
# The Liberalization of Natural Gas Markets: Regulatory Reform and Competition Failures in Italy

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FOREWORD

Italy is one of the largest gas markets in Europe and has pursued a liberalisation path significantly different from other EU countries. Yet there is little academic literature available on the detail of the Italian gas market. I was therefore delighted when Professor Alberto Cavaliere proposed that he should write such a paper during a visiting fellowship at the Institute in 2006. Our grateful thanks to him for providing us with the first paper that the Gas Research Programme has published on this important European market.

Professor Jonathan Stern
May 2007

**ABSTRACT**

In the last decade, the EU has started to liberalize national gas markets and regulatory reform has followed in member countries. We analyse the basic issues concerning network and storage regulation and the implementation of regulatory reforms in Italy. We then try to explain why, in gas importing countries, such reforms are not sufficient to foster competition. Even regulation ex-post by the Competition Commission has proved to be a formidable task, to the extent that entry barriers in the market for imports depend on congestion of transit pipelines still controlled by the incumbent. Moreover, when gas supply is characterized by long-term importing contracts with take-or-pay clauses, liberalization policies lead to entry and market segmentation without benefits for consumers. In order to foster gas-to-gas competition, the development of wholesale exchanges at market hubs is then necessary. However, new investments in essential facilities are required to reach this aim. At present, new investments are both subsidized and exempted from third party access regulation for financial reasons, but we claim that the incentive to invest is negatively affected by a lack of ownership unbundling.

## 1. INTRODUCTION

The European Union (EU) began a liberalization process during the past decade, in order to create an internal market for gas by breaking up vertically integrated national companies, allowing entry on the supply side and consumer switching on the demand side. The final aim of this process – to create a single market for gas – is still far from being achieved and the degree of competition is considered to be unsatisfactory within Member States (Commission of the European Communities, 2007). Although liberalization was expected to induce the most prominent gas producers to compete all over Europe for gas sales (Golombek, Gjelsvick and Rosendahl, 1998), national gas markets still remain separated and dominated by the former integrated gas utilities. Granting access to international pipelines devoted to gas transit proved to be a formidable task for regulators and interconnection capacity for gas imports appears to be insufficient to meet the requirements of new entrants in gas markets.

In this paper we consider the basic liberalization principles and their implementation at the European level. We then analyse the regulatory reforms that implemented liberalization in Italy and the barriers to trade still preventing the development of competition in the Italian natural gas market. We would like to point out that the Italian case is not only interesting *per se* but also because it represents an advanced experiment of liberalization[1] in a continental country where gas consumption is highly dependent on imports, requiring access to international pipelines. Previous (and more successful) experiences with liberalization involved gas-producing countries such as the UK, the US or Australia, where imports still account for a minor share of consumption or are absent due to abundant indigenous production.

In the past the Italian natural gas industry was characterized by vertical integration and monopoly by a state-owned enterprise Ente Nazionale Idrocarburi (ENI). In distribution and retail sales, a fragmented market structure allowed the existence of small private firms and municipal undertakings operating as local natural

[1] As of January 2003, the Italian market has been completely liberalized on the demand side and both legal unbundling and regulated third party access had already been implemented at that time.

monopolies together with ENI subsidiaries. Such a market structure contributed to network expansion to the extent that monopoly rents and public subsidies made it possible to finance the huge investments required to extend gas networks to most parts of the country. A state-owned monopoly (protected against new entry) at the wholesale stage allowed cross subsidization among regions characterized by different climatic conditions. By this means, natural gas was able to reach consumers located even in the warmest regions, where investment was not considered to be profitable in view of distribution costs[2].

Liberalization was expected to eliminate subsidies and monopoly rents. The development of gas-to-gas competition should have helped to decouple gas prices from oil prices. However, the price of natural gas in Italy not only remains linked to oil prices, but is also considered excessive when compared with prices in other EU countries, in spite of the fact that the dominant supplier has access to cheaper imports in comparison with other European companies (see Section 6.2.2). Regulatory reform consistent with liberalization principles has proved to be a necessary, but in itself not sufficient, condition for competition. At present, the Italian gas market seems to be characterized by free entry without competition. New entrants therefore benefit from liberalization, but consumers do not.

In Section 2, we briefly analyse the main features of the natural gas industry in Italy. In Section 3 we consider the basic principles that characterize the European liberalization process. In Section 4, the implementation of the main liberalization principles in Italy is described. Regulatory reform of transmission, storage and distribution is analysed in Section 5. Section 6 focuses on the analysis of the gas supply following liberalization and regulation ex-post by the Antitrust Authority. In Section 7, we consider gas hubs and the potential development of a spot market outside long-term contracts, and finally draw some conclusions in Section 8.

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Moreover, Italy was the first continental country to introduce legal unbundling concerning storage and to implement a network code and regulated storage tariffs.

[2] For example, this was the case for many areas located in the south of Italy, where the low consumption both in the household sector (for climate reasons) and in the industrial sector (for development reasons) could not justify the extension of the network from the point of view of economic and energetic efficiency, due to high distribution costs. See also Subsection 6.2.2 on this issue.

## 2. THE ITALIAN NATURAL GAS MARKET IN A NUTSHELL

The natural gas network first expanded in Italy in the northern part of the country (Po Valley) after World War II in order to exploit indigenous production. Gas production was driven by rapid industrial development concentrated in those regions. The impressive rate of economic growth that followed in the 1960s also contributed to the increase in household consumption (Ascari, 1985). The extension of the network to most parts of Italy took place more rapidly after the oil crisis of the 1970s, inducing a widespread use of natural gas both by industries and households, supported by imports from the Netherlands, the former Soviet Union and Algeria. The completion of the national gas network was therefore accompanied by investments in international pipeline connections by ENI, the former integrated state-owned company in Italy. Further development of natural gas consumption in the last decade is related to the phasing out of fuel oil in the power sector, also due to environmental pressures and technological progress that contributed to the success of gas-fired power plants after Italy gave up nuclear power.

As a result, gas accounted for 35.8% of total Italian energy consumption in 2005, the second most important energy source after oil. In 2005, industrial consumption accounted for 24% of total gas sales, residential and commercial consumption 35% and power generation 38%[3]. When considering the evolution of gas consumption since 1990, the most striking feature is the growth in power generation: demand more than doubled between 1990 and 2000. In the same period, residential and commercial consumption increased by 32.5% and industrial consumption by 29%. After the introduction of liberalization, total gas consumption increased by 13.4% between 2000 and 2004. Residential and commercial consumption followed the same pattern with an increase of 12.5%, while the increase of industrial consumption was less than 5% in the same period. Gas demand in the power generation sector increased by 22.8% and its growth is expected to continue as more and more power plants are converted to natural gas[4]. By contrast, the household and industrial sectors can be considered mature.

[3] See the Italian Energy Balance Sheet, *Autorità per l'Energia Elettrica e il Gas* (2006) p.10.
[4] Data from *Ministero dello sviluppo economico* www.sviluppoeconomica.gov.it and *Statistiche Energetiche Enea* www.enea.it.

Before liberalization, the Italian gas industry was vertically integrated. ENI was involved in the gas chain from production to retail sale, either as a monopolist or as the dominant player. In the past, ENI enjoyed exclusive rights in hydrocarbons exploration and production in the Po Valley, where the most promising oil and gas fields were located. Gas storage was bundled with production and controlled by a subsidiary of ENI: AGIP Spa. SNAM Spa, another subsidiary of ENI holding, enjoyed a *de facto* monopoly over national gas transmission and supply to the wholesale market, and controlled international transmission pipelines in joint ventures with other foreign companies (see Section 6). Gas distribution was a separated business, bundled with retail sales. Local gas distribution monopolies were controlled either by municipal companies or by other small firms on the basis of local concessions granted by municipalities. However, ITALGAS, a subsidiary of ENI owning local gas undertakings especially in central and southern Italy, was the dominant player with about 30% of the distribution and retail market.

## 3. THE EUROPEAN LIBERALIZATION PROCESS

European liberalization aimed to break vertical integration in the gas industry and introduce competition by requiring each country to implement the following: (1) Unbundling potentially competitive activities of the gas industry (production, imports, wholesale and retail sale of gas) from those segments of the gas chain characterized by a natural or *de facto* monopoly (transmission, storage and distribution networks); (2) Third Party Access (TPA) to essential facilities (not only transmission and distribution networks but also liquefied natural gas (LNG) terminals and storage facilities) which dominant players continue to operate; (3) Liberalization on the demand side, by allowing consumer switching (initially granted only to eligible customers, to be extended to any gas customer by July 2007).

As we shall see, the correct implementation of these principles is a necessary condition in order to achieve competition in the gas market, though it may not be sufficient to actually achieve this aim, as the recent experience of Italy shows. The transposition of the European directive 98/30/CE in Member States demonstrates

different attitudes towards gas market liberalization. France and Germany are at one extreme as the most conservative countries and the UK is at the opposite, having already achieved all the liberalization goals plus a national spot market with prices de-coupled from oil. This variation between countries appears to be due also to the directive allowing for a different degree of transposition of the basic liberalization principles quoted above. A second liberalization directive concerning the gas market (2003/55/CE) amended the first but most European countries have not yet implemented it (Commission of the European Communities, 2007). As far as Italy is concerned, we can show that most principles characterizing the second European directive were already implemented at the national level after transposition of the first.

### 3.1 Unbundling

The separation of the competitive segments of the industry can take place to varying degrees and may concern both vertical and horizontal unbundling of the gas chain[5]. The mildest version of unbundling concerns the simple separation of accounts (accounting unbundling) of the former integrated utility. The strongest version of unbundling is ownership unbundling, which involves de-merging the different activities of the gas chain into separately owned companies. Legal unbundling implies that activities that were once integrated into the same firm are separated and assigned to new corporations whose shareholders are, however, the same as those who once controlled the former vertically integrated utility. Functional unbundling aims to keep management units completely separate within the same company.

