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in close cooperation with
INTERNATIONAL GAS UNION

Study on Underground Gas Storage in Europe and Central Asia

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Acronyms

CAM	capacity allocation management
CAM	capacity allocation mechanism
CAPEX	capital expenditures
CGV	cushion gas volume
CMP	congestion management procedure
CMP	congestion management procedures
CNG	compressed natural gas
DSO	distribution system operator
ERGEG	European Regulators
GGPSSO	good practice of storage system operators
ISO	independent system operator
LNG	liquefied natural gas
NRA	National Regulatory Authority
nTPA	negotiated third party access
OFC	online flow control
OPEX	operational expenditure
PSO	public service obligation
PSO	public service obligation
QHSE	quality, health, safety & environment
rTPA	regulated third party access
SBU	standard bundles units
SBU	*standard bundled unit'*
SME	small and medium enterprise
SSO	storage system operator
TPA	third party access
TSO	transmission system operator
TSO	transmission system operator
UGS	underground gas storage
UNECE	United Nations Economic Commission for Europe
VAT	value added tax
VSI	vapour space inhibitor
WGC	World Gas Conference
WGV	working gas volume
WGV	working gas volume

Executive Summary

Underground gas storage (UGS) is one of the most critical components of the natural gas market. Along with other forms of storage such as line pack, LNG ships, or storage at LNG receiving terminals, UGS provides a range of functions needed for proper functioning of the gas market. UGS provides the lion's share of the gas storage function in Europe and Central Asia. Gas demand varies as a function of weather, economic activity, gas prices (and the costs of alternatives) and does so continuously, daily, seasonally, and annually. Proper management of storage plus market-based pricing ensures that varying demand can be met without interruption. Efficient matching of demand with supply ensures optimal use of the gas chain infrastructure, notably the transportation and distribution networks, and it permits technically and economically sensible long-term management of upstream gas reserves and resources. Further, with adequate levels of storage security of supply is enhanced with respect to either demand surges or unanticipated supply interruptions. Globally there are 606 UGS facilities in the world with a working gas capacity of more than 300 billion cubic metres. Europe and Central Asia have a 200 bcm total working gas volume and respondents to this study's questionnaire have 110 bcm of working gas volumes.

Energy markets are shifting to a mix of primary fuels that includes a greater share of intermittent renewable energy sources (e.g., wind, solar, tidal). Energy storage in the form of gas storage will be an important enabler for the transition since simple cycle and combine cycle gas turbines are cost-effective means of back-stopping the variable electricity output of intermittent renewables. That function can be met only if the power generating units and their fuel supply are available.

Underground gas storage can take many forms, and includes storage in depleted oil and gas reservoirs, in aquifers, and in leached salt caverns. Abandoned mines and rock caverns are also used. Depleted oil and gas reservoirs are the most common type of underground storage. They are widely available, their geological and physical characteristics are better known than for aquifers as a consequence of many years of operation, and they require less injection of incremental cushion gas. Leached salt caverns can be highly attractive in terms of both withdrawal and injection rates, but they require disposal of brine from the mining process through delivery to the chemical industry for chlorine production, injection in deep saline aquifers, or disposal in the sea.

In Europe, storage regulation is governed by Directive 2003/55/EC, Article 19(1) and the Third Energy Package:

- Third party access (TPA) is to be provided to UGS facilities when technically and/or economically possible;
- Member States can choose between negotiated TPA, regulated TPA, or both for UGS facilities;
- Access must be provided on a transparent and non-discriminatory basis, and there must be legal and functional unbundling;
- Isolated markets may derogate from the TPA obligations;
- Exemption from TPA obligations for existing storage facilities may be granted it there is a lack of capacity, if access would prevent storage operators from meeting their public service obligations, or where access would cause serious financial difficulties because of existing take or pay obligations; and
- Regulators monitor UGS access conditions.

While there is some discussion of capacity allocation mechanisms and congestion management procedures in existing European legislation, European regulators consider that best practice guidelines should be developed. While gas storage operators are generally satisfied with requirements regarding transparency and application of regulatory requirements (including land access, damage compensation, and cushion gas rules), they are generally dissatisfied with the length of authorization procedures. The effort to create common rules for operation of gas markets would be facilitated by the spread of best practices in the field of regulation of storage sites. In light of the liberalization of gas markets in Europe, it is increasingly important for storage flexibility to be enhanced to respond to market shifts. Achieving that outcome will require improving public perception and the societal acceptance of storage through engaged dialogue and application of accepted best practices.

As natural gas assumes an ever greater role in countries' energy mixes, particularly with the advent of significant volumes of shale gas onto world gas markets, the European withdrawal from nuclear power, and the need for significant back-up capacity for intermittent renewable energy, the need for more storage capacity becomes evident. In addition, as the distances from gas producing regions to gas consumption centres grow, there is considerable need for UGS to ensure smooth market operations and security of supply. World natural gas demand is projected to reach 3.3 tcm by 2020. With the exception of shale gas production, which to date has taken place relatively close to consumption centres, natural gas production is increasingly far from demand centres. The main conclusions regarding the development of new storage capacity include:

- Develop UGS facilities (that may include strategic stocks if a relevant economic model is provided to operators);
- Conceive LNG import terminals with integrated UGS facilities;
- Encourage innovation in and development of new types of UGS (LNG/CNG in rock caverns or gas hydrates; extension to other gases such as helium, hydrogen, and CCS)
- Invest in new technology (reduce switch time between injection and withdrawal; improve operational and cost efficiency as well as reliability; reduce environmental impact);
- Upgrade existing facilities generally, but in particular with full automation (smart UGS);
- Develop UGS for temporary storage of associated gas otherwise flared;
- Develop cross-border UGS.

The demands placed on underground gas storage are evolving since methane is not the only gas to be stored. Long-term storage of carbon dioxide (CO2) is under close evaluation as an element of countries' climate change strategies. Carbon dioxide can be used for injection to enhance output from existing oil and gas reservoirs, which translates into a form of sequestration for the injected gas. Helium and hydrogen can also be stored in underground gas storage facilities. These new kinds of storage represent opportunities for natural gas storage operators to develop new business by applying their current gas storage competence in new ways, but only if the economic model of these new businesses are proved (especially for CO2). The demand for storage of other gases results from businesses that are quite different from the natural gas storage business and that have different market drives. The service proposal is quite different especially for CO2 since the geological structure must be quite bigger than for natural gas, includes only porous substrates and excludes caverns, and can be onshore or offshore.

Introduction

The current and expected increase in natural gas demand in the United Nations Economic Commission for Europe (UNECE) region, coupled with the greater complexity of natural gas market operations and change in sources of supply, requires all natural gas market players to optimize flows of natural gas in order to ensure uninterrupted supply of the fuel, its delivery at competitive prices and flexibility in meeting demand peaks as well as various other consumer needs. While efficient and safe operation of the natural gas industry is certainly a prerequisite for the vast majority of companies for maintaining desirable profitability and meeting prescribed technical standards and safety requirements, it is also considered to be a condition for improving security of supply.

The expected rise in demand for natural gas in the UNECE region over the next 15 to 25 years, in the framework of the sharp increase in import dependency for most of the countries, has further accentuated the pressure on the natural gas industry to guarantee reliable delivery from ever increasing distances at a competitive cost. Underground gas storage within the whole industry chain plays an important role in securing a reliable and efficient supply of natural gas to industrial, residential and other consumers in the region.

Considerable recent and ongoing changes in the functioning of the natural gas market in the UNECE region have also affected the underground natural gas storage sector. New legislation has been introduced, including at the European Union level, which opened the sector to competition together with third-party access provisions. Unlike the past experience, where the key national natural gas industry players had a long investment horizon and little uncertainty with regard to the use of their underground natural gas storage facilities, in the current and expected market and regulatory framework, investment decision-making becomes more difficult. Potential new requirements regarding security of supply, unhindered access to third parties, ever higher standards for transparency of operations and clarity of price mechanisms also make it difficult for the key operators to make timely decisions on the investment needed in this major part of the natural gas industry infrastructure.

Underground gas storage services as the backbone of flexible and reliable natural gas infrastructure

With the deregulation and liberalization of the natural gas industry in the UNECE region, the natural gas industry has to rely more on the increasing role of underground natural gas storage facilities. In addition, new services have been developed and new roles designed, such as underground gas storage swaps and transforming the storage facilities into the heart of hub operations. In turn, they have contributed considerably to the integration of the gas markets in the UNECE region with the development of facilities which serve regional needs and has converted a set of national markets into a truly regional or even, as in the case of the European Union, into a European industry. In addition, considerable decline in transport tariffs in Europe also reinforced trend of an increasing reach of underground gas storage facilities.

To ensure the continuing efficient functioning of underground gas storage facilities in the UNECE region, a good understanding of the current and expected industry trends is essential. Also, the consequences of the regulation of the natural gas market and gas storage must be anticipated and their financial consequences estimated in a timely manner. It is therefore of vital importance, both for governments and corporations, to undertake a continuous assessment of the key trends in the underground gas storage sector and accordingly adjust their strategic, operational and investment decisions.

The purpose of the UNECE study on underground gas storage is to review the main trends in the sector with a view to increasing the visibility of future capacity and investment needs, as well as the regulatory, cost and operational challenges. It should also identify potential problem areas which might inhibit the sector’s ability to continue providing the desired services in a timely and affordable manner. Finally, it should assist gas companies in making informed investment decisions in underground gas storage facilities with obvious benefits for the natural gas end-user.

Aims

The market became more complex and changed significantly according to EU Directives for liberalization of the gas market and particularly due to TPA: investment decision making then became more difficult.

Gas storage became more important in the gas business as it is not only used for security of supply but also increasingly for commercial usage (also assisting the production, being a key instrument for managing technical/technological problems of the brown fields).

Due to further depletion of gas production fields, gas storage becomes and will become more and more important.

Many newcomers entered the market as storage operators (SSOs) or as customers (TSOs, shippers, DSOs and even end-users like power producers).

Investors and developers of the gas industry need to have a benchmark for well-founded investment decisions and improving/ensuring security (continuity and flexibility) of supply with benefits for natural gas end-users.

Common understanding and actions to prevent the possible effects of crises that may occur – reference the Ukrainian crisis in 2009.

A first Study on Underground Gas Storage in Europe and Central Asia was carried out by an UNECE Expert Group, published in 1999 and presented in the IGU WGC in Nice in 2000. With the following characteristics:

- The first study on UGS in Europe and Central Asia was finalized in 1999.
- It was composed of 6 chapters which dealt with new technologies, existing sites, planned projects, regulation frameworks, costs of storage and trends of market, providing with a benchmark study of all aspects of UGS.
- This study was unique by its multidisciplinary approach and the geographic areas concerned.

In 2008, the Working Party on Gas of the UNECE and storage companies expressed the need to update this First Study and different needs were identified for that purpose:

The purpose of the new UNECE study on Underground Gas Storage in Europe and Central Asia consists of updating the first study.

This Study reviews the trends in the sector with a view to increasing the visibility of future capacity and investment needs as well as the regulatory, cost and operational challenges. It also identifies potential problem areas which might inhibit the sector's ability to continue providing the desired services in a timely and affordable manner.

By providing a better understanding of the current status of the UGS business and by identifying the main trends of UGS markets, the Study should facilitate the dialogue between the gas industry and authorities for better implementation of the current regulatory frameworks or for setting up more suitable regulatory frameworks. It should also assist gas companies in making informed investment decisions in underground gas storage facilities with obvious benefits for natural gas end-user.

The structure which is related to various items such as emergent technologies, current status and projects, legal framework, market organization and tariffs, is as follows:

- **Chapter One**: New and emerging technologies and technological improvements in UGS
- **Chapter Two**: Current UGS status in Europe and Central Asia
- **Chapter Three**: Market structure and organization analysis
- **Chapter Four**: UGS projects and criteria for the selection of potential UGS facilities
- **Chapter Five**: Legal framework for development and operation of storage (incl. permitting process)

- **Chapter Six**: Cost of storage

  Chapter Seven: Outlook and main expected trends of gas markets and UGS developments (by country and regions)

All the Chapters of the new Study will be more or less an update of the corresponding Chapters of the first Study, with exception of Chapter 3 which will consider the major change in the organization of the market due to gas market liberalization.

With regard to the work methodology, particular attention has been devoted to the sources of primary information as well as to secondary information, to avoid duplication of effort and make efficient use of already available data within the International Gas Union or Gas Infrastructure Europe. In particular, a cooperation agreement was signed with IGU for sharing of the questionnaire (on-line tool) and resulting data for existing sites and storage projects.

The Study on Underground Gas Storage in Europe and Central Asia was launched by the UNECE in 2008 by forming a Working Group with representatives of gas companies, national and international bodies.

The rationale and work methodology for studying the UGS in Europe and Central Asia were defined in the "Terms of Reference" of the Study which was published in December 2008 and sent to all companies and national bodies in March 2011.

This Terms of Reference also defines the structure of the Study, particularly the content of the seven Chapters and the six market areas which were built by the Working Group.

Each Chapter was supervised by a team composed of Working Group members.

In 2009 and 2010, each Chapter team defined the questionnaire related to its Chapter. This questionnaire was finalized at the end of 2010 and sent to companies and National Regulation authorities, as well as mining authorities.

About 30 companies (mail addressed to 102 companies) and 15 NRAs responded to the questionnaire. Whilst not a significant number, the respondents do represent a major part of the gas storage business in Europe and Central Asia since most of the NRAS of major storage nations responded. Moreover responding companies also represented a major part of the storage business as their total Working Gas Volume (WG) represents 112 bcm of total working gas volume (200 bcm) stored in Europe and Central Asia, i.e. 60 % of the total European and Central Asian WGV.

Methods

Structure of the Study

The structure of the UNECE study on underground gas storage is as follows:

- Introduction
- Executive Summary
- Methodology employed and sources, glossary

Chapter One: New and emerging technologies and technological improvements in underground gas storage

- Heads: Mr. A. Iskhakov (Gazprom) and Mr. C. Gomez-Montalvo (Geostock).
- This Chapter will identify new and emergent technologies which are or may be cost efficient for storage exploration, construction or operation. The question will be related to the following items :
  - Subsurface and surface technological trends and improvements
  - Intelligent UGS (CAPEX and OPEX optimization)
  - Commercial optimization software
  - Technical developments (delta pressure, horizontal drilling …)
  - Economic Innovations in UGS operation

- Reducing environmental impacts
- Automation of well monitoring
- Increasing of daily peak production
- Drilling technologies for improvement of UGS well quality
- Technologies for ensuring liquid lifting from gas storage wells

Chapter Two: Current UGS status in Europe and Central Asia

- Heads: Mr. M. Sandu, (Romgaz), Mr. B. Ernecic (PSP) with the support of Mr. Gheorghe Radu (Romgaz) and Mr. A. Iskhakov (Gazprom).
- This Chapter is a database for existing UGS by country and focuses in providing a synthesis by market area with the following data:
  - Date of commissioning
  - Storage type
  - working volume,
  - total volume
  - peak withdrawal rate
  - nominal withdrawal rate
  - injection rate
  - calorific value
  - …

Chapter Three: Market structure and legal framework analysis

- Head: Mr. G.-H. Joffre (Storengy) with the support of Ms A. Brandenburger (RWE Gasspeicher).
- This Chapter will describe the organization of the market.
  - Chapter 3A (to be completed to National Regulation Authorities)
    - Status of Third Party Access
    - Status of Capacity Allocation Procedures
    - Status of Congestion Management Procedures
  - Chapter 3B (to be completed by System Storage Operators)
    - Public Service Obligation
    - Strategic stock obligation
    - Ownership structuration
    - Exemption of TPA
    - Contract duration
    - Physical restrictions CAM and CMP mechanisms
  - Chapter 3C (to be completed by NRA and SSOs)
    - Access to the transmission system

Chapter Four: UGS projects and criteria for the selection of potential UGS facilities

- Heads: Mr. M. Sandu, (Romgaz) with the support of Mr. Gheorghe Radu (Romgaz) and Ms A. Brandenburger (RWE Gasspeicher).
- This Chapter is a database for planned UGS by country and focus on a synthesis by market area with the following data:
    - Status of project (feasibility, FID, Construction, Commissioning)
    - Storage type
    - working volume
    - total volume
    - peak withdrawal rate
    - nominal withdrawal rate
    - injection rate
    - calorific value

Chapter Five: Legal framework for development and operation of storage (incl. Permitting process)

- Heads: Mr T. Korosi (Hungarian Energy Office), Mr W. Rokosz (PGNiG) and Mr G-H. Joffre (Storengy) with the support of Ms A. Brandenburger (RWE Gasspeicher) and Mr M. Laczko (E.On Földgaz Storage).
- This Chapter provides information by country regarding the legislation and procedures for granting consent/authorization to Storage Systems Operators (SSO) to explore, build and operate UGS in the:

o European Union countries with a common regulatory background (directives and Guidelines for Good TPA Practice for Storage Systems Operators (GGPSSO)) to be transferred to Chapter 3 as directly linked to Regulatory aspects.

o Non-European Union countries

It will include the following items:

o Mining laws per country and storage
o Fiscal framework
o Authorization for existing assets (renewal and extension) and for new projects
o Landownership (expropriation, easements,…)
o Legal framework for use of UGS for brown fields
o Safety
o Legal and fiscal aspects of cushion gas

Organization of work

The UNECE Task Force nominated heads for each chapter who established their own teams and discussed the scope and depth of each chapter.

Particular attention was devoted to the sources of primary information (focal points in individual countries and relevant corporations) as well as to secondary information, to avoid duplication of effort and make efficient use of already available data (the ongoing work within the International Gas Union, Gas Infrastructure Europe as well as the Study on Natural Gas Storage in the EU).

The inclusion of all relevant countries in the Task Force was of paramount importance for the success of the Study. All Task Force members provided suggestions and recommendations in this regard.

Work progress was assessed regularly, at three-month intervals with meetings taking place in various UNECE member countries, primarily hosted by the members of the UNECE Task Force.

Confidentiality issues

The following rules were defined for meeting the confidentiality requirements :

- The UNECE ensures that each data provider contribution is treated with confidentiality anyway.
- In line with the UNECE rules, each individual answer given by responding parties will not be published but only used in an anonymous way in our evaluation of comments.
- Each individual company and/or body will provide the on-line questionnaire with their own data without data being visible to any other individual companies or bodies.
- For carrying out their analysis and for drafting the report of the Study, the members of the Working Group will have access to the data of Chapter 3, 6 & 7, but only on an anonymous mode. This means the Working Group members will not recognize from which individual company the data were issued. For the data of the Chapters

1, 2, 4 & 5, the WG members will be able to identify the company which delivered them, as these data are non-sensitive:

1. Chapter 1 : the data will represent the opinion of the company about emergent technologies
2. Chapter 2 and 4 : the data about existing storage plants and planned storage projects are already public data (IGU database)
3. Chapter 5 : the data related to the legal framework are obviously public

CHAPTER 1

New and emerging technologies : identify the main technological improvements in UGS business that may lead to a better cost efficiency

By Mr. A. Iskhakov (Gazprom) and Mr. C. Gomez-Montalvo (Geostock)

Introduction

Supply of natural gas to consumers requires efficient storage and pipeline transmission infrastructure, even if most of the export of gas is moved by ship in liquid form. The questionnaire covers various types of storages, a wide spectrum of technological questions and describes modern conditions and trends in development of underground storage. It covers the following types of UGS facilities:

- Storages in oil and gas reservoirs
- Storages in aquifers
- Storages in leached salt caverns

The total number of respondents is 31. Responses were received from 14 countries, including one Asian country. The greatest numbers of responses were received from Germany. This is not surprising as Germany has the largest number of gas storage facilities.

Responses indicate that the innovative technologies in underground storage will be widely disseminated.

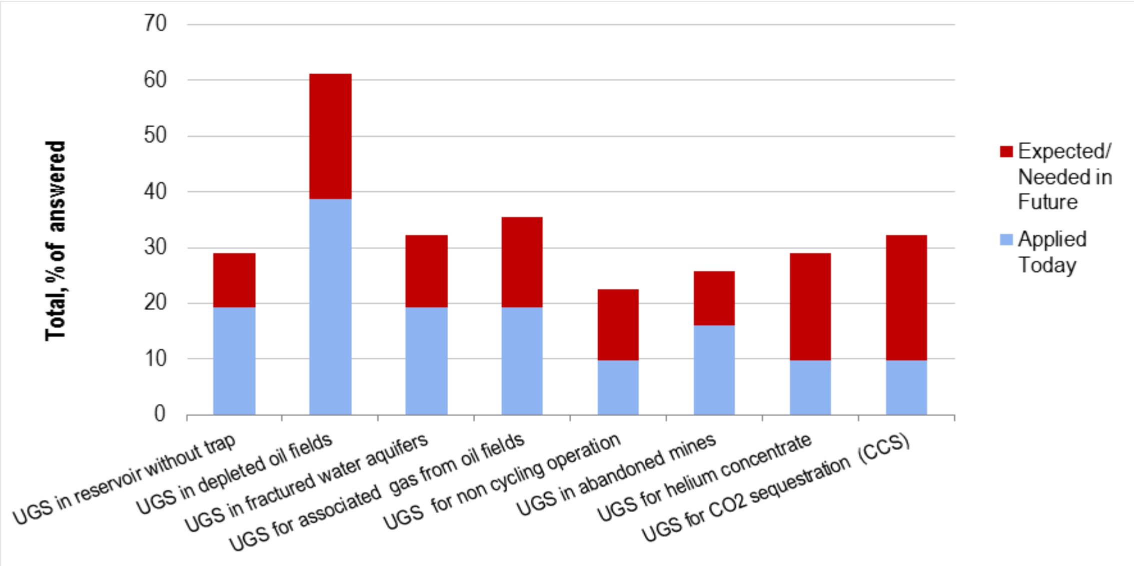
There are quite a number of new underground storages facilities and it is expected that this number will grow. Aquifer, salt cavern and depleted field storage facilities need to be located close to users to meet consumptions peaks as fast as possible. But there are few suitable sites with the geological properties required to ensure safe, long-term storage.

The purpose of the Chapter Ch. 1 is to describe the techniques and procedures preferred by most operators of underground storages, as well as developing trends. The current best industry practices have been extracted from the responses to the questionnaire. In general UGS technology is following oil and gas industry developments with adaptations to UGS specifics.

The rising number of storages indicates the increasing importance of underground storage facilities in the gas chain. The number of helium storages will be tripled and the number of facilities for the disposal of carbon dioxide will be increased three and a half times. The number UGS in abandoned mines and UGS created in reservoir without trap will grow significantly less - only 50-60%.

Technologies UGS in fractured water bearing reservoirs, UGS for associated gas from oil fields and UGS in porous media projected for non-cycling operation will double in the future.

Fig. 1.1 ● Innovation in UGS technological projecting



Source: UNECE UGS 2011.

The main measured data in storage facilities is pressure in the wells.

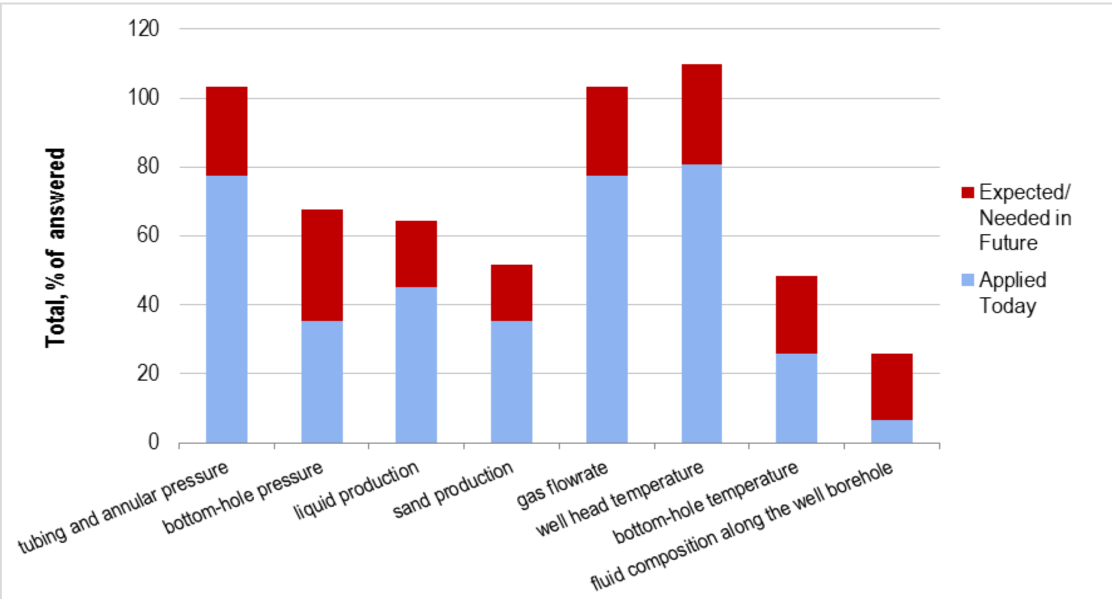
Almost everywhere, there are organized monitoring of temperature and pressure at wellhead. Down-hole gauges become more available for measuring.

However monitoring wells with bottom-hole pressure takes place on only 30-35% of sites. Temperature monitoring at the bottom-hole of wells is carried out even less (25% of the objects).

Monitoring of fluid composition along the well is in only l 5% of the responses. The reason is the homogeneity of the production wells in most cases.

But in the future, this is expected to increase to 20% with the increasing availability of appropriate measurement systems.

Fig. 1.2 ● Automated operation of wells

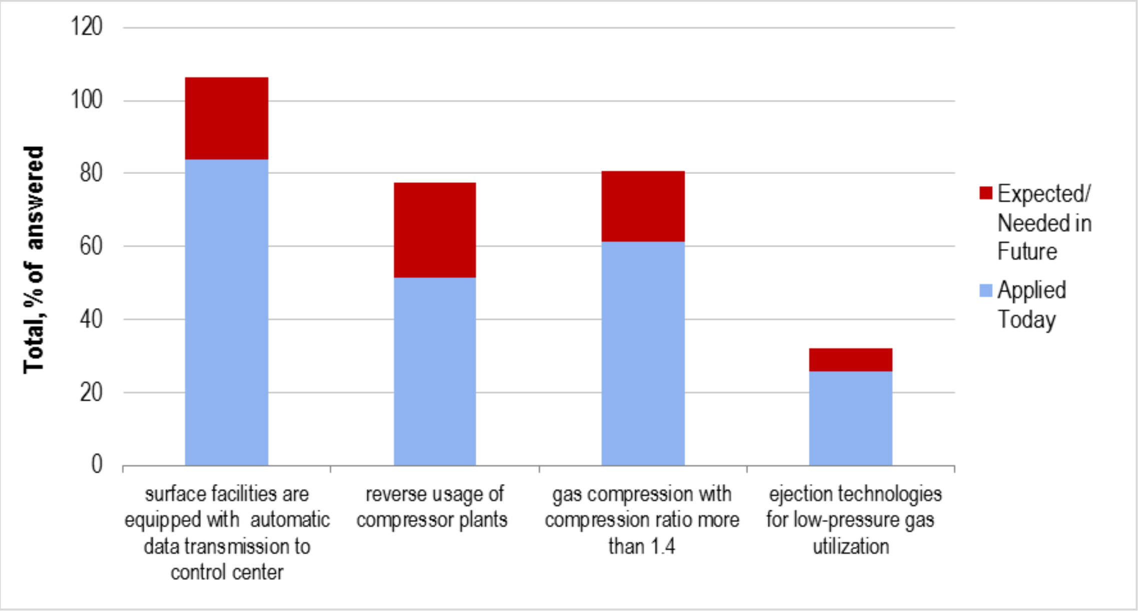


Source: UNECE UGS 2011.

Almost all UGS surface facilities are equipped with process and control systems for temperature, pressure and gas flow rate with automatic data transmission to control center. Reverse usage of compressor plants (compression at injection and production) is practiced on 50% of the sites and is expected to expand in the future.

Ejection technology for low-pressure gas utilization is fairly common (25% of objects).

Fig. 1.3 ● Innovation in surface facilities



Source: UNECE UGS 2011.

UGS intellectualization

Currently 35 per cent of all UGS operation is carried out based on an integrated model of sub-surface and surface facilities (including geological, reservoir and surface models). In the future this number will increase to 77 per cent.

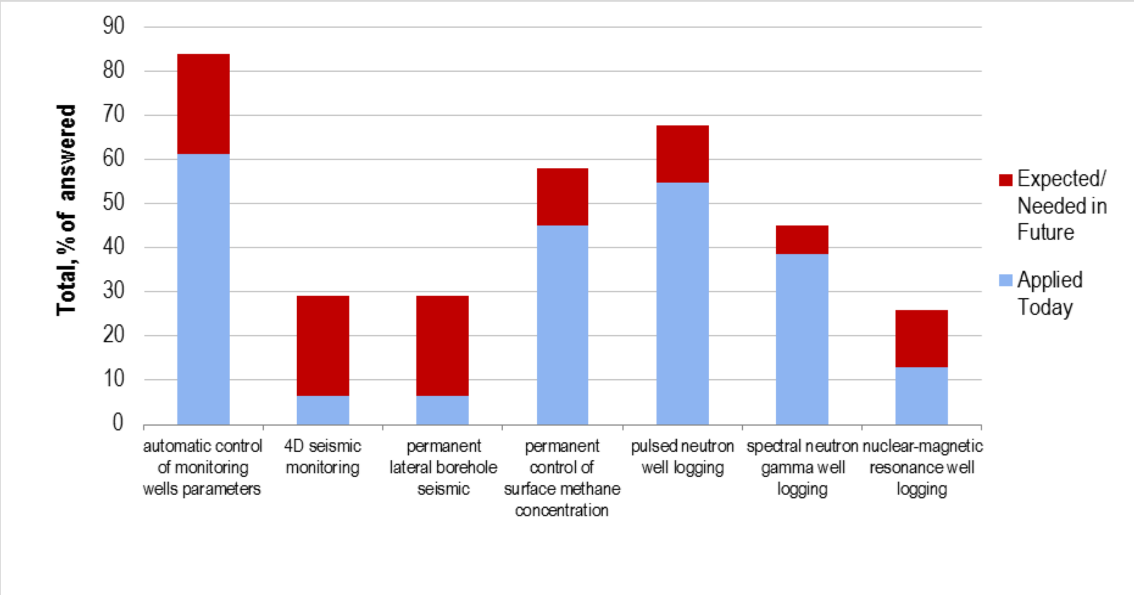
The main reasons for using seismic techniques are to confirm the size and features of the reservoir and to optimize well placement. 3D seismic monitoring has now become the standard for imaging subsurface structures and major reservoir characteristics.

Automatic control of monitoring wells parameters and permanent control of surface methane concentration is widespread.

4D seismic monitoring and permanent lateral borehole seismic are rarely used currently (6 per cent), but have great potential for growth (23 per cent).

Among the well logging technologies pulsed neutron well logging (55 per cent) and spectral neutron gamma well logging (39 per cent) are more common. Nuclear-magnetic resonance well logging is used 3-4 times less (13 per cent).

Fig. 1.4 ● Monitoring of safe UGS exploitation



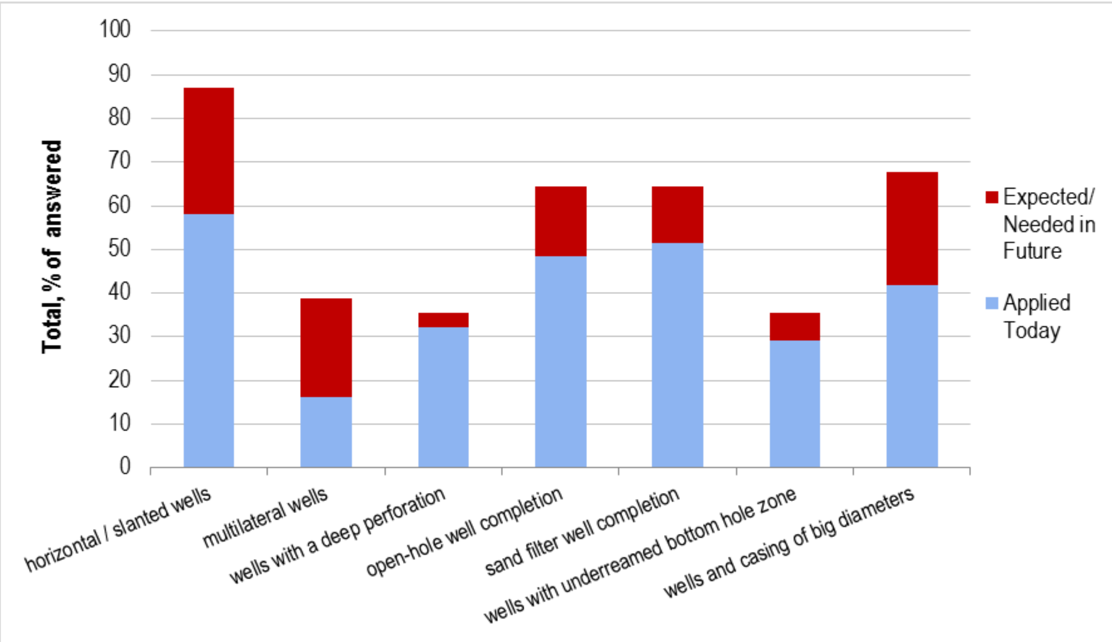
Source: UNECE UGS 2011.

Increasing of UGS daily peak production is associated with well productivity.

Productivity - a key indicator of storage. The construction of wells - the main factor influencing the rate.

Horizontal wells have long been applied in the gas storages to enhance the reservoir inflow performance of the wells. More than half the storage facilities have horizontal or slanted wells (58 per cent). Multilateral wells are used 4 times less (16 per cent). In the future, their using is expected to level off (29 per cent and 23 per cent respectively). Multilateral wells are not widely used because of the tubing constraints. Open-hole well completion and casing of big diameters are also often used to increase the productivity of wells.

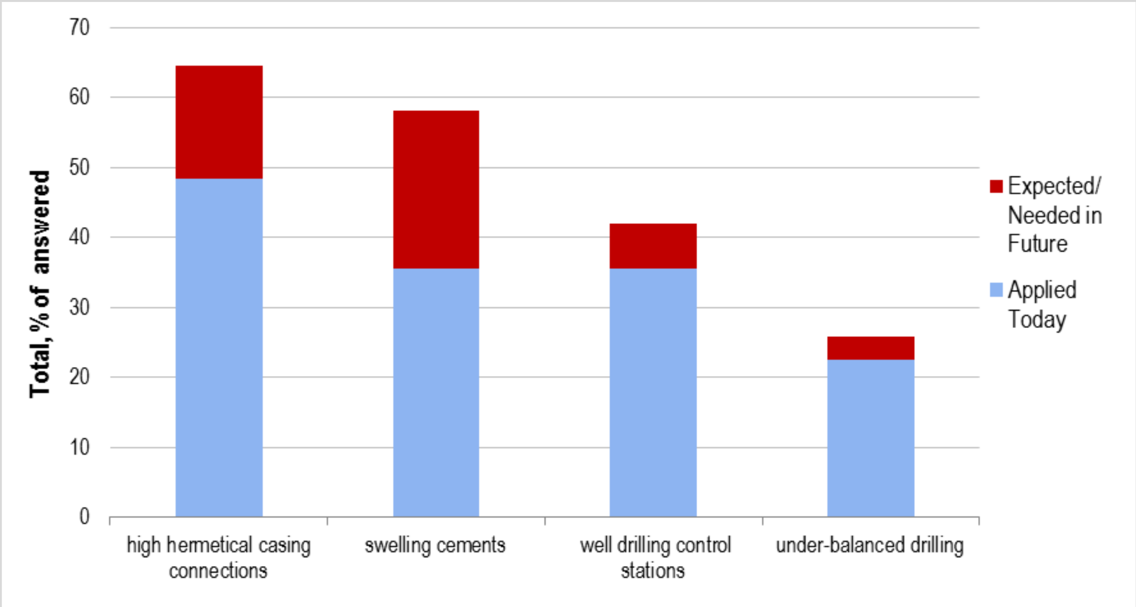
Fig. 1.5 ● Increasing of UGS daily peak production



Source: UNECE UGS 2011.

The quality of wells largely determines the UGS tightness. The greatest role for this purpose has high hermetical casing connections. The integrity of the wells are an important factor in maintaining UGS availability. In this regard, special attention in the future is paid to swelling cements.

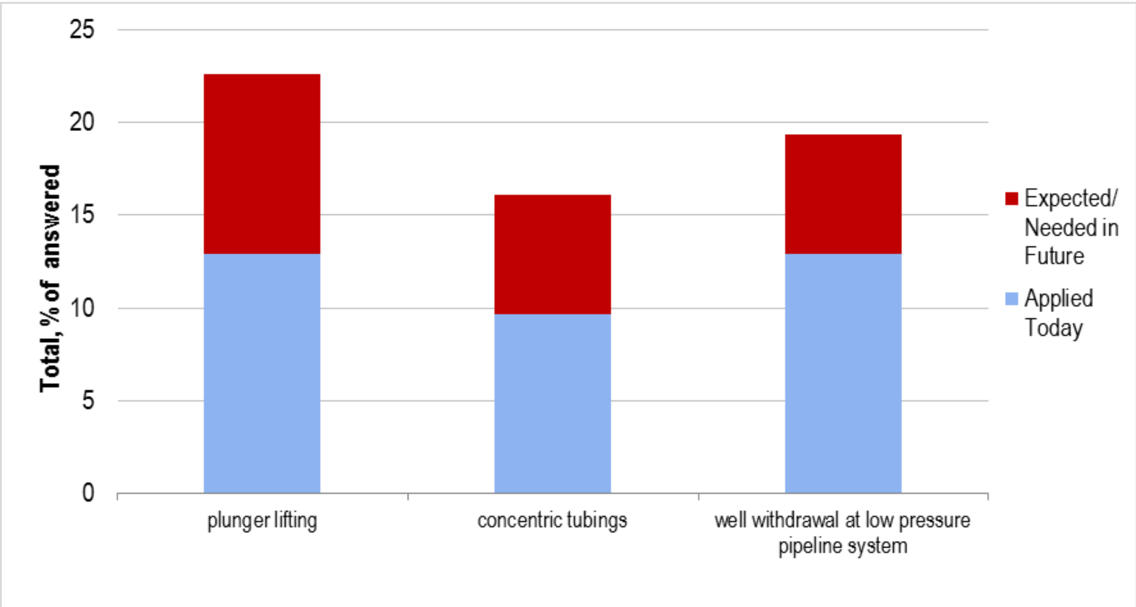
Fig. 1.6 ● Technologies for increasing of UGS well quality



Source: UNECE UGS 2011.

Among the technologies for ensuring the liquid lifting from gas production wells three technologies were roughly the same distribution. In general, this problem is noted in 30 per cent of the UGS. The presence of water in production wells often causes problems related to the formation of hydrates.

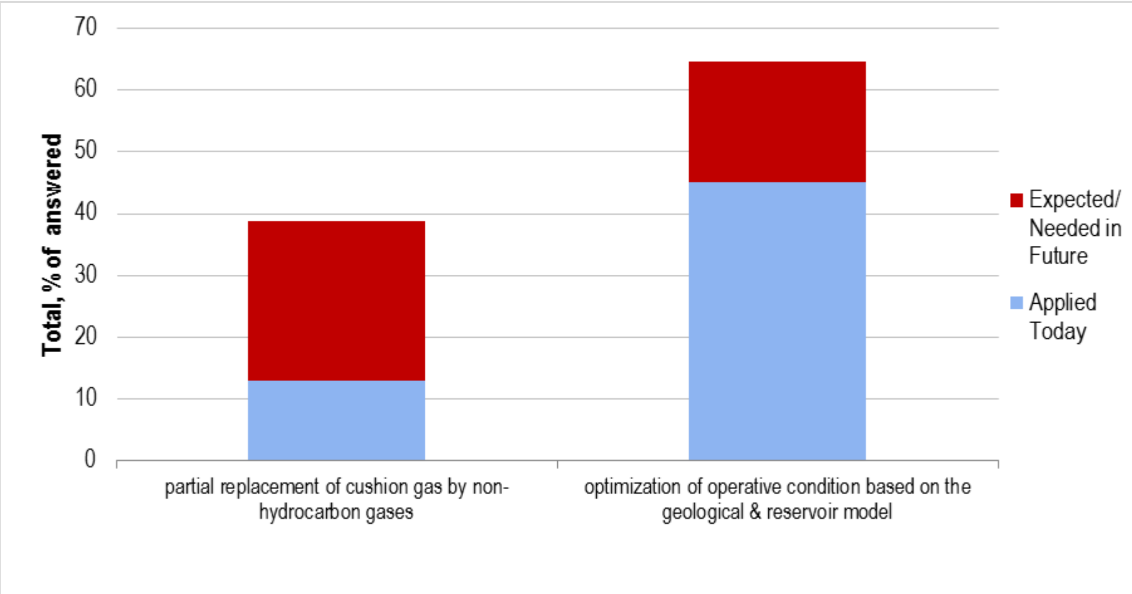
Fig. 1.7 ● Technologies for ensuring the liquid lifting from gas production wells



Source: UNECE UGS 2011.

With increasing gas prices, partial replacement of cushion gas by non-hydrocarbon gases has potential for wider use. Optimization of operative condition based on the geological & reservoir model is quite widely spread already but it seems that more operators plan to consider it so it could become a standard in the future.

Fig. 1.8 ● Applying of production methods to CAPEX and OPEX optimization

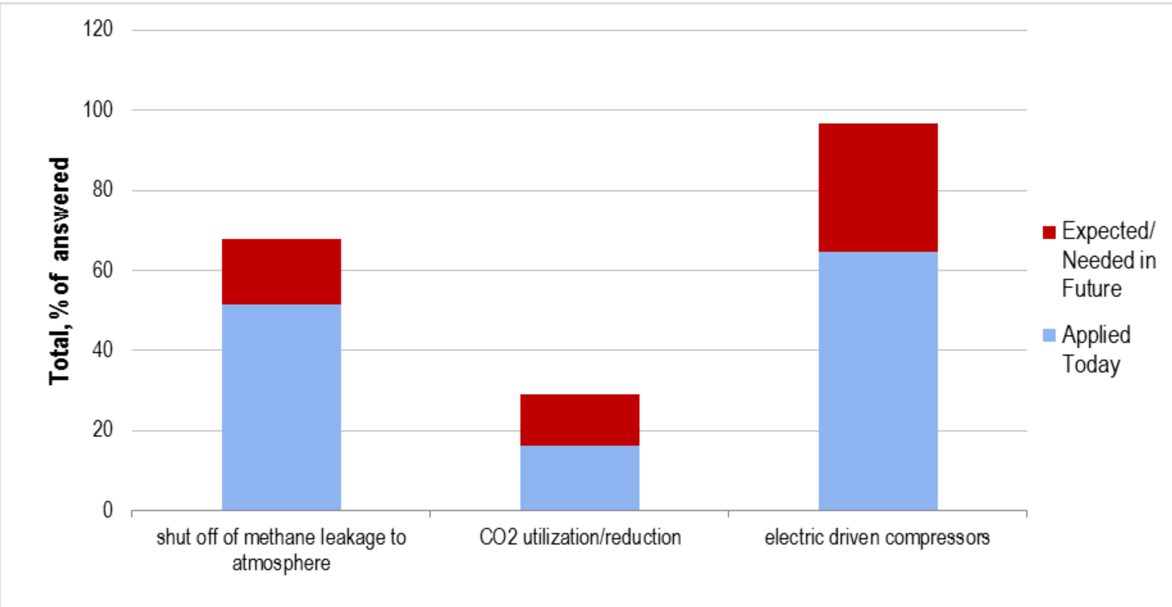


Source: UNECE UGS 2011.

The environmental aspects become an important component of UGS technology.

In order to reduce harmful emissions, great importance is attached to the implementation of electric driven compressors. The urgency of carbon dioxide utilization is indicated in less than 20 per cent of responses (Germany, France, Czech Republic).

Fig. 1.9 ● Diminishing of UGS footprint on the environment

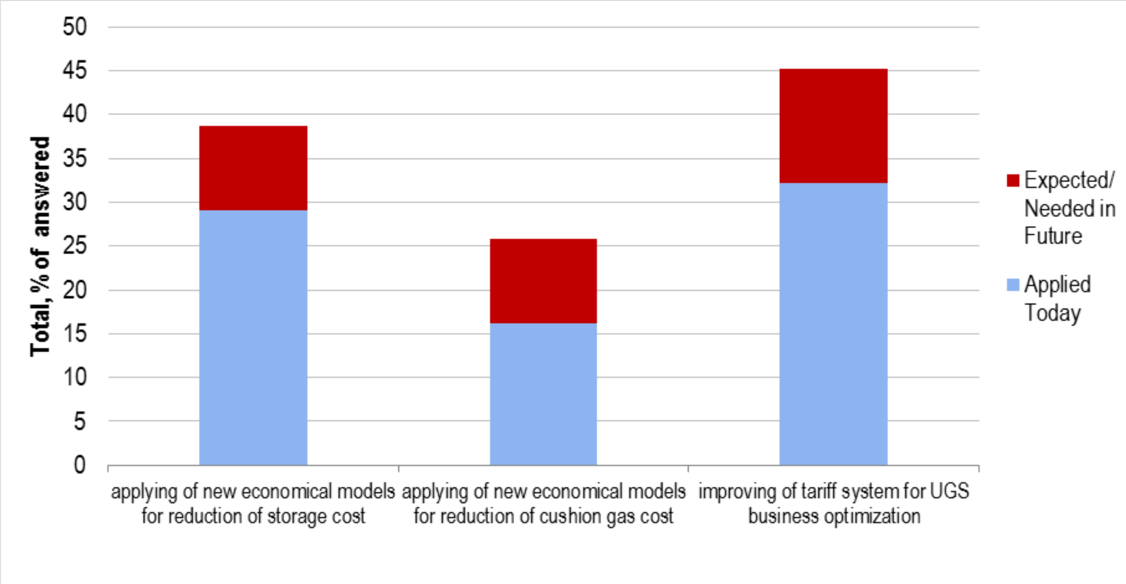


Source: UNECE UGS 2011.

Improving of tariff system for UGS business optimization stands out as the most significant economic innovation in UGS exploitation.

Tariff structure, tariff level, meeting customers' requests, operational flexibility, and contractual flexibility increase the attractiveness of the UGS. The main purpose of the UGS facilities is closing the distance to the market from the gas supply and thereby adding value by providing services and security of supply.

Fig. 1.10 ● Economic innovations in UGS exploitation



Source: UNECE UGS 2011.

Conclusions

Storage industry is a part of the oil and gas industry and uses the same technologies. The overall state of underground gas storage technologies is expected to remain stable in recent years, with some changes in separate directions.

Modern technology of underground gas storage makes extensive use of automatic measurements of key parameters in real time, which can effectively manage the processes in the reservoir and on the surface with the help of developed models. Creating a detailed database, which is conjugate with the applicable mathematical software, and allows response to the needs of UGS is important. Pressure, rate, temperature measurements are essential for monitoring storage performance and optimal exploitation. Simulation needs to be comprehensive, entailing a more deep knowledge of well behavior.

