	UNITED NATIONS ORGANISATION	
ECONOMIC COMMISSION FOR EUROPE		
COMMITTEE ON SUSTAINABLE ENERGY		
Working Party on Gas		
STUDY ON UNDERGROUND GAS STORAGE IN EUROPE AND CENTRAL ASIA		
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Background

The current and expected increase in natural gas demand in the 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 and 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 convert 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 natural gas end-user.

Aims

The market became more complex and changed significantly according to EU Directives for liberalization of gas market and particularly due to TPA : investment decision making became then 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 new comers entered the market as storage operators (SSOs) or as customers (TSOs, shippers, DSOs and even end-users like power producers),

Investors and developers of Gas Industry needs to have 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 – see 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 :

o The first study on UGS in Europe and Central Asia was finalized in 1999.
o 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.
o 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 this purpose :

The purpose of the new UNECE study on Underground Gas Storage (UGS) in Europe and Central Asia consists of updating this 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 dialog between gas industry and Authorities for better implementing 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 like emergent technologies, current status and projects, legal framework, market organisation and tariffs, would be the following :

- Chapter One: New and emerging technologies and technological improvements in underground gas storage
- Chapter Two: Current UGS status in Europe and Central Asia
- Chapter Three: Market structure and organisation 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, except the Chapter 3 which will consider the major change in the market organisation due to the gas market liberalization.

However, due to a significant lack of answers to the questionnaire for Chapters 6 and 7, these Chapters had to be cancelled.

As a result, the main trends which will have been analyzed through the seven Chapters of the Study will be presented to the WGC.

As for 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 co-operation agreement has signed with IGU for sharing 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 ToR 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 is 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 Regukation authorities, as well as Mining authorities.

Methods

Structure of the Study

The structure of the UNECE study on underground gas storage will be the following :

- Introduction

- Executive Summary

- Methodology employed and sources, glossary

- Confidentiality

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

    Heads: Mr A. Iskhakov (Gazprom), Mr H. Spreckels (E-On gas Storage) 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 :

- o Subsurface and surface technological trends and improvements
- o Intelligent UGS (CAPEX and OPEX optimization)
- o Commercial optimization software
- o Technical developments (delta pressure, horizontal drilling, ...)
- o Economic Innovations in UGS operation
- o Reducing environment impacts
- o Automation of well monitoring
- o Increasing of daily peak production
- o Drilling technologies for improvement of UGS well quality
- o Technologies for ensuring the liquid lifting from gas storage wells

- **Chapter Two: Current UGS status in Europe and Central Asia**

  Heads: Mr. M. Sandu, (Romgaz) *B. Ernecic (PSP) with support of Mr J. Wallbrecht (Storengy D / IGU) and Mr A. Iskhakov (Gazprom)*

  This Chapter is a data base for existing UGS by country and focus on a synthesis by market area with the following data:

  - o Date of commissioning
  - o Storage type
  - o working volume,
  - o total volume,
  - o peak withdrawal rate
  - o nominal withdrawal rate
  - o injection rate
  - o calorific value
  - o distance to town
  - o operator
  - o owner
  - o SSO
  - o ...

- **Chapter Three: Market structure and legal framework analysis**

  Head: *G.-H. Joffre (Storengy) with support of Ms A. Brandenburger (RWE Gasspeicher) and Mr U. Duda (E.On Gas Storage)*

This Chapter will describe the organisation of the market.

- o <u>Chapter 3A(to be completed to National Regulation Authorities)</u>
    - <u>Status of Third Party Access</u>
    - <u>Status of Capacity Allocation Procedures</u>
    - <u>Status of Congestion Management Procedures</u>
- o <u>Chapter 3B (to be completed by System Storage Operators)</u>
    - <u>Public Service Obligation</u>
    - <u>Strategic stook obligation</u>
    - <u>Ownership stucturation</u>
    - <u>Exemption of TPA</u>
    - <u>Contract duration</u>
    - <u>Physical restrictionsCAM and CMP mechanisms</u>
- o <u>Chapter 3C (to be completed by NRA and SSOs)</u>
    - <u>Access to the transmission system</u>

- • <u>Chapter Four: UGS projects and criteria for the selection of potential UGS facilities</u>

Heads: *with support of Mr J. Wallbrecht (BEB / IGU), Ms A. Brandenburger (RWE Gasspeicher) and Mr U. Duda (E.On Gas Storage)*

This Chapter is a data base for planned UGS by country and focus on a synthesis by market area with the following data:

- o <u>Status of project (feasibility, FID, Construction, Commissioning)</u>
- o <u>Storage type</u>
- o <u>working volume,</u>
- o <u>total volume,</u>
- o <u>peak withdrawal rate</u>
- o <u>nominal withdrawal rate</u>
- o <u>injection rate</u>
- o calorific value
- o distance to town
- o status of operator, owner, SSO
- o ...

- • <u>Chapter Five</u>: Legal framework for development and operation of storage (incl. Permitting process)

Head: *Mr T. Korosi (Hungarian Energy Office), Mr W. Rokosz (PGNiG) and Mr G.-H. Joffre (Storengy) with support of Ms A. Brandenburger (RWE Gasspeicher) and Mr M. Laczko (E.On Földgaz Storage).*

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This Chapter will provide an information by country about 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

A conclusion will focus on major findings and make a brief comparison with the results of the 90's Study.

Methods : Definition of market areas

Following the discussion during several months of the UNECE experts and their written proposals on definition of market areas, the UNECE Task Force decided on the matter as follows:.

- Area A. Western Europe (Austria, Belgium, Denmark, France, Germany, Ireland, Luxembourg, Netherlands, Norway, Sweden, Switzerland, United Kingdom)
- Area B. Central Europe (Czech Republic, Hungary, Poland, Slovak Republic)
- Area C. West Mediterranean (Italy, Spain, Portugal)
- Area D. East Mediterranean (Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Greece, Malta, Montenegro, Former Yugoslav Republic of Macedonia, **Romania,** Serbia, Slovenia, Turkey)

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- Area E. North-East Europe (Belarus, Estonia, Finland, Latvia, Lithuania, Russian Federation, Ukraine)
- Area F. Central Asian and Caucasus (Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Republic of Moldova, Tajikistan, Turkmenistan, Uzbekistan)

Organisation of work

The UNECE Task Force nominated heads for each chapter who had to establish their own teams and discuss the scope and depth of each chapter.

Particular attention has been 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 will provide suggestions and recommendations in this regard.

Work progress are 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 :

- o The UNECE ensures that each data provider contribution is treated with confidentiality anyway.
- o 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.
- o 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.
- o 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 recognise 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:
  - o Chapter 1 : the data will represent the opinion of the company about emergent technologies

- o Chapter 2 and 4 : the data about existing storage plants and planned storage projects are already public data (IGU database)
- o Chapter 5 : the data related to the legal framework are obviously public

Conclusion

Finally, the added value of this Study can be expressed as follows :

- o The exchanges were fruitful due to a multifaceted co-operation, as participants may be companies, national bodies, consultants,.. ;
- o The New Study on UGS in Europe and Central Asia will offer a major interest by comparing its result with result of the Study carried out in the 90's.
- o 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 by 3 years;
- o Europe and Central Asia is a geographic area which makes sense, marketwise, as this geographic area is of paramount importance both for production and for consumption and as storage business is a necessary link between production and consumption;
- o 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.

First results will be available for a first presentation in the World Gas Congress in Kuala Lumpur.