Ownership unbundling is necessary to ensure that operation of essential facilities is truly non-discriminatory, as emphasized by the European Commission in the conclusions of its recent market investigation (Commission of the European Communities, 2007). Let us consider, for example, a former integrated utility affected by legal separation between its gas transmission network – an essential facility operated by the Transmission System Operator (TSO) – and gas purchase and resale activities which are potentially competitive. The principle of Third

[5] Horizontal unbundling may concern multi-utilities selling not only natural gas, but also electricity, water and waste collection.

Party Access (TPA), implemented by an independent regulator, should ensure that no firm will be discriminated against while demanding access to the transmission network. However, investment decisions concerning network expansion still depend on the owner. They may be affected by potential strategic behaviour of the incumbent gas utility, restricting competition by preventing expansion of the transmission capacity needed by new entrants. Such a strategy may increase total profits of the incumbent due to its dominant position in the wholesale market, although the profits of its transmission subsidiary may be negatively affected. Ex-post regulation may deem these strategies to be abuses of dominant positions, but this is a weak solution compared to ownership unbundling requirements implemented by ex-ante regulation.

The 2005 report of the European Commission (Commission of The European Communities, 2005) showed that ownership unbundling had been implemented in the UK, Denmark, the Netherlands and Spain (at least as far as the TSO is concerned) while the majority of countries opted for accounting or at most legal unbundling. The second European liberalization directive (2003/55/CE) requires legal unbundling assisted by corporate governance rules that should assure the independence of TSO management with respect to utilities in charge of gas supply (functional unbundling), but such measures risk being inadequate for ensuring the neutrality of investment decisions.

### 3.2 Third Party Access

TPA refers to the definition of non-discriminatory access and tariffication rules for the transmission network, the distribution network, the LNG plants and storage facilities. Concerning networks, the first European directive allowed countries to choose between regulated and negotiated TPA. Most countries (Commission of The European Communities, 2005) opted for Regulated Access with the significant exceptions of Germany and the Netherlands (for the distribution network). The 2003 Directive imposed regulated TPA to the transmission and distribution network. In the case of storage facilities, the directive required an access regime separate from the transmission network, but retained a choice between regulated or negotiated TPA. Following consultation,

guidelines for good practice concerning access to storage were advanced for implementation by national regulatory bodies (ERGEG, 2006).

### 3.3 Consumer switching

Conventional wisdom frequently associates market liberalization with market opening on the demand side, i.e. the share of customers being free to choose their supplier (eligible customers). Here also differences persist among the Member States. Only England, Italy, Spain and Germany have fully opened their gas markets with other countries supposed to follow by July 2007.

Since market opening, estimates of switching by large industrial customers range from more than 85% in the UK, to 60% in Spain, 30% in Denmark, 23% in Italy and just 14% in France (Commission of the European Communities, 2005). Switching estimates for small and medium business customers range from more than 75% in the UK to 3% in Italy. Very small business customers and households have shown a remarkable switching rate only in the UK (more than 47%) while estimates for other countries range from 5% in Spain to less than 2% in Denmark and about 1% in Italy (Commission of the European Communities, *op. cit.*). Household prices may still be regulated in order to protect very small customers until competition gets underway.

## 4. LIBERALIZATION AND REGULATORY REFORM IN ITALY

The first European Liberalization Directive concerning the gas market was implemented in Italy in 2000 (decree n. 164/00). Even before the implementation of the European directive, other national laws introduced some changes in the Italian gas industry. ENI's exclusive rights to gas exploration and production were abolished. During the 1990s, ENI was progressively privatisated, with state ownership reduced to 30%. Throughout this period, an Independent Regulatory Commission for electricity and gas (*Autorità per l'Energia Elettrica e il Gas*, or AEEG) was created as regulatory policy shifting from direct control of public utilities and cost-plus practices to price cap methods, in order to achieve efficiency goals. AEEG was then charged with the implementation of the European Directive. When energy policy issues are also involved (as in gas

storage regulation, for example) AEEG shares responsibilities with the Ministry of Industry.

Italy went even further than the basic requirements of the first directive i.e. accounting unbundling, and a choice of negotiated or regulated TPA to the transmission and distribution network, with no requirement for separate access to storage, was left.

With respect to the transmission network, Italy opted for legal unbundling from the former integrated gas utility. The national transmission network is operated by SNAM Rete Gas, while gas imports and supply in the wholesale market are dealt with by a subsidiary of the former integrated utility, ENI Gas & Power. The newly created TSO (initially totally controlled by ENI) was partially privatised in 2001 by floating 40% of the shares on the stock exchange. Another privatisation deal reduced ENI control to slightly more than 50% but the former monopolist is currently expected to further reduce its participation to 20% by 2010. Italy also legally unbundled storage facilities from gas production and transmission activities. A separated storage company (STOGIT Spa), although completely controlled by the incumbent, was created. As far as TPA was concerned, Italy opted for regulated access to transmission networks, storage and LNG facilities, with access tariffs subject to price cap regulation by AEEG.

In the distribution sector, the former local monopolies had to separate their retail sale business from their network assets. Italy opted for regulated access to distribution, with tariffs set by the regulator. The retail market is completely opened and all final customers were eligible for competition from January 2003.

Thus Italy almost completely complied with the obligations of the second European Directive (2003/55/CE) when implementing the first, although this was not sufficient to introduce effective competition. Before discussing in more detail the reasons for this failure, we shall analyse the regulatory reform that followed the implementation of the European directive.

## 5. THIRD PARTY ACCESS REGULATION IN ITALY

TPA has been implemented through regulated access tariffs for transmission, storage and distribution. Access to transmission and distribution networks, storage and LNG terminals is also regulated. As current LNG imports are negligible – although they may increase in the future – we shall not deal with this subject here.

### 5.1 Regulation of transmission

Traditionally, gas-dispatching activities are bundled with high and medium pressure pipelines (respectively forming the national and regional networks). In the majority of European Countries, transmission networks are separated from (low pressure) distribution networks. Gas transmission in most countries represents a natural monopoly, though in some cases such as the US and Germany the market has developed some degree of 'pipeline-to-pipeline' competition. However, even in those markets where competition appears to be a technically feasible option, allowing market-based tariffs would not necessarily be the correct option unless some conclusive test excludes the existence of market power. Even in the US, where the extension of the interstate market for natural gas allows the existence of multiple TSOs, FERC (the Federal Energy Regulatory Commission) has never allowed them to set market-based tariffs due to the results of market power tests (The Brattle Group, 2002). Considering the existence of huge sunk costs in gas transmission, the potential for competition is weak.

#### *5.1.1 Basic issues concerning transmission tariffs*

There are specific technical features that help to distinguish the gas transmission network from the electricity network. Like electricity, the gas transmission network can be unbundled with separate transmission charges. Access pricing should therefore (at least in theory) be independent from the incentives of the incumbent utility in the supply market. In practice, such a statement would be completely correct only with the implementation of ownership unbundling, which is rather the exception than the rule. Moreover, natural gas has different physical properties from electricity, so the regulator should set transmission tariffs using different criteria.

Issues related to transmission tariffs can be crucial with respect to the implementation of liberalization not only because these tariffs affect the final price of gas, but also to the extent that new entrants cannot by-pass them; transmission networks are essential facilities.

The experience gained by energy regulators and professionals involved in regulation has already led to the analysis of transmission charges in Europe, also in the light of the aims of the liberalization process and the need for tariff uniformity across Europe (The Brattle Group, 2002). Most national networks in Europe are characterized by a meshed structure making it difficult to establish the actual route of gas flows. In this framework, a TSO would rely on a variety of tools to provide firm service, rather than assuring that each contracted transaction exactly corresponds to a precise flow in the network. Setting point-to-point tariffs can therefore lead to inefficiency in resource allocation. Point-to-point tariffs are based on distance parameters, while transport costs are more dependent on pipeline capacity and actual gas flows. Moreover, gas networks are also characterized by back-hauls, implying that delivering a supplementary quantity of gas at some point on the network may imply a reduction, rather than an increase, of marginal costs. Point-to-point (distance related) tariffs can therefore be cost reflective only for non-meshed networks without back-hauls, a condition which is far from satisfied in most national networks. An alternative would be for a TSO to know the precise route of gas related to each transaction and should also award discounts for back-hauls: an impossibility in practice.

As physical flows deviate from contractual flows in practice, an incumbent supplier in the wholesale market for gas with a wide portfolio of contracts may well be able to reduce total transmission charges paid to the TSO by the optimisation of gas flows related to its contracts. For example, a gas swap between two different entry points of the network may be feasible, and changing the in-take point may reduce the distance from the off-take point. A similar operation may not be feasible for a new entrant with only a few contracts, implying, for example, the supply of gas only through one entry point of the

national network. Distance-related tariffs therefore create entry-barriers to the extent that incumbents could face lower unit transmission costs than new entrants.

Considering that European networks may be congested and may need planned expansion, efficiency requires that transmission tariffs correctly signal over-utilization or spare capacity in different entry and off-take points of the network. Such a result can be achieved through entry–exit tariffs. In this case, different charges at different network entry and exit points can signal varying degrees of congestion. Entry–exit tariffs can be said to be more cost-reflective to the extent that if the prospective cost of any incremental flow of gas is greater at point A (congestion) with respect to point B (under-utilization of capacity) then flows through point B should be encouraged by setting lower charges. In order to be cost-reflective, entry and exit charges should then be set equal to Long Run Marginal Cost (LRMC) and back-hauls should give rise to negative charges[6].