In the light of liberalization in Europe it is necessary to maintain storage flexibility to enable a quick reaction to the market and to improve public perception and acceptances of storages in society. The role of providing a reliable gas supply at the lowest cost at all times is seen as being fundamental for the success of the gas business in the future.

The analysis of data shows that gas storage technologies are being developed that allow the efficiency of UGS creation and operation to be enhanced and new market requirements to be met.

CHAPTER 2

Existing UGS in operation - Data Request

By Mr. M. Sandu, (Romgaz), Mr. B. Ernecic (PSP) with support of Mr.Gheorghe Radu (Romgaz) and Mr A. Iskhakov (Gazprom)

Introduction

This chapter presents the actual situation in the UNECE region of the storage facilities. To have an overview of this we have to collect technical data regarding the storages in operation:

- Type of UGS (depleted, aquifer, salt cavity, rock cavern),
- working volume,
- total volume,
- maximal send-out capacity,
- maximal send-in capacity,
- annual cycles,
- focus on a synthesis by market area,
- Role for production of crude oil and natural gas (brown fields).

General overview:

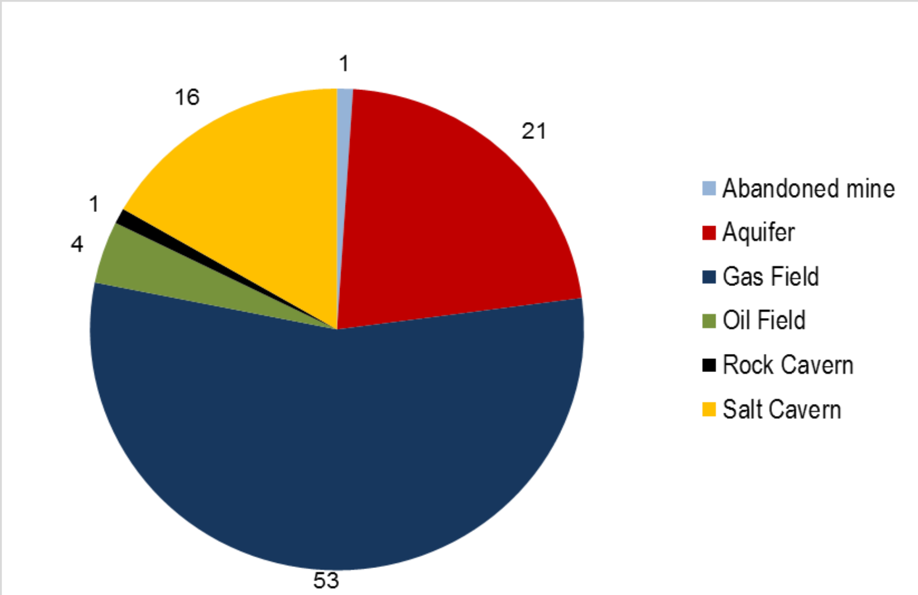
A total of 93 UGS facilities covering 12 nations (Austria, Azerbaijan, Belgium, Croatia, Czech Republic, France, Germany, Hungary, Romania, Russian Federation, Spain and UK) answered the UNECE questionnaire:

- Abandoned mine – 1 facility;
- Aquifer – 21;
- Depleted gas fields – 50;
- Depleted oil fields – 4;
- Rock cavern – 1;
- Salt cavern – 16.

The total capacity of the UGS's reported is around 230,270 bcm and the working capacity is around 112,600 bcm. The maximum potential withdrawal is around 69,000 bcm.

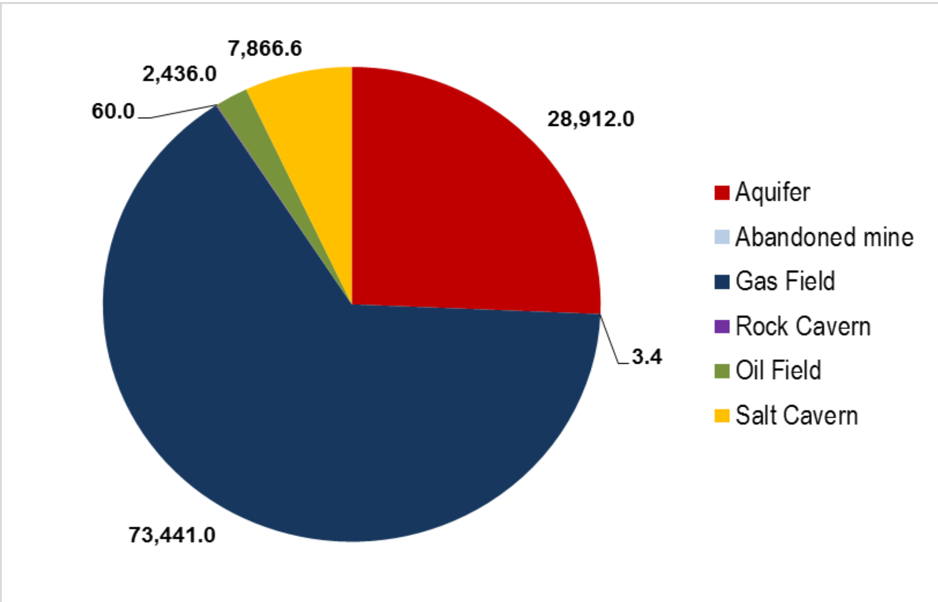
Beside their primary task to balance the variations in gas demand, the role of underground gas storage facilities as "energy storage" is getting more and more important. Underground gas storage facilities are indispensable in power generation concerning exploitation of renewable energy sources, such as wind and sun. When the share of renewable energy sources increases in the energy mix, more gas should be available in reserve to be used when wind turbines and solar collectors cannot generate power as a result of weather conditions. Natural gas used as feedstock in underground gas storage facilities and its conversion into electricity using gas fired power plants enables to compensate for the constantly increasing fluctuations resulting from the share of renewable energy sources in power generation.

Fig. 2.1 ● UGS distribution by type



Source: UNECE UGS 2011.

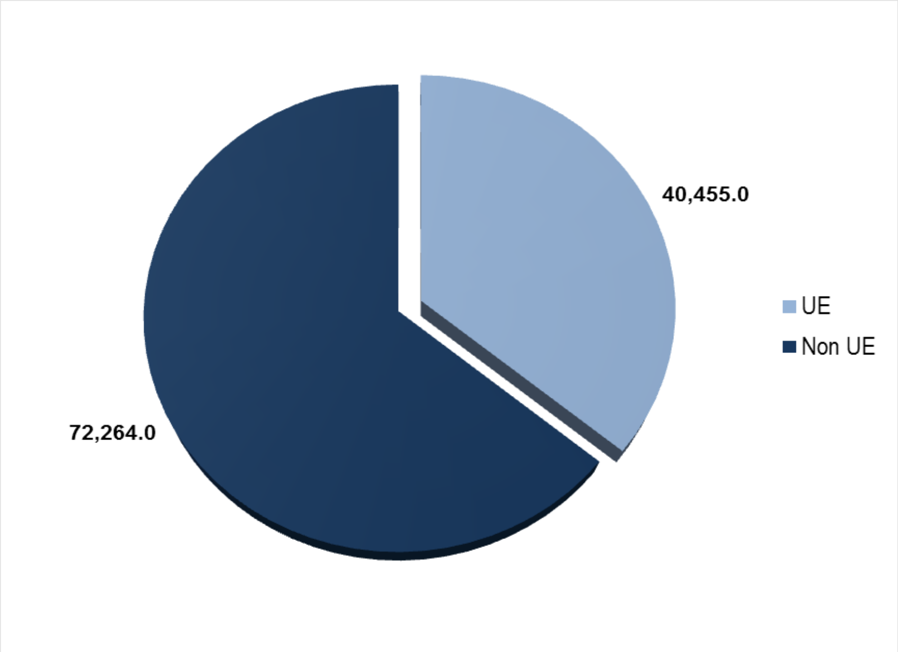
Fig. 2.2 ● Working capacities allocations by UGS type (bcm)



Source: UNECE UGS 2011.

The number and types of underground gas storage facilities vary from country to country in Europe and Central Asia. The most common underground storages are of three types: depleted reservoirs in oil and/or gas fields, aquifers, and salt cavern formations. (Several reconditioned mines are also in use as gas storage facilities.) Each type has its own physical characteristics (porosity, permeability, retention capability) and economics (site preparation costs, deliverability rates, cycling capability), which govern its suitability to particular applications. Two of the most important characteristics of an underground storage reservoir are its capability to hold natural gas for future use and the rate at which gas inventory can be withdrawn–its deliverability rate.

Fig. 2.3 ● UGS capacities split into UE and Non-UE regions (bcm)

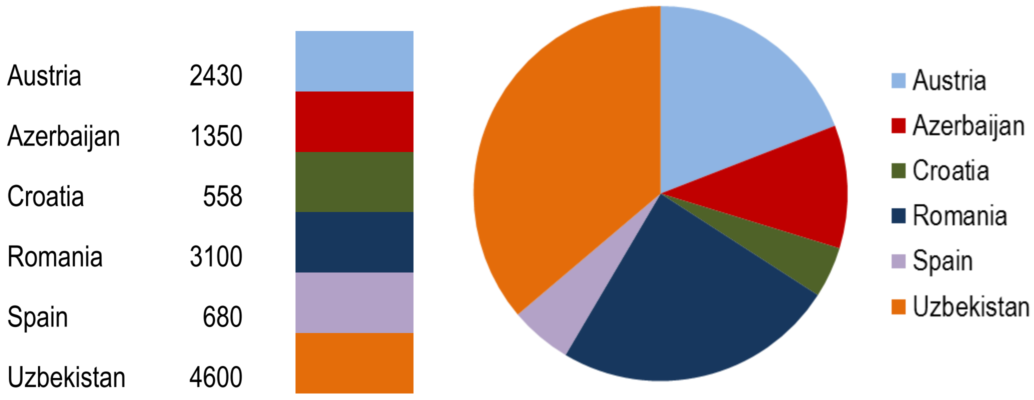


Source: UNECE UGS 2011.

Most existing gas storage in Europe and Central Asia is in depleted natural gas or oil fields that are close to consumption centres. Conversion of a field from production to storage duty takes advantage of existing wells, gathering systems, and pipeline connections.

Depleted oil and gas reservoirs are the most commonly used underground storage sites because of their wide availability. They are the reservoir formations of natural gas fields that have produced all their economically recoverable gas. The depleted reservoir formation is readily capable of holding injected natural gas. Using such a facility is economically attractive because it allows the re-use, with suitable modification, of the extraction and distribution infrastructure remaining from the productive life of the **gas field**. This also reduces the start-up costs. Depleted reservoirs are also attractive because their geological and physical characteristics have already been studied by **geologists** and **petroleum engineers** and are well known. Consequently, depleted reservoirs are generally the cheapest and easiest to develop, operate, and maintain of the three types of underground storage. In order to maintain working pressures in depleted reservoirs, about 50 per cent of the natural gas in the formation must be kept as cushion gas. However, since depleted reservoirs were previously filled with natural gas and **hydrocarbons**, they do not require the injection of gas that will become physically unrecoverable as this is already present in the formation. This provides a further economic boost for this type of facility, particularly when the cost of gas is high. Typically, these facilities are operated on a single annual cycle; gas is injected during the off-peak summer months and withdrawn during the winter months of peak demand.

Fig. 2.4 ● Gas field UGS capacities (bcm)



Source: UNECE UGS 2011.

In some areas, natural aquifers have been converted to gas storage reservoirs. An aquifer is suitable for gas storage if the water-bearing sedimentary rock formation is overlaid with an impermeable cap rock. While the geology of aquifers is similar to depleted production fields, their use in gas storage usually requires more base (cushion) gas and greater monitoring of withdrawal and injection performance. Deliverability rates may be enhanced by the presence of an active water drive. If the aquifer is suitable, all of the associated infrastructure must be developed from scratch, increasing the development costs compared to depleted reservoirs. This includes installation of wells, extraction equipment, pipelines, dehydration facilities, and possibly compression equipment. Since the aquifer initially contains water there is little or no naturally occurring gas in the formation and of the gas injected some will be physically unrecoverable. As a result, aquifer storage typically requires significantly more cushion gas than depleted reservoirs; up to 80 per cent of the total gas volume. Most aquifer storage facilities were developed when the price of natural gas was low, meaning this cushion gas was inexpensive to sacrifice. With rising gas prices aquifer storage becomes more expensive to develop.

Salt caverns provide very high withdrawal and injection rates relative to their working gas capacity. Base gas requirements are relatively low. The large majority of salt cavern storage facilities have been developed in salt dome formations located in the Central Europe. Salt caverns have also been leached from bedded salt formations to take advantage of the high injection/withdrawal rates and flexible operations possible with a cavern facility. Cavern construction is more costly than depleted field conversions when measured on the basis of dollars per thousand cubic feet of working gas capacity, but the ability to perform several withdrawal and injection cycles each year reduces the per-unit cost of each thousand cubic feet of gas injected and withdrawn.

1. Austria

Austria reported a number of 3 facilities with a total installed working gas volume of 2.43 bcm.

2. Azerbaijan

Azerbaijan reported a number of 2 facilities operated by Azerigaz with a total installed working gas volume of 1.35 bcm. The development of Caspian Sea oil fields by international consortia will make available important quantities of associated gas (12 billion m3 in 2010). The supply of these gas volumes to the Azerbaijan market will require the rehabilitation and modernization of the existing underground gas storage facilities. Gas storage is an essential component of the natural gas system. The restoration of the gas storage capacity in Azerbaijan is a serious issue since:

- gas production rates will be tightly linked to those of oil production (i.e. with no or very little flexibility);
- gas consumption, driven by customers, is dependent on climatic conditions,

A storage capacity is therefore required to act as a buffer between the fairly constant production rates and the seasonal fluctuation of gas demand. The benefits resulting from restoration of a gas storage capacity in Azerbaijan can be summarized as follows:

- with a supply and demand balancing tool, the country will be capable of using all the associated gas resulting from oil production without putting any constraint on oil production;
- there will be non-negligible environmental benefits associated with the use of natural gas instead of other fuels;
- the power generation sector should be modernized and developed. The new power plants to be implemented can take advantage of the new and efficient generation technologies such as the Combined-Cycle technology, provided there is a storage capacity allowing constant and secure gas supply. Without sufficient gas storage capacity, it would be necessary to build dual-fuel thermal steam plants capable of switching back and forth from gas to fuel oil to balance gas supply and fluctuating demand of the residential, commercial and industrial sectors. This type of power plant is costlier, less efficient and has a negative impact on the environment.

The upgrade of the Azerbaijan underground gas storage capacity must be considered as an essential component of the rehabilitation of the natural gas transit system in Azerbaijan.

3. Belgium

Belgium reported 1 facility with a total installed working gas volume of 0.7 bcm. Fluxys is appointed as the independent operator of natural gas storage infrastructure in Belgium and is responsible for operating and developing the underground natural gas storage facility at Loenhout, where natural gas is stored in aquifers more than one kilometre underground. Fluxys' storage services allow suppliers to balance the amount of gas they import and the amount consumed by their customers.

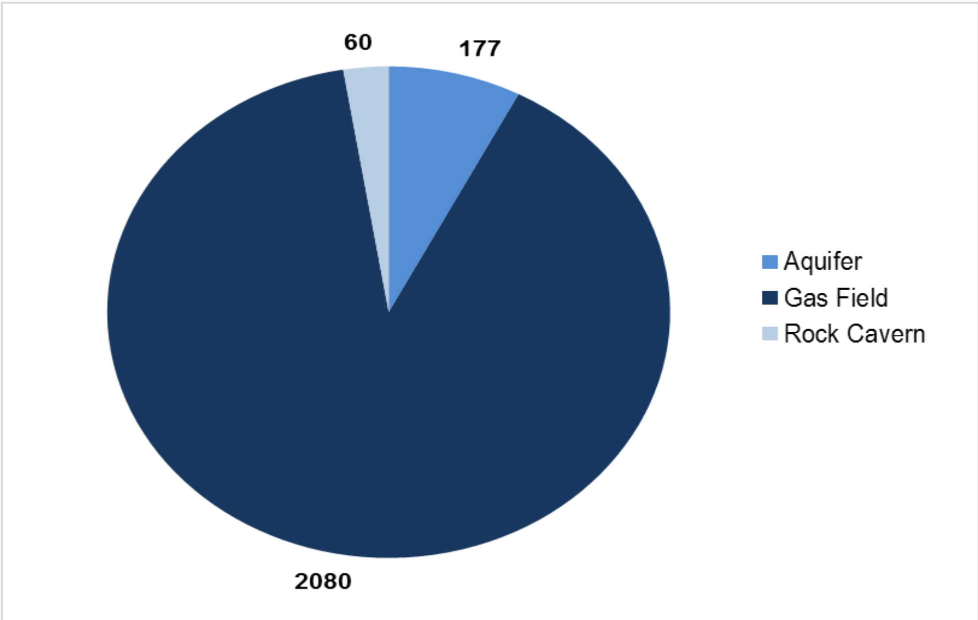
4. Croatia

Croatia reported 1 facility with a total installed working gas volume of 0.554 bcm. Podzemno Skladište Plina d.o.o. (PSP d.o.o.) is a Croatian gas storage operator that runs, maintains and develops a safe, reliable and efficient underground natural gas storage system.

5. Czech Republic

Czech Republic reported 6 facilities operated by RWE Gas Storage with a total installed working gas volume of 2.317 bcm. There are three storage system operators (SSO) in the Czech Republic: RWE Gas Storage, MND (Moravské naftové doly) and SPP Bohemia. Between them, they own and operate eight underground storage facilities in the country. The Dolní Bojanovice site is used exclusively for supplying the Slovak market. At the same time, a storage facility in Slovakia, at Láb, is used for supplying the Czech market. Total working storage capacity available to the Czech Republic is just over 2.9 bcm.

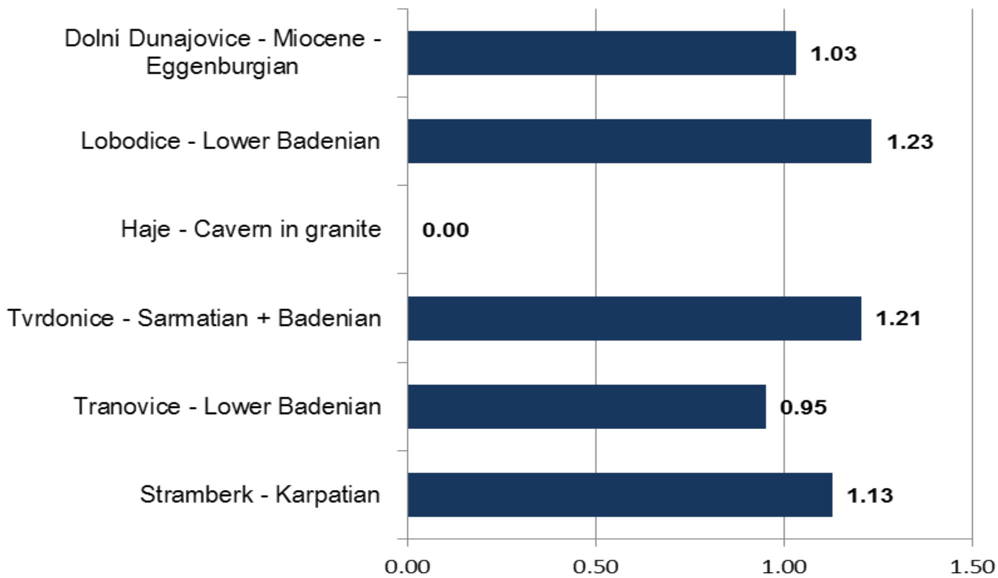
Fig. 2.5 ● Capacities distribution by UGS type in Czech Republic (bcm)



Source: UNECE UGS 2011.

The combined peak withdrawal rate from these storage facilities is 56.2 mcm/d. The Czech Republic maintains a high degree of natural gas supply security through a combination of several measures, including using long-term supply contracts, having a relatively high capacity of underground commercial gas storage, and requiring safety standards of the supply infrastructure by the transmission and distribution system operators. It seeks to improve security of supply through capacity extensions at a number of storage facilities and increased flexibility in its gas network, including reversibility of gas flows throughout the transmission system and expanding interconnectors to neighboring countries.

Fig. 2.6 ● Operating pressure / Initial reservoir pressure



Source: UNECE UGS 2011.

Following the January 2009 gas crisis in Europe, the Czech Government put in place over a short period of time and ahead of the 2009/2010 winter season a response plan for dealing with a reduction in gas supplies. This relies on coordination with industry to optimize gas storage use and regulate demand side measures in a crisis. This plan sets measures and actions to be taken during the periods of early warning and emergency crisis levels.

6. France

Underground natural gas storage in France

In 2011, there were 15 underground gas storage facilities in France, comprising:

- 11 facilities located in aquifer layers
- 3 facilities located in salt cavities
- 1 facility in a depleted gas field

They represent a total working volume of 12.6 Gm^3 and include one L-gas facility (Gournay) located in an aquifer formation whose capacity accounts for approximately 10 per cent of the total working gas volume.

Twelve facilities are owned by Storengy (77 per cent of total storage capacity), two by TIGF (21 per cent of total storage capacity) and one by Geomethane (2 per cent of total storage capacity).

TIGF (Total Infrastructures Gaz France), subsidiary of Total, was created in January 2005 to operate the storage activities and transmission infrastructures of Total in the Southwest of France.

Storengy is a company of GDF SUEZ founded on 1 January 2009 as a legally distinct entity dedicated to underground natural gas storage activities.

UGS facilities are pooled and marketed by different storage groups and products depending on the geographical position and physical characteristics of the facilities as well as gas quality. The products offered take into account the physical constraints of access to storage. Each year, the utilization rules regarding injection and withdrawal rates, or inventory are reviewed and defined in the storage access contract.

Table 2.1. ● Underground gas storages in France (June 2011)

OPERATORS	PRODUCTS / SERVICES	STORAGES	TYPE	CAPACITY
Storengy	Sediane Littoral, Serene Sud, Sediane Sud	Soings-en-Sologne, Céré-la-Ronde, Chémery	Aquifer	4,5 Gm3
	Serene Nord, Serene Nord 30/30, 60/60, 90/90, 120/120,	St-Clair-sur-Epte, Germigny-sous-Coulombs, Cerville, Trois Fontaines	Aquifer	2,1 Gm3
	Sediane	Beynes, St-Illiers-la-Ville	Aquifer	1,2 Gm3
	Sediane B	Gournay-sur-Aronde (L gas)	Aquifer	1,3 Gm3
	Saline	Etrez, Tersanne	Salt Caverns	0,75 Gm3
Géométhane	Saline	Manosque	Salt Caverns	0,27 Gm3
TIGF	Dynamic Service, Balanced Service	Lussagnet	Aquifer	1,1 Gm3
		Izaute	Aquifer	1,4 Gm3
France Total Storage Capacity				12,6 Gm3

The commercial offers of French storage operators are published on their web sites. As regards Manosque (Geomethane), its capacity is marketed by Storengy in the Saline product. The commercial products of the French storage operators are regularly reviewed and adjusted to be able to best respond to market needs.

Each storage group is connected to a transmission network through an Interconnection Point and associated with a balancing zone. At present there are three balancing zones in France: North Zone, South Zone and South-West Zone (or: PEG Nord, PEG Sud and TIGF, respectively).

In 2010 and subsequently in 2011, a new facility was put into operation in a depleted gas field by Storengy at Trois Fontaines near Saint-Dizier, in the Haute-Marne region.

Another new Storengy facility is in the final phase of construction. It is located in Hauterives in the Northern part of the Drôme region, at about 20 km from Romans-sur-Isère. The project involves creation of two caverns with a possibility of extension at a later stage.

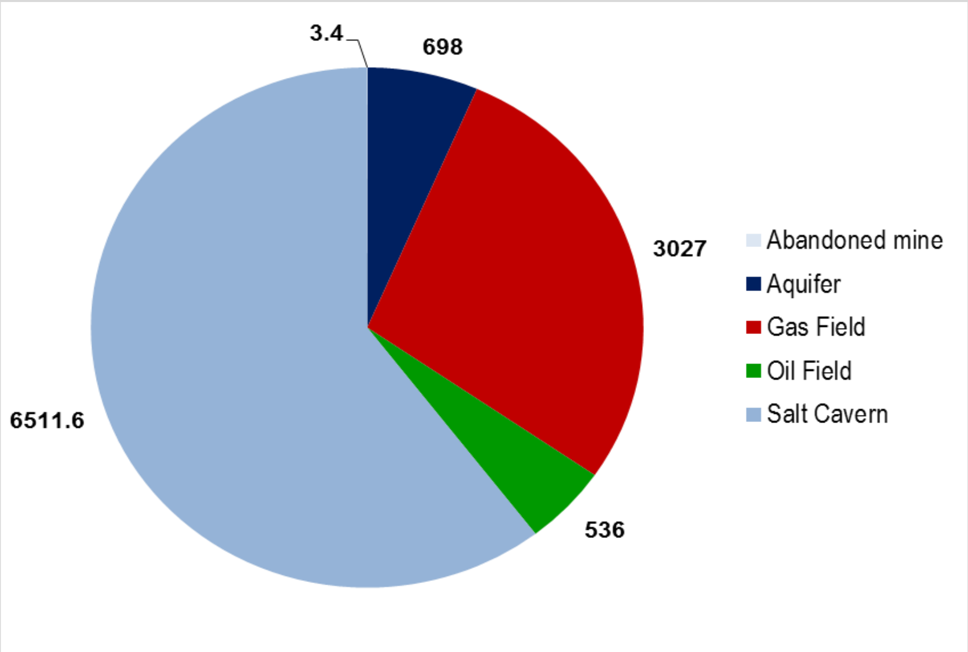
TIGF is currently increasing capacity at Lussagnet. To be carried out over a ten-year period, this project plans gradual replacement of the injection/withdrawal wells with wells with a larger diameter, installation of new compressors and the construction of new facilities for processing withdrawn gas.

The development of Manosque by Geomethane is also ongoing with a view to creating new caverns and the extension of the existing surface installations.

7. Germany

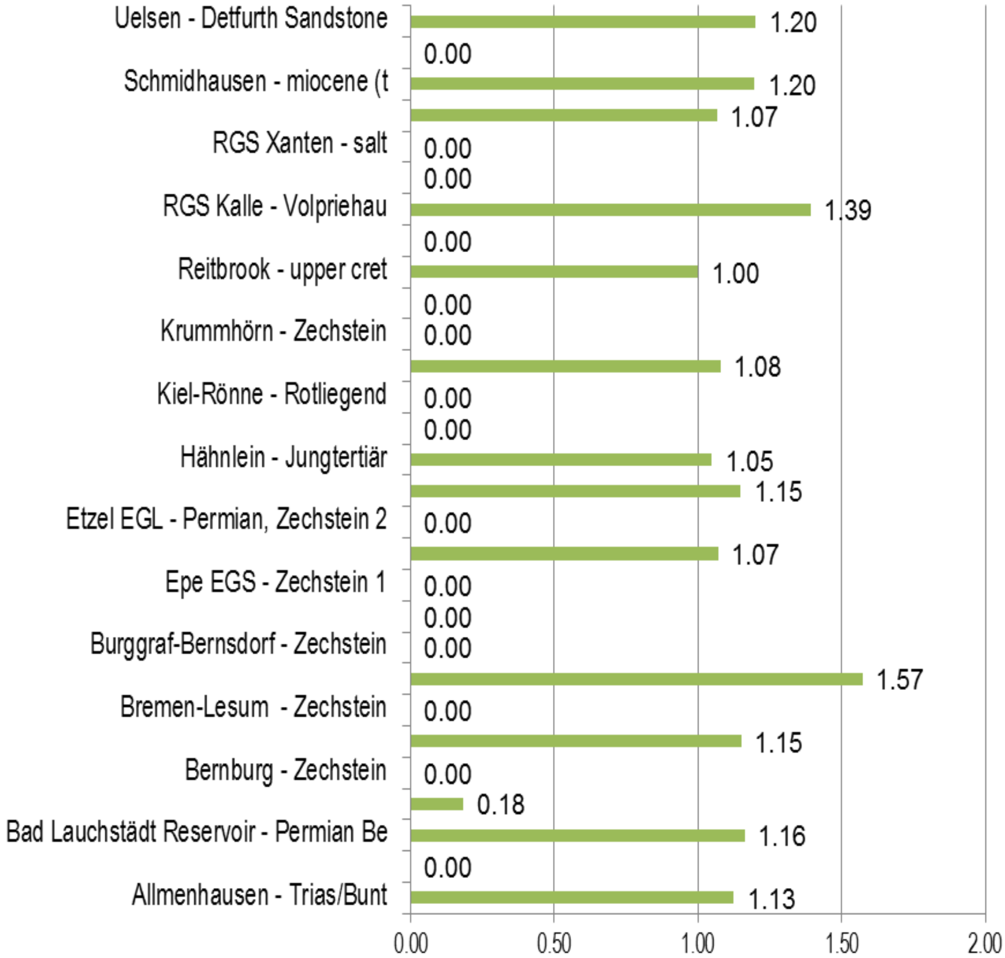
Germany reported 28 facilities with a total installed working gas volume of 10.654 Bcm.

Fig. 2.8 ● Capacities by UGS type in Germany (Bcm)



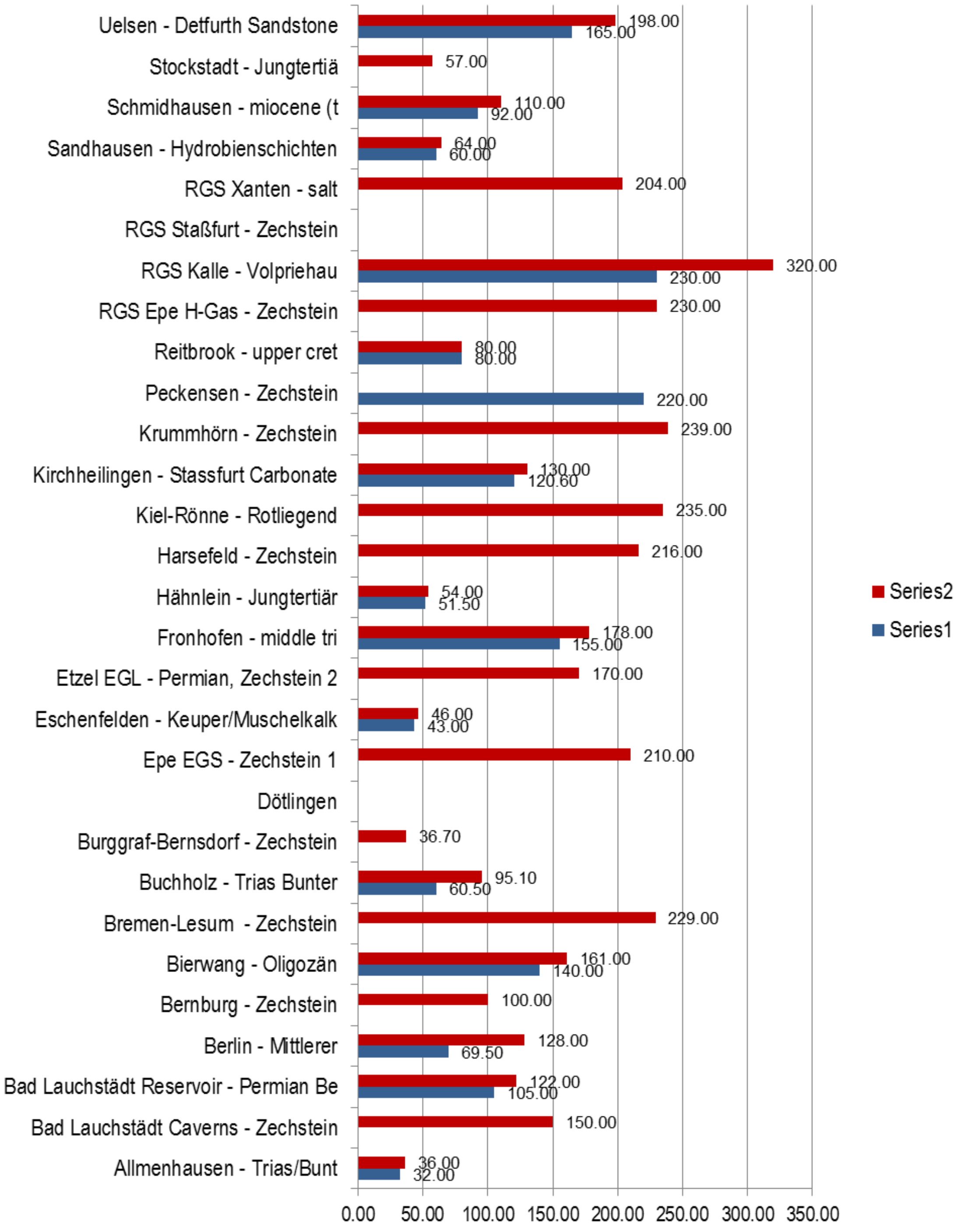
Source: UNECE UGS 2011.

Fig. 2.9 ● Operating pressure / Initial reservoir pressure



Source: UNECE UGS 2011.

Fig. 2.10 ● Operating pressure and initial reservoir pressure (bar)

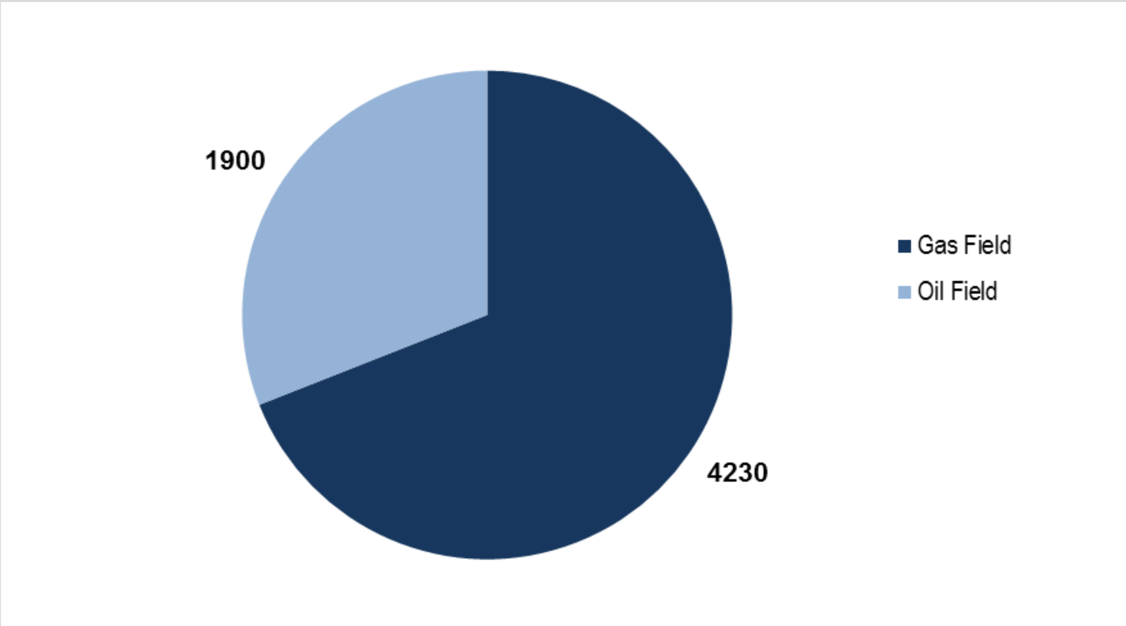


Source: UNECE UGS 2011.

8. Hungary

Hungary reported a number of five facilities with a total installed working gas volume of 6.13 Bcm. In Hungary, gas storage facilities are porous geological structures. In most cases the basic material is sandstone, and in one case it is limestone. Having extracted the original gas from these reservoirs, the geological formations, which were to a considerable extent depleted, were subsequently transformed to function as underground gas storage. Refurbishment included the conversion of wells bored originally for the purpose of extracting gas and the installation and construction of injection and gas preparation technology equipment. The first facility serving as underground gas storage for the Hungarian system was constructed near Őriszentpéter. From 1960, natural gas stored here was dedicated to assisting in meeting the peak demand of Budapest during the winter period. However, the continuous increase in the demand for natural gas made it necessary to establish further underground storage facilities. The programme started in 1977 with the conversion of the depleted working natural gas field in the area of Kardoskút, and was continued the following year by placing into operation two further facilities in Hajdúszoboszló, and Pusztaederics.

Fig. 2.11 ● Gas storage capacities by UGS type in Hungary (Bcm)



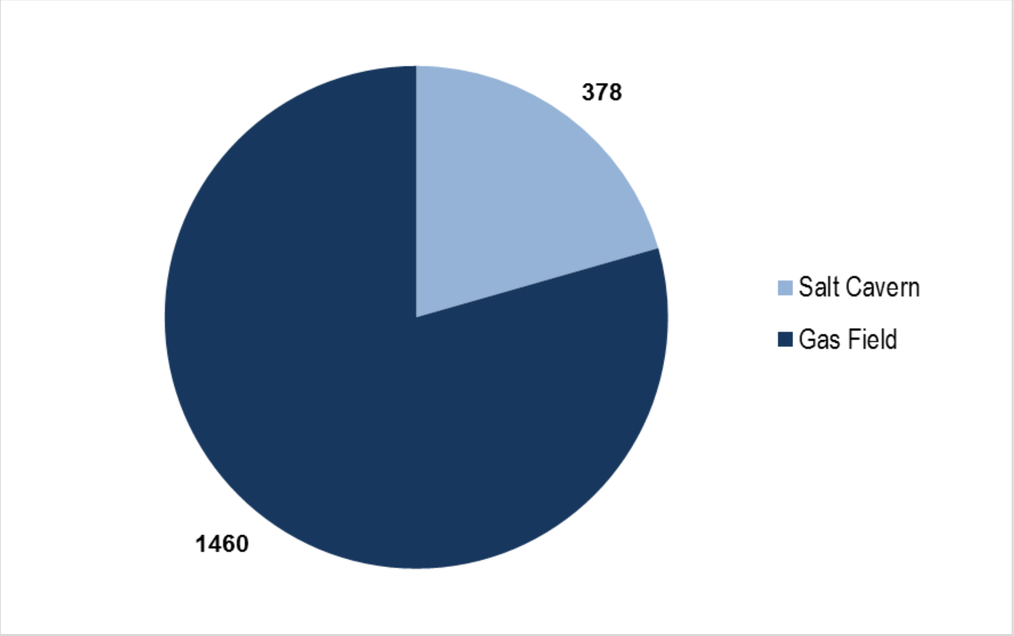
Source: UNECE UGS 2011.

Currently there are four underground natural gas storage facilities in operation: Zsana, Pusztaederics, Kardoskút, and Hajdúszoboszló (owned by E-on). The fifth UGS is operated by MOL MMBF Zrt. in Szőreg-1 reservoir in the depleting Algyő oil field. The facility is complete and has 1.9 bcm mobile and 25 mcm/day peak capacity and is used for both strategic and commercial purposes.

9. Poland

Polish Oil and Gas Company owns eight underground gas storage facilities. The task of the Storage System Operator is to offer the capacity of storage facilities in a manner that will meet the demand of market players for gas storage services while optimizing the utilization of the storage facilities and ensuring the performance of the existing gas sales contracts.

Fig. 2.12 ● Gas storage capacities by UGS type in Poland (Bcm)



Source: UNECE UGS 2011.

Poland's increased demand for storage volumes allocated to strategic stocks is driven by the act on stocks of crude oil, petroleum products and natural gas of 16 February 2007 (Journal of Laws No. 52/2007, item 343), according to which natural gas importers are obliged to create reserves at the level that will ultimately correspond to 30 days of their average gas imports volume. At the moment, a transition period is in force, according to which by the end of September 2009 the mandatory reserve should correspond to 11 days of the average daily imports; by the end of September 2010 - 15 days of the average daily imports, by the end of September 2012 - 20 days of the average imports volume; and beyond that date - 30 days of the average daily gas imports volume. The storage facilities have to provide sufficient withdrawal capacity to deliver the mandatory stocks to the system within no more than 40 days.

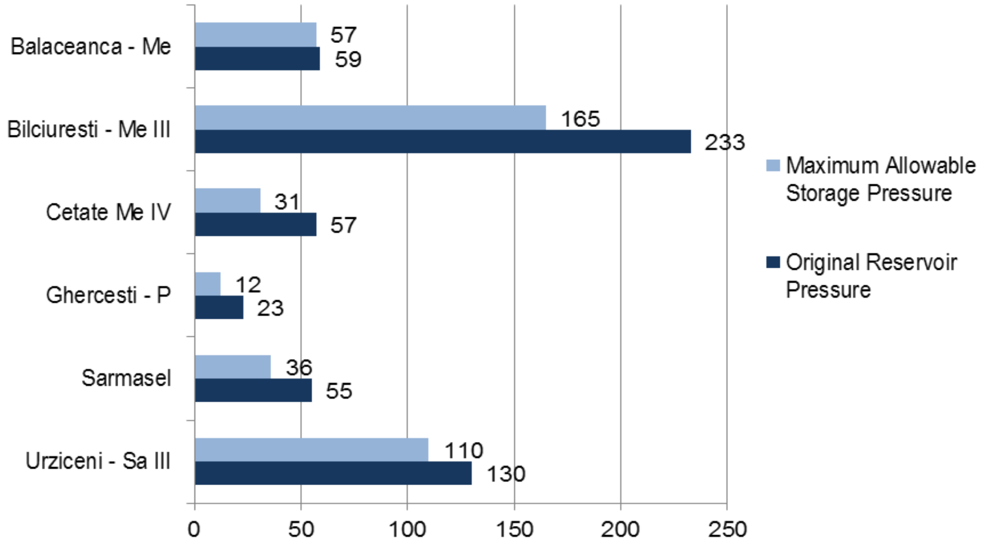
PGNiG S.A. as the owner of all underground gas storage facilities operating in Poland plays a key role in the process of ensuring the energy security of Poland.

10. Romania

Romania reported 7 facilities with a total installed working gas volume of 3.1 Bcm. Romgaz operates six natural underground gas storages of its own with total capacity of 4.2 Bcm, working gas 3.1 Bcm:

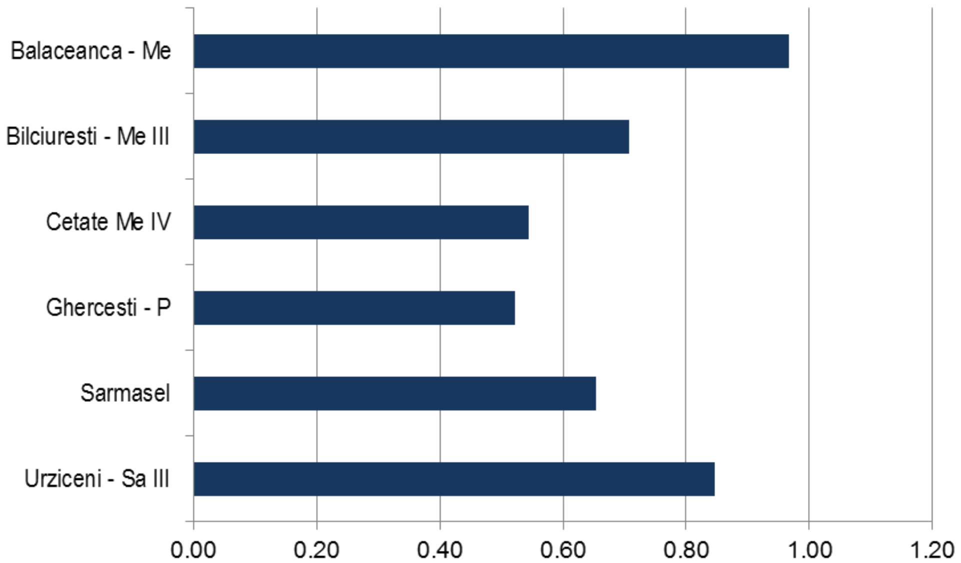
- 2 in the Transylvanian Basin - Sarmasel, Cetatea de Balta
- 4 in the extra Carpathian area - Bilciuresti, Balaceanca, Urziceni and Ghercesti
- 1 deposit in association with other companies
- Tg. Mures with Gaz de France Suez.

Fig. 2.13 ● Operating pressure and initial reservoir pressure (Bar)



Source: UNECE UGS 2011.

Fig. 2.14 ● Operating pressure / Initial reservoir pressure



Source: UNECE UGS 2011.

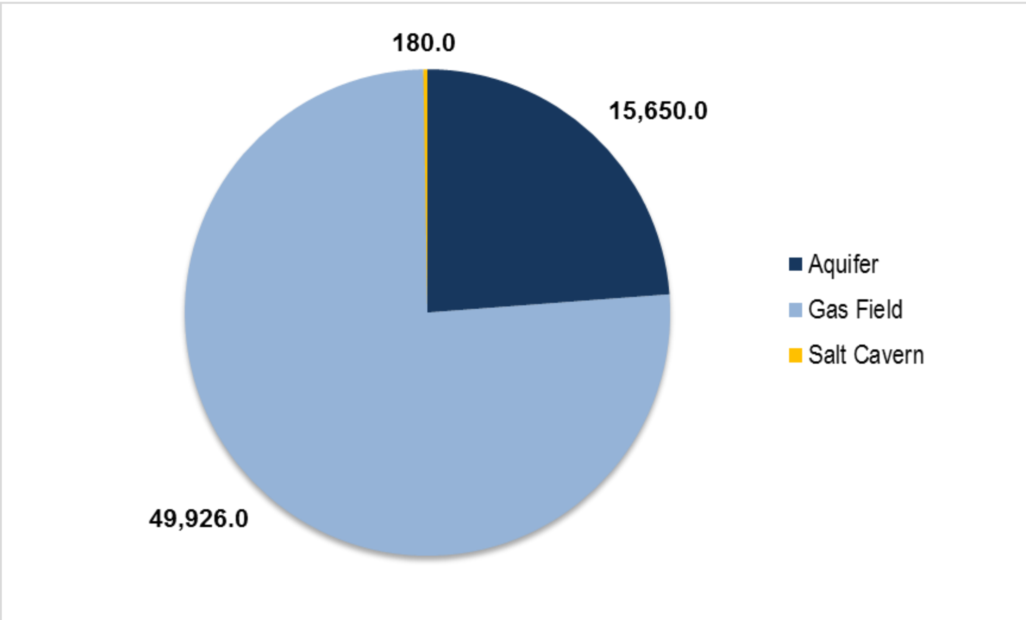
The maximum withdrawal potential of the natural gas production in the six deposits operated by Romgaz at the beginning of the production cycle: 28 million Scm/day + 2.5 milion Scm/day from UGS-s operated by Gdf Suez.

Considering the given European context where the Romanian gas industry operates and the current share natural gas occupies in the energy balance, it is estimated that in the future natural gas will represent one of the major primary energy sources in Romania.

