CURRENT STATE AND PROSPECTS OF LNG IN THE UNECE REGION

Francisco de la Flor
Background

BACKGROUND

• The Working Party on Gas decided at its 18th session (January 2008) to launch a study on the current state and prospects of liquefied natural gas (LNG) in the UNECE region.

OBJECTIVE

• Consideration of the current status of LNG market in the UNECE region and its prospects. Exchange of views on annual developments of LNG markets, factors affecting LNG marketing availability, forecast of LNG demand and other points of interest.
Structure of the Study

I. Executive summary.

II. Methodology employed and sources.

III. Chapter 1: LNG market.

IV. Chapter 2: LNG value chain and technology.

V. Chapter 3: Competition between LNG and pipeline gas.

VI. Chapter 4: Regulation.

VII. Chapter 5: Interoperability.

VIII. Conclusions and recommendations.

IX. Annexes.
# Participants

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Heads of chapter</th>
</tr>
</thead>
</table>
| 1       | LNG market                                 | • Benjamin Schlesinger  
                              | • Diego Portoghese                  |
| 2       | LNG value chain and technology             | • Ramon Diaz Casado   
                              | • Victor Tuñón                  |
|         |                                             | • Alfredo Puente                           |
| 3       | Competition between LNG and pipeline gas   | • Ulco Vermeulen                           
                              | • Jacques Rottenberg                  |
| 4       | Regulation                                 | • Luis Parada                                |
| 5       | Interoperability                           | • Arturo Alaejos                           |
|         |                                             | • Luis Gorospe                             |
Next steps

• The study will be completed by 30th May 2012
• Meeting/workshop with producers to be organise to gather their contributions
THANK YOU FOR YOUR ATTENTION
Chapter 1 Outline – LNG Markets

Main elements of chapter:
• LNG markets and basins
• Key LNG market issues
• LNG supply and demand
• Market dynamics, short and long-term

Four appendices, listing:
• Global gas reserves, supply, demand
• LNG imports, exports, terminals, tankers
LNG markets have grown in all basins, but not always where expected.

Source: ENI and BSA 2011.
With 8 trains in service, Qatar balances global LNG supplies.

In the coming decade, major global LNG suppliers will emerge.

- By 2020, Australia will overtake Qatar as the largest LNG supplier.
- By mid-2020s, North American exports could reach 90 BCM from 5-6 liquefaction terminals.
- Russia and Middle Eastern suppliers will become major LNG suppliers, as well.

Sources: BSA 2011; from ARI (through 2010), FERC/Bentek (wet gas reduced 10% to dry gas).
Pacific Basin LNG demand rose especially sharply in 2011.

- The Fukushima disaster boosted LNG demand for electric generation in Japan (+27% in FY2012 alone), and elsewhere, as nuclear plants were rechecked and plans were reevaluated.
- At the same time, Asian economies emerged strongly from the 2008-09 global recession, thus their demand for LNG increased as well, especially in China and India, which (together) raised LNG demand by approximately 65% during 2008-2010, as well as in Southeast Asia.
Fukushima’s impact on LNG markets cannot be understated.

European LNG demand is rising, due to supply & nuclear issues.

- Declining European gas production is intensifying LNG demand.
- In under a decade, UK has transformed from exporter to LNG importer on scale that exceeded Spain in 2011.
- Additionally, LNG demand grew in 2011 in South America and the Middle East.

Source: Gas Strategies, 2011.
The world’s largest 2010 importers depended critically on LNG.

Despite UNECE LNG demand, Asian requirements will dominate LNG.
US LNG exports appear economical. ($/MMBtu in 2015)

Exports to Japan: $5.40
Exports to UK: $11.03

LNG markets use a number of different price indexation systems.

Source: ENI, 2011.
Inter-basin LNG price indices differ greatly from one another.

Source: Gas Strategies, 2011.
By 2020, global LNG flows could reach 566 BCM per year.

Source: Cedigaz, 2011.
Appendices

- Natural gas reserves, production and consumption by region and country
- Inventory of LNG liquefaction and supply facilities
- Inventory of LNG receiving and regasification terminals
- Inventory of LNG tankers.