However, the calculation of LRMC may not be straightforward and the imposition of negative charges may not be feasible in practice. An algorithm for setting entry–exit charges on the basis of LRMC has been implemented in the UK[7]. While exit charges are still set by the regulator through this algorithm, entry charges in the British network are at present set through auctions that allocate transmission rights to shippers[8].

[6] Lawrey (1998) contends that pricing at LRMC is correct when selling firm capacity while pricing at Short Run Marginal Cost (SRMC) would be more appropriate when selling interruptible transmission capacity and in the case of spot sales. For natural gas pipelines, SRMC is equivalent to compressor operating cost, i.e. the cost of fuel to pump the gas along the pipelines. However, as recognized by Lawrey, pricing transmission rights at SRMC appear to be wise, but as soon as we consider congested network points, over-utilization of capacity leads SRMC to overcome even LRMC. Indeed, secondary markets for transmission rights – i.e. spot markets for capacity – at congested entry points typically lead to very high market prices, reflecting high SRMC to ship gas.

[7] Such an algorithm, known as *Transcost*, endeavours to measure LRMC: "One starts with a base case forecast expansion of the system able to deliver the forecast demand at least cost. One can then ask what would be the additional cost of providing a sustained increase in capacity between an entry and an exit point over some sensible period. The easiest way to think of this is that a buyer located at a particular entry point for a fixed period of time (10 years, for example), and at the same time signs a contract with Transco (*the British TSO, ndr*) to deliver that gas. Transco can then finance the necessary investment to provide capacity to deliver the agreed volume of gas to the buyer out of contract charges". Newbery (1999), p. 2.

[8] Past experience with transmission rights allocation through posted prices has proved to be inefficient, especially considering congestion issues at entry points. The system did not incorporate transmission constraints ex-ante and the increasing cost of constraints resolution lead the TSO to proportionally scale back bookings in order that total booked capacity equalled actual gas flows at the entry point. The result was that some shippers were rationed while others (such as the incumbent) still retained unused booked capacity that was successfully auctioned afterwards, so that scarcity rents were appropriated by some shipper operating in the gas market. The scaling

Auctioning transmission rights implies that scarce transmission capacity is assigned to shippers on a market value basis so that congestion at entry points is dealt with efficiently and scarcity rents may be appropriated by the TSO to finance network expansion and overcome congestion. Auction design includes reserve prices so that even at non-congested entry points the TSO is able to collect part of the revenues (without reserve prices, bid risk being lower than costs at those entry points). Reserve prices are also useful to control market power at those entry points characterized by significantly fewer bidders, where a shipper could bid below costs and still get the required capacity[9]. Auctions of monthly transmission rights are accompanied by daily auctions of both firm and interruptible capacity. A secondary market for trading transmission rights improves efficiency.

In some transmission systems, the fair allocation of retrospective costs may be a more important issue with respect to pipeline expansion. In that case, entry–exit tariffs should reflect average costs. In any circumstance, transmission tariffs must recover total costs. Deviations from a 'pure' entry–exit approach are therefore to be expected when considering regulatory practice.

Postage stamp tariffs can be seen as an entry–exit tariff with equal charges set in every point of entry and exit. They can hardly be considered efficient in respect of future network expansion, or superior to a retrospective cost allocation approach.

While setting transmission tariffs on the basis of entry–exit criteria (with capacity charges based on LRMC) may give satisfactory answers to cost-reflectivity issues, efficiency concerning resource allocation may still represent an issue to the extent that the TSO may offer different kinds of access services (long run and short run, firm and interruptible). Access requirements may also differ seasonally or among shippers. Issues related to demand elasticity may then be relevant when

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back approach itself was leading shippers to breach licence conditions, by nominating gas flows above their initially booked capacity in order to face uncertainty concerning the actual amount of transmission capacity they would dispose of (considering the ex-post scaling-back intervention) and be able in any case to ship an amount of gas consistent with their commercial commitments (McDaniel and Neuhoff, 2004).

considering the TSO as a multi-service natural monopoly. Optimal regulation with the aim of reducing distortions requires Ramsey pricing (Cremer, Gasmi and Laffont, 2003) but this has not been considered in regulatory practice yet.

### *5.1.2 Transmission tariffs and network access in Italy*

As far as gas transport tariffs are concerned, the Italian regulator opted for an entry–exit approach, but without considering LRMC analysis. The methodology followed by the regulator was to recover retrospective costs by applying the principle of inflating historical costs to obtain the revenue constraint of the TSO. New investments can then be recovered using specific charges. Postage-stamp tariffs have been adopted only for the regional (medium pressure) transmission network. Regulated access tariffs set for the first regulatory period implied a reduction of transport charges with respect to the unregulated regime that was in place before.

Tariffs are multinomial and characterized by capacity charges dependent on annual capacity booking at entry and exit points and a commodity charge dependent on gas flows. Though fixed costs amount to more than 90% of total costs and should be recovered through the capacity charges, the regulator established that capacity charges cannot exceed 70% of the revenue constraint. This provision can be considered as an incentive for the transmission company to increase gas flows in order to recover part of the fixed costs through the commodity charge (accounting for the remaining 30% of the revenue constraint)[10] and share the market risk (though we showed above that gas demand has steadily increased recently).

Transmission tariffs set for the first regulatory period were considered to be rather profitable for the Italian TSO, with a (pre-tax) rate of return of 7.94% on the regulatory asset base. Transmission tariffs are subject to a revenue cap, with the exclusion of the commodity charge subject to a pure price cap[11]. Transport tariffs

[9] At the Barrow entry point where there is essentially just one bidder, the reserve price equals the LRMC and auctions always clear at that price (McDaniel and Neuhoff, 2004, p. 215).
[10] Such incentives are also more pronounced in the UK, where 50% of the revenues are recovered from the capacity and 50% from the commodity charge.
[11] One can notice that transmission tariffs were set while the Italian TSO (SNAM Rete Gas) was undergoing a partial privatisation process with a flotation of 40% of shares on the stock exchange.

are expected to decrease further in the second regulatory period (2005–2008) as the (pre-tax) rate of return on assets has been reduced to 6.7% and a profit sharing mechanism has been introduced concerning the observed reduction of variable costs during the first regulatory period. New investments in the network are, however, allowed higher rates of return, potentially contributing to increased transmission tariffs. Moreover, in the second regulatory period, capital costs (with the exception of depreciation) are excluded from the revenue-cap mechanism as they are estimated from year to year on the basis of new data supplied by the TSO: a methodology which appears to be more consistent with rate of return regulation.

Regarding the regulation of network access, when congestion issues arise, priority is given to the incumbent to the extent that it can incur financial distress due to its TOP obligations related to long-term contracts concluded before liberalization was introduced[12]. Congestion issues mainly concern interconnections with foreign networks at the border (see also Section 6). Until 2006, capacity reservation was supposed to be annual (but can be extended to a five year duration); short-term capacity reservation is now allowed. Alternatively, gas transactions could be supported either by interruptible capacity allocated on 'use it or lose it' principles or by trading on a secondary capacity market.

The incumbent not only benefits from priority in capacity reservation due to its past TOP obligations, but also enjoys the flexibility allowed by its long-term import contracts (see following section on gas storage). Some spare capacity may therefore arise in the short-term – in spite of long-term reservation – when import flows are temporarily reduced. Congestion resulting from long-term capacity reservation made on the basis of priority rules may then be accompanied in the

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Obviously stock prices (and consequently Treasury revenues) were greatly affected by regulatory decisions with a considerable impact on public finances to the extent that 60% of this company was controlled by ENI, which in turn is still controlled by the National Treasury for a portion amounting to 30%. In such cases, regulatory policy faces an obvious trade-off between the protection of shareholders (including the State Treasury), requiring an high rate of return of investment, and the protection of both new entrants and final consumers, requiring lower tariffs.

[12] The priority given to firms with TOP obligations was a rule established by the regulator following the implementation of the first European directive. However, new entrants claim that firms with TOP obligations should also prove the financial distress deriving from the impossibility of importing gas due to the lack of transmission capacity. In practice, the priority is allowed simply by considering pre-existing take-or-pay contracts, without requiring any proof of financial consequences if such contracts were not respected.

short run by spare transmission capacity at interconnection points. Such additional capacity may not be available for trading due to asymmetric information[13]. In fact, the incumbent could hinder competition in the wholesale market by hoarding capacity at the expense of new entrants.

Since 2004, trade of daily transmission capacity in a secondary market has been allowed in order to facilitate daily trading at a virtual hub known as *Punto di Scambio Virtuale* (PSV), similar to the National Balancing Point (NBP) implemented in the UK[14] (see Section 7).

### 5.2 Regulation of gas storage

Demand for natural gas is subject to seasonal, daily and hourly changes (especially due to gas consumption related to space heating) while gas supply may be completely flat. For example, take-or-pay clauses in long-term import contracts imply flat gas delivery. However, take-or-pay obligations may be only 80% of annual contracted quantity. Importers can also enjoy some flexibility due to make-up clauses that make it possible to hold part of annual contracted quantities over to the following year. Gas production may also be flat (as in Italy) or offer some opportunity for supply modulation (as in the UK). In order to satisfy seasonal and peak day requirements, gas suppliers may also resort to interruptible contracts with industry. If the gas supplier is a multi-utility firm operating both in the electricity and gas markets, it can switch volumes devoted to electricity generation to satisfy sudden peak demand by households, especially if dual-fired generation plants are available.

However, the gas industry offers a further opportunity for matching a flat supply with demand fluctuations, as gas can also be stored. The possibility of gas storage means that it is possible to avoid building pipelines solely to meet peak demand.

[13] In the EU, a contradiction has been observed while comparing the amount of available capacity computed on the basis of the actual international gas flows and the amount declared by Gas Transmission Europe (GTE), the European Association of TSOs. Such a declaration implies that 42% of the 59 interconnection points are partially or completely congested (The Brattle Group 2002).