11. Russia

Russia reported 21 facilities with a total installed working gas volume of 65.576 Bcm. Underground gas storage facilities are an integral part of the Russian Unified Gas Supply System and are situated in the main gas consuming regions. UGS facilities help smooth out seasonal fluctuations in gas demand, reduce peak loads on the Unified Gas Supply System and provide for better flexibility and reliability of gas supply.

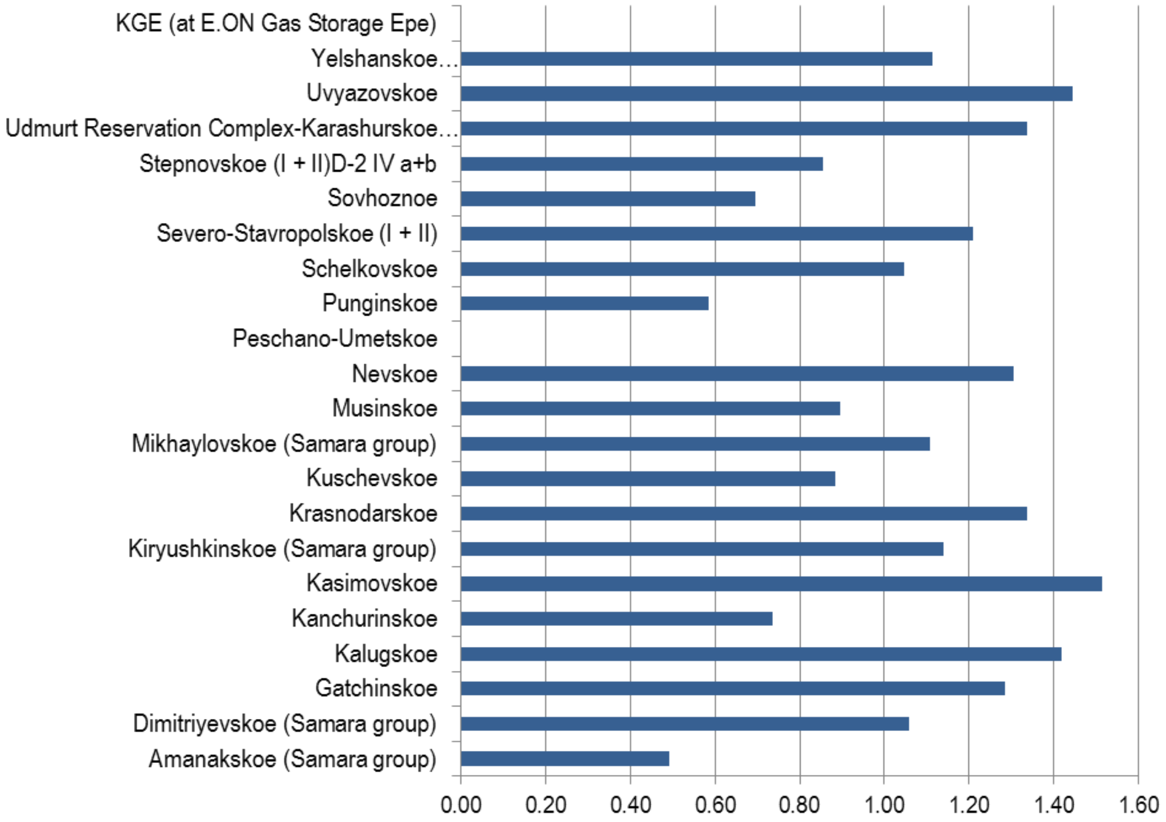
Fig. 2.15 ● Gas storage capacities by UGS type in Russia (Bcm)



Source: UNECE UGS 2011.

The network of UGS facilities supplies Russian consumers with up to 20 per cent of gas during the heating season and up to 30 per cent of gas during cold snaps. Over the entire operation period 2 trillion cubic metres of natural gas circulated through the domestic UGS facilities.

Fig. 2.16 ● Operating pressure / Initial reservoir pressure



Source: UNECE UGS 2011.

12. Spain

Spain reported one facility located between the towns of Jaca and Sabiñánigo (Huesca), with a total installed working gas volume of 0.68 bcm. Enagás manages the underground storage at Serralbo old natural gas field which has been depleted. .

13. United Kingdom

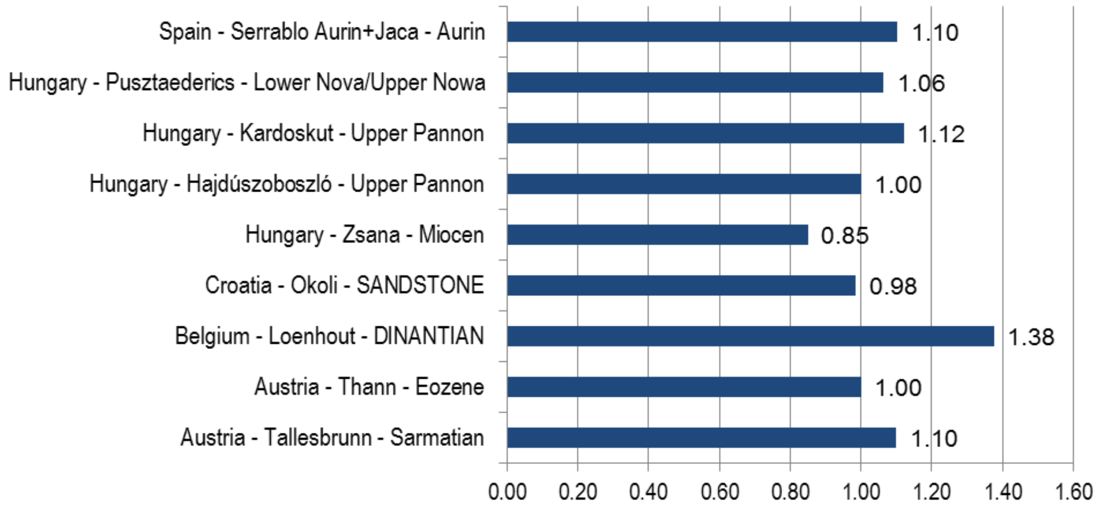
United Kingdom reported only one facility with a total installed working gas volume of 0.045 bcm, operated by EDF Trading, and in operation since 2001. Located in the Warmingham Brinefield, it consist of four caverns in the Northwich Halite, two caverns in phase 1, two in phase 2 and depths of between 300-400 m below ground level. The advantage of using these over other forms of natural storage, such as porous rock found in depleted oil and gas reservoirs, is that salt cavern stored gas can be delivered in large quantities relatively quickly. The caverns are also comparatively easy to fill and it will be possible to retrieve almost all of the stored gas when eventually the facility will be decommissioned. The use of salt caverns for gas storage will allow EDF Energy to react quickly to short term needs by providing a significant gain in its ability to meet the forecast energy demand.

The UK has storage capacity of about 4 per cent of average annual consumption, or about 14 days' worth. This makes the UK, which imported about 40 per cent of its gas last year, more vulnerable to supply disruptions. As North Sea output declines, Britain is expected to import up to 80 per cent of its gas by 2015.

14. Uzbekistan

Uzbekistan reported three facilities with a total installed working gas volume of 4.6 bcm. Joint Stock Company “Uztransgaz” which manages facilities, transporting natural gas to local consumers and its export, operates the three underground gas storage facilities, as well as the transit of natural gas from neighboring countries (Kazakhstan, the Kyrgyz Republic and Turkmenistan).

Fig. 2.17 ● Operating pressure / Initial reservoir pressure



Source: UNECE UGS 2011.

CHAPTER 3

Chapter 3: Market Organization

By Mr. G.-H. Joffre (Storengy) with support of Ms A. Brandenburger (RWE Gasspeicher)

Introduction

Structure of Chapter 3

Chapter 3 of the Study on Underground Gas Storage in Europe and Central Asia will consider the major change in the market organization due to the gas market liberalization in this region. This Chapter will describe the UGS market structure and the legal framework particularly for organizing the Third Party Access to UGS capacities.

It will screen the organization of the market all over Europe through the following items:

A: Legal requirements

- Main lines of Regulation framework: Organization of Third Party Access, exemption and price regulation
- Status of Capacity Allocation Management (CAM)
- Status of Congestion Management Procedures (CMP)

B: Storage contracts

- Public Service Obligation (PSO)
- Strategic stock obligation
- Ownership stucturation in companies
- Exemption to Third Party Access (TPA)
- Contract duration
- Physical restrictions: CAM and CMP mechanisms

C: Access to the transmission system

Part A was addressed to the National Regulation Authorities (NRA) to specify how they built the legal framework for regulating the gas storage market and to specify what they intend to do for improving the flexibility.

Part A is particularly dedicated to the current national legal framework in each country, namely:

- the rules by which the storage access is regulated,
- the Capacity Allocation Mechanism (first come first served, first committed first served, auction, open season, pro rata, …) and the Congestion Management Procedures (first come first served, first committed first served, market based, pro rata, secondary market, use it or lose it, use it or sell it,…) which was required by regulators,
- the evolution of the legislation that is expected in future years.

Part B was addressed to Storage Operators (SSO, technical operators, or all kind of company participating in storage markets) to ask for their marketing strategy, with which they sell their gas storage capacities or storage services, i.e. the way they manage the capacity allocation, the way they build the contract for marketing storage capacities and the way they manage the capacity congestion, according to the legal requirements.

Part B is particularly dedicated to the way the capacities are contracted on each storage site and it will particularly describe:

- The TPA regime,
- The storage services (virtual, hub, firm, interruptible, parking, lease, bundled, unbundled,..),
- The mode, the Capacity Allocation Mechanisms and the Congestion Management Procedures are implemented by SSOs,
- The characteristics of the contracts (duration, volume, withdrawal and injection rates, prices).

In part C, National Authorities and storage companies were asked about the legal requirement and organization pertaining to the access of storage capacities to the transmission system.

Part C is dedicated to the connection of existing or new storage sites to the Transmission system. Questions were essentially focused on priority rules and on restrictions for storage capacities for accessing to the transmission market.

Important notice: The objective of this Study consists of trustfully reporting the information collected from SSOs and National Authorities. For the sake of clarity and objectivity, all items will be introduced through the same questions which were asked within the questionnaire.

Responding parties

The table below (Fig.3.A.1) provides the number of answers from National Regulatory Authorities (NRAs) and from storage companies (SSOs) for each part of Chapter 3.

Fig. 3.A.1: Responding parties

	Responding NRAs in part A	*Responding SSOs in part B*	*Responding NRAs in part C*	*Responding SSOs in part C*
AUSTRIA	1	1	1	1
BELGIUM		1		1
BULGARIA	1		1	
CROATIA		1		1
CZECH REP	1	1	1	1
DENMARK		1		1
FINLAND	1		1	
FRANCE		2		2
GERMANY	1	10	1	7
HUNGARY	1	2	1	2
IRELAND	1		1	
ITALY	1	2	1	2
LATVIA	1		1	
POLAND		1		1
PORTUGAL	1			1
ROMANIA	1	1	1	1
RUSSIA		1		1
SLOVAKIA	1	1	1	1
SPAIN	1	1	1	1
SWEDEN	1		1	
UK	1	2	1	
TOTAL	**15**	**28**	**14**	**24**

As for part A of the questionnaire, among the 65 National Regulation Authorities (NRA) to which the questionnaire was addressed, 15 NRAs completed the questionnaire, but the responding NRAs represented the most important countries for storage business and the data collected are more or less representative of the main TPA regimes.

As for part B, among the 102 companies to which the questionnaire was addressed, there were only 28 SSOs which completed the questionnaire, but their storage business, in terms of working Gas Volume (WG) is representing 112 bcm of total working gas volume (200 bcm) stored in Europe and Central Asia, i.e. **60 per cent** of the total European and Central Asian WGV.

Main European Legislation

Most of all answering Nations named besides the specific national law, the following European Legislation:

- DIRECTIVE 2009/73/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 July 2009 concerning common rules for the internal market in natural gas

- REGULATION (EC) No 715/2009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 July 2009 on conditions for access to the natural gas transmission networks

- REGULATION (EU) No 994/2010 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 20 October 2010 concerning measures to safeguard security of gas supply

Furthermore one Nation mentioned the REGULATION (EC) No 713/2009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 July 2009 establishing an Agency for the Cooperation of Energy

Main principles of EU Legislation :

Current Regulation of Storage within Directive 2003/55/EC, Article 19(1) :

- TPA access to UGS facilities when technically and/or economically necessary;
- Member States can choose between negotiated TPA or regulated TPA for UGS or both procedures;
- access on transparent and non-discriminatory basis;
- exemptions from TPA under art 22;
- regulators generally monitor the access conditions to UGS.

GGPSSO (Guidelines for Good TPA Practice for Storage System Operators):

- In March 2005, a minimum set of rules required for the organization of the storage market were agreed, after a consultation of European Regulators (ERGEG) with SSOs. These guidelines will be regularly updated according to the new principles of Third Energy Package (See below) and to the progress of the TPA to storage.

Third Energy Package (July 2009) implemented in 2011:

- Member States can choose either or both negotiated/regulated access (regulated access implying conditions set by an independent regulator);
- legally binding guidelines (GGPSSO) gives details for management of services and capacity allocation;
- legal and functional unbundling;
- regulatory oversight;
- transparency on and pre-definition of criteria adopted for the definition of capacity for TPA (Member States or Regulators define these criteria) ;
- New Security of Supply Regulation (repealing 2004 SoS Directive).

European context

In Europe, the liberalization process first started in the UK which implemented procedures for opening market to competition that eventually led to full deregulation of the British gas market in 1998. In continental Europe, the implementation of Directive 98/30/EC in August 2000 was a milestone in the gradual restructuring of the gas sector. The key objective of the Gas Directive was to provide flexibility in gas flows and improve security of supply and industrial competitiveness in Europe. Most of the Member States forming the EU transposed this Directive into national law on 10 August 2000. Subsequently, a second Directive 2003/55/EC stepped up the pace of liberalization in the move to establish a single European gas market.

Directive 98/30/EC originally established a calendar for the legal opening of Member States' markets, including a transition over eight years and with a minimum opening threshold of 20 per cent in 2000, 28 per cent in 2003 and 33 per cent in 2008.

The Directive 2003/55/EC which abrogated Directive 98/30/EC included new measures intended to:

- Advance legal deadlines for full opening of national gas market to 1 July 2004 for all industrial users and to 1 July 2007 for households
- Reinforce the obligations to keep separate accounts. A new obligation stipulates that, until 1 July 2007, separate accounts must be kept for gas supply operations involving eligible customers and those involving non eligible customers.
- Further separate transport network management from other gas sector activities. The directive requires that incumbent operators must ensure that transport operations have a separate legal account from their other activities, effective 1 July 2004 for transport and no later than 1 July 2007 for distribution. The directive did not require a separate legal account for LNG terminals or **for storage facilities.**
- Enable Member States to impose transparent and non-discriminatory public-interest obligations on undertakings operating in the natural gas sector, which may relate to safety, security of supply, regularity, quality and price of supplies and environmental protection.
- Increase the power of regulatory authorities, particularly as regards the control of the level of transparency and competition of the market.

Obliging the operator to grant third party access to the network under the supervision of an authority responsible for setting network access tariffs is key to creating the conditions for competition. Accordingly, this new Directive contains a set of specific rules covering third party access to networks and storage installations.

The provisions of this directive are applicable to all Member States of the EU25 and took effect on 1 July 2004. Greece, Portugal, Finland, Cyprus and Malta derogate from this directive by virtue of their status as emerging or isolated markets.

The tariffs structure for the transmission network access must encourage competition and allow the operator to cover the costs of infrastructure development, while presenting suitable mechanisms of remuneration to provide adequate incentives for long-term investment. Generally, it has been found that an "entry-exit" system, for transmission tariffs as well as reserving capacity on a transport network, is more conductive to the development of a competitive market. Such market makes it possible to book capacity at entry and exit points by eliminating the identification of physical flows between points within the same tariff zone. Thus, they do not penalize users for distance, and they facilitate trade and the establishment of gas hubs. In Europe, "entry-exit" rates are coming into general use.

The **European Union's Third Energy Package** is a legislative package for an internal gas and electricity market in the European Union. Its purpose is to further open up the gas and electricity markets in the European Union. The package was proposed by the European Commission in September 2007, and adopted by the European Parliament and the European Council in July 2009. It entered into force on 3 September 2009.

One of the core elements of the third package is ownership unbundling which stipulates the separation of companies' generation and sale operations from their transmission networks.

The EU energy market principles

The European Commission and the Parliament wants to reach the goals of "Europe 2020 Strategy" through a secure, competitive and sustainable supply of energy to the economy and the society. The correct transposition of the European electricity and gas legislation in all Member States is still not complete. Because of this, the Third Internal Energy Market Package was adopted in 2009 to accelerate investments in energy infrastructure to enhance cross border trade and access to diversified sources of energy. There is still a market concentration on the energy market in the European Union (EU). The EU advises three options to de-concentrate the market power of the biggest firms. The first option is ownership unbundling. The second and third options are independent system operator (ISO) and independent transmission operator (ITO).

Ownership unbundling is proposed by the European Commission and the European Parliament. This option splits the generation (production of gas or electricity) from the transmission system (transmission gas or electricity from generating station via a system to a distribution system operator or to the consumer). It is the hardest method to regulate the energy market in the EU, but it is legitimate by EU law. The criticism of that system is who can buy the transmission networks, will it really regulate the market-place and who will pay possible compensation to the energy firms. Moreover, some economists also stress that the benefits will not pay off the costs.

Independent system operator (ISO): The Art. 13 – 16 of Directive 2003/54/EC give the member states also the opportunity to let the transmission networks remain under the ownership of energy groups, but transferring operation and control of their day-to-day business to an ISO. It is also a form of ownership unbundling, but with a trustee.

Independent transmission operator (ITO) : Austria, Bulgaria, France, Germany, Greece, Luxembourg, Latvia and the Slovak Republic presented at the end of January 2008 a proposal for a third option. This model, the ITO, envisages energy companies retaining ownership of their transmission networks, but the transmission subsidiaries would be legally independent joint stock companies operating under their own brand name, under a strictly autonomous management and under stringent regulatory control. However, investment decisions would be made jointly by the parent company and the regulatory authority. It is also named a legal unbundling.

New rules under the 3rd Energy Package for storage

With the coming into force of the 3rd Package (March 2011), the regulatory framework regarding storage changed. Parts of the new rules are based on different parts of the already existing Guidelines of Good Practice of Storage System Operators of ERGEG (such as verification by the Member States of choosing regulated or negotiated access and requirement for unbundling of the SSO). Furthermore, the 3rd Package contains some articles regarding capacity allocation mechanisms (CAM) and congestion management procedures (CMP). In general, this could strengthen the position of the regulatory authorities.

Although the 3rd Package is a step forward, the main question is whether this improvement of the regulatory framework is sufficient enough to deal with the problems in applying CAM and CMP as found in the status reviews of 2008 and 2009. As found out in the ERGEG research the general requirements of the GGPSSO are implemented by the most SSOs – but there are still remaining problems with different CAM and CMP. In this regard, the 3rd Package is (mainly) giving some considerations that need to be taken into account when defining CAM and CMP.

The 3rd Package made voluntary regulations binding on the basis of some parts of the GGPSSO, but does not provide sufficient detail. Taking this into consideration, as well as the legal position of some NRAs, ERGEG has come to the conclusion that an enhancement of the GGPSSO by developing guidelines for CAM and CMP is needed.

PART A : Legal Requirements (from questionnaire completed by National Authorities)

A1 : Regulation framework

Please provide the regulatory and legal frameworks applicable for the gas market of your country by naming all relevant legal documents for the following cases:

- European Legislation
- National Legislation
- Storage specific regulations
- Legal changes envisaged regarding 3rd Package or Security of Supply directive before, after or before & after the implementation of 3rd Energy Package.

NRAs made answers which are collected in Fig. 3.A.2.

Fig. 3.A.2 : Regulatory frameworks for gas market

Country	***European legislation***	***National legislation***	***Storage specific regulations***	***Legal changes envisaged regarding the 3rd Energy Package or Security of Supply directive***	***Date before or after 11 March 2011***
Austria	Direction 2009/73/EG Regulation 715/2009	Gaswirtschaftsgesetz 2006 (Natural Gas Act 2006)Gaswirtschaftsgesetz Entwurf 2011 (draft Natural Gas Act 2011)	Direction 2009/73/EG Regulation 715/2009 Gaswirtschaftsgesetz 2006 (Natural Gas Act 2006) Gaswirtschaftsgesetz Entwurf 2011 (draft Natural Gas Act 2011) GGPSSO CAM & CMP	Gaswirtschaftsgesetz Entwurf 2011 (draft Natural Gas Act 2011 - not yet in place)	After
Czech Rep	2009/73/EC of the Parliament and of the council of 13 July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC	Public notice on the Gas Market Rules			na
Germany	Regulation (EU) No 994/2010 of the European Parliament and of the Council of 20 October 2010 concerning measures to safeguard security of gas supply and repealing Council Directive 2004/67/EC Regulation (EU) No 994/2010 of the European Parliament and of the Council of 20 October 2010 concerning measures to safeguard security of gas supply and repealing Council Directive 2004/67/EC Regulation (EC) No 715/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the natural gas transmission networks and repealing Regulation (EC) No 1775/200	Gesetz über die Elektrizitäts- und Gasversorgung (Energiewirtschaftsgesetz - EnWG)com 17. Juli 2005 Verordnung über den Zugang zu Gasversorgungsnetzen (Gasnetzzugangsverordnung) vom 03.09.210		Legal framework changed according to 3rd energy package.	after

Finland	Directive 2009/73/EC. However, Finland has derogations from opening of gas market as long as the Finnish natural gas network is not directly connected to the interconnected system of any other Member State and having only one main external supplier (as it is today).	Natural Gas Market Act (Maakaasumarkkinalaki) 508/2000. Natural Gas Market Degree (622/2000)	No specific regulations	The implementation of the 3rd package in the Finnish legislation has been delayed (not yet implemented).	before
Hungary	DIRECTIVE 2009/73/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 July 2009 concerning common rules for the internal market in natural gas, REGULATION (EC) No 715/2009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 July 2009 on conditions for access to the natural gas transmission networks, REGULATION (EC) No 713/2009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 July 2009 establishing an Agency for the Cooperation of Energy Regulators, REGULATION (EU) No 994/2010 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 20 October 2010 concerning measures to safeguard security of gas supply	Act XL of 2008 on Natural Gas Supply, Government Decree No. 19/2009 on the enforcement of certain provisions of Act XL of 2008 on Natural Gas Supply Decree No. 31/2009. (VI. 25.) KHEM on fixing the fees for system use of natural gas, Act No. XXVI of 2006 on Strategic storage of Natural Gas, Decree No. 75/2007. (VIII. 17.) of Minister of Economy on the rules of use of strategic storage stocks, Government Decree No. 265/2009 on the restriction of gas supply, on the use of strategic storage stocks and about the issues needed in crisis situation of gas supply, Decree No. 13/2011. (IV. 7.) of Minister of National development on the quantity, sale and supplement of natural gas strategic stocks,	Act No. XXVI of 2006 on Strategic storage of Natural Gas, Decree No. 75/2007. (VIII. 17.) of Minister of Economy on the rules of use of strategic storage stocks, Government Decree No. 265/2009 on the restriction of gas supply, on the use of strategic storage stocks and about the issues needed in crisis situation of gas supply, Decree No. 13/2011. (IV. 7.) of Minister of National development on the quantity, sale and supplement of natural gas strategic stocks,	Act No. XXIX of 2011 on the amendment of energy related laws. Envisaged in December 2011: Amendment of Act XL of 2008 on Natural Gas Supply concerning to the implementation of the prescriptions of REGULATION (EU) No 994/2010.	Before & after
Ireland	EU Directive 2009/73/EC concerning common rules for the internal market in natural gas EU Regulation 715/2009 on conditions for access to the natural gas transmission networks	Petroleum and Other Minerals Development Act 1960 Gas Act 1976 Gas Interim Regulation Act 2002	SI 630 of 2011 European Communities (Internal Market in Natural Gas and Electricity) Regulations 2011	Currently, the State does not have a statutory basis under which the Minister for Communications, Energy and Natural Resources may grant property rights to another party to use a depleted gas field (or other offshore underground features) as a stand-alone gas storage facility. At present, Ireland has one offshore commercial gas storage facility off Kinsale – known as South West Kinsale. It operates in conjunction with commercial gas production activities and is regulated under the Petroleum and Other Minerals Development Act 1960. The Department has given a public commitment to the drafting of legislation to provide for the regulation of standalone offshore gas storage facilities.	na

Italy	Directive 98/30/EC of the European Parliament and of the Council of 22 June 1998 ("Gas Directive") concerning common rules for the internal market in natural gas. - Directive 2003/55/EC of the European Parliament and of the Council of 26 June 2003 co	Legislative Decree No. 164 of 23 May 2000 on implementation of Directive 98/30/CE concerning common regulations for the internal natural gas market. - Law No. 239 of 23 August 2004 on restructuring of the energy sector, as well as delegation to the g	Delibera No. 26/02 of Autorità per l'Energia Elettrica e il Gas concerning criteria for determining the tariffs for natural gas storage for the regulatory period 1 April 2002 – 31 March 2006. - Delibera No. 49/02 of Autorità per l'Energia Elettrica e	The new balancing regime starting from 1st of December 2011 accordingly with Delibera ARG/gas 45/11.	na
Portugal	DIRECTIVE 2009/73/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 July 2009, concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC; REGULATION (EC) No 715/2009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 July 2009, on conditions for access to the natural gas transmission networks; REGULATION (EU) No 994/2010 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 20 October 2010, concerning measures to safeguard security of gas supply.	Decree-Law n.º30/2006 of 15 February; Decree-Law n.º140/2006 of 26 July; Decree-Law n.77/2011 of 20 June.	Dispatch ERSE n.º 4878/2010 approving the following documents: 1. Third Party Access Code to natural gas infrastructures; 2. Quality Service Code to natural gas sector; 3. Natural gas tariff Code; 4. Commercial Relations Code.		Before & After
Spain	DIRECTIVE 2009/73/EC DIRECTIVE 2004/67/EC Regulation UE 994/2010	LAW 12/2007 Royal Decree 1716/2004 Royal Decree 1434/2002 Royal Decree 949/2001	Order ITC/3862/2007 Order ITC/863/2009 Resolution 14 March 2008 Resolution 19 may 2008 Order ITC/3354/2010	Unspecified	after
Slovakia	REGULATION (EC) No 715/2009 on conditions for access to the natural gas transmission networks and repealing Regulation (EC) No 1775/2005, REGULATION (EC) No 994/2010 of 20 October 2010 concerning measures to safeguard security of gas supply and repealing Council Directive 2004/67/EC, DIRECTIVE 2009/73/EC concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC	Act No. 276/2001 Coll. Of 14 June 2001 on Regulation in Network Industries and on amendments to certain acts, Act No. 656/2004 Coll. of 26 October 2004 on Energy and on amendments to certain acts, •Order of the Slovak Government No. 409/2007 Coll. setting the rules for gas market functioning on the version of the Order of the Slovak Government No. 212/2010 Coll.,	Ordinance of the Regulatory Office for Network Industries No. 216/2011 Coll. stipulating the price regulation in gas sector, Operational Orders of the underground gas storage operators, •Ordinance of the Regulatory Office for Network Industries No. 208/2008 Coll. setting the application details and the list of documents for granting an exemption from the duty to secure third parties access to the network and storage facility for new significant gas equipment or reconstructed gas equipment, •Ordinance of the Regulatory Office for Network Industries No. 328/2008 Coll. setting the quality standards of gas supplied and services provided in gas sector in the version of the Ordinance of the Regulatory Office for Network Industries No. 94/2011 Coll.,		

Sweden	Directive 2009/73/EC REGULATION (EC) No 715/2009 Regulation (EC) No 994/2010	Naturgaslag (2005:403)			Before & After
Latvia					Before & After
Romania					after

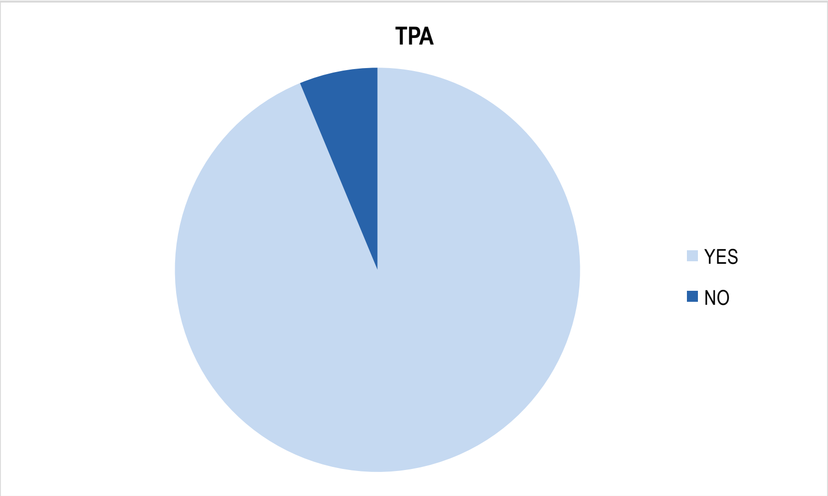
A.2 : TPA, exemption & Price regulation

The access to the storages is provided in most of countries on a TPA basis. But, according to the Article 49 of the Directive 2009/73/EC, isolated markets, which are not directly connected to the interconnected system of any other Member State and having only one main external supplier may derogate from the TPA obligations. For example, Latvia, Estonia and Finland, are exempted from the TPA rules.

A.2.1 : Is storage access provided on a TPA basis in your country?

As expected in nearly all nations the access to storage capacities is provided on a TPA basis except Latvia (see Fig. A.3).

Fig. 3.A.3 ● Third Part Access for storage



A.2.2 : On which basis TPA to storage capacities is provided ?

TPA to storage on the EU gas storage market is provided through two main forms of access regimes – regulated access (rTPA) and negotiated access (nTPA). TPA access may then differ between a negotiated and regulated regime. According to the Gas Directive, the negotiated or regulated access regimes are under the jurisdiction of the Member States. This means the access regimes in the EU gas market may vary from one Member State to another. The regulators are free to decide which approach should be used for a particular situation, but the criteria on which this decision is made has to be published in any case.

The TPA access may be exempted (see § A.2.3) for particular facilities and also depending on the status of capacities (existing, expanded, new).

Moreover, some countries which have negotiated access may also have regulatory involvement. That is why it is not always clear if the TPA to storage is fully negotiated or fully regulated and it is often referred to as "hybrid" TPA.

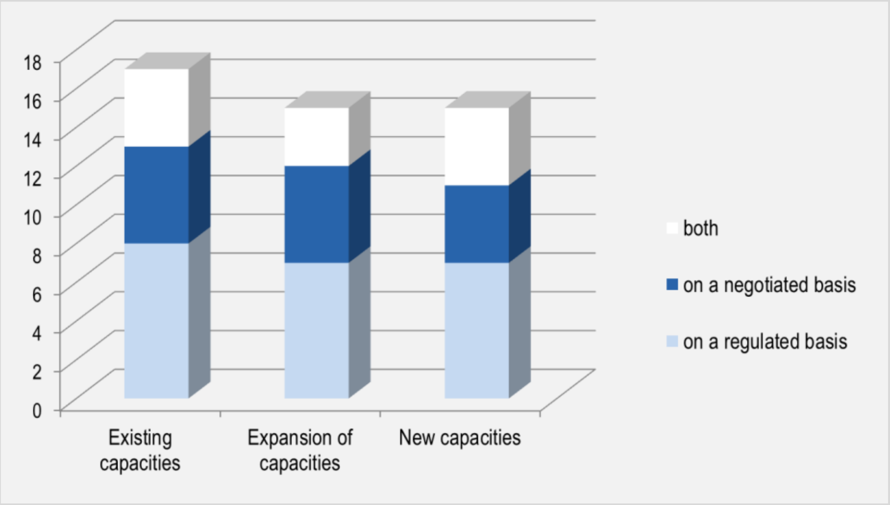
Newcomers to the storage market often complained about the negotiated access because of the lack of transparency, high prices, lack of secondary market and inadequacy of storage services.

According to the Gas Directive, the TPA should be regulated if there is a lack of competition or market imperfections.

From the feedback received, in about 50 per cent of the nations storage business is carried out under regulated TPA (see Fig. 3.A.4). The negotiated TPA is predominant in the majority of the bigger storage nations as Germany and France.

In general there is no difference between UGS in operation and new capacity developments.

Fig. 3.A.4 ● Regimes for TPA to storage



Looking at the map in part B / § B.3.2 (where the question about TPA regimes was addressed to SSOs), it is clear the negotiated approach was adopted by countries in the northwestern part of Europe, where the markets are also most developed.

Comments made by NRAs are collected in Fig. 3.A.5.

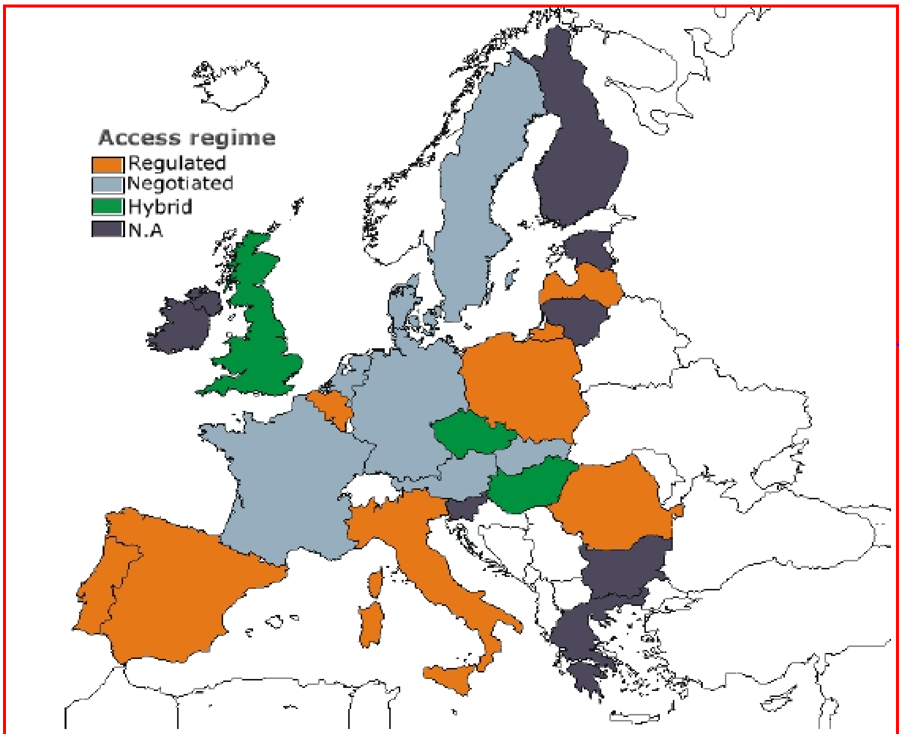
Fig. 3.A.5 ● Comments related to TPA regimes

• There is a kind of price regulation, as storage tariffs are not allowed to differ more than 20% from the EU average storage prices. If so, the regulatory authority is allowed to set the cost basis for the tariff calculation	Austria
• There are no gas storages in Finland and Finland has also derogations from opening of gas market as long as the Finnish natural gas network is not directly connected to the interconnected system of any other Member State and having only one main external supplier (as it is today). The Natural Gas Market Act does not include any provisions regarding opening of gas storages;	Finland
• No competition on the storage market, therefore the TPA is regulated.	Hungary
• Eather than "both", rTPA or nTPA is decided on a case by case basis by the CER in line with Directive 2009/73/EC	Ireland
• Expansion of capacity and New capacity: on a regulated basis (rTPA) - with price regulation according to the Legislative Decree No. 130 of 13 August 2010	Italy
• Negotiated with regulated tariffs; It is important to notice that Latvian UGS works in seasonal regime - it is filled during summer and Latvia is supplied with gas from UGS only during the winter	Latvia
• In the future the legislation foresees a possibility for nTPA for Storage System Operators with new concessions.	Portugal

The results above for TPA regime are in line with the information provided by companies in part B of the Chapter 3 (see § B.3.2) and with the map which was drawn out from this information (see the map also in § B.3.2).

However, these results are not fully in line with the map below (see Fig. 3.A.6), which was drawn out by ERGEG in 2006 and which show some evolution in the TPA regimes in some countries (for example Hungary).

Fig. 3.A.6 ● Map of TPA regimes



Source: The ERGEG 2006 Report on monitoring the implementation of the Guidelines for Good Practice for Storage System Operators (GGPSSO), the DG Competition Report on Energy Sector Inquiry and Gas Storage Europe

A.2.3 : Exemption

The Gas Directive provides the following reasons for granting an exemption from TPA to existing storage facilities:

- Under both the regulated and negotiated regimes, storage operators can only refuse access to the facility on the basis of lack of capacity;
- Where the access to the facility would prevent storage operators from carrying out their Public Service Obligation (PSO) (see § A.4), or
- Where the access to the facility would cause the storage operator serious economic and financial difficulties as a result of take-or-pay contracts being in place.

The amount of storage capacity exempted from TPA has to be published and the reasons of exemption be clearly explained.

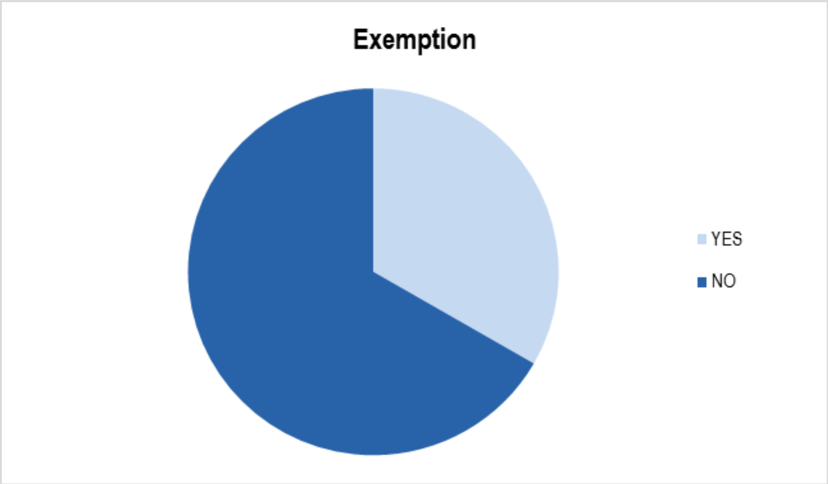
The GGPSSO also requires that parties responsible for PSOs demonstrate that they do not use more storage that is required by PSO obligation.

Exemption from TPA to existing storage facilities should be approved by the national regulatory authority.

A.2.3.1 : Are capacities in existing storage or expansion of existing storage fully or partially exempted from TPA ?

Despite there is in general mainly TPA access to storage capacities, exemption to TPA are granted in few cases (30%) for existing or for expanded capacities (see Fig. 3.A.7)

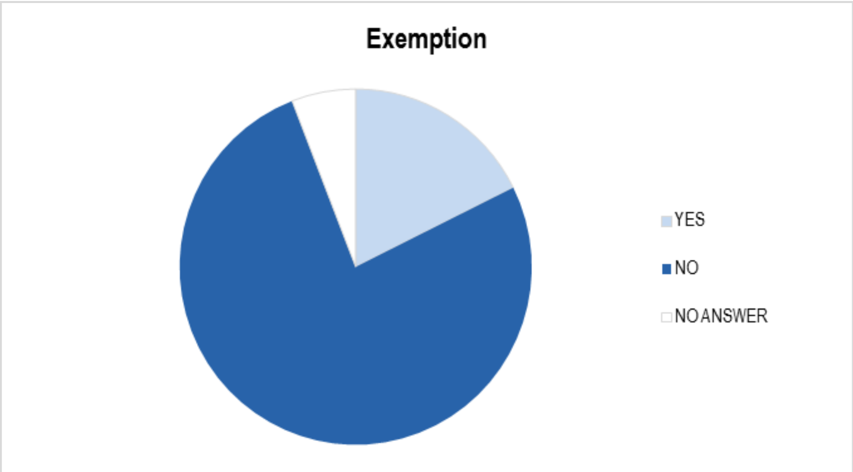
Fig. 3.A.7 ● Exemption to TPA



A.2.3.2 : Are capacities in new facilities fully or partially exempted from TPA ? :

Based on data derived from the survey even fewer exemptions (20%) are granted to new storage facilities (see Fig. 3.A.8).

Fig. 3.A.8 ● Full and partial exemption to TPA for new storage facilities



A.2.3.3 : If capacities in existing storage or expansion of existing storage are fully or partially exempted from TPA, indicate the amount of storage exempted in % of total storage capacities

Only four countries provided the exempted capacities percentage (see Fig. 3.A.9).

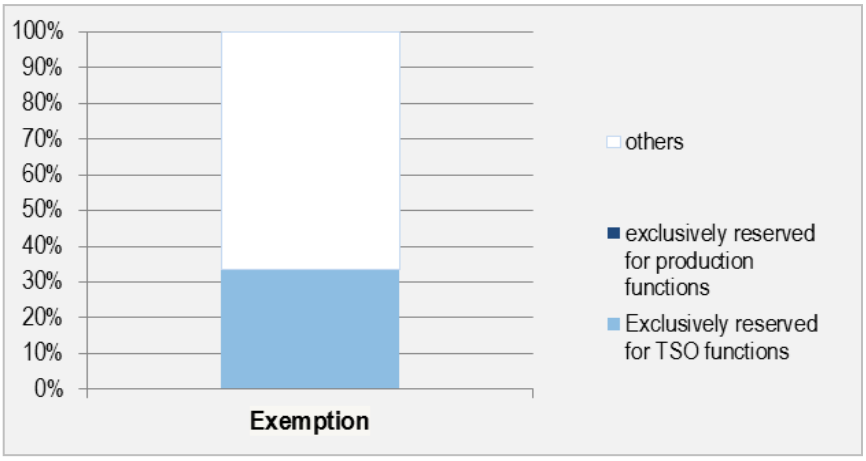
Fig. 3A.9 ● Percentage of exempted capacities for existing or expanded storage facilities

COUNTRY	Romania	GB	Hungary	Latvia
% EXEMPTED	8	18	20	100

A.2.3.4 : If capacities in existing storage or expansion of existing storage are fully or partially exempted from TPA, indicate the reasons for exemption

Reported exemptions are never granted for production purposes but sometimes for TSO functions (see Fig. 3.A.10).

Fig. 3.A.10 ● Main reasons for exemption



The other reasons mentioned (not defined in two cases) for exemption are collected in Fig. 3.A.11.

Fig. 3.A.11 ● Other reasons for exemption

• The existing storage facility is not economically or technically necessary for providing efficient access to the system for the supply of customers	UK
• Strategic storage exclusively reserved for household and communal consumption in crisis situation	Hungary
• Accessible storage capacity is Total capacity minus public service obligations	Latvia

A.2.3.5 : If capacities in existing storage or expansion of existing storage are fully or partially exempted from TPA, indicate the amount of storage exempted as a percentage of total storage capacities.

No available data were provides by NRAs.

A.2.3.6 : If capacities in existing storage or expansion of existing storage are fully or partially exempted from TPA, indicate the reasons for exemption.

No available data were provides by NRAs.

A.2.4 : Price regulation

Are there any kinds of price regulation in place?

Answers show that in 60 per cent of responding countries, a price regulation was implemented (see Fig. 3.A.12).

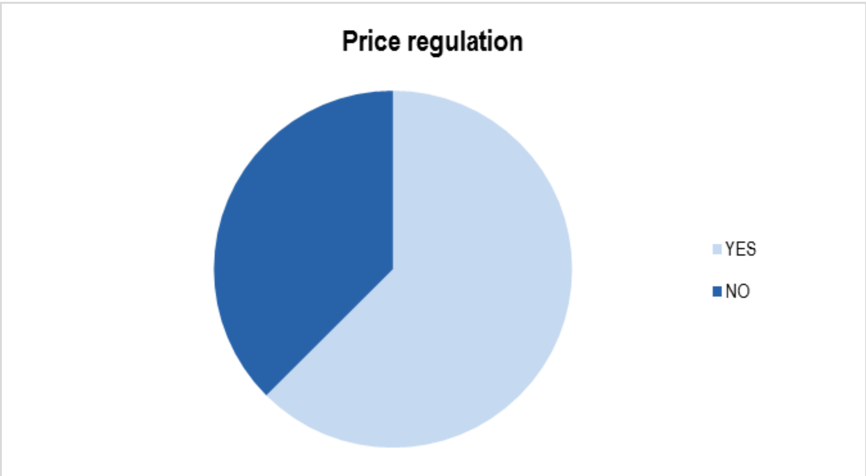
However, major storage countries, where the market has a critical size and is mature, have no price regulation (except Italy).

Moreover, price regulation is not always as a strictly fixed maximized price and different kind of regulation can exist.

Storage prices may be maximized only if they differ more than 20 per cent from the EU average storage prices. If storage prices exceed this European average, the regulatory authority are allowed to set the cost basis for the tariff calculation. The methodology used for price regulation may be based on capital rate of return, making no differentiation between summer/winter prices. The price is still one-component.

The regulated price may also be based on a Benchmarking model based methodology, from which a maximum price is defined.

Fig. 3.A.12 ● Price regulation



A.3 : Capacity Allocation Mechanism (CAM) & Congestion Management Procedures (CMP)

CAM & CMP are considered as crucial to avoiding market distortions or barriers to market entry in order to develop competitive gas market. As CAM & CMP procedures that can be applied are an important determinant of the business model for access to storage, and therefore for economic optimization and efficient use of storage capacity on both long term and short term contracts.

According to the Guidelines for Good TPA Practices for Storage System Operators (GGPSSO), storage Capacity Allocation Mechanisms and Congestion Management Procedures shall:

- Facilitate the development of competition and liquid trading of storage capacity and be compatible with market mechanisms including spot markets and trading hubs while being flexible and capable of adapting to evolving market circumstances and discourage hoarding;
- Take into account the integrity and the maintenance of the storage system concerned as well as security of supply where relevant legal rules are incumbent upon the SSO;

- Not create undue barriers to market entry and not prevent market participants, including new market entrants and companies with a small market share, from competing effectively;
- Ensure the maximum availability and efficient use under economic and non-discriminatory conditions of technical storage capacity;
- Be subject to consultation with storage users.

