ENERGY MARKET REFORM

INTERNATIONAL ENERGY AGENCY

REGULATORY REFORM: EUROPEAN GAS

OECD

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FOREWORD

The reform of natural gas markets in Europe is now firmly underway, with the implementation of the EU gas directive. Competition should bring lower prices for consumers. However, Europe faces some important security of supply issues. OECD Europe's import dependency is projected to rise from 40% of gas consumption to 60% or more by 2020. There are relatively few large producer countries. New and expensive long-distance supply projects will be needed to meet growing demand in the longer-term.

This book sets the scene for Europe's demand and supply outlook and reviews the reforms already in place in North America and Great Britain, before considering the specific issues surrounding effective reform in Continental Europe. Rendering efficient service to consumers means lower prices; but it also means secure and steady supplies. The book argues that, properly managed, reform should be beneficial to both objectives.

The new framework for Europe's gas markets is characterised by the introduction of competition among gas suppliers, third party access to natural gas supply infrastructure and a redefinition of the regulatory function of governments. The detailed implementation of this new framework includes setting the terms of third party access, tarification for gas transportation and related services, and the unbundling of functions within integrated gas companies. These are key issues that will determine how far and how fast competition and short-term trading will develop, and how well the new framework will provide for security of supply, both short and long-term. Liberalisation of electricity markets should also stimulate healthy competition between gas and electricity.

The main author of this book is Jochen Hierl. Caroline Varley managed the project.

The book is published under my authority as Executive Director of the International Energy Agency.

Robert Priddle
Executive Director

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INTRODUCTION AND EXECUTIVE SUMMARY

In 1998, the Member States of the European Union unanimously adopted a gas directive with the objective of creating an open internal market for natural gas in Europe and increasing competition while taking due account of security of supply. They committed themselves to implement its provisions by mid-2000. The significance of the Directive extends beyond the EU to the whole of Europe. The non-EU countries aspiring to accede to the EU and the member countries of the 'European Economic Area' will have to implement its basic provisions sooner rather than later. The Directive sets out basic principles for reform of the natural gas market. But countries are left considerable leeway in defining the regulatory framework for the supply of natural gas that is best suited to the specifics of their gas and energy markets.

Earlier IEA studies have shown that current institutional structures based on legal or de facto gas supply monopolies, long-term contracts and oil-indexed pricing have brought Europe the benefits of mature and secure gas supply systems[1]. But they have also brought higher than necessary costs and end-user prices[2] — mainly in gas distribution. These are an unnecessary burden to European economies in a globalising world.

The implementation of the EU gas directive is an opportunity for European countries to reform their gas supply systems, enhance economic efficiency and to maximise the benefits to consumers. But Europe's particular supply situation — growing import dependency and relatively few producers — raises the challenge of introducing effective competition whilst sustaining security of supply in both the short- and long-term.

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1. *See* The IEA Natural Gas Security Study, *IEA/OECD, Paris 1995.*
2. *See* Natural Gas Distribution, *IEA/OECD, Paris 1998.*

Europe's Demand and Supply Outlook

The IEA shares the belief of most European gas analysts that European gas demand will grow strongly over the next 20 years. The IEA's 'World Energy Outlook'[3] projects that Europe will have more rapid demand growth than the OECD's other two regions, North America and the Pacific. Europe's share of natural gas in primary energy supply is projected to reach about one-third in 2020. Most of this demand is expected to come from power generation, where natural gas is particularly cost-effective. The gas penetration of other sectors is already relatively high at European scale.

Given the gas reserves in Europe, most countries have a high gas import dependency. And this dependency is set to increase. About 40% of the gas now consumed in OECD Europe is imported; this figure could exceed 60% in 2020.

There are enough reserves near to Europe to supply future potential demand. A large share of Europe's future needs is already secured under long-term contracts. But more supply projects need to be developed for the period 2015-2020 and beyond. These will only materialise if European consumer markets can make such projects attractive to investors. The European gas consumer markets also face a relatively high concentration of natural gas production in the hands of a few large players: Russia, Algeria and in the North Sea.

Europe must be able to attract new gas supply projects to cover future demand and avoid becoming a victim of producer concentration. These objectives can be met by preserving an attractive environment for gas industry investment and development while creating open, competitive, liquid and flexible gas markets.

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3. See World Energy Outlook, *IEA/OECD, Paris 1998.*

Early Gas Reforms in the OECD

Gas markets that have already been liberalised have yielded clear benefits in the form of increased customer choice and lower prices to the consumer, though it is difficult to assess what part other factors have played in lowering prices.

These benefits have been achieved by bringing producers into competition with each other as well as with a multitude of traders by removing transport monopolies and establishing effective Third Party Access (TPA) to transport. Traders have played a key role as competing suppliers to the end user. Open access to transport and such services as storage has stimulated the appearance of large numbers of traders. By buying gas at one time from one or several producers and reselling it later to others, who in turn may then sell it again, traders are more than just middlemen in the supply chain, they act as competitors to the traditional suppliers.

Countries having already carried out reforms, like the UK and North America, present rather different characteristics from those in Continental Europe. In the US, the sheer number of small low-cost producers provides an essential ingredient to competition, and in the UK, the economic pressures for continuous off-shore production in the British North Sea have left producers no choice but to sell their gas into a highly competitive and volatile market. These systems, on the whole, guarantee low commodity prices so long as production/supply remains strong in relation to demand. But at periods when this ceases to be the case, commodity prices can rise sharply. Inter-fuel competition in these systems has not disappeared but changed character. The prices of competing fuels act as a ceiling and a floor for the price of gas. This is particularly evident in the US. Overall, however, low end-user prices have been the result of intense gas-to-gas competition plus trading and liquidity in both the commodity natural gas and in transport and related services.

Maintaining Security of Supply in a Competitive Market

Because of its import dependency and expected strong growth in demand, Continental Europe faces an important challenge in the reform of its gas markets. Security of supply — in both the short and long-term — is an integral part of ensuring an efficient service to end users, alongside lower prices. Harmonious reform must ensure that security is sustained or even enhanced.

In the short-term, this means preserving diversity of physical supply and providing back-up systems as an insurance against supply failure. It also means maintaining high operational standards to minimise the risk of system failure. In the long-term, there must be incentives for new gas supply projects and infrastructure.

Limiting the fragmentation of the market by ensuring that integrated gas companies have a continuing place in the reformed market is a key requirement. Long-term market and supply development, diversification of physical supply and back-ups require the continued presence of strong integrated companies, alongside other market players. The choice of access regime, unbundling and tarification are key aspects of reform, and they will determine to what extent such companies continue to have a place in the reformed market.

But governments also have an important strategic role to play in monitoring the reformed market's ability to maintain high standards of security. If necessary they must be prepared to introduce measures to support security.

Security of Supply: Meeting the Challenge of Producer Concentration

Europe faces another very specific challenge in the reform of its gas markets. There is a relative shortage of upstream competition. (This is in marked contrast to some other liberalised gas markets, notably the US). This problem can be mitigated by stimulating strong competition and trade downstream (in electricity *as well as* gas). This can be achieved by stimulating flexibility in demand through short-term plant or fuel switching.

Most of the potential growth for natural gas lies in power generation. Given the liberalisation of Europe's electricity sector and the present situation of significant excess in amortised power plant capacity, the market for gas will depend to a large extent on its price competitiveness with other energy sources and technologies in generating electricity.

In the case of multi-fuel power plants, gas will have to compete with other input fuels. The arbitrage in this case will be made on price and on the operational costs of heat or electricity production from natural gas compared with oil products or coal and taking into account the costs incurred in fuel switching.

Electricity generators with a diversified plant portfolio will have an incentive to switch plants or to buy electricity on the short-term market when the price of electricity is lower than the initial cost of producing it from gas. Gas producers and suppliers will have to price their gas to generators in competition with the market price for electricity if they want to sustain or increase sales.

With the establishment of liquid short-term markets for gas, traders and gas consumers will get the opportunity to trade or buy gas on the back of lower gas prices for electricity.

The medium-term outlook for this kind of short-term interfuel competition in power generation is good. There is excess generating capacity and adequate dual-fuel capacity in Europe. It will be important to establish conditions that allow the full exploitation of this arbitrage potential, namely a competitive electricity market with widespread electricity trading. These will provide market-driven incentives to switch fuels as appropriate.

If after the liberalisation of electricity and gas markets, sufficient arbitrage between electricity and gas is generated, producer power will be limited.

In the longer term, adequate fuel switching capability will have to be maintained or developed. The future development of dual-fuel capacity in power generation and in industrial/commercial heat production may need to be encouraged. This could take the form of applying tax incentives for dual-fuel capacity.

Regulatory Reform: Third Party Access

The starting point for reform is third party access to the transport network. Third party access needs to be effective in order to stimulate trade, competition, and liquidity. But it also needs to be organised so as not to deter potential investment in new supply projects and infrastructure.

The choice between *negotiated* and *regulated* TPA is a matter of finding the best balance between competition and security of supply. The advantage of *negotiated* TPA is that it leaves gas companies with more scope for commercially strategic use of their infrastructure and with some autonomy vis-à-vis large producers. The supply situation is likely to remain more transparent. There will come more scope for supply diversification, the building and use of additional interconnections and the contracting of back-up agreements to underpin trade and swap arrangements in case of a supply failure by a given party. This may be important in order to maintain a European industry willing and able to maintain a high level of short-term reliability and to invest in its further development.

On the other hand, *regulated* TPA would render access more effective and less complicated for third parties. Regulated TPA to gas transmission leads sooner or later to open access, which is the most effective means of promoting trade and competition. In the case of a dominant, integrated supply structure, regulated TPA may also be easier to implement and more efficient in terms of immediate market opening. But regulated TPA may undermine security of supply. If price becomes the overriding factor in the consumer's choice of a supplier, consumers may not be prepared to pay for more expensive gas in a diversified supply portfolio.

That said, regulated TPA can incorporate robust security mechanisms. Security of supply can be addressed by imposing responsibilities on transport providers and gas suppliers. For example, market access for gas suppliers could be conditional on meeting minimum technical and financial criteria and safety standards. Guarantees relative to supply could be required, including reserve stocks in storage, back-up contracts or a diversified gas portfolio. Again, it is a matter of balance. Too many onerous conditions on gas suppliers could deter the entry of new players, and the development of sizeable hubs and spot markets and short-term commodity and capacity trade (key to a competitive and liquid market) could be slow to develop. In countries where the current industry structure already contains a number of gas suppliers this is a less pressing issue.

The low-pressure distribution end of the transport network may be viewed differently. This network constitutes something of a natural monopoly (unlike high-pressure transmission, where competition is quite possible). There usually is, in effect, no other way of being a supplier than to access the network. The market consists of many small-volume consumers. They have an interest in the most efficient TPA to maximise their choice of suppliers and benefit from the competition between the latter. (Larger gas users are in a better position to attract competitive gas supplies due to the larger volumes they buy, their lower flexibility requirements or the short-term option of a substitute for gas.) Efficient access is the priority in distribution, and this implies that regulated rather than negotiated TPA is the better choice.

Regulatory Reform: Unbundling

The purpose of unbundling — the process of separating natural gas services and supply into components with each component priced separately — is to secure non-discriminatory treatment for companies seeking access to transport and to ensure that a vertically-integrated transport company does not discriminate in favour of its own gas supply business.

Unbundling also aims to ensure that costs are correctly allocated to a gas company's different activities, such as gas purchase, transmission, distribution, storage and other flexibility mechanisms. This is fundamental for efficient, cost-reflective pricing, as well as being the essential starting point of a non-discriminatory regime.

Unbundling can take different forms. In ascending order, these are: accounting separation, functional separation, operational separation, and divestiture. The choice is, again, a matter of striking a balance.

Divestiture — ownership separation — of transport from gas supply is the strongest form of unbundling. On the negative side, it may lead to inefficient investment decisions, difficulties in negotiations with upstream producers and a disincentive to supply diversification. The ability to contract large volumes from producers cannot be separated from the design and construction of the transport system needed to bring the new volumes to the market. Ownership separation also works against physical supply diversification through swaps. But the great advantage of divestiture is that it removes the ability as well as the incentive to discriminate against other suppliers, thereby greatly facilitating the development of trade and liquidity.

For import-dependent countries, weaker forms of unbundling may thus be preferable to complete separation, in order to secure the conditions necessary for investment and diversification. This argument, however, applies only to the high-pressure transmission network, since the development of *transmission* capacity depends on the construction of new systems. By contrast, *distribution* systems may require extension, but not duplication, of investment since distribution is a natural monopoly. Also, investment in transmission — which is not a natural monopoly — carries more risk, since it can be rendered uneconomic by pipeline competition.

These differences between transmission and distribution suggest that a strong vertical separation of transmission and distribution may be the best approach to market structure. This would allow trade, liquidity and competition to flourish at the distribution level, whilst preserving integrated midstream transmission companies that would be better suited to ensure security of supply.

Regulatory Reform: Tarification of Transport

The pricing of access to transport must be non-discriminatory as between all users of the system, and hence cost reflective. At the same time, it must provide effective incentives for investment in system maintenance and expansion.

The tarification issue poses two practical problems: defining the proper income the transport owner can collect (and which determines his incentives for investment into maintenance and development); and the method of recovery from transport users.

The first issue requires defining the value of the assets and the appropriate rate of return on assets, the period of time over which costs are recovered, tax rates and other economic/financial matters.

The second issue comes down to allocating costs among the various system users. Various allocation methods are available, such as distance-related tariffs or postage-stamp tariffs[4], tariffs which charge for capacity or those which charge for throughput.

Here again, different approaches to transmission and distribution may be warranted. With consumption increasing and trade developing, transmission systems will have to be expanded by further pipeline additions in order to avoid bottlenecks. This implies an approach that takes into account replacement costs. Furthermore, given that in transmission the cost of transport

4. A single transportation charge for all transactions within a defined zone, regardless of the origin or destination of the gas or the distance it has to travel within the zone.

increases with distance, this should also be reflected in transmission system tariffs. In gas distribution, network extension would not need to be addressed to the same extent through addition of large pipelines; and within a distribution network distance matters less. Therefore, a postalised approach may be suitable.

Regulatory Reform: Balancing Services and Storage

Balancing gas flows is an integral part of gas transport and supply. All gas suppliers must meet this requirement. It is, therefore, essential that new gas suppliers be given the same opportunity to contract for balancing services as incumbent suppliers. At the same time, the balancing rules set by transport companies should not be unnecessarily strict; otherwise they could constitute a discriminatory hurdle against entrants. Imbalance charges should be cost-reflective. A further step that might be given serious consideration is the development of a market in balancing services in which third parties would provide these services as well as the transport companies.

Storage is a key link in the gas chain. It performs seasonal and load balancing, security and network optimisation. Storage capacity takes different forms, such as aquifers, depleted gas fields, salt caverns and also LNG peak-shaving facilities. Storage facilities vary significantly among countries. The advent of competition gives storage a new role as a product of commercial value. For example, it can be used to profit from price fluctuations gas prices over time. It can lower the supplier's costs, and provide greater flexibility and security of supply to customers.

Access to storage is not only necessary but also a key source of potential competitive advantage for a supplier.

For operational purposes or to secure a country's strategic supply, a certain amount of storage capacity may be legitimately held back from public access and left with the transport operator. Where unbundling is weak, the use of this capacity should be monitored to ensure that it is used correctly. If a country decides to hold strategic gas reserves in storage, it should adopt clear provisions to distinguish storage capacity held as strategic reserves from the capacity held for commercial and operational purposes, and stipulate the conditions for their handling, build-up and release.

Regulatory Reform: Trading and Eligibility

In order to develop a competitive and liquid market that promotes both efficiency and security trade in gas as well as in transport capacity needs to be encouraged. To generate sufficient numbers of buyers and sellers in a commodity market two conditions are important. First, there must be sufficient transportation infrastructure and flexibility services available so that the commodity can be physically delivered. Second, there must be broad access to transportation in order to stimulate market liquidity. It follows that third party access rights to transport capacity should be given to a wide range of market participants, and that trade in transport capacity should be allowed to take place.

The phasing-in of consumer eligibility for TPA may be useful in a transitional phase, if full eligibility is certain to lead to significant problems of stranded cost (for example, if serious take-or-pay problems in a general way can be anticipated) or undermine investment in infrastructure development, notably in distribution. But a country should avoid lagging behind the opening of neighbouring markets so as not to disadvantage its gas consumers in an ever more integrated European economy.

As already recommended by the IEA[5], local distribution companies should be eligible for TPA and they should at the same time be subjected to TPA themselves.

5. *See* Natural Gas Distribution, *IEA/OECD, Paris, 1998.*

Regulatory Reform: The Institutional Framework

There is a need for strong regulatory institutions in the new competitive environment. Regulatory responsibility needs to be clearly vested with a body independent from the companies that are being regulated. Some countries have gone even further than this and set up authorities independent from the government. Whilst freedom from short-term political pressures is a clear asset, the accountability of such independent authorities is a difficult issue. Regulatory procedures must be transparent and competitively neutral in order to keep a level playing field for competition.

The introduction of competition implies that competition law should be applied to the gas supply industry. This requires either competition authorities or gas regulators (or both) to assume new roles to enforce competition law in the industry. The relationship with competition authorities has to be clarified and effective communication channels between gas regulators and competition authorities have to be built up. This may mean that during the transition, regulatory systems have to be reinforced and more resources will have to be engaged in regulatory activities than in the past.

Regulatory Reform: Other Important Issues

■ Information Access

Good, timely and accessible information regarding supply, demand and prices is critical to participants in a competitive market. Those who have access to such information can trade on it at the expense of those who do not. Market transparency reduces transaction costs and enhances the development of the market. It is important to encourage the provision of good, timely and easily accessible information at the earliest stages of market development.

■ Clear Vision and Determination

Regulatory reform of the gas sector requires a clear vision of a framework for an effective liberalised gas market, and of the changes that are required to develop this. Governments also need a clear political will to sustain the reform agenda through the transition period. This period inherently carries significant uncertainty over regulation and market development. It should be kept as short as possible so as to avoid too long a deferral of important investment decisions.

■ Stranded Costs

Only the costs which were incurred as a result of the transition to a competitive market and which are related to a public service obligation deserve to be considered as stranded. Costs incurred from poor management or which have already been compensated by the company's previous rate of return should not be considered as stranded. Long-term take-or-pay contracts could under specific circumstances constitute a stranded asset. In this case, it may be preferable to seek pragmatic solutions rather than designing explicit provisions from the outset.

■ Harmonisation

This is important to the integration of the national gas markets in Europe. Harmonisation efforts should be applied — by the gas industry as well as by national and supranational authorities — in the following fields: energy taxation (including royalties and concession fees); environmental regulation and standards; technical standards, specifications and practices. For some of these technical areas, full harmonisation is perhaps not attainable. For example full harmonisation of gas qualities may be difficult. In these cases, standard practices should be developed for the day-to-day handling of these problems. Remaining technical barriers must not be exploited to discriminate between market players. A harmonised approach to access regulation and tariffs would greatly enhance integration and market opening. But this may be very difficult to achieve in practice.

Security of Supply

A competitive gas market needs to be monitored and consideration given to regulatory measures or strategic targets to ensure that both the short and long-term security of gas supply is sustained through operational security standards and gas supply diversification.

SETTING THE SCENE

Present Institutional System in European Gas — the Case for Reform

For most of Europe, the gas supply system is or has been characterised by legal or de facto gas merchant and transport monopolies (both in transmission and distribution) that buy from producers and resell the gas on the basis of long-term contracts indexed for the major part on the price of oil products.

Indexation of the price of gas in relation to its competing fuels allows producers and transporters to maximise throughput and unit revenues, and thus, to recoup investment costs in the shortest possible time. This played an important role in the growth of the gas supply grid infrastructure in Western Europe. It also provided a guarantee that returns on gas sales are equivalent to those in oil — an important consideration for an oil producer in the start-up phase of gas supplies.