Current State and Prospects of LNG in the UNECE Region
Chapter 2: LNG Value Chain

UN Economic Commission for Europe
Committee on Sustainable Energy

Geneva, 24 January 2012

Gas Natural Fenosa          Stream Repsol-Gas Natural LNG
Current Situation and degree of completion

- First draft finalized in October 2010
  - according to the planned schedule

- In the last year important shocks have affected the LNG market
  - Shale gas & oil surge confirmation
  - Earthquake in Japan and nuclear uncertainty
  - MENA unrest
  - Macroeconomic perspectives changing

- New projects have been completed or have taken FID
Chapter Outline (I) – LNG Value Chain

1. Description ✓
2. History ✓
3. Gas reserves
   – To be updated, mainly for unconventional gas
   – Add technical information about shale gas coming from Ch 1
4. Liquefaction and regasification capacity
   – TBU with projects already completed, projects with FID and potential additional projects
5. Shipping
   – TBU New orders and recent trends
   – Small Scale Carriers
6. LNG Markets: to be included in Ch 1
   – TBU with latest demand estimates, global LNG flows and oil & gas prices
   – Modify macroeconomic forecasts
Chapter Outline (II) – LNG Value Chain

7. Project Economics. Avoid overlap with Ch 3
   – Probable bidirectional projects in the US. Compare costs of brownfield and greenfield projects

8. LNG Business Models ✓. Avoid overlap with Ch 3

9. Quality and Specifications ✓

10. Risk analysis and allocation ✓

11. LNG SPA Contracts ✓

12. Liquefaction technology ✓

13. Regasification technology ✓

14. Floating LNG
   – New FSRU in Escobar (Argentina)
   – FID for LNG FPSO Prelude (Australia)
Chapter Outline (III) – LNG Value Chain

15. CNG
16. GTL
   – Start of production in Pearl GTL (Qatar)
17. Satellite and peak saving plants ✓
18. Marketing strategies ✓
19. Uses of natural gas ✓
20. NGV
   – Potential boost in the US
21. Conclusions
   – To be written
Proposed next steps

• Meeting with producers still pending
  – Cairo meeting cancelled in October 2009

• Check overlaps and consistency with other chapters (mainly Ch 1 and Ch 3)

• Last update of the document

• Final language and wording review, including Conclusions
Thank you
Current State and Prospects of LNG in the UNECE region

Geneva, 24 January 2012
1. LNG Supply and Demand
   - New Projects
   - LNG Flows in 2011
   - LNG Demand

2. Pricing dynamics
   - Reasons of price decoupling

3. Recent shocks affecting the LNG Market
   - Shale gas
   - MENA unrest
   - Japanese earthquake & nuclear uncertainty

4. Trends
   - Increasing number of players
   - Offshore popularity
   - LNG as back up for renewables

5. Conclusions
2000-10: LNG supply has increased by 100 MTPA led by Qatar

2011-13: new projects slowing down. Algeria, Pluto, Angola

From 2014: Australian production booming

<table>
<thead>
<tr>
<th>Year</th>
<th>Additional capacity (mtpa)</th>
<th>Projects</th>
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<tbody>
<tr>
<td>2009</td>
<td>44</td>
<td>T4&amp;5 Qatargas II</td>
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<td></td>
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<td>Sakhalin</td>
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<td></td>
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<td>T6 Rasgas III</td>
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<td>T1 Yemen LNG</td>
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<td>2010</td>
<td>31</td>
<td>T7 Rasgas III</td>
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<tr>
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<td>T2 Yemen LNG</td>
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<td></td>
<td></td>
<td>Qatargas III &amp; IV</td>
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<td></td>
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<td>Peru LNG</td>
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<tr>
<td>2011 (E)</td>
<td>4.8</td>
<td>Pluto LNG</td>
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<tr>
<td>2012 (E)</td>
<td>5.2</td>
<td>Angola LNG</td>
</tr>
<tr>
<td>2013-15 (E)</td>
<td>9.2</td>
<td>Skikda replacement</td>
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<td></td>
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<td>Gassi Touil</td>
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<tr>
<td>2014 (E)</td>
<td>40</td>
<td>PNG LNG, Donggi Senoro</td>
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<td>Gorgon LNG</td>
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<tr>
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<td>Queensland CBM Projects</td>
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<tr>
<td>After 2016</td>
<td>• Export projects in North America; other projects in Australia; Russia: Shtokman, Yamal</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>• Other liquefaction projects in Mozambique, Brasil, Nigeria, etc</td>
</tr>
</tbody>
</table>
2011 LNG Flows (E)

Atlantic Basin
87 (▲8)
52 (=)
79 (=)

Middle East
4 (▲2)
32 (▲5)
100 (▲18)

Pacific Basin
148 (▲16)
61 (▲18)
101 (▲7)
76 (▼6)

Source: Stream Analysis.
Approximated data extracted from CERA
Rise of domestic gas demand constraining feed gas in producing countries

Gas demand growth driven mainly by fuel substitution for power generation

☑ Regulation uncertainty: CO2 emissions policy, renewable energy subsidies, domestic coal protection

US: lower LNG demand caused by shale gas boost.