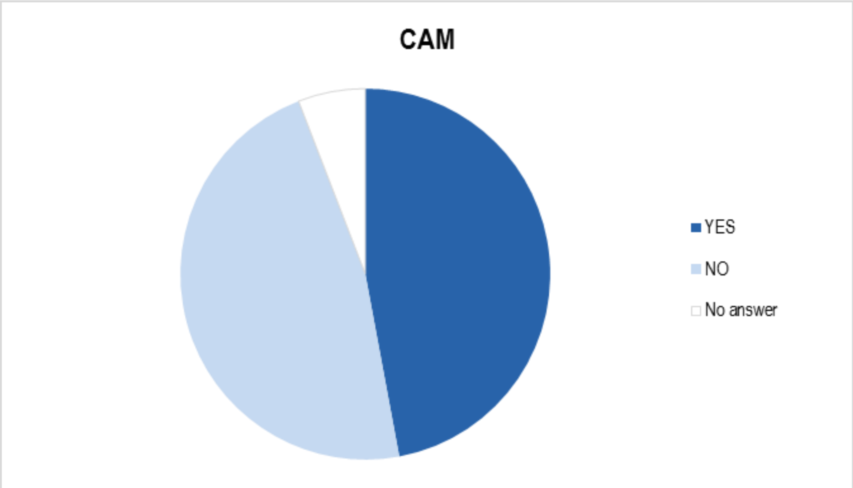
The current situation of storage market in Europe show the targets which were fixed to CAM and CMP procedures within the GGPSSO should be revised taking into consideration the new characteristics of the gas market.

A.3.1 : Capacity Allocation Mechanism

Are there any legal requirements on Capacity Allocation Management (CAM) in place ?

There are legal requirements on Capacity Allocation Management (CAM) in place in 50 per cent of countries which responded (see Fig 3.A.13).

Fig. 3.A.13 ● Legal requirement on Capacity Allocation Mechanisms



Nations for which there is a Legal requirement for CAM are listed in Fig. 3.A.14.

Fig. 3.A.14 : Nations having legal requirements for CAM

AUt	BGR	CZE	GER	FIN	GB	HUN	IRL	ITA	LTV	PRT	ROM	SPA	SVK	SWE
yes	no	no	no	no	yes	yes	yes	yes	yes	yes	yes	yes	no	no

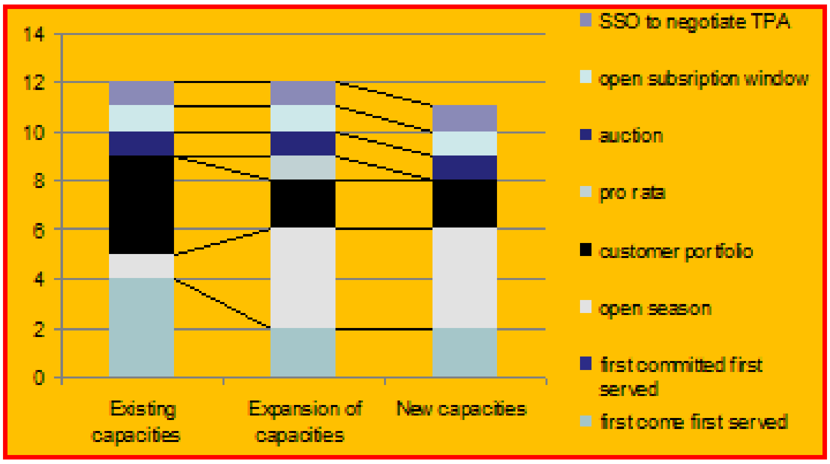
A.3.1.1 : If there are legal requirements, which procedures are in place for managing CAM ?

A lot of mechanisms were proposed for dealing with CAM (see Fig. 3.A.15): negotiation with TSO, open subscription window, auction, pro rata, customer portfolio, open season, first committed first served and first come first served.

A variety of capacity allocation mechanisms (CAM) are in place. For existing storage capacities "first come first served" and "customer portfolio" are mainly applied. For capacity expansions and new capacities "open season" is more representative.

"First committed first served" and "auction" were never reported as potential procedures except in the case of expansion of capacities.

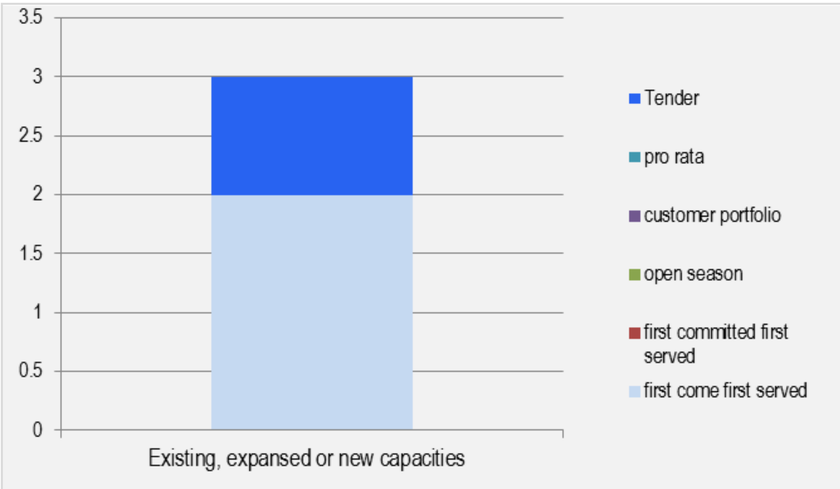
Fig. 3.A.15 ● Commercial mechanisms for managing CAM when there are legal requirements



A.3.1.2 : If there are no legal requirements, which mechanisms were designed by SSO for managing CAM ?

Among all possible mechanisms for managing CAM (see Fig. 3.A.16) , i.e., „tenders, pro rata, following the customer portfolio, open season, first come first served, first committed first served", only two mechanisms are significantly used : "first come first served" and "tender", when there are no legal requirements.

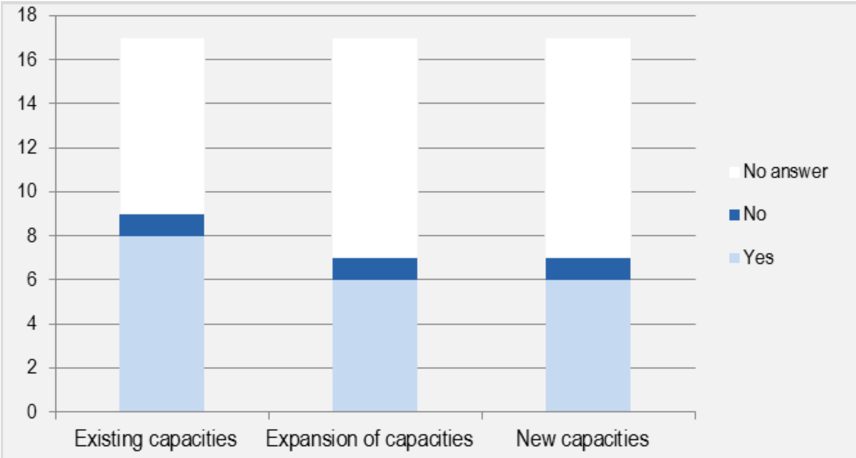
Fig. 3.A.16 ● Commercial procedures for managing CAM when there are no legal requirements



A.3.1.3 : please specify if there is any legal obligation with regard to capacity allocation procedure in case of existing or expanded capacities

The graph below (see Fig. 3.A.17) provides the number of countries where there are legal obligation for CAM.

Fig. 3.A.17 ● Number of countries where there are legal obligations for CAM



There is only one case in which there are no legal requirements.

The number of NRAs who did not answer to this question is surprising.

Comments related to these obligations were made by NRAs and are collected in Fig. 3.A.18.

Fig. 3.A.18 ● Comments about legal obligations with regard to CAM

Existing capacities	Expansion of capacities	New capacities
• According to Act XL of 2008 on natural gas supply (Hungary) • yes for strategic storage (Italy) • yes (Ireland, GB, Romania, Spain) • Natural gas security stocks (reserves) are mandatory and are allocated before any commercial stocks (Portugal). • non-discriminatory and transparent CAM (Slovakia) • No (Sweden)	• Market demand has to be defined by open season. (Austria). • non-discriminatory and transparent CAM (Slovakia) • No (Sweden) • yes (Ireland, GB, Romania, Spain) •	• Market demand has to be defined by open season. (Austria) • New major projects could be exempted per request (Romania) • yes (Ireland, GB, Spain)

A.3.1.4 If changes regarding CAM, are planned please provide :

-Your favored procedures that should be applicable to SSOs in your country ?

-Reasons for your preferences on how to manage congestion most suitable ?

The answers made by NRAs are collected in Fig. 3.A.19.

Fig. 3.A.19 ● Preferred procedures for managing CAM

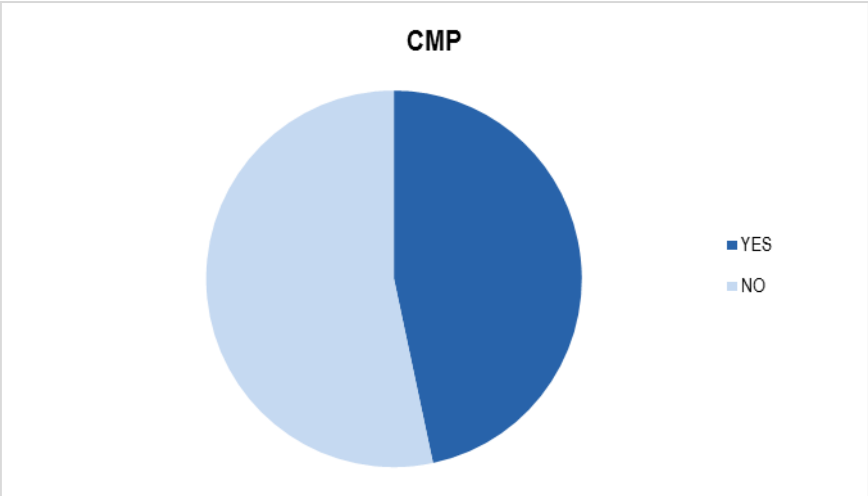
Your favored procedures that should be applicable to SSOs in your country?	Reasons for your preferences on how to manage congestion most suitable ?
• According to the new Austrian Gas Act which will be set into force in September, Auction is the most preferred mechanism in case of congestion, as it is market based. If the allocated capacity in comparison to the total storage capacity is only small, that first come first serve is also appropriate.(Austria) • NTPA regime will be envisaged from 2012. Auctions should be applied.(Hungary) • Depends on the outcome of the ENTSOG Network Codes and the discussions in the Council of Ministers where Sweden will apply for an exemption due to the fact that there is just one storage in the country.	• Auction is the most market based mechanism in case of congestion, as it is non-discriminatory and transparent. All planned CAMs have to be notified to the regulatory authority in time, who can ask for changes or new CAMs. (Austria)

A.3.2 : Congestion Management Procedures

A.3.2.1 : Are there legal requirements on Congestion Management Procedures in place ?

There are legal requirements on Congestion Management Procedures (CMP) in place in less than 50% of countries which responded (see Fig. 3.A.20).

Fig. 3.A.20 ● Legal requirements on CMP



Nations for which there is a legal requirements for CMP are listed in Fig 3.A.21.

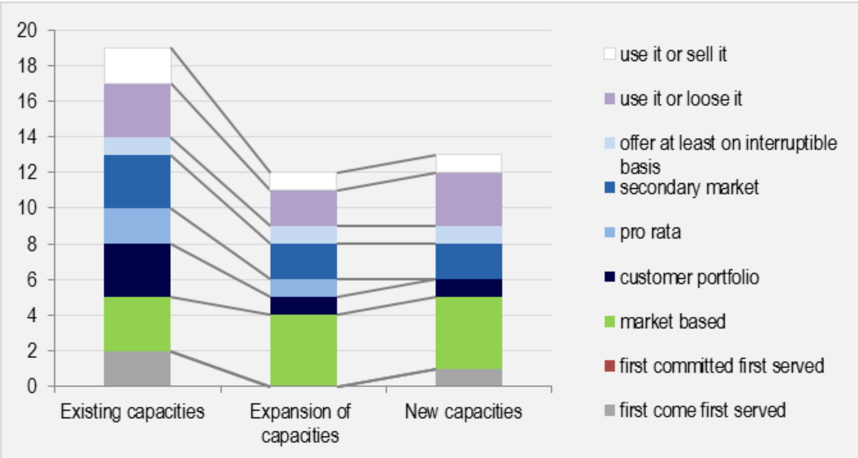
Fig. 3.A.21 : Nations for which there are legal requirements for CMP;

AUt	BGR	CZE	GER	FIN	GB	HUN	IRL	ITA	LTV	PRT	ROM	SPA	SVK	SWE
yes	no	no	no	no	yes	yes	no	yes	no	yes	yes	yes	no	no

A.3.2.2 : If there are legal requirements, which mechanisms are in place for managing CMP ?

A variety of congestion management mechanisms are in place (see Fig. 3.A.22). The available mechanisms are equally distributed and no measure is predominant, except for expansion of capacities or for new capacities for which “market based” procedures (i.e. auctions or open season) or “use it or lose it” are mainly used.

Fig. 3.A.22 ● Mechanisms for managing CMP, when there are legal requirements

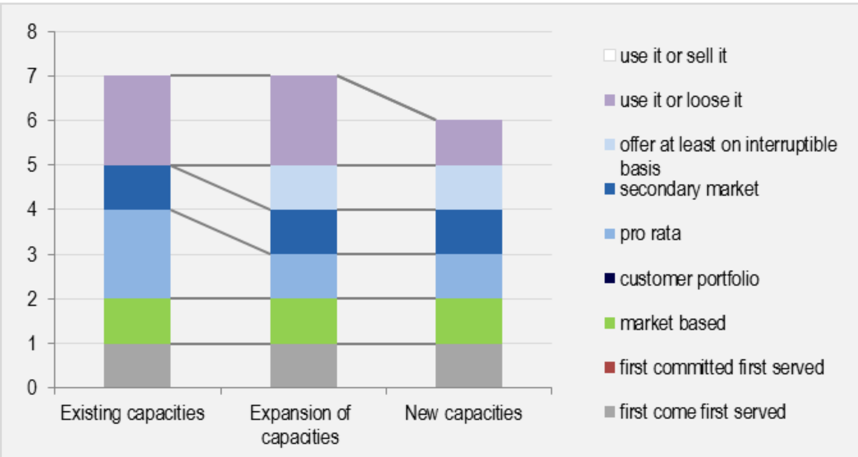


The SSOs also concentrate on measures as “secondary market” or “customer portfolio” but ”first come first served“ and “pro rata” are not often used and “first committed fist served” is never used**.**

A.3.2.3 : If there is no legal requirement on Congestion Management, please provide the congestion principles in place designed by SSOS

A variety of congestion management mechanisms have been designed (see Fig. 3.A.23) . The available mechanisms are equally distributed and no measure is predominant except for existing capacities for which “market based” procedures (i.e. auctions or open seasons) or “use it or lose it” procedures are mainly used.

Fig. 3.A.23 ● Mechanisms for managing CMP, when there are no legal requirements



.However, “use it or sell it”, “customer portfolio” or “first committed first served” are never used.

A.3.2.4 : please specify if there is any legal obligation with regard to Congestion management

NRAs reported answers which are collected in Fig. 3.A.24.

Fig. 3.A.24 : Legal obligation with regard to CMP

Existing capacities	Expansion of capacities	New capacities
• Currently there are no legal requirements (Austria) • According to Act XL of 2008 on natural gas supply (Hungary) • Yes, the obligations are stipulated within the Network Code of the National Transport System (Article 82 and related articles) approved by Order no. 54/2007 (Portugal) • Yes, the obligations are stipulated within the Network Code of the National Transport System (Article 82 and related articles) approved by Order no. 54/2007 (Romania) • non-discriminatory and transparent CMP (Slovakia)	• According to Act XL of 2008 on natural gas supply (Hungary) • non-discriminatory and transparent CMP (Slovakia) •	• According to Act XL of 2008 on natural gas supply (Hungary) • non-discriminatory and transparent CMP (Slovakia)

A.3.2.5 : If changes regarding CMP are planned please provide

-Your favored procedures that should be applicable to SSOs in your country ?

-Reasons for your preferences on how to manage congestion most suitable ?

NRAs reported answers which are collected in Fig. 3.A.25.

Fig. 3.A.25 : Preferred procedures regarding CMP and reasons for

Your favored procedures that should be applicable to SSOs in your country ?	Reasons for your preferences on how to manage congestion most suitable ?
• According to the new Gas Act SSOs should provide a platform for a transparent and efficient trade of secondary capacities or cooperate when developing such a platform. In case of congestion, storage users have to sell nominated but not used capacity to a third party, otherwise the SSO will sell the capacity day ahead and at least on an interruptible basis on the primary market (Austria). • NTPA regime will be envisaged from 2012. Auctions should be applied (Hungary). • Depends on the outcome of the ENTSOG Network Codes and the discussions in the Council of Ministers where Sweden will apply for an exemption due to the fact that there is just one storage in the country. (Sweden)	• In order to avoid capacity hoarding and even guarantee non-discrimination when allocating congested storage capacity. A firm UIOLI for storage is not applicable as it is difficult to define unused capacity. A range of flexibility in the storage use is needed. (Austria)

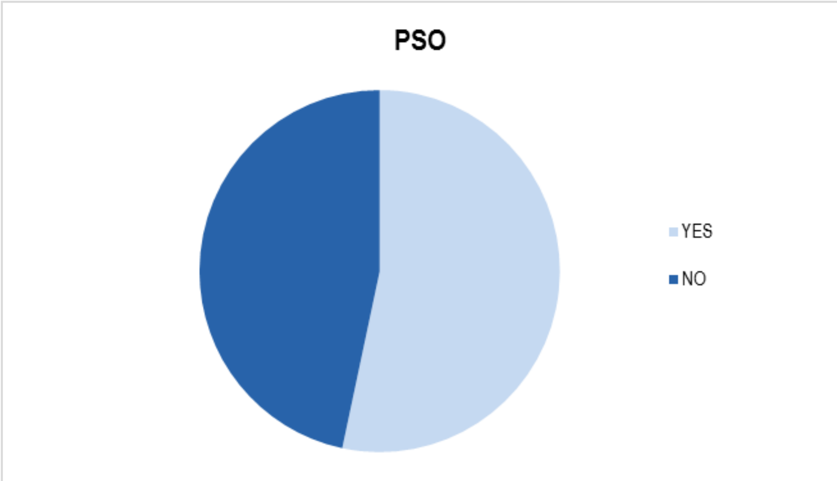
A.4 : Public Service Obligation (PSO)

The PSO was first defined by Directive 2004/67/EC through the measures to safeguard the security of supply. The interpretation of the PSO concept varies widely throughout EU Member States.

A.4.1 : Are there Public Service Obligation in place ?

The implementation of PSO is developed in more than 50 % of countries (see Fig. 3.A.26).

Fig. 3.A.26 ● Public Service Obligation



Nations for which there is a Public Service Obligation are listed in Fig. 3.A.27.

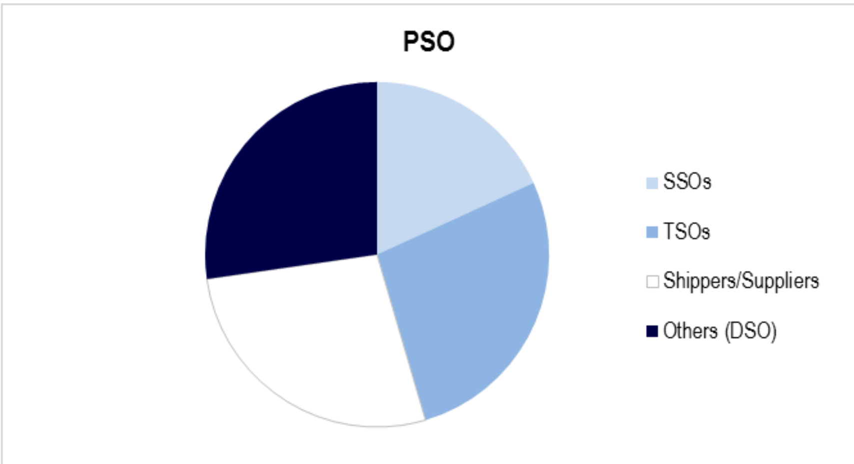
Fig. 3.A.27 : Countries with Public Service Obligation

AUT	BGR	CZE	GER	FIN	UK	HUN	IRL	ITA	LTV	PRT	ROM	SPA	SVK	SWE
na	yes	yes	na	no	na	yes	no	yes	yes	yes	yes	yes	na	na

A.4.2 : If there are PSO in place, indicate to which Party these obligations are assigned to ?

The PSO is equally distributed between SSO'S, TSO's and shippers (see Fig. 3.A.28) .

Fig. 3.A.28 ● Assigned parties for PSO



A.4.3 : specify the underlying provisions

Comments about underlying provisions are collected in Fig.3.A.29.

Fig. 3.A.29 : Provisions underlying Public Service Obligation

• SSO is obliged to provide access the gas storage facilities to TSOs, DSOs, public provider, suppliers of last resort, traders and to customers in non-discriminatory manner	Bulgaria
• Universal suppliers are responsible for the gas supply of households and communal customers on a regulated price	Hungary
• The obligation is referred to guarantee a modulated supply to residential customers	Italy
• Section 6 of the Energy Law (1) In the area of operation of its license and within the time period specified in the license, a system operator has a permanent obligation to ensure for system users and applicants access to energy transmission or distribution systems or natural gas storage sites if such access is permanently compatible with appropriate technical regulations and safety requirements. ... (3) An energy supply merchant, which supplies energy to captive consumers shall sell energy to them in the necessary or specified quality and the quantity demanded at the tariff specified by the regulator or for tariffs, which have been specified by the relevant service provider in accordance with the tariff calculation method specified by the regulator if a permit has been obtained from the regulator	Latvia
• Mandatory natural gas stocks (reserves): - 15 days yearly medium consumption for power producers; - 20 days for the remaining consumers. The PSO are applied to the suppliers (not directly to the costumers)	Portugal
• The Gas Law stipulates provisions on PSO	Romania

A.5 : Strategic Stocks

The definition of “strategic stock” refers to “gas stored in order to be used in case of a supply disruption, excluding seasonal variation.

Strategic gas stock is gas and corresponding storage capacity reserved and immobilized to be used in a predefined emergency event of gas supply disruption.

The standard for security of supply defined in the Security of supply Directive, as often Member States have national provisions which imply obligation on storing gas to be used in case of supply disruption, without necessarily calling it storage for security of supply or strategic stocks.

The criteria underlying the calculation of the gas stock amount are mainly based on consumption (83%) rather than on net imports.

The legal requirements for strategic stocks pertaining to:

- Taxes through regulated tariffs and Gas/ Petroleum Laws, which define Criteria and methods for approving prices and establishing regulated tariffs in natural gas sector;
- Financing when compulsory stocks are financed by companies having stocks obligations or when State strategic stocks are financed with strategic stockpile fees included in fuel price;
- Fees which are paid by all market stakeholders or by the suppliers and, as consequence, by consumers.

In other cases, 15% of the storage volume has to be kept in storage, but there is no legal provision (it is specified that this kind of rule may be subject to change). Mandatory natural gas stocks may be fixed to 15 days of yearly medium consumption for power producers and 20 days for the remaining consumers. Some Authorities also mentioned this PSO will change and will result from the current legislation.

A.5.1 : Are there legal obligation to provide strategic stocks ?

There are 33% of countries where strategic stocks are required by the National Regulation Authorities (see Fig. 3.A.30) .

But this figure does not correctly represent the real situation in Europe, as the countries where Strategic Stocks are required do only represent about 9 bcm which is about 9% of total installed working gas volume in Europe.

Moreover, major storage countries do not have any strategic stocks obligation (except Italy).

Fig. 3.A.30 ● Strategic stocks

Nations for which there are a Strategic Stock Obligation are listed in Fig. 3.A.31.

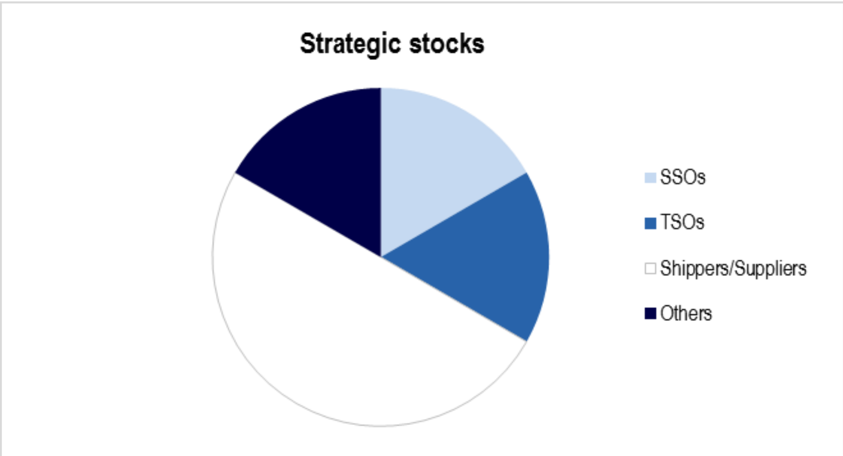
Fig. 3. A.31 : Countries where there are obligations for Strategic Stocks

AUT	BGR	CZE	GER	FIN	UK	HUN	IRL	ITA	LTV	PRT	ROM	SPA	SVK	SWE
no	no	no	no	no	no	yes	no	yes	no	yes	yes	yes	no	no

A.5.2 : If yes, please indicate which party has to provide mandatory stock levels

The mandatory stocks have to be provided by Shippers or suppliers in 50 % of responding countries (see Fig. 3.A.32).

Fig. 3.A.32 ● Party in charge of providing the mandatory stock level



Comments from NRAs when answering “Others” are collected in Fig 3.A.33.

Fig. 3.A.33 : Comments about "other parties" in charge of strategic stocks

• Gas fired power and heat plants have a legal obligation to have stocks of alternative fuel (usually)	Finland
• SSO of the special strategic storage	Hungary
• DSOs	Romania

A.5.3 : Indicate the amount of gas stocks that have to be kept in storage.

The amount of gas stocks were collected in Fig. 3.A.34;

Fig 3.A.34 : Amount of gas strategic stocks

• 30% (strategic stocks are equal to 5 bcm	Italy
• 20%	Hungary

A.5.4: describe the criteria underlying the calculation of gas stock amount.

In general, the calculation of strategic stock amount is related to national consumption for 85% and to net imports for 15%.

Essentially Shippers and suppliers are responsible for implementing mandatory strategic stocks.

But further specifications show other operators may have legal obligation but without having to take the corresponding financial risk. This risk can be borne by the final user.

For instance, power producers, using gas fired power plants, have an obligation to have stocks of alternative fuels or gas strategic stocks. In some countries, even Distribution grid Operators may have obligation to book for strategic stocks for securing the supply of their customers.

Few NRA indicated the criteria underlying the calculation, but the majority base their calculation on consumption criteria (see Fig.3.A.35).

Fig. 3.A.35 : Underlying criteria for the calculation of gas stock amount

Consumption	5
Net imports	1
Others	0

A.5.5 : describe the reason /rules when utilize strategic stocks ?

The reasons listed by NRAs for utilizing strategic stocks are:

- severe conditions;
- serious disruption of supply;
- jeopardized operation of gas fired power or heat plants.

Reasons or rules for utilization of strategic stocks are collected in Fig. 3.A.36.

Fig. 3.A.36 : Reasons or rules for strategic stocks

• Strategic stocks use may be allowed by National Emergency Supply Agency, if shortage of gas would jeopardize the operation of gas fired power and heat plants	Finland
• 20 % is the amount of the exclusive strategic stocks stored in a special different security storage unit. Therefore the strategic stocks are absolutely separated from commercial storage	Hungary
• According to the Ministerial Decree of 26 September 2001, the use of strategic stock is allowed for imports disruption and in case of severe conditions (cold winter)	Italy
• Serious supply disruptions. The ministry of economy is responsible for allowing supplies from the strategic stocks(security reserves)	Portugal
• According to continuity of supply contractual provisions	Romania

A.5.6 : describe the legal requirements for strategic stocks

Among the different requirements:

- taxes (e.g. gas stored, VAT, royalties,),
- financing
- storage fees

the last one was mainly mentioned.

The description of legal requirements for strategic stocks are collected in Fig. 3.A.37.

Fig. 3.A.37 : Legal requirements for strategic stocks

Taxes	• Regulated tariff (Portugal) • Petroleum Law, Gas Law and Decision no. 1078/2003 on approval of Criteria and methods for approving prices and establishing regulated tariffs in natural gas sector – Modified (Romania)
Financing	• Compulsory stocks are financed by companies having stocks obligations. State strategic stocks are financed with strategic stockpile fees included in fuel prices (Finland) • Decision no. 1069/2007 for the approval of the Energy Strategy of Romania for 2007-2020 period (Romania).
Storage fees	• The fees are paid by all market stakeholders (Hungary). • Shippers (Italy) • The tariffs are paid by the suppliers and, as consequence, by consumers. (Portugal) • Decision no. 1078/2003 on approval of Criteria and methods for approving prices and establishing regulated tariffs in natural gas sector – Modified (Romania)

A.5.7 : if none of the above questions are applicable, please describe your legal obligations

The answers are collected in Fig. 3.A.38.

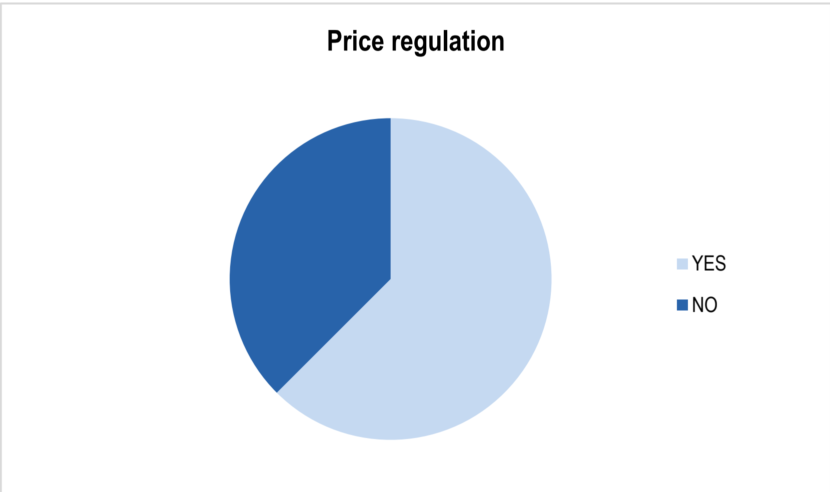
Fig. 3.A.38 : Other legal obligations

• 15% of the storage volume have to be kept in storage, but not a legal provision	Bulgaria
• This may be subject to change. It depends on result of legislation process.	Czech Rep.
• Mandatory natural gas stocks: - 15 days yearly medium consumption for power producers	Portugal

A.6 : Are there any kinds of price regulations in place?

About 60% of countries are subject to a price regulation (see Fig.3A.39).

Fig. 3.A.39 ● Price regulation



Additional comments from NRAs are listed in Fig.3A.40.

Fig.3.A.40 : Comments about price regulation

• Under nTPA, storage prices are not allowed to differ more than 20% from the EU average storage prices. If so, the regulatory authority are allowed to set the cost basis for the tariff calculation	Austria
• The methodology used for price regulation is capital rate of return, no differentiation between summer/winter prices; the price is still one-component	Bulgaria
• There is RTPA on a maximized price	Hungary
• Cost based	Italy
• It is set that the price of gas must not exceed its acquisition costs plus costs related to the acquisition (costs of financial instruments involved etc)	Latvia
• Strategic stocks(security reserves) pays the regulated (storage) tariff, as any commercial stock	Portugal
• Decision no. 1078/2003 on approval of Criteria and methods for approving prices and establishing regulated tariffs in natural gas sector – Modified	Romania
• Tariffs Regulated	Spain
• Benchmarking model based methodology, maximum prices for access to a storage tank and gas storage in 2011 and 2012 for individual storage services	Slovakia

A.7 : Trends of regulation framework

A.7.1 : What are your main work items regarding storage market arrangements in the next years ?

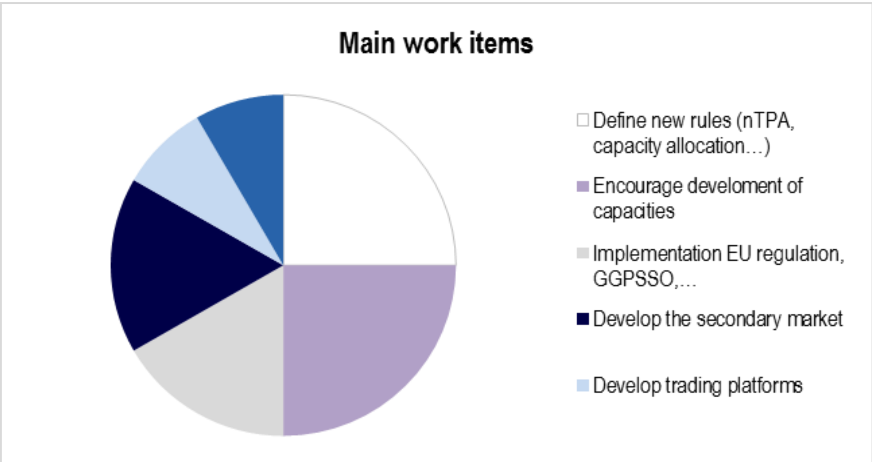
The answers to this question were various but bring a rather positive message which consist in a will for a developing new rules about issues like nTPA, Capacity allocations etc.(see Fig. 3.A.41)

Some NRAs also intend to develop the secondary market, to monitor the development of trading platforms and to implement the GGPSSO on CAM and CMP.

Other NRAs intend to monitor transparency and competition according to 3rd Energy Package, even to the EU regulation n0 994/2010.

Some NRA also suppose the underground storage facilities are being widely expanded and, for that reason, the capacity allocation mechanisms should put more emphasis on medium/long term contracting.

Fig. 3.A.41 ● Trends for regulation frameworks



A.7.2 : provide any additional comment

Some NRAs made additional and quite constructive comments by suggesting that, underground storage facilities are being widely expanded and, for that reason, the capacity allocation mechanisms should put more emphasis on medium/long term contracting.

Additional comments from NRAs are collected in Fig.3.A.42.

Fig. 3.A.42 : Additional comments about regulation framework

• There are no gas storages in Finland and Finland has derogations from opening of gas market as long as the Finnish natural gas network is not directly connected to the interconnected system of any other Member State and having only one main external supplier (as it is today). It is not visible that there will be gas storages in Finland in near future and also removal of derogations are not visible	Finland
• The underground storage facilities are being widely expanded and, for that reason, the capacity allocation mechanisms should put more emphasis on medium/long term contracting	Portugal

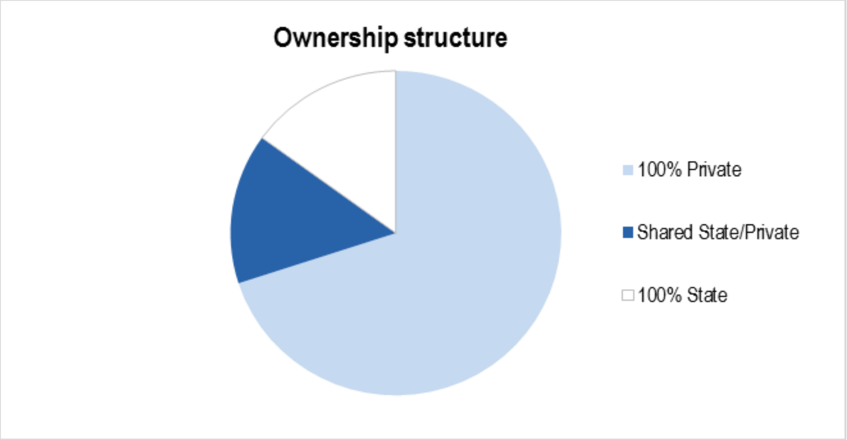
PART B : Storage contracts (from questionnaire completed by storage companies)

B1 : Ownership structure

What is the owner ship structure of you company ?

Most of responding companies (70 %) are private whereas 15% are 100 % owned by State and 15% have a mixed shareholder structure (see Fig. 3.B.1).

Fig. 3.B.1 ● Ownership structure

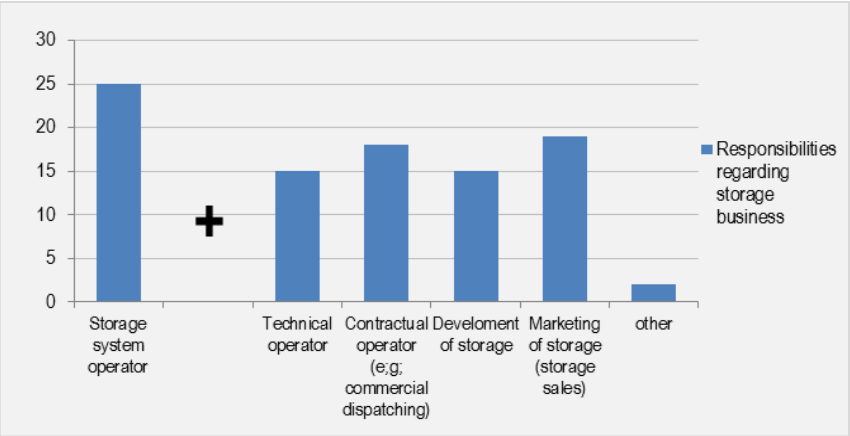


B2 : Field of company activities

What are your responsibilities regarding storage business ?

All responding companies were Storage System Operator but they also have other fields of activities, such as technical or contractual operatorship, storage development or storage marketing (see Fig. 3.B.2).

Fig. 3.B.2 ● Responsibilities regarding storage business



Comments made when answering "other" are collected in Fig. 3.B.3.

Fig. 3.B.3 : comments about responsibilities regarding storage business

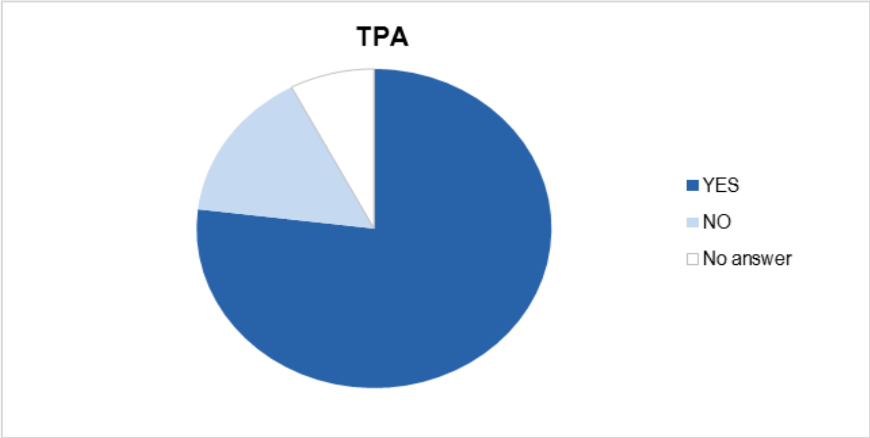
• Storage owner	Belgium
• Operator of Rivara UGS site	Italy

B3 : Third Party Access to storage

B.3.1 : Is access to your storage capacity provided on a TPA basis ?

For 70% of the responding companies, their storage capacities are provided on a TPA basis (see Fig. 3.B.4).

Fig. 3.B.4 ● TPA to storage.



This result somehow differs from the results provided in §A.2.1 (question A.3.4) as most of responding NRAs were in EU countries.

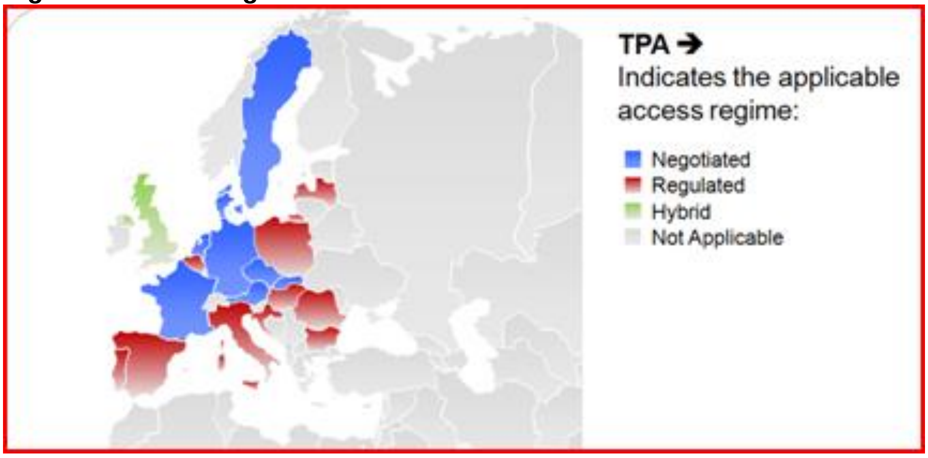
B.3. 2 : Indicate the applicable access regime

Which regime of TPA is applied : regulated, negotiated or hybrid, for existing, for expanded or for new capacities ?

TPA access may differ between a negotiated and regulated regime. The answers made by companies below do not differ from the answers from NRAs (see § A.2.2, Question A.3.5) and show about 50% of the nations storage business is carried out under regulated TPA. The negotiated TPA is predominant in the majority of the bigger storage nations such as Germany and France.

The results, which did not differ significantly when considering existing, expanded or new capacities, can be represented on the map below (see Fig. 3.B.5).

Fig. 3.B.5 ● TPA regime.



For France, it was specified that TPA to storage capacities is provided on a negotiated basis (no price regulation) but there are also access priorities. Decree no. 2006-1034 of 21 August 2006 and Decree n°2010-129 of 10 February 2010 organize access to underground natural-gas storage : In particular, Article 3, pertaining to the allocation of storage capacities to suppliers that have an existing portfolio of end customers in France.

B4 : Exemption to TPA

B.4.1 : For which reasons your capacities are exempted from TPA ?

The exemption to TPA may be implemented through the article 22 of the Gas Directive 2003/55 EC, but TSOs, for their necessary need to balance their network, or the producers (E&P operators) for the need of regulating their production, can also be exempted.

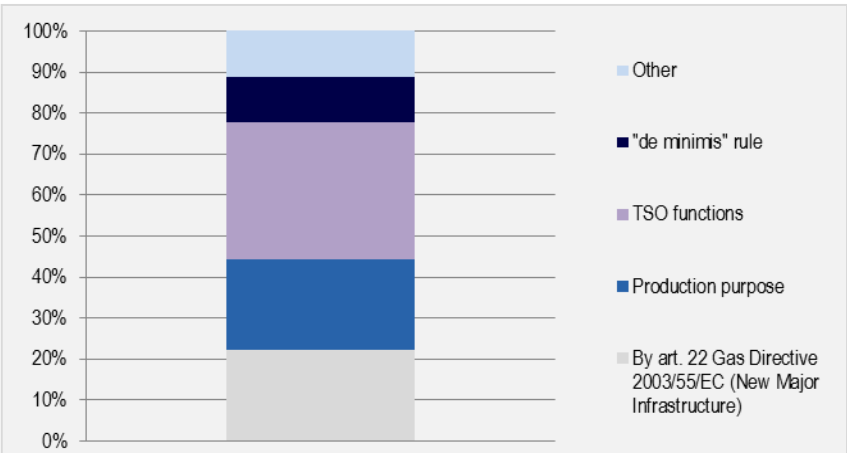
The Third Energy Package also covers a concept of exemption. But this exemption concept requires the demonstration of absence of economic impact on the market. This is linked to the “de minimis rule“ concept which refers actually to SSO who have a limited share of the market and the storage capacity of which will never change the economic conditions of this market**.**

In a notice on **agreements of minor importance (de minimis)**, the Commission quantifies, with the help of market share thresholds, what is not an appreciable restriction of competition under Article 101 of the Treaty on the functioning of the EU (TFEU, ex Article 81 TEC) [Commission notice]. The Commission holds the view that an agreement between undertakings, even if it affects trade between Member States, does not appreciably restrict competition within the meaning of Article 101 § 1 of the TFEU if: (a) the aggregate market share held by the parties to the agreement does not exceed 10% on any of the relevant markets affected by the agreement, where the agreement is made between undertakings **which are actual or potential competitors** on any of these markets; or (b) the market share held by each of the parties to the agreement does not exceed 15% on any of the relevant markets affected by the agreement, where the agreement is made between undertakings which **are not actual or potential competitors** on any of these markets. In these cases the Commission will not institute proceedings either upon application or on its own initiative.

Agreements entered into by small and medium enterprises (SMEs) whose annual turnover and balance-sheet total do not exceed EUR 40 million and 27 million respectively and which have a maximum of 250 employees are rarely capable of appreciably affecting trade between Member States and are not, in principle, investigated by the Commission. However, there exists a "blacklist of hardcore restrictions" - such as price-fixing, market-sharing or territorial protection - which, because of their nature are regarded as typically incompatible with Article 101 § 1 of the TFEU and hence liable to be caught by the ban on agreements, even if the parties' market shares are below the above-mentioned thresholds.

The responding companies reported that the main reason for exemption is TSO function (see Fig. 3.B.6).

Fig. 3.B.6 ● Reasons for exemption to TPA.



No comments were made about answer “other”, except by Hungary which mentioned strategic storage as a reason for exemption.

B.4.2 : Percentages of total storage capacities exempted

What percentage of your total storage capacities are exempted?

The exempted percentage may vary from 100 to less than 1 per cent (see Fig. 3.B.7).

Fig. 3.B.7 : Percentage of exempted capacities

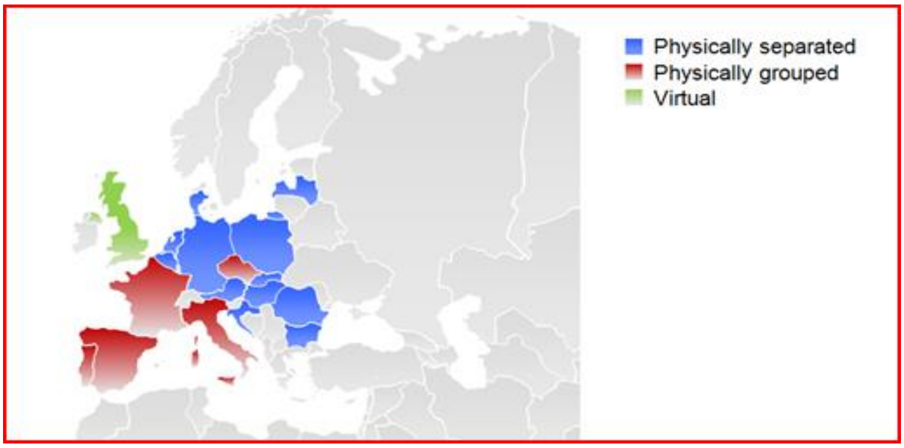
	Art.22	Production purposes	TSO functions	De minimis rule
Number of cases	2	2	3	1
% of total capacities	100	100	18	na
		56	3	
			0,36	

B5 : Storage services : How and where ?

B.5.1 : How is storage service offered ?

Except for Czech Rep., there is a clear preference for offering physically separated services on the East part of Europe and for offering physically grouped services in the South-Western part (see Fig. 3.B.8).

