The Economics of Natural Gas Storage: An Overview

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Outline of the presentation

Cross–Country overview of gas storage services: main facts and figures in France, Germany, Italy and UK

Four main topics:
- Commercial Storage (Germany)
- Storage and Market Power (France)
- Optimal Regulation of Access to Storage with Capacity Constraints (Italy)
- Storage and Security of Supply (UK)
Storage services in theory and practice
In evolving global markets for natural gas and restructuring efforts in the EU, storage provides flexibility, promotes competition, and enhances security of supply.

In the European Union
- There is **no working market** for commercial storage (except UK)
- Several countries are characterized by a **lack of storage capacity**
- Directives **let member Countries opt between rTPA or nTPA** as storage is not a natural monopoly and competition is feasible in principle.
- **Security of gas supply** raises serious concerns and strategies against disruption are becoming of crucial importance.
Cross-Country overview
Cross-Country Overview: distribution of storage capacity in the EU

- Germany: 22%
- France: 18%
- Italy: 18%
- Others: 15%
- Hungary: 5%
- Spain: 5%
- Austria: 6%
- The Netherlands: 6%
- UK: 5%

Source: IEFE Assessments on EUROSTAT Data
Cross-Country Overview: storage use in the EU

Storage capacity vs Annual consumption

Source: IEFE Assessments on EUROSTAT Data, 2007
Focus on Production.
Data confirm a generalized decrease in natural gas production

<table>
<thead>
<tr>
<th>Country</th>
<th>Production</th>
<th>Peak production (monthly)</th>
<th>Min Production (monthly)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2006</td>
<td>2007</td>
<td>Change</td>
</tr>
<tr>
<td>Germany</td>
<td>17,16</td>
<td>15,72</td>
<td>-8,40%</td>
</tr>
<tr>
<td></td>
<td>1,64</td>
<td>1,52</td>
<td>-7,34%</td>
</tr>
<tr>
<td>France</td>
<td>1,21</td>
<td>1,06</td>
<td>-12,33%</td>
</tr>
<tr>
<td></td>
<td>0,11</td>
<td>0,10</td>
<td>-11,37%</td>
</tr>
<tr>
<td>Italy</td>
<td>10,93</td>
<td>9,71</td>
<td>-11,13%</td>
</tr>
<tr>
<td></td>
<td>0,96</td>
<td>0,87</td>
<td>-9,05%</td>
</tr>
<tr>
<td>UK</td>
<td>87,16</td>
<td>79,02</td>
<td>-9,34%</td>
</tr>
<tr>
<td></td>
<td>9,28</td>
<td>7,91</td>
<td>-14,80%</td>
</tr>
</tbody>
</table>

Source: IEFE Assessments on EUROSTAT Data
Focus on Consumption.
Data signal a generalized decrease in peak consumption and an increase in min consumption.

<table>
<thead>
<tr>
<th>Country</th>
<th>Demand</th>
<th>Peak Demand (monthly)</th>
<th>Min Demand (monthly)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>97,06</td>
<td>93,58</td>
<td>-3,59%</td>
</tr>
<tr>
<td>France</td>
<td>47,41</td>
<td>46,81</td>
<td>-1,25%</td>
</tr>
<tr>
<td>Italy</td>
<td>83,20</td>
<td>84,91</td>
<td>2,06%</td>
</tr>
<tr>
<td>UK</td>
<td>98,56</td>
<td>99,83</td>
<td>1,29%</td>
</tr>
</tbody>
</table>

Source: IEFE Assessments on EUROSTAT Data

Focus on net import.  
Data signal heterogeneous patterns.

<table>
<thead>
<tr>
<th>Country</th>
<th>Net Import</th>
<th>Peak import (monthly)</th>
<th>Min import (monthly)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>81,12</td>
<td>75,40</td>
<td>-7,05%</td>
</tr>
<tr>
<td>France</td>
<td>47,41</td>
<td>45,17</td>
<td>-4,73%</td>
</tr>
<tr>
<td>Italy</td>
<td>75,80</td>
<td>73,88</td>
<td>-2,54%</td>
</tr>
<tr>
<td>UK</td>
<td>12,05</td>
<td>20,29</td>
<td>68,39%</td>
</tr>
</tbody>
</table>

Source: IEFE Assessments on EUROSTAT Data
Storage Capacity & Concentration, 2008

<table>
<thead>
<tr>
<th>Country</th>
<th>Storage System Operators (SSO)</th>
<th>Market Concentration (WC by the 1st SSO)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>&gt;20</td>
<td>26%</td>
</tr>
<tr>
<td>France</td>
<td>2</td>
<td>79%</td>
</tr>
<tr>
<td>Italy</td>
<td>2</td>
<td>98%</td>
</tr>
<tr>
<td>UK</td>
<td>5</td>
<td>57%</td>
</tr>
</tbody>
</table>