☑ Potentially LNG exports from 2015

Asia: strong gas and LNG consumption in the emerging countries and also in Japan to replace nuclear production.

Europe: LNG demand growing in UK, NWE and Italy but stable or decreasing in Spain due to weak economy and Medgaz PL

South America and Middle East: new seasonal markets
Pricing dynamics

2011 so far

$/MMBtu

JKM
Oil Europe
NBP
HH

01-ene 16-ene 31-ene 15-feb 02-mar 17-mar 01-abr 16-abr 01-may 16-may 31-may 15-jun 30-jun 15-jul 30-jul 14-ago 29-ago
1. LNG is not a global market, but different regional markets interconnected
   - Asia: oil indexed premium market
   - Europe: gas-LNG competition with introduction of partial indexation to liquid hubs in long and medium term contracts
   - US: Henry Hub priced according to production cost, probably below NBP. Increasing volatility from seasonal effects

2. Tight shipping means a restriction for spot diversions
   - Currently charter rates hitting record >100,000 $/day
   - More than 50 new vessels ordered in 2011
3. LNG investments need to leverage on a long term market/client in order to obtain finance
4. LNG spot liquidity much lower than other commodities, but

- Increasing short term activity coming from projects with uncommitted LNG volumes (as Qatar or Algeria)
- The expansion of the Panama Canal could boost the flows between the Atlantic and Pacific Basins

**Churn ratio (Liquidity)**

- Brent (Oil) 500
- HH (gas USA) 100
- NBP (gas UK) 15
- TTF (gas NL) 4
- LNG 1

* "Churn ratio": measures the number of times that the same physical volume transacts between several partners

**Short vs Long Term LNG Sales**

- **2005**
  - Long term Volume: 85%
  - Short-term volume: 15%

- **2011E**
  - Long term Volume: 66%
  - Short-term volume: 34%
1. Shale Gas:
   - LNG demand in US has dropped due to the surge of unconventional gas production
   - Several projects to export LNG from US and Canada

2. MENA unrest
   - The most relevant effect has been an increase of LNG imports to Italy to replace interrupted piped gas from Libya

3. Japanese earthquake & nuclear uncertainty
   - Higher prices and additional LNG flows in North East Asia
# Trends in the LNG Market

## Old LNG business model
- Highly regulated monopoly markets,
- Long Term Contracts (inflexible)
- One destination market: Diversion Restrictions
- Oil indexation Prices
- Fragmented LNG value Chain
- From producer to consumer
- Sales from NOC to State Companies
- Regional Markets: low interbasin exchange
- Competition with alternative energies

## LNG Business model changes
- Open Market: multiple buyers and sellers from the same country
- Short and Medium Term contracts (options)
- Multiple destinations: flexibility - diversion with PSM
- Liquid Markets indexation (HH, NBP, JKM...)
- Vertically integrated companies (including NOCs)
- From producer to consumer/aggregator/trader/...
- Sales from NOC to Private utilities or State Companies
- Global Markets
- gas – gas competition
Increasing number of players with different interests:

<table>
<thead>
<tr>
<th>Producers</th>
<th>Aggregators</th>
<th>Traders</th>
<th>Utilities and Customers</th>
</tr>
</thead>
<tbody>
<tr>
<td>- NOCs</td>
<td>- NOCs</td>
<td>- Investment Banks</td>
<td>- Gas and Power Utilities</td>
</tr>
<tr>
<td>- IOCs</td>
<td>- IOCs</td>
<td>- Pure traders</td>
<td>- Final customers</td>
</tr>
<tr>
<td>- Utilities</td>
<td>- Utilities</td>
<td>- Shipping Companies</td>
<td>(Power plants, Large Industries)</td>
</tr>
</tbody>
</table>
Trends in the LNG Market

Shale gas

Global Unconventional Gas Resources

Unconventional Gas Resources in Europe

Will unconventional gas in other regions follow the North American success story?
Trends in the LNG Market

Floating

**Offshore popularity:**

- **Easier permitting process:** either as a transition up to completion of the onshore terminal or as a permanent solution. Lead times are much shorter in general: 1 year vs 4-5 years.

- **Fast track solution:** simpler (environmental issues, local opposition), avoiding delays in the project, very common to conventional terminals.

- **Less capital intensive:** for an equivalent capacity in most cases. FR can make the entrance in new LNG markets feasible, where the demand is insufficient for conventional regas.

