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Gas storage services and regulation in Italy: a Delphi analysis

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Abstract: This article explores the economic characteristics of the Italian gas storage system. Microeconomic and qualitative methods are used to shed light on past, present and forecasted trends. Notwithstanding the entrenched stagnation of the sector, the analysis highlights a break in trends. The policy-driven phase of liberalization is ending and the market-driven phase has just begun. The former phase has granted fair access to storage, thus narrowing the drawbacks of dominant players, but it has proved dynamically inefficient. Cost-reflective tariffs, capacity constraints and low penalties have both lowered incentives to expand the range of tools for balancing gas demand and penalized industrial customers in the storage service provision. The market-driven phase has just started. The expected increase in working capacity and the entry of newcomers in the authorization process for new facilities are a progress towards the commercial use of storage. To this end, however, a further change in gas market design is needed: the creation of a well functioning spot market.

Keywords: Gas market, Storage, Italy, Delphi questionnaire

JEL Codes: L95, L51, C61

1. Introduction

The Italian gas market has been rapidly growing. According to the Italian Ministry of Industry[1], total gas demand has increased steadily in the years 2002-2007, up to 4.0% year-over-year, reaching 84.90 Bsmc. With its 10% increase per year, due to the huge amount of combined cycle gas turbines (CCGT) commissioned in the last decade, the power sector is largely accountable for this trend. Since 2004 the power industry has become the largest user of natural gas, surpassing domestic sector consumption, and in 2007 its contribution to total gas demand exceeded 40% for the first time, while residential demand has remained below 35%. These trends might further accelerate in the years to

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[**] We wish to thank the participants to the research group "The Economics of Natural Gas Storage" for their valuable comments.

[1] "Ministry of Industry" is used to refer to both the "Ministry of Productive Activities" in the past legislation and the "Ministry of Economic Development" in the current one.

come, depending on the development of new power plants. National gas production has been constantly declining since 1995 at a rate of 7-8% per year and currently covers less than 12% of demand. Italy must therefore strongly rely upon imports: in 2007 liquefied natural gas (LNG) and its pipelines accounted for some 87.0% of Italy's gas demand (33.2% of its total imports come from Algeria, 30.7% from Russia, 12.5% from Libya, 10.9% from the Netherlands, 7.5% from Norway).

This fast growing market had to cope with a rather strong climatic emergency during the winter of 2005-2006, that once more shed light on some weaknesses and crucial bottlenecks in the gas system and more specifically in the storage sector (see Di Domenico, 2007; Cavaliere, 2007).
The gas crisis was mainly due to two different sets of reasons. The first one stems from a structural point of view and includes several factors – such as a gas demand increase caused by new power stations, insufficient import capacity, decrease in domestic gas production, and low gas storage capacity, planned only for domestic use – that have prevented the adjustment to tight conditions. The second one consists of contingent reasons that have worsened the situation: the coldest winter on average in the last twenty years, with a consequently higher demand for heating (roughly +3 Bscm); the simultaneous increase in demand from the thermoelectric sector (+13%), mainly related to new CCGT plants; the 0.19 Bscm reduction in imports, which was due to the coldwave that hit Eastern Europe and to the geopolitical tension between Russia and Ukraine (see AEEG, 2006d).
The emergency was solved through a *crescendo* of measures, including the reduction in consumption and the obligation for operators to maximise imports and domestic production. A strong exploitation of the existing underground gas storage facilities, with a withdrawal of 1.2 Bscm from strategic reserves out of a total of 5.1 Bscm, proved crucial to solving the crisis that ended in March 2006.

In the aftermath of this crisis, the Government hastily devised an Emergency Plan to deal with a possible gas deficit in the winter of 2006-2007, caused by a repetition of the severe climatic conditions of the previous winter combined with possible supply interruptions. The Emergency Plan included an increase in seasonal storage capacity through pressure increases (see Table I.1 in the Appendix). The additional capacity would have allowed a reduction in the use of strategic storage to meet peaks in demand in the event of particularly cold spells at the end of the winter period. Among the measures taken, the most important one concerned the restocking and upkeep of the reserves in storage, imposed on suppliers; this led to a consistent increase in natural gas imports (5.4% from 2005) despite the fall in consumption recorded during the year. The mild temperatures of the winter periods in the following years have thus resulted in a significant increase in end of year storage (AEEG, 2007a).

The events of the 2005 gas crisis in Italy have shown the critical role of storage services. As in all other European countries, storage capacity in Italy was developed to cover the needs of a monopolistic market, and since then it has remained unchanged. For this reason, we believe, the role of storage

services and infrastructure has very often been neglected by the economic literature on gas market liberalization. Very few works are devoted to "modern" storage in Europe, with the notable exception of Hoffler and Kluber (2007) and the research reports by CIEP (2006 and 2008). The latter provide a general assessment of storage in Europe, while the first focuses on storage gas demand to the horizon of 2030. Both analyses emphasize the lack of investment in storage capacity at European level.

Our approach is a rather different one, as we focus on a country-level analysis. Our objective is twofold. First, we will present a very detailed overview of storage infrastructure, services and regulation. We will highlight some critical aspects in this segment of the Italian gas industry that we have regrouped into four areas: market structure and competition; regulation and security of supply; commercial storage and flexibility tools; and investment. Second, in the most original part of the paper, we will be presenting the results of a Dephi survey aimed at assessing how the crucial aspects of the Italian storage sector, that emerged in the first part of our research, are appraised by storage operators, shippers and sector's experts. We have conducted our survey within the context of a broader research on gas storage[2] that has eased the selection of a representative panel of experts and provided the basis for evaluating results.

To our knowledge, there are no specific European country surveys based on a similar approach. Despite the specificity of the study, our paper contributes to the understanding of the liberalization process in the gas industry, by pointing out a number of market inefficiencies along the gas chain – notably the impact of weak competition in the national market upon storage usage, and the lack of flexibility tools for seasonal balance and peak shaving. Moreover, we will be discussing the effectiveness of regulation in providing the right incentives to enhance security and/or balancing gas flows in the Italian context.

The paper is organized as follows. Section 2 describes the storage sector and its regulation in Italy. In section 3 we will detail the methodology of our Delphi survey and in Section 4 we will explain the results. Section 5 is a brief conclusion.

2. Storage in Italy: provision of services, infrastructure and regulation

Gas market characteristics in Italy vary considerably on a seasonal and daily basis, mainly due to residential demand for heating. Figure 1 illustrates monthly consumption, import, production and stock change patterns over the period 2002-2008. With the exception of national production, which is

[2] The output of the research project "The Economics of Natural Gas Storage" is available at www.iefe.unibocconi.it.

stable along the year, the other variables show a clear seasonality. Figure 1 also illustrates the exceptional conditions on the gas market over the winter of 2005-06 (the "gas crisis").

In 2007, the average daily consumption in the summer did not exceed 0.18 Bsmc, while in the winter it was equal to 0.29 Bsmc and can reach 0.37-1 Bsmc on a peak day.[3] On the supply side, the flexibility ensured by imported gas and national production is rather limited because technical and economic factors impose a great burden on their use.[4] The major source of flexibility is storage, but capacity is scarce. In 2007, the ratio of storage capacity to the overall winter and annual gas consumption was 31.08% and 15.88% respectively. Furthermore, the self-sufficiency granted by the Italian storage system in the winter period is about 46 days.