The system relies heavily on long-term contracts. Such contracts usually extend over a period of 15 to 20 years or more. The prime reason for this is to provide a stable economic basis to guarantee the pay back of the investment in upstream and downstream infrastructure. The latter was of particular importance in the early growth phase of the European gas infrastructure in which markets were still limited, in need of development and provided no alternative outlets for the gas. The length of gas contracts is also important for gas purchase contract negotiations with external producers. Vis-à-vis the few producers, a gas purchaser can negotiate the terms for his future requirements from a stronger bargaining position if he has a diversified portfolio of long-term contracts. Without a time cushion, he could come under pressure to accept gas supplies under less favorable terms.

The merchant gas transport monopolies were put in place, or have been tolerated, partly because of their role in bundling demand.

This proved successful in terms of the large volume offtake — crucial to the realisation of some large projects — they made possible.

In the majority of the countries, distribution was developed by or together with local or regional authorities, mostly in the form of local distribution monopolies. This was instrumental in the rapid development of distribution networks. Some countries, however, chose to integrate gas distribution with the transmission monopoly (e.g. France, UK).

These institutional systems have fulfilled the purpose of building mature and secure[6] gas supply systems. They have provided great benefits to Europe's energy supply in terms of secure energy supply diversification. The drawbacks of these systems are, however, that downstream suppliers have enjoyed or enjoy monopoly positions that provide them with relatively weak incentives for cost-efficiency and customer care. This is particularly the case in gas distribution.[7] The results are higher-than-necessary costs and end-user prices.

This represents an economic cost that may have been justified for as long as the gas supply industry in Europe was young. But most of Europe has now passed this stage. The European upstream gas business has grown into a large industry branch of the petroleum exploration and production sector. And most countries have well-developed gas transmission and distribution networks, most of which are interconnected.

In this environment, by introducing or improving gas-to-gas competition, market forces can be freed that will empower consumers, reduce end-user gas prices, and force companies to increase the quality of the energy services/products they offer. This will add to industrial competitiveness and to domestic consumption — both drivers of GDP.

6. *See* The IEA Natural Gas Security Study, *IEA/OECD, Paris, 1995.*
7. *See* Natural Gas Distribution, *IEA/OECD, Paris, 1998.*

Natural Gas Demand and Supply in Europe — Situation and Outlook

There are two main gas consuming regions in Europe: 'Western Europe' defined as the European Union plus Switzerland[8], and 'Central Europe' including the Baltic States and reaching from Poland to Bulgaria. Turkey — an emerging but fast growing gas market — is a further country with potentially high significance in Europe. Both Western and Central Europe are net importers of natural gas, though in 'Western Europe', the gas industry has succeeded in constituting a highly diversified gas supply portfolio. In 'Central Europe', the supply structure is so far still essentially based on imports from Russia and indigenous production. The countries in 'Central Europe' are still in transition towards market-based economies, and market based gas pricing — a precondition for attracting sufficient gas supplies from the west — only recently started to be implemented.

The European Union and Switzerland consumed about 368 bcm in 1998 of which approx. 43% was imported, from Russia (18%), Algeria (13%), Norway (12%) and other sources (less than 1%). Gas demand in the European Union is expected to increase by about 1/3 by 2010 and 40% by 2020, while indigenous production is set to stagnate. Consequently, the EU's gas import dependency on Russia, Algeria and Norway is expected to increase to over 70%.

Central Europe consumed approx. 74 bcm in 1998 of which it imported roughly 2/3, almost all from Russia. Gas demand in this region could grow by 20% or more during the next decade, while indigenous production diminishes. This will bring its import dependency up to 80% in 2010. But provided physical *and* contractual (swaps) diversification of gas imports is successful, the region's dependency on Russian gas supplies may not increase significantly.

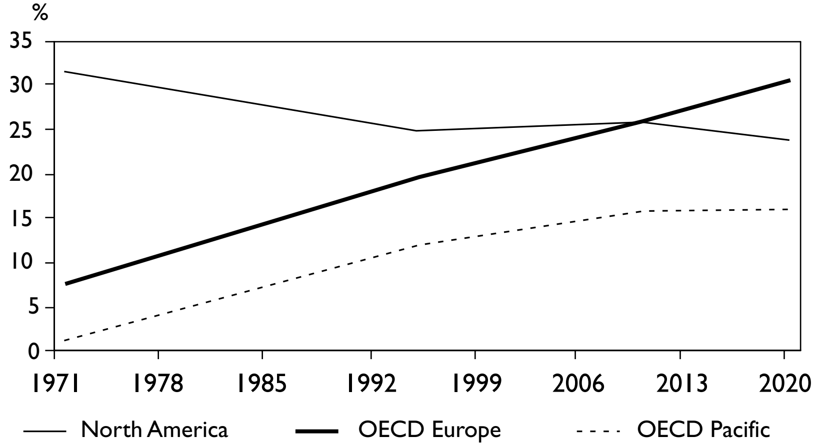
8. Norway, though a major gas exporter, is excluded from these statistics because its own gas market is insignificant.

■ Demand

The rise of natural gas in Europe started in the early 1960s. Since then it has known steady growth, which is likely to continue well into the next century. Present expectations are that by the end of the next decade, natural gas will take a greater share in Europe's energy mix than in North America and any comparable other large world region.

Figure 1

Share of Natural Gas in Primary Energy Consumption

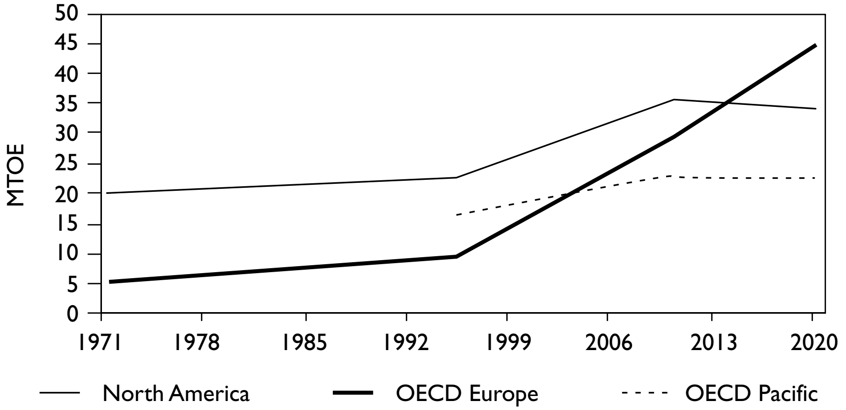


Source: IEA (statistics and World Energy Outlook)

The reasons for the expected demand growth are different depending on the region. In Western Europe, the rapid progression of natural gas in the power generation sector is the main factor. The fact that growth expectations for gas demand in Central Europe are slightly lower (even though still strong) can be attributed mainly to the transition from still artificially low end-user energy prices to market prices, to increasing energy efficiency as well as to a modest economic growth outlook. Motors of growth in gas demand are likely to be the power generation and residential/commercial sectors, whereas demand from industry will most likely remain flat.

Figure 2

Natural Gas in Power Generation



Source: IEA (statistics and World Energy Outlook)

Figure 2 sets the expected dash (business as usual scenario) for gas in Europe's power generation sector in the perspective of the two other OECD regions. The development is impressive, though some differentiation is needed. Not all countries are expected to go for a dash for gas in power. For example, France, Sweden, Switzerland, Norway will probably experience much lower gas growth and penetration rates than Italy, Spain, Denmark or Belgium.

In summary, natural gas has already taken a major share in the European energy mix. And in the medium-term, Europe's reliance on natural gas is expected to increase substantially, especially in power generation where the use of gas had been discouraged until the early 1990s.

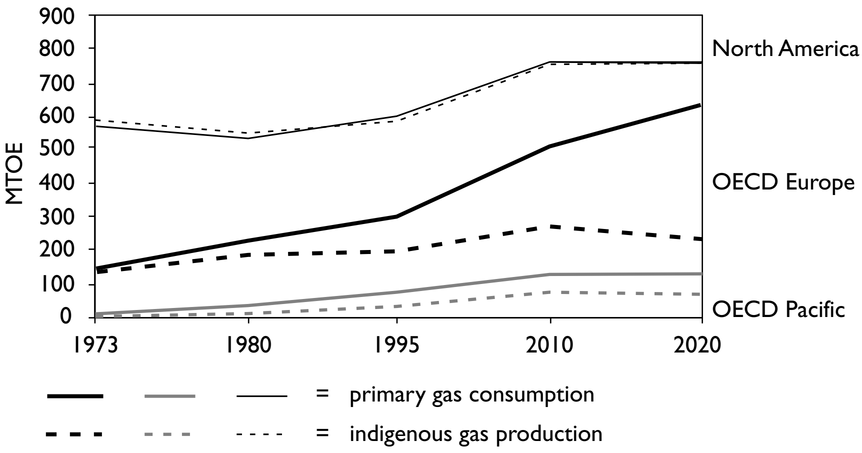
The power generation sector is the last to be penetrated to significant degree by natural gas. This adds a new dimension to gas security. Most mature gas countries have high shares of gas in the household, commercial and industry sectors. If, as expected, similar levels of gas penetration were to be reached in power, the economies in question could at some stage become exposed to gas supply related risks. The diversification factor that natural gas usually offers for the energy mix could then become negative. For comparison, if oil were to regain a significant share in power generation in addition to its near monopoly in the transport sector, concerns would be raised immediately. With gas, the case is less serious given its lighter presence in the total energy balance and its substitutability in almost all its applications. But given Europe's supply situation, it is serious enough to warrant monitoring.

Supply

On the supply side, there is an issue of concentration and above all proximity of gas resources to meet forecasted demand in Europe.

Figure 3

Natural Gas Demand and Supply



Source: IEA (statistics and World Energy Outlook)

Figure 3 shows that OECD Europe is seeing a progressive de-coupling of its gas consumption from its indigenous production (not to be confused with a supply gap). With indigenous production stagnating, sufficient supplies need to be *mobilised* around Europe and *transported* to the European markets. The scale of import dependency sets out Europe as a region different from other OECD regions.

Russia and North Africa, in particular Algeria, have the greatest potential in terms of reserves and distance. But there are economic challenges to the development of sufficient supplies in the long-term, which need to be overcome.

At least up to 2010, transport capacities from the main gas regions to the European borders seem to be sufficient. It is estimated that total annual delivery capacity of the export systems from Russia and Algeria to west European markets currently exceed 140 bcm (Algeria 67 bcm/y; Russia 75 bcm/y)[9]. This figure could increase somewhat with the completion of the "Yamal I" pipeline running from Russia to Germany. This compares with an estimated import need in 2010 of Western Europe of roughly 160 bcm/year[10].

For the longer term, potential demand in Western Europe could bring import needs in the range of 250 bcm/year (2020)[11]. In order to bring these imports to the markets considerable new transport capacity will be needed.

The arithmetic for Central Europe is similar, though on a lesser scale. The need to diversify gas supplies means that transmission pipes are required which can bring gas from western sources (e.g. Norway, Netherlands, Germany) eastward, or that transit pipeline flows can be reversed in case of a serious disruption further upstream in Russian supplies (the latter requires adequate storage and transport capacity in the west).

Given that additional gas transport infrastructure is a major cost factor in gas supply, other more distant gas-rich regions will have difficulty in becoming significant gas suppliers for Europe.

For example, piping gas from the Caspian Sea region on economic terms into Europe beyond Turkey would require a favourable price

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9. CEDIGAZ, Stern.

10. Based on the 1998 IEA World Energy Outlook *and various sources.*

11. Based on the 1998 IEA World Energy Outlook *and various sources.*

Figure 4

Proven Natural Gas Reserves in and around Europe

Source: CEDIGAZ, 1998

level within the European markets. The Caspian Sea region offers a huge supply potential in principle, but its realisation requires the solving of key issues. For instance, before gas companies can contract significant volumes and build the necessary transport infrastructure (e.g. the TransCaspian pipeline project) the region needs a settlement of the transit issues which inspires confidence in potential investors, a perspective of minimum political stability, and the (re) development of the upstream sector. This is likely to require still some time. Last but not least, prices have to be competitive with Russian and Algerian gas.

Meanwhile, a range of alternative or mutually competing gas supply pipeline projects is being considered in the region that could offer Europe possibilities for diversifying supplies, for example gas supplies from Iran, and not least Russia (and other CIS countries) via the "Blue Stream" pipe.

In addition to pipeline gas, LNG supplies offer interesting options for coastal countries, in particular in southern Europe. Here piped gas from Russia and Norway comes at higher prices, which opens economic opportunities for LNG. Nigeria, Trinidad & Tobago and Qatar are becoming increasingly important LNG suppliers to Europe. Other Middle East countries and Venezuela could potentially join the list further ahead in the future.

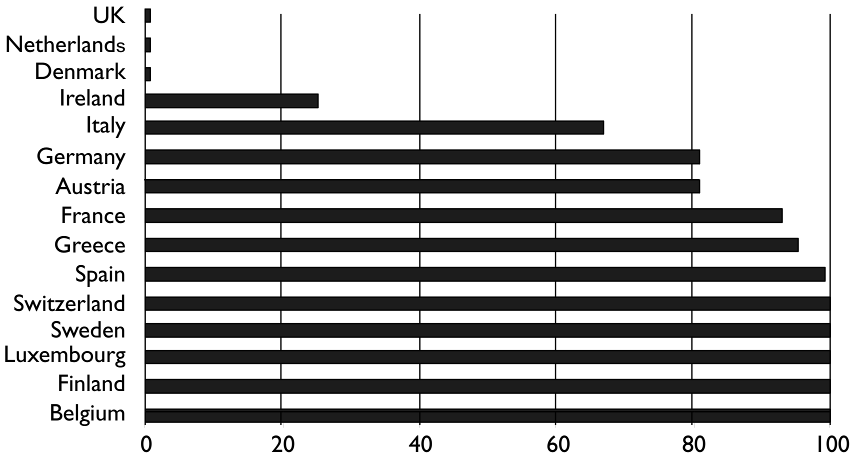
But on the whole, Europe's dependency on its three main gas supplying countries, Russia, Algeria and Norway will increase. These countries each have a monopoly structure for gas export sales. There is currently no evidence that suggests an opening of these structures in the medium term. Russia and Algeria are countries where the stability of gas supplies (both in physical and commercial terms) is exposed to political risk.

The limited number of sizeable sources of production to European markets could also contain a potential for upstream market power during periods of strong demand growth.

Even though this report takes a generic view on Europe, national specifics need to be taken into account. For example, most

Figure 5

Import Dependency of West European Countries (%), 1998



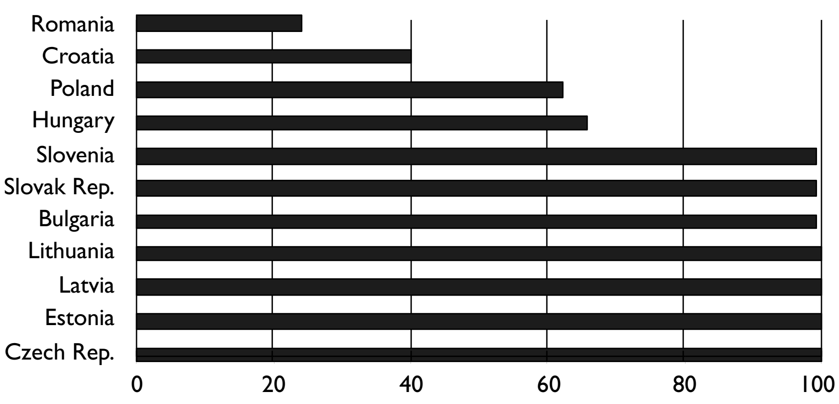
countries have a much higher import dependency than would appear from the European average figure.

In Western Europe, the gas industries have dealt with import dependency by building-up considerable flexibilities — mainly in the form of storage — and diversifying their supply portfolios on the basis of long-term contracts. Both are key in guaranteeing security of supply to the end-user. The latter element — buying large volumes 10-20 years ahead of when they will be needed from a diversified set of producers — also allows the downstream gas industry important flexibility in purchasing contract negotiations. For virtually all western European countries, the gas industries have contracted considerable volumes with a time horizon of 2020 to 2030. The European Commission currently estimates the supply gap between contracted volumes and potential demand at below 10% for the horizon of 2010, but expects a progressive increase during the period to 2020. The industry's task in the coming years is to fill the gap as it progresses in time, as it has done in the past. But the prospect of a competitive market sets additional challenges to individual gas companies in the form of heightened volume and price risks.

In Central and Eastern Europe, gas import dependency is more concentrated on Russia. For historical reasons, import diversification has not been an issue until ten years ago. Subsequently, it was rendered difficult by subsidised low end-user gas prices that kept western European gas uncompetitive. Only with the gradual introduction of market prices in the end-user markets did gas imports from the west become affordable, and could diversification begin. As a result, the share of non-Russian gas imports into the region is still relatively low and need to be developed. The potential supply gaps and the time horizons are comparable with those in the west.

Figure 6

Import Dependency of Central European Countries (%), 1998



■ Market Maturity

Market maturity matters in relation to investment needed for new inland transport and storage infrastructure. With high levels of maturity it can be assumed that there is less need for investment in incremental infrastructure, and that there is already some room in the existing system to provide part of the capacity needed to fulfil growing demand. At the same time, the volume risk connected to forward investment may be somewhat less, because of the higher number of outlets.

Maturity also determines the market outcome when competition and TPA is introduced. Only mature markets can offer the customer choice between suppliers and the kind of liquidity in both commodity and capacity that are needed to get competition going.

Compared to the electricity sector, the notion of maturity in gas is very different. Electricity being an essential, non-substitutable form of energy, maturity in power supply is attained with the full coverage of the country by the grid infrastructure, and with the necessary production and transport capacity in place to cover the demand of the entire economy and population at all times. Natural gas, however, is different in that it is not an essential good. The heat, warmth, or coolness, the electric power or the feedstock that is gained from it can be — and often is — obtained from other sources of energy. There are economically accessible substitutes to natural gas in virtually everyone of its applications. Maturity in gas should thus be measured in terms of how much gas penetration can be achieved under economic conditions in competition with other sources of energy.

Considering this, the state of maturity of the gas market at the downstream is generally high, though not the same everywhere. Maturity is assumed to be achieved when gas penetration of the commercial and household markets is advanced and can only be marginally improved, because these sectors entail the highest costs in terms of infrastructure (distribution) and supply flexibility.

Maturity does not mean saturation, and there is still considerable scope for growth in Europe, particularly in power generation. But the anticipated demand growth from the power sector would, by contrast, require comparatively little investment in downstream transport infrastructure, with shorter amortisation times.

Based on this definition, countries such as the Netherlands, the UK, Germany, Hungary and Italy, but also France, Poland, the Czech Republic and the Slovak Republic can be considered as having mature downstream gas markets. Spain, Ireland and Sweden still constitute “young” gas markets in the sense that still much infrastructure development in both transmission and distribution will be needed in order to reach a state of maturity that is comparable to the countries named above. Greece, Portugal and Turkey are nascent gas countries, in which the development of a country-wide gas supply infrastructure is still at the beginning. A country with a relatively insignificant downstream gas market is Norway. There are projects of gas-to-power schemes that could be realised in the coming years, but gas in Norway is unlikely to penetrate the residential, commercial and industrial sectors in any significant way.

Regardless of the state of market maturity, transport infrastructure is still growing in most countries, but especially in the young or nascent gas markets. Recently added infrastructure is a reflection of anticipated demand growth over the next ten years. Meanwhile, many of these pipelines (such as the UK-Belgium Interconnector, the WEDAL, JAGAL, rTr, ZEBRA, the so-called “artères” in France) constitute in the short to medium term an increase in marginal capacity that is or could be used for short-term trade.