- **Greater degree of flexibility** than conventional:
  - FR vessel used as LNG carrier
  - FR vessel used in different locations in different seasons
Floating regas terminals in operation in 7 countries…

Argentina (2)
Brazil (2)
Chile (FSU)
Kuwait
Dubai
UK
USA (3)
Floating regas is a growing reality...

... and many more planned or under development
Floating regas configurations:

- FSRU moored in harbour:
  - Bahía Blanca and Escobar (Argentina)
  - Rio de Janeiro and Pecém (Brazil)
  - Kuwait
- HP arm in harbour with no permanent FR vessel:
  - Teeside (UK)
- Offshore buoy:
  - Northeast Gateway (Boston, USA)
  - Neptune (Boston, USA)
  - Gulf Gateway (US Gulf)
  - OLT Livorno (Italy). Under development, permanent FSRU with STS transfer. Continuous send-out

Floating liquefaction:

- Prelude LNG (Australia, Shell) has taken FID
- Many projects under study: Brazil, Nigeria, etc.
High power demand & low wind availability

Room for thermal production: Coal+Gas ~ 20,000 MW

Source: REE
Trends in the LNG Market
Competition gas-coal-renewables

Low power demand & high wind availability

Room for thermal production cut by subsidised renewables

Source: REE
Gas has increased its share in power generation in Europe during the last decade, thanks to the efficiency and environmental advantages of modern CCGTs.

Renewables are taking the lead for new investments, followed by gas.
Massive penetration of intermittent renewables is leading to increased operational constraints and requires “back up” power (mostly gas)

Wind power generation in Spain, 26/12/2010

This new model generates new challenges...

- Defining appropriate remuneration schemes
- Grid integration
- Increased operating costs
- Underutilized gas infrastructure
- Dealing with uncertainty in gas demand.

CCGTs are acting as a back up power source, increasing the requirement for flexibility and reliability

Source: Red Eléctrica de España
Trends in the LNG Market

Prices

US Exports
Australia
India/China
Europe
Trends in the LNG Market

Importers:

- Japan
- South Korea
- Spain
- UK
- France
- Taiwan
- US East
- China
- India
- Italy
- Turkey
- Belgium
- Otros
Despite global economic downturn, LNG demand continues growing and increasing its share regarding total gas consumption (currently 10% approximately).

New players with different profiles and new countries are joining the LNG business.

The market is continuously changing due to new technology and unexpected shocks.

Trading and arbitrage opportunities adds value to portfolio flexibility and shipping capabilities.

New business models and new players could become a reality in the coming future.
Thank you
CHAPTER 3: Competition between LNG and pipeline gas

Mr. Ulco Vermeulen (Gasunie, The Netherlands)
Mr Jacques Rottenberg (Elengy, France)
Content of Chapter 3

• Introduction
• LNG development and market shares
• LNG / pipelines economics
• Evolution of the LNG environment
• Main drivers for LNG in Europe
• Conclusion
LNG vs Pipeline gas: an already long story

- First LNG commercial deliveries in the middle of 60s, just a few years after long distance pipeline commercial supplies

- Development of LNG in different gas market determined by the alternative supplies at competitive cost

- Three main gas markets: Europe, USA and Asia, each having its own characteristics
  ⇒ accounting in 2010 for 61% of world gas consumption and 96% of global LNG imports
Gas market vs LNG market
Europe

Competition issues led to:
- UK to give up LNG supplies during more than 25 years
- Italy to interrupt LNG imports during about 10 years
- Germany to postpone development of LNG terminal
Gas market vs LNG market
North America

- Historically supplied by indigenous conventional resources

- In the 1980s, building of 4 LNG terminals in order to benefit from potential low-cost supplies; but dramatic changes => for more than two decades: 2 terminals with little activity and 2 others completely idle; moreover, exporting LNG to Asia was then proposed!

- Early 2000s, US domestic production moved to rapid decline, and it was foreseen that the US would become a major LNG importer => new LNG terminals…

  …but non conventional gas developed “suddenly” => LNG export very seriously considered!
LNG / pipeline economics

- Liquefaction accounts for the majority costs of the global LNG chain.

- Transportation costs between producer and consumer countries are an important aspect of competitiveness of gas supplies; typical breakeven distances: between 1000 and 2000 nautical miles.