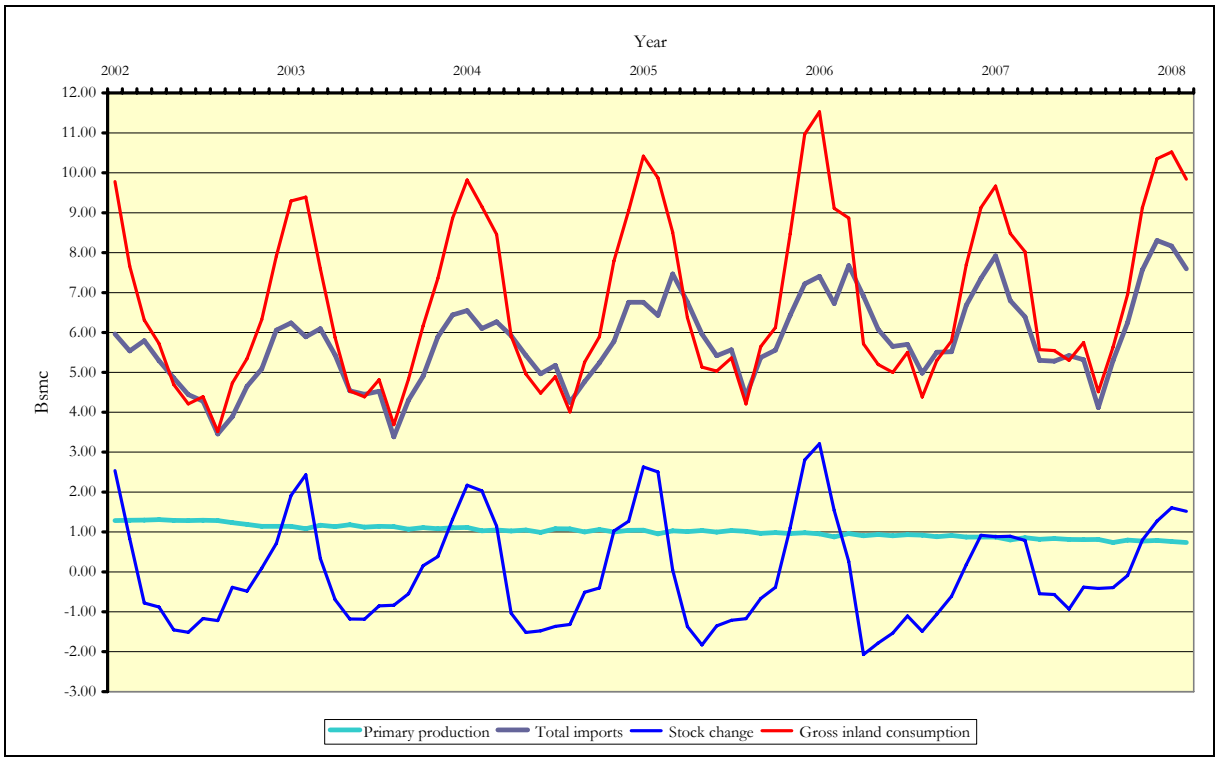

Figure 1. Source: EUROSTAT (2008)

The Italian storage system, which in 2007 accounted for 13.42 Bsmc of working gas, is highly concentrated on both a geographic[5] and operational extent (see Figure 2). It encompasses ten on-shore fields. These gas fields are half depleted at simple expansion or moderate water drive, with good efficiency (working gas/immobilized gas ratio equal to 65%-70%) and good permeability of the formation, which allows high daily flow rates with a limited number of wells.

[3] Source: our evaluations on data published by SNAM rete gas, 2006-2007.
[4] Maximum and minimum daily import in the winter period of 2007 was 0.26 Bsmc and 0.14 Bsmc respectively; national production reached 0.03 Bscm/day.
[5] About 76% of the available storage capacity is located in Northern Italy. The remaining part is located in Central Italy.

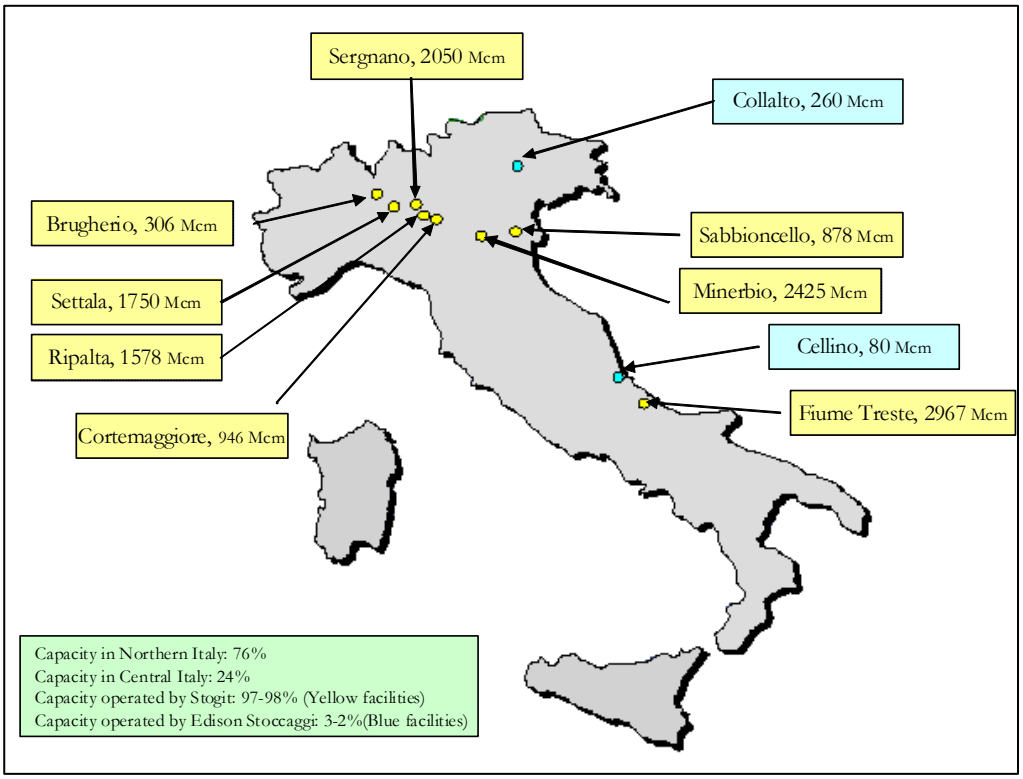

Figure 2. Geographic and operational distribution of storage facilities.

Eight of those fields are operated by Stoccaggi Gas Italia S.p.A. (Stogit S.p.A.), a subsidiary of ENI. Stogit S.p.A. manages the natural gas storage and modulation activity with an integrated system comprising of reserves, gas treatment plants, compression plants and a dispatching centre. With its 13.08 Bscm of working gas, which accounts for 97% and 98% of the storage capacity in Central and Northern Italy respectively, Stogit remains a dominant player in the Italian storage market. The remaining facilities, accounting for some 3% of the Italian working gas, are managed by Edison Stoccaggio, entirely owned by Edison. Even if not yet fully operating (the facility at Cellino is under expansion), since 2001/2002 Edison Stoccaggio has been offering storage services and increasing capacities. During this period working gas has almost doubled: from 0.27 Bscm to 0.34 Bscm, and the number of users has increased from 1 to 10.

2.1 Regulation

The Government, the Ministry of Industry and the Energy Regulator supervise the storage activity. Government functions include sector directives, while the Ministry of Industry is responsible for safety, economics and long-term planning of the national gas system through the concession regime. The Ministry is also responsible for security of supply and coordinates the operation of the storage system. The Energy Regulator is granted powers to regulate both the use of and access to the storage

system, and to approve the Storage Code (more details on the legislation are provided by Dolcino, 2001).

