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Initial Impact Assessment

Accompanying the document

Framework Guidelines on Interoperability and Data Exchange Rules for European Gas Transmission Networks

Ref: ACER/AP/TQ/2012/992

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The aim of this document is to describe the nature of the problem targeted by the set of policy options listed in the corresponding Framework Guideline. The description should be supported with clear evidence. The Initial Impact Assessment is a work-in-progress that gathers the evidence collected from various stakeholders during the process of drafting the Framework Guidelines on Interoperability and Data Exchange Rules. This document has been handed over to ENTSOG on 16 October 2012. ENTSOG will work on further evidence alongside the development of a Network Code. Any remark on the content of this document should be addressed to ENTSOG.

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PART I: GENERAL INTRODUCTION

1. Introduction

The completion of the internal gas market by 2014 is an ambitious goal decided by the Heads of State and Government at the European Council of 4 February 2011. Consequently, establishing all the major elements of market design and operations of systems before this deadline is therefore necessary.

The third internal energy market package[1] (hereinafter 'Third Package') provides the legal instruments to set up rules for achieving the integration of European gas markets. Within this process, the European Commission may request the Agency for the Cooperation of Energy Regulators ('the Agency') to prepare framework guidelines. The European Network of Transmission System Operators for Gas ('ENTSOG') is then responsible for drafting network codes upon an invitation by the European Commission, according to the principles set by the framework guidelines prepared by the Agency.

The Framework Guidelines on Interoperability and Data Exchange rules ('the Framework Guidelines') will be the first framework guidelines of an operational and technical nature to be developed, as opposed to the previous framework guidelines adopted by the Agency, which rather addressed commercial issues related to the creation of a single European market for gas.

Procedures of an operational or technical nature can strongly influence and even hamper the development of markets. Therefore, rather than covering details subject to constant technological developments, the Framework Guidelines focus on general requirements, with a view to ensuring the interoperability and efficiency in operating networks. Similarly, the data exchange rules streamline practices in that area.

The policy choices made in the Framework Guidelines are underpinned by an identification of the problems and an assessment of the possible solutions . The present document describes those problems identified, discusses how these are best addressed keeping in mind the overarching objectives of the single European gas market and assesses the structural, social and environmental impact of policy options, in line with the European Commission's guidelines on Impact Assessments2. The present document can be seen as the basis for the final Impact Assessment that is needed to complete the network code process through comitology.

2. Procedural issues and consultation of interested parties

Following its inauguration on 3 March 2011, the Agency set out to complete the preparatory work on the Framework Guidelines on Interoperability Rules. This scoping process included bilateral meetings with key stakeholder organisations as well as an informal consultation. A workshop on 13 September 2011 was held to

[1] http://ec.europa.eu/energy/gas_electricity/legislation/third_legislative_package_en.htm
[2] http://ec.europa.eu/governance/impact/commission_guidelines/docs/iag_2009_en.pdf

allow interested stakeholders to help the Agency gain a full understanding of the scope of issues stakeholders expected to be treated in the Framework Guidelines[3].

The European Commission invited the Agency by a letter from the 31st of January 2012 to develop, within a time frame of 6 months, Framework Guidelines on Interoperability and Data Exchange rules. As part of this process, a public consultation was held from the 16th of March 2012 until the 16th of May 2012. In total, 34 responses to the consultation were received. An Evaluation of Responses [4] ('the Evaluation of Responses') was prepared by the Agency. A detailed list of stakeholders is attached to this document as ANNEX A.

During the consultation period, a stakeholder workshop was organised on the 23rd of April in Ljubljana and bilateral meetings with key stakeholder organisations were held.

The final ACER Framework Guidelines on Interoperability and Data Exchange were submitted to the European Commission on 26 July 2012.

3. Problem description

Regulation (EC) No 715/2009 (the 'Gas Regulation')[5] sets forth the necessary technical rules for the creation of an integrated energy market across the EU. To that end, it is essential to promote of cross-border trade and unhampered gas flows.

The use of infrastructure in a network industry such as natural gas is non-substitutable. Nowadays, a natural gas shipper or a trader willing to cross a European border generally faces a new infrastructure operator[6].

In that context, in order to facilitate cross-border trade and remove obstacles to the physical flow of gas within the internal energy market, it is crucial that interoperability[7] between transmission systems is ensured.

Ideally, in a fully integrated system, the interoperability level is such that users of two or more transmission systems operated by separate entities in Europe do not face technical, operational, communications or business-related barriers higher than those that would have been reasonably expected, if the relevant networks had been efficiently operated by a single entity.

The Gas Regulation promotes an optimal use of the interconnection capacity between countries by setting the relevant rules and principles, while foreseeing, by way of delegation, the issuance of implementing acts such as guidelines and network codes on interoperability rules, to be adopted through the Comitology process. The purpose of these network codes or guidelines is to set out the detailed provisions that will eventually allow the creation of a level playing field necessary for new entrants to step into sustainable and successful competition with incumbents, either on the wholesale or the retail market.

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[3] http://www.acer.europa.eu/portal/page/portal/ACER_HOME/Stakeholder_involvement/Events/Gas_Framework_Guidelines_Interoperability_Workshop

[4] ACER Public Consultation on the Draft Framework Guidelines on Interoperability and Data Exchange Rules for European Gas Transmission Networks, Initial evaluation of responses - PC_2012_G_07_EoR

[5] 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 1775/2005, OJ L 211/36 14/08/2009.

[6] http://www.entsog.eu/mapsdata.html

[7] In the context of the Framework Guidelines, the term "interoperability" refers to the ability of the transmission systems to work together and interact with network users and adjacent systems (inter-operate) in a technical or operational sense in order to facilitate the functional and cost effective exchange of gas across networks.

a. Context of the problem

Throughout the whole natural gas chain, from the production and the external borders of the EU to the transmission, storage, LNG and distribution and the delivery to final consumers, technical and operational rules and procedures are put in place by players in order to operate systems efficiently, safely and according to the needs of network users and adjacent system operators.

Before the opening of the electricity and gas sectors, a single party could be responsible for:

- Operating the infrastructures (transmission, distribution, LNG, storage);
- inputting gas in the system, either from national sources of production or through contracts with other countries;
- off-taking gas from the system in order to supply consumers or distribution systems;
- the local commercialising of natural gas.

Necessary technical and operational rules and procedures were then internal to the integrated company.

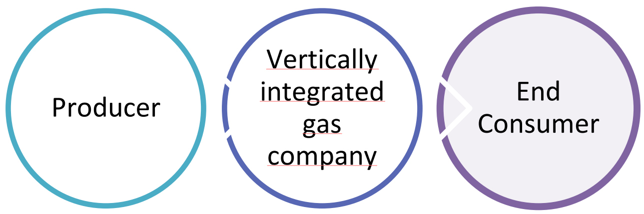


Figure 1: communication path from producer to consumer along the gas chain before the opening of the gas sector

Now that unbundling is ensuring competition in European gas markets, stakeholders and interfaces between them have been multiplied.

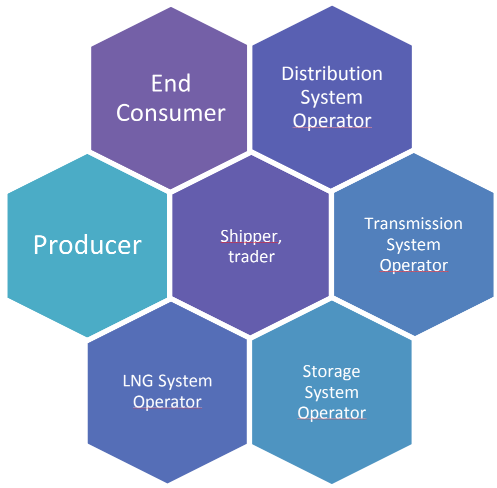


Figure 2: interfaces among stakeholders after the opening of the gas sector

Interactions at interfaces are codified within bilateral agreements, possibly including:

- technical parameters such as the capacity available for system users, based on a capacity calculation methodology;
- operational procedures;
- communication protocols and information exchange, including data units.

These agreements are necessary in order to ensure a smooth conduct of business across systems operated by different system operators as well as between system operators and system users.

b. General Principles established by the Third Package

The Third Package provides some orientations on the approach to interoperability.

According to Article 8 of Directive 2009/73/EC[8] (the 'Gas Directive') on Technical Rules, "*the regulatory authorities where Member States have so provided or Member States shall ensure that technical safety criteria are defined and that technical rules establishing the minimum technical design and operational requirements for the connection to the system of LNG facilities, storage facilities, other transmission or distribution systems, and direct lines, are developed and made public. Those technical rules shall ensure the interoperability of systems and shall be objective and non-discriminatory. The Agency may make appropriate recommendations towards achieving compatibility of those rules, where appropriate*."

The Framework Guidelines cannot put obligations on other stakeholders than transmission system operators; however:

[8] 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 repealing Directive 2003/55/EC, OJL 211/94, 14.8.2009.

- Distribution system operators ('DSOs') are included to the extent defined in recital (6) of the Gas Regulation: *"High-pressure pipelines linking up local distributors to the gas network which are not primarily used in the context of local distribution are included in the scope of this Regulation."*
- Article 15(b) of the Gas Regulation requests that *"LNG and storage system operators shall […] offer services that are compatible with the use of the interconnected gas transport systems and facilitate access through cooperation with the transmission system operator".*

4. Objectives

a. General objectives

The general objective is the creation of the necessary regulatory framework on interoperability issues, which will allow the creation of a well-functioning, efficient and open internal gas market. This objective is in line with the following EU Treaty goals:

- to establish a functioning internal market in gas, in the spirit of solidarity between the Member States (Article 3(3) TEU; Article 194(1) TFEU);
- to ensure security of energy supply in the Union (Article 194(1)(b) TFEU);
- to promote the interconnection of energy networks (Article 194(1)(d) TFEU).

b. Specific objectives

The specific objectives are in line with the EU energy policy objectives, which are outlined in Article 1 of the Gas Regulation:

- Set non-discriminatory rules for access conditions to natural gas transmission systems taking into account the special characteristics of national and regional markets with a view to ensuring the proper functioning of the internal market in gas;
- Facilitate the emergence of a well-functioning and transparent wholesale market with a high level of security of supply in gas and provide mechanisms to harmonise the network access rules for cross-border exchanges in gas;
- Improve competitiveness and transparency in the gas market.

c. Operational objectives

The operational objectives set out broad general requirements rather than they introduce detailed technical rules. It will thus provide flexibility and an opportunity for transposing the new practices and methods into the network code and its possible future revisions.

The operational objectives include:

- The technical and structural harmonisation of the terms under which adjacent TSOs shall set the ground for their cooperation;
- The harmonisation of data formats and units used by TSOs when communicating to counterparts;
- The creation of incentives for TSOs to monitor, communicate to end-users and cooperate with adjacent TSOs on gas quality issues and solutions;
- The prevention of odorisation practices as a cause for the hampering of cross-border flows;
- The creation of incentives for TSOs to cooperate when calculating cross-border capacity, with a view to ensuring a maximisation of the offered capacity.

d. Legal base and principles of subsidiarity and proportionality

The procedure for the adoption of detailed EU regulation on interoperability and data exchange rules is set out in Article 6 and Article 8 of the Gas Regulation,[9] where the right of the Commission to request from the Agency the submission of framework guidelines on this issue is established, with a view to the eventual the development of a network code. The Framework Guidelines are expected to contribute to non-discrimination, effective competition and the efficient functioning of the market.

The subsidiarity principle is enshrined in the same provisions, where foreseen that the network codes shall be developed for cross-border network issues and market integration issues, without prejudice to the necessary national network codes for non cross-border issues.[10]

The Commission's initiative to request the Agency to draft the current framework guidelines is fully in line with the principle of subsidiarity, according to which the EU shall act only insofar the objectives of the proposed action cannot be sufficiently achieved by the Member States, as it only exercises the rights which it has been attributed by the Gas Regulation.

In line with the principle of proportionality, under which the content and form of any EU action shall not exceed what is necessary to achieve the objectives of the Treaties, these framework guidelines are fully compatible with the aim of the completion of the internal gas market, while their scope of application is within the limits set by the Gas Regulation.

5. Policy options and enforcement design choices

As described in section 3 above, interoperability regroups issues of different technical fundamentals.

In the following part, and for each of these issues, after identifying current problems, this Impact Assessment examines several approaches addressing these problems, aiming at selecting solutions that are proportionate, while respecting subsidiarity.

The first approach follows a baseline scenario understood to be "business as usual". Under this scenario, no further action is taken on a European level to mitigate the problem identified, else than the implementation of the provisions of the Third Package. The other options presented for each policy area cover various levels of harmonisation, from a differentiated approach to a far-reaching one.

[9] Article 6(2) and Article 8(6) of the Gas Regulation: R715/2009
[10] Article 8(7) of the Gas Regulation.

PART II: IMPACT ASSESSMENTS

6. Interconnection Agreements:

a. Interconnection Agreements: context of the problem

The objective of the Interconnection agreements is to define the full range of obligations and rights of the counterparts, under all conditions, as legally acceptable, while preventing unnecessary barriers to cross-border trade.

These conditions, as set out in ANNEX B, can be broadly categorised as:

- safety-related,
- physical & operational,
- commercial, and
- contractual.

Arrangements among TSOs at a given interconnection point can be expected to be captured bilaterally in an interconnection agreement. From an historical point of view, these topics were agreed among the existing vertical integrated parties or incumbents, in the context of the supply contracts. As the landscape of the sector changed due to liberalisation (see chapter 3.a), and independent operators have taken over the operational branch, these agreements have to be set independently, in a transparent and non-discriminatory way.

b. Interconnection Agreements: current regulation

The Network Code on Capacity Allocation Management[11] ('CAM Network Code') provides for its purposes a definition of interconnection agreements and some elements of the regulatory context within which they operate.

- ***Section: 1.2. Definitions***

(k) 'Interconnection Agreement' means an agreement entered into by and between adjacent transmission system operators, whose systems are connected at a particular Interconnection Point, which specifies terms and conditions, operating procedures and provisions, in respect of delivery and/or withdrawal of gas at the Interconnection Point with the purpose of facilitating efficient interoperability of the interconnected transmission networks.

- ***Section: 3.1. Coordination of maintenance - 1) and 5)***

1) Where maintenance of a pipeline or part of a transmission network has an impact on the amount of capacity which can be offered at Interconnection Points, the respective transmission system operators shall fully cooperate with their adjacent transmission system operator(s) regarding their respective maintenance plans to minimise the impact on potential gas flows and capacity at an Interconnection Point. The exchange of data between the respective transmission system operators shall be integrated in their respective Interconnection Agreement.