Note:
- Real figures depend on a lot of parameters.
- Doesn’t take into account the gas production cost.
Evolution of the LNG environment:

From dedicated LNG chains to a global LNG market:

- Increase of LNG production capacities, number of producers
- Increase of LNG regas capacities, nb of importing countries
- Development of trading hubs and increased market liquidity
- Change in LNG business models
- Price decoupling between the main gas market
- Development of new trans-Mediterranean pipeline capacities (Medgas…), releasing liquefaction capacity in Algeria

⇒ Increasing possibilities of diversion / arbitrage, LNG is a price taker
Main drivers for LNG in Europe

- Rising gas demand for power generation, combined with decline in domestic production

  => Needs for large increase of EU imports, that should be mainly covered through Russian gas and LNG

- Security of Supply and Diversification of Supply remain key consideration for EU

  => LNG imports are expected to increase their share in the EU energy mix
European gas supply prospects

2010
Total = 570 bcm

LNG share: 15%

Source: CEDIGAZ

2020
Total = 640 bcm

LNG share: 23%

Source: CEDIGAZ
However, uncertainty remains large, in particular in relation with

- world economic growth,
- Global LNG demand (Asia…)
- Unconventional gas
- EU policy (carbon, renewables, energy saving, target model, Roadmap 2050…)
- Long term contracts …
THANK YOU FOR YOUR ATTENTION
CHAPTER IV: REGULATION

CURRENT STATE AND PROPECTS OF LNG IN THE UNECE REGION

Luis I. Parada
Regulation, deregulation, competition and various combinations of them are not good or bad in the abstract...to make the right choice requires that we carefully balance the advantages and disadvantages of different institutional arrangements in light of the characteristics of the products and firms to which these institutions will apply.

Paul Joskow, professor of economics, MIT
Chapter IV outline

1. Regulatory evolution and trends.
2. Strategic issues affecting regulation in importing countries.
3. Authorisations & licences.
4. Unbundling requirements.
5. Access to LNG regasification terminals in Europe.
7. Conclusions.
1. Regulatory evolution and trends

Detailed review of LNG regulation at a European level, in the USA, and in Japan, 3 areas where different regulatory models have been adopted.

LNG regasification terminals:

- **part of the downstream?** ➔ more likely to be considered essential infrastructures which must be regulated just like the transmission business

- **part of the upstream?** ➔ light-handed approach to regulation would be more appropriate
1. Regulatory evolution and trends

EUROPE


Third Package (2009): new Regulation also applicable to LNG!

Focus on transparency, and effective access (CAM/CMP, UIOLI, secondary markets, …)

Relevant monitoring activity by ERGEG/CEER to ensure Third Package implementation.

In Europe nowadays rTPA and exemptions coexist, sometimes even applied to the same physical terminal.
1. Regulatory evolution and trends

Partially exempted:
80% exempted / 20% rTPA
1. Regulatory evolution and trends

LNG capacity, 2000-2010 comparison

Source: Enagás estimates based on GLE data (GLE Investment database) and company’s websites
1. Regulatory evolution and trends

LNG capacity, 2003-2010 comparison

Source: Enagás estimates based on GLE data (GLE Investment database) and company’s websites
1. Regulatory evolution and trends

LNG capacity, 2005-2010 comparison

Source: Enagás estimates based on GLE data (GLE Investment database) and company’s websites
1. Regulatory evolution and trends

**USA**

Terminals had traditionally been subject to open access obligations.

In 2002 the Hackberry decision changed the landscape.


All terminals built in the last decade are, thus, exempted from open access obligations. However, three historical terminals remain subject to open access obligations.
1. Regulatory evolution and trends

LNG Terminal locations in the US (lower 48)
1. Regulatory evolution and trends

JAPAN

TPA subject to negotiation between the parties concerned. Guidelines to ensure the fairness of transactions jointly published by the METI and the JFTC in August 2004.

Guidelines state that it is desirable that LNG terminals create manuals for negotiations about TPA, and that they make sufficient information disclosure with regard to the capacity of LNG terminals, the current status of capacity utilisation and plans for future utilisation.

As of March 2007, since 12th August 2004, 14 companies had already published basic information and guidelines for a total of 23 terminals (out of 27 LNG terminals in Japan in 2007) but no TPA in practice!
2. Strategic issues affecting regulation in importing countries

Strategic issues might be taken into account by authorities when designing regulations, and these might have an impact on the development of LNG infrastructures, given the benefits they bring and also their potential drawbacks.

  - E.g. EU Regulation on SoS (N-1 infrastructure standard, bidirectional physical flows at IPs)
- Flexibility of Supply.
- Liquidity
- Effect on prices
  - Debate in the US of effect on prices of LNG exports
- Competition and market integration
  - EU Connecting Europe Facility ➔ identification of corridors and Projects of Common Interest
3. Authorisations & licences

Regulation not only regards aspects like access to infrastructures or the determination of allowed revenues, but also the conditions to build them.