Legislative Decree 164/00 ('Letta Decree') set the rules for implementing EU Directive 98/30/EC concerning common rules for the internal market in natural gas.[6] The decree introduced important innovations in the organisation of the storage system, mainly the separation of company procurement and sales activities from transport and storage activities as of 1 January 2002. It allowed the possibility of developing new storage capacity in production fields at an advanced stage of exploitation and delegated the planning of additional storage capacity in the medium-long term to the Ministry of Industry. It organised storage availability into three different services:

a) *mining storage*, designed for production optimization within the national territory;
b) s*trategic storage*, designed to ensure security of supply. Each importer shall have a storage capacity within the national territory equal to 10% of the volumes imported from non-European Union countries, with a peak daily availability at the end of the peak seasonal period equal to at least 50% of the average daily volume in the winter period. This "national insurance policy" is imposed on shippers importing gas produced in non-EU countries. In addition, an obligation is placed on household suppliers to ensure supplies in the case of a "1 out of 20" winter. To satisfy this obligation, priority access to storage space is also conferred to market players. Both Stogit and Edison Stoccaggio are required to store gas, 5.08 Bsmc and 0.02 Bsmc respectively, for strategic purposes; therefore the capacity at shippers' disposal does not exceed some 8.00 Bsmc (i.e. 18.50% of winter gas demand).
c) *storage for market modulation*, designed to respond to the seasonal nature of the market in terms of both volumes and peaks.

2.2 Access to storage

Whilst effective third party access to storage is of paramount importance, there is no legal obligation, under the Second Gas Directive, to provide regulated access.[7] Italy is one of the few European countries that opted for the regulated regime.[8]

[6] Italian Legislation on storage also comprises: a law dated 26 April 1974 n. 170 – storage of natural gas in hydrocarbon fields; a Ministerial Decree of 28 July 1975, on basic legislation for natural gas storage concessions; and Legislative Decree of 25 November 1996 n. 625 implementing Directive 94/22/EC on the conditions for granting and using authorizations for the prospection, exploration and production of hydrocarbons.

[7] The Guidelines for Good TPA Practice for Storage System Operators (GGPSSO) provide a minimum set of rules required for the organisation of the European market for storage capacity. They are addressed to all Storage System Operators (SSO) falling under the scope of European Directive 2003/55/EC as well as to the users of these systems. The purpose of the GGPSSO is to ensure that SSOs provide the services needed by storage users on a fair and non-discriminatory basis. Systems and processes should facilitate the sustainable development of competition in gas supply, and these tasks are pursued taking into account technical constraints and the efficient use of the storage

After a three-year period of provisional regulations, in 2005 the Italian Energy Regulator (henceforth AEEG) established the rules and criteria for access to the national storage system and the supply of related services, contained in Resolution 119/05 (see AEEG, 2005c). Those rules aim at ensuring maximum transparency and impartiality as well as non-discriminatory access to storage. Resolution 119/05 also makes it possible to directly negotiate customized services, in accordance with the principle of non-discrimination.

The Resolution allows the possibility of transferring storage capacity from one user to another in the event that a consumer switches suppliers, and the possibility of trading capacity and gas in storage for *ex-post* imbalance resolution or other purposes. It includes a capacity allocation mechanism based on a precise order of priorities, strict provisions for unauthorized use of strategic reserves, detailed provisions for the coordination of the overall system by storage companies, and constant monitoring of the system performance and of the patterns of shippers behaviour over the course of the year.

The actual price of access to storage is a single national storage tariff to be applied by both Stogit and Edison Stoccaggio; it encompasses unit fees for space, injection and withdrawal capacity, gas movement and strategic storage.

Unit fees	Space (€/GJ/year)	Injection (€/GJ/day)	Withdrawal (€/GJ/day)	Movement (€/GJ)	Strategic storage (€/GJ/year)
Amount	0.155673	9.503475	11.295975	0.102119	0.156773

Table 1. Unit fees. Source AEEG (2006a), Resolution 56/06.

Storage operators are paid on a capacity basis and not for the use of the gas immobilized to ensure security of supply. Furthermore, to guarantee each company the recovery of costs, an equalisation system provides for the payment of a variable additional charge applied to the energy moved to cover possible imbalances. Another distinguishing feature of the Italian discipline is the introduction of a specific fee for the peak availability service at the injection phase and the differentiation between fees at the injection and delivery phases, in order to stimulate the correct use of storage availability by users, and to maintain system performance at the end of the replenishment of storage facilities.

The rate of remuneration of invested capital is set at 7.1% in real terms before tax. New investments benefit from a higher rate of remuneration. For infrastructural investments aimed at the construction of new storage reservoirs, the rate increase is 4% for 16 years; for investments aimed at strengthening and developing storage facilities already operating, the rate increase is 4% for 8 years. The

infrastructure. An overriding principle is that storage systems and processes implemented by the SSOs maintain a secure, reliable and efficient operation of the storage system.

[8] Access is regulated in Belgium, Bulgaria, Italy, Romania and Spain. In the Czech Republic, United Kingdom, Hungary, Latvia and Poland access is partially regulated. In Austria, Denmark, France, Germany, the Netherlands, Portugal and Slovakia access is negotiated.

remuneration, and the relevant amortisation quota, of new investments is independent of volumes. With respect to the first phase of regulation, up to 2005, incentives to investment have been substantially reinforced.

The unit fee for gas movement is updated annually applying the 2% price cap. The remaining components are reassessed annually according to Resolution 50/06.[9] Moreover, in compliance with Resolution 56/06 (AEEG, 2006a), storage companies can propose adjustments in tariffs, based on data which are necessary to check the business charges in the relevant thermal year.[10] The allowed revenue referred to remuneration of the net capital invested is also subject to update by annual recalculation of the revalorised historic cost of the net capital invested, with amortisation taken into account.

Other resolutions have been set concerning the *use of the modulation storage service* during the delivery phase. In particular, Resolution 303/07 (AEEG, 2007c) governs the arrangements for the use of allocated storage capacity. It introduces an obligation on users who have been assigned this capacity to keep a minimum stock available at the end of each month during the delivery phase.[11]
Please also note that there is a special agreement between the company that transports gas, ENI's subsidiary SNAM Rete Gas, and the storage company. The transport company signs an agreement with the storage company for the use of storage services in order to ensure operational network balancing and hourly modulation. The regulated tariffs, which the storage company bills for the sale of both basic and special services, determine the allowed cost in the transport tariff that is paid by all gas users (balancing revenue).