Fig. 3.B.8 ● Map of grouped/separated/virtual offers



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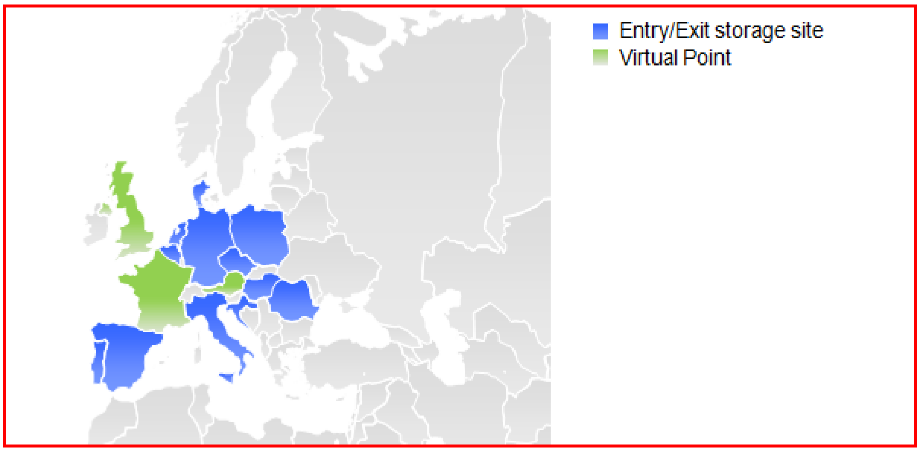
B.5.2 : Where is the delivery point ?

Entry/exit points are used in most of countries except in Austria, France and the UK where virtual points are used as delivering points (see Fig. 3.B.9).

Fig. 3.B.9 ● Map of options for delivery points



Some companies made comments collected in Fig.3.B.10.

Fig. 3.B.10 : Comments about delivery points

• entry/exit point of the transmission system	Germany
• Point of connection to the trunk gas pipeline	Russia

B6 : Type of services offered

In general, storage capacities are sold in bundles called Standard Bundles Units (SBU). These SBUs include a mix of available volume, injection and withdrawal capacities, which are based on the physical (geological) and technical (wells & Above Ground Installations) restrictions of the storage.

The shippers may have quite different needs for storage flexibility depending on their demand/supply portfolio. The variety of products offered by the storage operators show big differences in flexibility requirements of shippers, that generally expect to see storage operators offering several products. However, shippers can sometimes buy SBUs from different operators in the same market area, if they exist.

Even if capacities are sold in predetermined bundles, this may be an entry barrier for market players who have small portfolios and are subject to prefer a single product different from the offered SBUs.

Anyway, the SBUs are recommended by the GGPSSO as they are easily comparable products.

Storage operators with several storage facilities may be able to offer several bundled units by combining their services from several storage facilities. Instead of operating different storages independently, they may offer their services as several different SBUs from only one virtual storage facility. This allows storage operators to continue to market SBUs in relation to the technical constraints but allow to optimize their portfolios by dealing with only one storage operator.

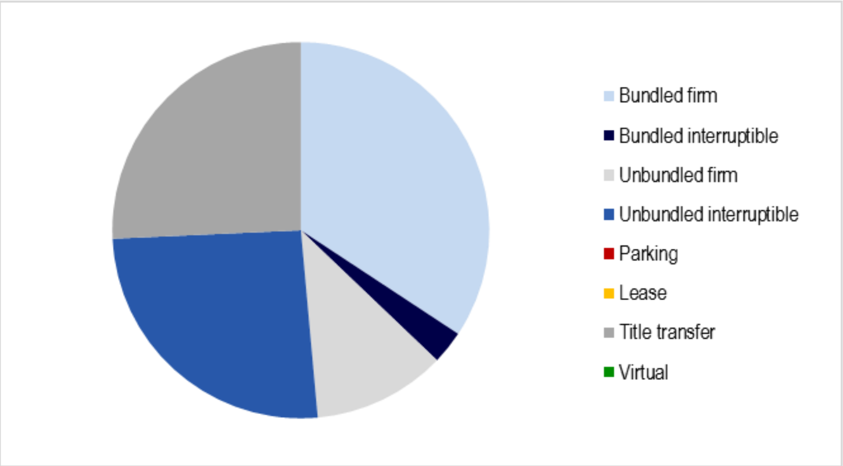
What kind of services do you offer ?

This question was asked for all types of storage.

B.6.1 : Aquifers :

In case of aquifers, 75% of services offered are classical services (bundled + unbundled) and the only non-classical service used is title transfer (lease, parking and virtual are never used in the reported cases) (see Fig.3.B.11).

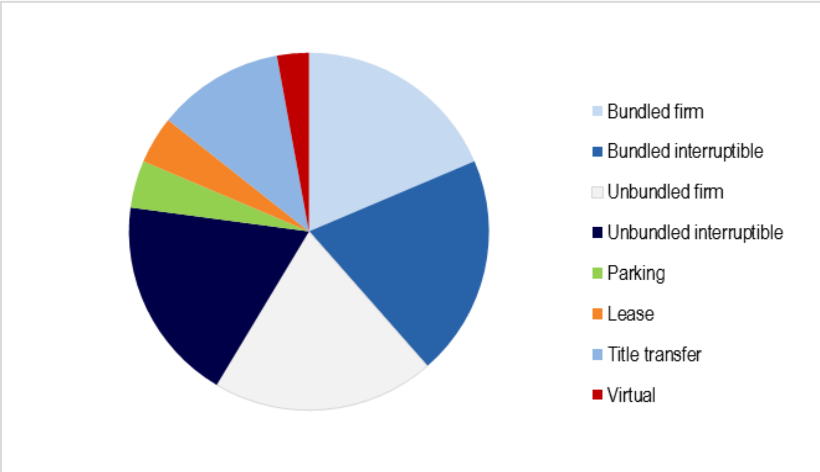
Fig. 3.B.11 ● Kind of services offered for aquifers.



B.6.2 : Depleted fields :

In case of depleted fields, classical services (bundled + unbundled) are representing more than 75% of all services and non-classical services are also moderately used. But all non-classical services mentioned in the questionnaire are used (Parking, lease, title transfer or virtual) (see Fig.3.B.12).

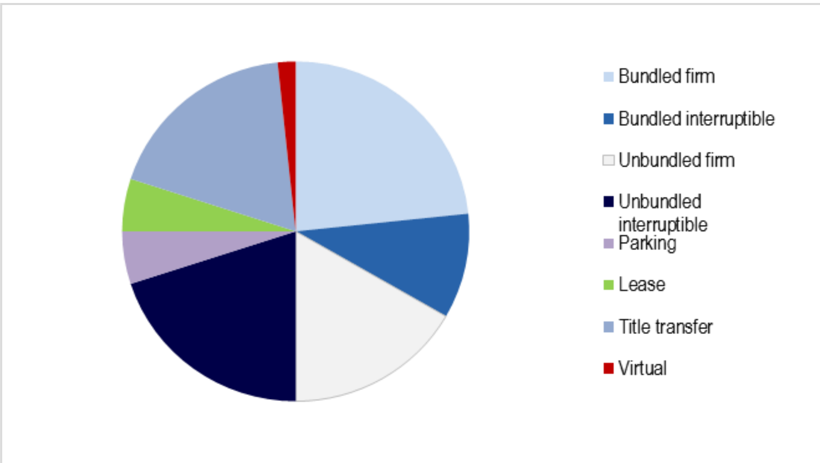
Fig. 3.B.12 ● Kind of services offered for depleted fields



B.6.3 : Salt caverns :

The results for salt caverns are not very different from the results shown above for depleted fields even if classical services are representing a little less than 75 % (and non-classical services a little more than 25 %) of all services. Moreover, title transfer is preferentially used as for non-classical service (see Fig.3.B.13).

Fig. 3.B.13 ● Kind of services offered for salt caverns.



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As a result, whatever the type of storage, the non-classical services are implemented in a very limited number of countries, except for Germany (using all non-classical services) and also Czech Republic (using all non-classical services except virtual). In all other countries, the companies prefer to use a limited number of non-classical services (France, Austria and Hungary use only title transfer service).

As a conclusion, there is a low emphasis for cross selling (un-classical) services.

In the table below (see Fig. 3.B.14), the countries using these non-classical services for each type of storage.

Fig. 3.B.14 : Kind of services offered by nations and for each type of storage.

Type of unclassical services	Salt caverns	Aquifers	Depleted fields
Title transfer	Germany, France, Denmark	Germany, France	Germany, Hungary, Czech Rep., Austria
Parking	Germany		Germany, Czech Rep.
Lease	Germany		Germany, Czech Rep.
Virtual	Germany		Hungary

Moreover, the following comments were added (see Fig.3.B.15).

Fig. 3.B.15 : Comments about services offered.

• 1) bio-methane storage accounts (planned) • 2) switch of storage capacity rights for customers having capacity rights in more than one facility if available	Germany
• (a) Day Ahead, interruptible • (b) OFC (online flow control) • (c) Biogas balancing	Germany
• We offer Interruptible Bundled Services, since shippers are allowed to nominate above 100% of their booked capacity whenever there is available capacity. (**)We offer Unbundled Services, for both firm and interruptible, in the Secondary Market.	Spain
• UIOLI service (Use It Or Lose It) The UIOLI service enables a customer with a basic storage service in a given storage group to access subscribed injection and withdrawal capacity that is not being used by other customers of the group in question. UIOLI capacity is offered on an interruptible basis so that priority can be given to any intra-day changes in demand for basic capacity subscribed to by customers in the Group. FLOW PLUS Flow Plus enables a customer to access to additional flow in a firm basis. Storengy makes available some additional capacity beyond conditional capacity and inform the Clients through a notification on D-1 for D. These capacities are allocated under a pro rata of demands mechanism	France
• We are currently in the stages of marketing Holford capacity	GB
• All gas traded on market	GB
• Gazprom's UGS satisfy demand of UGSS consumers in the mode required for the balanced operation of all UGSS facilities.	Russia

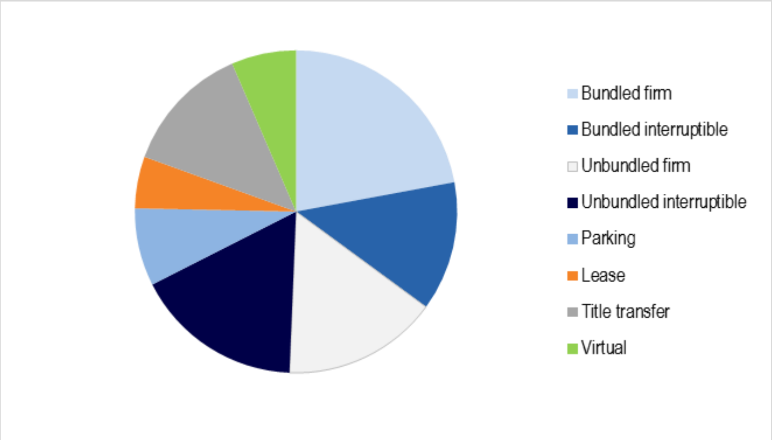
B.7 : Type of services demanded

What kind of services have been demanded ?

The services demanded by customers are well distributed and are quite close to the distribution of services offered by SSO (see Fig. 3.B.16), especially by comparing with the salt cavern case (See § B.6.3 above).

As a result, aquifer offer might be somehow far from the demand.

Fig. 3.B.16 ● Kind of services demanded



But one may wonder whether SSOs have a precise representation of their customer demand.

Some companies answered “Other” with the comments collected in Fig. 3.B.17.

Fig. 3.B.17: Comments about “other services” demanded

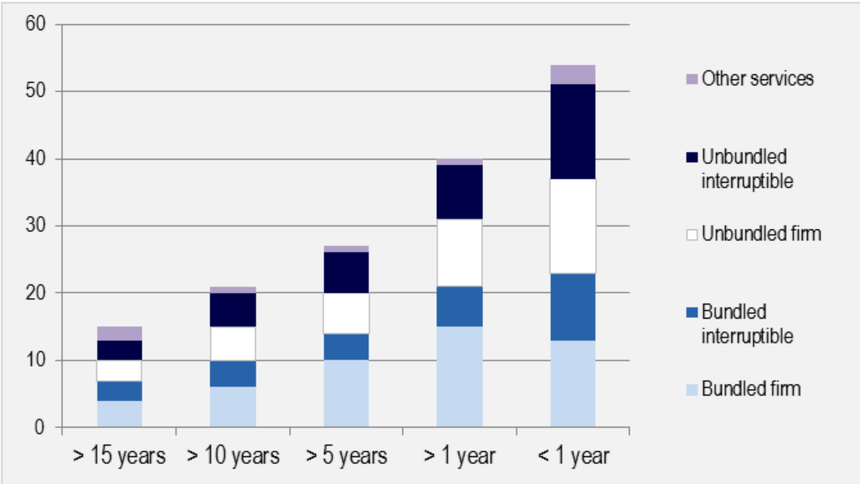
• Virtual Service offered currently on Zeebrugge VSI entry/exit point and Eynatten VSI entry/exit point	Belgium
• (a) OFC (online flow control) • (b) Biogas balancing	Germany
• Same products VNG offer	Germany

B.8 : Contract duration offered

What kind of contract duration do you offer?

The share of bundled services (firm or interruptible) is decreasing when duration of contracts is decreasing. Consequently, the share of unbundled offers (firm or interruptible) are increasing when durations of contracts increase (see Fig. 3.B.18).

Fig. 3.B.18 ● Contract duration offered.



However the firm offers (bundled or unbundled) is always representing 50% of offers whatever the duration of the contract is.

Comments of companies answering “Other services ” are collected in Fig. 3.B.19.

Fig. 3.B.19 : Comments about contract duration offered

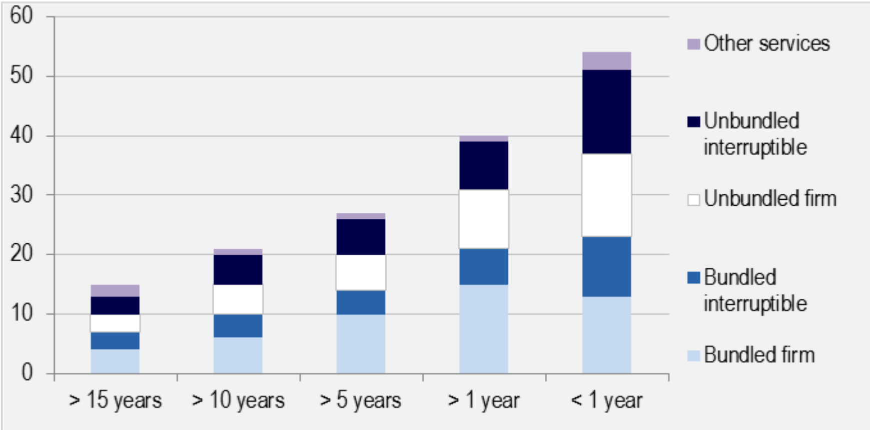
15 years	special product 7Fields XLT (investment like) Germany	Germany
< 1 year	• Day Ahead IC & WC interruptible, (b) OFC Germany	Germany
	• day ahead for existing customers Germany	Germany
	• UIOLI, Flow Plus France	France

B.9 : Contract duration demanded

B.9.1 : What kind of contract duration have been demanded ?

The results are quite close to the results of § B.8 (Contract duration offered) and show the durations offered are not different from the duration demanded (see Fig. 3.B.20). However, is it possible to conclude that the clients always obtain the duration they demand? Once again, it is difficult to answer as the question about duration demanded is answered by SSO companies and not by their clients and their answer can only be considered if SSOs do know the need of their customers.

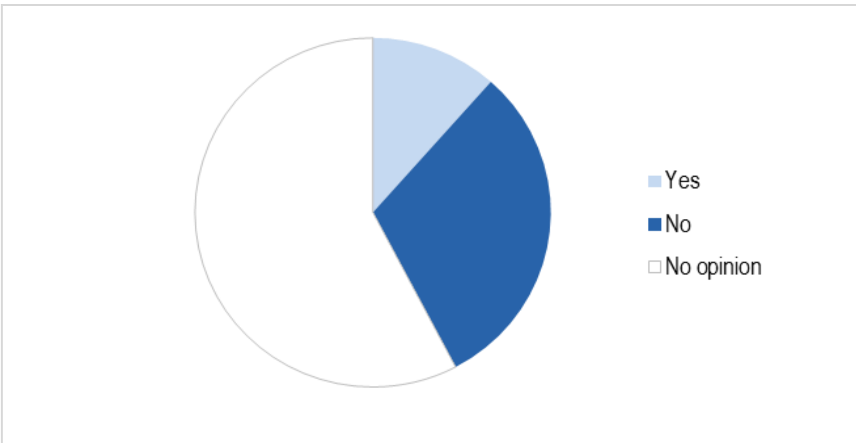
Fig. 3.B.20 ● Kind of contract duration demanded



B.9.2 : Are there any preference on services demanded with regard to contract duration requested by the market ?

Surprisingly, the SSOs generally have no preference regarding the contract duration demanded by customers (see Fig. 3.B.21).

Fig. 3.B.21 ● Preference about services demanded.



As long as customers are ready to demand both long and short term contracts and, as a result, as long as SSOs are able to build a mixed portfolio of long and short term contracts, SSOs will have no preference.

But, if the market changes and if clients only ask for short term contract, SSOs could miss long term contracts and prefer them as long term contracts will become rare products.

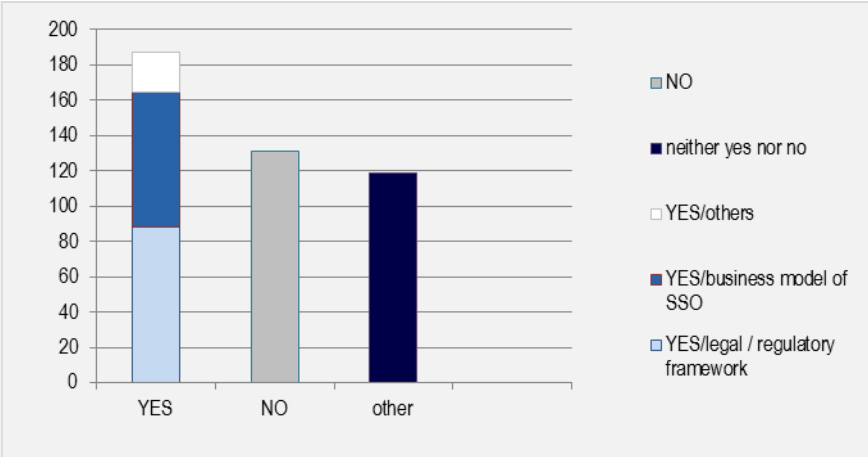
B.10 : Storage offer with regularly recurring time frames

B.10.1 : Do you offer storage capacities in regularly time frames ? If Yes, please indicate the reasons for regular recurring storage capacity offers, e.g, according to legal/regulatory obligation, according to business model of SSO or according to others reasons.

Most of storage capacities (see answer "YES" in Fig. 3.B.22 below) are offered with a regular timeframe, mainly due to the business model of SSO or to legal/regulatory obligation.

However, for 35% of offers, there are no regularly recurring time frames and for 25%, the SSO did not answer the question. This may be due to some confidential issues, as no SSO made any comment when responding

Fig. 3.B.22 ● Reasons for offering regular Time frames



B.10.2 : If applicable, please make reference to article(s) and/or law(s)

Information about articles or laws are collected in Fig. 3.B.23.

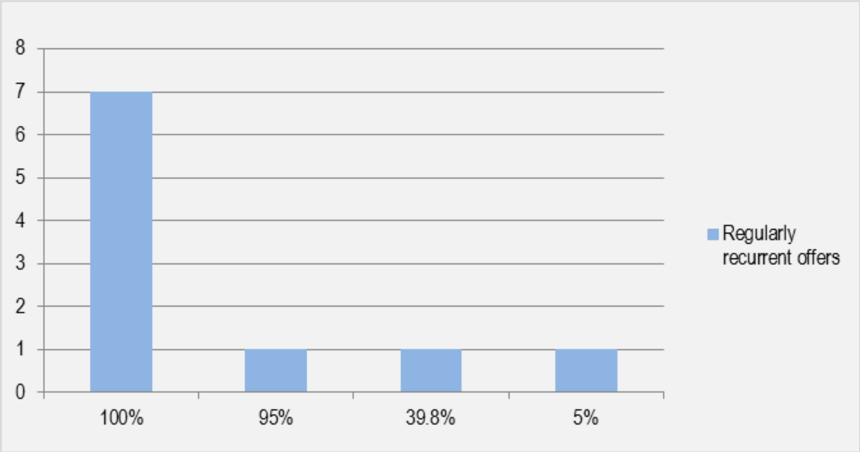
Fig. 3.B.23 : Article or laws related to timeframes of offers

• See Storage Code at: http://www.fluxys.com/en/Services/Storage/StorageModel/StorageModel.aspx	Belgium
• ORDEN ITC/3862/2007	Spain
• The Storage Rights Envelope is a set of capacities (about 95% of ours available capacities) made available, as a priority, to suppliers of final Customers in order to best meet their needs in respect with their Storage Rights. Beyond this priority, the Storage Rights Envelope is accessible to any market player. Storage capacities volume and withdrawal rate of the Envelope are defined each year in the French Government storage order on unit rights and profiles (Order of 7 February 2007)	France
• Grid Code of the Hungarian Energy Office (last change made in decree no. 80/2011 of the HEO)	Hungary

B.10.3: Amount of storage offered for regular offers in percent of total storage capacities ?

As shown below, the amount of storage reserved for regular offer is higher than 95% of total volume for 80% of offer cases (see Fig. 3.B.24).

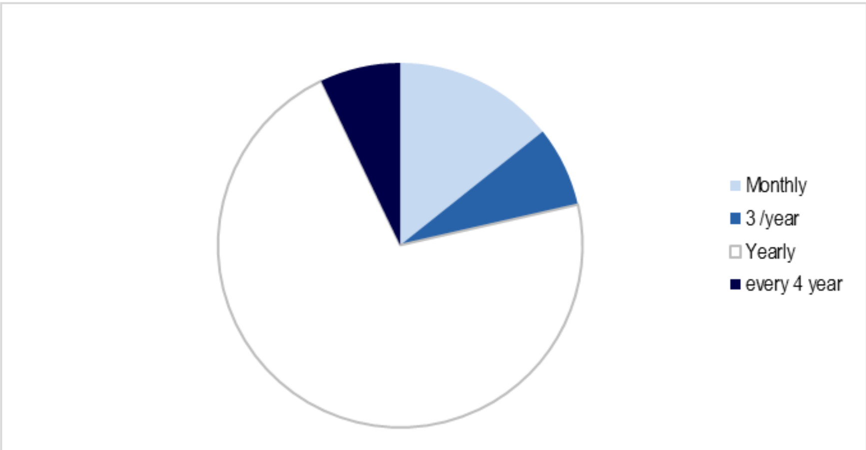
Fig. 3.B.24 ● Percentage of capacities offered in regularly recurring timeframes



B.10.4 : Are the storage capacities offers in regularly recurring timeframes proposed monthly, yearly, or with others periods ?

75 % of storage capacities offered in regularly time frames are proposed on a yearly basis but only 15 % are proposed on monthly basis (see Fig. 3.B.25).

Fig. 3.B.25 ● Timeframes of regularly recurring offers



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Comments of the two companies answering “Other” are collected in Fig. 3.B.26).

Fig. 3.B.26 : Comments about other Timeframes of regularly recurring offers

• Every year on April 1st, on July 1st and November 1st ;	France
• 4 years and as available.	Poland

B.10.5 : If applicable, please describe the underlying reason(s) of these offers

Comments about the underlying reasons for regularly recurring offers are collected in Fig. 3.B.27.

Fig. 3.B.27 : Comments about underlying reasons for regularly recurring offers

• Storage year starting on 15 April	Belgium
• Offering demanded services on a regular basis	Germany
• The storage capacity Envelope is allocated every year on April 1st, on July 1st and November 1st (due to French Government storage order	France
• Shippers having a portfolio in TIGF zone get a "right to storage". This right is reviewed once a year and adjusted two times within the year due to portfolio swaps between shipper.	France
• Public procurements law (maximal contract duration = 4 years)	Poland

B.11 : Characteristics of offered services

B.11.1 : What are the characteristics of your offered services ?

Offered services were compared on the basis of 4 criteria:

- volume expressed in kWh;
- injection capacity expressed in kWh/h;
- withdrawal capacity expressed in kWh/h;
- price in €.

Different types of products were considered for bundled services, with or without transport fees included. They were split in three categories:

- - firm, for porous storage;
- - non firm for porous storage;
- - firm for salt caverns.

Only one offer was quoted by SSOs including transport fees.

Moreover, all offered service described by SSOs are including withdrawal curve, except two.

There was no clear and exploitable data concerning unbundled services.

B.11.1.1 : Products for porous storage, with firm service and without transport fees

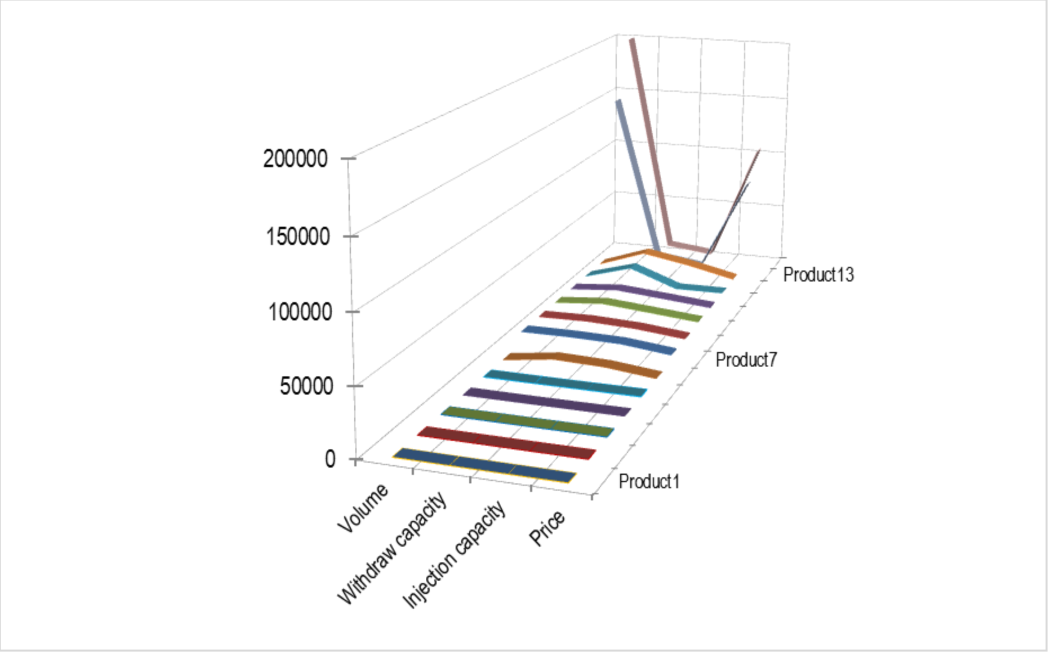
When comparing all available products for porous storage (aquifers and depleted fields), the range over which they are distributed is very wide.

In the graph below (see Fig. 3.B.28), there are 14 products proposed by companies from France, Germany and Belgium.

Considering the bundles mentioned by SSOs with volume varying from 10 000 kWh to 20 000 000 kWh, withdrawal capacities varying from less than 10 to more than 20 000 kWh/h, injection capacities varying from 3 to 16 000 kWh/h and prices varying from 72 to 100 000 €, it is not possible to compare all products together as they are all built for particular needs of customers and on the basis of the physical (geological) characteristics of subsurface structures as well as the technical performances of above ground installations.

As a result, graphs for products 1 to 12 seem quite flat compared to products 13 and 14.

Fig. 3.B.28 ● all porous storage products

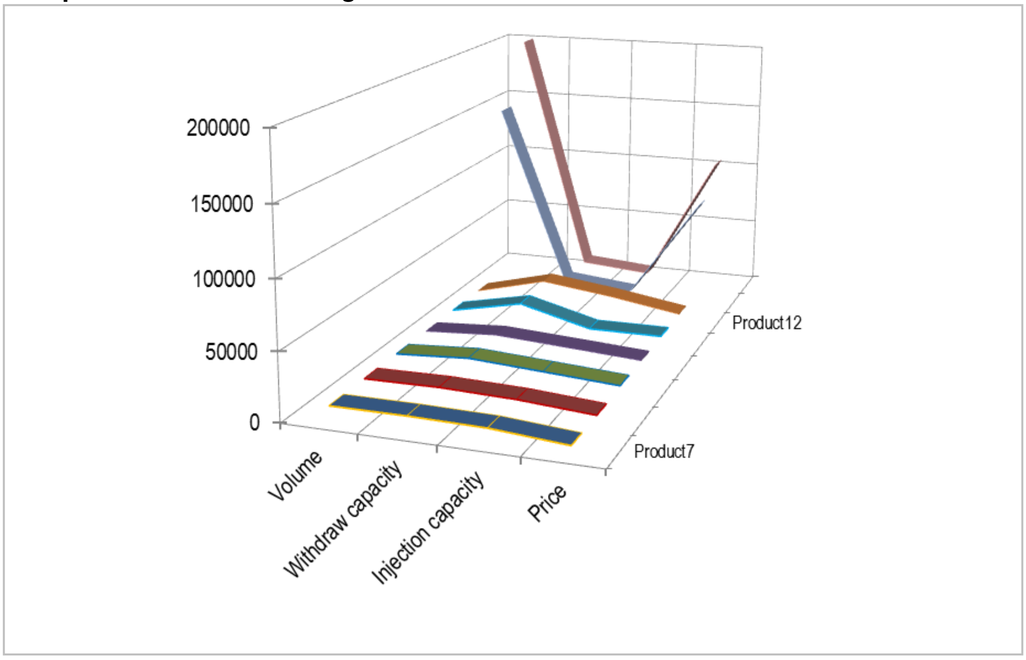


In all the figures above, Volume are divided by 100

However, more relevant comparisons are possible with parts of the 14 products.

The graph below (see Fig.3.B.29) was built by considering the products 7 to 14 of Fig.3.B.28, i.e. 6 products of a French company (product 7 to product 12 of Fig. 3.B.28)) and 2 products of a German company (products 13 & product 14 in the above Fig.3.B.28). But there is still a huge gap between these two sets of products. Graphs for products 7 to 12 seem also quite flat compared to products 13 and 14.

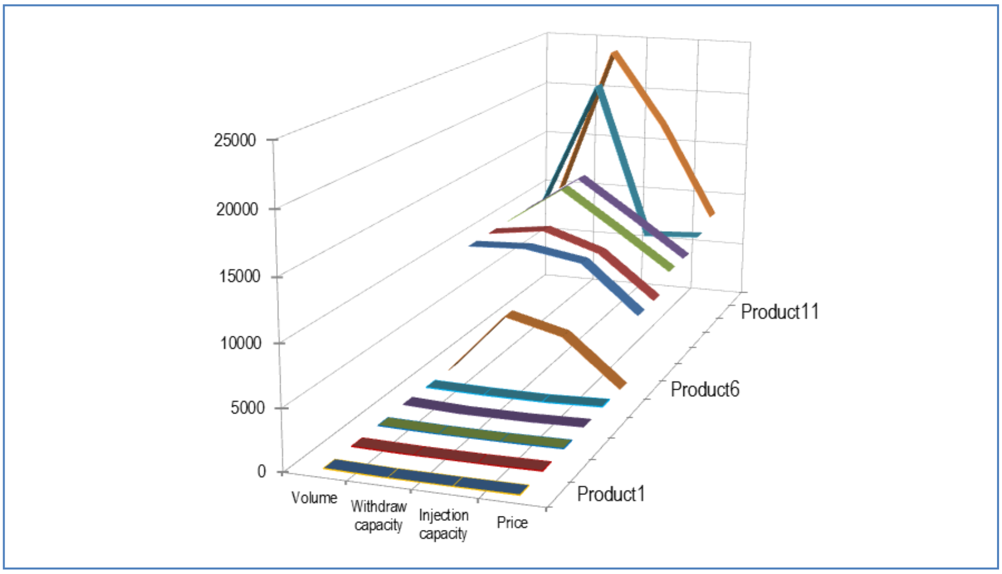
Fig. 3.B.29 ● porous storage products : products 7 to 12 of Fig. 3.B.28 are compared with products 13 & 14 of Fig. 3.B.28 :



In all the figures above, Volume are divided by 100

Fig. 3. B.30 was built by considering products 1 to 12 of the above Fig. 3.B.28, i.e. 6 products of a French company (product 7 to product 12 of above Fig. 3.B.28), 2 products of another French company (products 1 and 2 of Fig. 3.B.28), products of 3 German companies (i.e. products 3 to 5 of Fig. 3.B.28) and the product of one Belgian company (product 6 of Fig. 3.B.28), but there is also a huge gap between these products. Graphs for products 1 to 5 seem also quite flat compared to products 6 and 12.

Fig 3.B.30● porous storage products : products 1 to 12 of Fig. 3.B.28



In the graph above, Volume is divided by 100

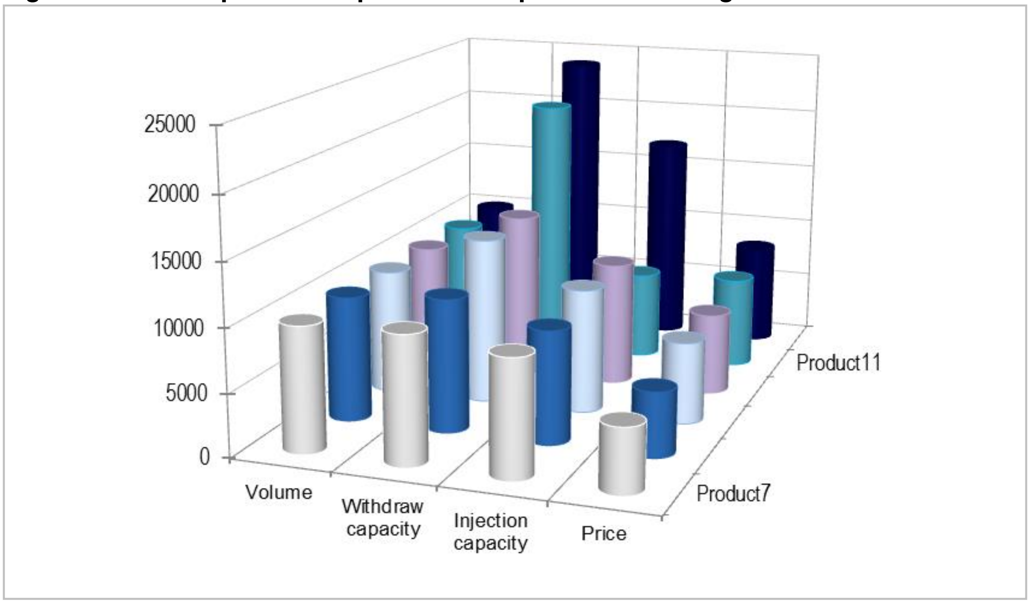
In the graph above, there are 11 products proposed by companies from France, Germany and Belgium. These products are all related to porous storage, (i.e. aquifer in France with volume of 1 x 10 6 kWh and aquifers or depleted fields in Germany, France and Belgium with volume of 10 000 to 24 000 kWh) for firm service, without transport fees, and with withdrawal curve.

The comparison becomes more relevant when it is made between the products of each group, taking in consideration:

1. products 7 to 12 in the above Fig. 3.B.28
2. products 1 to 6 (except product 4) of Fig. 3.B.28
3. products 13 and 14 of Fig. 3.B.28

1. For products 7 to 12 in the above Fig. 3.B.28 which are related to groups of aquifer storage (offered by one French company) all with a volume of 1 x 10 6 kWh) for firm service, no transport fees incl., and incl. Withdrawal curve (see Fig. 3.B.31).

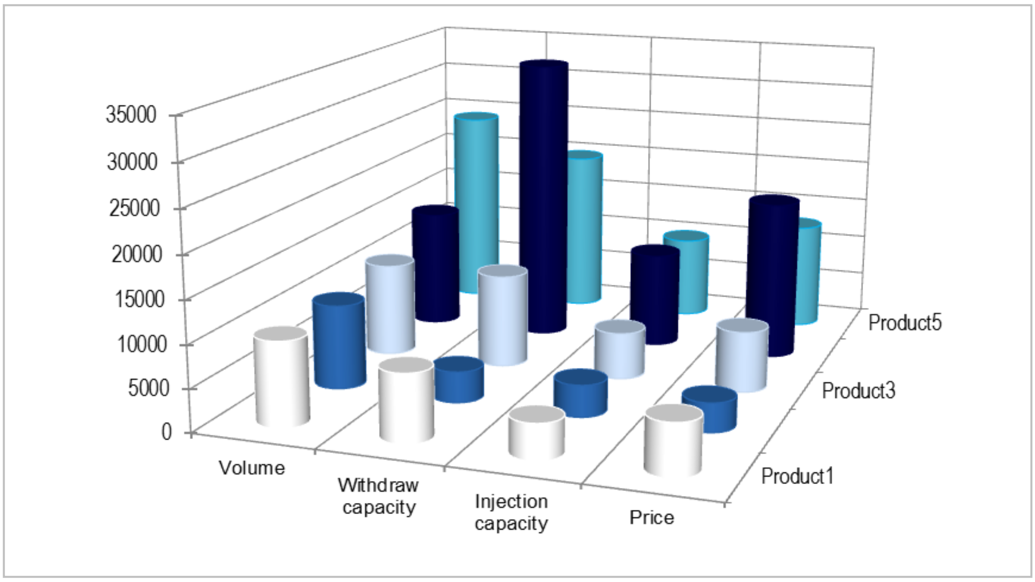
Fig. 3.B.31 ● comparison of product 7 to product 12 of Fig. 3.B.28



N.B. : volumes are divided by 100

2. For products 1 to 6 (except product 4) of Fig. 3.B.28, which are related to porous storage (aquifers and depleted fields in France, Belgium and Germany with volume from 10 000 to 20 000kWh) for firm service, no transport fees incl., and incl. Withdrawal curve, a comparison is also possible (see Fig. 3.B.32).

Fig. 3.B.32 ● comparison of product 1 to product 6 of Fig. 3.B.28



N.B. : In the graph above, price x 100 , injection capacity x 1000, withdrawal capacity x 1000

As shown in the Fig 3.B.32 above, the comparison of all firm products (transport fees excluded) related to Porous storage make appear two categories of bundled products: one with low price, low volume, the other with higher price, higher volume.

All figures for porous (depleted and aquifers) storage products (for firm service, without transport and with withdrawal curves) are collected in Fig. 3.B.33.

Fig. 3.B.33 : Figures for porous storage products (firm service, without transport fees)

Storage type	Nation	Product Name	Volume kWh	Withdrawal Capacity kWh/h	Injection Capacity kWh/h	Price €
aquifer	FRA	Product 1	10000	8	4,17	60,5
aquifer	FRA	Product 2	10000	3,67	3,75	34
aquifer	GER	Product 3	11100	11,1	5,55	72
depleted	GER	Product 4	11600	5452	4176	68
Aquifer	GER	Product 5	14250	34,2	11,4	190,7
depleted	BEL	Product 6	24157	19,84	9,92	128,54
Aquifer	FRA	Product 7	1000000	10204	9346	5150
Aquifer	FRA	Product 8	1000000	10638	9009	5150
Aquifer	FRA	Product 9	1000000	13333	10000	6550
Aquifer	FRA	Product 10	1000000	13333	10000	6550
Aquifer	FRA	Product 11	1000000	21277	7143	7420
aquifer	FRA	Product 12	1000000	23810	16949	8250
depleted	GER	Product 13	15000000	10000	4550	82782
depleted	GER	Product 14	20000000	10000	5560	104567

However, even separated in two groups, the criteria are spread over a wide range, probably due to various physical and technical conditions of storage assets.

In the first group, prices and volume are comparable but withdrawal and injection capacities vary from 1 to more than 2.

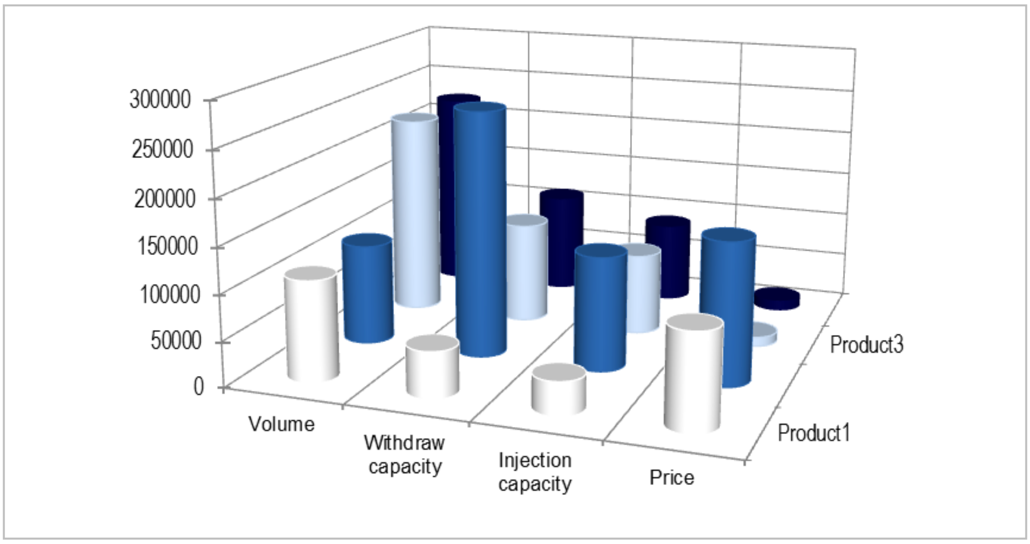
In the second group, all criteria are more or less comparable but all varying in a range of 1 to 2 and more for the price.

For product 4 (gasfield Germany), it was not possible to insert it in any of the two groups as its volume and price were comparable to the second group range but its injection and withdrawal capacities were 1000 times higher.

B.11.1.2 : Products for non-firm service and without transport fees

For products with non-firm service, without transport fees and with a withdrawal curve, the comparison is possible for the 4 following products offered by Austrian and Polish companies for both porous storage and salt caverns (see Fig. 3.B.34).

Fig. 3.B.34 ● comparison of product 1 to product 6 for non firm service



N.B. : volume/100, injection capacity x 10, withdrawal capacity x 10

One of these products (product 2 in dark blue in the graph above) is related to salt caverns and all others to depleted fields.

However, the criteria also differ very much for non firm services.

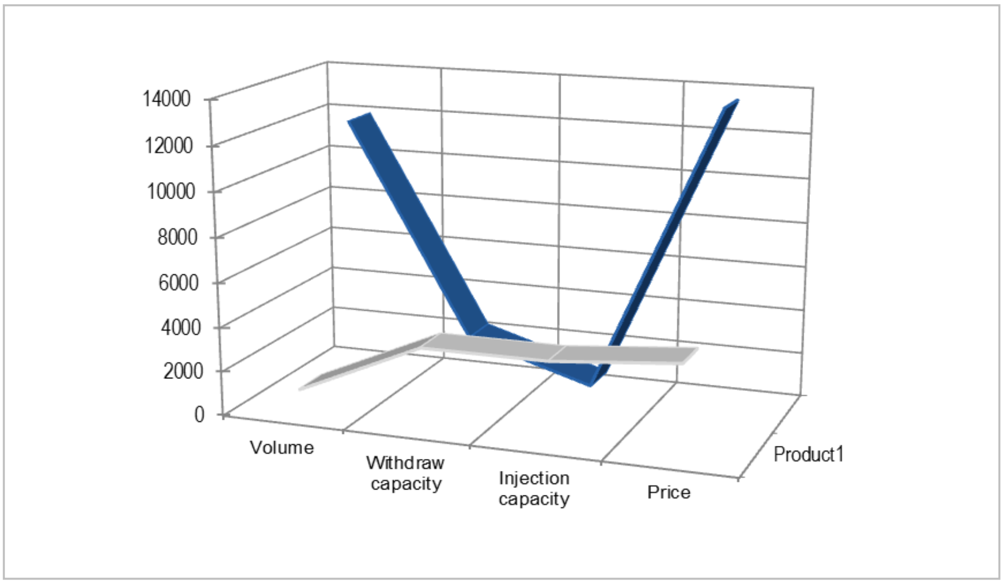
All figures for non firm service, without transport and with withdrawal curves) are collected in Fig. 3.B.35.

Fig. 3.B.35 : Figures for non firm service, without transport fees

Storage type	Nation	Product Name	Volume kWh	Withdrawal Capacity kWh/h	Injection Capacity kWh/h	Price €
depleted	POL	Product 1	11055555,5	5085,56	3648,33	103972,14
Salt cavern	POL	Product 2	11055555,5	26975,56	12492,78	155064,38
depleted	AUT	Product 3	22380000	11190	8952	10336
depleted	AUT	Product 4	22380000	11190	8952	11886

Two other products (which were the only products without withdrawal curves) offered by a German and a Belgian company were not comparable to the product represented above as the volume and price of one is 10 000 times smaller and the other is 1000 times smaller (see Fig. 3.B.36).

Fig. 3.B.36 ● comparison of product 1 to product 6 for non firm service



N.B.: injection capacity x 100, withdrawal capacity x 100 and price x 100

All figures for porous (depleted and aquifers) storage products (for firm service, without transport and with withdrawal curves) are collected in Fig. 3.B.37.

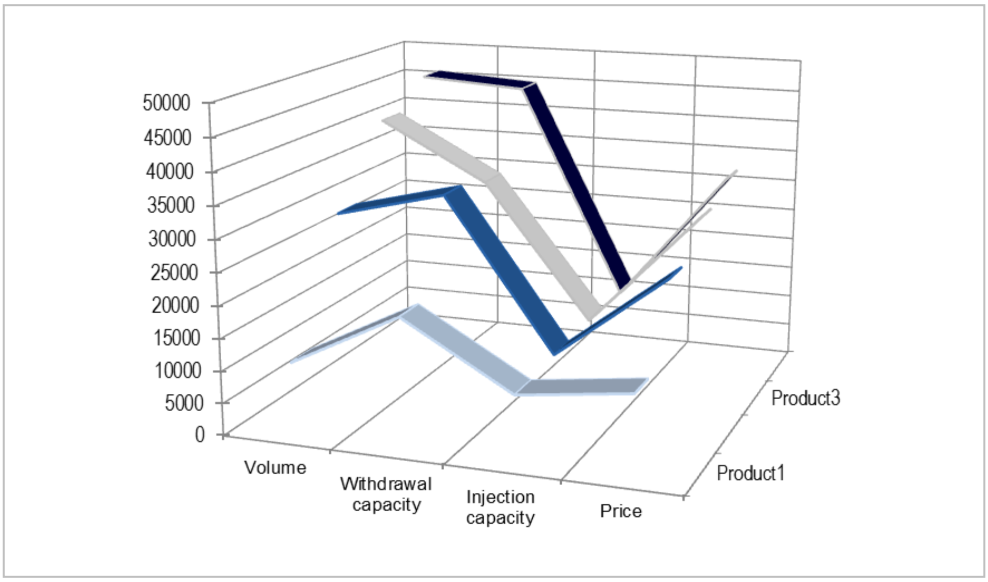
Fig. 3.B.37 : Figures for porous storage products (non firm service, without transport fees)

Storage type	Nation	Product Name	Volume kWh	Withdrawal Capacity kWh/h	Injection Capacity kWh/h	Price €
depleted	*BEL*	Product 1	*1000*	*35*	*35*	*40*
depleted	GER	Product 2	*12000*	*24*	*7,2*	*136*

B.11.1.3 : Products for salt caverns, with firm service and without transport fees

For products related to salt caverns and for firm service, without transport fees and with withdrawal curve, the criteria are also very scattered except for the 4 products of a German companies (each product being site specific) (see Fig. 3.B.38).