Time-consuming procedures and negotiation in order to obtain the necessary authorizations with different government levels and agencies (in particular, in an increasingly environmentally sensitive world). A wrongly-designed regulation on authorisations may neutralize the positive effects of a good regulation in other areas.

Section 3 ➔ Snapshot of authorisations and licence requisites in different regions, in particular in USA and Spain, where LNG terminals are based on fundamentally different regulatory models.
3. Authorisations & licences

**USA:** process for onshore terminals perceived as complex and time consuming. But it did not deterred LNG investments once the appropriate regulations where put in place.

**Italy:** NYMYB effect, investments have so far only been possible in offshore facilities. Apparently a problem of parallel competences of regions and the Central State: all the government bodies, at all levels (including municipalities) are involved in the authorisation process and can stop it in a way or another. In addition, Regions have a veto power.

**Spain:** widespread perception that economic benefits from LNG terminals largely outweight their costs resulted on competition to attract new terminals between regions (and sometimes different provinces within the same region). Once the seventh terminal is in operation by late 2012, seven of the eight Spanish coastal regions in the Iberian Paninsula will have a LNG terminal.
4. Unbundling requirements

Unbundling requirements over LNG regasification operators are present in some regulatory regimes. These requisites, aimed at ensuring effective independence of LNG operators, are naturally related to the regulatory access model.

In general:

• no requirements where LNG regas is considered part of the upstream ➞ no TPA

• different requirements where LNG regas is considered part of the downstream: from accounting/legal unbundling to ownership unbundling ➞ TPA
4. Unbundling requirements

Company profile of players in the EU

Vertical integration vs. ownership unbundling.

Ownership unbundling

<table>
<thead>
<tr>
<th>Pure infrastructure operators</th>
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<tbody>
<tr>
<td>gasunie</td>
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<tr>
<td>nationalgrid</td>
</tr>
<tr>
<td>enagas</td>
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<tr>
<td>REN</td>
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<td>FLUXYS</td>
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Vertical integration

<table>
<thead>
<tr>
<th>Present at least in supply and LNG regas</th>
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<tbody>
<tr>
<td>GDF Suez</td>
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<tr>
<td>Qatar Petroleum</td>
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<tr>
<td>BG Group</td>
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<tr>
<td>PETRONAS</td>
</tr>
<tr>
<td>Sonatrach</td>
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<tr>
<td>ExxonMobil</td>
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<tr>
<td>TOTAL</td>
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Planned
5 & 6. Access to LNG terminals

- Access rules.
- Services offered.
- Capacity allocation procedures.
- Long term/short term capacity offering requirements.
- Contracts duration.
- Programming / Nomination procedures.
- Congestion management procedures.
- UIOLI.
- Send-out requirements.
- Balancing regime/ Management of LNG stock levels.
- Own consumption record and gas in kind.
- …
5 & 6. Access to LNG terminals

- Charges and penalties for imbalance, cancellation and other, including Ship-or-Pay and minimum payment obligations.
- Financial Guarantees.
- Secondary market.
- Limitation in vessel size.
- Force Majeure.
- Ship Approval Procedure at LNG terminal.
- Standard contracts.
- TPA tariffs.
- Capacity booking procedures.
- Effective access.
## 5 & 6. Access to LNG terminals

### Access rules

<table>
<thead>
<tr>
<th>Country</th>
<th>LNG terminal</th>
<th>Code</th>
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</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>Zeebrugge</td>
<td>Network Code for terminalling¹</td>
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<tr>
<td>France</td>
<td>Fos Cavaou</td>
<td>No access code – access rules published in different documents</td>
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<tr>
<td></td>
<td>Fos Tonkin</td>
<td>No access code – access rules published in different documents (Contract)³</td>
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<td></td>
<td>Montoir de</td>
<td></td>
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<tr>
<td>Greece</td>
<td>Revithousa</td>
<td>Network Code approved in April 2010⁴</td>
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<tr>
<td>Italy</td>
<td>Adriatic LNG</td>
<td>Regasification code published in 2011⁵</td>
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<td>Panigaglia</td>
<td>Regasification code for Panigaglia⁶</td>
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5 & 6. Access to LNG terminals

Services offered

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<tr>
<th>LSO/LNG Terminal</th>
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<th>DEPA</th>
<th>ELENGY</th>
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<th>Grain LNG</th>
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ELENGY and STMFC:

(*) Under certain conditions

ENAGAS

- Please note that “liquefied nitrogen loading” and “Bunkering while ship at berth” is not a service provided by the LSO but a service allowed by the LSO while ship is at berth.
- Ship can be supplied with liquid nitrogen and fuel but the supplier will not be the LSO but an external supplier.
- Wobbe index correction and Calorific Value correction are not services offered in Spain, because they are not needed. Spanish market is able to accept any Wobbe index and any Calorific Value.
- Some of the services included as technical specific are ancillary services in Spain according to current regulation.
- ENAGAS would like to clarify that regasification/storage/unloading capacity trading services are not offered due to the fact that there are enough available capacity at the LNG terminals and also because access contracts are available from one day to 20 years.
- This fact along with a very liquid secondary gas market for gas exchanges make that users have enough flexibility and they do not ask for additional trading services.