Exemptions pursuant to article 22 of the second European Directive, 2003/55/EC on the opening of gas markets towards competition, are set and monitored by the Ministry of Industry.[12] AEEG is consulted on exemptions pursuant to article 22 of the Directive and also sets the norms through which the TSO gains access to storage. Legislative Decree 239/04 ('Marzano Decree') defines TPA exemption for a new infrastructure (or for increased capacity of an existing infrastructure). Investors

[9] For further details, see AEEG, 2006e.
[10] For instance, upon verification of the information received, the Authority approved (Resolution 56/06) business charges and determined single national charges for the 2006-2007 thermal year. With later Resolutions 180/06 (AEEG, 2006b) and 191/06 (AEEG, 2006c), the Authority approved a percentage reduction in the unit charge for interruptible storage capacities for the 2006-2007 thermal year, which was proposed by Stogit Spa and Edison Stoccaggio Spa respectively. Further adjustments in the thermal year 2007-2008 were approved at the beginning of 2008 (Resolution 35/08, AEEG, 2008b).
[11] This stock should be equal to the smaller of: 1) the stock resulting from the difference between allocated capacity and gas withdrawals from storage for modulation purposes, established on the basis of actual climatic conditions; 2) the stock needed to ensure that consumption can be covered for the rest of the winter in such very cold conditions as would occur every 40 years on average. If the amount of gas held by users exceeds such minimum, they will be allowed to withdraw gas for uses other than those envisaged by priority in the allocation of storage capacity defined by Resolution 119/05 (AEEG, 2005c).
[12] Article 22 of the Gas Directive allows new storage facilities to be exempted from TPA regulation on condition that "the investment must enhance competition in gas supply and enhance security of supply". Given the anticipated scarcity of storage amounts in the future, such an exemption seems to make sense. However, it highlights that there is a trade-off between establishing short-term competition in the downstream market and investment incentives in storage facilities.

are entitled to an exemption for at least 80% of the new capacity and a period of 20 years, based on a case-by-case approach. Moreover, a Ministerial Decree of 26 August 2005 defines the procedure to grant the concession, the duration, the extension period, as well as storage operation modes.

2.3 Investment

The Ministry of Industry has granted Stogit authorizations to convert two new reservoirs into storage facilities at Alfonsine and Bordolano and to expand its existing storage facility at San Salvo; this will allow Stogit to increase its total active reserve by 3.70 Bscm.

Authorisation procedures are also underway for six new storage sites (5 depleted reservoirs and 1 aquifer facility), for a total nominal capacity of about 5.00 Bscm. The authorizations are to be granted to three companies: Edison Stoccaggio, Independent Gas Management, and Geogas. At the end of 2006, five more depleted gas fields were offered for storage by the Ministry, but the tendering procedure is still underway. This also unveils a critical issue in the Italian storage sector: the length of the authorization process becomes a real barrier to the entry of new capacity; environmental impact assessment further delays (or blocks) the process. As a consequence, despite a regulatory framework setting strong measures to foster investment and recover efficiency, the development of the storage infrastructure cannot yet be considered satisfactory. According to Di Macco (2007), between2002-2005 storage volume (including strategic reserves) has increased by about 10%, while domestic gas demand by 22.50%. In 2005 and 2006, due to the winter emergency, storage volume reached a high level. Nevertheless, expansions carried out up to now were not sufficient to cover the increase in users' demand that since 2003 has exceeded offered capacity. According to a study by CESI Ricerca (see Gallanti et. al., 2005), the estimated lack of capacity amounts to 4.00 Bscm of space, and withdrawal capacity to 75.00 Mscm/day (at the end of winter). This gap could increase if we consider new demand following the opening of the European energy market, in terms of power generation prices dynamics and gas trading opportunities (Gallanti, 2007).

AEEG (2008a) states that within this context it was difficult to develop storage services in a way that promotes a competitive, non-discriminatory and efficient access so as to best meet shippers' needs. The conclusions of the fact-finding investigation, launched jointly by AEEG and the Antitrust Authority at the end of 2007 (AEEG, 2007b), will shed light on whether Stogit has invested very little in new capacity to preserve ENI's dominant position in the downstream supply market. Indeed the weakness of legal unbundling with regard to gas transmission had been previously pointed out by AEEG, which had already sent a notice to the Italian Parliament and Government in 2005, calling for the dominant operator in the gas market, ENI, to lower its stake in Stogit.

2.4 Critical issues

The Italian gas storage system is thus characterized by structural and increasing deficiencies in the coverage of peak consumption in case of exceptionally cold weather conditions, and by the inadequacy of working gas, mainly oriented to the modulation of residential consumption but not to commercial use. To preserve security of supply to residential consumers, a rather strong regulation has been put in place, encompassing precautionary reserve provisions, regulated TPA and favourable rules to foster investment in storage sites. However, the complex set of regulatory rules is not a panacea that solves the difficulty of balancing demand and supply as long as alternative flexibility tools, such as a large portfolio of interruptible customers or a spot market, are not adequately developed. A concentrated market structure does not help achieve an efficient usage of storage, nor reach a level of excess capacity that is the prerequisite to a fair and fully liberalized gas market.

The critical aspects which have emerged with the description of the set-up and operation of the Italian storage system could be grouped into four areas:

1. market structure and competition,
2. regulation and security of supply,
3. commercial storage and flexibility tools, and
4. incentives to investment.

The analysis in the first part of the paper, although exhaustive and consistent with other research on the issue conducted at both national and international levels,[13,14] has two main drawbacks. First, by moving apart from market players' attitudes, it may over- and/or under-assess real barriers. Second, by discussing the sources of actual bottlenecks but disregarding dynamic considerations, it is unsuitable to forecast the evolution of the storage system. We opted for a qualitative method to restrict such limits.

The rest of the paper is devoted to a detailed analysis of the above crucial issues trough a Delphi survey.

3. The methods of the Delphi survey on gas storage in Italy

[13] See AEEG (2005a), (2005b), (2007a), (2007b), (2007c), (2007d) and (2007e).
[14] See the output of the research project "The economics of Natural Gas Storage", and the relevant working papers.

The distinguishing features of the Delphi technique are its methodology and its recruitment/use of experts. Our purpose has been to merge *Classical* and *Argument-Delphi* approaches (see Appendix II for methodological details).

We have *focused on few key topics*, as a result of the critical analysis of storage services and regulation described in Section 2. We have set up a *one-round Delphi*, as the storage activity involves a very limited number of actors and this favours the consensus needed to validate the analysis. Finally, we have *limited the time horizon of the scenarios* submitted to the experts, in order to minimise the impact of unreliable forecasts on results.

Experts were selected according to several criteria. A balanced and diverse[15] list of people with skills in the appropriate fields was assessed based on the participants in IEFE research projects[16], and experts were invited to join the panel. Candidatures directly suggested by experts were also welcome. The average response rate of 65% is well beyond expectations (see Table 2).

Categories	***Response rate %***
Shippers	73.33
Storage operators	100
Institutions	25
Universities and private consultants	72.73

Table 2. Response rates.

The final sample consists of 25 experts, ranging from all storage operators to about 50% of Italian shippers accounting for the 86.59% of the 2007 operational storage capacity. Representatives of Italian institutions, together with academics and private consultants, completed the sample (8.33% and 33.33% of the sample respectively).

Before assessing results, we wish to provide two further considerations on the methodological support to our Delphi survey. First, our panel is representative of storage market players, especially considering that, by its nature, the storage activity does involve a limited number of players. We have full coverage of storage operators and the sample is responsible for supplying some 87% of the working gas available (see Table 3) and 100% of strategic storage. Second, our findings are robust with respect to panel composition. Since market players are much more represented than consultants and regulators, we conducted robustness investigations and assessed the extent of intercategory convergence to study the existence as well as the extent of biases. It turns out that heterogeneity in the sample composition does not affect answers qualitatively: this strongly supports our results.

[15] With respect to the underlying expertise (i.e. shippers, storage operators, regulators and consultants).

[16] "The economics of natural gas storage – Sicurezza dell'approvvigionamento: il ruolo dello stoccaggio del gas" and "Il potenziale ruolo del GNL nell'incremento della concorrenzialità dei mercati europei e nella sicurezza dell'approvvigionamento energetico".