Fig. 3.B.38 ● comparison of product 1 to product 4 for salt caverns and firm service



N.B. : injection capacity x 1000, withdrawal capacity x 1000, price x 100

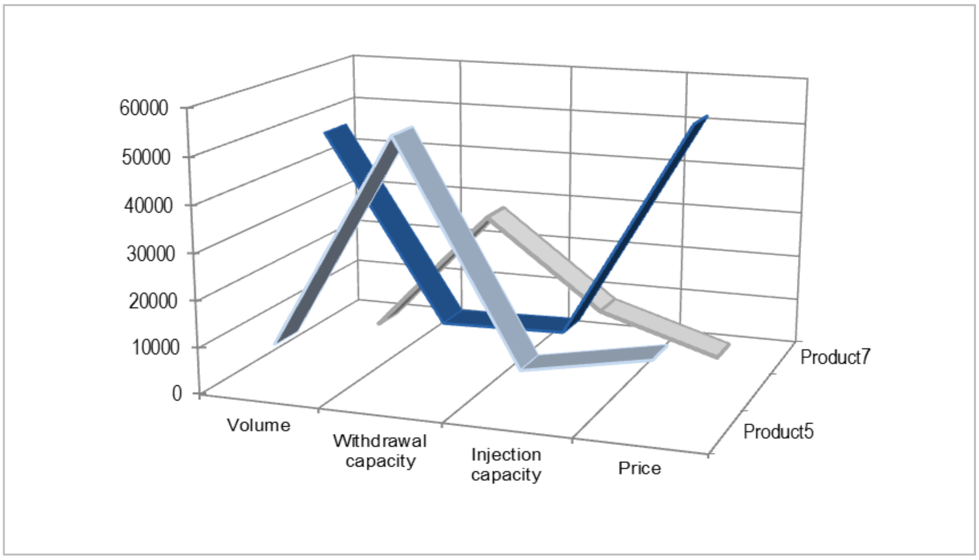
All figures for salt cavern storage products (for firm service, without transport and with withdrawal curves) are collected in Fig. 3.B.39.

Fig. 3.B.39 : Figures for salt cavern storage products (firm service, without transport fees)

Storage type	Nation	Product Name	Volume kWh	Withdrawal Capacity kWh/h	Injection Capacity kWh/h	Price €
salt	GER	Product 1	10780	19,6	9,8	120,3
salt	GER	Product 2	29680	33,92	10,6	241,3
salt	GER	Product 3	41329	32,39	11,17	293,2
salt	GER	Product 4	45920	44,8	11,2	320,8

The characteristics of 3 products offered by one French company (a multi site product) and for 2 German companies are represented below (see Fig. 3.B.40).

Fig. 3.B.40 ● comparison of product 5 to product 7 for salt caverns and firm service



N.B. : Volume are divided by 100

However, in the case of salt cavern, there is less spread of data between offered service as the salt cavern can be more standardized than depleted fields or aquifers.

All figures for salt cavern storage products (for firm service, without transport and with withdrawal curves) are collected in Fig. 3.B.41.

Fig. 3.B.41 ● Figures for salt cavern storage products 5 to 7 (firm service, without transport fees)

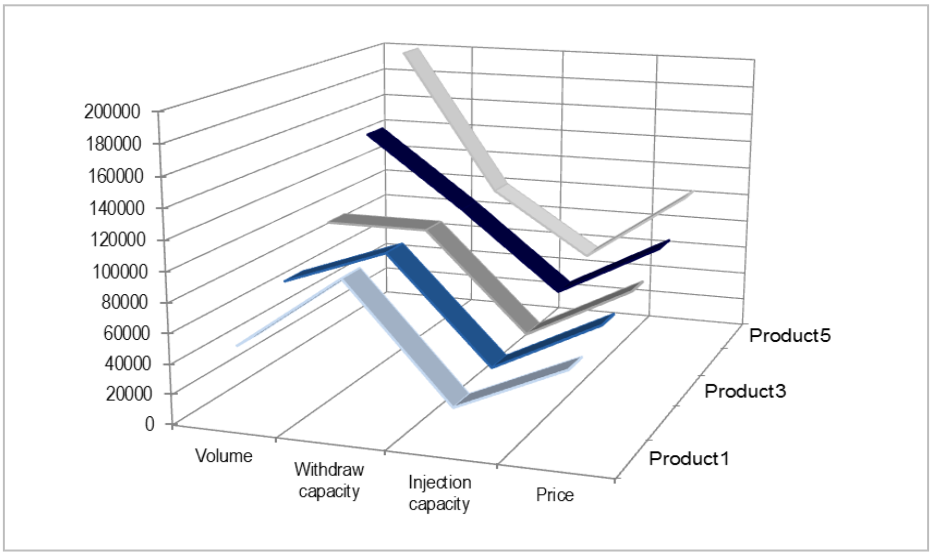
Storage type	Nation	Product Name	Volume kWh	Withdrawal Capacity kWh/h	Injection Capacity kWh/h	Price €
salt	*FRA*	Product 5	*1000000*	*55556*	*10000*	*14950*
salt	GER	Product 6	*5000 000*	*10000*	*2500*	*56640*
salt	GER	*Product 7*	*12100*	*27709*	*8228*	*191*

Product 7 could have been also compared with products 1 (see Fig. 3.B.38) as its volume is quite comparable to the volumes of products 1 to 45 but its withdrawal and injection capacities are more comparable to those of products 5 to 7.

B.11.1.4 : Multi-site products (for salt caverns and for depleted fields) with firm service and without transport fees

When comparing 5 products of one German company (products which seem not related to site but on a group of sites, depleted and / or salt caverns), each criteria clearly appears to be well distributed (also for products related to for firm service, no transport fees incl., and incl. Withdrawal curve)(see Fig. 3.B.42).

Fig. 3.B.42: comparison of 5 multi site products for salt caverns or for depleted fields and for firm service



N.B. : In the graph above, Volumes are divided by 100, injection and withdrawal capacities are multiplied by 10

All figures for 5 multi-site products for salt caverns or for depleted fields and for firm service, without transport fees and with withdrawal curves) are collected in Fig. 3.B.43.

Fig. 3.B.43 : Figures for 5 multi site products for salt caverns or for depleted fields and for firm service

Storage type	Nation	Product Name	Volume kWh	Withdrawal Capacity kWh/h	Injection Capacity kWh/h	Price €
Salt cavern	GER	Product 1	5000000	10000	2500	56640
Salt cavern and depleted field	GER	Product 2	7500000	10000	3000	65355
Salt cavern and depleted field	GER	Product 3	10000000	10000	3330	69711
depleted field	GER	Product 4	15000000	10000	4550	82782
depleted field	GER	Product 5	20000000	10000	5560	104567

As a conclusion, SBUs and corresponding prices vary a lot from storage to storage. Both within and across markets , the products are not set in accordance to overall market needs but are more a product of the technical and physical specifics of the storage.

As a result, the products offered by the storage operators are very different regarding the flexibility needs of shippers, that generally expect to see storage operators offering several products. However, shippers can sometimes buy SBUs from different operators in the same market area, if they exist.

B.11.2 : If your company publishes information on the services you offer, please specify the web-address below

Links for accessing the websites are collected in Fig. 3.B.44.

Fig. 3.B.44 : list of links to websites

• www.omv.com / products / natural gas / gas storage / Products	Austria
• http://www.fluxys.com/en/Services/Storage/StorageModel/StorageModel.aspx	Belgium
• http://www.rwe-gasstorage.cz/en/clients-section/	Germany
• www.eon-gas-storage.com	Germany
• www.eon-thueringerenergie.com	Germany
• www.rwegasspeicher.com	Germany
• www.storengy.de	Germany
• www.speicherportal.vng.de	Germany
• www.energinet.dk	Demark
• http://www.enagas.es/cs/Satellite?cid=1146232320370&language=en&pagename=ENAGAS	Spain
• www.storengy.com	France
• www.tigf.fr /	France
• www.psp.hr	Croatia
• http://www.eon-foldgaz-storage.hu www.mmbf.hu	Hungary
• www.stogit.it	Italy
• www.osm.pgnig.pl	Poland
• www.gazprom.ru	Russia

B.12 : Physical restrictions of storage service

B.12.1 : What are the essential physical restrictions of your storage service offered ?

The essential physical restrictions of offered services were compared:

- rest period;
- obligation to employ working gas;
- required min or max flows;
- Number of storage cycles per year;
- Maintenance duration;
- Refill requirements.

All proposed types of physical restrictions were considered by responding SSOs.

Moreover, among all physical restrictions in storage services, “maintenance duration” and “required min or max flows” are most often quoted whatever the type of storage (depleted field/aquifer or salt cavern) and whatever the type of offer (bundled/unbundled, firm /interruptible) is (see Figs. 3.B.45 to 3.B.50)

Fig. 3.B.45 ● Physical restrictions for bundled service (firm and interruptible) for salt caverns :

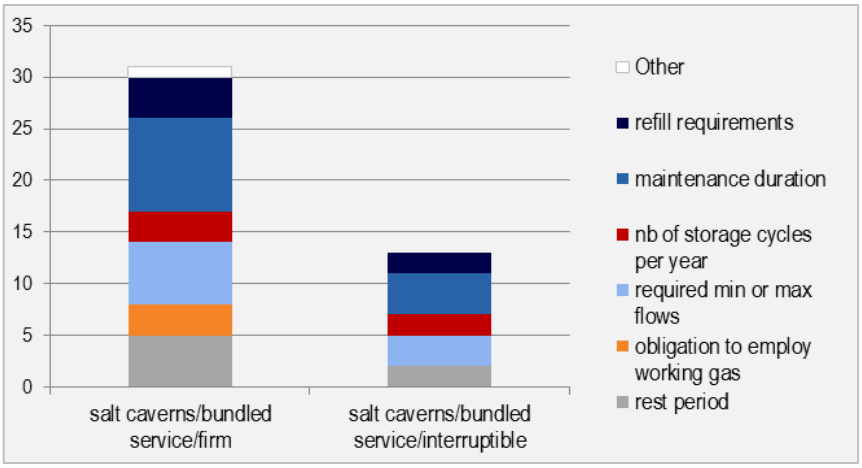
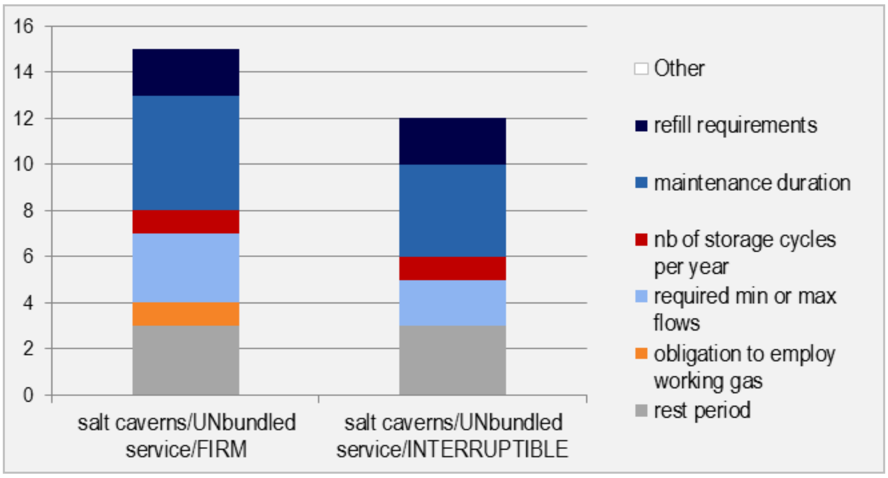


Fig. 3.B.46 ● Physical restrictions for unbundled service (firm and interruptible) for salt caverns



For salt caverns, SSOs answered “Other” making comments collected in Fig. 3.B.47

Fig. 3.B.47 : comments about other types of physical restrictions for salt caverns

• the case of maintenance periods which are published in advance in the internet (Germany);	Germany
• And the refill of requirements according to mining authority restrictions (Germany).	Germany

Fig. 3.B.48 ● Physical restrictions for bundled service (firm and interruptible) for aquifers or depleted fields

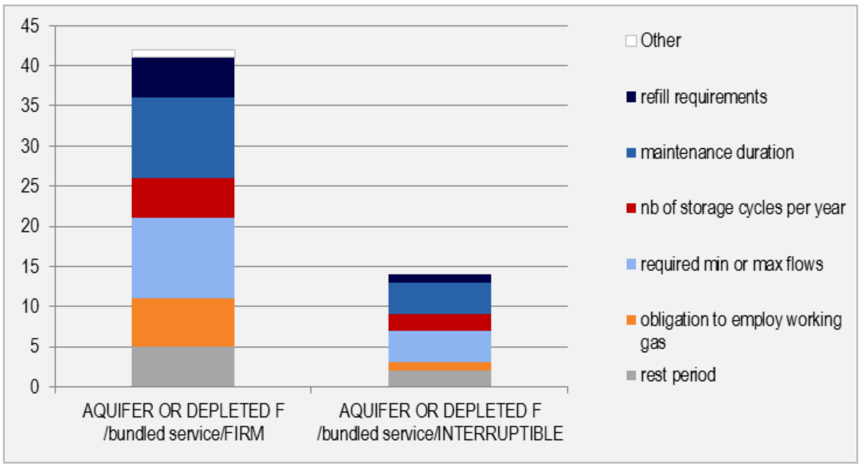
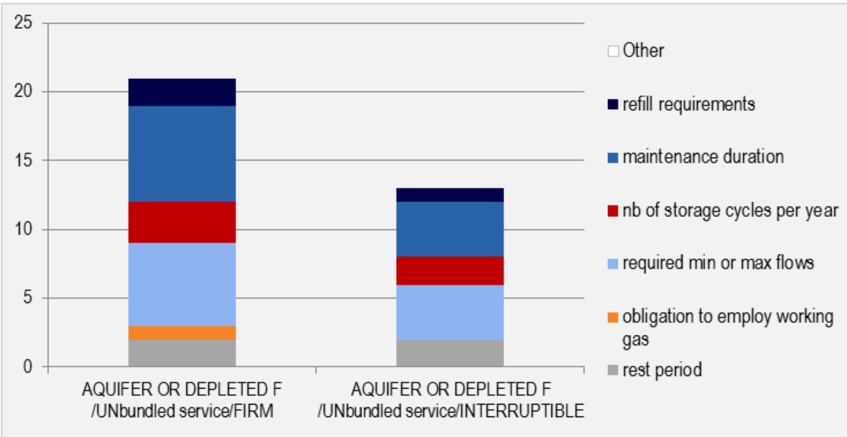


Fig. 3.B.49 ● Physical restrictions for unbundled service (firm and interruptible) for aquifers or depleted fields



For depleted fields or aquifers, SSOs answered “others” and made comments collected in Fig. 3.B.50.

Fig. 3.B.50 : comments about other types of physical restrictions for depleted fields or aquifers

• UGS technological indicators are projected accounting for physical restriction	Russia
• maintenance periods are published in advance in the internet. Refill requirements according to mining authority restrictions	Germany

B.12.2 : If you have any further comments to the question on physical restrictions

Additional comments about physical restrictions were reported by SSOs and are collected in Fig. 3.B.51.

Fig. 3.B.51 : Other comments about physical restrictions

• physical minimal and maximal flow restrictions and possible rest periods are avoided for customers by aligned measures within the storage facilities and in cooperation with related TSO	Germany
• Rest period only in case of volume expansion Min. fill volume by 1 November and 15 February (to guarantee security of supply and withdrawal capacity)	Belgium
• Rest period: Dynamic offer: 115 days, Equilibrium offer: 106 days Obligation to employ...: TIGF have temporal constraints on working gas with a minimum and a maximum level everyday Required minimal or maximal flows: No minimum flow - Maximum flow related to withdrawal and injection curves Nb of storages cycles: 1 cycle per year Maintenance duration: planned maintenance (max 15 days) is available online Refill requirements: Shippers must respect temporal constraints as well as injection curves	France
• Maintenance duration is yearly 10-14 days, but storage sites are not all at the same time out of operation	Hungary
• 3.35 Additional: In case of salt caverns - rest period of the facility at a maximum working gas level, please specify below (2 weeks) - required min or max flows, please specify below (technical capabilites) - No. of storage cycles per year (1 storage cycle per year. User decides on the number of storage cycles) - Maintenance duration e.g periods, days/year (2x2 weeks) - during the rest pperiod at maximum & minimum working gas levels (bundled services, firm, interruptible) unbundled services, firm, interruptible) In case of depleted fields and aquifers - rest period of the facility at a maximum working gas level(2 weeks) - required min or max flows(technical capabilites) - No. of storage cycles per year (1 storage cycle per year) - Maintenance duration e.g periods, days/year (2x2 weeks) - during the rest period at maximum & minimum working gas levels (bundled services, firm, interruptible) unbundled services, firm, interruptible)	Poland

B.13 : Type of Capacity Allocation Mechanisms (CAM)

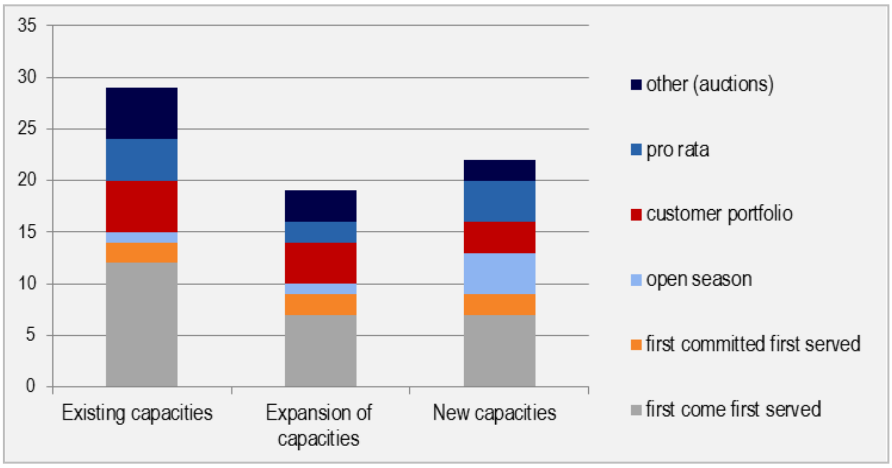
B.13.1 : What are the capacity allocation mechanism applied ?

The use of the various Capacity Allocation Mechanisms was assessed in the following cases:

- First come first served;
- First committed first served;
- Open season;
- Customer portfolio;
- Pro rata.

The main capacity allocation mechanism applied is |"first come first served" for existing capacities, for expanded capacities or less for new capacities (see Fig. 3.B.52).

Fig. 3.B.52 ● Capacity Allocation Mechanism



SSOs answered “Other“ making comments which are collected in Fig. 3.B.53.

Fig. 3.B.53 : Comments about Capacity Allocation Mechanism

• Rule 1 : "following clients portfolio" If remaining capacity, "pro rata"	Belgium
• Auction	Czech Rep., Denmark, Spain
• In general, click & book system (first committed first served); in some cases auctions, first come first served or other mechanisms (e.g. priority of longer term bookings) are applied	Germany
• (a) Bilateral negotiation, • (b) Auction	Germany
• According to the National Grid Code there is a capacity booking priority for registered consumers and TSO. The remaining demands are satisfied on pro rata.	Hungary

B.13.2 : Specify if there is an order of priority and for which customers

Comments about orders of priority were reported by SSOs and are collected in Fig. 3.B.54.

Fig. 3.B.54 : Comments about orders of priority for Capacity Allocation Mechanism

Existing capacities	Expansion of capacities	New capacities
Auctions first (Denmark)		
Firstly TSO for balancing purposes, secondly registered (i.e. domestic) capacities, thirdly all other demand (Hungary)		
According to the National Grid Code there is a capacity booking priority for registered consumers and TSO. The remaining demands are satisfied on pro rata.(Hungary)	According to the National Grid Code there is a capacity booking priority for registered consumers and TSO. The remaining demands are satisfied on pro rata.	According to the National Grid Code there is a capacity booking priority for registered consumers and TSO. The remaining demands are satisfied on pro rata.
residential customers first (Italy)	residential customers first	residential customers first
yes (TSO+obligatory gas reserves+current client) (Poland)	yes (TSO+obligatory gas reserves+current client)	yes (TSO+obligatory gas reserves+current client)

B.13.3 : If changes, regarding CAM, please provide :

- your favoured procedure that should be applicable to SSOs in your country:

- your preference on how to allocate capacities most suitable

Comments about favoured procedures and preference on how to allocate capacities were reported by SSOs and are collected in Fig. 3.B.55.

Fig. 3.B.55 : Comments about favoured procedures for Capacity Allocation Mechanism

Preferences	Reasons	Country
first come - first served	fastest reaction time	Austria
In line with market need		Belgium
first committed, first served	most convenient for customers in combination with web-based booking system	Germany
	Current CAM is suitable for current market conditions.	Hungary
Auction	transparency	Hungary

B.14 : Type of Congestion Management Procedures (CMP)

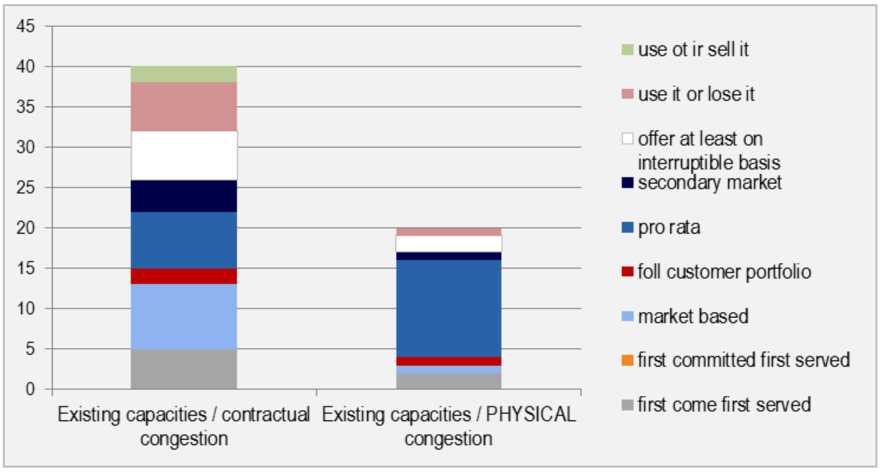
B.14.1 : In case of congestion, what kind of principle are applied ?

The different case of principles applied in case of congestion were assessed:

- Use it or sell it;
- Use it or lose it;
- Offer at least on interruptible basis;
- Pro rata;
- Following customer portfolio;
- Market based;
- First committed first served;
- First come first served.

This assessment was made both in case of contractual and physical congestion and for existing, expanded and new capacities (see Fig. 3.B.56).

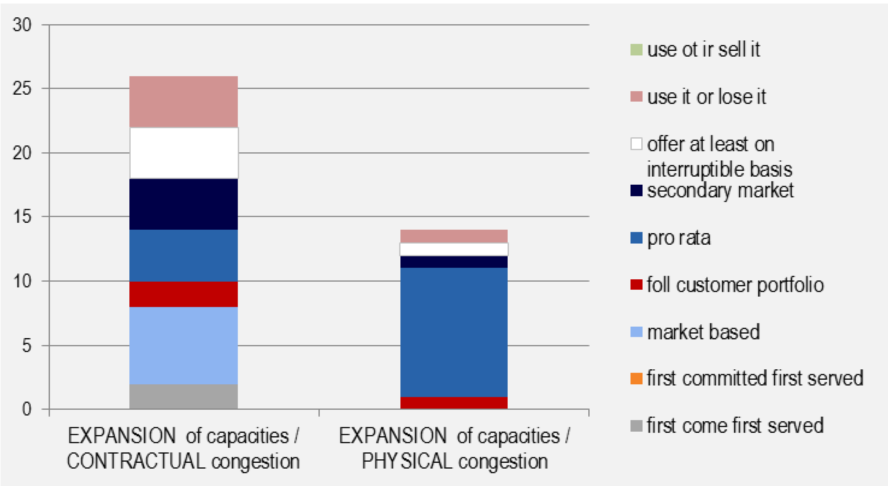
Fig. 3.B.56 ● Congestion Management Procedures for existing capacities



In the case of existing capacities, “pro rata” is mostly applied for physical congestion.

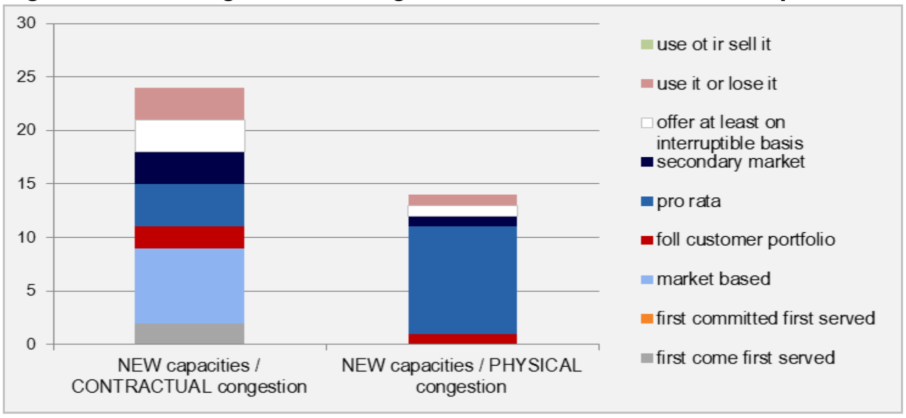
For contractual congestion, all principles are applied except “first committed first served” (see Fig. 3B.57).

Fig. 3.B.57 ● Congestion Management Procedures for expanded capacities.



For expansion of capacities, the same comments can be made as above for existing capacities (see Fig. 3.B.58).

Fig. 3.B.58 ● Congestion Management Procedures for new capacities.



For new capacities, physical congestion is also mainly treated by "pro rata" principle and contractual congestion by all principles except "first committed first served", but with a major use of "market base" (auction, open season,…) principles.

As a comment, Spain stated having not experienced physical congestion.

B.14.2 : Specify if there is an order of priority or combination of principles

Comments about orders of priority or combination of principles were reported by SSOs and are collected in Fig. 3.B.59.

Fig. 3.B.59 : Comments about orders of priority for Congestion Management Procedures

• In case of physical congestion: first interrupted are interruptible customers followed second ranking firm customers (	Germany
• Auction to highest price	Germany
• Auction first	Denmark
• TSO and portfolio	France
• TSO (for balancing purposes) then secondly registered (i.e. domestic) capcities are preferred	Hungary
• TSO, obligatory gas reserves and current clients (also for expansed and new capacities).	Poland

The TSO priorities seem to be taken into account well.

B.14.3: If changes regarding CMP are planned, provide :

- **your favoured procedure that should be applicable to SSOs in your country and**
- **reasons for your preference on how to manage congestion most suitable**

Comments about favoured procedures and preference on how to manage congestion were reported by SSOs and are collected in Fig. 3.B.60.

Fig. 3.B.60 : Comments about favoured procedures for Congestion Management

Preferences	Reasons
For contractual congestion: offer interruptible services For physical congestion: pro rata (Austria)	
Market based (e.g. auctions) principles : use it or sell it , use it or lose it (Germany)	Market based procedures reflect fair market value for newly offered capacities. Use it or sell it is the market based procedure to reduce contractual congestion. Only if this does not work, use it or lose it is to be applied
	Current CMP is considered as suitable (Hungary)
	SSO Website (www.osm.pgnig.pl)

B.15 : Secondary trading

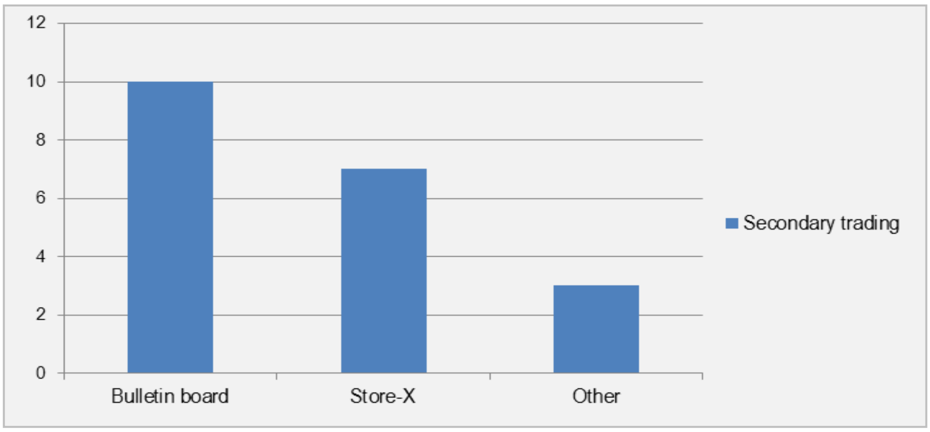
How do you facilitate secondary trading of storage capacity ?

This question was asked by suggesting 3 answers:

- Bulletin board
- Store-X
- Other

Results are collected in Fig. 3.B.61.

Fig. 3.B.61 ● Secondary trading facilitation



Bulletin board is mostly preferred to Store-X.

Others tools mentioned by SSOs are collected in Fig. 3.B.62.

Fig. 3.B.62: Other tools for secondary trading.

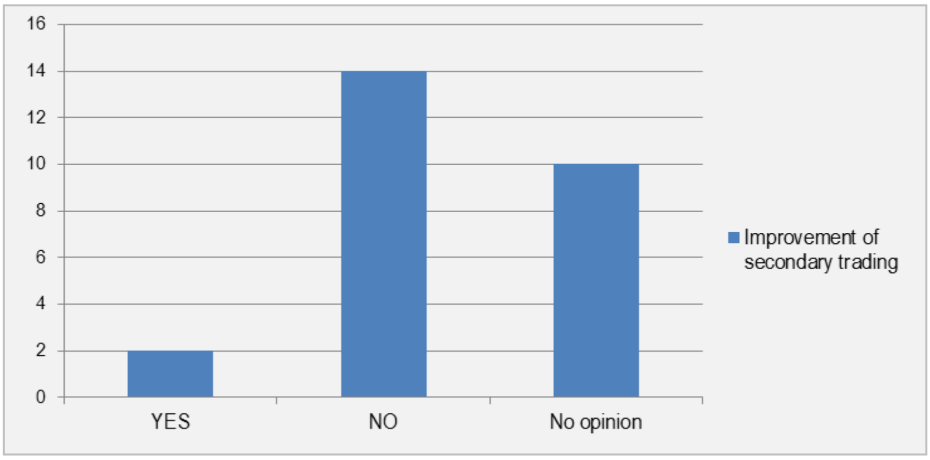
• ad hoc secondary market IT platform	Italy
• SSO Website (www.osm.pgnig.pl).	Poland

B.16 : Trends

B.16.1 : Do you take the view that SSOs could further improve and support secondary trading ?

Opinions about improvement of secondary trading were reported by SSOs and are collected in Fig. 3.B.63.

Fig. 3.B.63 ● Opinions about improvement of secondary trading



There are a clear majority of SSOs considering there are no possible further improvement and support for secondary trading.

B.16.2 : If yes please describe in detail your suggestions you have on this

Two suggestions are made by SSOs and collected in Fig. 3.B.64.

Fig. 3.B.64 : Suggestions about improvement of secondary trading

• UIOLI is planned to be implemented	France
• To enable the use of Store-X	Hungary

B.16.3 : If no, explain why you take this view

The reasons of SSOs for considering there are no possible improvement are collected in Fig. 3.B.65.

Fig. 3.B.65 : Reasons why there is no possible improvement of secondary trading

• Secondary trading up to storage users. SSO can only provide a platform	Czech Rep.
• Store-x is already very well organized for secondary trading	Germany
• UGS owned is to small to improve secondary trading	Germany
• As in Germany there already exists a well known and regularly used trading platform for storage capacities, there is now need for an individual SSO to set up an own platform. It's better to concentrate the potential market interest on one platform where transparent market prices are established by supply and demand;	Germany
• secondary trading is part of gas trading business, SSO can only provide the current level framework conditions	Germany
• no publication on bulletin board only OTC transactions	France
• The current methods are suggested by the consumers and applied by the SSOs	Hungary

B.16.4 : Due to planned changes regarding legal transparency requirements on storage data within European gas markets, please state your opinion on what could be effective within the scope of transparency on storage data and provide reasons for

Opinions on what could be effective within the scope of transparency on storage were reported by SSOs and are collected in Fig. 3.B.66.

Fig. 3.B.66 : Opinions of SSOs about transparency requirements:

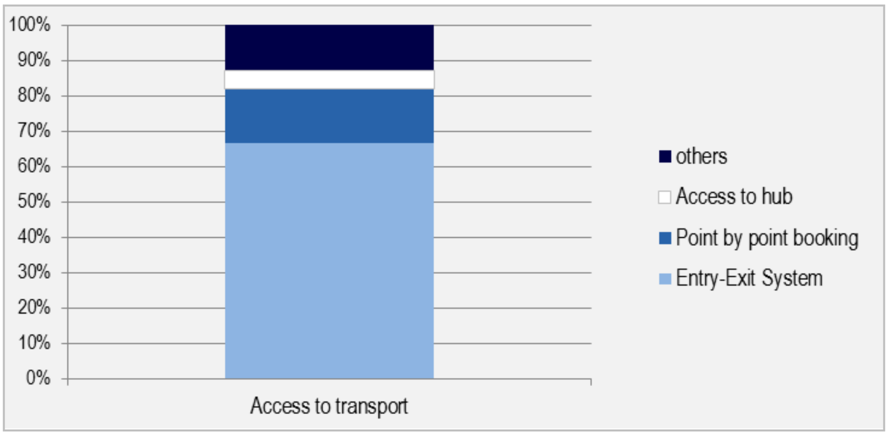
• Current & planned transparency requirements are fully sufficient, no additional requirements necessary	Austria
• National transparency requirements go far beyond the third package so we don´t see any reason for changes	Czech Rep.
• Current level of transparency is sufficient	Germany
• Company(ies) already implemented on line publications such as : -On a weekly basis : level of storage (aggregated), Injected quantities (aggregated), Removed quantities (aggregated) Rate of volume used Rate of injection capacity used Rate of withdrawal capacity used. - On a daily basis : Marketable capacities for current year and the last 3 years; Booked capacities for current year and the last 3 years ; Available capacities for current year and the last 3 years; Planned maintenance and impact for current year and the last 2 year	France
• Regulation prescribes our traffic data to be gathered automatically and published by the TSO. It is not recommended cost, capex, opex data to be made more accessible than the balance sheet or the income statement. However, creating a benchmarking pool would possibly be supported	Hungary

PART C : Access to transmission network (from questionnaire completed by storage companies and National Regulatory Authorities)

C.1 : Access to transmission capacities regarding existing storage capacities – C1.1 : specify the predominant access regime to transport capacities in your country

Among access regimes, "Entry-Exit System" is used almost at 70% and then "Access to hub" or "Point by point booking" much less. Entry-Exit system is preferred probably as it is much simpler and flexible (see Fig. 3.C 1).

Fig. 3.C.1 ● Predominant access regime to transport capacities



When responding "Other", SSO made comments which are collected in Fig. 3.C.2.

Fig. 3.C.2 : other procedures for access to transport capacities

• regulated by the Russian Government decree on providing access to independent organizations to Gazprom's gas transmission system	Russia
• Capacity allocation with priority according to different classes of supply contracts and pro-rata in case of congestion	Italy
• post stamp	Croatia
• virtual Hub	Italy
• Currently point by point, with implementation of the new market model on the basis of 3rd package entry/exit	Austria
• post stamp	Bulgaria
• There are no gas storages inf Finland also gas markets are not opened.	Finland
• Finland has not implemented TPA on the basis of a right to derogation in the gas market directives.	Finland
• negotiated access/reg. tariffs	Latvia
• not in place in SR	Slovakia

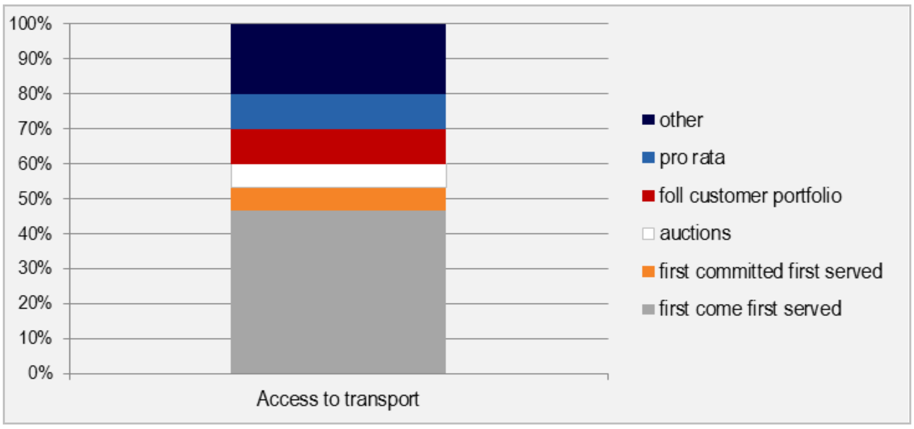
C.1.2 : On which basis, access to the transmission system is allocated for holders of existing storage capacity ?

The proposed basis for access to the transmission network were:

- First come first served
- First committed first served
- Auctions
- Customer portfolio
- Pro rata

The access to the transmission system is mainly (almost 50%) offered to holders of storage capacities on the basis of “first come first served” process (see Fig. 3.C 3).

Fig. 3.C.3 ● access to the transmission system for holders of existing storage capacity



Comments of SSOs or NRAs answering “Other” are collected in Fig. 3.C.4.

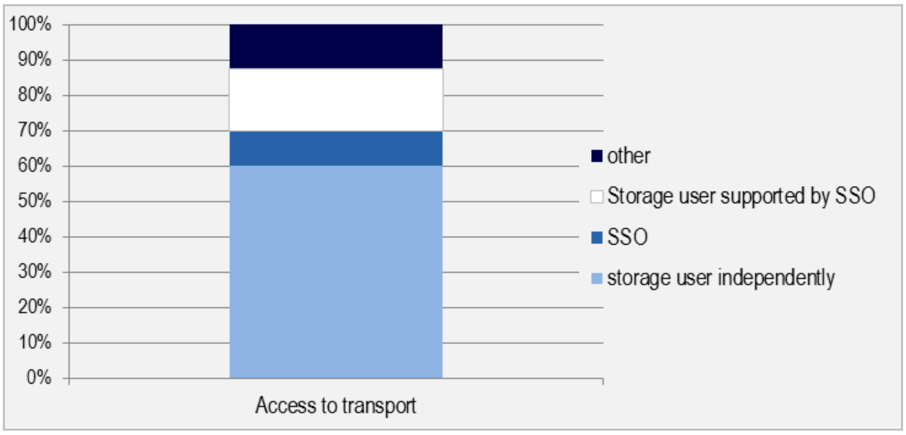
Fig. 3.C.4 ● other procedure for access to transmission system

• Capacity matching at TSO/ISO IP	Belgium
• Automatical allocation	France
• Open Subscription Period	Portugal

C.1.3 : Who books storage related to transport capacities ?

The storage users are booking transport capacities independently in 60% of cases (see Fig. 3.C 5).

Fig. 3.C.5 ● Parties booking transport capacities.



Comments of SSOs or NRAs answering “Other” are collected in Fig. 3.C.6.

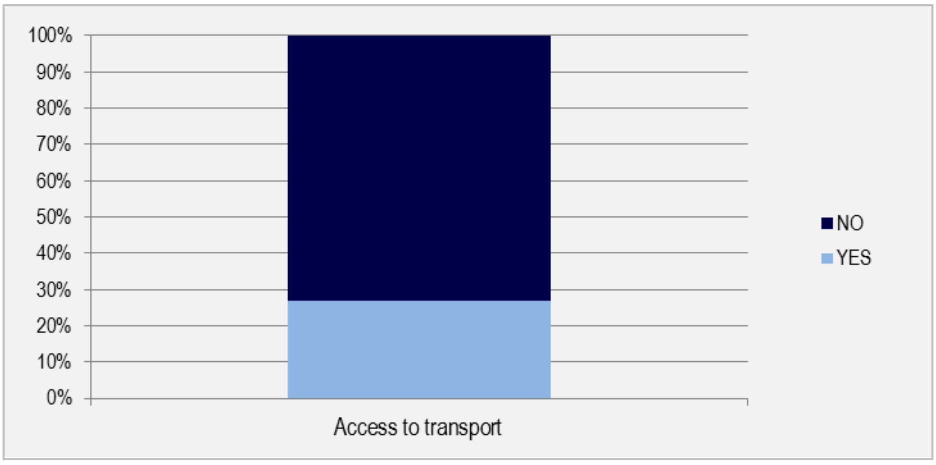
Fig. 3.C.6 ● Other parties booking access to the transmission system

• SSOs can be also TSO;	Spain
• The Network users book transport capacities	Belgium
• The storage users book capacity (application is given via head of the balance group)	Croatia
• The TSO book transport capacities	France
• Storage user book transport capacities but under entry-exit system, it is carried out by the SSO;	Austria
• The Network users book transport capacities	Romania

C.1.4 : Priority rules : are any provisions in place to grant storage users storage related to transport capacities ?

There are most often (75%) no provisions in place to grant storage users storage related to transport capacities cases (see Fig. 3.C 7).

Fig. 3.C.7 ● Priority rules.



If yes please describe briefly below ?

Descriptions of SSOs or NRAs are collected in Fig. 3.C.8.

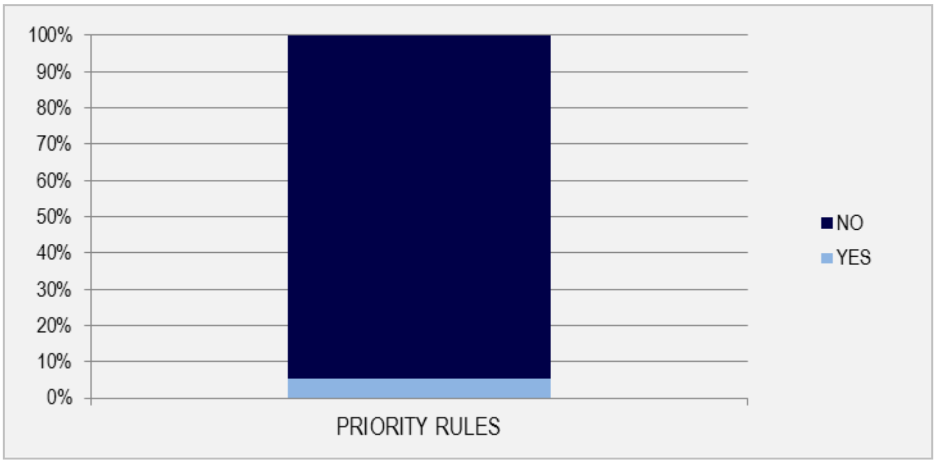
Fig. 3.C.8 : description of provisions to grant storage users storage related to transport capacities

• Only in case of crisis for the strategic storage stocks	Hungary
• per contractual provisions	Romania
• Minimum existences by law	Spain

C.1.5 : priority rules : is any provision/regulation or change planned in the future to grant storage users storage related to transport capacities?

There are very few cases in which changes are planned (see Fig. 3.C 9).

Fig. 3.C.9 ● provision/regulation or change planned in the future to grant storage users storage related to transport capacities.



There are very few cases in which changes are planned.

If there is any provision/regulation or change planned in the future to grant storage users storage related to transport capacities, describe briefly below which process is used

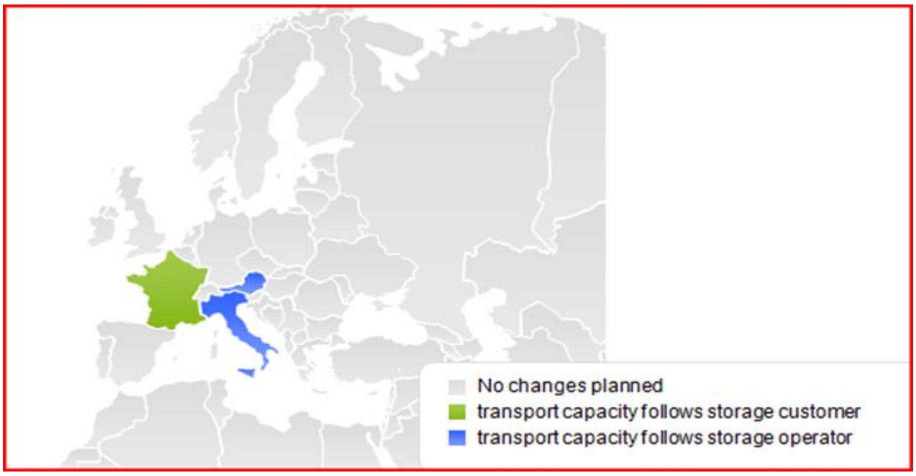
Most of SSOs or NRAs did not answer this question (see Fig. 3.C 10).

Fig. 3.C.10 ● provision/regulation or change planned in the future to grant storage users storage related to transport capacities

There are also countries where transport capacities should follow storage operators.

The map (Fig. 3.C.11) shows these evolutions.

Fig. 3.C.11 ● map of change planned in the future to grant storage users storage related to transport capacities



When SSOs and NRAs answered "other", they expressed comments which are collected in Fig. 3.C.12.

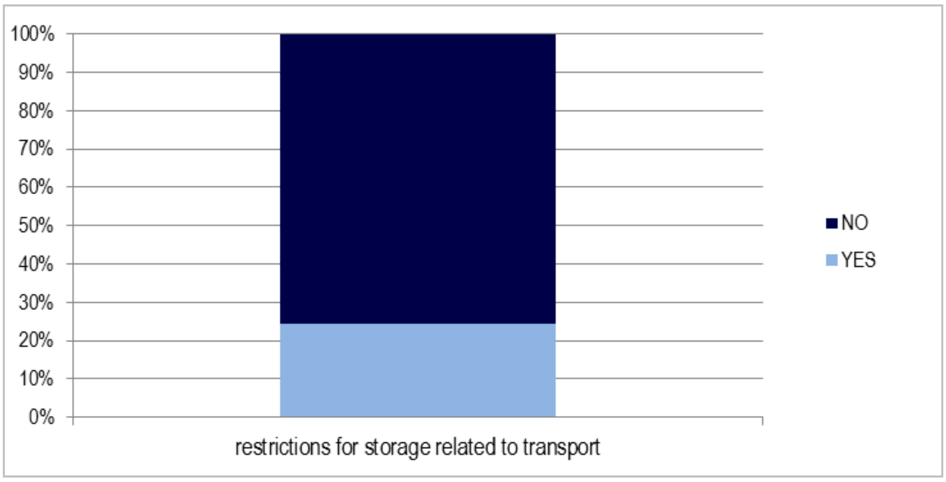
Fig. 3.C.12 : other provision/regulation or change planned in the future to grant storage users storage related to transport capacities

• There is an ongoing consultation by the NRA to allocate transport capacity directly to SSO instead of storage users	Italy
• in the future it shall be possible to book storage and transport capacities by the SSO	Austria

C.1.6 : Are restrictions related to access / usage for storage related to transport capacities in place ?