FLUXYS LNG

- According to present regulation, all of these services are ancillary services in Belgium

GRAIN LNG

- Odorising - Grain has an odorant plant on site but this is the property of the Distribution Network and Grain staff only perform basic services to the plant. Odorant is only used for the boil-off supplies that go direct to the distribution network.
- Basic - while Grain is able to offer these ancillary services they would be expected to be linked in some configuration for a bundled product for any additional Term User

SOUTH HOOK LNG

(*) bunkers may be available ex-barge outside of cargo operations subject to Port Authority approval.
5 & 6. Access to LNG terminals

CAM: Open seasons

The Netherlands
Gate LNG

November 2005: start of open season for terminal capacity

UK
Grain LNG

All primary capacity has been allocated by OS:
- 1st phase 2006
- 2nd phase 2008
- 3rd phase 2010

Belgium
Zeebrugge

Fluxys launched the non-binding phase of the OS for additional capacity at the Zeebrugge

Italy
Adriatic LNG

Adriatic LNG launched an OS to allocated non-exempted capacities

France
Dunquerke LNG

EDF launched an OS to test market demand. The investment was decided in 2011.

Belgium
Zeebrugge

Fluxys launched the binding phase of the OS for additional capacity at the Zeebrugge

France
Montoir de Bretagne

Elengy launched an OS to extend the lifetime of the terminal up to 2035 and gradually expand capacity. The results did not allow for the expansion of capacity, but triggered the investment for the extension of the lifetime.

France
Fos Tonkin

Elengy launched an OS to extend the lifetime of the terminal up to 2035. The results did not trigger the investment

France
Montoir de Bretagne

Elengy launched an OS for additional capacities.

France
Fos Tonkin

Elengy launched an OS to extend the lifetime of the terminal up to 2035. The result did not triggered the investment. Decision postponed

France
Fos Faster

Vopak launched an OS to test market demand for Fos Faster LNG terminal capacities.

The Netherlands
Gate LNG

November 2005: start of open season for terminal capacity

UK
Grain LNG

All primary capacity has been allocated by OS:
- 1st phase 2006
- 2nd phase 2008
- 3rd phase 2010

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Fos Faster

Vopak launched an OS to test market demand for Fos Faster LNG terminal capacities.
Programming/nomination procedures

Programming schedule at Spanish LNG terminals

- **21\(^{st}\) of Month M-1:** Users send:
  - Unloading dates, cargo and quantities binding for Month M and for the first fortnight of Month M+1 and non-binding nominations for the second fortnight of Month M+1 and for Months M+2 to the LSO, and
  - Monthly quantities to be regasified with daily detail for Month M and for the first fortnight of Month M+1

- **28\(^{th}\) of Month M-1:** Enagás as GTS confirms the final monthly program to all stakeholders

- **25\(^{th}\) of Month M-1:** LSOs informs about viability of the monthly program

- **14h Thursday W-1:** Users send:
  - Daily quantities to be regasified each Gas Day for Week W
  - Unloading date, name of cargo and quantity

- **10h Friday W-1:** LSOs communicates weekly viability

- **12h Friday W-1:** Enagás as GTS confirms the final weekly program to all stakeholders

- **14h D-1:** User sends its initial nomination for the next day D

- **17h D-1:** LSO checks and communicates to the user the nominated quantities

- Renomination periods

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5 & 6. Access to LNG terminals
## 5 & 6. Access to LNG terminals

<table>
<thead>
<tr>
<th>Country</th>
<th>LNG terminal</th>
<th>CMP applied</th>
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<tbody>
<tr>
<td>Belgium</td>
<td>Zeebrugge</td>
<td>Secondary market</td>
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<td>France</td>
<td>Fos Cavaou</td>
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<td>Fos Tonkin</td>
<td>Penalty for late cancellation of a scheduled unloading operation</td>
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<td>Ex-post UIOLI</td>
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<td>Greece</td>
<td>Revithousa</td>
<td>UIOLI</td>
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<td>Italy</td>
<td>Adriatic LNG</td>
<td>Ex-post UIOLI and ex-ante UIOLI</td>
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<td>Sines</td>
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<td>UIOLI</td>
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<td>UIOLI: Auctions held by primary holders</td>
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</table>
7. Conclusions

PRELIMINARY CONCLUSIONS UNDER DEVELOPMENT

- Regulated or non-regulated regimes are not good or bad per se, the decision between them should be informed by the characteristics of the market.