Share of capacity used and operated	*Share of representatives in the sample*	*Corresponding share of capacity covered by the sample*
> 5%	100	68.88
1% - 5%	46.15	15.34
<1%	33.33	2.36

Table 3. Shippers' representatives.

4. Results

In this section we will detail the results of the questionnaire, by regrouping them into four topics: competition and market structure (Section 4.1), regulation and security of supply (Section 4.2), storage and flexibility tools (Section 4.3) and investment (Section 4.4).

4.1 Competition and market structure

Over the last decade, despite advances in the liberalization process, gas market competition has remained limited as a result of both insufficient infrastructure developments and ENI's dominance. The following issues have characterized the last five years. Notwithstanding the steady growth in natural gas demand, available import capacity and LNG terminals have remained almost unchanged[17], while production has remained highly monopolized.[18] Three operators – i.e. ENI, ENEL and Edison –, each with a market share exceeding 5% of total gas supply (either produced or imported), have covered 87.6% of the aggregate market demand. In particular, ENI holds 86.6% of current long-term contracts. Finally, notwithstanding import dependency, storage capacity has remained below 16% of annual natural gas consumption.

The results of our survey on "competition and market structure" confirm AEEG concerns on market concentration (see AEEG, 2006d and 2007a). In fact, the majority of experts consider long-term contracts with incumbents a suitable means to block entry and foreclose the gas market. 91.67% of respondents answered "*from high to medium extent*" to the question: "*How much do long term contracts serve as an entry barrier?*" (see Fig. 3). Limited storage capacity too is classified as a barrier to entry by 84% of respondents, who foresee outflows of investments toward foreign countries. New liquefied gas terminals and pipelines are identified as valid tools to break the current market structure. Two effects clearly emerge: new infrastructures will improve flexibility of long-term contracts and increase short-term contracts (according to 62.5% and 76% of respondents respectively). Nonetheless, despite advances in the liberalization process, new infrastructures are insufficient to determine a decoupling of the gas price from oil price (according to 68% of respondents). Therefore, lacking storage excess capacity, the current framework is unsuitable to the exploitation of

[17] The sole exception is Greenstream pipeline (Gela), which entered into operation in October 2004.
[18] In 2006 ENI produced 84.4% of national natural gas, a slight decrease compared to 89.8% in 2001.

intertemporal arbitrage opportunities and commercial storage. A very large share of the experts (80%) confirms such evidence while pointing out their disagreement to the following question: "*Does the current framework (i.e. regulation and infrastructures) allow the exploitation of arbitrage opportunities?*".

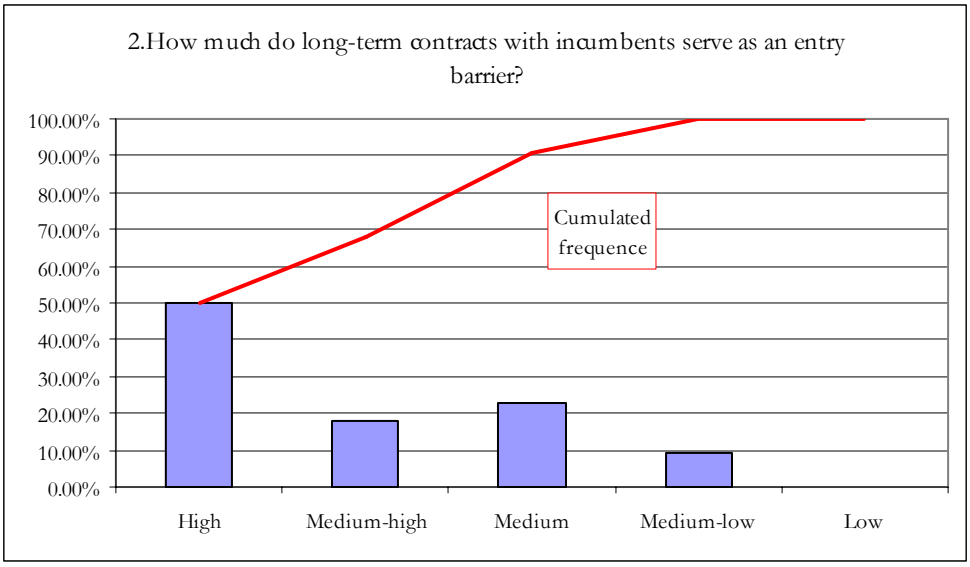

Figure 3. Long-term contracts as an entry barrier.

Eliminato

Question	I agree (%)	I do not agree(%)	I don't know (%)
New pipelines and LNG terminals would increase long-term contracts flexibility.	62.50	25	12.5
New pipelines and LNG terminals would increase short-term spot transactions.	76	16	8
New pipelines and LNG terminals would decouple gas-oil dynamics.	8	68	24
Does the current framework (i.e. regulation and infrastructures) allow the exploitation of arbitrage opportunities?	12	80	8
Limited storage capacity is an entry barrier and redirects investments to foreign countries.	84	12	4
According to your experience, current storage regulation leaves some gas supplier with excess capacity with respect to residential needs.	39.13	34.78	26.09
(If you agreed to the question above) Is such excess capacity supplied in the secondary market.	-	63.64	36.36
According to your experience, current storage regulation leads some gas supplier with excess capacity with respect to its market share.	33.33	38.10	28.57
(If you agreed to the question above) Is such excess capacity supplied in the secondary market.	-	60	40

Question	High	Medium high	Medium	Medium low	Low
How much do long-term contracts with incumbents serve as an entry barrier.	50	20.83	20.83	8.33	-

Table 4. Competition and market structure in the Delphi questionnaire.

Gas storage capacity seems to be fully booked by the main gas suppliers to serve the need of their residential consumers (39.13% of experts agree with this explanation). A share of the sample also believes in a more subtle strategy by gas suppliers: they might have excess capacity (33.33%), but they withhold it without supplying it in the secondary market for storage capacity. The latter is one of the measures that Resolution 119/05 accounts for (see Section 2.1). In addition to regulating mandatory services (strategic, mining and modulation storage), the Resolution lays down rules for the provision

of special services, which offer an opportunity for storage companies and shippers to optimise the use of infrastructures. In particular, the direct negotiation of customised activities on secondary capacity markets is allowed, as long as there is no violation of general policies or the principle of non-discrimination. In June 2007, the main storage operator opened a dedicated platform, Negotium, whose objective is to allow shippers to freely exchange storage capacity. This secondary market, however, is not developed yet. As Stogit (2008) reports, no transaction have been registered on the Negotium platform; since the opening of the secondary market in April 2007, 71 transactions have taken place, of which 66 have been dealt with by Stogit "extra Negotium".

4.2 Regulation and security of supply

As noted in Section 2, access to storage is regulated in Italy. According to AEEG, Italy's gas storage tariffs are efficient in that they reflect storage marginal costs. In this vein, the price of access to storage is among the lowest in Europe. Our sample confirms the supremacy of regulated TPA over the negotiated counterpart (58.33% affirms that regulated TPA is more efficient as it favours transparency).

A special feature of the Italian storage sector is that regulation also encompasses the usage of gas withdrawn from reservoirs. Let us recall that Resolution 303/07 introduces an obligation on users who have been assigned this capacity to keep a minimum stock available at the end of each month during the winter period. The majority of respondents (60.87%) affirms that the priority service scheme introduced by this resolution is a good measure to preserve the continuity of gas supply to all consumers.