[11] Document CAP0210-12 of 6 March 2012 as available on ENTSOG's website: http://www.entsog.eu/publications/camnetworkcode.html

[…]

5) For the avoidance of doubt the maintenance arrangements set out in a transmission system operator's Capacity Contracts or Interconnection Agreements are not prescribed in this Network Code.

c. Interconnection Agreements: problem definition

The aim of the Framework Guidelines in respect of interconnection agreements is to ensure that TSOs reach an agreement on all Interconnection Points and that these reach the necessary level of harmonisation so that they do not impose unnecessary risks or costs on users.

There are a range of different costs/risks that are dependent on the structure of interconnection agreements which might lead to higher costs and/or lower flows:

- Commercial compatibility issues generally impact on users' costs and risks, such as the processes for allocating gas quantities to specific users (see ANNEX C);
- Physical and operational: at any given moment in time, only one TSO can be physically controlling flow. It is important therefore to establish which TSO is responsible for controlling flow and under what conditions. Without establishing these responsibilities, uncoordinated actions by TSOs could result in artificial constraints, limiting the capacity available on-the-day, thereby impacting users. Specification of flow control is a necessary prerequisite for establishing an Operational Balancing Account (OBA).

The main concerned parties in an interconnection agreement are TSOs. However, due to the nature of the topics tackled within this agreement, and as illustrated by the example in ANNEX C, an incomplete or missing interconnection agreement will impact the ability for users to balance in either or both markets thereby increasing costs.

d. Interconnection Agreements: extent of the problem

When evaluating problems arising in relation to interconnection agreements, NRAs face the following difficulties:

- The access to information is difficult, due to the cross-border and the confidential nature of the agreements*;*
- The problems faced in the past have since been solved, although to the price of costly, lengthy and time consuming processes.

However, examples provided by NRAs show the existence of problems resulting in a hampering of cross-border trade.

Arguments in favour of a "business-as-usual" or "need-based" approach are:

- problems observed do not affect all interconnection points in the EU
- problems observed in the past have been successfully solved bilaterally;
- the already good harmonisation level provided by EASEEgas CBP on interconnection agreements[12], as observed in the 2010 Review of the Implementation progress of the EASEE-gas Common Business Practices[13].

[12] CBP 2005-002/02 Interconnection Agreements
[13] http://easee-gas.eu/media/6229/cbp_implementation_report_final.pdf

The counter-arguments to the above, calling for a harmonised approach for all IPs include:

- resolution of the observed problems required lengthy procedures which would be avoided with full harmonisation;
- harmonisation is only partial and mainly concerns western Europe;
- the Evaluation of Responses to the public consultation led by the Agency[14] ('Evaluation of Responses') shows wide support by the stakeholders for further harmonisation.

e. Interconnection Agreements: policy options and enforcement design choices

When considering the general policy options to tackle the commercial, physical and operational issues triggered by faulty or non-existent interconnection agreements, there are essentially four main choices:

- **Option 1:** *no further EU action;*
- **Option 2:** *setting of minimum requirements to be respected by TSOs within interconnection agreements;*
- **Option 3:** *specifying a set of requirements to serve as default rules;*
- **Option 4:** *full harmonisation of a standard interconnection agreements.*

i. Option 1 – No further EU action

This policy option does not foresee any further rules on interconnection agreements beyond the provisions already enshrined in the CAM Network Code, relating to the coordination of maintenance[15], or picked up in the balancing Network Code discussion, relating to the nomination process.

Along this line, changes induced by the implementation of the Third Package might possibly lead to bilateral renegotiations of interconnection agreements.

The main changes induced by the implementation of the Third Package that may be incompatible with existing interconnection agreements and therefore drive renegotiation are:

- unification of the gas day;
- daily balancing;
- bundled capacity products (i.e. bundled exit/entry capacity at an interconnection point);
- unified nomination and re-nomination times; and
- gas quality cooperation.

Risks and unintended consequences

As a consequence of this policy option:

- some of the existing deficiencies in the quality of the existing agreements, e.g. dual metering, flow control or gas allocation arrangements, would remain in renegotiated agreements;
- no solution would be imposed on lengthy process caused by difficulties for TSOs to reach an agreement, in particular with regard to disputes settlement.

[14] ACER Public Consultation on the Draft Framework Guidelines on Interoperability and Data Exchange Rules for European Gas Transmission Networks, Initial evaluation of responses

[15] See section 6.b *supra.*

There is a risk that this option results in protracted negotiation timescales. This is mitigated by attaching a timescale for delivery of the agreement, under the threat of NRA involvement, ultimately with referral to the Agency for arbitration

There is a risk that pairs of TSOs are exposed to different and incompatible legal requirements; for example, security legislation might prevent the transfer of 3rd party information from a TSO which might rule out the use of an OBA.

ii. Option 2 – Setting of minimum requirements

This option establishes a set of minimum requirements for an interconnection agreement, thereby establishing a minimum standard that ensures that poor quality interconnection agreements cannot become a barrier to trade.

The minimum requirements would contain the following:

- safety requirements;
- requirements for the physical operation of the infrastructure, setting out which TSO is responsible for flow control under normal operation (and where applicable, in either direction);
- commercial balancing arrangements that, respecting principles of non-discrimination and information security, minimise resultant imbalances for all users at the interconnection point, thereby minimising costs;
- metering and measurement arrangements;
- definition of allocation arrangements;
- definition of communication requirements;
- a definition of unexpected events.

While this policy option provides remedies to the insufficiencies observed in existing agreements, it does not provide a solution for situations when TSOs fail to agree within a reasonable delay, or when TSOs disagree. Therefore, in addition, this option establishes specific rules on dispute settlement:

- to be included in the interconnection agreements, for future disputes;
- to address disputes arising during the drafting of the interconnection agreements.

This policy option would address lengthy processes caused by disagreements among TSOs.

iii. Option 3 – setting of default rules

This option establishes a set a fully defined rules, to be used by default if TSOs fail to agree on the terms of an interconnection agreement within 12 months.

This option could be seen in combination with option 2 described above. It establishes a set of minimum requirements for an interconnection agreement, thereby ensuring that poor quality interconnection agreements cannot become a barrier to trade, but also includes a default agreement that is imposed in the case of protracted independent TSO-TSO negotiation.

Risks and unintended consequences

The risks associated with this option are similar to the risks presented above. However the chance of them materializing is lower than the previous option. The risks are:

- safety and/or technical parameters end up more onerous than they could otherwise be. This could potentially lower technical capacities where the parameters are associated with system integrity;

- the default agreement may impose additional administrative costs to establish any modifications (i.e. modifications to the default agreement would need appropriate governance – possibly comitology); and
- In addition, the default agreement could prove more acceptable to one TSO than the other, thereby distorting the negotiation ground. Within this risk, the default agreement could impose sub-optimal arrangements for a particular.

iv. Option 4 – Require a fully detailed Interconnection Agreement

This option requires the specification of a fully detailed interconnection agreement in the Network code that is mandated to apply at each interconnection point. It would contain the minimum criteria set out above, as well as several other parameters, to the extent technically feasible.

This option ensures a minimum standard is achieved for cross-border flows and trading, and is less likely to end in a protracted negotiation period.

Risks and unintended consequences

The specification of safety and/or technical parameters, e.g. minimum pressure, will need to rest with the TSOs. There is therefore a risk that agreement is only established with technical parameters that are more onerous than they could otherwise be, impacting on technical capacity where the relevant parameters are associated with system integrity. It might be possible to mitigate this risk with suitable involvement from NRAs and/or relevant safety regulators.

See QUESTION 1 to ENTSOG

v. Conclusions

There is a potential for some interconnection agreements not to be created or only to be created after a lengthy process, and for existing interconnection agreements to be insufficient to support efficient trade and transportation of gas across an interconnection point. Thus, it seems sensible to intervene in some way. Of the intervention options, the imposition of a standard agreement appears to have some particularly challenging and costly risks. The choice between the 'minimum list' options appears to be narrow, however given the risk of protracted negotiation frustrating the establishment of efficient cross-border transport and trade, the inclusion of a default agreement as a deterrent appears to present the most suitable outcome.

As specification of non-OBA arrangements indirectly requires the cooperation of shippers (e.g. to form agency arrangements, or to become a balancing shipper), it is difficult to see how such non-OBA arrangements could be specified in a default agreement. The default agreement could therefore establish an OBA arrangement while the minimum list establishes an OBA as the standard preferred option.

7. Units:

a. Units: context of the problem

A variety of units are used throughout Europe for describing various parameters. Whilst there are various standards available (ISO, CEN, etc.), none of these is consistently adopted and uniformly applied.

Units used within the industry include:

- **volumes of gas**, usually specified in volume terms (cubic metres) at specified reference conditions (pressure and temperature), and sometimes assuming a non-specific calorific value (which should be stated) and therefore analogous to a unit of energy;
- **energy content**, usually specified in Watt-hours or multiples thereof (kWh, MWh, GWh), although occasionally in units of therms ('th', approx. 29.31 kWh), British thermal units ('Btu', equals 0.00001 therms), or Joules and multiples thereof (especially MJ);
- **calorific value** (CV), a measurement of the energy content of a volume of gas, usually either expressed in mega-joules per cubic metre (MJ/m3) or kilo-Watt-hours per cubic metre (kWh/m3), and at specific reference conditions for the volume of gas (i.e. a pressure and a temperature) and for the final temperature of the combustion products (so there are two reference temperatures quoted);
- **Wobbe index**, a measurement of the flame characteristics of a gas, usually either expressed in MJ/m3 or kWh/m3 at specified reference conditions, similarly to CV;
- **pressure**, usually expressed in bar (either relative to ambient pressures, 'gauge pressure', or relative to a vacuum, 'absolute pressure'), although sometimes (especially in respect of reference conditions) in units of Pascal or multiples thereof;
- **temperature**, usually in units of degrees Celsius or Kelvin;
- **constituents of natural gas**, usually expressed in molar per cent, but sometimes also parts per million or parts per billion by either mass or volume, volumetric per cent, or units of mass per volume (g/m3, etc.); and
- **financial units**.

b. Units: current regulation

The Gas Regulation foresees harmonisation in the area of units:

- the revised Chapter 3 of Annex I to Regulation (EC) No 715/2009[16] (the 'Transparency Regulation') states in section 3.1.1. "*Form of publication*":

  "(1) Transmission system operators (TSOs) shall provide all information referred to under paragraph 3.1.2 and paragraph 3.3(1) to 3.3(5) in the following manner: [...] (f) in consistent units, in particular kWh (with a combustion reference temperature of 298,15 K) shall be the unit for energy content and m 3 (at 273,15 K and 1,01325 bar) shall be the unit for volume. The constant conversion factor to energy content shall be provided. In addition to the format above, publication in other units is also possible;"

- the CAM Network Code, in section 4.3. "*Applied booking unit*" states that "*The capacity offered shall be expressed in energy units per unit of time. The following units shall be used: kWh/h or kWh/d. In case of kWh/d a flat flow rate over the Gas Day is assumed.*"

c. Units: problem definition

This Impact Assessment addresses the relevant and possible ways to ensure harmonisation of units in communications between stakeholders.

The use of different units leads to inconsistencies, among others, resulting from approximate conversion factors. The most obvious conversion mistakes seems to appear in relation to the use of volume, pressure, gross calorific value and energy units, as the use of different units in these areas, unnecessarily adds complexity to the daily activity of network users.

[16] Commission Decision of 10 November 2010 amending Chapter 3 of Annex 1 to Regulation (EC) No 715/2009 of the European Parliament and of the Council on conditions for access to the natural gas transmission networks, OJL 293/67, 11.11.2010

The lack of harmonisation of units affects traders, network users and transmission system operators on the wholesale markets:

- Traders using conversion factors face mismatches between counterparties and invoicing discrepancies;
- Network users face difficulties in the nomination process: nominations to the transmission system operators using different units lead to difficult interfaces interactions between portfolio handling and nomination systems;
- Transmission system operators facing a lack of harmonised use of units are obliged to build conversion tools in their nomination handling systems in order to exchange messages with their adjacent operators and network users (matching and confirmation). This complicates the handling of measurement differences and requires them to provide assistance to market participants in order to sort out mismatches.

No direct technical barrier to trade has been observed, resulting from the lack of unit harmonization, as all individual parties have created their own solutions. However, firstly, the solving of this issue will result in general efficiency improvement. Secondly, as TSOs play a central role in communications within the gas market, they are the stakeholders that will logically be at the origin of unit harmonisation.

Whilst underlying systems may measure and record data in particular units, there is no technical reason why TSOs cannot communicate in a standard set of units.

d. Units: extent of the problem

Due to the central role of the TSOs in the operation of the internal gas market, their communication choices bear significant impact on the stakeholders, going beyond the communication at the interconnection points.

EASEE-gas published a Common Business Practice on Harmonisation of Units ratified on 01 November 2003[17], to be implemented by the 10th October 2005 or before that date.

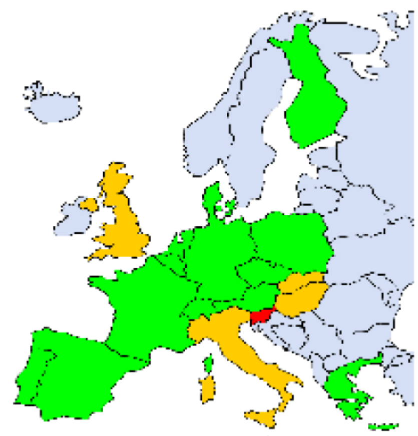
Figure 3 shows the results of an implementation review conducted on 2010 of the CBP.

[17] http://easee-gas.eu/docs/cbp/approved/EASEE-gas%20CBP%202003-001-01.doc

Energy:
Most respondents (37 out of 46) indicated that are using kWh as energy unit.

Gross Calorific Value:
Most respondents (33 out of 44) indicated that are using the harmonized Gross Calorific Value. Members in Austria and Italy also mentioned that changes are required from the Regulatory Offices, with impact in the network codes.

Pressure:
Most respondents (36 out of 43) indicated they are using bar to measure pressure.



Units:
Most respondents (37 out of 46) indicated that are using normal m3 to measure volume. However, some EASEE-gas members in Slovakia, Italy and UK are using standard m3 (measured at 15°C). Slovakia indicates that legislative and regulatory changes are required, as well as contractual, IT systems and network code changes.