There are only 25% of cases in which restrictions for the access or usage for storage are related to transport capacities (see Fig. 3.C 13).

Fig. 3.C.13 ● restrictions related to access / usage for storage related to transport capacities in place



If yes, please describe briefly which restrictions are in place

The proposed restriction regime for access to the transmission network were the following :

- Seasonal or customer profile requirements;
- No restrictions, but (partly) interruptible;
- Obligation to deliver national customers;
- Obligation to deliver a defined group of customers;
- Obligation to deliver protected customers (i.e. household customers);
- Other solutions (please specify).

Major restrictions used are :

- Seasonal or customer profile requirements;
- No restrictions, but (partly) interruptible;
- Obligation to deliver protected customers (see Fig. 3.C 14, Fig.3.C.15 and Fig.C.16).

Fig. 3.C.14 ● descriptions of restrictions related to access / usage for storage related to transport capacities in place

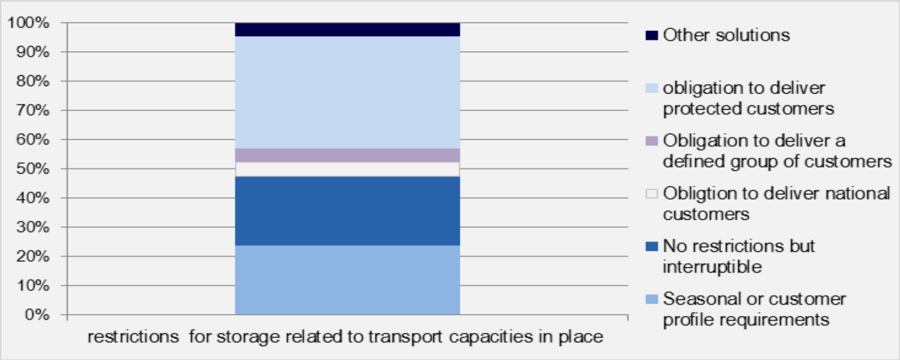
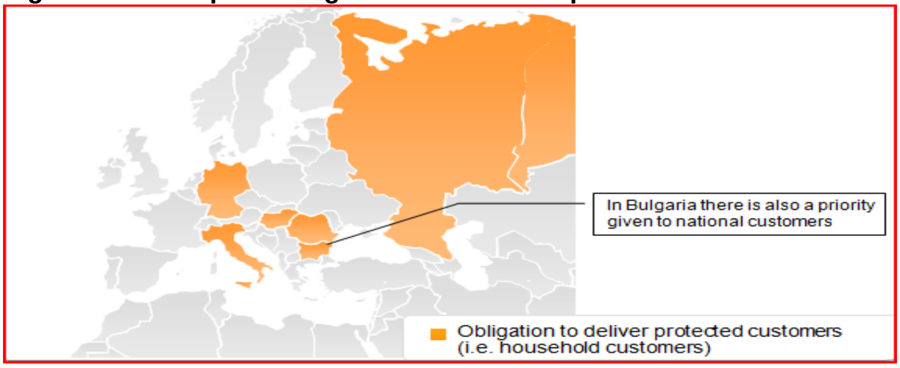


Fig. 3.C.15 ● map for seasonal or customer profile requirements

Fig. 3.C.16 ● map for obligation to deliver to protected customers



Only one SSO answered “other” and expressed the following comments :

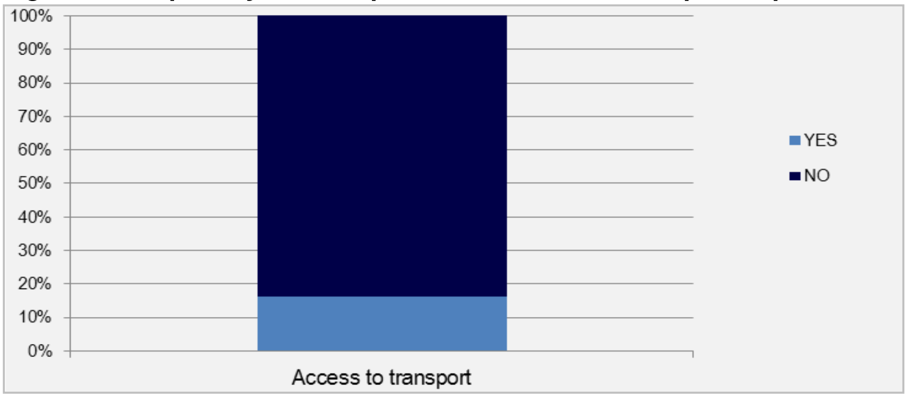
• some ENTRY/EXIT points are congested	Germany

C.2 : Access to transmission capacities regarding expansion of storage and new storage

C.2.1 : Priority rules : are provisions in place to grant storage users storage related to transport capacities

There are most often (85%) no provisions in place to grant storage users storage related to transport capacities (see Fig. 3.C 17).

Fig. 3.C.17 ● priority rules in place for access to transport capacities



If yes please describe briefly below

SSOs and NRAs made some descriptions which are collected in Fig. 3.C.18.

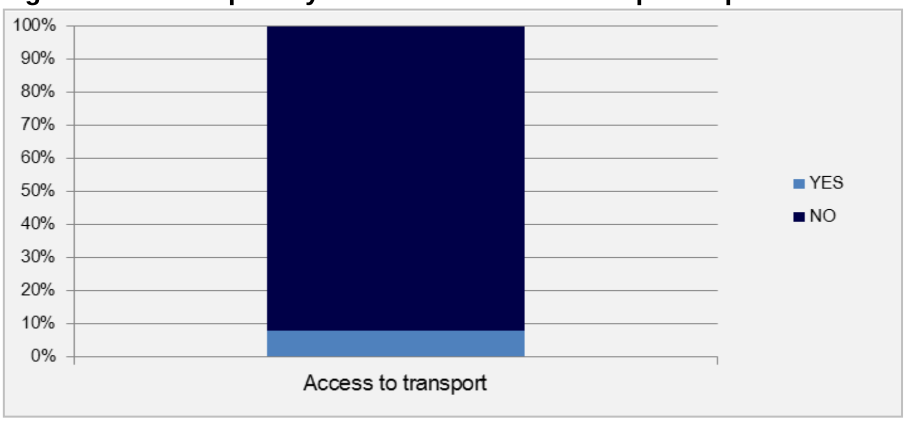
Fig. 3.C.18: description of provisions for access to transport capacities

• Capacity matching at TSO/ISO IP	Belgium
• Process parameters of UGS expansion and UGS under construction are coordinated with transmission capacities	Russia
• Storage capacities imply transportation capacities	France
• Minimum existences by law	Spain

C.2.2 : Priority rules : are any new provisions/regulation or change planned to grant storage users storage related to transport capacities ?

There are very few case (<10%) in which changes are planned (see Fig. 3.C 19).

Fig. 3.C.19 ● new priority rules for access to transport capacities



If yes, please describe briefly which Provisions/obligations

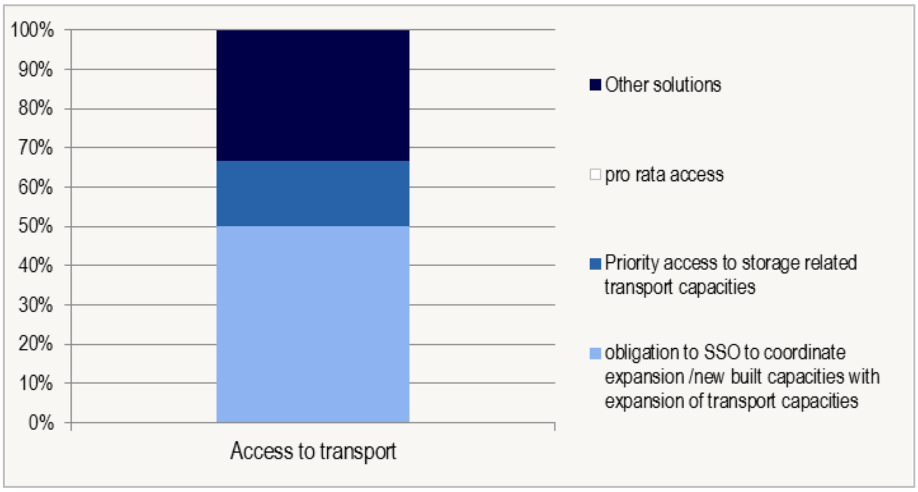
The proposed provisions or obligations for access to the transmission network were the following :

Obligation to SSO to coordinate expansion / new build capacities with expansion of transport capacities;

- Priority access to storage related to transport capacities;
- Pro rata access;
- Other solutions or combinations (please specify).

The main obligation is addressed to SSO. No pro rata access is used for this purpose (see Fig. 3.C 20).

Fig. 3.C.20 ● provisions/regulation or change planned to grant storage users storage related to transport capacities



One SSO answered "other solutions", and made the following comments :

• SSO shall request the according expansion of the transmission system.	Austria

C.3: General comments to the access to storage related transport capacities

C3.1: Did you observe problems/congestion related to access to or availability of transport capacities for storage capacities ?

In 13 cases, SSOs reported that there were no problems or no complaints received so far and that there was no congestion for existing or planned storages (new storage interconnection capacity defined ex-ante between SSO and TSO) or related to input or send-out flows to (or from) storage facilities.

SSOs and NRAs reported comments which are collected in Fig. 3.C.21.

Fig. 3.C.21: comments about problems/congestion related to access to or availability of transport capacities for storage capacities

• Transport capacities may not allow transportation of existing storage capacities at all times	Germany
• TSO show little interest to improve availability of transport capacities for storage needs as regulatory focus is elsewhere	Germany
• No	Hungary, France, Belgium, Denmark, Spain, Russia and GB
• No problems	Hungary
• Limited available transport capacity limits the scope of services we can provide	Czech Rep
• Yes, we do have following Problems with ENTRY/EXIT transport capacities: - congested - fees are too high/expensive - drawback in competition with alternative flexibility sources due to high ENTRY/EXIT fees - In general we question the appropriateness	Germany
• yes, congestion in transport capacities take place on our storage sites	Germany
• No congestion for existing or planned storages (new storage interconnection capacity defined ex-ante between SSO and TSO	Italy
• No complains received so	Croatia
• storage cannot be used within country, as there is no transport connection; it is a long termed process to get this connection, driven by demand	Austria
• Problems/congestion have not been observed	Ireland
• We didn't observe, until now, any congestions related to input or send-out flows to (or from) storage facilities	Portugal

C.3.2 : Please leave your general remarks or opinions/suggestions you might have

SSOs and NRAs reported comments which are collected in Fig. 3.C.22.

Fig. 3.C.22 : general remarks or opinions/suggestions

• To 3.53 EnWG amendment regulates expansion obligations related to transport capacities, but SSO has to take the risk for under utilization (Germany);	Germany
• Finland has derogations from opening gas markets as long as the Finnish gas network is not directly connected to the interconnected system of any other Member State and having only one main external supplier (as it is today). There are no gas storages in the country;	Finland
• Access conditions to transmission networks related to storage capacities are not in place in Slovak Rep.;	Slovak Rep.
• There is enough transport capacity in place (Romania);	Romania
• We didn't feel the need to implement bundled capacity products (Transmission network/storage facilities (Portugal);	Portugal
• Latvia derogation from the Gas directive	Latvia

Conclusion :

Chapter 3 was aimed at describing the organization of the market in some of the European and Central Asian countries.

The objective was not to draw out guidelines or recommendations from the data collected, but to provide data in their most expressive figures and to provide them in the most useful way. When possible, specific comments and analysis were developed directly from the information available.

The number of questions and representations (graphs, tables, …) of corresponding answers also make available to all players of the storage market (SSOs, TSOs, shippers, power producers, regulators…) a huge amount of information on all following aspects :

A : Legal requirements

- Main lines of Regulation framework : Organization of Third Party Access, exemption and price regulation;
- Status of Capacity Allocation Management (CAM);
- Status of Congestion Management Procedures (CMP);

B :Storage contracts

- Public Service Obligation (PSO);
- Strategic stock obligation;
- Ownership stucturation in companies;
- Exemption to Third Party Access (TPA);
- Contract duration;
- Physical restrictions : CAM and CMP mechanisms;

C : Access to the transmission system.

The whole collected data provide a clear overview regarding methods which are designed and used by SSOs regarding their legal obligation.

But the major information provided by this questionnaire is mainly focused:

- on existing **CAM & CMP** practices;
- on the status of **TPA regime, PSO, Strategic stocks, exemption**,…

Due to the amount of data collected on this item, CAM & CMP procedures can be considered as the central part of the Chapter 3.

In general CAM & CMP are considered crucial for avoiding market distortions or barriers to market entry in order to develop a competitive gas market. As CAM & CMP procedures that can be applied are an important determinant of the business model for access to storage, and therefore for economic optimization and efficient use of storage capacity on both long term and short term contracts, it is important to bring forward the SSOs and NRAs practical experience from CAM & CMP.

As for storage products, the study shows that most storage operators offer only specific SBU to the market. This might create a relatively transparent market, although different storage operators often use varying calibrations of their products, i.e. their bundles offered are not of the same size in terms of volume. That makes it more difficult to compare products.

SBUs vary a great deal from storage to storage. Both within markets and across markets the products offered are very different. This could be an indication of the fact that storage products are not set in accordance to overall market needs but are more likely a product of the technical specifics of the storages. That is, if the variety of products offered by the storage operators were a testimony to big differences in flexibility requirements of the shippers in the market, one would expect to see storages within the same region offering several products. Thus, the differences in products could be attributable to the fact that storage products are offered in alignment to the technical restrictions of the storage facilities with no or very little consideration to what the market may, in fact, require or demand.

Shippers may have quite different needs for storage flexibility depending on their individual demand/supply portfolio; e.g. some shippers may cater to households that use natural gas for heating and therefore require greater flexibility, while others may have a supply portfolio containing mostly imported gas or mainly industrial consumers requiring less flexibility.

Thus shippers in order to optimize their storage portfolio may have to buy storage products from different operators or alternatively they can buy it all from one operator and buy/sell necessary/excess capacity on secondary markets. Neither solution however is optimal because storage products bought from several storage operators may entail higher transaction and administrative costs for the shipper, and possibly additional transportation costs. It may not even be possible to find storage operators within geographical vicinity that can accommodate the shipper.

Regarding a secondary market for gas storage capacities, the market very often lacks the necessary liquidity.

If storage capacities are sold mainly in predetermined bundles, this may be an entry barrier for market players, who due to perhaps relatively small portfolios are somewhat subject to having certain types of customers which may require a different combination of storage capacities than those offered via the SBU.

Allowing any possible combination of withdrawal, injection and volume capacity to be sold, i.e. abandoning the idea of offering storage products in SBUs and selling each capacity individually, could naturally cause a less than optimal utilization of storage capacity, because storage operators would risk ending up with spare capacities. The use of SBUs is actually one of the recommended practices in the GPSSO. The advantage of SBUs is that products are more comparable and that storage operators are ensured that they always have a saleable product to offer, i.e. no missing capacities.

However, it is possible to combine the benefits of both systems.

Even if the questionnaire was not fully completed by NRAs and by SSOs, most representative nations and companies in the storage business were fulfilling the questionnaire and the output of this Chapter which is presented as aggregated data can be used by NRAs, companies and any other international body (IGU, GSE, IEA…).

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CHAPTER 4

Planned UGS / Projects Data Request

By Mr. M. Sandu, (Romgaz) with support of Mr.Gheorghe Radu(Romgaz) and Ms A. Brandenburger (RWE Gasspeicher)

Introduction

This chapter presents the proposed storage facilities in the UNECE region. The need for more storage in Europe goes hand in hand with advancement of gasification. It is evident that the need for new storage will be greatest where new gasification occurs. Underground gas storage has achieved a high level of development. There are currently 606 UGS facilities in the world with the working gas capacity of more than 300 bcm.

The globalization process implies more and more provisions regarding energy security, especially in the oil and gas sector, where the main activity is that of gas underground storage. Because of the increasing dependence (reaching over 30 per cent on single source) of EU countries, and taking into consideration the recent crisis (Russia-Ukraine dispute in January 2009) this should be the right moment to set, agree and issued a common integrated policy and to launch a strategic program of urgent measures to evaluate the impact (negative consequences)-risks analysis arising from geopolitical factors. Such program should include:

- Strategic UGS – national and regional with minimum strategic volumes to ensure consumption for a certain number of days, performance withdrawal rates to cover the lack of import sources up to demand levels;
- LNG terminals connected with UGS;
- Connections between UGS and national grids and transit pipelines.

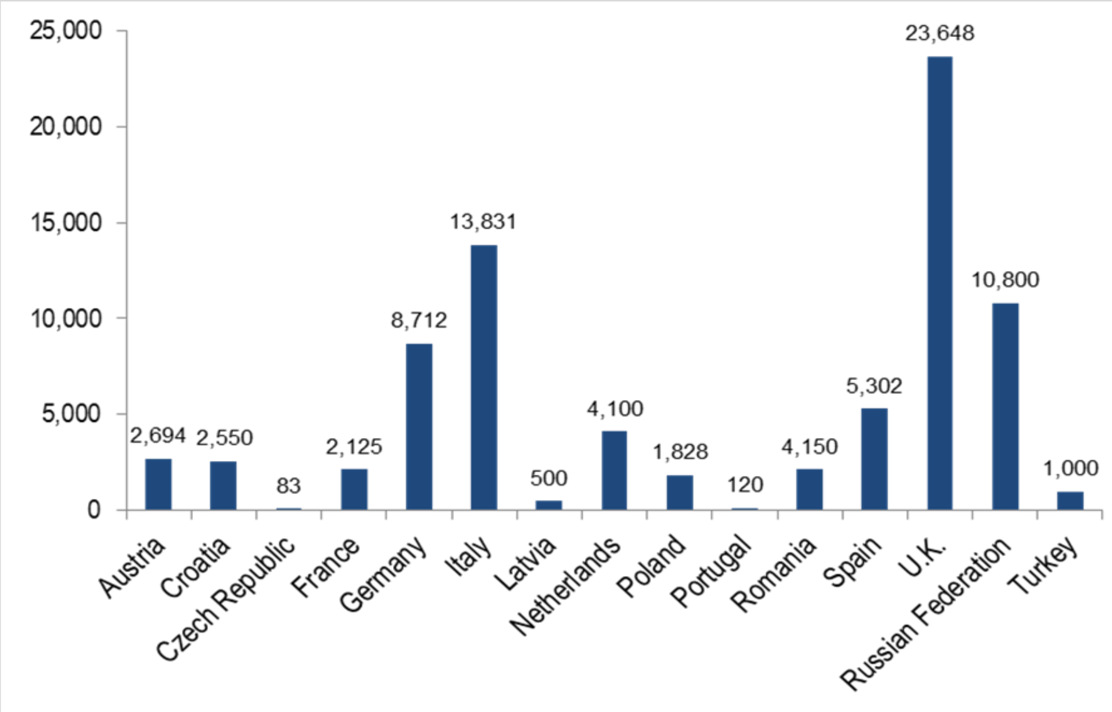
The development of gas storage capacity and flexibility is meant to increase the security of gas supply to consumers under crisis conditions, and contribute to the key issue of setting up an energy strategy.

Under these circumstances, the underground storages are currently used mainly for:

- Covering the peak consumption and the fluctuation of demand;
- Pipeline system balancing;
- The delivery control in extreme situations (technical accidents, supply interruption etc.) – emergency backup.

Therefore, in addition to the traditional function, counterbalancing the source and consumption, the storages have to support the entire chain of activities, starting from sources – production up to the final users. Gas storages should be used as a support during the low consumption periods, for mature reservoirs, especially for natural gas reservoirs that need to have an uninterrupted production process. Likewise, the gas storages connected to the transmission systems, having several interconnections with national grids, may be used as an instrument for improving the operation (to maximize the flow capacity) of the transmission systems, a vital factor in ensuring the continuity of supply and the increase of the safety of the system, as previously detailed.

Fig. 4.1. ● Expected total capacity (Mcm)



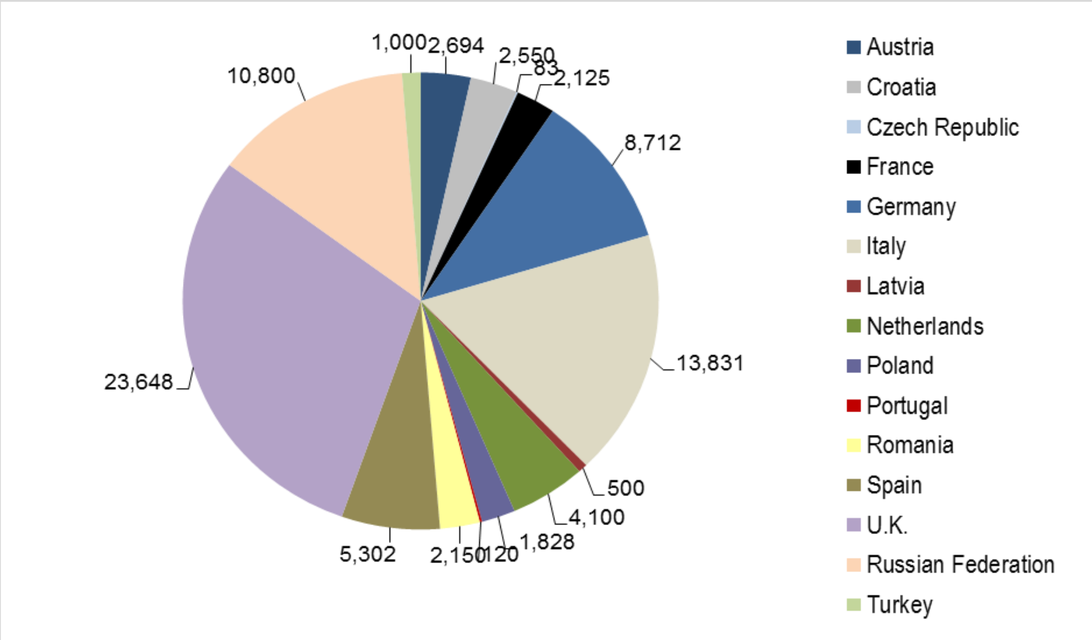
Source: UNECE UGS 2011.

General overview:

A total of 10 nations (Croatia, Czech Republic, France, Germany, Italy, Poland, Russian Federation, Spain, Turkey and UK) answered the UNECE questionnaire. The database was completed with information about 24 nations, provided by GSE Investment Database 2011, and GSE Storage Map Data 2012 with a total of 120 UGS facilities as follows:

- Aquifer – 7;
- Depleted fields – 59;
- Salt cavern – 46;
- LNG peak shaving – 8.

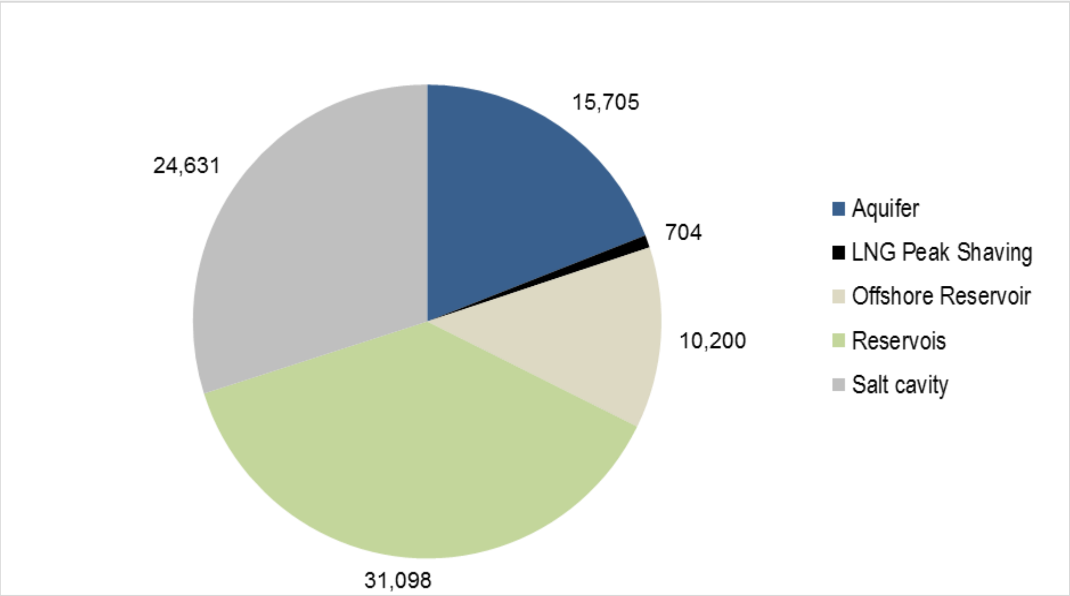
Fig. 4.2 ● Distribution of the total capacity by nation (Mcm)



Source: UNECE UGS 2011.

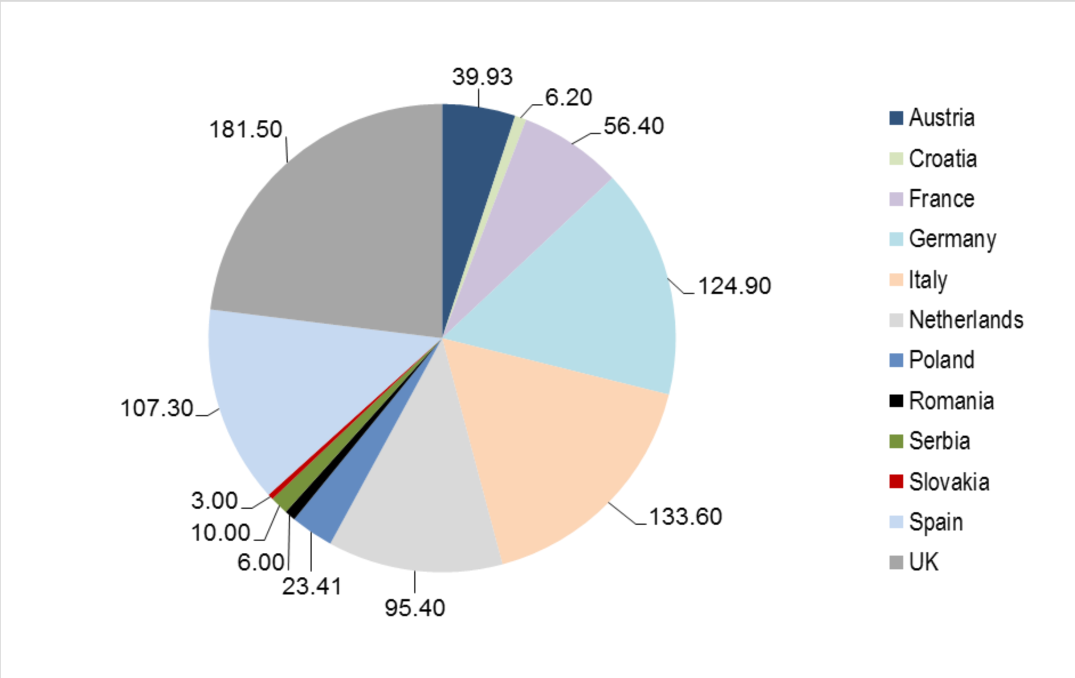
The total working capacity of the UGS's reported is around 70 bcm.

Fig.4.3 ● Expected capacity by type of the facilities (Mcm)



Source: UNECE UGS 2011.

Fig.4.4 ● Expected total deliverability (Mcm)



Source: UNECE UGS 2011.

Fig. 4.5 ● Expected reservoir capacities (Mcm)

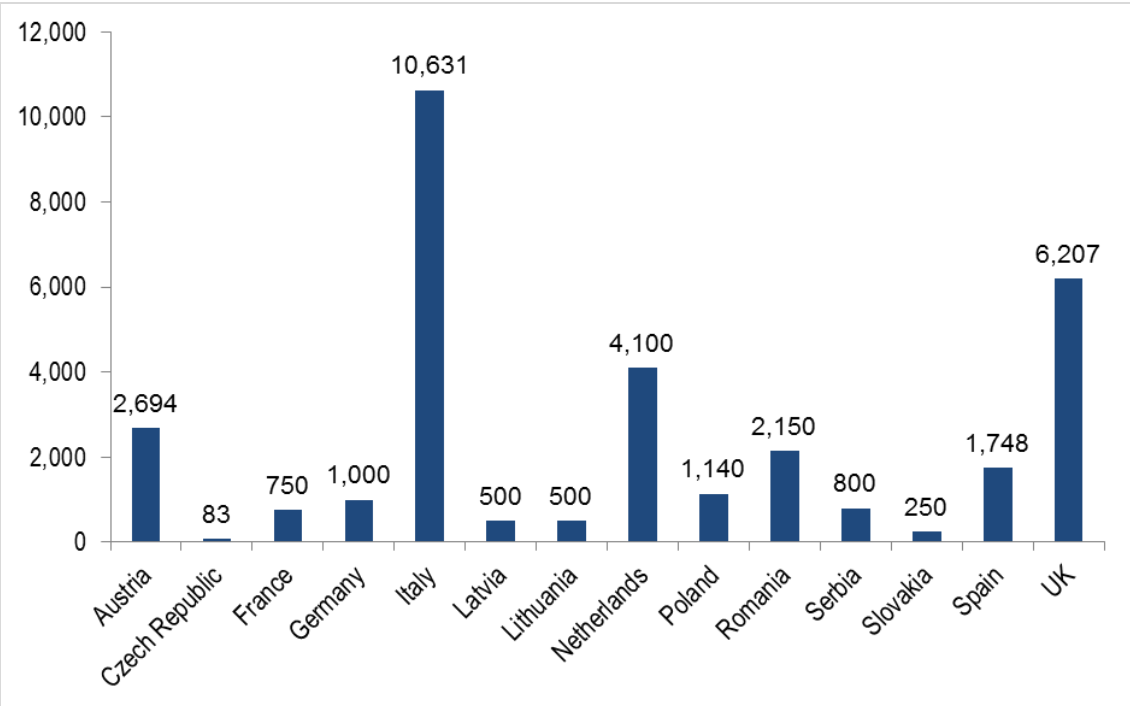
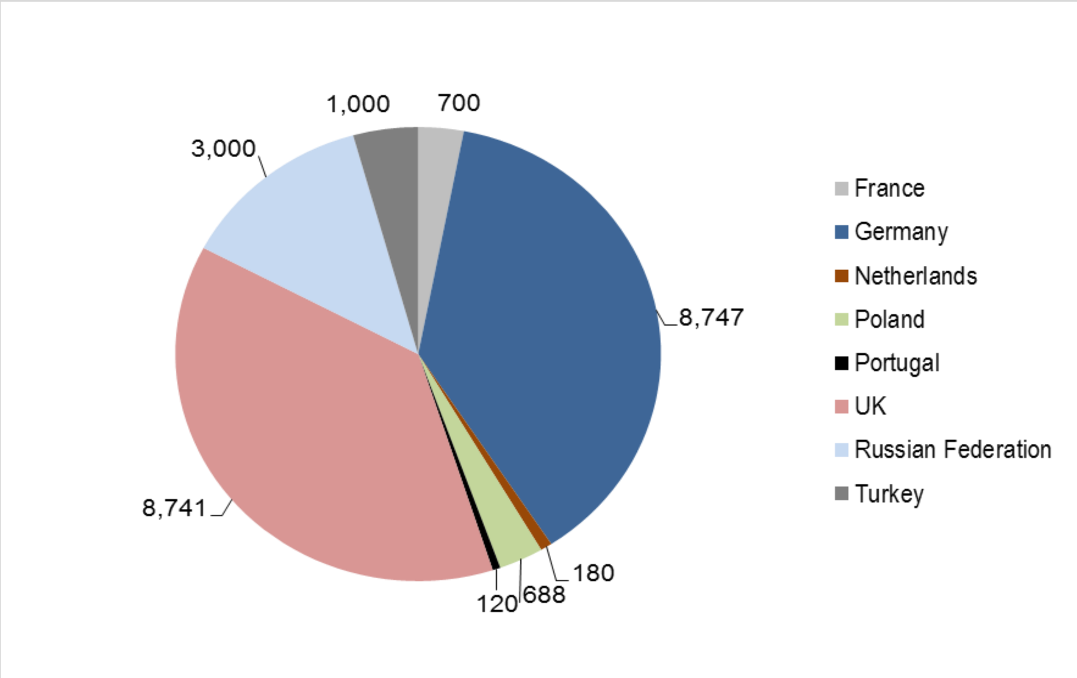
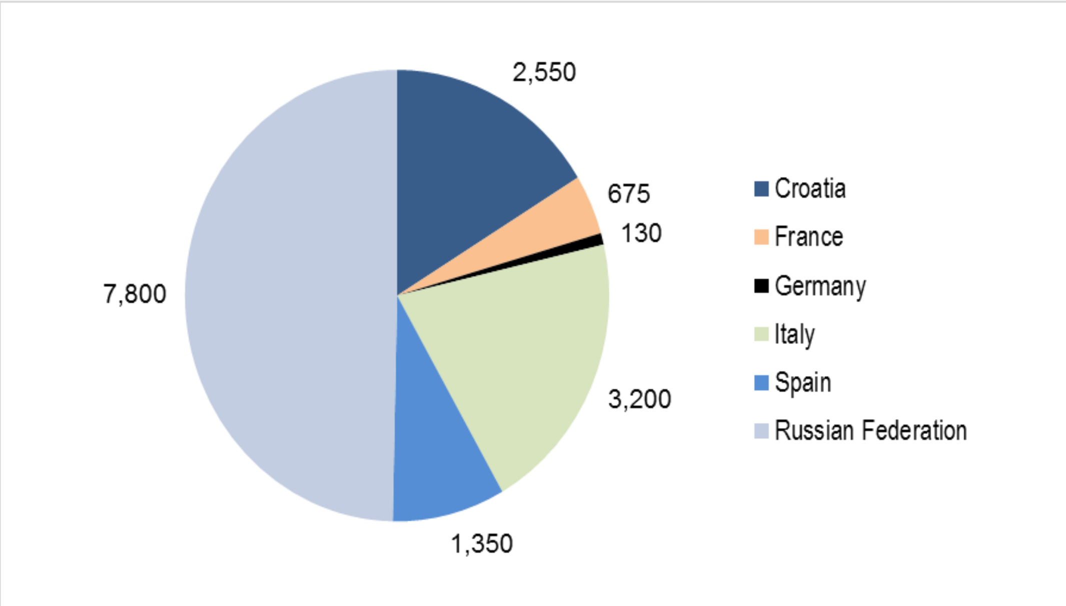


Fig. 4.6 ● Expected capacities on salt cavities (Mcm)



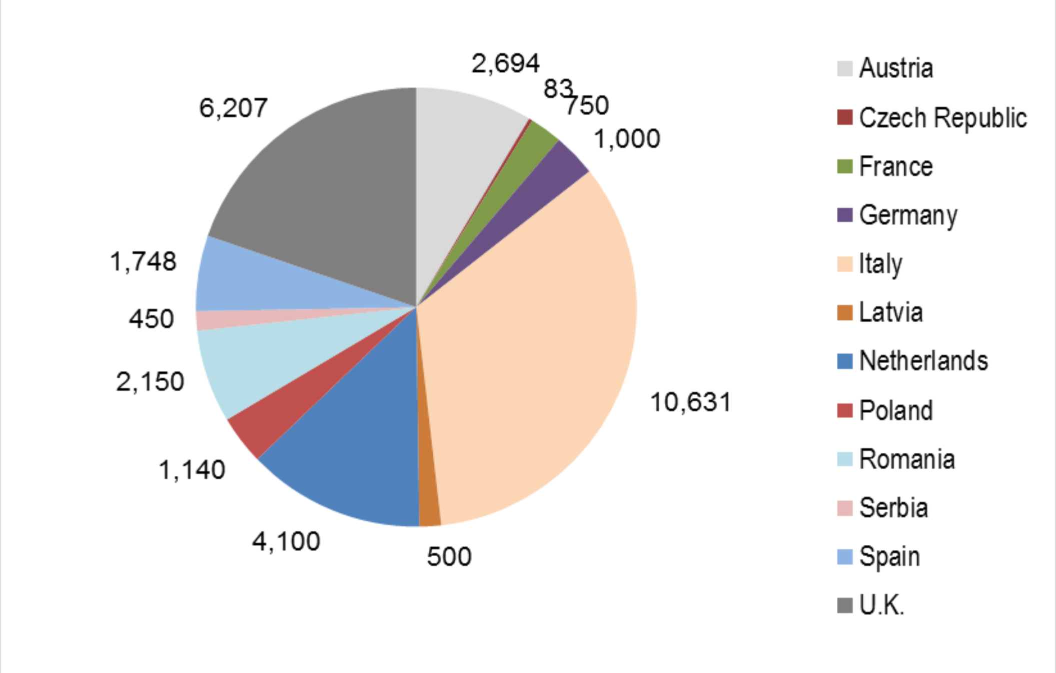
Source: UNECE UGS 2011.

Fig. 4.7 ● Expected capacities on aquifers (Mcm)



Source: UNECE UGS 2011.

Fig. 4.8 ● Distribution of expected reservoir capacities by nation (Mcm)



Source: UNECE UGS 2011.

1. Croatia

Intended construction of BENIČANCI facility with a deliverability of 8.256 million cubic metres per day and working gas volume of 510 million cubic metres. The volume of natural gas storage at Beničanci enables the possibility of storage for the neighboring countries of the region.

2. Czech Republic

Třanovice underground gas storage is located in Northern Moravia, 4-14 kilometres to the southwest from Český Těšín. The underground gas storage has been constructed in a former gas deposit. The entire deposit consists of four independent units - Nové pole, Západní pole, Čočka, and Staré pole. In 2009 – 2012, with the financial support of the European Union, the storage underwent vast modernization, including the extending of storing capacity to the total of 530 million cubic metres with a daily production capacity of up to 8 million m3. The increasing of storing capacity was achieved by utilizing previously unused geological structures and by reducing the minimal working pressure in the storage. During the modernization, ten new wells had to be drilled and five old ones renovated, the central area technologies had to be upgraded and four new compressors were installed. Both the newly drilled and renovated wells had to be connected to the central area of the storage, which is why 8.5 km of new pipelines was built and 5.5 of the existing pipelines renovated.

In order to carry out the overall modernization of the central area surface technology it was necessary, among other alterations, to fit new drying columns, install new transforming plant to increase the input power up to 1 MW, renovate the piping yard, build new microfilters and metering runs and purchase a set of gas air coolers.

3. France

France reported 7 proposed facilities with a total installed working gas volume of 1.87 bcm, 3 salt caverns and 2 aquifers (operated by Storengy), and 2 abandoned mines (operated by TIGF).

4. Germany

Germany reported 11 proposed facilities with a total installed working gas volume around 6 bcm, 10 salt caverns and 1 depleted gas field. About 60 per cent of the working gas is stored in storage reservoirs and some 40 per cent in storage caverns. At the end of 2010, there were more than 25 storage operators offering some 21 bcm of working gas. For a number of years, underground gas storage in Germany has been showing a strong upward trend with existing facilities – especially caverns – being expanded and new facilities being built. In Germany storage access is possible, with terms offered by various SSO such as BEB, EON Gas Storage, RWE, Wingas, EWE and others. However, utilising storage commercially is difficult for many players due to difficulties in gaining access to storage services. The rapid growth of gas trading, both on the GUD and NCG system, is likely to boost the use of storage as a trading tool and increase the demand for storage even further. In this context the auctioning of 5.75 TWh of working gas capacity by E.ON Gas Storage in 2009 is a promising start but further action is needed.

5. Italy

Italy reported one proposed facility in an aquifer with a total installed working gas volume of 3.2 bcm. The Rivara underground gas storage facility will open up a range of valuable commercial opportunities including gas balancing, gas trading and mitigating long-term take-or-pay constraints, as well as enhancing the country's security of gas supplies.

With a potential capacity of 3.2 bcm, Rivara could become one of Italy's largest and highest-performing gas storage facilities. It will be capable of storing both the company's own production and that of other gas producers and suppliers.

As well as being a major strategic asset in its own right, Rivara could also provide important leverage for the acquisition of additional value-adding E&P assets in the Mediterranean region as it provides a vital key to the high-value Italian gas market for producers outside Italy.

The key potential benefits of the Rivara storage facility are:

- the large capacity of the structure
- its expected very competitive unit costs
- its unique geological features which not only allow for faster injection and withdrawal than conventional gas storage facilities, but at near-constant peak gas deliverability throughout its annual operational cycle
- its potential to go a long way towards closing Italy's current storage deficit and meeting the growing demand for gas storage capacity in Italy
- its geographical location, in-market and close to a trunk-line intersection on the transcontinental "gas highway" and likely future Mediterranean gas trading "hub"
- its strategic value in a regional context

The Rivara project was granted a provisional long-term concession by Italy's Ministry of Economic Development (MSE) which is subject to completion of a satisfactory environmental impact assessment and final approval by MSE.

The project includes two phases that are consistent with the permitting process as defined by MSE (via its technical committee – the CIRM). A first phase of appraisal would allow the company to prove the technical parameters that form the basis for the project. This first phase would also confirm safety and feasibility parameters by way of a new 3D seismic survey, followed by drilling, logging and testing, for a planned investment of approximately EUR 20 million. Following this appraisal phase, and under the assumption that CIRM confirms a positive outcome, the project would proceed to a construction phase and an operational phase.

Currently there are 10 active storage fields in Italy, all of which are in depleted gas fields. The *working-gas* capacity is equal to 14.79 bcm, out of which 5.1 bcm is for strategic storage. The total storage capacity, which takes the cushion gas into account, is equal to 25.352 bcm. The

"Cornegliano" (1,3 bcm working gas) concession was released on 15 March 2011 to Ital Gas Storage Company Ltd.

6. Poland

Poland has won European Union approval to give euro 390 million ($478 million) to an energy company to expand the country's gas storage by 60 per cent - just as a new gas dispute between Russia and its neighbors threatens supplies. EU governments need regulators' permission to give large state handouts to companies. Poland wants to give the money to its state-owned oil and gas company PGNiG to increase gas storage to 1.6 billion cubic metres.

The Polish gas industry is largely dominated by PGNiG (Polish Oil & Gas Company), which is responsible for 98 per cent of gas production in Poland, and owns most of the transmission network.

The proposed storages are:

Facility name	Operator	Storage Capacity (mcm)	Withdraw (mcm/day)	Injection (mcm/day)	TPA*	Type
Moglino	PGNiG	422	..	..	R	Salt Cavern
Wierzchowice	PGNiG	625	10.8	7	R	Depleted Gas Field
Brzeznica	PGNiG	35	0.41	0.28	R	Depleted Gas Field
Husow	PGNiG	150	..	..	R	Depleted Gas Field
Strachocina	PGNiG	180	2.36	0.54	R	Depleted Gas Field
Kosakowo	PGNiG	250	9.6	2.4	R	Salt Cavern
Total		1662	23.17	10.22		

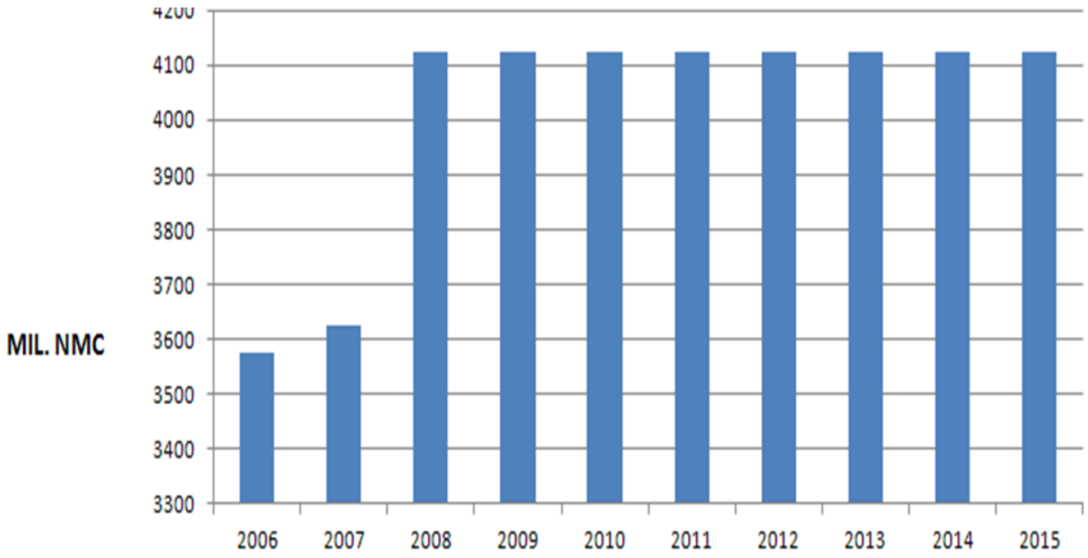
*TPA: Regulated (R) - Negotiated (N) - Hybrid (H) - Not Applicable (X)
Source: Gas Infrastructure Europe: GSE Storage Map 2011

7. Romania

Romgaz operates six natural underground gas storages of its own with total capacity of 4,375 bcm, working gas 3,06 bcm – to be developed up to 4.1 bcm, located:

- 2 in the Transylvanian Basin – Sarmasel (development from 0.8 bcm up to 0.9 bcm), Cetatea de Balta (0.2 bcm, working capacity);
- 4 in the extra Carpathian area – Bilciuresti (development from 1.3 bcm up to 1.4 bcm), Balaceanca (peck shaving buffer – 0.05 bcm), Urziceni (development from 0.25 bcm up to 0.5 bcm) and Ghercesti (development from 0.15 bcm up to 0.6 bcm);
- 2 deposits in association with other companies
    - Tg. Mures (development from 0.25 bcm up to 0.6 bcm) and Nadeş with Gaz de France Suez.

Fig. 4.9 ● Forecast of total UGS capacity until 2015



Source: UNECE UGS 2011.

The maximum withdrawal potential of the natural gas production in the 6 deposits operated by Romgaz at the beginning of the production cycle: 27,3 million. Scm/day + 2,5 milion Scm/day from UGS-s operated by Gdf Suez.

Considering the given European context where the Romanian gas industry performs its activities, and the current share of natural gas in the energy balance, it is estimated that in the future natural gas will represent one of the major primary energy sources in Romania.

We have often stated on several other occasions that, in Romania, natural gas is still the most important energy resource and will further hold a dominant position in economy.