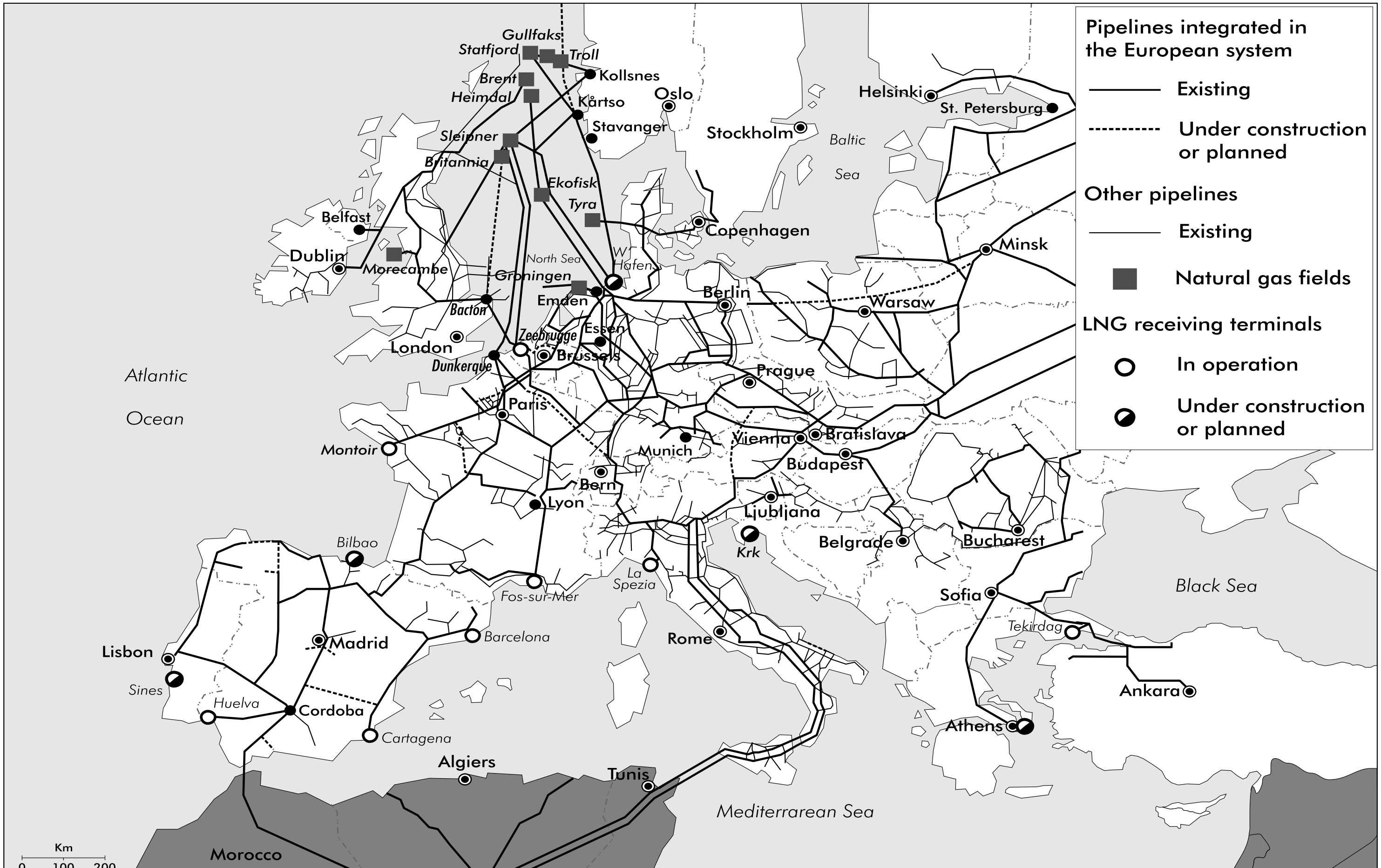
■ Market Integration

Despite national differences, given the highly interconnected gas transmission systems (see gas map, Figure 7) in most of Europe, and given the fact that already today more than half of total European natural gas consumption is traded over at least one border, there are strong interrelationships and interdependencies between these national markets.

With liberalisation, national markets will tend to integrate more. Cross-border trade will grow, and as a result, wholesale gas prices across Europe will converge. This is positive. It would offer a larger

Figure 7

The European Natural Gas Transmission Grid, 1999



outlet potential for the large-scale long-term gas purchase agreements that are necessary to underwrite new supply projects. In normal times, it should also help to keep gas price levels low. In cases where a supply constraint occurs locally or regionally, it will help to bring in alternative supplies from other European markets and level out the price effect. But it also means that changes in the gas price at regional or national level will have price effects in other countries. For example, the fact that the UK is now interconnected with the continent has made European gas price levels an additional factor in the formation of UK gas prices.

Countries also differ in the environmental standards they impose as well as in the taxes they levy on the use and treatment of energy. For the purpose of integration, it would be desirable to harmonise these over time.

For the facilitation of trade, harmonisation of the technical aspects of gas supply is also desirable, for example gas qualities (wobbe index, calorific value), load balancing, odorisation, and accounting methodologies.

■ Conclusion

In conclusion, overall in Europe, the new market mechanisms of balancing gas demand and supply generated by liberalisation will impact on demand growth, gas availability (resource development), gas deliverability (transport infrastructure development), and import dependency as well as the potential for producer power.

This list of factors shows that Europe is in quite a different situation from most countries that have so far opened and regulated their gas sector to third party access. This has to be taken into account when reforming the gas sector in the Continental European countries.

OPENING UP THE EUROPEAN GAS MARKETS

Experiences with Gas Market Liberalisation

Countries as diverse as Argentina, Australia, Canada, New Zealand, the USA and the UK have introduced competition into their natural gas markets via third party access to pipeline and storage infrastructure.

The main principles and conditions of gas regulation in these countries are the following:

- Non-discriminatory access to the transport pipeline systems and to the storage infrastructures for consumers, producers, traders and shippers.
- Structural unbundling of the transport and storage activities from the merchant gas activities.
- Provisions allowing for extensive trading in secondary transport and storage capacity (onward trading in booked pipeline or storage capacity).
- High market transparency through the setting up of publicly accessible and understandable information boards. With a competitive market, the need for detailed and timely information regarding supplies, demand, capacities and prices is critical.

These principles permit extensive trade as well as flexibility in trade and supply to take place, and enable the creation of spot and futures markets, which determine the reference price level at which gas is traded (even when not traded on the spot market itself).[12]

12. See Natural Gas Pricing in Competitive Markets, *IEA/OECD, Paris, 1998.*

■ More Choice, Better Service, Lower Prices

The experiences of those countries are that regulatory reforms have yielded identifiable benefits in the form of increased customer choice, broader ranges as well as better quality of services, and lower end-user prices (though it is difficult to assess what part other factors played in lowering end-user prices). Over the past decade until a few months ago, average gas prices to end-users in most of these countries have fallen or held stable while supplies have increased.[13] The drop in end-user gas prices has been particularly pronounced in the UK. Last but not least, reliability of supply has been maintained, and sometimes rendered more cost-efficient.

On the whole, by generating intense gas-to-gas competition, open access has eliminated previously existing monopoly rents in gas supply (shared by producers and gas transmission and distribution companies) and passed these cost savings, at least in part, to (eligible) consumers.

The way gas is priced in these countries is different from the traditional market value pricing that still prevails on the European Continent, and which is based on cross-subsidisation between customers. If not by straight regulation, competition has brought about a separation of the transport (and storage) element from the commodity (the gas) with separate prices and pricing mechanisms for each element. Roughly speaking, there are three to four main elements of prices and costs: transmission, distribution, flexibility and the commodity itself. Depending on the customer's location, choice of services, load factor, duration of contract and gas price indexation, total bundled price levels have changed from those under the old oil indexed "all in" pricing. Consequently, some customers may perhaps not be better off, but where competition was allowed to develop sufficiently, most — by far — are.[14] For

13. The latter is also true for Continental European countries, but their gas prices fluctuate at a higher absolute price level.

14. See also: Natural Gas Pricing in Competitive Markets, *IEA/OECD, Paris, 1998.*

example, in the case of the US, official sources claim that all consumers have benefited from the gas reforms.

■ Price Volatility

However, another feature of competitive markets is that price volatility has increased. The term “price volatility” is used to describe rapid price fluctuations of a commodity. Volatility is measured by the day-to-day percentage difference in the price of the commodity. The degree of variation defines a volatile market, not the level of prices. Gas price volatility has grown with competition in almost all the above named countries. But overall, and on a longer period, prices have decreased. Hence, price volatility is not necessarily associated with high prices.

The impact of price volatility varies among consumers. Prices to residential customers tend to be much more stable than for commercial or industrial users because their bills usually reflect average prices over a given period (usually a month) which do not fluctuate as much as daily prices. On the other hand, power generators, other large users and traders who often rely to some extent on short-term markets are dealing with fluctuating natural gas prices. They have developed or are developing new skills and forms of risk management to counter market risks and add greater value to their business.

■ Interfuel Competition

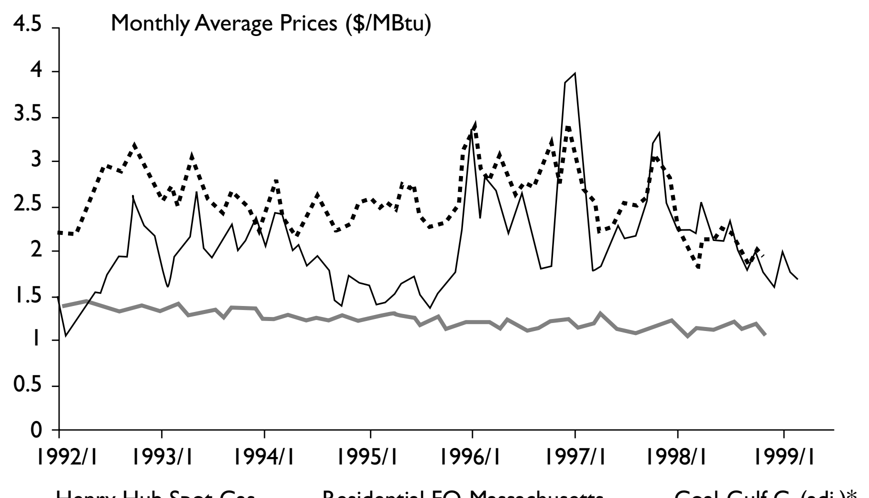
Interfuel competition — and in this respect also the taxation of energy —, nevertheless continues to be a key factor in gas price formation in competitive markets, even though its nature changes (marginal interfuel competition instead of net back pricing). This is often not acknowledged enough in gas market surveys.

Interfuel competition is especially evident in the US, where there is a highly developed capability in industry and power generation for short-term switching between natural gas and other fuels. In power generation this is done mostly via multi-fuel generation capacity and, to a lesser extent, through plant switching. The existence of such fuel-switching capability means that there is a strong link between gas demand, gas prices and the prices of oil products (mainly heavy fuel oil) and coal, as shown in the following graph.[15] Those market participants that can use these links to their advantage can reap significant benefits. Official US sources state that those consumers with the ability to substitute fuels have seen greater benefits from the gas reforms than those without this ability.

However, interfuel competition can only benefit the consumer as long as oil products prices are low. Since end-1999, the US market has seen high wholesale gas prices, even exceeding the 1996 record level of US$ 4.60 per MBtu. This was caused by a combination of strong and inelastic gas demand in power generation due to a tight power capacity situation, high oil product prices, unusually low pre-summer storage levels, and a phase of low investment in exploration and production development.

Figure 8

US Spot Gas Price & Interfuel Competition



** C. (adj.) = coal price adjusted for slightly lower thermal efficiency in power generation*

15. Source: Natural Gas Pricing in Competitive Markets, *IEA/OECD, Paris, 1998, p. 108.*

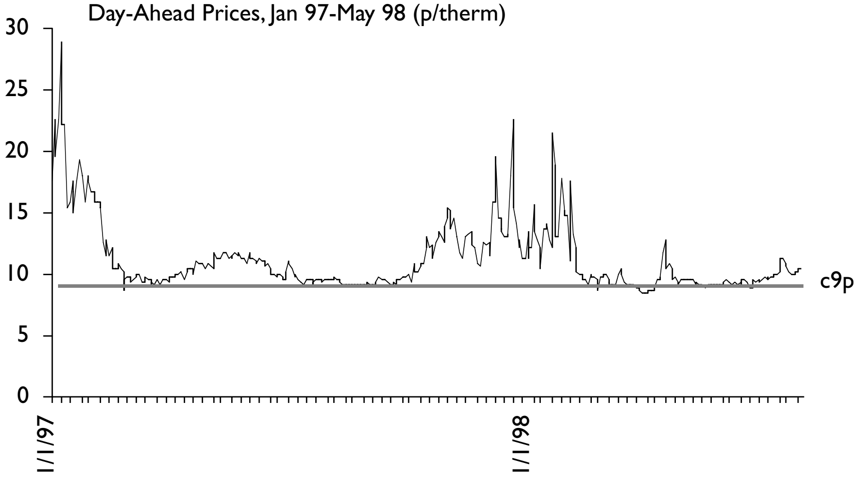
In the UK, the impact of interfuel competition on gas price formation has been less clear.[16] An oversupply of gas and intense upstream competition since 1994 have — until recently — pushed gas prices to levels well below those of competing fuels. At present, virtually all gas end users with dual-firing capability are already using gas, and the share of interruptible gas supply contracts has decreased. Since 1995, even firm gas prices have effectively been determined by gas-to-gas competition for medium and large industrial consumers, most of the time at levels below those of the cheapest competing fuel (until a few months ago). Since the beginning of 1996, interruptible gas prices have been lower than coal prices to large industrial consumers. Similarly, in the power generation sector, spot gas prices to CCGTs have from 1996 to 1999 been consistently below average coal prices, adjusted for differences in thermal efficiency. There may, however, have been times when the cost of generation from imported coal at certain power stations located near an import terminal was lower than that from spot gas. For all their volatility since 1994, spot prices have on several occasions fallen to around 8.5 – 9 p/therm, but at no time have they fallen significantly below that level. This effective floor price appears to be determined by a combination of demand-side and supply-side factors. On the one hand, increasing use of gas in the UK reduces the need to import spot coal. On the other hand, it can act as floor when North Sea producers are collectively unwilling to offer gas onto the spot market at less than this price.

UK spot prices have recently recovered from the low price levels of 1997-1999, mainly due to a summer decrease in gas supplies and increased demand for UK gas at the Zeebrugge side of the UK-Belgium Interconnector. Spot gas prices for June at Britain's main pricing point had increased by 33% over the space of a fortnight to over 20 pence per therm ($3 per million Btu) as heavy offshore maintenance combined with unrelenting outflows of gas to mainland Europe. Scheduled maintenance by a number of North

16. *Source:* Natural Gas Pricing in Competitive Markets, *IEA/OECD, Paris, 1998, pp. 151-170.*

Figure 9

UK Spot Gas Prices



Sea fields combined with a temporary albeit planned shutdown of the Teesside beach terminal had eaten into the availability of summer gas, already drained by the continued exports through the Interconnector at close to its 20 billion cubic meters per year (1.93 billion cubic feet per day) forward-flow capacity. Strong demand in mainland Europe for UK imports was due to higher prices on the continent, where gas contracts are indexed to oil products which have been expensive since the second half of 1999. That prompted UK gas to flood through the Interconnector to Belgium and beyond at almost the full capacity of the pipeline, thus tightening UK availability.

■ Market Liquidity

This prompts the question of market liquidity, which is a key factor for effective competition. Without abundance in both commodity and system capacity it becomes difficult to generate competition. All the above named countries are self-sufficient in near-to-market natural gas sources, and thus have the enormous advantage of cheap and direct access to abundant natural gas sources. Several of these countries also inherited very mature gas infrastructure systems from the earlier era. In putting the described regulatory systems in place, they succeeded in creating very liquid market places in which not only producers are competing against each other (among other things by the working of traders), but are competing with traders as well, as with gas on offer from other gas holders (e.g. dual-fuel end-users, storage holders). But as the recent UK experience indicates, the regulatory regime is only one factor determining liquidity. Abundance of supply and demand flexibility are the other main components. Liquidity determines the scale and scope of the benefits of a liberalised market for end-users.

■ Supply Side

So far, most of the gas markets that have been opened to gas-to-gas competition by way of regulated TPA and unbundling benefit from a sufficient and well developed indigenous supply base. The US and the UK have so far enjoyed particularly favourable supply conditions, although very different from each other. The US counts thousands of relatively small gas producers that compete with each other, the geographic distribution of wells is favourable in relation to customer markets, and the largest portion of gas comes at relatively low production costs. The UK upstream sector is distinctly less well off with virtually all its production offshore, but there is a sufficient number of producers that are compelled to sell their gas in competition with each other, even at low prices due to the technical nature of their fields (associated gas, little flexibility).

■ Drawbacks

No system is perfect. In fact the regulated access systems in gas (as in other sectors) present some inherent problems:

- Dynamic inefficiencies in the regulated system with system extension and maintenance of quality standards.

- Need for extremely complex and therefore costly metering and dispatching technology on the entire system in order to keep a minimum reliable basis for cost calculation[17].

- Economic costs due to higher risk for potential long-term investors and risk of reduction in long-term investment.

- Inefficiencies caused by arbitrary allocation of fixed costs or the unbundling of economies of scope.

- Increased transaction costs.

- High regulatory costs due to the complexity of the challenges and the systems that are to be regulated; practically no single regulatory approach (cost-of-service regulation, price-cap-regulation, yard-stick-regulation) is applicable in pure form, which increases the need for very detailed (micro) regulation[18]; cost of bureaucracy and administration due to need for large regulatory agencies, costs of negotiations to regulator, dispute settlements etc.[19]

Furthermore, political accountability of regulating authorities may pose problems either when competition policy objectives clash with policy objectives on which the regulator has little political competence, like for example energy security, environment or social policy, or when the regulator is seen as accumulating too much political competence. Either of those cases could lead to an issue of democratic deficit.

A counter-argument is that the need for intense and detailed regulation arises only for the phase of transition from the former

17. It cost over £300 million to set up the Transco system, the shipper systems and business processes in the UK.
18. A fundamental difficulty is, for example, the definition of economically efficient transport tariffs or system usage tariffs of a gas transport system. All the recently reformed/ing countries maintain de facto transport monopolies in the form of a single entity per area covered. This raises crucial issues of transport pricing, flexibility pricing (insofar as that is also handled by the monopoly) and incentive regulation. In theory, regulation should aim at keeping transport revenues in line with actual costs while applying incentives for cost-efficient management on the one hand and system maintenance and upgrade on the other hand. In practice, this has turned out to be very difficult, and attention is now turning to market based approaches.
19. There have been about 280 modifications proposed to the UK network code in its first 30 months of existence, of which 150 have been implemented.

system to the new competitive system. In reality, though, no gas regulatory office or effort has been scaled back so far. In the UK for example, which may be seen as having entered now a more mature regulatory phase in gas, having initiated reform in 1982, there seems to be a continuous stream of new rules and regulations.

■ Summary and Critique

In most countries that have introduced competition via third party access regulation, particularly in the UK and the US, the price benefits that have been obtained for gas consumers are the result of exposing the upstream players to competition with each other as well as with a multitude of traders in the market. The latter, even though they physically receive the gas from producers, act as competing suppliers in the market thanks to flexibility mechanisms and trade. By buying gas at one point in time from one or several producers, and reselling it at another point in time to others, who in turn may also resell the gas, traders do not just act as middlemen in the supply chain, but also as multipliers of supply.

The traders appeared thanks to the open access systems that have been put in place.

In the US, the sheer number of small low-cost producers provides an essential ingredient to competition, and in the UK, the economic pressures for continuous off-shore production in the British North Sea, have left producers no choice but to sell their gas into a highly competitive and volatile market.

These systems, on the whole, guarantee low commodity prices for as long as production/supply remains strong in relation with demand. However, at times when this ceases to be the case, for example in periods of demand peaks, the commodity prices have a tendency to peak.

Inter-fuel competition in these systems has not disappeared but changed character. The prices of competing fuels act as ceiling and floor for the price of gas. This is particularly visible in the US.