- The debate will remain open in Europe and the USA; in the former, exemptions are granted for a given period (typically around 20 or 25 years), are adopted on a case-by-case basis, and the coexistence of both regimes is posing some challenges and raising some questions; in the latter, the current regime was only approved until 2015 and a decision on whether terminal authosised after that year will or not be subject to open access requirement has to be made.
7. Conclusions

PRELIMINARY CONCLUSIONS UNDER DEVELOPMENT

- Permitting processes might be complex and time-consuming but they have not generally been an obstacle for the successful development of several projects (given an adequate investment climate).

- …except in some cases (NYMBY effect).

- Unbundling only occurring in Europe, where a tendency to ownership unbundling of LSOs linked to the regulatory requirements for TSOs is observed.
7. Conclusions

PRELIMINARY CONCLUSIONS UNDER DEVELOPMENT

- Increasingly detailed access regulations in European countries. Also increasingly harmonised access principles (CAM/CMP, UIOLI, secondary markets,…) and transparency requirements.

- Tendency in Europe to make use of Open Seasons for new capacity.
THANK YOU FOR YOUR ATTENTION
CHAPTER 5: INTEROPERABILITY AND SAFETY
LNG Quality and Interoperability

- LNG specifications
- Impurity specifications
- Sampling, Analysis and Measurement
- Quality Adjustment:
  - At LNG Liquefaction Plants
  - At LNG Receiving Terminals
- Impact of LNG Quality:
  - On Gas Turbines
  - On Domestic Appliances
LNG FACILITIES COMPATIBILITY

- Characteristics of the LNG Facilities
- Operational Safety:
  - LNG Facilities
  - LNG Carriers
- Vessel Approval and Compatibility Procedure
EXECUTIVE SUMMARY (1)

- Great Expansion of LNG Business:
  - 360 Tankers
  - 95 LNG Trains
  - 90 Regasification Terminals
- Q-max tankers: 270,000 LNG m$^3$
- Safe delivery of more than 220 million tons LNG/year
- Major Transport Route: Maritime
EXECUTIVE SUMMARY (2)

- Critical aspect: Ship to Terminal interface
- Enormous range of port environments
- Differences in local operational procedures from port to port
- Tremendous variety of LNG tankers design
- Ever-changing regulations and technology
EXECUTIVE SUMMARY (3)

- Gas Quality Harmonization
- Gas Quality Standards for the European Union Countries: Association EASEE-gas
- Unconventional gas: lean composition
  - Shale Gas
  - Tight Gas
  - Coal-to-bed methane
EXECUTIVE SUMMARY (4)

- Ship to Terminal Compatibility safer: global issue
- Increasing spot-trading cargoes
- Floating off-loading projects
- LNG Industry: excellent safety record
EXECUTIVE SUMMARY (5)

- Environmental issues
- Information available is growing fast
- New Facilities (e.g. FSRU) and new Markets
- Flexible compatibility management
EXECUTIVE SUMMARY (6)

- Encourage collaborative dialogue
  - LNG producers and receivers
  - LNG shippers
  - Regulatory Bodies
  - Commercial Organisations
  - As much standardization as possible
  - Growing efficiency
EXECUTIVE SUMMARY (7)

- Re-export adaptation of Terminals
- Bi-directional capability
- Regasification + Liquefaction: the same Plant
- Safety Approval Process:
  - Hazard and Operability (HAZOP) process
  - Safety Integrity Level (SIL) classification and reviews
  - Third Party reviews by Peers
- Detection and Fire Fighting Systems
CONCLUSIONS (1)

- Special attention to quality control
- Analysis for Interchangeability is critical
- Selection of chromatographs and sampling equipment
- A real challenge: LNG tanks management procedure
- Regional or Global Harmonization?
CONCLUSIONS (2)

- New Terminals with Quality Adjustment Facilities
- Increasing ship-shore compatibility
- Example of Standardization:
  - Emergency Shutdown Systems

- Summing up, Chapter 5 tries to identify the current issues, trends, requirements and challenges to allow the LNG industry to grow in safety and interoperability, worldwide
End of the presentation of Chapter 5: Interoperability and Safety

- Many thanks for your attention!