[14] Italy, like the UK, has adopted an entry–exit tariff system for gas transport. Such a system is particularly suitable to foster gas exchanges in a virtual hub, to the extent that natural gas already flowing into the network is homogenous from the point of view of entry and could be easily exchanged among shippers and taken off at any exit point. See Section 8.

It then becomes convenient to plan networks characterized by lower transmission capacities, coupled with storage plants where gas can be injected when final demand is lower[15] and withdrawn when consumption grows. Gas can be stored in depleted fields, aquifers, salt cavities and also in LNG plants. Storage plants differ both with respect to storage space[16] and injection/withdrawal rates. Depleted fields provide substantial storage space but limited injection and withdrawal rates. Salt caverns, on the contrary, allow high injection and withdrawal but are generally small in terms of storage space. It would therefore be optimal for any gas system to have a portfolio of different storage plants in order to satisfy flexibility requirements. However, the structure of storage facilities depends on geological features and on past choices of former integrated utilities. These firms were not interested in the optimisation of storage *per se*, but rather considered storage as an ancillary activity to gas production and transmission.

In a liberalized gas market, TPA to storage facilities is as important as TPA to the transmission network. For new entrants in the gas industry, storage might be the only means to cope with demand fluctuations. New entrants do not possess either a wide portfolio of flexible import contracts or a sufficient portfolio of interruptible contracts. Therefore, new entrants must be either multi-utilities with access to (interruptible) gas supplies for electricity generation or must at least have access to storage to achieve the amount of flexibility they need to provide their customers with supply security.

In order to expand market shares new entrants must induce some customer switching, and to keep their customers they must be able to ensure supply security regardless of demand. Any failure of supply would destroy their reputation. Storage capacity may therefore represent an entry barrier in a liberalized gas market. Incumbents also need storage capacity, as the flexibility they can obtain

[15] Gas storage represents an important source of flexibility to cope with seasonal, monthly and weekly variations of demand. For hourly variations, the necessary flexibility is provided by the gas network through 'linepack', consisting of gas storage into pipelines, a service offered by the TSO.
[16] Space can be identified with the volume of 'working gas' that can be injected and withdrawn, distinguished from the amount of 'cushion gas' that is never extracted because it ensures the necessary pressure to withdraw 'working gas' when necessary.

from alternative sources will not be sufficient to meet demand fluctuations they need to accommodate during peak times.

### *5.2.1 Basic issues concerning storage regulation*

Gas storage is not a natural monopoly, although scale economies in storage may be relevant. However, the decrease in cost with storage demand does not give rise to a sub-additive cost function. Any new entrant in the gas market could build a storage facility *a priori*. Therefore, in principle, storage may not be an essential facility. However, storage plants require huge investments and a long time for construction; there are also natural (geological) restrictions to the number of suitable storage sites. Even gas utilities that can afford this kind of investment need TPA for storage at the start of liberalization, while they wait for their own facilities to become available.

Storage plants may therefore initially represent an essential facility for firms competing in the gas market. However, storage-to-storage competition can be feasible and is already working in the UK where the storage industry is controlled only by competition authorities.

The new European directive imposes access to storage independently from the transmission network and requires administrative unbundling of storage activities. Countries can opt for regulated or negotiated TPA. Importing countries can also retain 'strategic storage', which means reserves allocated to supply security (to compensate for accidental interruption of imports for technical or political reasons). Because of its purposes, strategic storage is managed by central governments through their energy policies, but it obviously affects storage regulation having liberalization goals.

### *5.2.2 Access to storage in Italy*

In Italy, storage remains a *de facto* monopoly. The implementation of the European Directive did not set out any obligation for the former integrated utilities to give up some of their storage fields in order to create some competition in the market. Therefore ENI, through its subsidiary Stoccaggi Gas Italia

(STOGIT), controls 98% of gas storage capacity in Italy. The only provision to create some storage-to-storage competition concerns the allocation of further storage concessions to new entrants in order to let them exploit some depleted fields (less efficient with respect to those already allocated to the incumbent). However, the assignment of these concessions has not yet been completed, and therefore opportunities for competition are delayed.

Access tariffs to storage fields are regulated by AEEG. In the first regulatory period, storage tariffs were multinomial with two capacity charges, one related to the reservation of storage space and the other related to the maximal withdrawal rate required by customers, as well as a commodity charge dependent on gas flows injected and withdrawn from storage plants. Previously unregulated storage tariffs were set by the monopolist on the basis of a price discrimination strategy: the level of charges was dependent on the period of injection and withdrawal without any reference to storage costs. In contrast, regulated tariffs are cost-reflective. Since Italian storage consists of depleted fields, which are larger than most existing European storages, both the duration of remaining amortization and economies of scale imply comparatively lower storage costs. Considering also the valuation given to cushion gas (the main asset of a storage firm), storage tariffs are rather low in Italy (the lowest in Europe[17]).

In order to encourage new investments in gas storage by new entrants and to foster competition among them, new storage was exempted from tariff regulation during the first regulatory period when marginal costs were increasing. Access pricing was regulated as far as standard services are concerned, with a single cycle of gas injection in summer and gas withdrawal in winter. Special (short term) storage services requiring multiple cycles of injection and withdrawal or gas parking were left unregulated in order to give storage firms the incentive to develop innovative services capable of satisfying the growing demand for short-term flexibility in a liberalized market.

Beyond storage devoted to seasonal and day peak requirements, one must consider also strategic storage. As Italy is dependent on huge gas imports from

[17] Such a comparison can be found in the website of the storage monopolist: www.stogit.it

outside the EU, and in view of the (geo-political) risk connected with gas purchases from Russia and Algeria, supply security is warranted also by imposing on importers the obligation to store 10% of their gas purchases. Strategic storage tariffs are regulated and include a charge on gas renting, so importers can profit from the huge amount of gas already stored by STOGIT in existing fields in order to satisfy their obligations. By allowing gas renting from the storage company, the regulator enabled importers to devote the entire amount of gas purchased abroad to the wholesale or retail market with greater benefits for new entrants which have smaller volumes of gas available than the incumbent. Were the opportunity of gas renting not available, new entrants would experience a further reduction of gas available for sale.

During the first regulatory period, demand for storage capacity appeared to be greater than supply[18]. Some rationing took place and, for example, storage capacity was insufficient to cover the increasing demand for storage related to industrial customers and power generation. Access to gas reserves devoted to strategic storage had to be granted in order to satisfy final demand during recent winters. Furthermore, rationing of regulated storage services implied that gas sellers had to resort to unregulated special services in order to satisfy their storage requirements[19]. Short-term storage services also represent the main tool shippers can use for balancing their flows in the gas network and typically were sold at competitive prices with respect to imbalance penalties. The storage monopolist could therefore exploit its market power by supplying unregulated services – sold at higher prices with respect to regulated tariffs – while restricting regulated storage services by not investing in additional capacity.

Multiple issues are then at stake when considering the scarcity of storage capacity in Italy. One issue is related to national rules (set by the Ministry of Industry) concerning the amount of strategic storage necessary to ensure supply security (until 2005, strategic gas reserves amounted to 5.1 billion cubic metres (bcm) versus 7.5 bcm available to shippers for seasonal modulation purposes). If storage

[18] During the thermal year 2005–2006, storage demand by shippers totalled 10 bcm while available storage capacity (measured as storage space) amounted to 7.5 bcm (excluding strategic reserves).
[19] Strategic storage is released under conditions established by the Ministry of Industry. When firms exhaust the storage capacity allocated to them for commercial aims they are practically making resort to strategic stocks, and therefore are penalized for using them improperly.

devoted to the requirements of seasonal fluctuations is scarce, the opportunity cost of keeping huge amounts of gas reserves devoted to strategic storage increases.

Another issue concerns the very cautious rules (also set by the Ministry of Industry) regarding withdrawal requirements that should be satisfied by the gas system in the (infrequent) event of exceptionally cold winter days. These rules affect the amount of gas that should be kept in storage in order to ensure adequate gas pressure even in the event of an exceptional peak day. That is why in Italy 4.5 bcm of 'pseudo-working gas' additional to the 9.4 bcm of cushion gas is constantly retained in storage. To the best of our knowledge, this type of pseudo-working gas is not known in other national storage systems and this huge amount of storage reduces the amount of capacity available to wholesalers for commercial purposes. A careful assessment of social costs and benefits related to the implementation of these cautious rules would be worthwhile, but has never been undertaken. Huge amounts of stored gas also create private benefits for the incumbent when it negotiates the price of gas in the international market. Moreover, the availability of storage space affects the ability of importers to cope with their take-or-pay obligations.

Another critical issue concerns the way storage capacity (excluding strategic storage) is allocated by the regulator in case of congestion. Present requirements from the TSO – for physical balancing purposes – and from production units must be completely satisfied. The remaining capacity is rationed on a pro-rata basis according to the market share[20] held by each gas seller requiring access to storage facilities in order to comply with public service obligations. This rationing rule is not optimal, however, considering that some gas utilities may have access to alternative flexibility services that reduce their storage needs, while others can only rely on access to storage in order to satisfy their demand for flexibility. However, following the rule described above, they all pay the same price for a unit of storage capacity.

[20] The market share that is considered concerns customers consuming less than 200 000 cm per year i.e. those customers that once were non-eligible for competition (the household market and small firms).