Overall, the benefits in terms of end-user prices that have been achieved are the result of intense gas-to-gas competition and gas (commodity) trading.

However, whether the access regulation and tarification itself has contributed to this, i.e. whether it has lowered the cost and the price of transport, is much less clear. Claimed benefits in that respect should be considered critically. In practice, it is extremely difficult for a regulation authority to determine the "right" price level that would allow the transport monopoly enough revenues to maintain and develop its grid while pressuring it into efficiency optimisation or cost savings.

Issues with Gas Market Opening and Security of Supply in Europe

The key issue that differentiates Continental Europe from other regions as it engages gas sector reform is security of supply.

Security of supply concerns the degree to which, in both the short and the long-term, the prospect of uninterrupted supply of gas can be assured. It means in particular:

- having the capacity to maintain supplies even in periods of peak demand;
- minimising the risk of supply failure and ensuring the capability to cope with them in the short-term;
- mobilising adequate gas volumes for the long-term.

Most European countries are in a different situation than either the US or the UK. They are to a large extent dependent on gas imports from distant sources and — on the whole — a limited number of producers. At the same time, trade in commodity or capacity across borders on the European gas market — which would help to compensate for lack of abundance in producers —, is likely to be slowed up due to the difficulties of effecting technical interoperability of pipeline systems[20], harmonisation of standards and a uniform regulatory system. This makes generating liquidity more difficult, and raises other fundamental challenges with the introduction of gas-to-gas competition at the downstream, if Europe's gas consumers are to reap similar benefits in price and choice of supply as in the US and in the UK. These consist of the following:

- to maintain at all times high security levels in the supply of natural gas (short-term security);
- to keep supply in tune with increasing demand over the long-term so as to avoid drastic movements in the gas price (long-term security);
- to bring all suppliers along the gas chain into effective gas-to-gas competition.

In summary, the challenge of introducing gas-to-gas competition in Europe is to make market opening as effective as possible, while sustaining security of supply at a high level. The two issues are entwined: effective market opening will help to support future high levels of security but raises issues that need very careful handling in the Continental European context. These issues correspond to core concerns raised in the past and ongoing political discussions on liberalising the European gas supply sector:

- the capacity of competitive gas markets to maintain the present high standards of short-term gas supply security;
- the difficulty of developing needed incremental gas supply projects and related infrastructure (long-term security);

20. The composition of natural gas varies depending on the production reservoir where it comes from. Each gas has different properties such as the methane number, molecular weight, soot index, dew point, hydrogen to carbon value, specific gravity, volume stoichiometric air-fuel ratio, volumetric heating value, Wobbe index, etc. Each pipeline system carries a specific quality range of natural gases that is used by the consumers it supplies. The gas from the various sources needs to be blended and brought to the required quality range. For historic and physical reasons, pipeline systems in Europe carry gas of different properties. The shipper who wishes to ship gas over several transport systems has to adapt his gas each time to each system's specified quality bands. This burden on the shipper can be reduced if pipeline operators agree to common gas quality standards or practices in adapting different gas qualities.

- the fragmentation of demand versus the apparent oligopolistic supply structure and risk of a seller's market with increasing border prices.

These issues will be examined in turn.

Short-term Gas Supply Security

The IEA Gas Security Study of 1995 noted the European gas industry's excellent record and preparedness in coping with supply disruptions. More recently other studies and documents, notably by the European Commission, have confirmed the European gas industry's excellent achievements in short-term supply security. The following focuses on the issues to be watched in the future in connection with market opening.

In principle, the risks of a significant physical supply disruption can be considered as relatively low, although it is not impossible that a major supply country may be tempted again at some point in time to enforce higher prices by the threat of a supply interruption[21], and problems remain with transit across the Ukraine. This risk is unlikely to increase with the shift to competitive markets. All the major gas-producing countries have more to gain from gas exports than without them. In particular, neither Russia nor Algeria would want to lose their most important source of income. Any severe disruption or risk or threat of a disruption in the gas supplies from Russia or Algeria would tarnish their image as reliable energy suppliers, and have long-term repercussions on their export sales. Both countries are well aware of this and are in a process of diversifying their supply routes (e.g. Yamal I).

The opening up of the gas markets in Western and Central Europe may help to further reduce the risk of physical gas supply interruptions in that it invites external producers to actively take part in the downstream gas markets. Vice-versa, the participation

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21. In 1980, Algeria stopped contracted LNG deliveries to the US in an attempt to enforce unilaterally a higher gas price adjustment.

of downstream actors in the upstream will enhance integration and interdependencies (examples are the 4% participation of Ruhrgas in the capital of Gazprom, the strategic alliances between Gazprom and respectively ENI and Shell, the co-operation of Gazprom and BASF in gas production, BPAmoco in Algeria's In Salah gas development and marketing).

Nevertheless, Russia and Algeria are not immune to political trouble or technical problems nor are some of the countries through which the gas transits. There is no guarantee that the gas flow from these countries will remain untouched in the event of political trouble.

The events in Russia during the last two years provide an idea of the kind of pressures gas exports can easily become subject to:

- proposals to slash Gazprom in several parts (which could have required the re-negotiation of major Russian gas supply contracts between European gas importing companies and the new Gazprom entities).
- introduction of a 5% tariff on Gazprom's gas exports[22] at a time when the historic drop in the oil price brought its gas export margins close to zero, and while Gazprom had suffered severe set-backs on new export projects due to financial difficulties,
- extensive tax claims on inland sales while Gazprom is facing non-payment problems.

Today, the bulk of the gas imports from Russia is covered by long-term contracts, and these events did not have repercussions on the import prices or end-user prices. But it is not impossible that a more short-term market would react nervously to such events.

Whether or not, or to what extent, spot markets react to political events or to physical supply disruptions depends on how the demand and supply flexibility within each market develops, i.e.:

22. Later scrapped; excise duties of 30% on exports and 15% on domestic sales remain.

- the availability of alternative supplies,
- the interruptible supply volumes,
- the volumes and withdrawal rates of gas in storage (projects started or planned indicate that this is set to increase in line with demand growth until around 2015[23]),
- the presence of back-up agreements.

The following paragraphs deal with this issue.

With increasing gas demand, gas imports and transit over third countries will inevitably increase. They represent already today about 2/3 of consumed gas volumes in Europe. This makes co-operation of transmission grid operators in transit and dispatching (e.g. back-up and swaps that are underwritten by supply as well as shipping contracts) a key element in European gas supply security.

For the sake of being prepared for and being able to cope with possible disruptions or slow downs of supply flows, it is important that gas companies continue to have incentives to co-operate with each other on back up, dispatch and transit. If integrated gas companies concentrate their attention on competing with each other they may not be able to maintain co-operation to the present extent. But then, increasingly, co-operation will be replaced by commercial transactions. The fact that most large gas companies will increasingly import *and* export could provide enough incentives to trade with each other constructively.

It is also important that liberalisation does not lead to too much fragmentation of the market, making it virtually impossible to provide the kind of combinations of supply and shipping contracts that are needed to diversify supplies to specific markets (e.g. in central Europe). The expectation is that the liberalisation of the European gas market will result in an increase in liquidity in the form of many kinds of short-term deals. On paper, these can appear

23. *See* Security of Supply of Natural Gas in Western Europe, *Eurogas — The European Union of the Natural Gas Industry, Brussels, March 1998, annex 1.*

to increase the diversification. However, at the same time, the complexity of contractual flows also increases. A fragmentation of swaps and mini-swaps occurs, and the number of intermediary links increases. There is a risk that many large and small contracts will no longer be directly supported one-to-one by shipping contracts that guarantee the physical connection between the original source/supplier and the customer. Thus, while diversification increases on paper, the actual supply security guaranteed by the physical possibility of back-up may well decrease.

This leads to the question of how far to take unbundling, i.e. the choice between keeping gas companies integrated or creating independent transmission pipeline system operators.

Declining or low end-user gas prices will exert strong pressures on the costs and margins of gas supplying companies. At the same time, the contractual framework will become more short-term, and transactions more short-lived. This could affect the ability of gas supplying companies to maintain present high level standards of operational supply security.

A competitive market may not automatically deliver a sufficient degree of gas supply diversification. Up to now, the gas transmission companies have taken upon themselves the responsibility to diversify their supplies. Though diversification and security of supply could receive commercial value in an open market, and therefore be offered by wholesale traders/suppliers, there is no guarantee that this will be maintained or increased by market mechanisms alone. In fact, in a fully open and competitive market it seems doubtful that diversification and security of supply could receive commercial value and therefore be offered by wholesale traders/suppliers. Liberalised markets tend to focus on the price of the commodity, and with trade and liquidity gas could come to lose its identity. If at each location in the market it is the cheapest gas that is consumed, diversification will inevitably decrease and regional dependencies increase, in particular when geographical and technical constraints exist, when transit or transport routes pose security risks, or the number of wholesale suppliers remains low. This can perhaps be remedied if governments set strategic policy targets. But it may also become necessary to impose rules on gas suppliers or pipeline operators in import dependent countries in order to guarantee specific levels of diversification. A difficulty with that, though, is to avoid reducing the scope for competition too much. For instance, an obligation on suppliers to hold a satisfactory supply portfolio of different gas purchase contracts would considerably slow down the emergence of traders — and thus the development of short-term trade.

■ Long-term Supply Security

Long-term supply security is about developing adequate incremental gas supply projects and related infrastructure to cover potential demand and assure a harmonious gas market development.

The distance of new sources of gas supplies and their concentration outside western and central Europe means that new supply projects have to be prepared by long-term agreements well ahead in anticipation of future potential demand. Concerns expressed as to the feasibility of this in the context of a competitive gas market are based on the following assumptions:

- growing disparity between a competition-induced decrease in end-user gas prices and a high cost level of new gas supply projects due to increasingly difficult geographical and geological conditions and distance;
- in a competitive gas market where gas sales contracts would become more short-term and transactions short-lived, gas merchant companies could no longer be sure of their outlet sales in the long-term and would have difficulty in signing the kind of high-volume, long-term take-or-pay contracts that have been regarded up to now as necessary requirements for the financing and investment of new long-distance transport capacity;

- market uncertainties (in particular during the phase of transition) will increase risks to individual gas companies or gas projects which in turn increases the cost of finance of large, long-term investment.

To a large extent these concerns stem from a conventional perspective of the development of liberalised European gas markets that focuses on the difficulties of transition from the present system to a competitive, open gas supply system. Eventually, market players will learn to live with a new competitive environment and adapt.

Concerning the issue of long-term contracts to underpin new gas projects, it should be kept in mind that most Continental European long-term take-or-pay contracts are more flexible than those that have caused problems during the transition phases in the US and the UK.

Flexibility elements in Continental European long-term take-or-pay contracts include price and volume re-openers and price indexation (e.g. spot gas price indexation). Such provisions should enable gas companies to commit themselves also *in the future* over the long-term. Thanks to those flexibility elements, *existing* long-term take-or-pay contracts in Continental Europe should offer some flexibility for adapting to competitive markets. The fact that during the past five years, while EU Member States were negotiating the principles of market opening through third party access, EU gas companies signed large gas import contracts of ever longer duration periods (up to 25 years), could support this.[24] It should also be borne in mind that usually in such a contract not all of the contracted volumes are covered by take-or-pay obligations, leaving room for flexibility in terms of volumes. Nevertheless, the possibility of real problems occurring with take-or-pay contracts should not be discounted.

24. Until the last stages of the negotiations on the EU Gas Directive, it was not clear whether the Directive would in the end contain provisions to protect take-or-pay contracts.

The increase in shorter term trading will probably not bring a total demise of long-term contracts at the downstream (as experience in the US and the UK shows). Given the maturity (and yet growth) of most European gas markets and their growing integration, the development of spot markets or hubs should in any case progressively provide outlets for surplus contractual volumes that gas merchants may find themselves with.

The example of the US shows that new major pipeline projects can be realised in a competitive gas market. The US Department of Energy expects that in 1999 and 2000 as many as 70 major pipeline projects could be completed, adding approximately 500 million cm/day of new capacity to the natural gas pipeline network at a cost of more than $10 billion. This does not automatically mean that a competitive European gas market could be equally successful since the US are in a better supply situation and represent a larger market in which a multitude of gas producers and well interconnected large centres of consumption help to reduce pipeline investment risks. But in principle, there should also be possibilities for pipeline investment in a competitive European gas market.

The issue of too low a gas price level to enable additional supplies to come on stream is one of demand and supply. Gas prices are likely to increase once supply constraints are being felt or anticipated. This in turn can stimulate new production and supplies. In this process, price hikes cannot be excluded. But provided there will be enough short-term fuel switching capacity, they are likely to be brief since a prolonged uncompetitive gas price level vis-à-vis the price of fuel oil would cause a drop in gas consumption or a decrease in anticipated demand growth, and thereby be unsustainable.

The global oil price level is thus likely to remain a key factor in the development of new gas supply projects to a similar extent as today.

Nevertheless, the challenge of developing the gas resources needed to cover potential demand and bringing them to the market is a significant one. In the near- to medium-term, existing production will be able to cover growing demand. But in the long-term existing fields have to be replaced or developed further and additional fields need to be developed to cover growing demand. Even though the largest potentials in terms of reserves and proximity are found in Norway, Russia and Algeria, other sources will be solicited. Nigeria and Trinidad have already entered the European scene; Libya and Egypt currently seem to offer promising potential; and perhaps further ahead in time the Middle East, Venezuela and the Caspian area. The challenge consists of two key issues.

Firstly, given that Europe does not enjoy an outlet monopsony to any of these potential new sources, it will have to compete for this gas with other gas markets in the world. This means that the European gas market has to offer competitive price terms to the producers of this gas.

Secondly, the development of additional reserves and production and transport capacity will require huge investments. These can only be attracted by strong alliances and long-term agreements. This may mean that the downstream gas industry needs reinforcement, i.e. that concentration — either horizontally or vertically with upstream players — will become inevitable.

The likelihood of a vertical integration of downstream actors with upstream actors becomes evident also from the already perceptible need to redistribute volume and price risks in future long-term agreements. With the price volatility liberalisation will generate, gas purchasers will be asked to share more of the price risk, and vice versa producers more of the volume risk. At the same time, gas purchasers may be asked for a stronger involvement in the transport systems linking the production fields to their markets. Furthermore, the efficient development of reserves in Algeria, Russia and elsewhere will require more foreign involvement. Algeria has already opened its upstream sector somewhat, notably to BPAmoco. In Russia, this has been resisted so far, although Gazprom has signed so-called strategic alliances with, notably, ENI and Shell. Generally, liberalisation of the upstream sector seems to be inevitable if enough investment is to be attracted for the kind of production development needed to supply Europe's potential demand 30 years ahead from now.

■ Risk of a Seller's Market ?

It is often argued that the introduction of an open access system "à la UK/US" into European gas markets will fragment demand at a time when demand is strong and concentration in supply is strengthening, with the consequence that potential gas buyers will end up competing for gas purchases and that upstream gas prices increase. A proposal made recently by the CEO of Gazprom to create a cartel of gas exporting countries has drawn attention again to the issue.

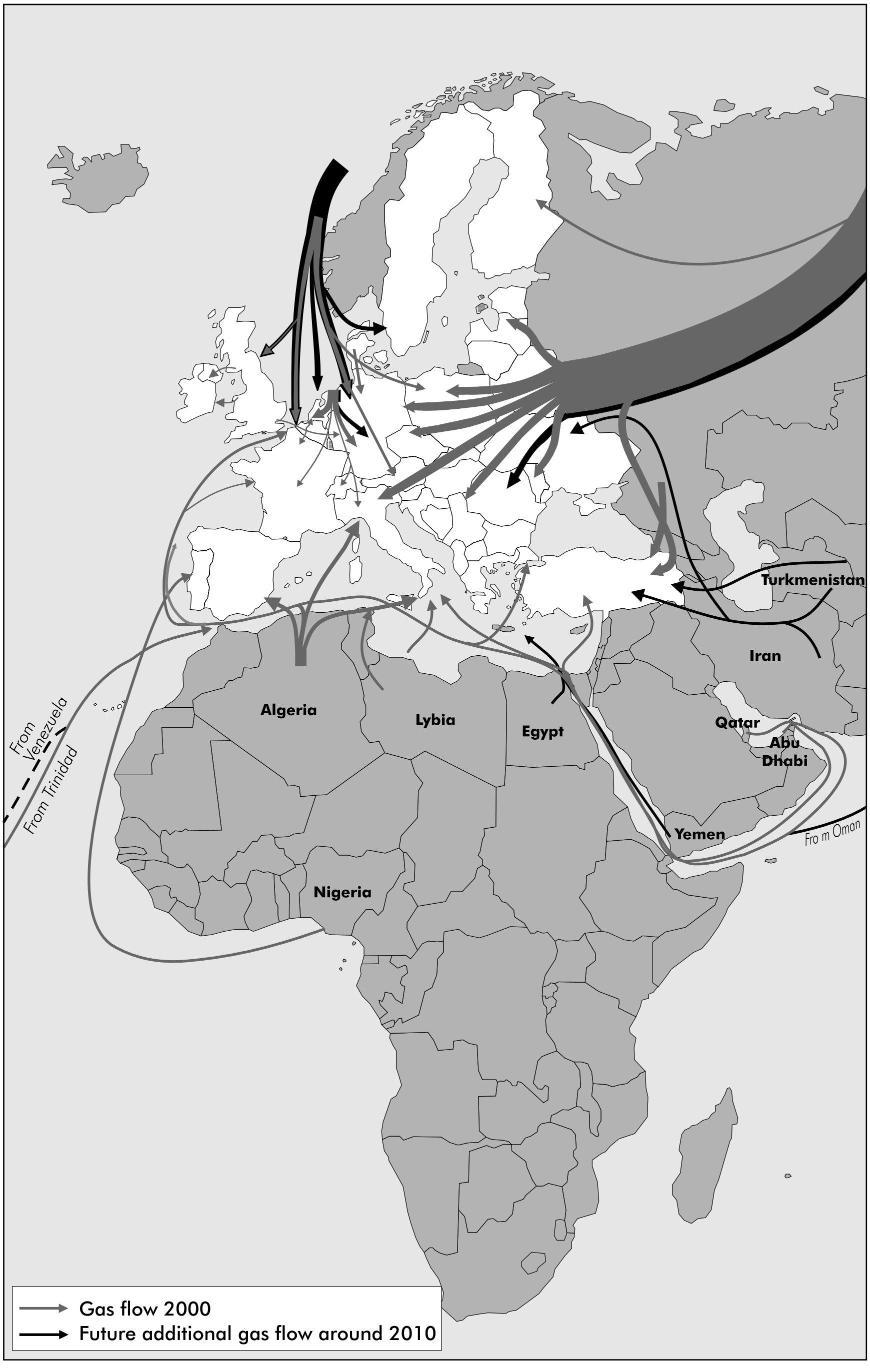
Based on the current assessment of natural gas reserves, it is anticipated that indigenous gas production in the European gas consuming countries is stagnating, if not declining, whereas demand is growing strongly. In Germany, Hungary and Italy indigenous production could deplete over the next two or three decades. There is some uncertainty about the UK reserves lifetime. Though production is currently higher than in the Netherlands, the UK's proven reserves are smaller. One may, therefore, expect the UK to become dependent on gas imports before 2010. Dutch exports are likely to continue to play a significant role for a longer time, though at a lower level. Norway, on the other hand, is set to play a growing role for the next 10 to 30 years. It boasts an R/P ratio of 85 years — which is more than Russia's 82 years, despite less stringent Russian reserve definitions.[25] But Norway does not have a significant indigenous gas market itself, and its interests are concentrated on maximising revenues from gas exports.