Figure 3 : Review of the implementation of CBP 2003-001/01 on harmonisation of units
Milestone completed –Milestone partially completed – Milestone not completed
source: "Implementation progress of the EASEE-gas Common Business Practices – 2010 review"

Conclusions to the review are as follows:

- there is a high level of harmonisation in units in the EU;
- however, non-harmonisation remains at EU level;

- a voluntary approach will not allow reaching further harmonisation.

Arguments in favour of a harmonised approach for all communications from TSOs include:

1. the failure of a voluntary approach;
2. the fact that, by their central role, TSOs impose their communication choices to other stakeholders;
3. the practical benefit in having one set of units for system users.

The counter-arguments to the above, calling on a "need-based" or voluntary approach are:

1. the problem does not result in a clear hampering of cross-border trade;
2. the visible benefit for system users will be partially neutralised by the costs for the TSOs of adapting existing IT.

e. Units: Policy options and enforcement design choices

When considering the general policy options to tackle the issues related to units, looking at gaining the insurance that the use of units does not constitute barriers to trade, there are essentially 2 choices:

- **Option 1:** *no further EU action;*
- **Option 2:** *harmonised units.*

While there is no direct problem observed in relation to the current level of unit harmonisation, an increased harmonisation would be considered highly beneficial to the stakeholders.

Following the option 1 would imply relying on EASEEgas CBP 2003-001/01. While this has proved a major step forward, it does not appear to provide incentives towards a full harmonisation implied by option 2.

Looking at the second counter-argument attached to option 2, the effect of scale should make costs for TSOs associated with the harmonisation of units only a fraction of all costs that network users and traders are facing now as units are not harmonised. This will apply for units expressing volume, pressure, gross calorific value and energy, as these unit are used in business related processes where network users and traders are involved.

See Question 2 to ENTSOG

8. Gas Quality:

a. Gas Quality: context of the problem

This Impact Assessment assesses the harmonisation level regarding gas quality specifications deemed necessary in relation to interoperability.

A gas quality specification is a set of parameters that describe acceptable limits for various characteristics of a gas:

- the specific constituents (e.g. methane, hydrogen sulphide),
- the physical characteristics (e.g. energy content, density), or
- derivations of these (e.g. Wobbe index, rates of change).

Boundaries are established in order to[18]:

[18] See Figure 4: Reasons for gas quality parameters

- ensure safety,
- ensure the integrity of the infrastructure,
- prevent a negative impact on particular applications .

The establishment of boundaries implies establishing the width of these boundaries. Wide boundaries boundaries give flexibility to the nature of the product, as natural gas is a product explored in different circumstances and places. Narrow boundaries ensure that the properties of the gas consumed by an end-user are fully defined and allow total safety and process optimisation.

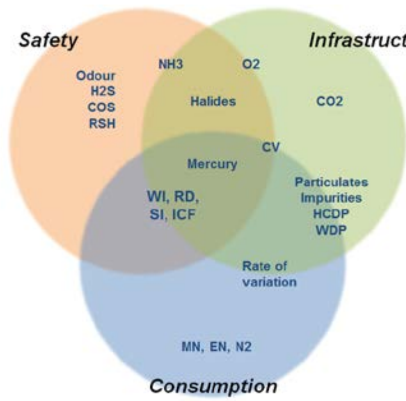


Figure 4: Reasons for gas quality parameters

There is a variety of different sources of gas flowing into Europe, with a corresponding variety of gas qualities. With respect to their historical supply portfolio, Member States have developed their own practices with regard to the control of gas qualities within their national systems and with respect to the control of the safety of natural gas appliances. This has resulted in the establishment of a range of disparate gas quality specifications throughout Europe.

Each specification contains a range of different parameters[19].

b. Gas Quality: current regulation

The Gas Regulation foresees harmonisation in the area of gas quality:

- the Transparency Regulation states in section 3.1.2. "*Content of publication*" that *"Transmission system operators shall publish at least the following information about their systems and services: […]. if relevant for access to the system, for all relevant points as defined in paragraph 3.2 of this Annex, a specification of relevant gas quality parameters, including at least the gross calorific value and the Wobbe index, and the liability or costs of conversion for network users in case gas is outside these specifications"*

[19] See the "*Study on Interoperability - Gas Quality Harmonisation - Cost Benefit Analysis*" prepared for the European Commission in July 2011

- regulation (EU) No 994/2010[20] (the 'Security of Supply Regulation') states in its Article 9(1)(b) on Risk assessment that "*By 3 December 2011, each Competent Authority shall make a full assessment, on the basis of the following common elements, of the risks affecting the security of gas supply in its Member State by: [...] (b) taking into account all relevant national and regional circumstances, in particular market size, network configuration, actual flows, including outflows from the Member State concerned, the possibility of physical gas flows in both directions including the potential need for consequent reinforcement of the transmission system, the presence of production and storage and the role of gas in the energy mix, in particular with respect to district heating and electricity generation and for the operation of industries, and safety and gas quality considerations*".

c. Gas Quality: problem definition

No direct EU-wide technical barrier to trade has been observed, resulting from the lack of harmonisation on gas quality parameters. Supply sources seem to offer steady and reliable natural gas quality. As major supply patterns on a European scale do not change rapidly, the effects or problems due to different gas quality are not that obvious. However, several concerns were raised.

- Evolution of the flow patterns

With the current flow patterns, in line with existing supply portfolio of a Member State, the differences in gas quality specifications are managed by the TSOs and do not hamper cross-border. However, traditional supply routes could be modified by:

- the establishment of an integrated internal European market organised around hubs;
- new supplies to compensate the decline in supply of internal European sources;
- the priority corridors defined by the EU Commission in the Infrastructure Package.

A change in flow patterns will raise the issue of feasibility and cost of handling the differences in gas quality specification, as illustrated by the UK-Belgium issue presented in ANNEX D.

See question 3a to ENTSOG

- *Variation of gas quality within specification – case study : Gate LNG terminal*

The observed range in acceptable gas quality is wide, even though locally, the observed gas quality is stable. As a consequence, processes are adapted to the local reality. Any unforeseen significant variation in gas quality, even within specifications, will bear consequences, as observed when commissioning the Gate terminal.

See question 3.b to ENTSOG

d. Gas Quality: extent of the problem

As shown by Marcogaz in its 2002 review[21], the European ranges within which gas parameters may vary are not aligned. This was confirmed in 2011 by a study prepared for the European Commission[22].

The EASEEgas attempt at harmonising gas quality parameters via voluntary rules in CBP 2005-001/02 on Harmonisation of Natural Gas Quality was not successful, as shown in Figure 5.

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[20] 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, OJL 295/1, 12.11.2010.

[21] National situations regarding gas quality - Report prepared by MARCOGAZ working group "GAZ QUALITY" – 29/11/2002

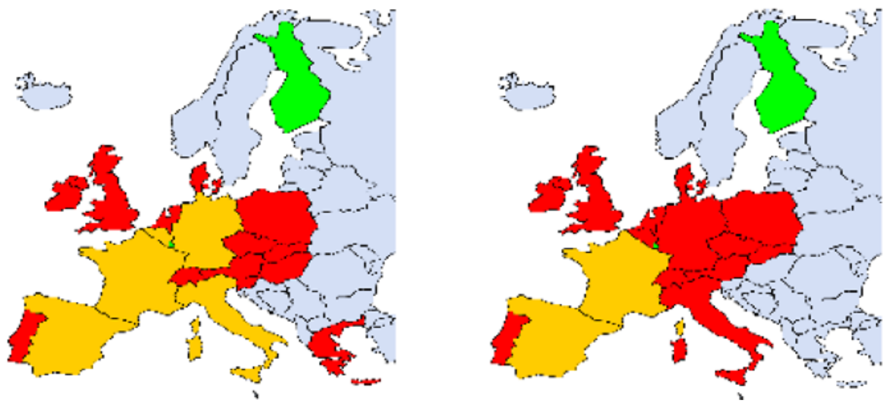
[22] See 19 *supra*

In this non-harmonised context, evidence shows that observed hampering of flows caused by gas quality issues are limited. Gas quality has, to date, only caused five individual instances[23] of gas being rejected at an interconnection point. Four of the instances have been of duration of less than a day.

Thus, arguments calling for a “business as usual” or “need-based” approach are:

- the observation that the current lack of harmonisation does not result in a EU-wide hampering of cross border trade;
- the lack of conclusive evidence of a clear benefit from harmonisation, that would possibly outweigh its costs[24].

The main counter-argument to the above is that a “Business as usual” approach would not address the current transparency issue in relation to the identification of the evolution of the flow patterns (long term visibility) or the variation of gas quality within specification (shorter term visibility).



Harmonised parameters:

- S - Total Sulphur (max 30 mg/m3)
- H_2S + COS - Hydrogen sulphide + Carbonyl sulphide (max 5 mg/m3)
- RSH - Mercaptans (max 6 mg/m3)
- CO_2 - Carbon dioxide (2.5 mol %)
- H_2O DP - Water dew point (-8°C at 70bar)
- HC DP - Hydrocarbon dew point (-2°C at 1-70bar)

Most respondents (31 out of 42) are still working towards the accomplishment of the parameters ranges and values described on CBP,

Harmonised parameters:

- WI - Gross (Superior) Wobbe Index - 13.6 to 15.81 kWh/m3
- d - relative density - 0.555 to 0.700
- O_2 - Oxygen (*) 0.001 mol%

The majority (26 out of 31) is still working towards the accomplishment of the parameters ranges and values described

Figure 5: Review of the implementation of CBP 2005-001/02 on Harmonisation of Natural Gas Quality
Milestone completed –Milestone partially completed – Milestone not completed
source: "Implementation progress of the EASEE-gas Common Business Practices – 2010 review”

[23] Two instances occurred in Bulgaria in September 2010 and September 2011, where the downstream network refused gas because of a water dew point issue. The other instances reported by ENTSOG were due to Wobbe index in Belgium and due to water dew point issues Poland.

[24] It should be noted that the study referred to in 19 *supra* includes an attempt at analysing the costs of harmonizing gas quality, concluding that the cost would outweigh the benefits. This is further developped in paragraph 8.e.iii below.

e. Gas Quality: policy options and enforcement design choices

When considering the general policy options to tackle the issues related to gas quality raised by the evolution of flow patterns in Europe and the variation of gas quality within specifications, the choices are as follows:

- **Option 1:** ***no further EU action;***
- **Option 2:** ***reinforced requirements in terms of monitoring and cooperation, possibly including:***
  - enhanced TSO cooperation;
  - requiring TSOs to provide sufficient information to enable users and consumers to understand the forward-looking risks associated with gas qualities; and
  - requiring TSOs to provide sufficient information to enable users and consumers to assess historical gas qualities against the applicable specifications.
- **Option 3:** ***gas quality harmonisation and cost allocation rules, possibly including:***
  - full physical harmonisation of the entire EU gas (H-gas) market to a broad (H-gas) specification that encompasses the majority of existing specifications;
  - harmonising specifications by obliging TSOs to accept all gas presented at any interconnection point;
  - requiring TSOs to cooperate to manage non-compliant gas presented by an upstream TSO (by reduction or acceptance) wherever it is economically/financially appropriate.

i. Option 1: no further EU action

The first option is characterized by a situation where:

- existing gas quality specifications prevail;
- existing TSO information practices prevail such that users and consumers are unable to quantify and/or manage their risks; and
- existing TSO behaviour is not coordinated.

An important consideration in this baseline counterfactual is that future supplies of gas to Europe might be substantially different to the current supplies, and that the future patterns of flows within Europe might be substantially different to current patterns of supply. This might require investment to enable new supplies to enter the EU, and might lead to constraints appearing at interconnection points where the current disparate gas quality specifications do not usually present constraints.

To the extent that gas quality constraints are expected to become more prevalent, the increased reliance on the flexibility of LNG cargoes may increase short-term security of supply risks.

ii. Option 2: reinforced requirements in terms of monitoring and cooperation

In this second option, existing gas quality specifications prevail, although some supportive actions could be taken into account.

Option 2.a - Enhanced TSO cooperation

This option seeks to require TSOs to cooperate to seek to overcome differences in their gas quality specifications.

Description

Within operational timescales this option should result in TSOs communicating to identify the possible options available to them to overcome and emerging situation or any near-term forecast (e.g. in response to day-ahead nominations). A list of potential actions could examined, which first looks to see if alternative network configurations might facilitate commingling in either upstream and/or downstream networks, before examining the potential for more invasive actions such as the interruption of interruptible capacity, the exercise of flow management contracts, etc.

Within longer timescales, this option should result in TSOs engaging with each other to identify the potential requirements for mitigating gas quality issues. The potential requirements might involve commercial solutions such as flow management actions, which might require each TSO to tender for services to ascertain costs. Physical solutions could also be investigated. Engagement with users and consumers in the relevant markets could provide some measure of the benefits that might be obtained in each individual case, and sanction would be required from NRAs to enable any costs to be recovered by the TSOs.

Risks and unintended consequences

There is a risk that TSOs fail to identify potential solutions to another TSOs problem because there is no incentive for them to do so.

Because there is no transfer of risk from users to the downstream TSO (i.e. the users are not relieved from their obligation to present compliant gas at the entry point), in the longer-term solutions, there is a risk that a downstream TSO does not procure an appropriate volume of commercial options despite being given a specific allowance to do so by his NRA.

These two observations indicate that a level of scrutiny will need to be applied by the NRA.

Option 2.b Improve information provision

Description

This option seeks to improve the provision of existing information by TSOs to network users.

The current legal provisions do not extend to other parameters included within applicable gas quality specifications, and allow TSOs to restrict publication of averaged values. Users therefore have insufficient information on which to judge the risk of gas quality issues emerging. This option seeks to redress this particular issue by requiring:

- the timely publication of an appropriate set of good quality (i.e. void of data errors) measured data (e.g. if not all data, including minima and maxima, percentiles and averages over defined periods) pertaining to any of the parameters included within neighbouring TSOs specifications; and
- publication of an opinion of the current level of risk of non-measured parameters becoming gas quality issues within operational (e.g. day-ahead, day-to-day) timescales, and the methodology and assumptions used at deriving the opinion.

Risks and unintended consequences

There is a risk that the measured data relies on units that are not otherwise harmonised.

There is a risk that the methodology and assumptions used at deriving the opinion of the current level of risk of non-measured parameters is inappropriate and not fit for purpose. This risk could be mitigated by requiring the network code to set out high level requirements for the methodology and assumptions.