Italy's dependence on imports, in particular from non-EU sources, has been increasing in the last five years, and in 2007 accounted for more than 87.00% of consumption. This has exacerbated the issue of security of supply and has led to strong policy interventions. Security of supply has been addressed in our questionnaire considering the adequacy of the Italian storage system from a dynamic perspective: in the short-term, to cover winter demand peaks; in the medium-term, as for the demand of storage capacity; and in the long-term, with respect to strategic reserves.

As for the coverage of an unexpected peak of demand at the end of winter, when it is most difficult to withdraw gas from storages, due to low working capacity and pressure levels, we have supplied the experts with a forecast by Gallanti et al. (2005), anticipating a demand gap of almost 0.02 Bsmc/day at the end of February 2007 and for the next three years. The majority of the sample (52.17%) considered this event rather improbable. It is our opinion that the result was influenced by the contingent and

favourable climatic situation. However, if we look at the demand for storage capacity, the current demand gap of 31% for seasonal balancing of residential consumers is expected to increase in the next two years, according to 44% of respondents (while 28% of them expects a decrease in the gap).

Question	I agree (%)		I do not agree (%)		I don't know (%)
Is the priority ranking by Resolution 303/07 effective to protect all storage customers?	60.87		30.43		8.7
Negotiated tariffs do not lead to an efficient use of storage systems.	76		16		8
Is the revision of current strategic storage obligation necessary?	22.73 (Increase)	54.55 (Reduction)	22.73		9.09
Question	**Increase**		**Stand still**		**Reduce**
In 2007/2008 some 31% of demand for storage services remained unfulfilled. In the next two years do you expect the share to:	44		28		28
Question	**Sure (Prob. 100%)**	**Probable**	**Possible (Prob. 50%)**	**Unlikely**	**Very unlikely (Prob. 0%)**
Assess the likelihood of at least a 0.02 Bscm/day demand gap in the winter peak within the next three years.	8.7	39.13	17.39	34.78	-

Table 5. Security of supply in the Delphi questionnaire.

Table 5 details the statistics on security of gas supply. Overall, the surveys concerning competition and market structure and security of supply confirm the inadequacy of the available storage capacity. These are probably the reasons why 54.55% of respondents would lower the strategic reserves obligation that limits the usage of 5.1 Bscm of gas to exceptional circumstances endangering security of supply. However, with domestic production declining and consumption increasing, lowering strategic reserves would exacerbate the vulnerability of the Italian storage system even further. Therefore, it is our opinion that the gas precautionary reserve will not change.

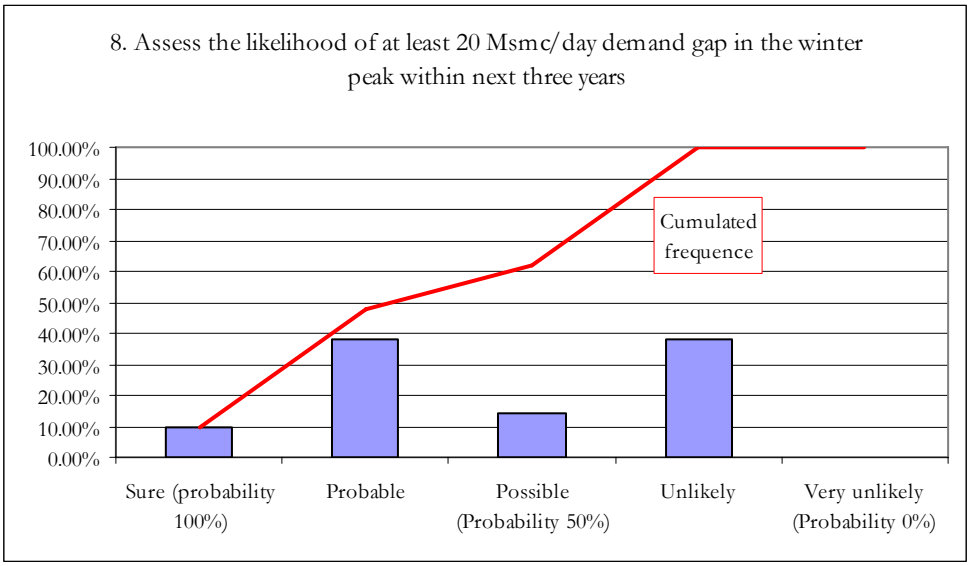

Figure 4. Security of supply in the short-term.

Eliminato

4.3 Storage and flexibility tools

How do imperfect competition and limited capacity in the gas storage sector affect the usage of stored gas? Four questions are devoted to this central issue. We investigated the intensity of storage usage as a means to balance seasonal and/or peak demand. We refer here to the system of payments and penalties that encourage shippers to maintain a balance between the gas injected into the system and the gas withdrawn from it, with the aim of minimising the volume and frequency of unbalanced periods. In order to tackle the issue of inadequate storage capacity, Resolution 119/05 accounts for balancing fees, to ensure prompt replenishment if more capacity is used than the capacity booked, and severe penalties if the unbalance is so big as to entail an unauthorised use of strategic reserves.

To provide an exhaustive overview, we asked experts to rank several tools (i.e. production, interruptible contracts – with and without thermo –, spot market, flexibility of import contracts and interruption of thermo facilities) according to their suitability as alternatives to storage (with or without penalties) for seasonal and peak imbalances. Production and flexibility of import contracts are related to the (limited) flexibility of the upstream supply of gas. Various forms of interruptible contracts are also considered: interruptible contracts with thermoelectric consumers (they can be direct customers of the company that uses storage or belong to the group of competitors), as well as interruptible contracts with gas consumers.[19] Finally, the spot market can be used to buy and sell gas. However, a true market for this kind of transaction does not exist in Italy. Some exchanges take place at the "*Punto di Scambio Virtuale*" (PSV), a virtual hub where shippers can trade gas for delivery anywhere in the country. The PSV was established in 2003 and is managed by the gas transmission company Snam Rete Gas.[20]

Concerning the various flexibility tools, the Delphi questionnaire investigated their suitability for seasonal and winter peak purposes, as well as their corresponding efficiency. Replies were collected and rankings adjusted to uniform the weight of the experts' opinions; rankings are reported in Table 6. Red, orange and green are used to indicate the top three tools: storage, import contracts and storage with penalties respectively.

[19] Please note that maximisation of production and imports as well as interruptibility are also the measures taken during the gas crisis to save some gas volumes (see Table I.1 in the Appendix).

[20] The platform allows shippers to trade contracts on the day and the day ahead. The prices are agreed off-line and are not publicly available; the quantities are communicated to SNAM for the gas transportation service to be organized.

Question / Ranking	Suitability for seasonal modulation (decreasing)	Suitability for winter peak (decreasing)	Costs (increasing)
1	**Storage**	**Storage**	**Storage**
2	**Contract flexibility**	**Storage with penalties**	Interruptibles (thermo excluded)
3	**Storage with penalties**	Spot market (PSV)	**Contract flexibility**
4	Spot market (PSV)	**Contract flexibility**	Interruptibles (thermo included)
5	Interruptibles (thermo included)	Interruption own thermo	**Storage with penalties**
6	Interruption own thermo	Interruptibles (thermo included)	Interruption own thermo
7	Interruptibles (thermo excluded)	Interruptibles (thermo excluded)	Production
8	Production	Production	Spot market (PSV)

Table 6. Storage and flexibility tools: suitability and efficiency.