Source: IEFE Assessments on EUROSTAT Data
Access Tariffs in 2004/05 vs 2007/08

Revenue/Working Capacity, 2007/2008

Source: SSO Data & IEFE Assessments

Revenue/Working Capacity, 2004/2005

Source: SSO Data & IEFE Assessments
### Planned Capacity & Concentration, GSE 2008

**Diagram:**
- Germany: EON Gas Storage (7 Bcm), Centrica Storage (9 Bcm), Stogit (3 Bcm)
- France: GdF (1 Bcm), EON Gas Storage (2 Bcm), Centrica Storage (8 Bcm)
- UK: GdF (1 Bcm), EON Gas Storage (12 Bcm), Centrica Storage (4 Bcm)

**Table: Market Concentration**

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>&gt;20</td>
<td>&gt;20 (+5)</td>
<td>26%</td>
<td>30%</td>
</tr>
<tr>
<td>France</td>
<td>2</td>
<td>2</td>
<td>79%</td>
<td>76%</td>
</tr>
<tr>
<td>Italy</td>
<td>2</td>
<td>4</td>
<td>98%</td>
<td>79%</td>
</tr>
<tr>
<td>UK</td>
<td>5</td>
<td>12</td>
<td>57%</td>
<td>30%</td>
</tr>
</tbody>
</table>
BACKGROUND: Natural gas storage in the EU is not always operated within a market-oriented perspective.

- In the UK, injections and withdrawal from facilities do not influence price formation on the spot market, but this is not the case in Continental Europe

ANALYTICAL FRAMEWORK: Storage operators are profit maximisers. Profits are functions of spot prices and storage costs. The technical characteristics of natural gas storage facilities constrain optimal patterns.

APPLICATION: UK (Rough) and Germany (Dötlingen)
Question: whether storage users in a competitive environment, differ in their operation of natural gas storage capacities.

RESULTS: Derivation of the optimal use (i.e. injections and withdrawal rates) of natural gas storage facilities.

Storage systems in restructured markets are more arbitrage-oriented than in countries where the opening to competition is less advanced.
Storage and Market power
Theoretical modeling
BACKGROUND: Gas hubs and TPA to storage services should increase the liquidity of the supply and enable operators to discriminate between gas supply sources: market power issues.

ANALYTICAL FRAMEWORK: Public service obligations & strategic dimensions of storage services. Very intuitive model of gas markets focusing on the incentives for firms to strategically use natural gas storage facilities.

APPLICATION: France
Storage, as an intermediate good, can influence vertical relationships between upstream operators and suppliers through the spot market.

Access to facilities allows rival firms to adjust strategically the gas price on downstream market (when competitive suppliers are integrated with an upstream oil&gas company).

**RESULTS:** Strategic use of storage sites may occur with: pre-emptive access to storage facilities (i.e. leadership), vertical integration (i.e. no unbundling) or low flexibility degree of storage facilities.
Optimal Regulation of Access to Storage with Capacity Constraints

Theoretical modeling
BACKGROUND: Analysis of regulatory issues

ANALYTICAL FRAMEWORK: Analysis of both productive efficiency of gas suppliers, who demand storage as a flexibility tool, and allocative efficiency

- Dominant firm – competitive fringe model (consistent with several EU gas markets)
- Technological asymmetry
- rTPA - cost reflective tariff & rationing depending on market shares – versus nTPA - multiple unit auction.

APPLICATION: Italy
RESULTS: Storage plants are de facto essential facilities, because of the asymmetric distribution of storage substitutes between incumbents and new entrants and the long time span required to install new capacity.

Charging cost reflective access tariffs may be effective in controlling the exercise of market power by de facto storage monopolists, but may prevent efficient capacity allocation.

The final allocation of storage resources depends on the rationing rule arising from congestion management: auctioning is a possible remedy.
BACKGROUND: Precautionary storage is indispensable to ensure uninterrupted gas services in the short-medium term.

ANALYTICAL FRAMEWORK: Model in which a private sector has the incentive to store as it foresees the probability of a supply disruption. Stockholding decisions balance the valorisation of gas in the event of a crisis with its carrying cost.

APPLICATION: The UK
Original method to evaluate storage anti-speculative policies in a dynamic setting completes the theoretical analysis (cost of imperfect policies in a detailed example calibrated on UK data).

RESULTS: equilibrium prices, optimal stockpiling and drainage rules.

A rationale for accumulating strategic gas stocks does exist, thus casting some doubts on the current UK gas security policy.
The Economics of Natural Gas Storage: A European Perspective