Option 2.c Provide forecasting services

Description

By making assumptions about the most likely pattern of near-term gas flows, it should be possible for TSOs to calculate the gas qualities that might be presented at different network points using suitable network analysis software.

Alongside this would be a need to show the potential patterns of flow that, assuming gas flowed at historically normal gas qualities, would give rise to gas quality problems at relevant cross-border points (i.e. where the downstream specification could not be met.) This could be a potentially onerous exercise because of the numerous flow scenarios that might need to be considered (especially in more complex networks), however it is likely the analysis would have a relatively long 'shelf life'.

This set of information would allow gas traders to accommodate any near-term risk in the price signals within the market, for example by allowing prices of secondary capacity to vary by location according to the attractiveness or otherwise of the gas quality available at that point. This information would also potentially be beneficial to gas consumers, so it would be useful to specify this for exit points as well as cross-border points. If the task is accomplished for cross-border points, this should be a trivial exercise.

In addition to this, a longer-term view of the potential changes to gas quality that could arise as a result of capacity changes on the network would also allow the market to factor in gas quality concerns into price signals. This might be accommodated in TSOs long-term capacity development plans or in ENTSOG's Ten Year Network Development Plan. We note that future upstream gas qualities are not known, so there would be a limit to the accuracy of these forecasts.

Risks and unintended consequences

There is a risk that publication of the network analysis uncovers confidential information (e.g. gas flows at individual connections). One possible way to mitigate this would be to require the publication of a subset of results/assumptions; however this may not deliver the full benefits.

There is a risk that the forecasts are insufficiently accurate or not updated frequently enough for users to adequately manage their gas quality risks.

Option 2: Conclusions

Table 1: Summary of gas quality management policy options

Option	Impact on efficiency	Impact on transparency	Costs of implementation	Risks
Require cooperation	++	+	-	-
Improve info provision	+++	++	--	-
Require forecasting	++++	+++	---	--
All three combined	++++	+++	---	--

Each of the three options presented above appear to offer some economic benefit and do not appear to be particularly costly. They are also independent options that, when combined, provide significant mitigations to the risks faced by users and consumers. FG therefore presents them as a single, combined policy choice.

iii. Option 3: gas quality harmonisation and cost allocation rules

In the scope of the Framework Guidelines, issues related to Gas quality are driven by changes in gas quality, as well as variations within specifications.

The European Commission has committed to develop a Roadmap for Gas Quality. As part of the process, harmonisation options have been explored, that might relate to the gas quality issues observed in relation to interoperability.

Option 3.a full physical harmonisation of the entire EU gas H-gas market

Such option implies a trade-off between security of supply (associated to the choice of a broad specification that encompasses the majority of existing specifications), as opposed to the choice of a narrow specification, that would ensure unhampered flows between European TSOs, and safety for the end consumer.

As far as interoperability is concerned, the definition of an EU-wide narrow scope would solve the issues in connection to changes in gas quality, as well as variations within specifications.

However, this choice would raise the following risks and unintended consequences:

- the definition of a narrow gas quality scope would contradict the promotion made in the Security of Supply Regulation of the diversification of gas routes[25];
- Benefit to European consumers of removing the current gas quality constraints are at most €0.2 Billion per annum. However processing costs to meet local gas quality specifications ensuring appliances will operate safely is estimated at €11 Billion. Alternatively replacement of gas appliances would cost an estimated €179 Billion[26][27].

Option 3.b harmonisation of the allocation of the costs triggered by gas quality management

The issue of cost allocation was triggered by the following questions:

- Who bears responsibility for the quality of gas?
- Who should bear the costs associated with the processing of gas quality?

Neither these questions nor their possible answers tackle the issues identified in relation to the Framework Guidelines.

iv. Conclusions

The observed issues in relation to the full physical harmonisation of the quality parameters of natural gas are found to be regional at maximum, with a potential to become EU-wide in the future. Other issues consist in an evolution of flow patterns in Europe and the variation of gas quality within specifications.

As the issue for the stakeholders is essentially a difficulty to access the relevant information, the option 2 above appears to be proportionate.

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[25] Further input to this trade-off can be find in the documents delivered and presented during the Madrid Forum process (http://ec.europa.eu/energy/gas_electricity/gas/forum_gas_madrid_en.htm.. The European Commission Mandate to CEN for standardisation in the field of gas qualities of 16 January 2007 (M/400) can be seen as one deliverable of this process.

[26] See 19 supra

[27] Other costs could be involved, such as the necessary investments resulting from a harmonisation of Gross Calorific value, possibly implying an increase in volume (i.e. new pipelines) to carry the same amount of energy.

A status-quo would not address the concern over the evolution of the situation, as it would not allow a better access to the relevant information. A full harmonisation, while no relevant European cross-border wide barrier has been identified, might imply important costs, as well as issues in terms of security of supply.

9. Odorisation:

a. Odorisation: context of the problem

This Impact Assessment addresses the relevant and possible ways to ensure relevant harmonisation in gas odorisation practises.

Natural gas is an odourless and colourless flammable gas. In order for users to possibly detect the presence of gas in concentrations below the lower explosive limit (LEL)[28], it is odourised: a distinctive and unpleasant odour is added to the gas.

Regulations in force in European countries have the following requirement in common: a gas leak should be possibly detected when a concentration of one fifth of the lower explosive limit is achieved.

Practices and regulations differ regarding the following: the choice of an odorant and the technical approach to odorisation.

- *Choice of an odorant*

Odorants must follow basic requirements:

  - the distinctive odour must remain perceptible as long as the fault of technical equipment is detected and removed;
  - the combustion of the odorant must not alter the gas properties.

Odorants mainly differ in the fact that they can be sulphur-based (mercaptans) or, more recently, sulphur-free (acrylates).

Promoters of the sulphur – free odorant argue that it circumvents the corrosive impact of sulphur (increased integrity of the system), the emission of sulphur dioxide after combustion (reduced impact on the environment).

- *Technical approach to odorisation : centralised vs. local*

The majority of the EU countries[29] choose to odorise the gas downstream at a regional or distribution level, leaving the transmission system unodourised. This decentralised approach allows preserving industrial processes connected to the transmission system from the negative effects induced by mercaptans[30].

Several countries (i.e. France, Spain, Portugal and Hungary) have nevertheless chosen to odorise the gas at the transmission level, for economic, technical and safety-related reasons. Centralising odorisation allows cost-

[28] Lowest concentration of a gas in air capable of producing a flash of fire in presence of an ignition source
[29] See Marcogaz review on "Odorisation of Natural Gas" - http://www.marcogaz.org/index.php/component/docman/cat_view/111-gas-infrastructure?Itemid=135
[30] Mercaptans notably negatively impact refining process (production of sulphuric wastes), turbines and fuel cells (poisoning of the catalytic surfaces involved).

effectively minimising the number of odorisation stations. Technically, it is more efficient to odorise large volumes of gas. Safety-wise, countries in favour of odorisation at transmission level argue that odour can be used for leak detections on the transmission system as well as in industrial sites connected to the transmission system.

Countries in favour of local odorisation underline that odour is not a defining safety factor at transmission level:

- **High pressure pipelines** undergo constant preventive surveillance (surface, integrity of the pipeline (pigs), anti-corrosion measures), thus preventing leaks resulting from progressive wear of the pipeline. Due to the high pressure, leaks resulting from a sudden breach of the pipeline would be visible and audible immediately.
- **Industrial sites** that can accept odorised gas will not possibly rely solely on the sense of smell to determine if natural gas is present in the ambient air of a work space, as:
    - the odorant might be disguised by other odours in the working environment;
    - individuals who have worked around natural gas odorant for an extended period of time are likely to suffer from odour fatigue thus being unable to recognize the presence or change in odour;
    - odour fade may unexpectedly occur during the process.

Thus, such industrial sites are monitored using electronic hydrocarbon sensing devices in order to detect natural gas leaks, coupled with heat sensing devices to detect fires.

- *compatibility issues*

The different approaches are not compatible. While it is not problematic for a country with a centralised odorised gas to receive non-odorised gas, the opposite is not true:

- technically, as mentioned above, industrial sites, unequipped for mercaptans removal, will see their processes altered;
- safety-wise, there could be a risk of
    - increased corrosion on the industrial equipment and pipelines, and
    - over odorisation: the already odorised gas will possibly be odorised again, with a risk of inexistent leaks being reported (supplementary OPEX and disorganisation of the safety intervention teams).

b. Odorisation: current regulation

European Regulation does not address the issue of odorisation.

c. Odorisation: problem definition

The observed barrier to trade is caused by the differences in odorisation practice between France (centralised approach), Belgium and German (local approach).

ENTSOG, in its 2011-2020 Ten Year Network Development Plan ('TYNDP') conducted a series of assessments of market integration, consisting in analysing the extent to which the network would hamper flows from a given source. In that series, LNG was considered as one source.

The barrier to trade due to incompatibility of odorisation practices between France, Belgium and Germany was confirmed as follows: "*In 2020 taking into account non-FID LNG terminal projects, even if the capacity congestion between Spain and France will have been relieved, the lack of eastward export capacity from France will hamper LNG maximization in Iberian Peninsula and France and its spread further into the European gas network.*"

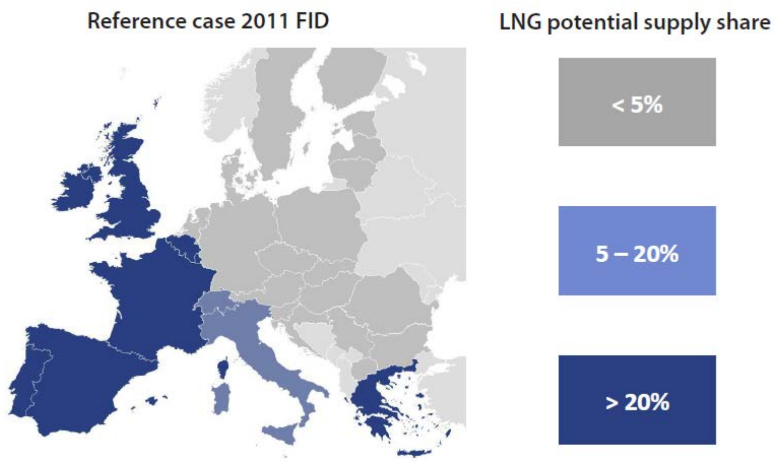

Figure 6: market integration scenario illustrating the lack of possible LNG flows from the South-West to North-East
source: ENTSOG Ten-Year Network Development Plan 2011 - 2020

d. Odorisation: extent of the problem

The main argument calling for a "business as usual" or "need-based" approach is that the problem could be considered bi-lateral, and that there is already a high level of observed harmonisation. However, counter-arguments to the above, calling for further harmonisation, are the following:

- the observed bi-lateral situation has trans-regional consequences;
- these consequences consist in a clear hampering of cross-border trade.

e. Odourisation: Policy options and enforcement design choices

When considering the general policy options to tackle the issues related to capacity calculation, looking at gaining the insurance that the maximum capacity is offered, there are essentially 3 choices:

- **Option 1:** *no further EU action;*
- **Option 2:** *increased transparency and TSO cooperation;*
- **Option 3:** *harmonised odorisation practices.*

As currently, odorisation issues are tackled in National Regulations only, following option 1 would imply assessing that the problem is only and will remain local.

However, the problem observed has trans-regional consequences, and results in a clear barrier to trade. It is not driven by transparency issues and a lack of TSO cooperation; thus, option 2 might prove ineffective.

As the two different approaches are not compatible, and as this incompatibility results in a clear barrier to trade, the promotion of harmonised odorisation practices, as already adopted by a vast majority of countries, and as in option 3, appears proportionate.

10.Data Exchange:

a. Data Exchange: context of the problem

This Impact Assessment addresses the relevant and possible ways to facilitate communications between stakeholders.

Information, be it technical (i.e. physical measurements) or commercial (i.e. nominations, allocations, trade confirmations), is continuously exchanged among transmission system operators, as well as between transmission system operators and stakeholders.

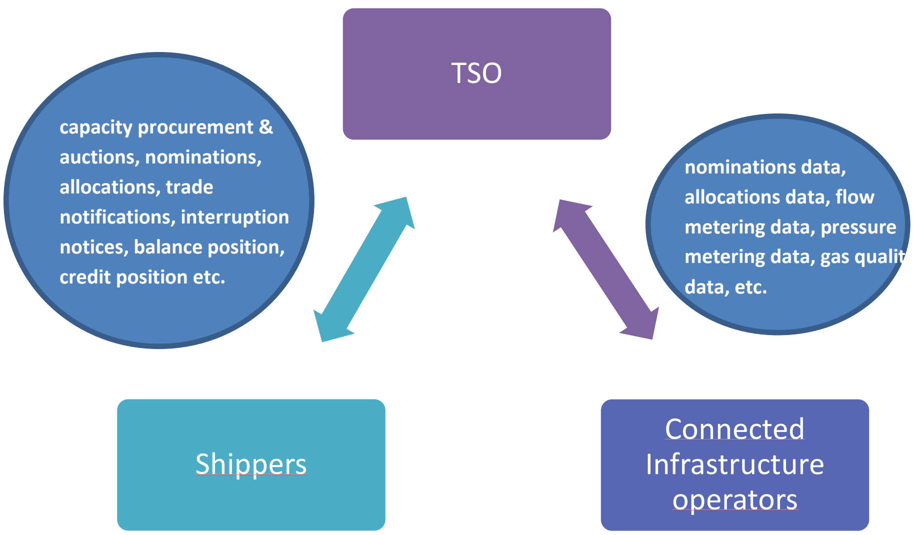

Figure 7: exchanges of information between TSOs and stakeholders

In order to possibly communicate, two parties must agree on a common standard, including:

- a format, supporting the information;
- a communication channel, via which information will be exchanged;
- a communication protocol, codifying possible interactions between the two parties[31].

b. Data Exchange: current regulation

Regulation already foresees harmonisation in the area of capacity calculation:

CAM Network Code – Section 3.2 - Standardisation of communication

1) *To ensure information exchange with network users, particularly for reservation of capacity, transfers of capacity rights, planning day-to-day network operation and information on potential congestion, transmission system operators shall coordinate the implementation of standard communication procedures, coordinated information systems and compatible electronic on-line communications such as shared data exchange formats and protocols, as well as agreed principles as to how this data is treated.*

[31] For example, a protocol might specify that a sender of a message receives from the receiver a confirmation receipt.