Unsurprisingly, the most suitable tool for both seasonal and peak flexibility is storage.[21] The role of flexible import contracts and storage with penalties is reversed when we move from seasonal to peak demand. The payment of penalties for unbalances is not considered a "last resort" tool, but a rather usual one. This suggests that the penalty value is too low to discourage unbalances or that this is a forced solution, given the lack of storage capacity. The spot market ranks fourth for seasonal balance and third for the peak counterpart. The role of interruptible contracts remains stable for seasonal and peak shaving; similar assessments apply to production, which is in fact rather inflexible.

When moving from suitability to costs, discrepancies arise, thus revealing some inefficiencies. Except for storage and import contracts, the most used tools are not always the cheapest ones. However, the ranking in Table 6 (last column), which reflects the "opportunity costs" of the selected tools, neglects actual availability. Some tools are not truly available to all shippers, as for instance production and the related modulation of import flows. The explanation is confirmed by the statistics on the question: "*According to your experience, the ranking of costs for flexibility tools varies with gas suppliers*", on which 71.43% of respondents agreed (see Table 7).

The PSV is the most expensive tool, even more than production, despite it should be freely accessed by all shippers. To date trading has been severely constrained by a lack of available volumes. Most of the imported gas and the transmission capacity to deliver it is tied up in long-term contracts with ENI. The regulator has forced ENI to reduce its market share by implementing a gas release programme,[22] but the strategy has proved unsuccessful since ENI has preferred to dispose of excess supply abroad.

[21] It is widely recognized that depleted fields are unsuitable to peak shaving purposes. However, for lack of aquifers and salt cavities, depleted fields are used for both modulation and peak requirements in Italy. This may be a valuable rationale for keeping low penalties for unbalances.

[22] For further details on gas release programmes, see Polo and Scarpa (2007).

Consequently, most Italian wholesale trading takes the form of cross-border acquisitions under term deals, rather than actual spot trade.

It is worth recalling that over the last few years PSV volumes shot up by 66% to 10.4 Bscm, as Italy's energy authorities channelled more gas through a series of measures. New rules include an obligation for operators extracting gas in Italy to convert royalties into gas and sell it on the PSV, which entails the sale by the operator of the liquefied natural gas terminal of Panigaglia GNL Italia to the users of the terminal.[23] Notwithstanding the doubling, volumes remain low compared to Italy's annual gas demand (i.e. below 15%).

Question	I agree (%)	I do not agree (%)	I don't know (%)
According to your experience, the ranking of tools for seasonal balance has remained unchanged in the last five years.	66.67	16.67	16.67
According to your experience, the ranking of tools for seasonal balance is expected to change in the next five years.	70.83	12.50	16.67
According to your experience, the ranking of tools for peak shaving has remained unchanged in the last five years.	50	33.33	16.67
According to your experience, the ranking of tools for peak shaving is expected to change in the next five years.	62.5	20.83	16.67
According to your experience, the ranking of costs for flexibility tools has remained unchanged in the last five years.	40.91	31.82	27.27
According to your experience, the ranking of costs for flexibility tools is expected to change in the next five years.	18.18	40.91	40.91
According to your experience, the ranking of costs for flexibility tools varies with gas suppliers.	71.43	9.52	19.05

Table 7. Dynamics of the ranking in Table 6.

The questionnaire also investigated the dynamics of the ranking reported in Table 6, analyzing their evolution in the past as well as in the next five years. About the ranking of flexibility tools for both seasonal and peak balances, experts stress an overall stability in the past (66.67% and 50% respectively), but expect a change for the near future (70.83% and 62.50% respectively). However, costs are perceived as invariant in both the past (40.91%) and the future (40.91%), even though answers are less polarized.

In other words, experts recognize divergences between suitability of different tools and efficiency patterns, and assess the rationale for such divergences (i.e. non-availability due to both physical and/or operational constraints). However, convergence in trends in the near future is expected. Since a relevant share of current long-term contracts will expire by 2017, this positive effect will be enhanced by new investments in storage facilities and import infrastructures. In this vein, the Gas Storage Database (GSE, 2008) foresees a 25% increase in working capacity by 2010 (see Table I.2 in the Appendix).

[23] In January 2008, the Italian energy group Edison offered about 13 million cubic metres of gas on PSV for February and March contracts. Only half of it was sold.

Results, therefore, suggest a relative uncertainty about the cost of flexibility, but also a possible change in the intensity of usage of the different tools, probably as new storage capacity will be operational in the next few years. This of course paves the way to the assessment of investment plans, as we will detail in the next Section.

4.4 Investment

One of the objectives of Resolution 119/05 was to establish rules fostering investment in new storage capacity. Market forces, such as the increase in gas demand and the dependence on imports, also revealed the need for new storage infrastructures. To date, however, 72% of the sample affirms that the expansion of the existing storage infrastructure, as well as investments for new facilities, will improve security of supply, but it is not expected to enhance competition in the sector.

This answer may sound somewhat contradictory, at least with respect to the issue of security of supply, especially if we compare it with the results on strategic reserves and of Resolution 303/07 about the continuity of gas supply to residential consumers (see Section 4.2). One possible explanation to this discrepancy is that, given the resources and constraints in the short-term, the usage of actual storage capacity is perceived as positive in terms of adequacy with respect to protected consumers. The reduction of the amount of gas immobilized for strategic reasons could be a "cheap" (but unfeasible, in our opinion) strategy to increase accessible gas for primary uses. When the long-term capacity planning is taken into account, investment should increase faster.[24] The majority of respondents affirmed that the current incentives to investment given by AEEG are substantially adequate (34.78%). As a matter of fact, as we noted in Section 2.3, the allowed capital rate of remuneration is quite generous. The major barrier to investment remains the length and unpredictability of the tendering and authorization processes, as well as the environmental impact assessment for new storage sites. For instance, it will take 11 years from the tendering to the full operation of a new site at San Potito and Cotignola (Edison Stoccaggio, 2007). Indeed, together with Edison Stoccaggio and Stogit, newcomers, mainly shippers, have started investing in storage capacity (see Table I.2 in the Appendix).

An example of this new strategy is the project by Independent Resources PLC that plans to build a large underground storage facility in a deep, naturally fractured reservoir in Italy's Po Valley (Rivara).

[24] Pending the fact-finding investigation on the lack of investment by the main storage operator, as a strategy of capacity restriction that favours ENI's dominant position, alternative explanations of our results, based on anticompetitive behaviours, are not backed by sufficient evidence.

The project was granted a provisional long-term concession by Italy's Ministry of Productive Activities, which is subject to completion of a satisfactory environmental impact assessment and final approval.

Question	I agree (%)		I do not agree (%)		I don't know (%)
Current and planned storage facilities might ensure security of supply and increase competition.	72		24		4
Storage capacity is expected to significantly increase by 2010.	44		20		36
Question	**Very satisfactory**	**Satisfactory**	**Adequate**	**Unsatisfactory**	**Very unsatisfactory**
Incentives to invest in new storage facilities are:	13.04	26.09	34.78	13.04	21.74

Table 8. Investment in the Delphi questionnaire

The positive consequences of this investment campaign are pointed out by the majority of the sample (44%): gas storage will significantly increase by 2010.

5. Conclusions

This paper is the first attempt to provide a microeconomic analysis of the Italian gas market in general and of storage services in particular. Furthermore, the Delphi approach has assured a direct involvement of actors in the market (storage operators, shippers, consultants and regulators), thus allowing for a coherent assessment and evaluation of the empirical evidence on the storage gas sector.
Let us briefly reassess the results of the survey. Experts implicitly distinguish two phases in the development of the Italian gas storage system: a policy-driven phase and a possible market-driven phase.

