algeria and partially from Russia. Gas demand in this region has the potential to grow at a faster rate than in Northern Europe. This could justify the development of LNG trade with gas coming from the Middle East through the Suez Canal as well as the development of gas reserves in Libya, given favourable political conditions. Ample gas reserves of potential LNG exporters from the Middle East must not be disregarded: Abu Dhabi 5.4 Trillion m³ (TCM), Qatar 6.4 TCM and Saudi Arabia 5.2 TCM. The problem with LNG is its high cost. Gas liquefaction and re-gasification are highly energy-intensive, and plants are expensive to build. In addition comes the high investments to build a fleet of LNG carriers. The strategic interests of potential LNG exporters must also be considered. Gas in this region would necessarily be introduced in markets by displacing oil. Whether this type of consideration will still be relevant for Middle East oil exporters after the year 2000 is an issue that is highly uncertain. Supplies can thus represent a constraint on the development of gas markets in the Mediterranean.

The type of organization likely to emerge in this region could conceivably resemble the one in Continental Europe during the 1970s, namely, consortia of national companies backing rigid take-or-pay contracts indexed to oil prices and maybe, some form of counter-trade with the exporters such as delivering engineering and financing for these projects, supplying LNG carriers and components for the plants, or governments granting upstream concessions to the oil companies of gas importing countries.

The fourth region would be Eastern/Central Europe. The main characteristic of this area would be its capacity to become an inter-

mediate station for gas supplies from Russia, the FSU republics and Iran, in transit to Western Europe. Traditionally Eastern Europe has been a gas market reserved exclusively for Russia. After the dismembering of the Soviet Bloc the issue of gas supply diversification became a major priority. Several efforts were made to buy gas from Norway and Algeria but inevitably transportation costs and competition for supplies with Western Europe put an end to these projects. Gazprom has recently reviewed its gas exports strategy towards Eastern Europe, as it is realized that Eastern/central Europe represents a market with solid growth potential. The region has also a strategic importance since it can provide transit or represent a market in its own right for ambitious import schemes for gas from Southern FSU republics or from Iran.

The involvement of foreign companies in building domestic gas markets and transit routes will accelerate the integration of the East/Central European gas industry into the Western European gas market.

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