2) *Standard communication procedures shall include those particularly relating to Registered Network Users' access to the transmission system operator(s)' auction system or a relevant platform and the review of auction information provided. The timing and content of the data to be exchanged shall be compliant with the provisions set out in this Network Code, particularly article 4.*
3) *The standard communication procedures adopted shall have an implementation plan and duration of applicability, which shall be in line with the development of booking platform(s) as set out in article 8 of this Network Code. The procedures shall ensure confidentiality, including of commercially sensitive information.*

c. Data Exchange: problem definition

- *Variety of existing standards*

Some standards have been developed and adopted across several EU parties, but they are not universally applied.

- **Edig@s**

The Ediga@s standard has several different and not necessarily compatible versions (notably, early versions use an implementation of EDIFACT – a standard developed by the UN, whereas later versions use an implementation of XML – a standard developed by the World Wide Web Consortium). These different versions enjoy a different level of deployment in those member states who have implemented Edig@s, for example, TSOs in Germany generally use the latest version which requires communication by XML, however many German DSO continue to use a retired version of the standard that uses EDIFACT.

- **EFET data communications standards**

EFET have developed standardised communications protocols (and contracts) which are used by many shippers for trading energy products. The primary focus of these systems has been for the trading of electricity, and EFET are also active in supporting the development of standards of the electricity markets.

- **Energy Identification Coding Scheme (EICCODE)**

This is an initiative of ENTSO-E (with ENTSOG as a partner), and provides a unique identification of the market participants and other entities active within the European Internal Energy Market (gas and electricity participants). It is also supported by EFET.

- *Problem : trading inefficiency - market integration*

No direct technical barrier to trade has been observed, resulting from the lack of harmonisation on data exchange. However, firstly, the solving of this issue will result in general efficiency improvement. The lack of IT standardisation is a supplementary burden for small network users willing to expand their activities. In the same line, the development of a local standalone communication solution within a marketplace will increase difficulties to reach that marketplace.

d. Data Exchange: extent of the problem

Edig@s standards have been implemented in a few member states. The EASEE-gas progress document (dated 2010), states that 11 members have implemented the protocol (11 positive responses, from 26 responses - including 13 TSOs – from an EASEE-gas membership of 102.) We note that several TSOs (e.g. energinet.dk, GRTgaz and Gas-System) have also now implemented the protocol as one of the available communication protocols.

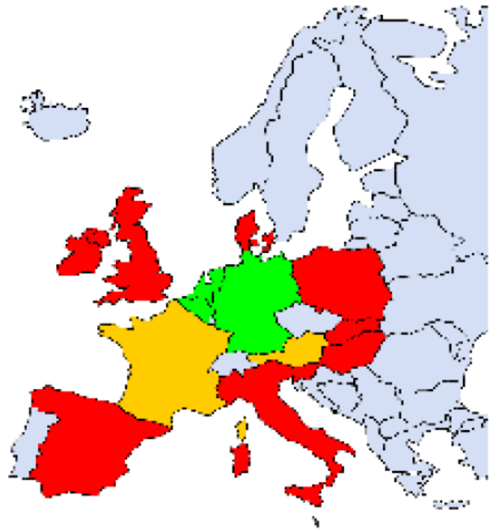

Figure 8: Review of the implementation of Edig@s standards
Milestone completed –Milestone partially completed – Milestone not completed
source: "Implementation progress of the EASEE-gas Common Business Practices – 2010 review"

There are several TSOs (e.g. National Grid, Bord Gais, Snam Rete Gas, Enagas, FGSZ, Eustream, Net4Gas) who have not implemented an Edig@s standard.

- *Case study*

A shipper trading gas along three different routes – two North-South routes, and a South-East to South-West route would be exposed to a maximum of 10 different standards (see ANNEX E).

e. Data exchange: Policy options and enforcement design choices

When considering the general policy options to tackle the issues related to units, looking at gaining the insurance that the use of units does not constitute barriers to trade, there are essentially 3 choices:

- ***Option 1:*** *no further EU action;*
- ***Option 2:*** *format harmonisation;*
- ***Option 3:*** *format and content harmonisation.*

Following the option 1 would imply relying on guidelines of good practice provided by EASEEgas[32]. While this has proved a major step forward, it does not appear to provide incentives towards a full harmonisation. The harmonisation of content as implied in option 3 should take into account the outcome of processes defined in other Framework guidelines and cannot possibly be anticipated in the Framework Guidelines. It is already possible to harmonise data exchange format (option), provided that the detailed process takes into account the necessary flexibility.

See Questions 4a and 4b to ENTSOG

[32] See EASEEgas CPB 2007-001/01 on Message Transmission Protocol, CBP 2007-002/01 on Common Data Communications Network and CBP 2007-005/01 defining EDIG@S

11. Capacity calculation:

a. Capacity calculation: context of the problem

Article 2 of the Gas regulation defines technical capacity as "*the maximum firm capacity that the transmission system operator can offer to the network users, taking account of system integrity and the operational requirements of the transmission network*".

Capacity calculation, the first step in the evaluation of the technical capacity, can be understood as a mathematical calculation of the volume of pipelines. This calculation is performed under the assumption that the considered network faces the maximum level of technical stress for which it has been designed.

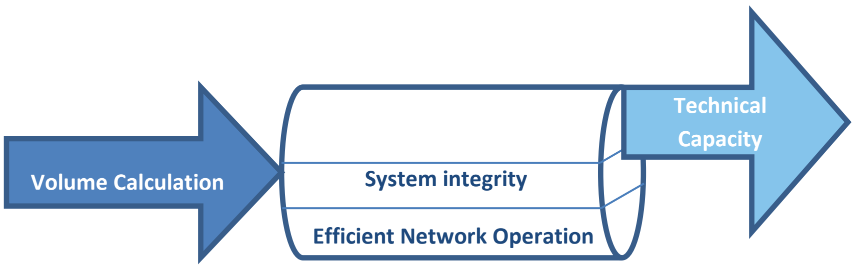

Figure 9: Technical capacity calculation

This calculation is based on:

- a set of fluid dynamics equations;
- a set of reference parameters, including, but not limited to:
  - the definition of the maximum level of technical stress;
  - the corresponding temperature reference;
  - the corresponding pressure level etc.
- stress distribution across a given network.

b. Capacity calculation: current regulation

Regulation already foresees harmonisation in the area of capacity calculation:

- On calculation parameters, and in particular on the definition of the maximum level of technical stress, REGULATION (EU) No 994/2010[33] (the 'Security of Supply Regulation'):
  - defines in article 8 on supply standards extreme temperature conditions under which any European transmission system should ensure gas supply;
  - defines in annex 1 the "N-1 formula" and sets it in recital 13 as a realistic extreme scenario;
- the Transparency Regulation states in article 3.1.2(m) that *"transmission system operators shall publish a detailed and comprehensive description of the methodology and process, including information on the parameters employed and the key assumptions, used to calculate the technical capacity."*

[33] 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, OJL 295/1, 12.11.2010.

- On cooperation between TSOs, the CAM network code[34] states in article 3.3.3 that *"Adjacent transmission system operators shall exchange relevant information with the aim of coordinating the results of their capacity calculations to maximise Technical Capacity."*

c. Capacity calculation: problem definition

This Impact Assessment addresses the possible ways to ensure maximisation of offered capacity on IPs between gas transmission systems.

Technical capacity is calculated by TSOs and serves as a basis for the offer of commercial capacity. This impact assessment focuses on the maximisation of technical capacity[35].

If the European transmission systems were operated by a single operator, the set of equations, reference parameters and stress distribution used for capacity calculation would be unique and lead for a single result at each side of a given interconnection point.

In the current context, TSOs are likely to adopt various approaches to capacity calculation. As a result, at a given interconnection point, the outcome of the calculations conducted at each side of the point may lead to different results. In case of congestion, not ensuring that convergence between the two results towards the highest possible value is achieved would result in a partial hampering of cross-border trade.

- Set of equations

As shown in the non-exhaustive review conducted in ANNEX F, a variety of fluid dynamics equations are available when calculating capacity.

See Question 5a to ENTSOG

- Set of reference parameters

Article 8 of the Security of Supply Regulation requires that networks be able to resist stress conditions associated to a probability of once in 20 years.

In its 2011 - 2020 Ten Year Network Development plan, ENTSOG conducted a review of the probability associated to stress scenarios in use by the European TSOs (as reproduced here in ANNEX G) and concluded that *"Regulation still allows TSOs to use stricter climatic conditions when planning and designing their own networks. As such, some countries have submitted demand under such stricter conditions."*

See Question 5b to ENTSOG

- Stress distribution

The calculation of maximum capacity is partly empirical, in particular for large and meshed transmission systems where there are multiple possible choices for the reference configuration of the transmission system while under maximum technical stress[36]. Cooperation between TSOs is necessary when addressing optimisation of stress distribution at interconnection points. TSO cooperation on the issue appears to be

[34] CAP210-12 - http://www.entsog.eu/publications/camnetworkcode.html
[35] The maximisation of commercial capacity via incentives is foreseen in the CAM Network Code & CMP Guidelines.
[36] As explained further in ANNEX H

functioning within countries; however, TSOs acknowledge that they do not communicate on the issue at cross-border IPs[37].

As a result, two TSOs calculating capacity at the same interconnection point are likely to use different assumptions and models, and thus reach different results. The lowest value will be the one taken into account when commercialising bundled products[38].

d. Capacity calculation: extent of the problem

Understanding the details of transmission system capacity calculation requires a high level of expertise that is exclusively found among TSOs. Harmonisation policies will thus possibly apply to IPs.

Further evaluating the extent of the above identified problem implies:

- Reviewing the different approaches to capacity calculation among European TSOs

  The conclusion of this review is double. First, there is a variety of approaches in Europe, without harmonisation[39]. Then, the requirements set by the Transparency Regulation are not met: of the 40 TSOs analysed, details on the capacity calculation methodology applied were identified for 26 TSOs [40].

- Identifying the discrepancies in the calculated capacities at interconnection points

  The resultant capacity values are included in ANNEX K. Significant discrepancies can be observed throughout Europe between the capacity value calculated by the upstream and downstream TSO[41]. It should be noted that identifying these discrepancies is not straightforward[42].

- In particular, identifying the possible discrepancies at congested points.

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[37] Outcome of the 2nd expert group meeting.
[38] as foreseen in the CAM Network Code
[39] See ANNEX I
[40] See ANNEX J
[41] for example Fluxys calculate their capacity as 1003 GWh/d in one direction and 746 GWh/d in the reverse direction, whereas I(UK) calculate capacities as 808GWh/d ad 630GWh/d respectively; Open Grid Europe calculate capacity at Bunde/Oude Statenzijl of 243GWh/d, whereas the corresponding capacity reported by Gas Transport Services is 500GWh/d.
[42] In particular, from the transparency platform set by ENTSOG - http://www.gas-roads.eu/

Arguments in favour of a harmonised approach for all IPs include:

1. the explicit obligation set by the gas Regulation to maximise offered capacity;
2. the practical benefit regarding transparency in providing clear principles to be followed by TSOs across the EU; and
3. even if discrepancies are justified at any given interconnection point in time, and lead to no congestion, TSOs should be able to provide justification based on cooperation, including action to be taken in case of congestion.

The counter-arguments to the above, calling on a "need-based" approach are:

1. the problem does not affect all IPs in the EU;
2. it is likely that in most cases, conducting an analysis of the observed situation would have no other effect than an increase in transparency;
3. incentives provided by other mechanisms in the CAM Network Code as well as the congestion management procedures ('CMP Guidelines')[43] constitute a sufficient guarantee that TSOs do their best effort to maximise the capacity offered.

It is difficult for external parties to assess that the methodologies applied, when calculating capacity, are compliant with the requirements of the regulation to maximise the capacity offered. Furthermore, a variety of approaches are identified, either on the calculation inputs or the methodologies in used. As a consequence, discrepancies on the outcomes of calculations are to be expected at interconnection points. The approach to these discrepancies remains unclear. With this impact assessment, it will be analysed whether new measures are necessary and if so what new rules would be the most adequate to face these challenges.

e. Capacity calculation: Policy options and enforcement design choices

When considering the general policy options to tackle the issues related to capacity calculation, looking at gaining the insurance that the maximum capacity is offered, there are essentially 3 choices:

- **Option 1:** *no further EU action;*
- **Option 2:** *increased transparency and TSO cooperation;*
- **Option 3:** *harmonised capacity calculation practices.*

Following the option 1 implies relying on the Transparency Regulation as far as capacity calculation is concerned, and rely on incentive mechanisms provided by CAM Network Code and CMP Guidelines to ensure maximisation of offered capacity. This does not address the issue of transparency or the lack of TSO cooperation on cross-border issues. The option 3 could prove costly and inefficient:

- Harmonising the capacity calculation methodology without possibly harmonising the inputs (as this would be in contradiction with existing Security of Supply Regulation) would not ensure output consistency or capacity maximisation;
- As both NRAs and shipper lack of the necessary expertise to assess in details the capacity calculation methodology, the monitoring of the quality of the information provided and thus the evaluation of the gain in terms of transparency will be difficult to assess.

[43] http://ec.europa.eu/energy/gas_electricity/consultations/20110412_gas_en.htm

Following option 2, focusing on the expected outcome of the process by monitoring the capacity calculation at both sides of an interconnection point appears proportionate to the issue considered.

12. General Conclusion: Preferred options, monitoring and evaluation

The following set of options received stakeholders' support.[44]

- Interconnection Agreements

  While the bilateral setting of interoperability principles is favoured, the imposition of default rules in addition to a specific dispute settlement procedure will preclude protracted negotiations between parties (see 6.e.ii – option 2.c).

  The core indicators of progress concerning more effective handling of interconnection agreements are

  - the number of interconnection agreements leading to dispute settlement;
  - the average duration for resolution of these disputes.

  Outcome of the consultation:

  - *16 out of 27 respondents support the introduction of a common template.*
  - *Out of 25 answers, 22 are in favour of a dispute settlement procedure*.

- Units

  Harmonisation of units for energy, volume, pressure and GCV is in the prolongation of the work lead by EASEEgas, to the benefit of system users (see 7.e. option 2).

  The core indicator of progress concerning the harmonisation of units is the number of standards in use in the EU by TSOs in relation to volume, energy, Gross Calorific Value and pressure.

  Outcome of the public consultation: a majority of 27 repondents out of 29, do think that there is a need for harmonisation of units.