With respect to the latter mechanism, competitive auctions would allocate scarce storage capacity more efficiently on the basis of its value, which differs structurally across bidders[21]. As storage has some substitutes in the market for flexibility, and considering that these substitutes are asymmetrically distributed among gas sellers, use of auctions to resolve congestion[22] means that scarce storage capacity can be assigned to those bidders that value it most (i.e. new entrants with less flexible supply sources than incumbent utilities). In the long term, any gas seller will be induced to increase its availability of alternative flexibility sources if the price of storage rises, thus reducing pressure on scarce storage resources[23]. Relying on auctions to allocate scarce storage capacity implies that the unit price of storage increases in relation to regulated cost reflective tariffs. Only workable competition in the wholesale and retail market can put a cap on storage prices; shippers will not bid too high a price if storage costs cannot be recovered in the final market because of the fierce competition that reduces profit margins. Implementing storage auctions without effective competition in the downstream market may lead to the risk of increasing retail prices. However, the share of storage costs on average retail prices does not exceed 3% in Italy. Incremental storage revenues resulting from auctions could then be allocated to the expansion of storage capacity.

In fact, no investments been made either in building new or expanding existing facilities[24] during the first regulatory period, thus exacerbating the problem of rationing. In 2006, AEEG defined tariff criteria for the second regulatory period. The introduction of competition in storage has been delayed and priority has been given to the investment subsidies by introducing a very high rate of return on new assets (11%) and the exclusion of 80% of new storage capacity from TPA, according to new EU principles concerning the financing of new infrastructures[25].

[21] The UK experienced the allocation of storage capacity through auctions before introducing ownership unbundling and completely relying on competition and regulation ex-post of this sector (Hawdon and Stevens, 2001).

[22] According to a recent report, most European countries lack enough storage capacity (ERGEG, 2006).

[23] In order to avoid capacity hoarding by the incumbent or by any other gas seller, an upper limit on the total amount of storage assigned to a single firm should be introduced, otherwise there is a risk of competition distortions in the wholesale market.

[24] Two new concessions had already been allocated to the incumbent even before liberalization but were not developed until recently when Italy was threatened with a gas shortage.

[25] Beyond these provisions, new storage tariffs include a further charge for injection capacity, eliminating the distinction between regulated and unregulated storage services. For example,

With such provisions the regulator hopes to remove storage bottlenecks in the long term, at least in relation to storage space. In fact, a shortage of capacity concerning the maximum withdrawal rate required by storage customers for modulation purposes is likely to persist, even with the new investments currently planned by the incumbent and by new entrants. In order to remove these final bottlenecks, some LNG peak shaving plants are required and explicitly encouraged by the regulator who provided the subsidies described above.

In spite of these subsidies, the growth of investments in storage remains uncertain. By considering strategic issues affecting investment behaviour, one may conclude that the reluctance of the monopolist to develop new storage capacity in the last few years was not due to the low tariffs[26] but rather to the fact that any new investment could benefit new entrants more than the incumbent that has storage substitutes available. As the storage monopolist is still completely controlled by the dominant supplier, a conflict of interest arises insofar as profits from gas sales are much higher than those earned from storage. The incumbent may therefore find it convenient to limit storage if this strategy contributes to its keeping a larger market share and high profits in the wholesale market. A storage company owned independently from the incumbent, and therefore neutral with respect to the wholesale business, would maximize its profit by increasing storage capacity.

### 5.3 Regulation of distribution networks

In Italy, gas distribution is separated from gas transmission. In the former vertically integrated industry, distribution was bundled with retail sales and there were about 700 local and municipal gas undertakings providing both services. Due to mergers and acquisitions, the number of companies was reduced to 480 in 2004. However, fragmentation still remains a major handicap for this segment of the gas chain, preventing the full exploitation of scale economies that characterize the local distribution network and are usually extended beyond municipal limits[27].

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injections are allowed at any time of the year if injection capacity is available. Injection flows during withdrawal time (cold season) simply pay the commodity charge insofar as they produce a collective benefit consisting of easier peak withdrawals from storage fields.

[26] According to the regulator, the profits of the storage monopolist presently amount to 33% of sales value (Autorità per l'Energia Elettrica e il Gas, 2006).

[27] Empirical analysis concerning the pre-liberalization period showed a marked profitability but a low growth in total factor productivity of distribution firms (Erbetta and Fraquelli, 2003).

Following the requirements imposed by the liberalization process, distribution has been separated from retail sale, with legal unbundling. In addition to vertical unbundling between distribution and gas retail sales, most utilities were also affected by horizontal unbundling from the administrative point of view, as they frequently provide additional local services such as electricity and water distribution, public transport or waste collection. Horizontal unbundling was necessary to get separate accounts for gas distribution activities in order to improve tariff regulation.

### *5.3.1 Distribution tariffs*

Due to the structural features of distribution (a local natural monopoly), gas distribution tariffs (inclusive of sale charges) have always been regulated. A reform of distribution tariffs was implemented by AEEG in 2001 with the aim of increasing productive efficiency in the distribution industry. Due to the high number of competing firms, some yardstick competition is feasible in this industry. Regulation has tried to define distribution tariffs with capacity and commodity charges based on cost parameters obtained from a sample of the most efficient firms, in order to create incentives to improve productive efficiency and eventually exclude inefficient distribution units. However, some distribution firms appealed to the courts against this reform, claiming that companies subject to balance sheets audits should be able to impose tariffs based on the asset value resulting from their accounts, instead of linking tariff charges to estimated cost parameters. As the courts accepted this claim with respect to capital costs, the decision of the regulator was partially reversed. Since only operating costs could be estimated through yardstick competition, most distribution units now operate as companies subject to audit obligations concerning their balance sheets.

Conflict is continuing in the second regulatory period. AEEG resorted to price capping as the only instrument able to affect productive efficiency, by increasing the efficiency factor (X) in the price cap formula. However, following new legal proceedings, the courts again reversed the regulator's decision. This conflict has produced continuing revisions of the distribution tariffs and extreme national variations in tariffs. The result for gas sellers is increasing uncertainty about

distribution costs, particularly strikes firms without stakes in distribution companies.

### *5.3.2 Distribution concessions*

In order to increase efficiency in the gas distribution sector, the implementation of the first European directive in Italy also introduced competition in the market, to the extent that municipalities should organise auctions to award gas distribution concessions every 12 years. Before liberalization, distribution concessions were generally awarded by municipalities for decades and then renewed without reference to competition rules, thereby excluding any market contestability. However, even after liberalization, the existing distribution system operators (DSO) continue their local monopolies as the start of auctions was delayed by the central Government. Such a delay keeps economic and financial benefits either for municipalities – still holding total or partial ownership of local distribution companies – or other local stakeholders (mainly unionised workers) involved in this business. Delays were initially granted only to firms undergoing partial privatisation or involved in merger and acquisition operations that extended the size of distribution franchises[28]. As auctions were definitely supposed to start in 2005, a few municipalities have already had to resort to them to renew gas distribution concessions (before a new postponement was introduced by the Government). The results were astonishing from the economic point of view.

In view of the fact that distribution tariffs are defined by the regulator as fixing the revenue constraint of any DSO operating in a distribution area, bids mainly concerned the rent that contending firms promise to pay to the municipality to get the monopoly franchise (the revenue constraint set by AEEG being the upper bound of bids). Winners committed to pay rents that amounted in average to about 50% of revenue constraints, with peaks reaching as high as 80%. Since firms that are able to pay such high fees are supposed to be characterized by the lowest distribution costs, productive efficiency is likely to be achieved by auctions. However, if a distribution business could be run with such net revenue, one

[28] In fact, privatisation of firms providing local public services and the increase of concentration in these industries have always been considered an important aim of reforms implemented since 1990, concerning not only gas distribution but also other local public utilities.

wonders about actual distribution costs and the cost reflectivity of tariffs defined by the regulator[29]. Regardless, the welfare benefits of auctions are only accrued by municipalities as they cannot affect either access prices of the distribution networks or final prices paid by gas consumers.

## 6. COMPETITION IN IMPORTING COUNTRIES: THE ITALIAN CASE

In Italy, the demand for natural gas is mainly covered by imports, amounting to 84.8% of the total supply in 2005. Imports mainly come from Algeria (37.4%) and Russia (31.8%), followed by the Netherlands (10.8%), Norway (7.8%) and Libya (6.1%). The remaining share of imports comes from other countries of the EU (4.5%) and from other non-European Countries (1.5%). Almost all gas imports take place via pipelines, except for a small share of Algerian gas and some negligible spot cargoes that are traded in the unique LNG terminal controlled by ENI, accounting for about 3.4% of total imports in 2005 (AEEG, 2006). National production is steadily declining (from 23% to 13.9% of total supply during the period 2000–2005; AEEG, 2006), partly due to heavy national and local regulation that imposes excessive costs and risks on new entrants in exploration and production activities[30].

### 6.1 Competition and ex-post regulation in the market for gas imports

The dominant firm is still the most important national producer (84.1% in 2005). Assuming that new investments in production were not going to be relevant in the near future[31], the Government, while implementing the first European Directive, tried to introduce effective competition in the Italian market through liberalization of gas imports jointly with market share limitations. A reduction of the dominant firm's share of total imports to 70% was initially imposed, to be followed by another reduction to 61% by 2010.

[29] It was also noticed that in many cases the winners were not traditional distribution firms but companies involved in contiguous sectors (such as pipeline-laying) characterized by lower operating costs (for example lower wages due to a different collective working contract) and presumably a low propensity to invest in network expansion.

[30] One should consider that the 'time to market', i.e. the time span from the start of exploration activities to the commercial exploitation of production fields ranges from 90 months (at present) to 120 months (due to a new law which extends the political power of regional authorities in the energy field).

[31] Due also to regulatory barriers imposed by national legislation.

Despite market share limits and the growth in the number of importers after liberalization, the market for gas imports still remains highly concentrated. Between 2000 and 2005, 18 new licences have been granted by the Ministry of Industry to import gas from outside the EU. Among these, only 15 have actually given rise to import flows. Communications to the Ministry of Industry concerning gas imports within the EU amount to 128, but they mainly concern negligible flows related to spot contracts (AEEG, 2005). In 2004, gas imports by the dominant firm amounted to 62% of total gas imports in Italy, consistent with antitrust ceilings. However, ENI market share is even larger as part of the gas imported by its competitors derives from gas sales carried out abroad by the company itself, before gas flows reach the entry points at the Italian border.