Given this development, additional imports of natural gas by pipeline or LNG will be necessary. In the first instance, these

25. Source: Cedigaz, 1999.

Figure 10

Current and Future Gas Supply Flows,



Source: Gasunie

additional supplies will come from Russia and Algeria, which already make the lion's share of exports to Western Europe. In addition to that, other countries could develop supplies to Europe. For example, Nigeria, Trinidad & Tobago and Qatar could expand LNG supplies; Libya, Turkmenistan and Iran could come on stream if conditions are ripe; and in principle there could be further potential in the form of LNG from Yemen, Venezuela and Egypt.

But on the whole, it seems certain that for the next 15-20 years, Europe will concentrate its dependency on its main supply sources Russia, Algeria and Norway. These countries have in common that they retain monopolised structures for their gas export sales. There is currently no evidence that this will change.

■ The Theory ...

In theory, lack of upstream competition should not be a crucial issue, *provided* there is a truly open and highly flexible market with widespread trade of both gas and capacity, including spot trade. With sufficient capacity and trade in storage and interruptible gas volumes, producers would be unable to impose prices above the value of gas in its marginal use. Even a producer monopolist would have to accept the marginal price, i.e., the price the consumer with the cheapest alternative to gas would accept to keep consuming gas.

The marginal price in an open system is determined by the consumers who would stop consuming gas at a slightly higher price and switch to an alternative fuel — the marginal consumers. The marginal consumer could be a multi-fuel plant or an electricity producer with a choice between several plants based on different fuels. In a truly open market, the dual-fuel marginal gas consumer would not be hindered from buying more gas than he needs at the marginal price, and from reselling that surplus gas at a profit on the market. The consumers that do not have the capability to switch would buy gas on the spot market or at a price influenced by the spot market. Thus, most gas would be traded slightly above the marginal price level, assuming sufficient liquidity for trade. In periods of extremely high demand, e.g. a harsh winter, spot prices would increase to reflect the fact that capacity and/or the commodity is becoming scarcer. If prices exceed what the marginal customer is willing to pay, he will stop consuming and sell his reserved volumes and capacity on the market.

A producer monopolist's only possible price strategy to obtain a gain in price would be to reduce supply until most consumers with a capability to switch in the short-term to heavy fuel oil or coal — the cheapest alternatives — will have done so. In this case, the marginal consumer would become the one with capability to switch to light fuel oil or to distillates, which come at a higher price — and, thus, the whole market would trade at a higher price level. There would, however, be significant practical difficulties involved for the producer monopolist/oligopoly. They would consist of the difficulty of reducing supplies or restricting new supplies to the extent needed, and at the same time avoiding the almost inevitable gas competition that the higher gas prices would induce. In other words, the supply reduction would have to be substantial to exclude potential heavy fuel oil consumers — a difficulty in itself within a cartel —, and the increase in prices obtained would trigger alternative supplies, e.g. LNG, which would then compete with the incumbent supplier(s), reduce the latter's price gains and their market share.

There could be time lags between the incoming new supplies and the price increase. But gas utilities tend to negotiate new contracts years in advance of when they require the supplies. Different contracts will start at different times and when new contracts will come at higher prices, the remaining portfolio need not necessarily be affected by it. This offers a cushion against price shocks. In practice the flexibility of such a portfolio allows the buyer with time to explore as many potentially competing supply options as possible, and renders producer power difficult.

Producers will also have to take into account market development and interfuel competition. If they price their gas too high, it will become uncompetitive and the potential demand growth will not materialise, which in itself could bring prices down for some time until excess volumes contracted ahead are consumed.

■ ... and the European Fuels Market

All this looks positive, but the outcome critically depends on the market's flexibility and liquidity, i.e., the accessibility and tradability of available gas volumes from storage throughout Europe, from the dual-fuel market, or from alternative sources of indigenous production or imports, and to what extent gas can be freely traded across Europe.

For the short- to medium-term, the European gas markets will be well endowed with storage capacity and excess pipe capacity for short-term trade and substitution. The issue is whether an effective regulatory framework will be established to allow for a rapid development of widespread trade, and whether there will be enough gas quantities offered short-term to set the ball rolling.

Over the long-term, the issue will be inverted, i.e. can storage and short-term substitutability remain in balance with growing demand and can this keep competition alive? Both issues are explored below.

At present, the levels of storage, of volume sales under interruptible supply contracts (suggesting fuel-switching capacity), and of indigenous production in the OECD European gas markets are high (even when discounting Norway)[26]. They should provide a sufficient basis for open trade and market flexibility in relation to overall demand. But it cannot be assumed that this relationship will automatically maintain itself over the medium to long-term with the rapidly growing demand in gas. Whereas storage working capacity in Western Europe is expected to grow with total gas consumption over the next decade[27], indigenous production in the

26. Norway, though integral part of Western Europe and Member of the European Economic Area as well as of the OECD and IEA is a pure gas exporting country with an insignificant inland gas market.

27. See Security of Supply of Natural Gas in Western Europe, *Eurogas — The European Union of the Natural Gas Industry, Brussels, March 1998, annex 1.*

OECD European gas markets can be expected to decrease over the next 20 years. Also, the possibility that in expectation of a seller's market traders, speculators and indigenous producers could hold back gas in storage or reserve in speculation of higher prices should be kept in mind.

Turning to the crucial issue of the capacity for rapid fuel switching, a number of developments that could reduce the role of the marginal customer in the liberalised market seem possible at this stage, though it is difficult to paint a clear picture of what the future holds.

Because fuel-switching capacity exists in very different forms in the industry, the power generation and the commercial sectors, exact figures on the capacity for rapid switching from gas to other fuels are not available. Figures supplied by the European gas industry[28] on interruptible gas supply volumes for the European Union give an indication of the importance of short-term fuel switching capability, which can be roughly estimated at over 15% of the EU's total annual gas consumption.[29] Taking into account that most gas supplying companies hold a substantial share of interruptible contracts with customers they never interrupt in practice due to lack of effectively workable switching capacity, but also that there is scope for additional plant switching in the power generation sector, the EU's present total short-term switching capacity can be cautiously estimated at somewhere between 5 and 10% of total annual gas consumption. One has to take into account that this is an average figure and individual country situations will be different. But on the whole it represents a comfortable potential to protect against upstream market power, provided that cross-border short-term trade will be facilitated so as to activate the full potential.

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28. See Security of Supply of Natural Gas in Western Europe, *Eurogas — The European Union of the Natural Gas Industry, Brussels, March 1998, annex 2.*

29. By interruptible gas supply contracts the buyer gets the gas at a discounted price throughout the year. In exchange for this the supplier may interrupt the gas flow at mutually agreed times. The buyer will usually hold non-gas capacity in reserve to bridge the interruptions. The volumes of interruptible gas supply contracts can thus be used as indicator for short-term fuel switching capacity.

For the future, the outlook is that multi-fuel capacity is unlikely to increase at the same rate as total gas demand unless new economic incentives for it develop.

Presently, economics and efficiency favor single-fired capacity based on natural gas. At the moment, most of the gas growth in power generation will be on the basis of the construction of new CCGTs, thanks to their low investment and operation costs and Europe's high emission and efficiency standards. The long-term effect of this would be a reduction in the share of gas volumes that can be switched away from at short-term. But it could very well be that the new market provides enough incentives to develop multi-fuel capacity.

It is likely though that the incremental multi-fuel capacity that will be built goes increasingly to the more expensive fuels. In the electricity sector, the basis for new dual-firing capacity would mainly be oil products rather than coal. At present, the largest share of back-up capacity is based on relatively cheap heavy fuel oil. But the trend in industry and power generation towards clean and high efficiency gas firing installations will shift the potential for additional dual-firing installations into the distillate fuels, which come at a higher price.

Besides the issues of the growth in dual-fuel capacity and of fuel price, there is also a cost issue involved with the operation of switching. In a dual-firing combined cycle plant, switching from gas to fuel oil reduces the plant's efficiency and increases maintenance costs. For an electricity utility the switch from a gas fired plant to different fuel type plant can create associated costs in having to switch to more expensive plants in the merit order of dispatching.

Furthermore, the potential for managing *large-scale* interruptions or self-interruptions of customers over *prolonged* periods seems to be constrained by limits in back-up capacity (most dual-fuel CCGTs or GTs have days or, at most, weeks of storage). Once the back-up fuel reserve is used, those consumers would have to revert to buying their back-up fuel at short notice. This may strain the downstream oil industry sector's supply logistics. Even with the present over-capacity in the European refinery sector (calculated on an annual basis), fuel oil distribution logistics sometimes reach their limits at regional level during winter demand peaks when interrupted gas consumers require fuel oil on top of peaking demand from the usual fuel oil consumers. Furthermore, refineries tend to minimize production of HFO since it generates low revenue, unless they produce for maritime transport (mostly refineries located near a port). This may also limit the release of large quantities. And it seems that with the EU drive towards cleaner fuel oils, the European refinery industry will continue to reduce production capacity in heavy fuel oil.

All of this could lead to a potentially smaller role of the marginal customer in the future, *unless* the market will explicitly value interruptibility and fuel switching — either on its own account or "helped" by the introduction of appropriate Government policies or incentives, and shift the market towards the more expensive higher quality fuels in back-up capacity.

The effect will be that the ceiling for natural gas pricing may come to lie on average somewhere above the heavy fuel oil price level. This ceiling is not absolute, and short-term price peaks for gas will always be possible (in the US, gas prices on some peak days can even reach as high as $7/MBtu), but it protects against longer periods of high prices.

A mitigating factor, however, could be the future nature of interfuel competition in power generation as consequence of the liberalisation in both electricity and gas.

Oil indexed gas supply contracts may decrease in favour of contracts with different indexations, for example through "indifference pricing" by which the operating and capital costs of a gas-fired power plant and a coal-fired power plant are compared and the gas price set equal to the difference between total costs for the coal plant (including fuel costs) and the operating and capital costs of the gas-fired plant, so that the buyer is indifferent between the two alternatives. But such pricing is likely to remain restricted to when new capacity is being built. Once the contract runs out, it remains to be seen whether the pricing principles will be maintained.

In the worst case, i.e. in the case of limited interruptibility and high cost of back-up fuels, given the relatively high concentration of players in European gas production, suppliers could be tempted to restrict their total sales of gas at the marginal price (heavy fuel oil) into the dual-fuel market to the volumes that only these dual-fuel customers would consume themselves. But that would be difficult in practice given the competition between merchant suppliers, other traders, producers, and self-interrupting consumers on a competitive market. If it would work out, the other consumers would then buy their gas at a higher price level. However, such a strategy is likely to be self-defeating in a relatively short span of time since it would provide precisely the market incentives to increase interruptibility or to bring in alternative supplies. And if gas prices are not competitive with those of the competing fuels (operational and other costs taken into consideration) in the growth sectors like power generation, the initial potential for additional demand will not materialise, which in turn will depress the gas price.

Probably the most positive contribution to short-term fuel switching will come from the reforming electricity sector itself, which will account for the bulk of the future growth in gas demand. Generation overcapacities and liberalisation are key to this:

The generation overcapacities in Europe are high and likely to remain high for some time (especially since political demands for drastic reductions in the lifetimes of nuclear plants are becoming more moderate in view of economic considerations in some countries).

Liberalisation should enable the sharing of the benefits of the overcapacities between power suppliers and consumers across

Europe, though tight cross-border transmission capacities in electricity may limit its potential somewhat.

This means that gas supplies to power plants can be interruptible, which opens opportunities for arbitrage between electricity and gas.

This arbitrage would work as follows: when the difference between the market price of electricity and the price of gas at the power plant, plus variable production costs, is positive, the power generator will generate electricity from gas. When this is not the case, he will produce from another source or buy the electricity on the market.[30] The value of gas consumed on the market could therefore increasingly be determined by the market price of electricity.

Since most of the growth potential for natural gas lies in power generation, gas prices to generators will need to be competitive with the electricity market price if this demand potential is to be realised. Europe's overcapacities in power generation capacity and the resulting depressed electricity price levels in most of Europe mean that for some time, gas to power needs to be priced low. In the long-term, though, if generation overcapacities are allowed to completely disappear, gas-fired electricity may become the price setter.

However, even under favorable conditions, one cannot discount that over some periods of time the marginal price could reach the price level of light fuel oil (as happens occasionally in the US during winter) or even exceed it. But even then the majority of gas consumers may still enjoy lower prices than under the present systems (in most European countries, customers consuming less than 100 000 cm per year are already paying prices that are above the price of gas oil). The firm industrial consumers above 100 000 cm per year could be hit though.

30. In this case, he also needs to take into account the cost of not using his gas plant.

It should be mentioned here, that if such a scenario were to cause too high gas prices for too long, governments could ultimately resort to fiscal interference. For example, by lowering taxation of fuel oils during periods of high gas prices, a government could trigger a downward adjustment of gas prices. But it should be clear at the outset about the long-term effects on the energy mix and the consequences of this for other policy objectives (e.g. CO2 abatement objectives).

■ Conclusion

With market opening, interfuel competition acquires a new significance. Oil-indexed netback pricing at the wholesale level/border and indexation at end-user level are already changing. In those end-user segments in which oil products form an effective competing source of energy (for example heating), the prices of those oil products are likely to form the price ceiling for gas. In other market segments such as power generation or large industrial consumers, gas prices could be indexed on the spot market, on electricity prices or any other commodity price, if producers are not allowed to exert market power.

Market power of producers can to a large extent be avoided if effective conditions for widespread trade in gas are put in place, and provided that sufficient flexibility in power generation capacity is maintained and the development of short-term switching capacity is not stifled. This will allow the marginal consumer to arbitrage between gas-fuelled power generation, other modes of power generation and spot electricity prices, and to exert an effective impact on gas price formation. It is important that electricity market liberalisation is pushed so as to generate sizeable short-term trading.

REGULATORY REFORM

This chapter considers what regulatory reform approach is best suited to develop effective competition and increased trade and liquidity in Europe's gas markets, taking account of the analysis and conclusions in the previous chapter on Europe's import dependency and security of supply context.

The 15 Member States of the European Union formally agreed in 1998 to create an internal market for natural gas by adopting the EU Directive 98/30/EC, commonly called the 'Gas Directive'. This sets out the minimum rules and requirements to be implemented into national legislation by the EU Member States. The gas directive is also relevant to the countries that are part of the European Economic Area (e.g. Norway) and all those countries that have entered negotiations with the EU in view of their accession to it. In order to be accepted as EU Member State the latter will be required to comply with the so-called "acquis communautaire" which includes the EU's internal market rules.

Briefly summarised[31], the European countries are required to give, as a minimum, a right of access to the natural gas transportation systems to natural gas transmission undertakings, power generators and final gas consumers that have been designated as eligible, and grant distribution companies the right of network access for the volumes of gas consumed by the eligible customers located in their distribution area. Eligibility is defined in terms of minimum volume-consumption thresholds which countries can exceed. The countries may choose between negotiated access or regulated access. They are required to see to it that their gas companies unbundle transport from supply and other services in their internal accounting and make this transparent to a regulating/supervising authority. In addition to the access provisions, the countries are required to subject the construction and operation of natural gas facilities to objective, non-

31. A more complete summary can be found in annex 1.

discriminatory and transparent criteria, and thus abolish any exclusive rights in this field.

The Gas Directive leaves the European countries considerable scope in deciding the exact shape and extent of the reforms they wish to make. This should allow each European country to define a regulatory framework best suited to its specific circumstances, in consideration of the positive experiences with third party access regulation in, for example, the USA and the UK, but also the drawbacks of the approaches taken there. On the other hand, this subsidiarity-approach could lead to inconsistencies between national approaches to regulatory reform which could be an obstacle to the rapid development of a fully open and fluid market.

Gas-to-gas Competition

Gas-to-gas competition through third party access (TPA) has been the key factor in the success of the gas sector reforms in the UK and the US. The analysis in the previous chapter concluded that the specific European gas supply situation warrants specific precautions in terms of security of supply, but that open, flexible and liquid markets — and thus generalised and effective gas-to-gas competition — are key to the latter. In fact similar benefits as have been recorded in the US and the UK can be expected for Europe.

The key is thus the introduction of competition. As far as possible, competition should be introduced in all links of the gas chain so as to minimise the potential for market power in any given part of the chain.

This is of course difficult insofar as the major part of the upstream activity is outside the gas consuming countries in Europe. But as argued in the previous chapter, a lack of competition upstream should in theory not be a crucial issue provided there is widespread effective TPA to the pipeline grids and sufficient flexibility from short-term fuel and plant switching, since this effectively increases the number of suppliers (e.g. traders, gas released from fuel/plant switching).

■ Transport of Gas — a Natural Monopoly?

The first question to consider is the monopoly nature of natural gas transportation.

In the 'history of natural gas', monopoly constellations or potentials thereof have often been converted by governments into permanent legal monopoly areas by the creation of protection fences or nationalisation. Examples are numerous and range from the concentration of the transmission and distribution industry into a single state-owned player, such as the former British Gas in the UK or Gaz de France in France, to the former exclusion from the general competition law of the concession and demarcation contracts in Germany's electricity and gas sector granting or allowing suppliers formal or de facto exclusivity of supply in their respective supply areas.

But from a modern perspective on competition policy, it is important to explore whether the supply of natural gas constitutes a natural monopoly a priori, or to what extent there is competition or potential for competition. Other sectors provide examples of market constellations in which alleged natural monopolies were broken by market growth or technological progress. Sometimes the threat of market entrance of a potential competitor or the existence of a market/supplier in substitutes can force a monopolist into a price policy to such extent that he will be unable to exert much market power.[32] This also applies to the gas market. Some European gas companies even argue that from a pure economic perspective there is no such thing as a gas market but rather an energy market, since no gas buyer is interested in the gas itself but in the heat or electricity, which he can also generate from other sources of energy.

Natural gas *transmission,* i.e., the cross-regional or regional gas transport by high-pressure pipeline[33], is developed in specific

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32. Martin, S.: Advanced Industrial Economics, *Cambridge (Mass.) and Oxford, 1993, chapter 4.*
33. See also Natural Gas Distribution, *IEA/OECD, Paris, 1998, annex 1; and* Natural Gas Transportation, *IEA/OECD, Paris, 1994, chapter II.*

projects on the basis of entrepreneurial risk, often with a long-term contract as backbone. This can be a purchasing contract with a producer (or a conglomerate of producers) or a sales contract to one or several buyers (for example a distributor, a power plant or a large industrial consumer).

In an open, non-discriminatory regulatory framework, and for the sake of long-term market development, there should a priori be equality of opportunities for any company with the ability and will to enter into such a project.

Such a legal and regulatory framework can be found in the US, Germany and the Netherlands. The EU Gas Directive seeks to introduce the same principles for all the EU Member States. In both the US and Germany, it has led to increased competition. In Germany, a Russian-German joint venture created in 1993 under the name of WINGAS had gained 12% market share by end 1999 on the basis of the construction of its own pipeline system of several thousand kilometers. The US counts numerous competing pipelines — the famous 'Henry Hub' would not exist without the crossing of several parallel pipelines. The recently built ZEBRA line in the Netherlands has significantly contributed to competition and trade there.

In a sufficiently large market, the freedom to build and operate pipelines — and thus also the existence of parallel transmission pipelines — is not economically inefficient as the examples of Germany and the US show. Other European countries may have smaller markets, but with the implementation of the Gas Directive national markets will eventually integrate into a large European market, and so enhance opportunities for new pipeline projects.

The non-existence of a natural monopoly in gas transmission can also be explained by the technical-economic limitations to capacity increase. In most cases, a sizeable increase in demand for transmission capacity between two geographical points requires the building of a new pipeline, given the limitations to an increase in compressor capacity or to bi-directional flow. If there is demand for a new pipeline, there is a priori no reason why the incumbent gas pipeline operator should build and operate it rather than another (for example a newly setup) operator.

On the other hand, natural gas *distribution* resembles more of a natural monopoly. A duplication of a distribution system by a newcomer would in the vast majority of cases be a loss-making enterprise (a single direct line to a large consumer excepted[34]), and would be economically inefficient. The local distribution system therefore constitutes an essential facility. This raises the issue of defining the proper, specific mode of regulation of transmission, and separately distribution.