- Gas Quality

  A close monitoring of the issue, combined with enhanced TSO cooperation and transparency (see section 8.e.ii – Option 2) will address at best the concerns over locally observed issues and their possible European wide evolution.

  The core indicators of progress on the issue of Gas Quality is, on the short term monitoring, the assessment of relevant publications by TSOs and, regarding long term monitoring, the delivery of a gas quality Outlook by ENTSOG.

  Outcome of the public consultation: a majority of the respondents (19) assess positively the proposal.

- Odourisation

  Harmonisation is the solution to a bilateral issue resulting in a clear barrier to cross-border trade, with cross regional consequences (see 9.e – option 3).

  The core indicator of progress on the issue of odourisation is the evolution of cross-border trade along routes where odorisation is an issue.

[44] See 4 *supra.*

Outcome of the public consultation: Out of 30 respondents, 26 respondents agree that there is an issue with odourisation and agree on the default of non-odourised gas.

- Data Exchange

  Harmonisation is necessary to allow system users to overcome the difficulties they are currently facing in relation to the lack of harmonisation currently observed regarding data exchange practices. The most feasible approach to harmonisation is to address format at first (see 10.e – option 2).

  Outcome of the public consultation: Out of 24 respondents, 16 associations or companies agree on the benefit to be gained from harmonisation data exchange.

- Capacity Calculation

  Harmonisation should come as an answer to the observed lack of transparency and cross-border cooperation over observed discrepancies in the capacity offered (see 11.e – option 2).

  The core indicator of progress is the publication of an outlook by ENTSOG assessing technical capacity discrepancies at Interconnection Points in Europe.

  Outcome of the public consultation: Out of 25 respondents, 13 reacted positively to the policy proposal.

Article 41 of the Gas Directive 73/2009/EC already foresees very broad monitoring rights and duties for NRAs. Nevertheless it is proposed that the Agency monitors the status of contractual and physical congestion at interconnection points pursuant to Article 6(6) of Regulation (EC) No 713/2009.[45]

[45] 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, OJ L 211/1 14/08/2009.

Abbreviations

ACER	Agency for the Cooperation of Energy Regulators
CAM	Capacity Allocation Mechanism
CBP	Common Business Practice
CEN	Comité Européen de Normalisation (European Committee for Standardization)
CMP	Congestion Management Procedure
DSO	Distribution System Operator
ENTSOG	European Network of Transmission System Operators for Gas
FG	Framework Guideline
IP	Interconnection Point
ISO	International Organization for Standardization
LNG	Liquefied Natural Gas
NC	Network Code
NRA	National Regulatory Authority
OBA	Operational balancing Account
TSO	Transmission System Operator

RELATED DOCUMENTS

- Implementation progress of the EASEE-gas Common Business Practices - 2010 Review - http://easee-gas.eu/media/6229/cbp_implementation_report_final.pdf
- ACER Public Consultation on the Draft Framework Guidelines on Interoperability and Data Exchange Rules for European Gas Transmission Networks, Initial evaluation of responses - PC_2012_G_07_EoR - http://www.acer.europa.eu/Official_documents/Public_consultations/PC-07_Draft_FGs_on_Interoperability_and_Data%20Exchange%20Rules/Document%20Library/1/Evaluation%20of%20Responses%20to%20ACER%20Public%20Consultation%20on%20Interoperability%20and%20Data%20Exchange%20Rules%20for%20Gas.pdf
- ENTSOG Network Code on Capacity Allocation Management - CAP0210-12 of 6 March 2012 as available on ENTSOG's website: http://www.entsog.eu/publications/camnetworkcode.html
- Study on Interoperability - Gas Quality Harmonisation - Cost Benefit Analysis - Preliminary report for consultation - Report prepared for the European Commission by GL Noble Denton and Pöyry Management Consulting - July 2011 http://ec.europa.eu/energy/gas_electricity/consultations/doc/20110916_cost_benefit_analysis_report.pdf
- National situations regarding gas quality - Report prepared by MARCOGAZ working group "GAZ QUALITY" – 29 November 2002 - http://www.marcogaz.org/index.php/component/docman/cat_view/112-gas-utilisation?Itemid=135
- Marcogaz review on "Odorisation of Natural Gas" – 2 November 2006 - http://www.marcogaz.org/index.php/component/docman/cat_view/111-gas-infrastructure?Itemid=135
- 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 repealing Directive 2003/55/EC, OJ L 211/94, 14.8.2009;
- 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, OJ L 211/1 14/08/2009.
- 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 1775/2005, OJ L 211/36 14/08/2009.
- European Commission Mandate to CEN for standardisation in the field of gas qualities of 16 January 2007 (M/400).
- European Commission Mandate to CEN for standards for biomethane for the use in transport and injection in natural gas pipelines of 8 November 2010 (M/475).
- Agency Framework Guidelines on Capacity Allocation Mechanisms for the European Gas Transmission Network of 3 August 2011 (FG-2011-G-001).
- Agency Framework Guidelines on Gas Balancing in Transmission Systems of 18 October 2011 (FGB-2011-G-002).

List of Annexes

ANNEX A: List of shareholders consulted

	Name	Organisation	Segment	Country of origin
1	BDEW	Association	Network user, Industry	Germany
2	CEDEC	Association	Distribution	Europe
3	DEPA	Company	Network user	Greece
4	EASEE gas	Association	Producer, Network user, Transmission, Industry	Europe
5	EDF	Company	Network user	France
6	EDP	Company	Transmission	Portugal
7	EDISON	Company	Network user, Trader	Italy
8	EFET	Association	Trader	Europe
9	Enagas	TSO	Transmission	Spain
10	ENBW	Company	Network user, Trader	Germany
11	ENEL	Company	Network user	Italy
12	ENI	Company	Network user, Trader	Italy
13	ENI Adriaplin	Company	Network user	Slovenia
14	ENTSOG	Association	Transmission	Europe
15	EURELECTRIC	Association	Industry	Europe
16	EUROGAS	Association	Network user	Europe
17	EUROGAS distribution	Association	Distribution	Europe
18	EUROMOT	Association	Industry	Germany
19	EXXONMOBIL	Company	Producer, Network user, Storage, LNG	UK
20	GasLink	TSO	Transmission	Ireland
21	GasNatural Fenosa	Company	Network user	Spain
22	GDF Suez	Company	Network user, Trader	France
23	GEODE	Association	Distribution	Europe
24	GIE	Association	Transmission, Storage, LNG	Europe
25	GMT	Company	Network user, Trader	UK
26	GTG Nord	TSO	Transmission	Germany
27	IFIEC/CEFIC	Association	Industry	Europe
28	JP Morgan	Company	Trader	UK
29	MARCOGAZ	Association	Industry	Europe
30	National Grid	TSO	Transmission	UK
31	OGP	Association	Producer	Europe
32	Statoil	Company	Producer, Network user	Norway
33	VEN	Association	Producer, Network user	The Netherlands
34	VNG	Company	Network user, Trader	Germany

ANNEX B: Interconnection agreement potential contents and categorisation

	Categorisation			
Purpose:	**Safety related**	**Physical & operational**	**Commercial**	**Contractual**
Demarcate geographical boundaries and connection points	✓	✓		
Set out safety requirements and the routines to be followed in emergencies and/or exceptional events[46]	✓	✓	?	
Set out other technical requirements in respect of the physical construction and operation of the infrastructure		✓	✓	
Set out commercial operations (e.g. OBAs) and timings that are compatible with or relied upon by other commercial processes such as a network code			✓	
Specify metering and measurement arrangements		✓	✓	
Set out required characteristics for the gas conveyed	✓	✓	✓	
Define communication requirements, methods and channels		✓	✓	✓
Enable maintenance activities to be planned/carried out		✓		
Set out each counterparty's liability toward the other				✓
Set out requirements for confidentiality				✓
Set out change management process			✓	✓
Set out dispute resolution practices & choice of law				✓
Set out force majeure considerations			?	✓
Set out duration and termination clauses				✓

[46] The Framework Guidelines define an exceptional event as *"Any unplanned event that may cause, for a limited period, capacity reductions, affecting thereby the quantity or quality of gas at a given interconnection point, with possible consequences on interactions between TSOs as well as between TSOs and system users."*

ANNEX C: Case Study – Tarvisio/Arnoldstein IP – differing Nomination procedures as an obstacle to implementing capacity allocation

To be Updated by ECONTROL

Within the GRI SSE, the Austrian TSO TAG is planning to implement a pilot project on the Austrian-Italian border consisting of offering/auctioning day-ahead transportation capacity on interruptible basis.

Two solutions have been presented by TAG, with one being hardly implementable in practice due to the difference in nomination times at the interconnection point:

Time Schedule D-1 for Day-Ahead Auctions
(Solution 1)

TAG GmbH proposes the following time schedule for Day-Ahead Capacity Auctions:

16:30	Matching finalization for Ship or Pay Shippers
16:30 – 17:30	Reserve time to be used for • data verification • system configuration • troubleshooting
17:30	Sending of auction invitation to Qualified Shippers
17:45 – 18:15	Day-Ahead auction event
18:15	Communication of results
18:15 – 18:30	Shipper to nominate to TAG GmbH's operator OMV Gas GmbH
18:30 – 20:00	Day Ahead Matching finalization and communication of acceptance/refuse to the Day Ahead Shippers

Time Schedule D-1 for Day-Ahead Auctions
(Solution 2)

TAG GmbH proposes the following time schedule for Day-Ahead Capacity Auctions:

Gas Day-2
16:30 publication on TAG Website of available Day Ahead Capacity

Gas Day-1

10:00	Sending of auction invitation to Qualified Shippers
10:30 – 11:00	Day-Ahead auction event
11:15	Communication of results
11:30 – 12:30	Shipper to nominate to TAG GmbH's operator OMV Gas GmbH
16:30 – 17:00	Day Ahead Matching finalization and communication of acceptance/refuse to the Day Ahead Shippers

Option 1 foresees that shippers nominate to TAG's operator GasConnect Austria (formerly OMV Gas) by 18:30 on D-1, whereas nominations have to be sent to SNAM Rete by 13:00 of D-1. This creates an important risk of mismatches for shippers and renders coordinated capacity auctioning at the IP virtually impossible. There is no OBA in place at the Arnoldstein/Tarvisio IP.

TAG GmbH might now to implement the Solution 2 for their pilot project, which means that only D-2 capacity can be made available if the risk of mismatches is to be reduced.

No renomination is possible at cross-border entry points into Italy, whereas hourly renominations are possible with a 2-hours lead time on the Austrian side.

In a shipper consultation in December 2011, 18 out of 20 respondents indicated a preference for solution 2, although some shippers clearly stated in the framework of GRI SSE stakeholder group meetings that option 1, if it was feasible (i.e. if nomination procedures were harmonized) would be clearly preferable.

Media reported that traders active on the Italian market even consider the first option as risky because of the difference in nomination rules. Traders might end up having capacity at Tarvisio but not have time to sell the gas on the PSV (day-ahead), obliging them to sell it intraday, if possible. Since Italian market rules forbid being unbalanced at the close of the day, traders would need to ship unsold volumes into storage through TAG, limiting the use of the auction to traders having access to storage facilities.

Snam Rete Gas, the Italian TSO, has been asked to strive for a harmonization of (re)nomination lead times in order to make the coordinated auctioning of capacity possible.

From the response of a trader to the public consultation organised by TAG GmbH it becomes clear to what extent the diverging (re)nomination rules at the IP are a barrier to trade:

- “The introduction of short-term capacity products to be allocated via auction, although only on a interruptible basis, represents indeed an important progress towards a major integration between the Italian and the Austrian systems and could certainly contribute to develop more liquid trading activities between the two markets. Nevertheless, the process will only be completed with the achievement of full coordination and harmonisation between the two interconnected TSOs, TAG and Snam Rete Gas (...).”

- “ (…) we acknowledge that this timing (Option1) would not be of any use for shippers who have not the corresponding entry capacity on the Italian border, given that Snam Rete Gas currently does not allow for re-nomination after 13h of D-1(…)”

- “In our opinion, this makes the solution inconsistent with:

  - The objective of facilitating the entry of new operators and increasing spot trading,

  - The evolution of capacity products that, according the requirements of the CAM Network Code, in the near future will be only sold as bundled, in order to ensure full correspondence between entry and exit capacity. “

- “we call for a more active cooperation between the two involved TSOs, being certain that it would successfully contribute to meet the targets set by the GRI and to make of the interconnection between Italy and Austria a testing point for the future measures on capacity allocation as defined by ACER’s Framework Guidelines.”

ANNEX D: Case study – Gas Quality issue between Belgium and Great Britain

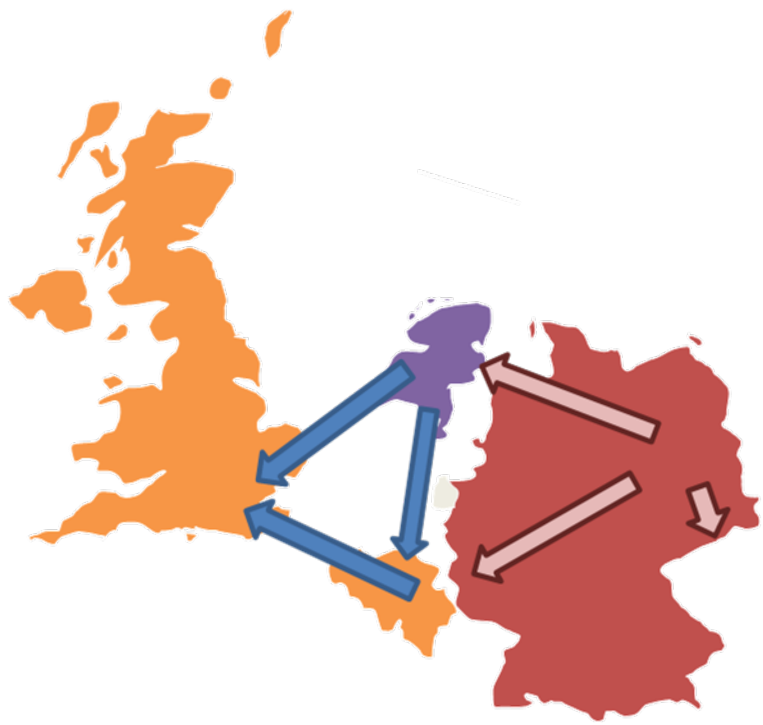


Figure 10 : Gas Swaps between Norway and Belgium

L-Gas H-Gas

The existing contractual route at stake goes from East (Germany) to West (United Kingdom), from Germany to UK, via the WINGAS Transport system through Fluxys/GTS system and BBL and I(UK) interconnectors to National Grid.