In the liberalization law, nothing was said about the implementation of market share limits. They could in fact lead either to competitive auctions for the sale of gas belonging to the incumbent (gas release) or to bilateral negotiations with new entrants. ENI chose to sell part of its gas abroad, to a small number of companies under long-term contracts (all expiring in 2010)[32]. For example, in 2002 the market share of the dominant firm officially accounted for 72% of total imports, but considering the sales made abroad to its national competitors this figure increased to 83%. In addition, as far as national production is concerned, ENI still controlled about 93% of gas supply in Italy in 2002.

This result shows the failure of market share limits as a method of introducing competition in gas markets dominated by imports. Gas release programs such as those carried out in the UK and in Spain probably perform better with respect to the aim of promoting competition in the wholesale market for gas. Market share limitations cannot be considered equivalent to the extent that the dominant firm has formally complied with them while being able to partially compensate the loss of sales in the Italian market with an equivalent transaction upstream. Under this transaction, the dominant firm supplies gas to its competitors for resale in the

[32] This was an amount of gas imported from Norway by the dominant firm and then sold wholesale at the border between France and Germany to four new entrants in the Italian gas market.

domestic market, exploiting its access to cheap gas abroad to impose a mark-up that reduces the profit margins of new entrants.

However, the Italian Competition Authority established ex-post that ENI was abusing its dominant position in the gas market, to the extent that exclusive gas sales abroad to selected new entrants were coupled with proportional capacity reservation in international (transit) pipelines, so as to exclude any other firm from directly supplying the Italian gas market with independent imports in the near future[33]. In fact, liberalization policies failed to consider that ENI continues to hold exclusive transmission rights in transit pipelines located outside Italy, to which it contributed to the building of when it was a vertically integrated monopolist.

Therefore, unbundling the national transmission network from the former integrated utility may not be sufficient to introduce competition if the utility still keeps the control of all the essential facilities located abroad[34]. These facilities are furthermore exempted from the principle of non-discriminatory TPA as they are devoted to transit. Hence, the incumbent was asked by the Italian Competition Commission to expand its foreign network facilities to allow incremental gas imports by new entrants. Failure to comply with such a request meant that the incumbent faced both a heavy fine and an obligation to carry out a gas release program (1.7 bcm) under the control of the Commission. Such a program was, however, ineffective with respect to the promotion of more competition as it merely implied a pro rata sharing of the additional gas available among new entrants at a fixed price.

Examining import capacity booked at interconnection entry points of the Italian transmission networks, it appears that there is no spare capacity. The only

[33] See the decision of the Italian Competition Commission (decision A329 –BLUGAS–SNAM, 11th November 2002 www.agcm.it ).

[34] At present, ENI controls the TENP pipeline crossing Germany to import gas from the Netherlands, the TAG pipeline crossing Austria to import Russian gas and the TRANSITGAS pipeline which crosses Switzerland and is connected both to TENP and to the French network in order to import gas from both The Netherlands and Norway. Outside Europe, ENI controls the TTPC pipelines in Tunisia and the connected TMPC offshore pipeline that crosses the Mediterranean Sea and reaches Sicily to import gas from Algeria. A new pipeline crossing the Mediterranean and connecting Libya with Sicily is also controlled by the incumbent; gas imports through it began in 2004.

exception is Sicily, characterized by some spare capacity (13% in 2003) at the interconnection point with the Mediterranean pipeline (Transmed) which connects Tunisia with Italy to allow gas imports from Algeria. Even in this case, however, additional imports of gas cannot take place because of the lack of capacity in Tunisia, where the incumbent still controls the transmission facilities.

In February 2006, the Italian Competition Authority established again that the incumbent was abusing its dominant position in the Italian gas market by failing to carry out the investments aimed at increasing import capacity in Tunisia. This was preventing the expansion of gas imports from Algeria, despite the fact that some contracts between the Algerian exporting company Sonatrach and some gas suppliers had already been concluded[35]. Such behaviour was effectively preventing new entrants from by-passing the incumbent intermediation and importing more Algerian gas to Italy (for onward sale to other countries). Although some expansions of capacity have now been completed, further barriers to trade have recently been introduced by the Tunisian Government[36].

In the past few years, the incumbent claimed that its opposition to capacity expansion in transit pipelines was due to its forecast of an excess supply of gas in Italy (literally, a 'gas bubble'), as some new entrants were trying to by-pass the existing bottlenecks by planning to build new LNG terminals[37]. The incumbent's forecast was refuted in 2006, when Italy was threatened with a gas crisis due to its structural lack of import and storage capacity, dramatically highlighted by the reduction of gas imports from Russia[38]. At present, only one of the planned LNG

[35] See the decision of the Italian Competition Commission (process A358–ENI–TRANSTUNISIAN PIPELINE, 11th February 2006, www.agcm.it )

[36] This Government imposes the obligation to conclude importing contracts with the Algerian Company Sonatrach to get access to the infrastructures located in its territory, then preventing separate access to the pipelines for shippers without such a contract. See the warning by the Italian Competition Commission to the Italian Government: process AS366 "Transporto internazionale di gas tramite il gasdotto TTPC", 19th October 2006, Bullettin n. 41/2006 www.agcm.it

[37] At the time of writing, only one of these LNG facilities is expected to be in operation by 2008.

[38] During the 2005–2006 winter, the crisis of gas supplies was worsened by large withdrawals of gas from storage in order to increase electricity production as higher electricity prices at the French power exchange suddenly made electricity exports from Italy (where electricity prices were lower) economical. In order to safeguard household consumption for space heating it became necessary to ration industrial consumption and switch power plants to fuel oil. Resort to large gas withdrawals from strategic storage was also necessary at the beginning of February 2006. The steady decline of gas stocks, when the winter season was far from being over, increased concerns about the eventual failure of the storage system to deliver a sufficient amount of gas in case of a sudden peak in daily demand.

terminals is expected to be working by 2008 and the required expansion of capacity concerning transit pipelines owned by the incumbent has only been completed in Austria (TAG pipeline).

## 6.2 Competition in the wholesale and retail market

After liberalization, market share limitations also imposed on the incumbent a requirement not to exceed a market share of 50% in national sales. In order to assess the degree of competition in the Italian wholesale and retail market for gas, we analyse both the evolution of market structure and pricing policies.

### *6.2.1 Market structure*

The evolution in the structure of the wholesale market since liberalization is documented in Table 1.

**Table 1**

| | **2002** | **2003** | **2004** | **2005** |
|---|---|---|---|---|
| **Number of operators (#)** | 55 | 40 | 41 | 60 |
| ENI Gas & Power | 1 | 1 | 1 | 1 |
| Wholesalers with sales greater than 10 bcm | 1 | 1 | 1 | 2 |
| Wholesalers with sales between 1 and 10 bcm | 4 | 4 | 6 | 8 |
| Wholesalers with sales between 0.1 and 1 bcm | 17 | 20 | 19 | 29 |
| Wholesalers with sales lower than 0.1 bcm | 32 | 14 | 14 | 20 |
| **Amount of sales (Bcm)** | 85.2 | 90.6 | 95.9 | 110.5 |
| ENI Gas & Power | 52.3 | 51.3 | 53.6 | 58.0 |
| Wholesalers with sales greater than 10 bcm | 12.9 | 17.8 | 16.3 | 27.0 |
| Wholesalers with sales between 1 and 10 bcm | 15.8 | 15.6 | 18.4 | 14.0 |
| Wholesalers with sales between 0.1 and 1 bcm | 4.0 | 5.6 | 7.6 | 10.8 |
| Wholesalers with sales lower than 0.1 bcm | 0.2 | 0.2 | 0.1 | 0.7 |

Source: AEEG (2006), p.96

Despite the growth in the number of wholesalers and in the amount of sales due to new entrants, the wholesale market remains highly concentrated. The cumulative market share of the top four companies (ENI, Enel trade, Edison and Plurigas) accounted for 80% in 2005 (AEEG, 2006).

Regarding the retail market, it should be recalled that prior to liberalization final sales were bundled with distribution activities at the local level. Each firm was a local monopolist in one of the 5700 municipalities with a distribution network. Beyond the 300 municipalities that directly supplied gas to final customers, there were about 300 private firms and about 150 public or mixed firms operating on the basis of local concessions. After liberalization, sales activities had to be unbundled from distribution activities.

Only legal unbundling was required, and in most local markets the distribution system operator and the retail company share the same ownership. However, the liberalization process had the merit of boosting a concentration process that is still in progress. Firms involved in gas sales tried to reach the critical threshold required either to be able to import gas or to exercise some market power when purchasing the commodity at the wholesale level, thereby increasing their market share. The most active municipal firms created a few companies capable of carrying out gas imports independently from the incumbent. Some new entrants, such as Gaz de France or E.ON (Ruhrgas), expanded their market shares by acquiring distribution assets to pursue vertical integration downstream and extend their control to the local retail markets connected to the related distribution networks. Other companies such as Edison, beyond directly supplying some retail markets, pursued a different strategy by subscribing participation agreements in local municipal companies, thereby becoming their wholesale gas supplier. The incumbent traditionally operated downstream through its control of the distribution company ITALGAS. After legal unbundling, the incumbent increased its vertical integration downstream initially through a buy-back of ITALGAS shares in order to gain complete ownership of this company and then incorporate it within the commercial division ENI Gas & Power.

Despite the reduction in market fragmentation, in 2005 there were still 409 firms holding the sale licence now required to operate at the retail level. AEEG has carried out a survey on the retail market, with results displayed in Table 2[39].