Some of the consequences of the natural monopoly of natural gas distribution in Europe have been described in the IEA's study of natural gas distribution[35]. Its findings are that inefficiencies, costs and yet profits are on average significantly higher in gas distribution than in gas transmission. There is thus a more urgent need to improve economic efficiency in gas distribution than in transmission. Furthermore, the opening of distribution through third party access is essential to extend the benefits of competition to the small and medium-sized gas consumers.

The most effective approach to distribution should involve two simultaneous steps. The first is to consider making distribution companies fully eligible for access to the transmission pipeline systems, giving them a choice of supplier and hence opportunities to purchase at least cost. The second is to consider full eligibility of all consumers within gas distribution, so that distribution companies are encouraged to pass on the benefits of their lower costs through lower prices to end users.

It follows from this that when reforming gas sector regulation, in particular when designing third party access models for the gas

34. A distribution grid is not per se (and shouldn't be) protected from competition of a spur line. A spur line from a transmission system, a producer or a neighboring distribution grid to a consumer or group of consumers can be economically interesting, in which case this would constitute a threat of competition.
35. Natural Gas Distribution, *IEA/OECD, Paris, 1998.*

sector, it is important to take account of the differences between transmission and distribution in gas and to adopt different approaches accordingly.

Annex 2 provides a more complete listing of differences between transmission and distribution in gas, and also compares gas with electricity. Given that there is no universal definition of public service (in fact quite the contrary), the table does not list the task of meeting public service obligations. But there could be substantial differences in this respect between gas transmission and distribution as well as gas and electricity.

Annex 2 shows that there are significant differences between gas transmission and distribution (for example, physical characteristics; a natural monopoly in one segment, none in the other; high specificity of investment on the one hand, low on the other; connected to this, higher risk versus low risk). And the question arises how to address each segment of the gas chain properly when reforming regulation and increasing competition in the gas sector. May this for example warrant taking different approaches in TPA, like negotiated for one, regulated for the other, or in the tariff setting? There is also an important and related issue of unbundling transmission from distribution.

These questions do not arise to the same extent with electricity, as the differences between transmission and distribution are less important.

The evidence so far is that the countries that went through a reform process have not changed the historical structures of their gas sectors (distribution and transmission remain largely integrated in the British transport system; the US, Canadian and Australian sectors remain split between transmission pipeline companies and distributors). But political considerations rather than economic efficiency may have influenced this.

Regulated or Negotiated Third Party Access

Effective and efficient third party access requires that the procedures, terms and conditions of access are non-discriminatory, fair, and encourage access and competition.

The straightforward approach to this would be via regulated third party access, which would set without ambiguity the rules and access conditions, and reduce the potential for disputes between market players to a minimum.

One difficulty already noted with this (under sub-chapter "Issues with gas market opening and security of supply in Europe") is how to ensure the efficient operation and development of the industry, i.e. quality of service standards, infrastructure extension.

Regulated third party access also requires a considerable degree of regulation. For example, the cost structure in gas supply needs to be known and defined in detail so as to enable fair tariff setting by the legislator/regulator. This includes cost of transport in the widest sense (investment, pressurization, personnel, maintenance etc.), cost of connection, of metering etc. Generally applicable detailed tariffs and pricing rules are difficult to set. It was done in the UK, which started from a fully integrated grid structure. Other European countries have large numbers of gas supply companies, in particular distribution companies (e.g. 23 in Belgium, over 30 in the Netherlands, over 600 in Germany and Italy). There are 18 transmission companies in Germany. Given that each such company has its own grid and grid cost features, applying centrally set access prices will pose problems. And given the numbers of companies involved, an integration of the existing grids into one or several will also pose problems.

In this respect, negotiated third party access could offer the advantage that it avoids imposing difficult structural changes. Under negotiated access grid or pipeline owning gas merchant companies would have to establish — at least internally — their cost structure (internal unbundling of accounts) in order to be able to publish their basic conditions for access and related services. This could be done individually by each company or for a group of similar grid companies. For example, in Germany, the natural gas industry is looking into generally applicable cost-based tarification methodologies as part of the negotiations it is conducting with the consuming industry associations on an agreement on gas transport tarification.

Negotiated third party access implies an element of freedom for the parties in defining access terms and conditions. A key challenge with negotiated third party access is to arrive at a basic level of non-discriminatory treatment of access seekers (in particular between the transport company's own gas sales business arm and competing gas sellers), and still allow enough freedom for parties to negotiate access conditions.

The non-discrimination problem can be addressed by an audit of the gas companies' accounts, and an obligation on them to publish indicative tariffs for transport/capacity. In case and for as long as a company enjoys a de facto monopoly in flexibility services (e.g. storage), it should also publish indicative tariffs for these services. However, controlling company accounts is difficult and requires considerable effort on the part of the regulator.

For the sake of efficiency (as well as non-discrimination between customers) it will have to be ensured that negotiations and the granting of access proceed swiftly. In other words, clear, efficient and mandatory procedures of negotiation and access should be set in order to avoid undue delays or barriers to access, or so that a party can exploit its dominant position in the negotiations.

Speedy dispute settlement procedures are also essential, irrespective of regulated or negotiated third party access, but in particular with negotiated third party access as it is prone to disputes about all kinds, e.g. capacity price, flexibility price, time and duration.

There is also a need, irrespective of the choice of regulated or negotiated third party access, for a clear definition of the right of access refusal. For example, if lack of capacity or specific public service obligations should be grounds for access refusal than it would be useful to clearly define from the outset "lack of capacity" or the public service obligations in question.

The choice between the two approaches starts with the analysis above that there is a fundamental difference between transmission and distribution, which implies that regulated access may be more appropriate for distribution and negotiated access for transmission. This is because there is, in effect, less need of straightforward access in a situation where competition can also evolve by building one's own pipeline.

Another key issue that should guide the choice between negotiated and regulated TPA is related to security of supply: how much commercial and investing entrepreneurship does a country wish to maintain to develop its gas transmission system; what transactions costs does it want to avoid (for example in order to favour supply diversification of reliable gas supplies and back-ups, for instance via swap arrangements); what autonomy does it want to maintain for its gas industry vis-à-vis the large producers; how much transparency does it wish to keep in the gas supply (e.g. in order to keep track of the origins of gas).

If the answers to these considerations are "as much as possible", then a country should opt for negotiated TPA to gas transmission. With negotiated TPA a gas merchant company would keep a larger degree of freedom in using its transport system for strategic and commercial purposes. The drawback would be less short-term trade and a lesser scope for a multitude of individual transactions, but gas supply would remain more transparent from a security of supply perspective.

Regulated TPA to gas transmission leads sooner or later to open access, which is most effective in promoting trade and competition. In the case of a dominant, integrated supply structure such as in France, regulated TPA may also be easier to implement and more efficient in terms of immediate market opening.

But there is no guarantee that a fully competitive market will provide adequate security. For example, when price becomes the overriding factor in the consumer's choice of a supplier this will work against diversification and security. While operational supply security can be addressed by imposing minimum provisions on the infrastructure provider, long-term security of supply and supply diversification with regulated TPA may require setting conditions on gas suppliers as well. For example, market access for gas suppliers may have to be made conditional on a minimum technical or financial capability, to minimum safety standards, or to certain guarantees underpinning supply, such as reserve stocks in storage, back-up contracts or a diversified gas portfolio.

However, if conditions on gas sellers are set high, entry of new market players will be limited. In practice, this could mean that traders will find it hard to meet the requirements, and that mostly established gas companies would be able (allowed) to compete with the regulated gas supplier/transporter. Short-term commodity and capacity trade — key in developing competition and liquidity and spreading the benefits of competition to most consumers — could then be slower to emerge. In countries with several gas supplying companies, competition could perhaps start that way, but would most likely stay considerably under optimal level. The approach would be more problematic for countries with highly monopolised and vertically integrated structures, since competition would then mainly have to come from abroad. Given transmission distances and with the absence of independent distributors (who could act as aggregators for small consumers, but also as traders) only large gas users that offer potential suppliers critical offtake-volume would then benefit from a wider choice of suppliers. Thus in this case, such conditions should be restricted to a minimum so as not to render market access too difficult and restrict development of competition and short-term trade.

At the distribution level, there is less need for caution in relation to security of supply due to the many individual small-volume supplies.

Security of supply at this level is achieved mainly through the contracting of sufficient flexibility or back-up (e.g. from storage) by the consumer, which poses less difficulty with a small-volume contract. In fact, given that gas distribution constitutes more of a natural monopoly, smaller end-users of gas have an interest in a maximum efficiency of TPA so as to enhance the choice of suppliers, and compensate their disadvantage over larger end-users that are in a better negotiating position with gas companies due to their larger off-take, lower flexibility requirements or the short-term option of a substitute to gas. Thus in distribution, concentration on efficient access deserves priority. This implies regulated TPA.

In support of that is the fact that gas distribution generally consists of a coherent and meshed pipe system that is easier to approach by cost-of-service, price-cap or yard-stick regulation than the more disparate and predominantly 'one-directional-flow' pipeline systems of a transmission company.

A further consideration in favour of introducing regulated TPA in distribution is that most countries have already taken a regulated TPA approach in electricity. Smaller gas consumers may only accept with difficulty that the choice in gas may be restricted compared to electricity. And with a regulated approach in electricity, the additional regulatory expense required for the gas distribution sector should be smaller.

■ Priority of Access

In principle, transport capacity should be released according to "first-come-first-served". Provided that a secondary capacity market exists, someone who urgently requires transport capacity could in case of transport bottlenecks buy it from capacity holders that are willing to sell at a higher price. Alternatively, there may be a possibility for swap deals. Over time, market participants will learn to apply cost-effective risk management against capacity constraints (similar to risk management regarding volume constraints or gas price).

A possible and economically efficient approach consists of establishing an auctioning system for capacity, in particular in the case of bottlenecks. Capacity would be priced at market value. Where demand is low, prices are likely to be low. Consistently high prices would reflect capacity constraints and provide economic incentives to expand capacity.

Nevertheless, in specific circumstances, access priority could be given to specific customers, such as distribution companies that could otherwise not fulfil their public service obligations, hospitals or households, though perhaps with a penalty charge in cases of urgency as an incentive to take appropriate preventive measures.

In cases in which a country maintains integrated gas and pipeline companies and applies a negotiated TPA system, the transport system remains a strategic and commercial tool. The gas companies will then keep on reserving themselves the priority usage of their system (which after all they built up and invested in), unless regulated otherwise. Whatever can be said in favor or against this — e.g. helps them to gain critical mass and strategic importance in dealings with producers (+), or restricts competition and access and is discriminatory (–) —, it is likely to become and remain a source of dispute, and reduce market transparency in a significant manner. This should be avoided, for example by setting rules for access refusal on the basis of lack of capacity. It goes without saying that a strict and clear definition of "lack of capacity" would be required. This would reduce somewhat the transport system owner's liberty of action, but not hinder it from formally reserving (and paying its transport division or subsidiary for) future capacity.

Unbundling

As noted earlier, a key challenge with TPA is to secure non-discriminatory treatment of access seekers and in particular to ensure that an integrated transport company does not discriminate in favour of its own gas supply business. When the gas merchant owns transport assets, it may have the incentive to favour its own commercial and strategic activities or its own clients. Unbundling may avoid self-dealing or other forms of discriminatory behaviour.

Unbundling ensures that costs are correctly allocated to a gas company's different activities such as gas purchase, transmission, distribution, storage, and other flexibility mechanisms. This is a fundamental basis for the pricing of these different services/elements, irrespective of the third party access regime chosen — regulated or negotiated — and for non-discriminatory treatment of all players.

Four basic approaches to unbundling are generally proposed:

- Accounting separation: keeping separate accounts of the commodity purchases and sales from the transport activities within the same vertically integrated entity. This includes a vertically integrated entity charging itself the same prices for transport services, including ancillary services such as balancing and quality fulfilment, as it does others and stating separate prices for the commodity, transport, and the ancillary services.
- Functional separation: accounting separation, plus (1) relying on the same information about its transport system as the other actors when buying and selling gas and (2) separating employees involved in transport from those involved in gas purchase and sales.
- Operational separation: operation of, and decisions about, investment in the transport system are the responsibility of an entity that is fully independent of the gas merchants; ownership of the transmission grid remains with the gas merchant.
- Divestiture or ownership separation: gas sales and transport are separated into distinct legal entities with different management, control, and operations and there is no significant common ownership.

Ownership separation solves most concerns because it eliminates both the incentive and the ability to discriminate. The "weaker" forms of separation limit, to different extents, the ability to discriminate and may be easy to adopt for some countries; but they may not eliminate the incentive to engage in discriminatory behavior as effectively as ownership separation. Also, to different degrees, market players may overcome the regulations intended to keep activities separate. However, as explained below, ensuring non-discrimination has to be balanced against the needs of long-term investment.

■ Investment Incentives under Vertical Separation

A concern with ownership separation of transmission and sales is that it may lead to inefficient investment decisions. The reason is that in fast growing gas markets (as is mostly the case in Europe) the contracting of large volumes from producers goes hand in hand with the design and construction of the transport system needed to bring the new volumes to the market (limited free capacity in existing systems; technical-economic limitations to expansion of capacity in existing pipes; different location of points of production and/or consumption). This can even apply in saturated markets when a supply stream dries up and needs to be replaced, or when there are economic or other motivations for a diversification of supplies.

On balance, for gas transmission, unbundling of accounts may be preferable to operational and ownership separation, because of the serious potential consequences for future investment if vertically integrated companies are in effect prohibited.

■ Regulation and Vertical Separation

That said, it should be emphasised that some degree of separation between regulated and competitive activities is likely to be needed to manage regulation effectively. For instance, the regulation of transmission revenues requires, at least, separate and transparent accounting of transmission. Stronger forms of separation facilitate a more effective ring fencing of regulated activities.

As already noted, there are good arguments for taking different approaches to TPA in transmission and distribution. This leads to the conclusion that a vertical separation of transmission and distribution is preferable to a vertically integrated supply system.

The advantage of separation of transmission and distribution is that it permits trade to flourish at the intermediary level of distribution, increasing competition, arbitrage opportunities and market liquidity. Where distribution companies exist that are not integrated with a large gas merchant, there would be more independent players, thus more room for trade.

If a fully integrated national transport system is retained, the emphasis needs to be on creating conditions that allow cheap and easy use of the system so as to guarantee a sufficient number of traders (this has been largely achieved in Britain and led to the development of a significant spot market).

Regulatory Responsibility

■ Need for Strong Regulatory Institutions in the New Competitive Environment

The new regulatory framework that has just been analysed needs appropriate regulatory institutions to manage it.

Regulatory responsibility needs to be clearly defined and vested with an appropriate body that is at the very least independent from the companies that are being regulated. For example, where the government owns the utility, it is important to avoid short-term budgetary pressures, as well as to ensure a degree of transparency and consistency in decision-making. Some countries have gone further and set up independent authorities in order to keep the day-to-day regulation of the gas sector free from political interference. While this approach has arguably proved successful in many cases, accountability remains a problem.

These are the key changes that need to be considered in the adaptation or development of an appropriate institutional framework. There are other important issues too.

To consider the first in more detail — separation of the regulator from the regulated — regulatory procedures must be transparent and competitively neutral in order to keep a level playing field for competition. This implies not just new regulatory procedures but also giving serious consideration to the establishment of new regulatory agencies that are independent from the private interests which they regulate (regulated firms, consumers, etc.). This is crucial. The basic principle is that regulators have to be independent from the regulated. Otherwise, conflicts of interests are unavoidable and regulation is bound to deteriorate. Careful design of regulatory institutions is needed to ensure effective independence of the regulator from the regulated entities.

Second, the introduction of competition implies that competition law has to be applied to the gas supply industry. This requires either competition authorities or gas regulators (or both) to assume new roles to enforce competition law in the gas supply industry. The relationship with competition authorities has to be clarified and effective communication channels between gas regulators and competition authorities, if they are not the same institution, have to be built up. This often means that during the transition, regulatory capabilities have to be reinforced and more resources have to be engaged in regulatory activities than in the past. In the longer run, as these needs recede, competition authorities may gradually take over gas regulation, perhaps retaining a specialised regulatory section for gas.

Third, structural obstacles and political resistance to the development of a competitive market in gas often results in regulatory agencies actively promoting pro-competitive reforms. Indeed, competition advocacy by regulators appears to have contributed significantly to the advancement of reform in gas and in other sectors (e.g., airlines and electricity).

And fourth, gas markets benefit from a stable or, at least, predictable regulatory framework. Creating an expectation of a stable regulatory framework may be better achieved by independent regulatory agencies, which are less subject to political change than other parts of government[36].

Independence of the Regulator Primarily Means Independence from the Regulated

The meaning of independent regulation is often misunderstood. The first and crucial dimension has just been explored above. However, a second dimension — independence from government and political actors — may also be desirable to ensure long-term stability of regulatory policies, to avoid the use of gas policies to achieve general policy objectives (e.g. more revenues from taxation or lower inflation) and, generally, to protect investors and utilities from political interference. The importance of political independence for an adequate regulatory performance is likely to depend on a number of country specific factors. The crucial issue is to what extent political interference is a real threat. This is influenced by the institutional design of each country. For instance, the role of courts in reviewing regulatory decisions, which is crucial in this regard, changes from country to country.

Nevertheless, political independence becomes a priority whenever there is public ownership of gas utilities. In this case, the government simultaneously faces responsibilities as owner and as regulator. Instituting a politically independent regulatory body avoids potential conflicts of interest between these two areas of responsibility.

Independence from electricity regulation may be important, at least in the beginning, in order to ensure that the specificities of the natural gas sector are properly taken into account in the first

36. This was generally the case of regulatory agencies in the US before liberalisation. However, to the extent that regulators also act as advocates of pro-competitive reforms, the impact of their actions on the expectations of market players is ambiguous.

years of transition away from the old market system. Alternatively, if a joint electricity/gas body is set up, it is important to ensure that it has the appropriate expertise to deal with gas.

■ Independent but Accountable Regulatory Agencies can Handle Regulation Efficiently

Independence of the regulator must be clearly differentiated from lack of accountability. Regulatory agencies, like any other public body, must be held accountable for their actions and be subject to adequate efficiency controls, specially in those aspects not directly related to gas regulation (e.g., general management). At the same time, it must be recognised that no optimal approach to accountability has yet been established. Regulatory agencies built on the principles of independence (from the regulated) and accountability have the highest potential to deal with the new regulatory challenges. A review of the regulatory structure must accompany regulatory reform since regulatory institutions designed in the past to deal with a different set of issues may not satisfy these general principles.

Tariff Setting for Gas Transportation

To encourage a level playing field and market development it is important that tariffs for access to and use of the transportation system should be as transparent and non-discriminatory as possible.

There are circumstances in which it can be preferable to leave access pricing to market forces, for example by a system of capacity auctioning (recently the case for storage in the UK; a debate on auctioning transport capacity has started in the US). But where circumstances are not favourable to such systems, e.g. where there is a dominant market position, tariffs should in principle be non-discriminatory. This means they should be cost-reflective. But they should also still provide sufficient incentives for maintaining high system quality standards, for system upgrade and for expansion (i.e., send adequate signals for investment).

"Non-discriminatory" does not mean that each shipper pays the same tariff. It means that differences between the tariffs payable by each shipper can be explained by differences between their service requirements, such as load factor (capacity booked), distance, volume or other tariff differentiators, and there is no differentiation driven by the use of negotiating power by the infrastructure owner (either with the regulator in the case of regulated TPA or with other companies in the case of negotiated TPA).

This poses a dilemma: how to provide the transport system operator with enough incentives for efficient system management and upgrade without departing from the principle of cost-reflectiveness and non-discrimination?

Achieving cost-reflectiveness is a challenge in itself. A proper cost-basis has to be found. There is firstly the difficult issue of separating and allocating correctly the cost elements to the different functions involved in transportation. Secondly, on the basis of this first point, there is the issue of calculating the access tariffs — how to reflect the different cost elements; defining a calculation method. Finally, there is the design of tarification.