This position is due to the following:

- The existence of important domestic resources and production;
- The transmission and distribution infrastructure, extended over the whole territory of the country;
- A favourable position in the international transmission system of Eastern and Central Europe;
- The existing transit through the Romanian territory to Bulgaria, Greece and Turkey – 3 pipelines of 28 bcm/year capacity;
- The possibility of interconnection, in the near future, to the West European system and West Balkans (Serbia, Croatia) to Italy, to the gas resources of the Caspian and Middle East region (to access at least two supply sources);
- The interconnection with Hungary - Szeged – Arad;

8. Russian Federation

Over 50 years an advanced underground gas storage system has been developed in the Russian Federation as part of the Unified Gas Supply System. There are currently 25 UGS facilities operational with 64.0 bcm of commercial gas (excluding long term reserves of more than 40.0 bcm) and 620 million cubic metres per day of potential peak send-out capacity as of the start of a withdrawal period.

The Russian Federation operates the world's largest Severo-Stavropolskoye UGS facility built in a depleted gas field and the Kasimovskoye UGS facility created in an aquifer with the total capacity of 24 billion cubic metres and 9 billion cubic metres respectively.

Underground gas storage is forecast to develop further in Europe and North America, as well as in Asia and South America. There are currently 36 expansion projects/existing UGS facilities modernization and 57 new projects under development or being scheduled for development in Europe and Central Asia up to 2015. 39 new promising projects are under consideration. It is planned to establish 3 UGS facilities with the total working gas capacity of 3 billion cubic metres in South America.

In spite of its present development to a mature industry, the UGS industry is however not static. Technical innovation triggered by competition is part of its day to day business, and results in a constant search for efficiency, for increased safety and environmental stability and for cost savings.

UGS designers and operators keep abreast of the latest technological developments – be they specific or derived from the E&P or the Information Technology- to adapt them into grass root projects or into the revamping of ageing facilities. The upgrading of existing facilities keeps in pace with present standards and performance requirement (particularly in terms of increased deliverability, flexibility, reliability, maintenance, operation management, data and knowledge management etc. aiming at improved economic efficiency) has been and is widely practiced by most operators as an ongoing process.

The Russian Federation UGS Development Strategy up to 2030 has been developed on the basis of global and Russian trends:

1. Maintaining the achieved level of UGS capacities by upgrading and replacing the obsolete and worn out facilities.

2. Increasing Russia's UGS daily send-out capacity with a relatively insignificant increase in the working gas capacity through:
   - expanding UGS facilities currently in operation;
   - constructing new UGS facilities (including peak shavers in salt caverns and LNG storages);
   - developing UGS capacities in deficit regions of Russia – the Northwest, Central, Urals, Siberian and Far Eastern Federal Districts.
   - developing the UGS system in conjunction with the long-distance gas pipeline system.

Another important direction of Gazprom's activity is accelerated development of UGS facilities in Europe. Nowadays, total capacity of UGS in Austria (Haidach UGS), Germany (Rehden and Bernburg UGS), France and Great Britain (Humbly Grove UGS) is about 2.5 billion cubic metres with the daily send-out capacity of 35 million cubic metres.

An agreement has been reached to launch a number of UGS facility construction projects in Europe, including: Bergermeer UGS facility in the Netherlands, Katharina UGS facility in Germany, Pusztafoldvar UGS facility in Hungary, Banatski Dvor UGS facility in Serbia, Damborice UGS facility in the Czech Republic, as well as Phase II of Haidach UGS facility in Austria. These projects are to make up the working gas capacity of 7.3 billion cubic metres in total with the daily send-out capacity of 100 million cubic metres by 2015. .

Conclusions and recommendations:

UGS development drivers in the world are presented below, and the main driver is that natural gas demand growth in the long run and considerable distance from areas of gas production to major consumption markets.

Worldwide natural gas demand is assumed to reach 3,300 billion cubic metres by 2020, which is a 1.4 per cent average annual increase. At the same time big gas provinces are becoming more distant from densely populated and industrial regions. There are, for example: 6,150 kilometres from Eastern Siberia fields to Saint Petersburg; 5,500 kilometres from Eastern Siberia fields to Moscow; 7,300 kilometres from Eastern Siberia fields to Berlin; 3,000 kilometres from Eastern Siberia fields to Vladivostok; 1,800 kilometres from Vladivostok to Tokyo; 1,500 kilometres from Shtokman field to Saint Petersburg; 2,150 kilometres from Shtokman field to Moscow; 2,950 kilometres from Shtokman field to Berlin; 10,000 kilometres from Shtokman field to Tokyo (marine route); 2,700 kilometres from Yamal peninsula fields to Moscow.

To date the average gas transit distance in Russia is about 2,500kilometres. Volatility of energy carrier prices is related not only to changes in supply and demand, but also to the ongoing economic crisis, (Oil and gas prices volatility in 2000-2009).The analysis of the information available shows that due to the global financial crisis there is a sharp drop in petroleum product prices and a slight decrease in gas prices.

UGS facilities aging and gas markets liberalization: the world's first UGS facility was created in a depleted reservoir in Welland County, Canada in 1915. The first UGS facility in the USSR was constructed in the Bashkatovskoye depleted gas field in the eastern part of Kuibyshev Oblast. Gas injection commenced on 5 May 5 1958. A half of the existing UGS facilities are over 30 years old and eight UGS facilities have been in operation for more than 40 years so far. The same situation is present in other countries. Tightening of industrial and environmental safety standards, political integration processes, climate change and innovative economic development are the others main drivers to determine trends in UGS development.

1. Natural gas demand growth in the long run and considerable distance from areas of gas production to major consumption markets:

- Creation of UGS facilities containing a strategic gas reserve.
- Developing UGS facilities integrated with LNG import terminals.

The USA is using tankers with LNG regasification systems on board and planning to construct an offshore regasification terminal. There are plans to construct a floating LNG terminal in the vicinity of a gas terminal (Great Britain) which will be linked to a gas storage facility in an offshore salt cavern (gas will be injected into this gas storage facility after regasification of LNG received). Development of UGS facilities integrated with LNG import terminals allows to reduce investments due to cost savings on isothermal reservoir construction for LNG storage.

- Creating new types of UGS facilities (LNG and CNG storage in rock caverns, gas hydrate storages.).

2. Volatility of energy carrier prices related not only to changes in supply and demand, but also to the ongoing economic crisis.

- Creation of UGS facilities containing a strategic gas reserve.
- Introduction of technologies aimed at minimizing the switchover period between gas withdrawal and injection.

3. UGS facilities aging and gas markets liberalization.

- Overhaul of UGS facilities making them fully automated (smart).
- Implementation of new technologies enhancing the performance, efficiency and cost effectiveness.

4. Tightening of industrial and environmental safety standards.

- Development and implementation of technologies increasing reliability of wells and UGS equipment.

- Development and implementation of technologies increasing environmental stability of UGS facilities and decreasing the environmental impact.
- Creation of UGS facilities for temporary storage of associated gas previously used for flaring.

According to official data, the associated petroleum gas (APG) volume flared at oil, gas and condensate fields in 2004 totaled as follows: 14.9 billion cubic metres in Russia (the 2nd largest contributor to global gas flaring) and 24.1 billion cubic metres in Nigeria (the largest contributor to global gas flaring).For the sake of comparison, 2.8 billion cubic metres was flared in the USA (the 11th largest contributor to global gas flaring). Today the amount of gas flared in the Russian Federation, has reduced by 70 per cent, due to creation of temporary underground APG storage facilities, inter alia. (Such projects are already implemented by a number of Russian oil companies).

5. Political integration processes.

- Creation of cross-border (international) UGS facilities.

Such examples exist in Europe: Gazprom store natural gas for Poskov Oblast in Inchukalns UGS-Latvia,arranged gas supplies from Haidach UGS-Austria,through Germany during the winter season. In the nearest future the number of such facilities (especially in Europe) will increase.

6. Global warming.

- Greenhouse gases burial.

More stringent environmental standards on CO_2 emissions to the atmosphere and growth of energy consumption demand expansion and creation of new storages for CO_2 burial. For this purpose technologies well tested in natural gas storage, including gas injection, as well as control over leakage of the facilities should be used.

- Creation of UGS facilities for temporary storage of associated gas previously used for flaring.

9. Innovative economic development.

- Creation of underground helium storage facilities.

Helium is one of the strategic feedstock materials. Huge gas fields with high helium content have recently been discovered in the Russian Federation. The total volume of helium that may be extracted from these fields amounts to several billion cubic metres. However, worldwide demand for helium is still not so high (in 2006 helium market accounted for 170 thousand cubic metres), therefore, helium storage facilities construction is a relevant issue.

- Creation of underground hydrogen storage facilities.

A ratio of alternative and renewable energy sources in the world fuel and energy balance will grow up from six to 22 per cent by 2030. Because consumption varies seasonally, storage facilities will have to be developed for alternative energy sources. It may be hydrogen storages, accumulators for the compressed gas, etc. In view of great volumes to be stored underground storage structures will have to be used.

CHAPTER 5

Analysis of the responses received to the questionnaire

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Introduction

In Chapter 5 our aim is to analyse and draw conclusions from the responses given to the questionnaire.

In Part A we address issues concerning which regulating laws and authorities that are involved in the storage-related activities. We are also going to present the steps of the granting procedure of operating a storage site, and the role of storage ownerships issues is also an important point of this chapter. At the end of Part A we will highlight the different treatment methods of remaining hydrocarbon reserves.

In Part B we are mostly interested in the satisfaction level of the storage operators with the current regulation and authorization process of storage-related activities and ownership issues.

PART A

Legal framework for development and operation[1]

In the group of the examined countries it is common that a respective regulatory authority is in charge of the implementation of storage legislation. The main regulatory frame in Latvia and Russia refers to the Law on subsurface natural resources. In Russia guidelines for UGS construction and operation in porous formations are also applied.

In Hungary Act No XL of 2008 on Natural Gas Supply and Act No XLVIII of 1993 on Mining constitutes the regulatory framework, while in Romania it is the Petroleum Law No. 238/2004 and the Natural Gas Law No. 351/2004.

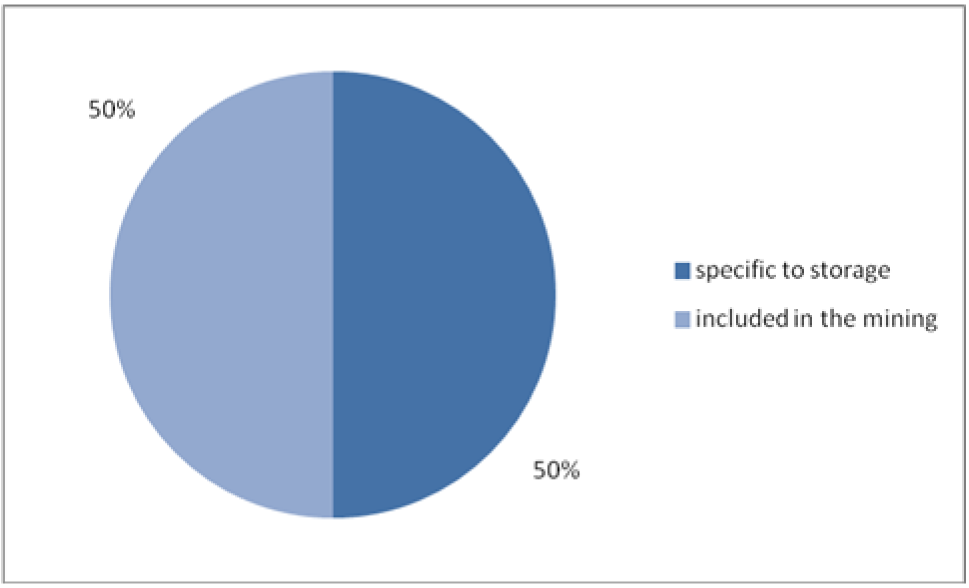
In Ireland the relevant sections of Gas Interim Regulation Act 2002 and Gas Act 1976 (as amended) refer to underground gas storage operation.

In Germany Federal Mining Act (BBergG), Deep Drilling Regulation (BVOT), and Energy Industry Act (EnWG) regulate UGS operation and development. Regarding environmental issues in Germany the following laws must be applied: Bundesimmissionschutzgesetz (BImSchG) and Wasserhaushaltsgesetz (WGH).

Leading authority which regulates storage-related activities operates at the national level in all of the countries. In Italy, Spain, Romania and Hungary storage-related legislation is specific to storage in the meanwhile in Ireland, Latvia Russia, Germany it is included in the mining legislation. In Ireland gas storage requirements are included in gas transportation and gas supply legislation.

[1] In Part A and Part B of this chapter we analyzed storage-related regulations of the following responding countries: Germany, Hungary, Ireland, Italy, Latvia, Russia and Spain

Fig. 5.1 ● Forms of specification in storage related legislation



Source: UNECE UGS 2011.

In all of the EU member states there are different laws aiming at ensuring the safety of sites containing large quantities of dangerous materials. The EU legislation includes the requirements of Seveso II Directive as a common ground on the control of major-accident hazards involving dangerous substances. Some nations do not apply Seveso II Directive for storage sites for example Hungary, Latvia, Ireland, Austria, Slovakia, hence other requirements are present with respect to the safety duties.

New storage site development

In Ireland authorities involved include: Commission for Energy Regulation, (CER) Department of Communications, Energy and Natural Resources, The Health and Safety Authority and Department of Transport.

In Hungary the respective authorities are: Hungarian Energy Office and Hungarian Office for Mining and Geology.

In Romania the Romanian Agency for Mineral Resources (NAMR) and the Romanian Energy Regulatory Authority are involved in the process.

In Germany mainly the competent mining authorities at state level are involved in the process of new storage development. In addition the national regulatory authority -the Bundesnetzagentur für Elektrizität, Gas, Telekommunikation- is responsible for the energy market. In Russia besides the Ministry of Natural Resources and Ecology and The Federal Service for Ecological, Technological and Nuclear Supervision (indicated as the main leading authorities), State Reserves Committee, OJSC Gazprom and regional authorities are also involved in new site development.

In Spain Ministerio de Industria, Energía y Turismo also has the decision-making power in this phase of site development.

In Latvia Ministry of Economy is marked as the main national authority in charge of the implementation of the storage legislation but in the stage of site development Ministry of Environment, Public Utilities Commission are involved as well.

In Italy Ministry of Economic Development (MED), Ministry of the Environment, Land and Sea (MATTM) are involved at the stage of new storage development.

In most of the countries, in addition to laws shown at point 5.1 acquiring a licence is also required.

The issue of the licence varies across the countries: in Latvia Public Utilities Commission,while in Hungary the Hungarian Energy Office is in charge.

The granting procedure of operating a storage site in most of the examined countries is made up of several steps including application for operating licence, having an environmental impact and safety assessment. It can be concluded that an Environmental Impact Study is mandatory in all of the investigated countries.

In Ireland it is supplemented by a Third Party Access Review and a systems agreement with the TSO and in Germany by a landscape conservation plan.

The duration of acquiring all the licences varies depending on the number of stages -normally it takes several years. In Russia it takes around 1 year, in Ireland around 1.5 year. In Italy it has 4 steps to launch a new storage site: 1) application to MSE 2) Environmental Impact Assessment 3) Regional Authority approval 4) Ministerial Decree.

In Hungary the process includes three steps: 1) applying for concession licence on 'closed areas' (in respect of hydrocarbons the whole territory of Hungary is declared as a closed area) 2) granting procedure taken by Hungarian Office for Mining and Geology 3) operation licensing taken by Hungarian Energy Office. The duration of total process can be a few months depending on other authorities that need to be involved.

In Romania all the steps are set up by the Governmental decision No. 2075/2004, subsequently amended and complemented.

Operation / Extension

The leading authorities involved in the process of operation and extension are the same national authorities in charge of storage-related activities mentioned before.

In Hungary a yearly Technical Operational Plan is required which must be approved by the Hungarian Office for Mining and Geology. The operation license is issued without time limit and concession license is usually given for decades to ensure the return on investment for the licence holder. In Hungary before taking a facility into operation, an exploration concession license for a five year period is required and this can be further extended.

In Latvia and Russia the operational plan must contain prognosis on the use of UGS and the planned developments. It isvalid for 10 years in Latvia.

In Germany the operation permission has to be submitted for re-approval to the relevant mining authority at state level every two years, including project definition and details regarding the working gas volume, injection and withdrawal capacities to be installed.

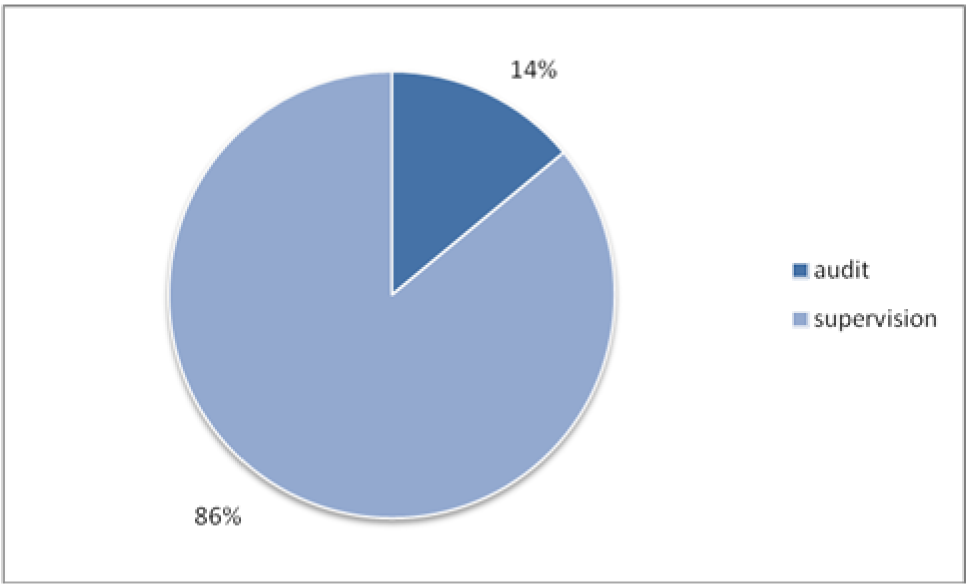
In Italy a formal summary of the Work Programme must be approved by Commission for Hydrocarbons and Mineral Resources of National Bureau of Mineral Hydrocarbons and Geothermal Energy. It is valid for 11 years if the necessary requirements are met.

In Romania, the operational plan must be implemented according to Petroleum Law, Gas Law and the related norms. Also, the Romanian Agency for Mineral Resources issues technical instruction of the exploitation project and the proposed works for exploitation and development.

Regardless of the frequency of the audit or supervision some form of following of the procedures is required by the authorities.

In Germany an audit on a regular basis is common, in all of the other countries constant supervision takes place.

Fig. 5.2 ● The rate of regular audit and constant supervision



Source: UNECE UGS 2011.

In all the investigated countries a QHSE system is introduced to ensure high quality of operation. It has to be emphasized that in the EU it is not allowed forany country to build in a certain kind of QHSE System or any standards in the legal systems. QHSE Systems are implemented by the companies themselves on a voluntary basis. In the investigated countries the most common QHSE Systems are the followings: ISO Systems, API (standard of the American Petroleum Institut), DVGW (Deutsche Vereinigung des Gas- und Wasserfaches= German Technical and Scientific Association for Gas and Water).These standards and norms have the role to ensure security and increase the efficiency of the operation.

For capacity extension there must be an economically rational reason for the storage operator and it must go through a permission procedure. Based on the answers we can conclude that the same national authorities make decision on allowing capacity extension as mentioned in the previous points.

The process takes a few months and in Germany it is dependent on the size of the UGS. An environmental impact study and a public inquiry with the involvement of stakeholders is normally mandatory with the exception of Russia where a public inquiry is not required. During the planning public has the right to obtain information about the operation of the storage facility and its possible environmental impacts.

In Latvia and Ireland not all of the steps required in new storage development have to be followed to extend the capacity (depending on the nature of the extension).

In the other investigated countries the same steps must be taken as for the process of capacity extension.

Abandonment / Recultivation

In the process of final abandonment (which includes the rehabilitation of surface and underground environment) the following authorities are involved:

- in Hungary Hungarian Office of Mining and Geology, Ireland Energy Ministry is developing a legislative proposal for the regulation of the stand alone gas storage projects,
- in Latvia Ministry of Environment, in Germany Landesamt für Bergbau, Energie und Geologie, in Italy Ministry of Economic Development through National Bureau of Mineral Hydrocarbons and Geothermal Energy,

- in Romania the Romanian Agency of Mineral Resources (NAMR) and other agancies for Environment, in Russia the Ministry of Natural Resources and Ecology, the Federal Service for Ecological, Technological and Nuclear Supervision and OJSC "Gazprom".

We can draw the conclusion that the same regulating authorities are in charge in the process of operation and expansion and in the process of recultivation. In most of the examined countries procedure-leading authorities include not only national but also local entities and other relevant regulation.

In Italy a technical and economical feasibility is necessary for recultivation procedure, in general in the responding countries, the procedure is determined by approved abandonment procedures.

Landownership issues

When storage license holder would like to perform measurements observations, maintenance and troubleshooting, the landowner is obliged by law to stand the necessary actions in all the responding countries. Mining law and relevant law on environmental protection applies in these cases.

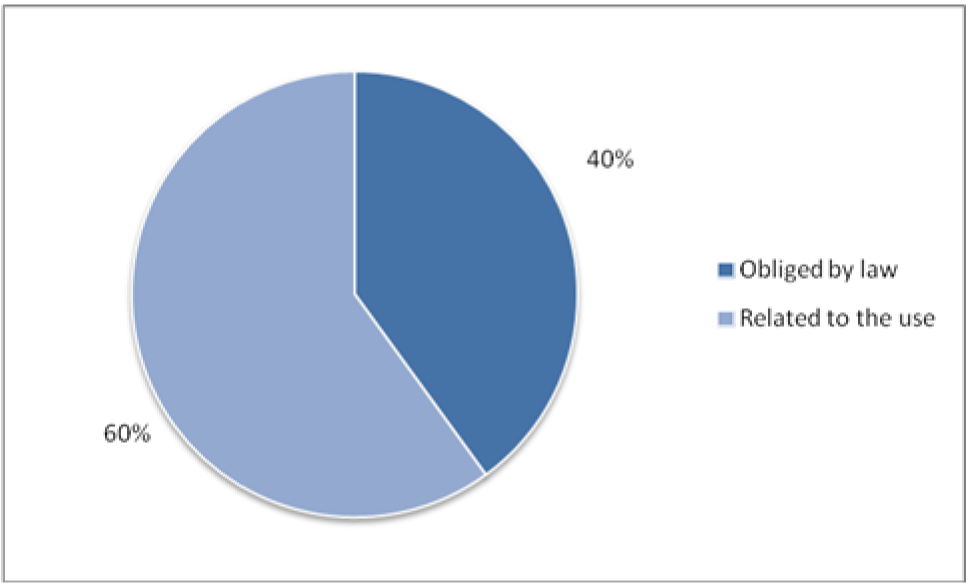
During the exploration as well as the operation phase the storage undertaking is obliged by law to provide compensation for the landowner for the incurred damage related to the use of land in Germany and Italy, however in Italy negotiated compensation is common as well.

In Hungary, Latvia and Russia the storage developer has to negotiate the compensation for the landowner.

In all the responding countries, in case the landowner is unwilling to cooperate the state has the expropriation right to enable the utilization of the land for exploration and exploitation.

During exploration: is the storage undertaking obliged by law or has the storage developer to negotiate any compensation for the landowner for the occurred damage related to the use of the land? the rate of regular audit and constant supervision

Fig. 5.3 ● The rate of forms of obligation

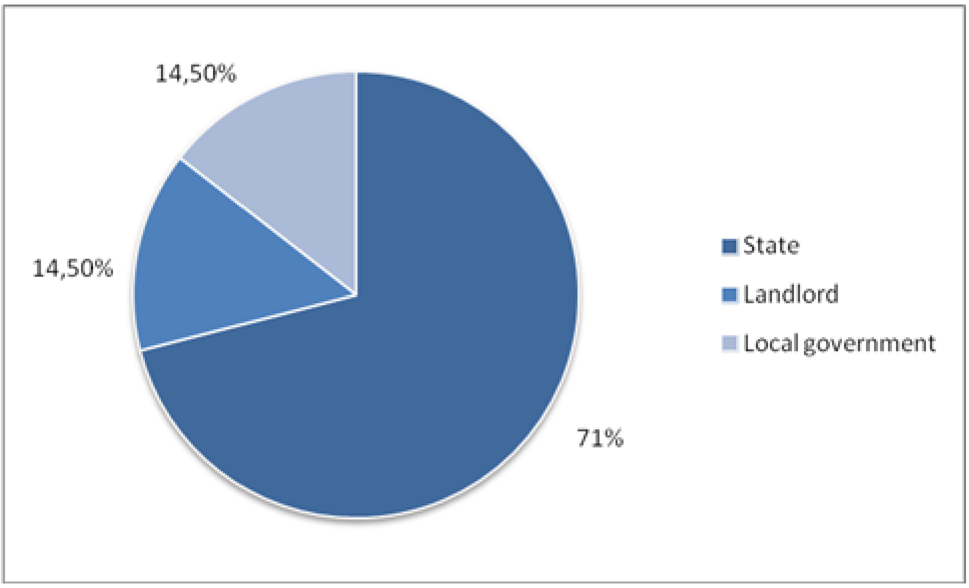


Source: UNECE UGS 2011.

Cushion gas / Ownership issues

In three of the responding countries (Hungary, Ireland, Romania) the underground oil and gas reserves are owned by the state, in Germany by the state and to some limited extend the landowner and in Latvia the mineral resources are the properties of the landowners.

Fig. 5.4 ● Ownership structure of underground oil and gas reserves/mineral resources



Source: UNECE UGS 2011.

The treatment of remaining hydrocarbon reserves when a depleted gas/oil field is utilized as storage facility solutions differ from nation to nation. It varies among countries whether SSO-s decide to buy, use or rent it. In all the responding countries cushion gas is considered as OPEX. In Latvia and Hungary there is no depreciation rule, while in Germany cushion gas is considered to be the subject of depreciation with a period of 33 years.

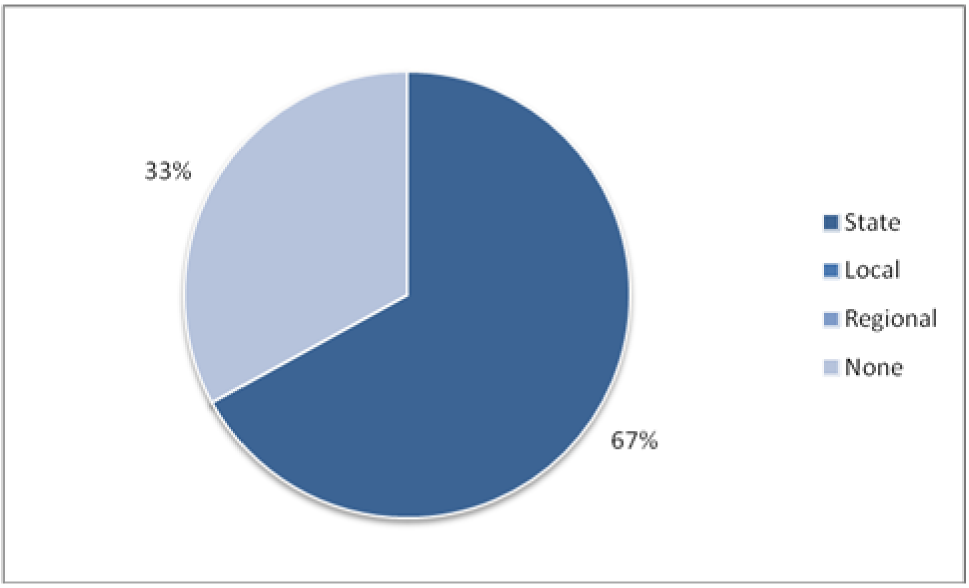
In Russia Gazprom's fixed assets classificatory applies, which is for 15 years.

Role of state

Dependent on the national legislation and the requirements the competent authority may decide to install strategic stocks and/or publish a tender for the construction of a new underground storage facility in order to increase the security of supply of a country. If there is no economic incentive to establish a new storage site the state can intervene and offer a return on investment.

In Russia, Hungary and Italy there are state-incentive schemes to motivate investment into storage facilities.

Fig. 5.5 ● Incentive schemes in motivating investments



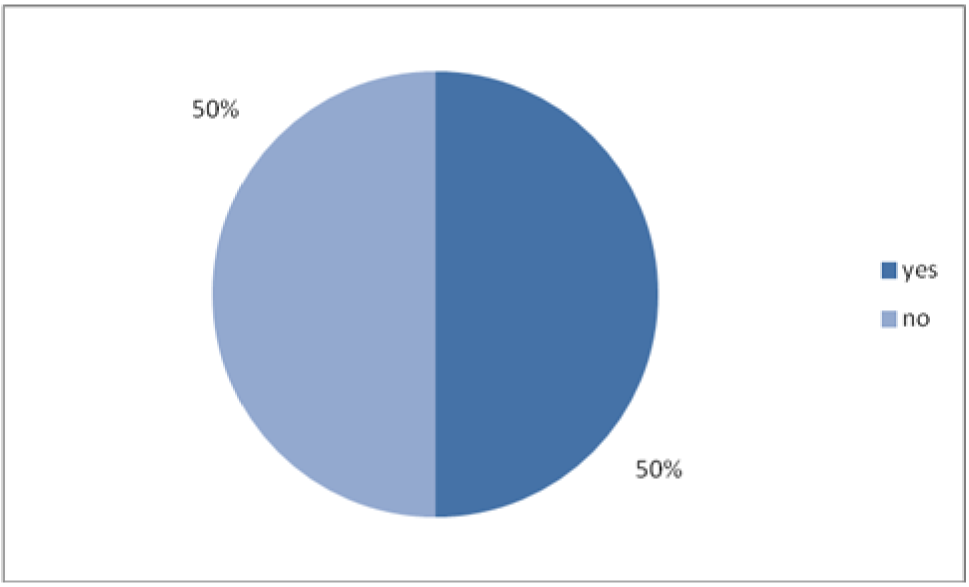
Source: UNECE UGS 2011.

Security provisions in all of the countries' procedures are regulated by industrial safety rules, which apply for all activities related to operation of hazardous facilities and emission regulations.

Additionally in Russia rules for construction and operation of UGS in porous formations and in Hungary Act No CXXVIII of 2011 on Emergency Management also apply.

From the responding countries in Hungary, Romania and Latvia storage facilities are classified as objects of Critical Infrastructure in contrast to Germany, Ireland and Italy. If a storage site is classified as Critical Infrastructure that implies higher attention on security.

Fig. 5.6 ● Question: Are storage facilities classified as objects of critical infrastructure?

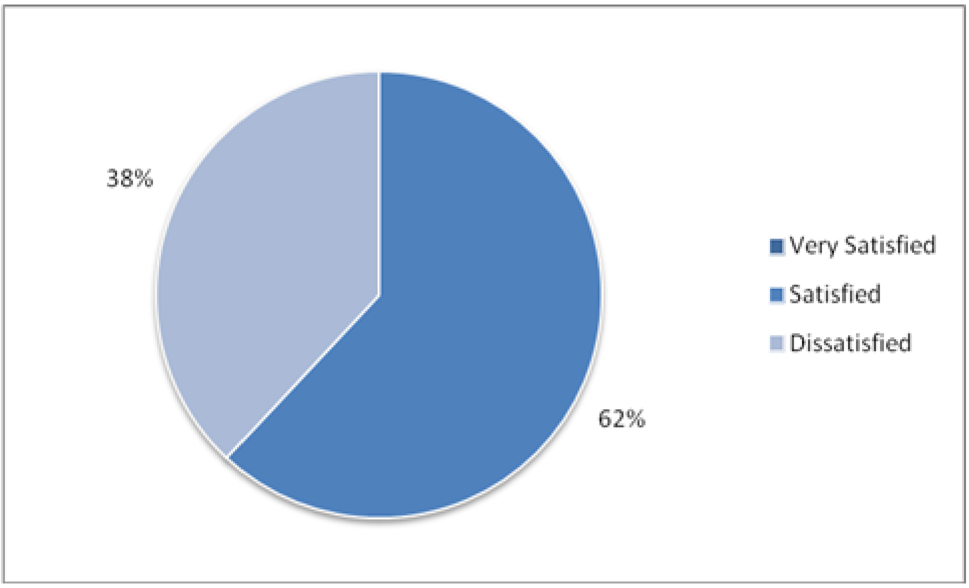


Source: UNECE UGS 2011.

PART B

Respondents were asked to evaluate regulation and authorization process concerning storage-related activities. 62% of the respondent countries were satisfied with the transparency of the regulation process and the general applicability of the regulation.

Fig. 5.7 ● Question: Are you satisfied with the applicability of regulation?

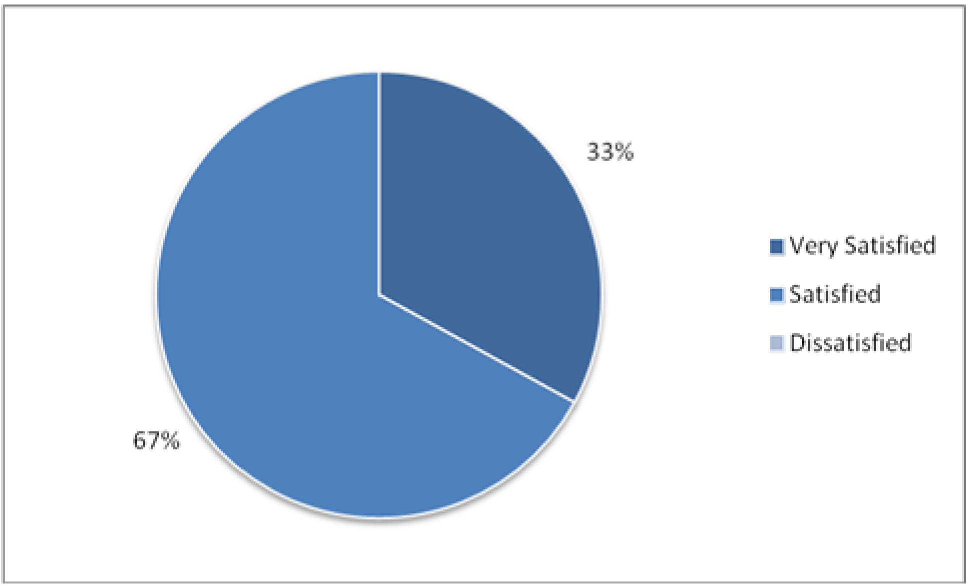


Source: UNECE UGS 2011.

Meanwhile regarding the length of the authorization procedure, 75% of the respondent UGS operators were dissatisfied which indicates that calculated period of gaining all the requested permissions is longer than ex ante expected.

The granting procedure in some of the examined countries includes the application submitted to national authority, environmental assessment and regional authority approval and each steps require authorization.

Fig. 5.8 ● Question: Are you satisfied about the real length of authorization procedure?

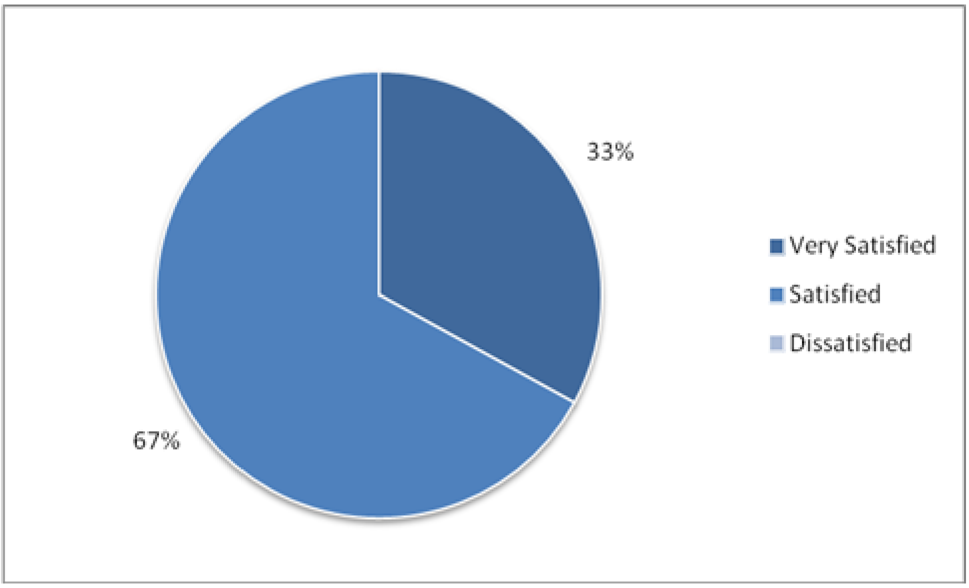


Source: UNECE UGS 2011.

Regarding the access to the land for mining companies of storage activities who intend to start exploration or operation we can see that 67% of the respondents were satisfied.

According to regulations present in all the examined countries, in case the landowner is unwilling to cooperate, the state has expropriation right to enable the utilization of the land.

Fig. 5.9 ● Question: Are you satisfied with the access to land procedure?



Source: UNECE UGS 2011.

In the issues of damage compensation and recultivation obligations all of the examined SSO-s expressed their satisfaction that suggests adequate applicability of the relevant laws and the endurability of the redemption mechanisms.

Regarding cushion gas related ownership and handling rules only 22% of the respondent SSO-s were dissatisfied which let us assume that this issue - which is of high importance due to its value – is handled transparently by the law.

Russia's legislation

Russia, as it is not an EU Member, differs regarding the following points:

- Public inquiry is not mandatory at the operation/extension stage (in other examined countries it is usually requested)
- In case the storage undertaking would like to drill new wells and to carry out workovers the decision is made with regard to the specific project, and depends on the type of property ownership and land zoning (in other countries it is determined by specific law). Land zoning is the practice of assignment permitted uses of land, which can vary from land to land.
- Concerning the different types of reservoirs there is no discrimination in other investigated countries, in Russia this is regulated by a branch of Gazprom.

Conclusions

In ***Part A*** we addressed issues concerning which regulating laws and authorities are involved in the storage related activities. We found that leading authority which regulates storage related activities operates at the national level in all of the responding countries. In some countries storage related legislation is specific to storage, while in other countries it is included in the mining legislation. The granting procedure of operation of a storage site in most of the examined countries is made up of several steps including application for operating licence, having an environmental impact and safety assessment. In all the responding countries when storage license holder would like to perform measurements the landowner is obliged by law to stand the necessary actions. In some of the responding countries the underground oil and gas reserves are owned by the state while in other countries the mineral resources are the properties of the landowners. The treatment of remaining hydrocarbon reserves differs from nation to nation. It is the obligation of the state when security of supply is threatened to ensure incentive schemes to motivate investment into storage facilities.

In ***Part B*** we were interested in the satisfaction of the storage operators with the regulation and authorization process of storage related activities and ownership issues. In general answers show that respondent countries were satisfied with the transparency and the general applicability of the regulation. Meanwhile regarding the length of the authorization procedure the majority of the respondent UGS operators were dissatisfied which indicates that period of gaining all the permissions needed is longer than previously calculated by the storage operators. In the issues of (1) access to the land for mining companies, (2) damage compensation obligations and (3) cushion gas related rules most of the respondents were satisfied.

In the ***final section*** we summarized the differences in Russian legislation, compared to those prevalent in the EU member states.

We can conclude that the examined storage operators expressed their satisfaction that suggests adequate applicability and transparency of the regarding laws. At the same time there are some critical areas which differ between member states therefore the main effort of European Union to create common rules for the gas markets can be facilitated by the spread of best practices in the field of regulation of storage sites.

Conclusion

Finally, the added value of this Study can be expressed as follows :

- The exchanges were fruitful due to a multifaceted co-operation, as participants may be companies, national bodies, consultants etc ;
- The New Study on UGS in Europe and Central Asia will offer value by comparing its result with result of the Study carried out in the 90's.
- An efficient use of already available data was made (IGU) and this data could be also shared in the future with other European, International or National bodies if they express this need when the study will be updated in 3 years;
- Europe and Central Asia is a geographic area which makes sense, from a market perspective, as this geographic area is of paramount importance both for production and for consumption and storage business is a necessary link between production and consumption;
- The main added value of the study is the outcome of both a multidisciplinary approach and an integrated analysis covering the broad scope of technical, storage capacity, market liberalization, legal framework and storage demand topics.

The objective was not to draw out guidelines or recommendations from the data collected, but to provide data in their most expressive figures and to provide them in the most useful way. When possible, specific comments and analysis were developed directly from the information available.

Even if the questionnaire was not fully completed by NRAs and by SSOs, most of the representative nations and companies in the storage business were fulfilling the questionnaire, and the output of this chapter which is presented as aggregated data can be used by NRAs, companies and any other international body (IGU, GSE, IEA…).

International Gas Union - UGS Glossary 2009

Glossary of relevant technical Underground Gas Storage Terminology

Scope of Glossary

The glossary covers the relevant technical terminology related to the storage of natural gas in underground gas storage facilities. As the technology is similar, the terminology can be applied for the storage of hydrogen, CO2, O2 and other gases

Term	Definition
Underground Gas Storage (UGS)	All subsurface and surface facilities required for the storage and for the withdrawal and injection of natural gas. Naturally or artificially developed containments in subsurface geological strata are used for the storage of natural gas. Several subsurface storage horizons or caverns may be connected to one common surface facility. All of this is referred to as the underground gas storage location
Type of Storage	There are several types of underground gas storage facilities, which differ by storage formation and storage mechanism: Pore storage • Storage in aquifers • Storage in former gas fields • Storage in former oil fields Caverns • Storage in salt caverns • Storage in rock caverns (including lined rock caverns) • Storage in abandoned mines
UGS in Operation	Storage facility capable to inject and withdraw gas
Greenfield Storage Project	New underground storage development project, not related to any existing storage facility
Storage Capacity	Total ability of a storage facility to provide working gas volume, withdrawal rate and injection rate
Inventory	Total of working and cushion gas volumes stored in UGS
Cushion Gas Volume (CGV) or Base Gas	Gas volume required in a storage field for reservoir management purpose and to maintain an adequate minimum storage pressure for meeting working gas volume delivery with a required withdrawal profile. In caverns, the cushion gas volume is also required for stability reasons. The cushion gas volume may consist of recoverable and non-recoverable in-situ gas volumes and/or injected gas volumes
Working Gas Volume (WGV)	Volume of gas in the storage above the designed level of cushion gas volume, which can be withdrawn/injected with installed subsurface and surface facilities (wells, flow lines, etc.) subject to legal and technical limitations (pressures, velocities, etc.). Depending on local site conditions (injection/withdrawal rates, utilization hours, etc.) the working gas volume may be cycled more than once a year (see annual cycling capability).

Term	Definition
Withdrawal Rate	Flow rate at which gas can be withdrawn from an UGS, based on the installed subsurface and surface facilities and technical limitations
Withdrawal Profile	Dependency between the withdrawal rate and the working gas volume. The withdrawal profile and the time (utilization hours) required for withdrawal are indicative of the layout of an underground gas storage facility. The withdrawal profile usually consists of a constant rate (plateau) period (see ‘Nominal Withdrawal Rate’) followed by a period of declining rates
Peak Withdrawal Rate	Maximum flow rate, the working gas volume can be withdrawn based on the installed subsurface and surface facilities and technical limitations. This flow rate is normally reached when the storage is at its maximum working gas volume, i.e. maximum allowable storage pressure. Also known as ‘maximum design deliverability’
Nominal Withdrawal Rate	Withdrawal rate representing the deliverability of the subsurface and surface facilities available over an extended period of withdrawal (plateau period). This rate corresponds to the constant rate period of the withdrawal profile
Last Day Withdrawal Rate	Withdrawal rate which can be delivered based on the installed subsurface and surface facilities and technical limitations when in the storage reservoir or cavern the working gas volume is nearly withdrawn, i.e. at or close to its cushion gas volume
Injection Rate	Flow rate at which gas can be injected into an UGS, based on the installed subsurface and surface facilities and technical limitations
Injection Profile	Dependency between the injection rate and the working gas volume. The injection profile and the time (utilization hours) required for injection are indicative of the layout of an underground gas storage facility. The injection profile may include a period of declining rates close to maximum storage pressure
Annual Cycling Capability	Number of turn over cycles of the working gas volume, which can be achieved by withdrawal and injection in one year
Undeveloped Storage Capacities	Storage capacities which could be developed in an existing underground gas storage, e.g.: by additional gas injection, in- crease of the maximum storage pressure, decrease of the minimum storage pressure, additional facilities (wells, compressors, process facilities) etc.
Storage Well	Well completed for gas withdrawal and/or injection
Observation Well	Well completed for the purpose of monitoring the storage horizon and/or the overlying or underlying horizons for pressures, temperatures, saturations, fluid levels, etc.
Auxiliary Well	Well completed for other purposes, e.g. water disposal
Abandoned Well	Well permanently out of operation and plugged

Term	Definition
Initial Reservoir Pressure	Initial pressure conditions encountered in a porous formation before any change due to operation of the reservoir, for ex- ample: start of production or injection. The initial pressure is related to a reference depth/datum level. Also known as ‘discovery pressure’
Maximum Allowable Storage Pressure	Maximum pressure of the storage horizon or cavern, normally at maximum inventory of gas in storage. This pressure is the outcome of geological/technical engineering and has to ensure the integrity of the UGS. The maximum allowable pressure is related to a datum depth and normally has to be approved by authorities
Minimum Storage Pressure	Minimum pressure of the storage horizon or cavern, normally reached at the end of the decline phase of the withdrawal profile. The minimum pressure is related to a datum depth. The minimum pressure of caverns is based on geomechanical investigations to ensure stability and has to be approved by authorities
Pressure Datum Depth	Vertical reference depth in a pore storage, normally related to the sea level, used for pressure normalisation and correlation throughout the reservoir. In caverns the vertical depth below surface of the last cemented casing shoe is normally used as the reference level for pressures
Depth Top of Structure/Cavern Roof Depth	Minimum true vertical depth from the surface down to the top of the storage formation/cavern roof
Caprock of a Pore Storage	Sealing formation for gas overlying the pore storage horizon. Caprock is a geological barrier of the pore storage and prevents the migration of oil and gas out of the storage horizon
Containment	Ability of the storage reservoir or cavern and the storage well completion to resist leakage or migration of the fluids contained therein. Also known as the integrity of a storage facility
Closure	Vertical distance between the top of the structure and the spill point
Spill Point	Structural point within a reservoir, where hydrocarbons could leak and migrate out of the storage structure
Areal Extent of the Storage Structure	Subsurface area of the storage formation at its maximum gas saturation contact extent. The boundary is normally defined by the gas water contact
Cavern Convergence	Reduction in geometrical cavern volume caused by e.g. salt creeping. The annual reduction of the geometrical cavern volume is expressed by the convergence rate

Normal conditions- Gas volumes are related to temperatures and pressures at normal conditions: 273,15 K (0°C) and 1,01325 bar (1,013 10-5 Pa)