**Table 2**

| | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|
| **Number of sellers** | 504 | 432 | 353 | 257 |
| Firms with sales greater than 1000 mcm | 2 | 5 | 4 | 4 |
| Firms with sales between 100 and 1000 mcm | 42 | 40 | 37 | 40 |
| Firms with sales between 10 and 100 mcm | 222 | 176 | 149 | 102 |
| Firms with sales lower than 10 mcm | 237 | 211 | 163 | 111 |
| **Amount of Sales** | 26.6 | 33.0 | 31.4 | 24.9 |
| Firms with sales greater than 1000 mcm | 7.5 | 15.8 | 14.6 | 8.5 |
| Firms with sales between 100 and 1000 mcm | 11.2 | 11.1 | 11.6 | 11.8 |
| Firms with sales between 10 and 100 mcm | 6.8 | 5.2 | 4.6 | 4.2 |
| Firms with sales lower than 10 mcm | 1.0 | 0.8 | 0.7 | 0.3 |

Source: AEEG (2006), p.100

The persistent fragmentation of the retail market is not only due to the slowness of the concentration process but also because the latter did not involve small gas sellers located in the south of the country.

### *6.2.2 Competition and prices*

Before liberalization, not only were household gas prices regulated but prices for industrial users were subject to negotiations between ENI and trade associations. Price controls coupled with legal monopoly at the wholesale level implied some cross subsidies among consumers. When the gas network was extended to the south of Italy, the low consumption of households due to a warm climate implied too high average distribution costs to support natural gas penetration. By spreading most of the commodity costs over consumers located in the coldest regions of the country – where average distribution costs were lower – natural gas became available at competitive prices all over Italy. Even in the industrial market, gas intensive industries were subsidized by firms with lower consumptions due to a regressive tariff structure (including transmission charges at the time).

[39] One should be cautious when examining these results, as about 40 licensed firms are no longer active in the market and many other firms did not participate in the survey.

When the market was completely liberalized, the end of legal monopoly in the wholesale market meant that cross subsidies were no longer sustainable and, therefore, some consumers experienced price increases. Gas intensive industries lost their benefits, considering also that regulated transmission tariffs are less regressive than before.

Wholesale contracts[40] show that after liberalization, gas prices are determined on a cost-plus basis and depend on the stand-alone cost characterizing each customer plus a profit margin. Stand-alone costs are affected in turn by the geographical location and the load curve of the customers. Geographical locations affect the stand-alone cost through regulated transmission and distribution costs, which decreased after liberalization. Competitive advantages in the wholesale market mainly depend on the weighted average cost of gas supplied, i.e. commodity costs plus international transmission costs. New entrants are then at a disadvantage with respect to the incumbent either because they generally bear higher import costs or because they cannot acquire independent gas supplies and have to resort to purchasing from the incumbent itself.

A survey of CIF (cost, insurance and freight) gas import prices in seven EU countries (Belgium, the Netherlands, France, Germany, Spain, UK and Finland) for the period 1994–2002 produces values between 10.8 eurocent/cm and 15.8 eurocent/cm[41]. The weighted average cost of gas imports in Italy in 2002 was about 12.8 eurocent/cm. However, the final price of gas for industrial users (without taxes) in the period 1997–2003 has almost always been higher with respect to the prices prevailing in these seven European countries. Household prices were among the lowest for the smallest customers and among the highest for larger customers (due to a cross subsidy among households which has now been removed)[42].

[40] The following analysis is based on an investigation jointly carried out by the Competition Commission and AEEG to assess the results of energy markets liberalization until 2004 (Autorità Garante della Concorrenza e del Mercato, 2005).
[41] Autorità Garante della Concorrenza e del Mercato (2005), p. 83; data were collected from the International Energy Agency and only concern gas imports via pipelines.
[42] Autorità Garante della Concorrenza e del Mercato (2005), p. 82; data about prices were originally collected from Eurostat statistics. More recent price comparisons are difficult to carry out as Italian prices have not appeared in official statistics published by Eurostat since 2003.

Even after liberalization, the competitive advantage enjoyed by the incumbent (being the main importer) in the international market has therefore never been passed on to final customers in the retail market. The Competition Commission found that the incumbent offered lower prices with respect to new entrants as far as industrial customers and power stations are concerned. New entrants can hardly offer lower prices with respect to the incumbent except for the fall in transmission and storage costs resulting from regulation. Their market share appears to be the simple effect of the imposition of market share limitations rather than a result of competition. Concerning the wholesale price paid by local retail firms operating as suppliers of the household market, it was ascertained that new entrants may offer more attractive contracts with respect to the incumbent. This may be due to the fact that ENI can directly supply the household market after the incorporation of its subsidiary ITALGAS (see above), and therefore can concentrate its competitive effort in the market for industrial users and electricity generation.

The strategy pursued by the incumbent allows an increase in profits compared to new entrants. Both the congestion of import facilities and the difference in market share limitations (70% for imports decreasing to 61% by 2010, and 50% for the sale of gas) allows ENI to be a supplier of its competitors in the wholesale market. As the incumbent benefits from a lower cost of imports due to its first mover advantage in the international gas market, it can obtain a supplementary mark-up by selling gas to new entrants, whose profit margin is significantly lower.

The distortions of competition in the wholesale market affect the retail market where, even after complete liberalization, a market structure dominated by local monopolies still persists, due to market segmentation. The rate of household consumer switching is negligible (less than 1%) and we know of no attractive offers to households other than from ENEL, which is the dominant firm in the electricity market[43]. Due to the lack of competition and in order to protect small consumers from the market power of the local monopolist, the regulator continues to impose tariff regulations for small consumers.

[43] However, one should be cautious about these offers insofar as ENEL continues to operate as a monopolist in the household market for electricity, where customers will not be eligible for competition until January 2007. Lower gas prices may simply be the result of a cross subsidy from the electricity market and be part of a strategy concerning the dual fuel (gas-electricity) market.

As the lack of competition in the wholesale market is apparently due to the congestion of imports and storage infrastructure, it would seem to be wise to require the incumbent to remove congestion through new investments in order to enable new entrants to obtain additional quantities of cheaper gas negotiated independently from ENI. Subsidization of new investments (Sections 5.1 and 5.2) and exemptions from TPA – fostered by the European Commission – can be explained by the need to eliminate bottlenecks in the gas chain (considered a pre-requisite for competition), as can interventions ex-post by the Competition Commission. However, even creating a level playing field in the wholesale market between the incumbent and new entrants has not led to price competition and a decrease in retail prices.

### *6.2.3 Take-or-pay obligations and entry without competition*

The development of competition in gas importing countries may require further changes as market segmentation and the persistence of a local monopoly at the retail level could also depend on the influence of long-term contracts characterized by take-or-pay (TOP) clauses. In 2005, 95% of natural gas imported in Italy was based on long-term contracts, most of which were signed by the incumbent dating back to the 1970s[44]. Contracts lasting more than 30 years accounted for more than 50% of the annual contracted quantity in 2005, followed by contracts lasting 15–25 years that accounted for 33%. The residual length of long-term contracts in 2005 was between 10 and 15 years.

Long-term contracts impose a heavy financial burden on gas importers due to TOP clauses and this burden may affect the development of competition in importing countries. Polo and Scarpa (2002) show that importers face huge fixed costs and negligible marginal costs due to their TOP obligations. As demand in the wholesale market is covered by gas imported on long-term TOP contracts,

[44] The Competition Commission has also pointed out that two of these contracts were signed by the incumbent just before the issue of the first liberalization directive by the European Commission inducing the suspicion of a pre-emptive strategy in the market for gas import and transmission capacity. Even a second offshore Mediterranean pipeline connecting Italy to Libya, built by ENI, dates before the liberalization of the gas market and was completed in 2004 when import flows started to take place. In this case, ENI shares capacity with some new entrants.

neither the incumbent nor the new entrants can bear a price war to achieve wider market shares, as Bertrand competition would drive prices to (very low or null) marginal costs and revenue would not be sufficient to cover fixed costs. Aggressive price policies to expand market share after entry are therefore not credible. In such a framework, firms are better off maximizing profits through segmentation of local markets, where they are able to impose a monopoly price (the reservation price) due to the lack of credible entry threats. The result of liberalization is then free entry without price reductions for consumers. Such a conclusion seems to be consistent with the Italian experience – the most advanced liberalization experiment in an importing country – as new entrants have expanded their market share by acquisitions of local distribution assets or local/municipal companies in order to gain access to retail markets.

This theoretical result can be generalized and applied to any importing country where supply takes place through long-term bilateral contracts with take-or-pay clauses. Real progress in competition could only be achieved if new entrants could obtain access to a sufficiently developed and liquid spot market for gas at a virtual or physical hub. In that case, purchase conditions in the wholesale market for gas would change as operators could avoid the heavy burden of TOP clauses and face a homogenous gas price depending on demand and supply reflecting scarcity of gas resources.

## 7. PROSPECTS FOR GAS HUBS IN ITALY

A centralized spot market for gas exchanges currently does not exist in Italy and there are no physical hubs for this purpose. However, a virtual hub for bilateral negotiations Over The Counter (OTC) has been launched by the national TSO (SNAM Rete Gas) through an electronic platform, following the earlier experience of the National Balancing Point (NBP) in the UK. Such a market is known as *Punto di Scambio Virtuale*, or PSV. Transactions takes place at a virtual point of the national transmission network and are therefore considered to have already entered the network (from production, storage or entry points at the border). Due to the fact that negotiations are bilateral, price information is not disclosed by any official source. Gas exchanges at the PSV have steadily been increasing (a monthly peak of 845.9 mcm was reached in November 2006), but

have not displaced spot transactions traditionally taking place at entry points of the national transmission network. Most transactions involve volumes of between 50 000– 100 000 cubic metres. In 2005, trading at the PSV accounted for 28% of the total amount of gas exchanges within the transmission network (AEEG 2006, p.99).