In UK, the upper limit for the Wobbe index is lower anywhere else along the contractual path; in particular, the gas injected into the system presents a higher Wobbe index.

The situation is currently ruled by a gentlemen's agreement. Gas arriving from Germany is co-mingled and swapped in the systems in The Netherlands and Belgium so that UK-compliant Norwegian gas arrives at Zeebrugge (B) and is sent into BBL and I (UK). This is however not a contractual obligation.

The traditional flow patterns allow easily keeping the gas for the UK in line with the UK-specifications. However, these flow patterns are evolving under the influence of new, more flexible sources (LNG and Nordstream). As a consequence, swaps and co-mingling will not suffice in the near future.

ANNEX E: Example of cross-border data exchange requirements

Route	Country/TSO	Data exchange system	# systems
GB to Italy via France/Switzerland	GB/National Grid	IXN (UK Link & Gemini)	4 to 6
	GB/Interconnector(UK)	ISIS	
	BE/Fluxys	Edig@s	
	FR/GRTgaz	Trasn@ctions (Edig@s/XML)	
	CH/Transitgas	Unknown	
	IT/Snam Rete Gas	Caminus	
GB to Italy via Germany/Austria	GB/National Grid	IXN (UK Link & Gemini)	4 to 7
	GB/BBL	Edig@s/EDIFACT	
	NL/gastransportservices	Edig@s	
	DE/OGE	Edig@s/XML	
	AT/BOG(WAG)	Unpublished; not Edig@s as at 2010	
	AT/TAG	Unpublished; not Edig@s as at 2010	
	IT/Snam Rete Gas	Caminus	
Greece to Portugal via BG, RO, HU, AT, SK, CZ, DE, FR, ES, PT	Greece	Unpublished	4 to 10
	Bulgaria	Unpublished	
	Romania	GMOIS	
	Hungary	Proprietary system (internet, XML)	
	Austria	Unpublished; not Edig@s as at 2010	
	Slovakia	Unpublished	
	Czech Republic	Edig@s/XML	
	Germany	Edig@s/XML	
	France	Trans@actions (Edig@s/XML)	
	Spain	SL-ATR	
	Portugal	Unpublished	

ANNEX F: Fluid dynamics equations commonly used for capacity calculation

General equations:

- Darcy-Weisbach
- Colebrook or Colebrook-White

Non-friction factor equations:

- Pole
- Mueller

Friction factor equations:

- Spitzglass
- Waymouth
- Panhandle

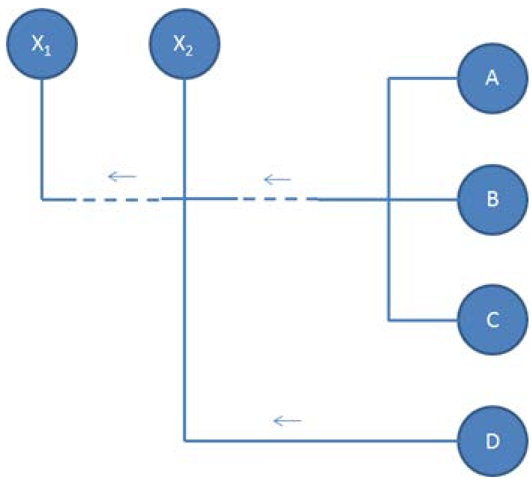
ANNEX G: review of the probability associated to stress scenarios in use by the European TSOs

(ENTSOG from TYNDP 2011-2020 ANNEX C)

ANNEX H: capacity calculation

This annex provides illustrates how the empirical choices made by an operator in terms of stress distribution can affect the outcome of the calculated capacity.

Network



	Sample normal flow pattern	Sub-method 1				2	3
		Capacity A	Capacity B	Capacity C	Capacity D	Capacity A	Capacity A
A	5	4	7	7	0	7	17
B	5	6	3	6	0	5	0
C	5	7	7	4	0	5	0
D	5	3	3	3	20	3	3
Total	20	20	20	20	20	20	20
Sum of maxima		31				…. >26	…. >56

<u>Substitution method to calculating technical capacity (sub-method 1)</u>

- Sample demand shows a typical, 'normal' flow at each entry point, A, B, C, D, to the exit points, X1, X2
- Technical capacity for entry point A: a guarantee of capacity taking into account 'system integrity'
- The hardest condition to get gas in is under conditions where B and C are flowing at maximum -> **Sub-method 1 Capacity A**
- Likewise, calculations for B, C are when other local entry points are assumed to be flowing at their maximum: Capacities B/1 and C/1
- Entry point D is not impacted by the same physical constraint, and has no other local entry points, so it's maximum capacity might be given when A, B, C are at their minimum capacity: Scenario D/1
- The same considerations apply exactly with exit capacities: the maximum capacity will depend on assumptions at local exit points

<u>Substitution using more realistic flows (sub-method 2)</u>

- Assuming maxima at B & C, whether it is concurrently or not, might not represent a realistic situation (there might be upstream physical capacity constraints, or a lack of gas)
- If more realistic flows were assumed, more capacity might be available -> Capacity A/2

- Likewise, Capacities B/2 and C/2 could be constructed
- It is difficult to understand what flows, in a forward looking context, might be reasonable – history can be a bad predictor
- The approach fails the definition of technical capacity per EC/715/2009, as it does not guarantee capacity from a technical standpoint

Substitution using favourable flows (sub-method 3)

- Another set of flows could be assumed where local supplies are set at minima – realistic or theoretical minima
- Note, theoretical minima could be defined as zero, or could be defined as 'converse' flow (i.e. exit flows assumed when calculating entry capacity). (Converse flows are equivalent to the absorption methodology, described later.)
- Ultimately, converse flow means that an very large amount of capacity can be made available if a very large amount of local converse flow is assumed.
- Assuming local flows at zero, A, B and C, could therefore have capacities of 17 units each
- Again, this fails the definition of technical capacity per EC/715/2009, as it does not guarantee capacity from a technical standpoint

Observations from the 3 sub-methods

- Sub-method 1 can result in a technical capacity figure that is lower than the capability of the network under normal conditions
- Sub-method 3 can result in a technical capacity that is significantly higher than the capability of the network under normal conditions.

ANNEX I: capacity calculation Methodologies

Key points extracted from published capacity calculation methodologies. Text kept true to original format (as far as possible).

Interconnector UK

Entry capacity in the Bacton-Zeebrugge interconnector is determined by the capacity of compression stations at each terminal. Compression station capacity is primarily a function of the required compression ratio, which in turn is primarily a function of pressure and temperature.

Exit capacity is a function of the temperature and pressure of the grid to which the gas is entering.

Capacity is calculated using fixed assumptions around inlet pressure, discharge pressure, temperature and compression station load.

Gas Transport Services BV

Based around existing commitments and the current network configuration.

Capacity is incrementally increased at entry and exit points to determine at what level obstructions will not occur in the network. This capacity is then offered to the market.

Thyssengas

Based on 1) Topological information about the grid 2) Contractural and technical limits on the grid [especially minimum and maximum pressures] 3) Gas quality parameters at entry points.

Demands of all directly and indirectly connected consumers are analysed to get temperature related demand scenarios. These demand scenarios are combined with entry scenarios under the premise of a completely balanced grid (entry equals exit).

All combinations of entry and exit scenarios are tested by a flow simulation to ensure that contractual and technical limits are complied with. As long as all of these limits are complied with, the defined entry and exit capacities can be sold as fixed technical capacities at the particular points.

Gascade

Potential limitations (bottlenecks) are calculated across the entire system. Historical flows are then used to determine technical capacities – a flow is considered statistically reliable if, historically, the flow was below this level for less than 24 hours in advance.

Potential capacity is maximised by combining bottlenecks and historical flows.

NET4GAS

Using data on technical, contractual and demand constraints, the system is modelled using SIMONE.

Worst case scenarios are defined for each border point; maximum entry and exit capacities are discovered by establishing the best possible management of the system and compressor stations, given the pressure conditions at each transfer point. Any theoretically possible combination of transmission must be feasible and transmission must be feasible at any off take for domestic consumption.

GRTGaz

GRTGaz takes the technical capabilities of compressor stations, pipeline capacities, consumption levels, movements into/out of underground storage facilities and the configuration of the system when calculating the system capacity.

Bulgartransgaz

Capacity is calculated based on the maximum quantity of gas entering transmission system entry point, the gas pressure and the pipeline's technical parameters.

To calculate the capacity of kilometre X in the gas flow direction, the technical capacity calculated for the off takes preceding kilometre X shall be considered.

DEFSA

Entry points: The transmission system is simulated, taking into consideration its operating conditions and requirements (e.g. guaranteed delivery pressures), for an estimated peak day.

Exit points: The technical capacity at exit points equals the maximum capacity of the respective metering station.

National Grid

Note that technical capacities are assumed to be equal to 'baselines' defined in their respective licence.

Entry point capability: Network capability at each entry point was defined as the maximum capacity that could be released at that entry point in a 1 in 20 peak day demand given the base network infrastructure and without triggering the need for network reinforcement.

The base network is developed as follows: 1 in 20 peak day demand and gas forecasts, as well as forecast infrastructure plans, are imported from the Gas Transportation Ten Year Statement. After setting exit flows equal to forecast 1 in 20 levels, the base network is balanced using a 'merit order' approach.

To determine maximum capacity at a given point, gas flows entering the chosen entry point are increased beyond the initial supply scenario forecast level (base flows) until a network constraint was identified - thereby indicating the threshold of maximum capability.

To keep the network in balance, supplies at other entry points are turned down as flows through the chosen point are increased. The entry points turned down are those identified as providing the least interaction with the entry point in question, whilst assuming flows at nearby entry points were relatively high.

Exit point capacity: Exit capacity baselines are calculated to be consistent with the maximum quantity of capacity available at each node, given a set of plausible scenarios for flows elsewhere on the network. Method: 1) Establish balanced demand and supply position based on 1 in 20 demand. 2) The NTS must be able to simultaneously meet the combined baselines at each offtake without the need for exit investment or significant buyback. 3) Increases in demand to determine the maximum exit capacity are matched with increases in supply based on forecast assumptions of additional entry capacity.

4) Modelling continues, by increasing exit flow until investment is required for 'exit' purposes.

TAG

The method applied considers: the geometry and altimetry of the TAG pipeline system, use of the maximum operating pressure admitted, use of the maximum operating power destined for the operation in the compressor stations, observance of border pressure constraints and observance of adequate standards for safety and quality for the long transportation services for the shippers.

Geoplin Plinivodi

Maximum technical transmission capacity is the capacity which is physically available for transmission from the agreed acceptance point to transfer point.

Maximum technical capacity takes into account the technical capacities of all components of the gas pipeline network involved in the configuration and operational characteristics of the gas pipeline network as a whole, and its operational boundary conditions.

The gas transport system is mathematically modelled to predict the behaviour of the network under different conditions.

SNAM Rete Gas

Transportation capacity is the maximum gas quantity that can be injected into the system (or off-taken from the system), for the Gas day, at a specific point, respecting the technical and operational constraints fixed in each pipeline section and the maximum performance of plants located along the pipelines.

The valuation of such capacities is performed with hydraulic network simulations carried out in appropriate transportation scenarios, respecting acknowledged technical standards.

Entry points to the network: Since the transportation capacity is strictly dependent on the capacity of contiguous injection and off-take points, it is not possible to define a unique value of maximum flow rate that characterizes each entry point from national production or from storage. This is even more the case for meshed networks such as SNAM Rete Gas's.

Exit points of the network: Transportation capacity is the sum of the capacities of the redelivery points within each area.

Redelivery points: Capacity is strictly related to the capacities at contiguous points. Therefore it is not possible to define a unique value of maximum capacity that characterizes a redelivery point. Capacities are determined taking into account network performance, not considering the effect of REMI plants that are not part of the SNAM Rete Gas system.

Main parameters for the determination of transportation capacities:

Technical constraints: Maximum pipelines' exercise pressure: pressure in pipelines cannot exceed the pressure for which authorization is given by the competent authority, minimum pipelines' exercise pressure: minimum pressures are specified to ensure the systems performance, performance of compressor plants and market scenarios (these are made up of the totality of the off-takes of the shippers of SNAM Rete Gas's transportation system. These scenarios are defined each time in order to take into account the most severe transportation conditions).

Operational constraints: Delivery pressures at the entry points (the pressure is limited by the delivery contractual pressures. These pressures have been defined on the basis of a joint technical analysis performed with the operators of the interconnected foreign systems).

BOG

Calculation of capacities in the WAG Pipeline:

Capacity is calculated using BOG's simulation tool; by tuning the compressor stations along the WAG as well as the volume flow in order to be able to deliver gas at stated delivery pressures

Design capacities can be used 100% in each direction and do not take into account netting measures between East-West nominations and West-East nominations.

TIGF

Principle of capacity calculation:

TIGF models the characteristics of all the elementary systems making up its transport network. From that model, it is then possible to simulate all the supply and consumption situations envisaged by TIGF.

Calculating the maximum tradable fixed capacity:

The maximum flow that the system is likely to transport under a given reference situation known as the "design case". The design case is determined by the transporter on the basis of the most demanding operating conditions that they are able to cover. In the winter this corresponds to subscription forecasts at delivery points – these make it possible to deal with a peak in consumption which is likely to occur once every 50 years. In the summer, this corresponds to the maximum injection into storage and minimal draw-off over the regional grid – equivalent to the average consumption over previous Augusts.

Ontras VNG

SIMONE software is used to model the system. There are no restrictions in terms of configuration and complexity of the network. Since the capacity calculation is a planning calculation, ONTRAS uses only a stationary scenario.

The historical capacity serves as a starting point for the load flow simulation of ONTRAS network. In this, market area and cross-border flows are considered. Contracted pressure commitments of partners are included in the calculation too. As a result, SIMONE provides the technical and the available capacities at entry and exit points. These statistically firm capacities are the basis for the statistical firm GASPOOL capacity model of the market area-wide network operators.

FGSZ Naturel Gas Transmission

FGSZ defines the type of capacity available, many of which are calculated using the maximum technical capacity. However they do not give a description of how maximum technical capacity is calculated.

Gaslink

The maximum technical capacity of both the Inch and Moffat entry points is determined by the capacity of the relevant compressor stations – which are determined by factors such as the required compression ratio, the available power of the compressor units, the gas temperature and density, etc.

Assumptions are published.