There are two key practical issues which need to be considered in respect of the design of tarification:

- the income the system owner will be allowed to collect, and
- the way this is recovered from the system users.

The first issue requires consideration to be given to such aspects as the value of the assets being used, the appropriate rate of return which those assets should be able to earn, the period of time over which costs are recovered, tax rates and other similar financial matters.

The second issue is one of allocating costs among the various system users. Briefly, the choice of allocation method influences how costs are recovered from various customer groups, and may involve cross-subsidies. Various allocation methods are available, such as distance related tariffs or postalised tariffs, tariffs which charge for capacity or those which charge for throughput.

Again, the differences between gas transmission and distribution (see earlier section and annex 2) may warrant different approaches. For the reasons listed in annex 2, the approach to access tarifing for high-pressure pipelines should include an element of replacement cost and some kind of distance element.

■ Income to the System Owner: Replacement Cost ?

The main financial considerations leading to the calculation of the total amount of money which a system owner is allowed to collect are asset value, rate of return, cost recovery period and required revenue.

The assets of pipelines and related assets can be valued in several different ways. The usual methods are historic cost or replacement cost (i.e., the cost that would be incurred in building a new pipeline).[37]

There are a number of reasons why replacement cost should be the preferred basis of tariff calculation for access to high-pressure pipeline systems:

- the technical-economic limitations to capacity expansion of a pipeline mean that for additional demand in transport, a new pipeline needs to be built;
- the design, route, and flow capacity of a pipeline is usually linked to an original purpose of point-to-point transport and linked to one or several high-volume long-term contracts;

37. PHB Hagler Bailly Ltd in its May 1999 report on 'Gas Carriage and Third Party Transmission Tariffs in Europe' to NV Nederlandse Gasunie states: "The convention is to base the replacement costs on the pipeline which would be built today to fulfil the same purpose as the pipeline which exists, but using current materials and techniques. Thus the replacement cost calculation captures the benefit of improved technology and would normally result in a lower figure than a strict 'reproduction of cost' approach would suggest."

- as a consequence, there is narrower flexibility regarding spare capacity (most of the capacity is reserved to the long-term commitment; economically efficient lay-out of the pipe's capacity precludes large unused capacities);
- last but not least, maintaining incentives for further construction of pipeline systems in order to facilitate new supply projects to cover rapidly growing demand.

Arguably this is different for dense pipeline networks, such as local distribution. Thus, there is less value here in basing tarification on replacement costs.

It should be noted that capital cost can differ substantially from one pipeline to another, and among European countries, given differences in geographical and geological features, technical standards, public policies towards pipelaying, and competition in the pipeline construction sector.

There are a number of other cost issues to consider when creating a tariff system, such as how to deal with load factor and other services which shippers may require, such as balancing services.

Gas pipeline systems have to be kept 'in balance' for reliability and safety reasons. If the system goes out of balance because too little gas is entering it to match the amounts being withdrawn by customers, then parts of the system will close down automatically to prevent air (which can cause explosions) entering the system. To avoid this, system operators may curtail flows to large consumers. Reconnecting consumers can be a time-consuming and expensive action, especially in local distribution networks, and safety is the prime concern. Similarly, the system can go out of balance in the other direction if too much gas enters the system. This can cause equipment failure due to overpressure.

System operators (i.e., pipeline owners), therefore, need to monitor their network continuously so as to stay within the tolerance levels required for a balanced condition. The frequency with which the operators intervene to flow gas to or from storage facilities, or to interrupt certain customers, or to request shippers to flow more or less gas, depends on the configuration of their transport and storage infrastructure, their contractual rights and the sources of flexibility for their system. So do the costs of these operations. They can thus vary significantly from one operator to another.

■ Prices to the System User: Distance-related Tariffs ?

When gas is transported over long distances from a point of supply to a point of consumption, a natural approach is to base the transport charges on the distance the gas has to travel.

The basic argument in favor of distance-related pricing is that the cost of transport increases with increasing distance. This is relevant in long-distance high-pressure transport, less so in distribution where the transport infrastructure is more dense, meshed and distance matters less. A distinction between gas transmission and gas distribution should thus be made if they are structurally separated.

Unlike electricity transmission, in which electrons do not physically flow but electricity moves by displacement, gas transmission systems do need to flow gas physically from inlet to outlet points, e.g. by applying and regulating pressure at specific points in the systems. Only to a limited extent does gas move by displacement. Some variations in short-term flows are capable of being managed by linepack[38] (depending on the configuration of the system), but normally gas must flow in a particular direction. Thus the operational costs of gas transmission are not insignificant. It follows automatically from this that capacity to apply bi-directional flows in one system is mostly very limited. Other cost-drivers may also be included in the tariff, such as load factor (i.e., the ratio between the average flow and the peak flow), but the main variable in the tariff is the distance.

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38. At periods of low demand, the quantity of gas in the pipeline can be increased in some circumstances, thereby raising the pressure and opening possibilities for flow modulation.

For local distribution or other dense networks, which do not involve long distances, where there is more movement by displacement, and it is difficult to be sure of the exact routing of a shipper's gas, other tariff systems may be more suitable, such as the postalised tariff system.

The postalised tariff is based on the concept that the same tariff is paid for each cubic meter of gas regardless of how far it is transported within a pipeline. This inherently involves cross subsidies between volumes that travel short distances and those that travel longer distances, but in the technical operation of a distribution system, these cross-subsidies are relatively minor in relation to the overall costs of gas transportation and supply.

Postalised tarification can of course be adapted to take distance into account. An example of the latter is the kind of distance related zonal pricing in American transmission, whereby a customer's transport costs are a function of the postage tariffs he has to pay for each transport zone which separates him from his gas supplier. The postalised system requires that rates are set in advance, agreed with the regulator (FERC) and made public.

In integrated systems that include transmission and distribution, hybrids between the distance and the postalised tarification are possible. In such an approach, the high-pressure system is charged on the basis of distance and the low-pressure system on a postalised basis.

Provided that access prices to eligible customers are transparent and non-discriminatory, non-distance related pricing can offer more consumer choice and provides a real market place in that it treats the whole transport system as one (a pool). This enables eligible customers to shop around and benefit from the full array of supply independent of both their own and the suppliers' location. Thus, non-distance related pricing increases competition and empowers the eligible customer to diversify and decide himself his gas supplies. It also enables a truly open market place in which eligible customers can trade gas among each other. The creation of a spot market is greatly facilitated by such a system.

A pipeline system can also be tariffed on the basis of separate fees for putting gas into the system and for offtaking it. This approach is used in Southern California and in Britain.

The British TRANSCO system consists of entry and exit fees that are fixed in advance and which try to reflect the combined cost of the use of capacity and of the grid's flexibility. Indirectly it also contains a distance element. It, thus, combines the advantage of a pool system without giving up the need to factor in the cost of capacity and distance. The major difficulty so far with this regime has been the lack of incentives it provides to the grid operator to expand capacity where needed. TRANSCO was notably suspected of cultivating capacity bottlenecks in order to be in a position to negotiate higher entry/exit fees with the regulator.

The basic drawback of non-distance related pricing systems is the difficulty of setting efficient tariffs that provide incentives to expand capacity at bottlenecks. This is because in practice it is very difficult to define the overall system and operation costs and hence to set appropriate tariffs. But incentives for grid expansion or grid capacity expansion remain crucial in growing gas markets where transport capacity is likely to become saturated. Hence, there may be a need to address the issue of avoiding or overcoming capacity congestion. This could be done through the auctioning of capacity in the case of bottlenecks, and the introduction of a liberal, non-discriminatory authorisation regime for the construction of pipelines. High returns in auctioned capacity would signal capacity constraints, and serve as incentives to third parties or the grid operator to invest in additional capacity. However, this would require that rules and regulation of network operation and specifications be harmonized over Europe in order to permit efficient interoperability of pipelines of different companies within Europe. That is not a reality yet.

In conclusion, non-distance related pricing is an efficient means to promote a fully open market place, but carries an inherent problem of offering too few incentives for capacity expansion. It may fit in cases when increases in transport capacity required are marginal or entail relatively marginal cost, for example in distribution grids or in fully mature transmission systems.

However, with the kind of gas demand growths predicted in Europe, fuelled in particular by the power sector, demand for new transport capacity will be concentrated in transmission. Hence, it may seem more appropriate to introduce a pricing system that includes a distance element in order to provide sufficient incentives for capacity growth.

There is also a range of technical and other matters which must be dealt with in a gas transportation agreement, such as nominations procedures, default provisions, tolerance levels (for calculating imbalances), etc.

■ Access Regime

Third party access tarification will depend on the access regime, in particular on the choice between regulated or negotiated third party access.

A particular challenge with tarifing under negotiated third party access is to avoid or at least minimise discrimination between customers (see also 'unbundling' and 'regulated or negotiated third party access') and to make it cost-reflective, and yet leave enough freedom for price negotiations.

With regulated access, tariff setting should be more straight-forward but requires a strong regulatory overview.

Under regulated TPA, the basic principles of efficient tariff setting are in theory simple and few. In practice, however, application of these principles and the effective implementation of efficient pricing are far from straightforward.

Information Access

Timely information regarding supplies, demand and prices is critical to participants in a competitive market. Those who have access to good, timely information can often trade on this at the expense of those who do not.

A conclusion from experiences in liberalised markets is that good, openly accessible information — i.e., market transparency — reduces transaction costs and enhances the development of the market. For example, when open access to the natural gas pipeline was introduced in the US, information on capacity availability was not common or comparable across pipeline companies. It was very difficult to use and as a result, may have impeded the development of the market. The industry has made an effort to overcome some of these difficulties with the Gas Industry Standards Board. By contrast, on the electricity side, FERC has been more proactive, and addressed this issue early with the "oasis" system.

In summary, it is important to encourage the provision of good, timely and easily accessible information as early as the market opens up in order to ensure a level playing field and enhance market development.

Trading

In order to develop a competitive, efficient and liquid market that serves both the purpose of competitive pricing and security of supply, it is important that trade in gas as well as capacity is encouraged (see sub-chapter "Issues with Gas Market Opening and Security of Supply").

■ Eligibility and Secondary Capacity Trading

In order to generate sufficient numbers of buyers and sellers in a commodity market to allow the market to become liquid, there must be sufficient transportation infrastructure and ancillary services available to market participants to permit that commodity to be physically delivered. The freer the access to transportation and flexibility, the higher will market liquidity be.

This means that third party access rights should preferably be given to a wide range of market participants (increases the numbers of buyers and sellers), and trade in capacity be allowed to take place where access is based on booking specific transport and storage capacity. Thus — as noted earlier — in Europe it is desirable that local distribution companies are eligible for TPA and at the same time are subject to TPA.

For example, the regulatory frameworks in North America provide for secondary trading of previously booked transportation and storage capacity released by shippers, through a computerized trading system operated by the pipeline companies. In the US, released capacity rates are capped at regulated levels, although a gray market in bundled gas services has emerged to allow holders of pipeline capacity to capture its full market value. Interest in capacity trading has increased in North America as shippers seek to reduce costs associated with holding unused capacity.

Where full eligibility is certain to pose problems for the contractual engagements market (for example take-or-pay contracts) or the viability of investments made prior to the decision to liberalise the gas market, one may consider phasing in consumer eligibility. But a country should avoid lagging behind the opening process of neighbouring markets in order not to disadvantage its gas consumers in an ever more integrating European economy.

■ Spot and Futures Markets

Spot and futures markets are important institutional characteristics of a liberalised market.

In order to have a liquid market, there needs to be a sufficient number of buyers and sellers so that either can buy or sell an amount of his commodity without that one transaction substantially altering the market price. In order to allow this to happen, the market needs to be transparent. This requires a level playing field for information — see above — for natural gas as well as for capacity.

The quintessential manifestation of transparency and liquidity is a spot market. It is a market in which goods are traded short-term. It can be observed that when a spot market's liquidity increases, the frequency of trades increases, and the amount of the commodity traded per trade decreases.

The evolution in some countries with competitive gas markets shows that spot markets have developed for several reasons. The principal factor for many market participants is supply optimization, based on the need to balance demand and supply on a monthly or daily basis. Trading exists as a complementary activity to the core business with a view to diversifying supplies and hedging positions. With market growth, new traders enter with profit making as the primary objective.

In countries that have established a spot market, markets for financial instruments have been established. Futures markets have evolved because they serve two main functions: price discovery and risk transfer.

Futures contracts provide an independent transparent pricing signal for the market, which can be used as a pricing index for other contracts. The future price of a commodity may be the best indicator of its expected spot price in the future.

Risk transfer is the other main function of the futures market. Participants in the futures market are generally hedgers or speculators. Hedgers use futures to offset and minimise the risks of price fluctuations. Speculators are willing to accept the risk in the hope of making a profit.

With the market price risk that arises from a liberalized and competitive gas (and/or electricity) market, there is a need for price management tools. A risk management strategy is required when there is price volatility that threatens to exceed the financial risk tolerance limits of a company. Risk management tools help reduce volatility in earnings, and they have the advantage of helping a company manage working capital and cash flow more accurately, lend assurance to investment and acquisition decisions, and improve financial leverage.

But spot and futures markets do not only bring economic benefits. A major drawback is that they tend to detach themselves from the real supply and demand situation. Traders are specialised in trading and seeking opportunities for trade, though often lack an in-depth knowledge or expert understanding of the underlying market. As a result, the significance of occurrences in the market is often over-interpreted which can trigger disproportionate reactions that are economically inefficient or can be damaging.

Balancing Services and Storage

Balancing gas flows is an integral part of gas transport and supply. Any gas supplier needs to fulfil this requirement. Therefore, it is essential that new gas suppliers have the same opportunity to contract balancing services as incumbent suppliers. For the sake of developing trade and liquidity and allowing an efficient access regime, non-discriminatory access to balancing services is essential. At the same time, balancing rules set by transport system operators should not be excessively strict — or they would constitute a discriminatory hurdle against entrants — and imbalance charges should be cost-reflective and promote the development of a competitive market. A recent report made for the European Commission notes that "*to evaluate whether a given set of balancing rules and imbalance charges are cost-effective and promote the development of a competitive market, it is first important to determine the amount and type of system resources that the TO* (transport system operator) *is reserving for itself to balance the system. Such system resources may include linepack, a share of storage* *or firm receipt and delivery capacity that would otherwise be made available to third parties. Obviously, there is a tension between the amount and type of resources the TO reserves for itself to manage the system, and the amount of capacity made available to third parties to promote competitive access. The resolution of this tension is very much dependent on the design and circumstances of the individual pipeline. In the U.S. and Canada, pipelines retain some system and storage capacity for balancing purposes while making significant amounts available to third parties. It is rare for U.S. and Canadian pipelines to impose less than monthly balancing requirements.*"[39]

Some European transport system operators require hourly balancing, which puts a high burden on system users. Governments are advised to check whether such a strict balancing obligation is justified. For example, if storage and/or linepack are insufficient to handle monthly or daily system imbalances, then perhaps hourly balancing may be justified (note that daily demand fluctuations can be significantly higher in some countries than in others), as long as imbalance charges reflect the costs and resources actually required by the transport system operator to handle the system imbalances.

Consideration should be given to allowing third parties to provide balancing services. That way competition can be introduced, and a balancing services market could emerge. In this respect, for the sake of system efficiency, it should be considered to allow third parties to perform/provide several forms of balancing that make use of a large variety of tools such as blending, physical or virtual storage. However, operators should retain the right to temporarily suspend third party activity if required for sound and safe system operation.

Storage is a key link in the gas chain because of the range of services it provides to the gas network: load balancing, flexibility, security and grid optimisation. Technically, storage capacity comes in different forms, such as aquifers, depleted gas fields, salt caverns

39. Methodologies for Establishing National and Cross-Border Systems of Pricing of Access to the Gas System in Europe, *prepared for the European Commission by The Brattle Group, 17 February 2000.*

and also LNG peak shaving facilities. A country's potential for storage capacity depends to a large degree on the geological and technical possibilities. Therefore it varies greatly from country to country. Some countries have none due to geological constraints; others have developed relatively large capacities. But on the whole in Europe, storage is expected to grow in proportion with growing gas demand for the next ten to fifteen years.

As European gas markets are about to change as a result of introduction of competition, storage could have new roles to play, enhancing its significance in overall gas supply. With market opening through TPA, storage will gain additional commercial value, such as arbitrage of gas prices over a period of time (for example summer – winter).

A look at North America demonstrates this. With the latest reforms of gas market regulation in North America, storage was unbundled from transportation and gas trading. This led to the emergence of hubs (exchange markets consisting of pipeline intersections equipped with storage capacities to match supply and demand). New actors appeared, offering a wide range of value-added sales services from storage to pipeline system balancing (making the producer less vulnerable to seasonal or random fluctuations in output by building underground storage in production areas), price hedging (making users less vulnerable to seasonal price increases: they can buy gas when it is cheap, store it and use it when it is expensive) or no-notice service (providing the customers with storage capacities that have not necessarily been booked in advance, when needed). In addition, thanks to available storage capacities, futures markets have developed within those hubs: storage serves as the physical support for financial transactions between various actors.

The ability to access storage represents one of the most significant sources of competitive advantage for a supplier of natural gas. It lowers its costs, facilitates balancing, and allows it to provide greater flexibility and security of supply to its customers. The refusal of storage access to third parties by an integrated transport system operator will therefore prove incompatible with the principle of non-discrimination. In conclusion, it would be beneficial if storage could be offered on non-discriminatory terms separately from transport capacity or gas to the widest range possible of gas users and traders.

For operational purposes or a country's strategic supply security policy, a certain amount of storage may be legitimately witheld from public access. Storage capacity allocated for operational purposes should be left at the disposal of the system operator. This should not pose problems if the system operator acts independently of the gas merchant/supply companies/arm. But with limited unbundling, the use of this capacity should be monitored. Preferential access to storage by incumbents would confer a major competitive advantage. Without access to storage, market entry becomes difficult or impossible. If a country decides to hold strategic gas reserves in storage, then it should adopt clear provisions and regulations that distinguish in a transparent manner the relevant volumes from the capacities available for commercial and operational purposes, and set the circumstances, conditions and objectives for their handling, building-up and release.

A gas market with effective TPA to transport should be able to provide companies with sufficient incentives to offer on their own initiative trade in storage services and capacity separately from the commodity as well as from transport (for example by publishing rates or auctioning capacity). In the process of unbundling transport from the commodity they need to identify the costs of other services, like storage, as well. At present in Continental Europe, storage costs/prices are usually integrated by the transmission company in the end price of the gas to the customer. Some storage capacity is already let out on commercial terms, mostly to other natural gas suppliers. Storage is one of several means of flexibility and is likely to compete on the integrating European gas market with other flexibility services such as interruptible sales & purchases, spot markets, pooling, swaps, pipeline buffering or LPG/air injection.

To the extent that competition between providers of flexibility services develops, there should be little need to regulate storage and TPA to it. But in those cases where storage effectively forms a monopoly, access rules and tariff control are needed. The existence of a monopoly in storage does require formal rights or dispositions. Geological constraints, the distances to alternative storage capacity or restrictive TPA regimes can be enough to place alternative storage capacity out of economic or practical reach. In these cases, the introduction of a specific access regime to storage or a non-discriminatory auctioning system of storage capacity should be considered.

TPA to storage may also be considered as a way to help kickstart competition in the initial phase of transition from the traditional supply system to a competitive supply system.

Liquefied Natural Gas (LNG) Facilities

Effective and non-discriminatory pipeline or grid access should enable interested parties to use or access a LNG receiving terminal. It is expected that LNG or LNG capacity holders will have economic incentives to sell gas from LNG terminals into a competitive market, e.g. on the spot market, and also to open LNG to third parties on a voluntary and negotiated basis.