Although the PSV can be used by shippers for spot transactions, it is currently difficult to use it for balancing. Since new entrants lack independent sources for gas imports, all shippers can end up having excess gas in summer and being short of gas in winter so that gains from trade for balancing are difficult to envisage. That is why they need short-term storage services in order to avoid balancing penalties (see Section 5.2). The evolution of the spot market therefore depends on the removal of bottlenecks which are a feature of gas imports (see Subsection 6.1). In the meantime, if sufficient investments in new infrastructure were made, Italy could launch a physical hub for gas exchanges in the Po Valley where the most important pipelines (carrying gas from Northern Europe, Eastern Europe and North Africa) cross close to huge storage fields and the centre of production. Italy could exploit its geographical position and turn itself into a transit country for gas flows, and incremental amounts of gas outside long-term contracts could be traded at exchanges. The liquidity of a market localized at this physical hub could be such to allow the transformation of the current OTC market at the PSV into an On-the-day Commodity Market (OCM), similar to that characterizing the NBP in the UK (Juris 1998; Wright 2006). The mechanism of price formation in the wholesale market and retail markets would then change radically.

## 8. CONCLUSIONS

The aim of the European liberalization process was to create a common energy market in the EU. However, not only is the implementation of liberalization principles in European Countries asymmetric, but the lack of interconnection capacity and the exemption of transit pipelines from regulated TPA has proved to be a strong barrier to gas trade. While in gas producing countries such as the UK or the Netherlands, competition in gas markets may follow from the implementation of liberalization principles. In countries that are net importers of gas, liberalization is a necessary, but not sufficient, condition for competition. The

case of Italy shows that even regulation ex-post by the Competition Commission until now has not been effective in removing bottlenecks. Barriers to competition are outside the national network and are likely to require regulation ex-ante at a European level. Unfortunately, a European Regulatory Commission does not exist yet. At present, only the intervention of the European Competition Authority has tried to remove barriers to gas trade by eliminating destination clauses characterizing long-term import contracts. The European regulation on gas exchanges[45] (approved in 2005 by the European Parliament and the European Council) could partially amend this gap but not completely, as some of the international pipelines that carry gas within Europe are located outside the EU.

The main barrier to competition in the Italian gas market appears to be the lack of incremental import and storage capacity to transport additional volumes of natural gas independent from the incumbent, which is responsible for capacity and gas shortages. By-passing transit pipelines by means of LNG imports appears to be the obvious solution to develop gas-to-gas competition. However, financial considerations lead firms investing in new infrastructures to ask for exclusive capacity reservation for a very long period of time (even for as much as 20 years). In the case of new LNG plants, 80% of the new capacity is going to be reserved to import flows controlled by subsidiaries of the company financing the investment. Investments in new infrastructures are encouraged as they are considered necessary for competition. However, in order to carry out these investments, gas utilities obtain exemptions from TPA rules that contradict EU liberalization principles. Furthermore, new LNG imports will be on long-term TOP contracts, which in turn are likely to prevent price competition in wholesale and retail markets. New long-term contracts hamper the growth of liquidity in the spot market to the extent that only a small fraction of new import flows are likely to be sold within a liquid spot market.

The EU commission did not pursue an interventionist policy against long-term contracts (compared with US market liberalization). While recognizing that long-term gas contracts may represent a barrier to competition (especially considering the market power of incumbents), the EU also considered their importance for

[45] Regulation n.1775/2005, 28 September 2005

supply security and relied on market mechanisms for the evolution of contracts. With the growth of gas-to-gas competition and price discovery in liquid spot markets, long-term arrangements are expected to coexist with short-term transactions. Moreover, some re-contracting could take place and price indexation clauses may evolve to spot gas indexation, thereby losing their link with the oil market (Creti and Villeneuve, 2003). However, such expectations risk remaining unrealised, given that Europe needs investments in new infrastructures to cope with the continuing growth of gas demand. Such an environment is quite different from the situation faced in the US during gas market liberalization where both gas demand growth and oil prices were lower.

The exemptions from TPA given to new investments is itself a demonstration that regulated tariffs may not be sufficient to create the required growth of infrastructure. Due to the fact that investment in pipelines or other gas infrastructures represents a case of 'dedicated asset', the need to minimize transaction costs means that the start of each new commercial relationship leads to long-term arrangements. As both gas producers, exporters and importers are locked into a bilateral relationship they try to avoid the hold up problem by using long-term contracts. For this reason, short-term transactions may continue to represent a negligible amount of gas trade, thereby threatening the development of a liquid spot market in importing countries.

In Italy, exemptions from TPA are coupled with subsidies for new investments that neglect the strategic reasons explaining the behaviour of the former vertically integrated utilities as far as new investments in infrastructure are concerned. In 2007, the European Commission declared its intention to further amend the liberalization directive in order to pursue ownership unbundling between essential facilities and utilities involved in gas sales. Without ownership unbundling, the former vertically integrated utilities can use their control of companies managing transmission and storage to limit capacity in order to preserve their dominant position in the wholesale market. This strategy is consistent with profit maximization by holding companies, as profits obtained in regulated activities are not of the same magnitude as gains obtained by incumbents in the wholesale market. Ownership unbundling should induce new owners of transmission and

storage infrastructures to consider capacity expansion independently of the wholesale and retail business.

Although we are supporting the thesis that implementation of liberalization principles is not sufficient to introduce competition in gas importing countries, there are however specific shortcomings that contributed to liberalization failures in Italy. Introducing competition by market share limitations has proved to be useless, given the reactions of the incumbents. Gas release programs carried out through auctions reserved to new entrants, or through sales in a centralized gas market, would probably better achieve the aim of providing new entrants with cheap gas. Even the reallocation of production and storage licences from the incumbent to new entrants could structurally reduce market power, but such a strategy has never been pursued. In addition, regulatory reforms concerning the distribution sector have failed. Gas distribution in Italy is still affected by inefficiencies due to excessive market fragmentation and monopoly rents protected by municipalities. The disappointing results of liberalization policies are also due to privatisation strategies pursued in the same period. Only partial privatisations have been pursued by central and local governments. In Italy, the National Treasury still controls 30% of the dominant firm and can share the financial benefits of market power with private shareholders. Such benefits are very important when one considers public finance requirements in a country such as Italy with high budget deficits, overwhelmed by a huge stock of national debt. Politicians could avoid unsustainable tax increases and public expenditure cuts by selling their stakes in energy companies.

**REFERENCES**


Ascari S. (1985) *Il Metano in Italia: Mercato, Prezzi, Distribuzione*. Franco Angeli, Milano.

Autorità Garante della Concorrenza e del Mercato (2005) *Indagine conoscitiva sullo stato della liberalizzazione nel settore del gas naturale* (IC 22). www.agcm.it

Autorità per l'Energia Elettrica e il Gas (2005) *Relazione Annuale alla Commissione Europea sullo stato dei servizi e sulla regolazione dell'energia elettrica e del gas*. 31 luglio 2005, www.autorita.energia.it

Autorità per l'Energia Elettrica e il Gas (2006) *Relazione Annuale sullo stato dei servizi e sull'attività svolta.* www.autorita.energia.it

Commission of the European Communities (2005) *Report on Progress in Creating the Internal Gas and Electricity Market.* COM (2005), 568 final.

Commission of the European Communities (2007) *Prospects for the internal gas and electricity market.* Communication from the commission to the Council and the European Parliament, COM (2006), 841 final.

Cremer H., F. Gasmi and J.J. Laffont (2003) Access to Pipelines in Competitive Gas Markets. *Journal of Regulatory Economics*, **24**(1), 5–33.

Creti A. and B. Villeneuve (2003) *Long-term Contracts and take-or-pay clauses in natural gas markets.* Energy Studies Review, 13, 75-94

Erbetta F. and G. Fraquelli (2003) *Produttività e Redditività nella distribuzione locale di gas naturale in Italia: proprietà, diversificazione e scala operativa.* HERMES Working Paper 3-2003.

ERGEG (2006) *Ergeg Interim 2006 Report on Monitoring the Implementation of the Guidelines for Good TPA Practice for Storage Systems Operators (GGPSSO).* Ref: E06-GBS-09-03, 10 May.

Golombek R., E. Gjelsvik and K. E. Rosndahl (1998) Increased Competition on the Supply Side of the Western European Natural Gas Market. *The Energy Journal*, **19**(3), 1–18.

Hawdon D. and N. Stevens (2001) Regulatory Reform of the UK Gas Market: the Case of the Storage Auction. *Fiscal Studies*, **22**(2), 217–232.

Juris A. (1998) *Market Development in the UK Natural Gas Industry*. Policy Research Working Paper, World Bank.

Lawrey R. (1998) Pricing and Access under National Competition Policy: the case of the Natural Gas Pipelines Sector. *The Australian Economic Review*, 31(2), 91–106.

T. McDaniel and K. Neuhoff (2004) Auctions of Gas Transmission Access: the British Experience. In Maarten C.W. Janssen (ed.) *Auctioning Public Assets*, Cambridge University Press.

Newbery D. (1999) *Deriving Long-Run Marginal Cost Tariffs using Transcost.* University of Cambridge (UK) mimeo

Polo M and C. Scarpa (2007) *Take or Pay Contracts and Market Segmentation*, Conefernce on "The Economics of Energy Markets", Toulouse, France January 15-16, 2007.

The Brattle Group Ltd. (2002) *Convergence of Non-Discriminatory Tariff and Congestion Management Systems in the European Gas Sector*. Research Report.

Wright P. (2006) *Gas Prices in the UK*. Oxford University Press, Oxford.