The core issues of the regulated phase, which encompasses the 'Letta Decree' 167/00 (implementing Directive 98/30/EC) and Laws 290/03 and 293/04 (implementing Directive 2003/54/EC), are *de facto* accountable for the monopolistic structure of the service. This has led to the regulation of storage access and destination (strategic, modulation and mining reserves). Moreover, the strategic and modulation reserves may be used, respectively, to offset unexpected emergencies and to satisfy the demand of storage services by domestic customers. Experts recognize that policy interventions have granted fair access to storage as a strategic and limited resource, and have limited the drawbacks of dominant positions. However, side-effects have occurred too. We have noted in Section 2 that one feature of the Italian gas market is its high seasonality. Gas demand in the winter is almost twice as much as gas demand in the summer. Gas storage facilities are used to store gas and smooth out production over the course of the year. As long as storage increases the flexibility of gas supply, it is highly valued by all market players. Cost-reflective tariffs (the lowest in Europe), storage capacity constraints and probably excessively low penalties have lowered the incentives to diversify the range

of tools to balance gas demand (i.e. seasonal modulation and peak shaving), and have penalized industrial customers in terms of service provision, despite their higher willingness to pay compared to domestic customers.

Let us revert to the second stage. According to the experts, we are about to enter the market-driven phase. The stagnation of the last decade, during which both storage capacity and import infrastructure (despite satisfactory incentive provisions) have been blocked by administrative requirements, is ending. Import capacity, via pipelines and GNL, will increase by over 300% and 50% respectively by 2010[25]. As for the storage system, capacity will increase by over 50% by 2015[26]; newcomers have entered the authorization process. Hence the system is opening to some degree of competition: the increase in working capacity is expected to leave some room for manoeuvre to serve industrial customers, whose demand is price elastic. This is a progress towards the commercial use of gas storage. To this end, however, a further change in gas market design is needed: the creation of a well functioning spot market, which is still to be achieved not only in Italy but also in continental Europe.

[25] Our estimates, based on AEEG data.

[26] Our estimate, based on the GSE Storage Database.

Appendix

Appendix I. Tables

Table I.1 Measures taken for the 2006 emergency.

Measures taken	Gas volumes saved (Bscm)
Maximisation of imports and national production (as of 24/12/05) including the reduction in Russian gas	0.85
Contractual interruptibility (from 23/01/06 to 22/02/06)	0.11
Dual fuel interruptibility without exceptions (from 27/01/06 to 27/03/06)	0.18
Dual fuel interruptibility and maximisation of fuel oil (from 27/01/06 to 27/03/06)	0.735
Civil consumption control (from 01/02/06 to 28/02/06)	0.22
Total	**2.095**

Source: AEEG 2006d, based on MSE data.

Table I.2 Storage projects in Italy. [27]

	Company	Type of facility	Investment	Working gas[28]	Expected Date
GSE Gas storage database, February	Edison Stoccaggio	Reservoir	Expansion/New facilities	2867	by 2015
	Geogas	Reservoir	New facility	740	by 2015
	Ital Gas Storage	Reservoir	New facility	600	by 2015
	Stogit	Reservoir	Expansion/New facilities	3350 (4150)	by 2010 (by 2013)
	Companies that have submitted an application for concession			**Location**	
MSE - UNMIG - Italy, 2008	Hera Spa/Verbundnetz Gas AG			Bagnolo Mella	
	Sorgenia Spa				
	Edison Stoccaggio Spa/Retragas Spa				
	Northsun Italia Spa				
	Gaz de France/ACEA Spa				
	Geogas/2BEnergia Spa/Enova Srl				
	Blugas Infrastrutture Srl			Piadena Est/Voltido	
	Enel Trade Spa				
	Enel Trade Spa			Romanengo	
	Sorgenia Spa				
	Edison Stoccaggio Spa/Retragas Spa				
	Gas Natural SDG Sa			San Benedetto	
	Gas Plus Storage Srl				
	Sorgenia Spa				
	Gaz de France/ACEA Spa				

Source: GSE Storage Database, February. 2008, and Ministry of Industry, 2008.

[27] Table I.2 does not include the project by Independent Resources in Italy's Po Valley (Rivara). Rivara's working capacity is estimated at approximately 3.2 Bscm. The company currently expects to develop Rivara in three stages, with the first stage coming on stream in 2012.
[28] Expected working gas.

Appendix 2. The Delphi Inquiry methodology

The Delphi method is based on a systematic, interactive and structured process for eliciting, refining and collecting knowledge from a panel of independent and carefully selected experts by means of a series of questionnaires (Adler and Ziglio, 1996). A facilitator coordinates and controls players' interactions by processing the information and filtering out irrelevant contents. Respondents remain anonymous and have equal stature in the process, and their comments influence the others only through the logic of their argument, not their name recognition. When participants reach consensus on a matter, it is omitted from subsequent iterations; therefore during the whole process, which ends after a pre-defined stop criterion (e.g. number of rounds, achievement of consensus, stability of results), the range of answers decreases and the group converges towards the "correct" response. The mean or median scores of the last round determine the final outcome of the inquiry.

The method takes its name from the Oracle of Delphi, an ancient Greek soothsayer who was able to predict the future. The methodology, developed by Norman Dalkey of the RAND Corporation for a US sponsored military project,[29] can trace its origins in the American business community of the 1950s. Since then the approach has proved suitable through not only extensive application in various sectors (i.e. health care, business, education, information technology, transportation engineering, etc.) but also its technical flexibility. The technique can be and has been effectively modified to meet the needs and circumstances of the given study. Besides *Classical Delphi*, which adheres to Rowe and Wright's (1999) characteristics (i.e. anonymity of Delphi participants, iterations, controlled feedback and statistical aggregation of responses), alternative processes have been used (see Linstone and Turoff, 2002). Although a three-round Delphi is typical, single- and double-round are rather common. Furthermore, the sample size varies from 4 to 171 "experts". As for the core intent, *Classical Delphi* aims at reaching a consensus of the most probable future scenario by iteration. However, alternative purposes are also possible. The *Policy-Delphi* (see Turoff, 1970) analyzes policy issues; it is a decision support method structuring and discussing the diverse views of the preferred future scenario. The *Argument-Delphi* (see Kuusi, 1999) focuses on ongoing discussions and aims at finding relevant arguments rather than focusing on the output. The *Disaggregative Policy-Delphi* (see Tapio, 2002) uses cluster analysis as a systematic tool to create various future scenarios in the last Delphi round.

"Delphi may be characterized as a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem" (Linstone and Turoff, 1975). Proponents of the Delphi method recognize human judgment as a

[29] "[…] to solicit expert opinion to the selection […] of an optimal US industrial target system and to the estimation of the number of A-bombs required to reduce the munitions output by a prescribed amount", Dalkey and Helmer (1963).

legitimate and useful input in generating forecasts and believe that the use of carefully selected experts can lead to reliable and valid results. In addition, the Delphi technique attempts to overcome the weaknesses implicit in other approaches, such as those relying on a single expert, a group average and/or a round table discussion. The former method puts too much weight on one person's opinion. The second fails because "the individuals consulted have neither the opportunity to provide their most thoughtful input nor the benefit of hearing other responses that might encourage a refinement of their contributions" (Clayton, 1997). Finally, the round-table approach is unreliable because some members of the group may unduly influence the final decision. In particular, the Delphi method addresses the latter concern by soliciting input anonymously, so that influences, such as the professional reputation of a respondent or the forcefulness of respondents' personalities, are neutralized.

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