Access to a LNG terminal or carrier seems to be difficult to impose by regulation because of the extent of co-operation/co-ordination needed between users of the LNG terminal. Competitors are not likely to share the infrastructure in the spirit needed for its efficient use. Efficient management of a LNG terminal sets natural limits to use of free capacity, due to the need to synchronise LNG deliveries (offloading of ships in harbour; availability of storage capacity at the site; relatively low number of terminals).

In situations where several LNG sites exist, competition can, however, be introduced by establishing an independent integrated

LNG merchant and operating company per LNG receiving terminal. Each company would run its terminal and buy LNG in competition with the other(s), either to supply the market itself or buy LNG on behalf of another party. This option could however be a sword with a double edge since those LNG merchant companies would have to compete against each other in purchasing LNG. Economies of scale and offloading flexibility due to availability of several LNG terminals and carriers may also be considerably reduced.

Issues to be Watched

A government which engages on the path of regulatory reform of the gas sector needs to have a clear vision of how a liberalized gas market can function and of the changes that are required to develop effective and sustained competition. It also needs to have the clear political will to see this process through the transition period, which can involve difficult issues. There also needs to be a clear recognition that some issues will have to be monitored, or addressed by accompanying measures, on a long-term basis. Some examples are outlined below.

■ Stranded Costs

The issue of stranded costs is not as important in gas as in electricity, except perhaps for the issue of take-or-pay contracts.

Only the costs which were incurred as a result of the transition to a competitive market and which are related to a public service obligation deserve to be considered as stranded. Costs incurred from poor management or that have already been compensated by the company's previous rate of return should not be considered as stranded.

A clear policy decision should be taken as to how stranded costs are to be assigned and how they are to be recovered. If (some of) the costs are to be recovered from consumers, the mechanisms for recovery should be transparent from the outset and not interfere with efficient pricing (as far as possible).

Long-term take-or-pay contracts could, under specific circumstances, constitute a stranded asset. Long-term take-or-pay contracts are typical for the gas industry in Europe and elsewhere. Long-term contracts contain clauses on price and volume. Take-or-pay clauses contain an obligation on the buyer to pay for a certain share of the offtake volume even if he does not take it. To a limited extent, volumes not taken but paid for can be ordered at a later time.

Long-term take-or-pay contracts were widespread in North America and the UK until the introduction of competition created take-or-pay problems. Europeans often blame third party access for this.

In the US, the take-or-pay crisis was due to a combination of several circumstances: inflexible price formulae, lack of price reopeners in the contracts, lack of incentive regulation, freeing distribution companies of their buying obligations with the transmission companies. The problems in the UK were essentially due to the lack of price reopeners in the take-or-pay contracts. In the UK gas market re-regulation, British Gas/Centrica became subject to producers "selling their gas twice" — while having take-or-pay sales contracts with British Gas/Centrica producers entered the downstream market and took large customers away from British Gas/Centrica by offering them direct and cheaper supplies, while British Gas/Centrica had to keep paying for the gas it could no longer sell. In the end, British Gas/Centrica managed to cope, thanks to several factors: government pressure on the producers in the UK offshore to negotiate settlements, the fact that British Gas/Centrica owned important production assets itself (which it partly traded with producers for acceptable take-or-pay settlements), and, perhaps more importantly, that it benefited from favorable tax treatment of its produced gas at Morecombe as a quid pro quo with the government for losses due to take-or-pay. Today, though, Centrica is still bound for part of its supplies to old expensive take-or-pay contracts, which have rendered it uncompetitive in parts of the industrial market.

In Continental Europe, contract duration is generally longer than current contracts in the USA or UK. But contracts tend to be more flexible: prices are linked to the price fluctuation of competing fuels, and can be renegotiated at periodic intervals. In more recent contracts, volumes are also specified more flexibly. This gives European transmission companies generally more possibilities in managing take-or-pay obligations when sales become lower than initially expected (e.g. due to warm weather or increasing competition). Nevertheless, it cannot be excluded that a take-or-pay contract will become a liability in a liberalised market.

This needs to be considered by national and European authorities. The UK "solution" does perhaps provide a lesson in the sense that the issue can perhaps be solved pragmatically rather than by explicit regulation/legislation from the outset.

■ Reciprocity

Reciprocity rules represent barriers to entry of potential natural gas supplies. Given the limited number of producers in and around most European countries, governments should have an interest in extending choices of supply to eligible customers as well as traders as much as possible — both for the sake of competition and security of supply. Foregoing alternative supply possibilities by setting general reciprocity rules is counter-productive.

Reciprocity provisions also carry potential discriminatory effects for access seekers, in particular in large countries. For example, on the grounds of the reciprocity principle enshrined in the recently reformed German energy law, a German gas customer situated close to the French border would not automatically gain access to the German pipes reaching gas in France if the same kind of customer does not have comparable rights in France. However, a similar end-user (and perhaps a competing company) situated next to the Dutch border could benefit from access to Dutch supplies, assuming the Dutch market is similarly open to the German market.

That being said, reciprocity provisions are often expected to have a stimulating effect on market opening in neighboring countries. In theory, reciprocity rules in a more open market could incite countries with a less open market to open up further in order to gain access to the former. This has indeed been the case in North American cross-border electricity trade, and may have been a motive for some reluctant EU member countries to go faster and further in market opening than initially planned.

Reciprocity provisions may be necessary to protect supplying companies against unfair competition, i.e., from companies enjoying formal or de facto exclusive rights in neighboring countries that have not opened the gas sector as far or at all (e.g., consideration should be given to reciprocity between EU and non-EU countries that are not liberalising). This is indeed the original idea of reciprocity. It should be done in such manner as to avoid the problems named earlier, i.e., care should be taken to avoid the provisions being used by inland utilities to fend off external competition. The rules should thus be made so as to allow the authorities to decide case by case by evaluating the interests of the supplier against those of the customer.

■ Harmonisation

Harmonisation will be important to the integration of the national gas markets in Europe. Harmonisation efforts should in particular be applied — either by the gas industry itself or by national and supranational authorities — in the following areas:

- energy taxation, including the levy of royalties and concession fees;
- environmental regulation and standards;
- differences in technical standards, specifications and practices that constitute barriers to gas trade.

Examples of the latter are (no order of priority):

- differences in gas quality (e.g. wobbe index, methane number, soot index, dew point, calorific value);

- differences in the technical codes and standards for design and construction of pipes, in pressure, in specifications for materials and welding;
- odorisation practices;
- gas metering and accounting (procedures and legal framework);
- load balancing.

For some of these technical areas, full harmonisation is perhaps not attainable. For example, full harmonisation of gas qualities may be difficult. In these cases, standard practices should be developed for the day-to-day dealing with these problems. It will have to be ensured that remaining technical barriers are not being exploited to discriminate between shippers or other market players and that charges made to shippers are cost-reflective and not discriminatory. Preferably, third parties should be allowed to provide alternative services to those offered by transmission system operators to overcome quality and other technical differences in cross-border gas exchanges.

Last but not least, it should be mentioned that a harmonised approach to access regulation and tarifing would greatly enhance integration and market opening. But this may be very difficult to achieve in practice.

Harmonisation should enhance competition because it helps to facilitate market entrance of new players and traders. However, given the physical and commercial complexities of gas transactions in Europe compared to electricity, gas trade is likely to remain dominated by the existing gas supply companies for some time.

Responsibilities

Until now, in Continental Europe, natural gas utilities have been held responsible for every aspect of supply. Among other things, they are required to provide reliable supply, flexibility, long-term security and to meet public service obligations. With the introduction of competition, these responsibilities will have to be shared among market participants. Consumer empowerment is also about taking one's own responsibilities and managing one's own security/flexibility needs. But security of supply has several dimensions, and some responsibility will have to remain with the supplier or grid operator.

Supply flexibility will become/is a separately priced commercial item, which eligible customers will be/are able to purchase. Market opening in this context gives the liberated end-user the opportunity to contract and pay only for exactly the kind of flexibility/security he requires, instead of paying his utility an overall non-transparent price that is supposed to contain the flexibility service. This means that the end-user needs to take his own responsibility for his supply security. This is a drastic change considering that most customers, even large industrial gas users, may have difficulties in assessing the value they ought to attach to specific security/flexibility services (e.g. diversification of supplies). They will have to go through a learning-by-doing process. Nevertheless, it is a welcome change since it empowers consumers to make their own choices.

The role of regulation and public authorities is to make sure that the system operator (transmission or distribution company) is responsible for the dispatch of the appropriate physical flow to meet instant demand. There should be provisions in legislation/regulation to ensure that traders/suppliers using the system have the necessary incentives to honour their contracts, e.g. by charging penalties in case of default, and that they have the financial back up to pay these penalties.

In those cases where the system operator is independent from commercial trade and sales, it will also have to be ensured that he receives the appropriate incentives for maintaining short and long-term supply security (e.g. proper grid maintenance and capacity expansion), for example through access pricing.

Special attention will have to be given, though, to the protection of the more vulnerable consumers, in particular households and small businesses. They are — at least for the present and until there is full competition — captive consumers. But even with full competition they would lack the critical mass, the financial muscle and the legal expertise of a large company to be able to cope with contract default of a supplier. This can be done within the framework of a public service policy. One approach could be to oblige the local grid operator to provide a back-up service for faulty supply contracts against a general fee to be levied on all TPA transactions through its grid. Other vulnerable consumers, for example poor people, will also need specific care.

■ Security of Supply

A competitive gas market may need to be monitored and, if needed, flanked by regulatory measures or strategic targets, related to:

- **Diversification of Gas Supplies and Supply Routes.** For some countries, the market may not automatically deliver gas supply diversification. Though diversification and security of supply could acquire a commercial value in an open market, and therefore be offered by wholesale traders/suppliers, there is no guarantee at the outset that this will be maintained or increased, in particular when geographical and technical constraints exist, when transit or transport routes pose security risks, or the number of wholesale suppliers remains low. Supply diversification may, therefore, have to be dealt with by regulation/legislation in import dependent countries. This may be necessary only for a transitional period until sufficient wholesale competition sets in and brings enough diversification. Such regulation is perhaps best done at national level in order to take into account each country's specificities.

- **Operational Security of Supply.** Regulation or public authorities may need to ensure that the system operators (transmission or distribution) receive appropriate incentives for grid maintenance and appropriate capacity expansion. There should also be provisions in legislation/regulation to ensure that traders/suppliers using the system have the necessary incentives to honour their contracts, e.g. by charging penalties in case of default, and that they have the financial back up to pay these penalties. Finally, there needs to be a protection of the weakest consumers in case of supply contract default by a third party.

- **Long-term Security of Supply.** In an open market, price signals dictate behaviour both in the supply of a commodity and the maintenance of infrastructure. As long as prices are accurate, choices made by purchasers or investors will yield an efficient allocation of resources and corresponding supply security. As discussed in the earlier chapters, there are adequate natural gas reserves, adequate alternative fuel sources and — at least for the present time — adequate switching capacity in Europe. And provided a sufficient degree of competition, fuel switching, market liquidity and transparency is achieved, producer market power can be avoided. But long-term take-or-pay contracts are still likely to be needed in a liberalised European gas market in order to underpin large import projects. Their share may diminish over time as other financial risk management tools become available. Nevertheless, governments need to be watchful and prepared to support the market in mobilising new supplies, and to promote flexibility on the demand side through fuel switching and trade.

ANNEX 2

Comparison of Gas Transmission, Gas Distribution and Electricity Supply

	NATURAL GAS		ELECTRICITY
	high-pressure transport	**low-pressure distribution**	**transmission and distribution**
GENERAL			
supply sources/ production	primary energy, depends for the largest part on location and size of natural reserves (place & duration)	primary energy, flexible supplies independent of production	secondary energy, available at choice, flexibility in choice of place and duration of production, and of primary energy
routing of transport lines	in accordance with input and exit points (source & consumption)	in accordance with grid optimisation	function of optimisation of location of generation
quality	gas has source-specific molecular properties; limited compatibility; different pipes with specific gas qualities	specific molecular properties; compatibility is assured before entry into the grid	uniform product quality (tension and frequency); no molecular properties
grid characteristics	laying of pipes depends on the project; point-to-point transport; specific direction of gas flow	meshed grid; direction of gas flow can be modified relatively easily	meshed grid, direction of current can be set at will

	NATURAL GAS		ELECTRICITY
	high-pressure transport	**low-pressure distribution**	**transmission and distribution**
technical-economic characteristics	doubling of capacity mostly requires duplication of specific costs (no natural monopoly)	increase in capacity entails less specific cost, i.e., in relation to existing capacity expansion mostly cheaper than duplication (natural monopoly)	increase in capacity entails less specific cost, i.e., in relation to existing capacity expansion mostly cheaper than duplication (natural monopoly?)
COST CALCULATION			
capacity	specifically reserved capacity (ex ante)	used share of total capacity (ex post)	used capacity (but can sometimes also be ordered capacity (high voltage))
risk			
specificity of investment	high (mostly linked to a specific purchasing or supply contract)	less	less
competition	inter-fuel competition; possibility of competition on the basis of competing lines (no natural monopoly)	inter-fuel competition; limited possibility of competition on the basis of competing lines (natural monopoly)	insignificant inter-fuel competition; limited possibility of competition on basis of competing lines
price formation	capacity utilisation risk (volume, duration)	practically no price risks	so far, price risks appear to be low (cost-plus)
ACCESS TARIFING			
	distance and service related	not distance related	not distance related

GLOSSARY OF TERMS AND ABBREVIATIONS

Aggregator
party which couples more than one order of supplies to gain a price advantage.

Balancing
see 'load balancing'.

Beach / border price
gas price at the border or at the point of delivery by an offshore producer (entry from upstream into a downstream transport system, which in case of imports usually is the national border, and/or which is often conveniently called "beach point" since much gas is produced offshore by a producer or upstream shipper.

Bcm, bcm/y
billion cubic meters, billion cubic meters per year.

Bypass
delivery of natural gas to an end-user by means other than the traditional local distribution company connected to the end-user.

Capacity charge
price asked for reservation or usage of a particular part of the transport infrastructure system (e.g. pipeline/s, storage).

CCGT
combined cycle gas turbine.

Commodity charge
part of the gas price or price asked for the contracted gas volume as such (distinct from other charged costs such as customer charge, capacity charge or charge for other services).

Customer charge
annual/monthly fixed price of connection (sometimes also called connection charge) charged to customers in addition to the

commodity charge and in some cases also in addition to the capacity charge.

Economies of scope
cost savings due to synergies between different activities (e.g. combined meter reading and billing in mixed energy utilities supplying gas, electricity and water).

Economies of scale
the reduction in unit cost as a producer makes/conveys/sells larger quantities of one product. Such reductions result from a decreasing marginal cost due to increasing specialization, use of capital equipment, benefits of quantity purchasing and other economies.

Eligibility, eligible customers
commercial entities or gas users meeting certain criteria specified in the EU Gas Directive or in national legislation which give them the right to request third party access (see also annex 1).

End-user (of natural gas)
is a natural gas consumer.

EU
European Union.

EU Directive, EU Gas Directive
binding legislation for the Member States of the European Union (they need to implement its provisions in their national laws). The so-called EU gas directive was adopted on 11 May 1998 by the EU Member States upon proposal by the European Commission and in co-decision with the European Parliament. Member states must implement the Directive into their national laws by August 2000.

Feedstock
natural gas which is used as the essential component of a process for the production of a product, e.g., fertilizer or glass manufacture.

FERC
Federal Energy Regulatory Commission (USA).

Interruptible gas

gas sold to customers at a lower price with a provision that permits curtailment or cessation of service at the discretion of the supplying company in specific mutually agreed circumstances that have been specified in the contract (typically during peak gas demand days in the winter).

Interruptible service

sales and transportation service that is offered at both a lower price and lower level of reliability. Under this service, gas companies can interrupt customers on short notice in specific mutually agreed circumstances (typically during peak service days in the winter).

LDC

stands for "local distribution company"; in the study, however, the acronym is used in the widest sense for distribution company (whether at local or regional level).

Line pack

gas delivered from line pack is the volume of gas supplied by the net change in pressure in the regular system of mains transmission and/or distribution (in other words, gas delivered from the grid system excluding storage and other infrastructures). Under efficient and economic use of the pipeline usually a limited volume capacity remains for line pack.

LNG

liquefied natural gas; it is methane cooled down below its boiling point (–163 Celsius degrees), thereby reduced to 1/625th of the volume it takes in gaseous form at ambient temperature and pressure. Liquefaction permits concentrating high volumes of natural gas for transport or storage.

Load balancing (hourly/daily/seasonal)

to balance demand and supply (at any given point) in a grid/ pipeline/supply chain.

Load factor
ratio of average to maximum requirement for a time period i.e. one day, one hour, etc. normally expressed over the year as a percentage.

mm^3/a
million cubic meters per year.

Netback, market value pricing
delivered price of cheapest alternative fuel to gas to the customer (including any taxes) adjusted for any efficiency differences in the energy conversion process

minus cost of transporting gas from the beach/border to the customer

minus cost of storing gas to meeting seasonal or daily demand fluctuations

minus gas taxes.

Off-take
actual amount of gas withdrawn.

Peak periods (e.g. peak day)
the period or 24h day of maximum system delivery of gas during a year.

Peak shaving
the use of fuels and equipment to generate gas (LNG stations) or manufacture synthetic gas to supplement normal gas supply from the system during periods of extremely high demand.

Peak storage
gas storage designed/used to supplement normal gas supply in periods of extremely high demand.

Shipper
is the entity using the transportation system to bring gas from point a to point b. The shipper requests the pipeline operator to recognise, account for and physically implement a transportation transaction.

Swing

a contractual commitment allowing a buyer to vary up to specified limits the amount of gas it can take at the wellhead, beach or border; the maximum daily contract quantity is usually expressed as a percentage of the annual contract quantity (100% equates to zero swing).

Storage

storage facilities are an important element in natural gas supply. Storage allows flexibility in pipeline operations and minimizes unwanted fluctuations in gas supply from production/abroad and its delivery to the consumer. It would not be possible or economic to vary production from gas wells feeding into the transmission line as widely and as frequently as demand varies. Natural gas storage is also needed to meet peak demands that may be much higher than the pipeline's average throughput. Gas demand is highly dependent on weather, and a method to handle this fluctuation is required. Natural gas is generally stored as a gas or liquefied gas in underground or aboveground containments. As a gas, it can be stored underground in rock or sand reservoirs that have suitable permeability and porosity; in salt caverns and aquifers, depleted oil or gas fields. The gas is injected under pressure, and then the pressure in the reservoir is used to force the gas out when it is needed. Each storage site does have its individual total storage volume capacity, and a specific hourly rate at which the gas is released, depending on the technical and geological characteristics of the site. When demand is low, gas is injected into storage; when demand is high gas is withdrawn. Some of the gas in the reservoir must be used as cushion gas to allow withdrawal and injection of usable gas. Natural gas stored as a liquid (LNG storage) is a way to do so compactly. LNG storage is usually used at LNG receiving terminals, where LNG is received from tankers and regasified as needed, and at peak-shaving plants, where gas is stored as liquid to meet peak demand.

Take-or-Pay (TOP)

a contractual commitment on the part of a buyer to take a minimum volume of gas, usually over a 12-month period. By this, a gas buyer agrees in principle to pay its supplier for the full amount of the contracted minimum gas volumes even when he does not take the full amount. Most TOP contracts contain clauses that allow deferring from one year to another the full off-take of contracted volumes. A TOP commitment from a buyer is his ultimate commitment to the seller to take the contracted annual volumes. It is an important – some sources from industry and finance claim *essential* – instrument for setting-up new gas production and supply projects in that it guarantees the producer/supplier adequate usage of the capital intensive production and upstream transport facilities which he will need to build.

Tcm
trillion cubic meters.

Third party access (TPA)
the right or possibility for a third party (shipper) to make use of the transportation related services of a pipeline company to move the gas it owns, against a charge/tariff.

TOP
see take or pay.

TPA
see third party access.

TPES
total primary energy supply.