Gas Transport Services

Existing commitments and the network configuration for the current calculation year are used at all times.

By incrementally increasing the capacity at entry and exit points, it is possible to determine at what level obstructions will not occur in the transmission network. This capacity can then be offered to the market. These calculations are performed for future years whose network configurations are known.

Gaz-system

The technical capacities at given exit points are determined by the TSO at the request/inquiry of the Entity once the amount and capacity of interest have been specified by them.

Technical capacity means the maximum firm capacity that the transmission system operator can offer to the network users, taking account of system integrity and the operational requirements of the transmission network and the given zone. The technical capacity at given exit points in a given zone is not equal to the technical capacity of the zone. Any change in the contracted capacity in one zone may affect the technical capacity of the remaining zones.

Gas Connect Austria

The calculation uses an iterative procedure. As regards construction and operating costs, a balance needs to be struck between compressor power and pipeline diameter. Technical, organizational, operational, environmental, geological and regulatory (legal) conditions have to be taken into account when making these decisions.

ANNEX J: TRANSPARENCY on capacity Calculation

Detailing whether 'technical capacity' is available on ENTSOG member TSO's websites.

TSO	Data	Notes
BOG	YES	Data available through Online Capacity Booking System. Difficult to extract.
OMV Gas	NO	Website provides links to Gas Connect Austria, a wholly owned subsidiary of OMV Gas. (See Gas Connect Austria).
TAG	YES	Using "Nominal (Technical)"
Fluxys	YES	Data can be accessed through www.data.fluxys.com , which gives the Contracted firm capacity and other measures of capacity availability. A website search of fluxys.com returns a pdf showing "Maximum Technical Capacity"[47]. It is unclear which should be used. In this analysis, the latter was used.
Bulgartransgaz	YES	Using "Technical capacity". Data is given in "thousand nm^3" and has proved difficult to translate for comparison with neighbouring TSOs. We have tried interpreting them on an hourly and on a daily basis and have used ENTSOG published GCVs, but have been unable to re-create the ENTSOG published capacity.
NET4GAS	YES	Using "Technical capacity".
Energinet.dk	YES	Data found, but only for "Total Capacity", which is equal to the sum of offered capacity and perhaps not the same as the technical capacity. Further, the Total Capacity offered appears to vary fairly frequently.
Gasum	NO	Unable to find anywhere on website.
GRTgaz	YES	Using "Maximum technical capacity"
TIGF	YES	Using "Marketable" "Firm Capacity"
Open Grid Europe	YES	Using "Technical Available Capacity"
Gasunie Deutschland Transport	YES	Using "Technical capacity"
Ontras VNG	YES	Using "Maximum technical capacity"
Thyssengas	YES	Using "TVK"
Wingas Transport (Gascade)	YES	Using "Technical capacity".
GRTgaz Deutschland	YES	Using "Firm entry (exit) capacity".
DESFA	YES	Using "Technical capacity". Data found does not appear to correspond to ENTSOG published data.
FGSZ Naturel Gas Transmission	NO	Capacity data is available, but not at relevant interconnection points.

[47] http://www.fluxys.com/en/TargetGroups/~/media/Files/Services/Transmission/OperationalData/Capacity/Fluxys_TechnicalMaximumCapacity.pdf.ashx

TSO	Data	Notes
Gaslink	YES	Using "Technical Entry (Exit) Capacity".
Edison Stoccaggio	NO	Website in Italian
Snam Rete Gas	YES	Using "Transportation Capacity".
Creos Luxembourg	NO	Unable to find on website – unable to find English Language version.
Gas Transport Services BV	YES	Using "Firm Total Entry".
Gaz-System	YES	Using "Technical capacity".
REN-Gasodutos	YES	Using "Technical capacity of relevant points".
Transgaz	YES	Using "Technical capacity".
Eustream	YES	Using "Technical capacity".
Geoplin plinovodi	YES	Using "Technical capacity".
Enagas	YES	"Nominal capacity", within "Available capacity"
Swedengas	NO	Unable to find anywhere on website.
Interconnector UK	YES	Using "Maximum technical capacity"
Svenska Kraftnat	NO	Unable to find anywhere on website.
National Grid	YES	http://marketinformation.natgrid.co.uk/Gas/CapacityReports.aspx. Note that capacities to be offered for sale currently reside in their licence, so are defined by Ofgem. See http://www.nationalgrid.com/uk/Gas/Charges/statements/Technical+Capacity/
Bayernets.de	YES	Using "TVK"
Gas connect Austria	NO	"Capacity segment" data is available[48]. However I have been unable to find data on interconnector capacities.
Gastransport Nord	NO	Unable to find anywhere on website
jordgasTransport	NO	Unable to find anywhere on website
Nowega	NO	Unable to find anywhere on website
Terranets bw	NO	Unable to find anywhere on website

[48] https://gms.gasconnect.biz/gma/VersionAKV/index.jsp?USER=guest_en&PASSWORD=anonymous&STARTCONTEXT=omv.akv.contexte.KapazitaetChartContext

ANNEX K: capacities at interconnection points

KEY: uTSO = Upstream TSO, dTSO = Downstream TSO - Sources: TSO websites and ENTSOG Capacity Map.

Interconnection Point	TSO	FORWARD				REVERSE			
		ENTSOG		uTSO	dTSO	ENTSOG		uTSO	dTSO
Interconnector (UK-BE)	Fluxys	805		1003		632			746
Interconnector (UK-BE)	Interconnector				808			630	
Zelzate (NL-BE)	Fluxys (to GTS)	304		172		209			NV
Zelzate (NL-BE)	Gas Transport Services BV				302			281	
Zelzate (NL-BE)	Fluxys (to Zebra)	140			172	140		NV	
Zelzate (NL-BE)	Zebra Pijpleiding				ND			ND	
Zandvliet H (NL-BE)	Fluxys	28		109		0			0
Zandvliet H (NL-BE)	Gas Transport Services BV				30			0	
Hilvarenbeek - Poppel/Zandvliet L (NL-BE)	Fluxys	615		875		0	0		0
Hilvarenbeek - Poppel/Zandvliet L (NL-BE)	Gas Transport Services BV (Zandvliet G)		47		47		0	0	
Hilvarenbeek - Poppel/Zandvliet L (NL-BE)	Gas Transport Services BV (Hilvarenbeek)		569		612		0	0	
Hilvarenbeek - Poppel/Zandvliet L (NL-BE)	Gas Transport Services BV (Total)				659		0	0	
Obbicht//Gravenvoeren - 's Gravenvoeren + Dilsen (NL-BE)	Fluxys	352		480		0	0		0
Obbicht//Gravenvoeren - 's Gravenvoeren + Dilsen (NL-BE)	Gas Transport Services (Gravenvoeren)		291		298		0	0	
Obbicht//Gravenvoeren - 's Gravenvoeren + Dilsen (NL-BE)	Gas Transport Services (Obbicht)		61		61		0	0	
Obbicht//Gravenvoeren - 's Gravenvoeren + Dilsen (NL-BE)	Gas Transport Services (Total)				359		0	0	
Bocholtz (DE-NL)	Gas Transport Services	0		0		439	0		515
Bocholtz (DE-NL)	Open Grid Europe		0		0		68	68	
Bocholtz (DE-NL)	Fluxys TENP		0		0		371	ND	
Bocholtz-Vetschau (DE-NL)	Gas Transport Services	0		0		12			12
Bocholtz-Vetschau (DE-NL)	Thyssengas				0			12	
Bunde// Oude Statenzijl H (DE-NL)	Gascade	96		99		37			57
Bunde// Oude Statenzijl H (DE-NL)	Gas Transport Services (to Gascade)				148			70	
Bunde// Oude Statenzijl H (DE-NL)	Open Grid Europe	243		243		72			71
Bunde// Oude Statenzijl H (DE-NL)	Gas Transport Services (to OGE)				500			163	
Bunde// Oude Statenzijl H (DE-NL)	Gasuine	27		NV		71			71

Bunde// Oude Statenzijl H (DE-NL)	Gas Transport Services (to Gasunie)			NV			NV
Hora Svate Kateriny//Obernhau (CZ-DE)	Gascade		222	ND		231	283
Hora Svate Kateriny//Obernhau (CZ-DE)	Net4Gas			322			231
Hora Svate Kateriny//Obernhau (CZ-DE)	Ontras		270	ND		108	
Hora Svate Kateriny//Obernhau (CZ-DE)	Net4Gas			322			231
Hora Svate Kateriny//Obernhau (CZ-DE)	Opal Nel		NV	NA		353	NA
Hora Svate Kateriny//Obernhau (CZ-DE)	Net4Gas			322			231
Waidhaus (CZ-DE)	Opengrid Europe	1010	552	552		201	NV
Waidhaus (CZ-DE)	GRTgaz Deutschland		458	458			#N/A
Waidhaus (CZ-DE)	Total Entry			1010			#N/A
Waidhaus (CZ-DE)	Net4Gas			1071			231
Kula//Sidirokastron (GR-BG)	Bulgartransgaz		0	33		134	26
Kula//Sidirokastron (GR-BG)	DESFA			0			109
Lanzhot (CZ-SK)	Eustream		261	255		783	1233
Lanzhot (CZ-SK)	Net4gas			280			1634
Travisio // Arnoldstein (AT-IT)	TAG		1135	1434		191	416
Travisio // Arnoldstein (AT-IT)	SNAM Rete Gas			1156			194
Gorizia // Sempeter (IT-SI)	SNAM Rete Gas		28	48		NV	22
Gorizia // Sempeter (IT-SI)	Geoplin Plinovodi			28			NV
Blaregnies Segeo // Taisnières H (BE-FR)	Fluxys		570	272		NV	74
Blaregnies Segeo // Taisnières H (BE-FR)	GRTgaz			590			199
Blaregnies // Taisnierès L (BE-FR)	GRTgaz		230	280		230	280
Blaregnies // Taisnierès L (BE-FR)	Fluxys			345			NV
Csanadpalota (HU-RO)	Transgaz		51	51	0	0	0
Csanadpalota (HU-RO)	FGSZ			NV		0	0
Larrau (FR-ES)	Enagas		100	100		50 OR 30	50
Larrau (FR-ES)	TIGF			100			50

Cieszyn (CZ-PL)	Gaz-System		4	4			0		4
Cieszyn (CZ-PL)	Net4Gas				28			0	
Lasow (DE-PL)	Gas-System		43	43			0		43
Lasow (DE-PL)	Ontras				ND			ND	
Überackern // Burghausen (AT-DE)	Bayernets.de		230		64		114	0	
Überackern // Burghausen (AT-DE)	Gascade				224			114	
Überackern // Burghausen (AT-DE)	Total Exit				288			114	
Überackern // Burghausen (AT-DE)	Gas Connect Austria			NV					NV
Ellund (DK-DE)	Open Grid Europe	41	4	4		28	17		17
Ellund (DK-DE)	Gasunie		37	37			11		10
Ellund (DK-DE)	Total Entry			41					27
Ellund (DK-DE)	Energinet.dk				82			17	
Dragør (DK-SE)	Swedegas		106		ND		0	ND	
Dragør (DK-SE)	Energinet.dk				41			0	
Zevenaar (NL-DE)	Open Grid Europe	494	270	NV					NV
Zevenaar (NL-DE)	Thyssengas		224	224			1		0
Zevenaar (NL-DE)	Gas Transport Services				602			NV	
Winterswijk (NL-DE)	Open Grid Europe		198	NV			0		0
Winterswijk (NL-DE)	Gas Transport Services				410			0	
Julianadorp // Balgzand (NL-UK)	BBL		454	ND			0		ND
Julianadorp // Balgzand (NL-UK)	Gas Transport Services				340			0	
Moffat (UK-IRE)	Gaslink		342	342			0		0
Moffat (UK-IRE)	National Grid				ND			ND	
Twynholm (IRE-N.IRE)	Premier Transmission		89	96			0		0
Twynholm (IRE-N.IRE)	Gaslink				NV			NV	
Oberkappel (DE-AT)	BOG		94	305			13		181
Oberkappel (DE-AT)	Open Grid Europe				94			13	
Oberkappel (DE-AT)	GRTGaz Deutshland		13		13		133	133	
Oberkappel (DE-AT)	BOG			305					181
Medelsheim // Obergailbach (DE-FR)	GRTGaz		620	650			133		125
Medelsheim // Obergailbach (DE-FR)	Open Grid Europe				118			0	
Kiefersfelden (DE-AT)	TIGAS		23	ND			0		ND
Kiefersfelden (DE-AT)	Bayernets.de				21			0	

Murfeld // Ceršak (AT-SI)	Geoplin Plinovodi		90	90	0	0
Murfeld // Ceršak (AT-SI)	Gas Connect Austria			ND		ND
Valença do Minho // Tuy (PT-ES)	Enagas		40 OR 30	12	25	57
Valença do Minho // Tuy (PT-ES)	REN Gasodutos			20		23
Badajoz // Campo Maior (PT-ES)	Enagas		134	101	70 OR 35	134
Badajoz // Campo Maior (PT-ES)	REN Gasodutos			134		NV
Baumgarten (SK-AT)	BOG	1612	463	640	187	187
Baumgarten (SK-AT)	Gas Connect Austria		111	ND		#N/A
Baumgarten (SK-AT)	TAG		1038	NV		#N/A
Baumgarten (SK-AT)	Eustream			1588		184
Negru Voda I (RO-BG)	Bulgartransgaz		210	82	0	0
Negru Voda I (RO-BG)	Transgaz			NV		0
Negru Voda II & III (RO-BG)	Bulgartransgaz		610	208	0	0
Negru Voda II & III (RO-BG)	Transgaz			NV		0
Eynatten // Lichtenbusch / Raeren (BE-DE)	Gascade		137	136	0	0
Eynatten // Lichtenbusch / Raeren (BE-DE)	Fluxys (Gascade)			351		0
Eynatten // Lichtenbusch / Raeren (BE-DE)	Open Grid Europe		282	NV	0	NV
Eynatten // Lichtenbusch / Raeren (BE-DE)	Fluxys (OGE)			NV		NV
Eynatten // Lichtenbusch / Raeren (BE-DE)	Fluxys TENP		80	ND	61	ND
Eynatten // Lichtenbusch / Raeren (BE-DE)	Fluxys (Fluxys TENP)			233		270
Eynatten // Lichtenbusch / Raeren (BE-DE)	Thyssengas		1	2	0	0
Eynatten // Lichtenbusch / Raeren (BE-DE)	Fluxys (Thyssengas)			NV		NV

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