GTE Balancing and Storage Report **27 June 2001**

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Executive Summary

1. The EU Context

This report is from the **Balancing and Storage** working group of GTE - the association representing the gas transmission function within the EU. The other three working groups of GTE are:

- Capacity and Congestion Management
- Interoperability,
- Transmission Tariff.

All four of these groups were set up as a result of discussions and issues raised within the European Gas Regulatory Forum (usually known as the "**Madrid Forum**"), which meets twice a year.

Particular issues raised by the Madrid Forum include consistency of balancing arrangements, access to storage, unbundling of transportation, trading and storage, imbalance charging and incentives, cross-border allocation, charge transparency and balancing period consideration. All these issues have been addressed in this report.

2. The Objectives

The working group agreed the following objectives and these have been reflected here:

- **Review** the various balancing arrangements, including the price structures and levels, presently applying within the member states.
- **Identify** from this review areas of concern from the standpoint of public interest and customer requirements.
- **Address** the underlying issue of whether harmonisation either of balancing rules or of the balancing regime itself, is appropriate at this stage or whether an approach of subsidiarity is more appropriate.
- **Suggest** developments within the balancing and storage regimes that would enhance moves already made to improve competition, cross border arrangements, economic charging, transparency, non-discrimination, accessibility for new customers and where considered desirable, consistency between transmission systems.
- **Consider** the way forward in progressing the results of these discussions

3. The Work of the Group

The working group consisted of representatives of most of the major Transmission System Operators (**TSOs**) in the EU and Transgas from the Czech Republic. To fulfil the above objectives, the working group members circulated and completed two questionnaires and reviewed the responses during a series of meetings. In addition, group members prepared and circulated reports that addressed specific issues where their experience was relevant. Within the same meetings, discussion took place on the relevant issues raised in the Madrid Forum, the responses made to the questionnaires and the reports written by group members.

4. Review of Regimes

Seventeen TSOs, or groups of TSOs, drawn from twelve member states and the Czech Republic, completed questionnaires. Of the member states with more than one TSO, the Italian and French companies submitted separate responses but Germany submitted a common response. The responses revealed both similarities and differences in approach. The regimes were characterised by:

- Two main types of balancing period – daily and hourly.
- Charging regimes based upon shippers' imbalances and accuracy of nominations. The charging structures sought to be reasonable, transparent, non-discriminatory and incentivise good balancing behaviour. In particular, TSOs believed that where high imbalance cash-out

rates applied there were always adequate measures in place for shippers to avoid paying these high rates, including the provision of free tolerances and/or a reasonably priced flexibility service There were, however, acknowledged to be some areas of weakness. Transparency, for example, was affected by differences in charging structures between regimes and there were examples of legacy arrangements that were not covered by TPA balancing rules. Even so, analysis of the systems in detail concluded that most of the regimes fitted into a common template.

- "**Operational Balancing Agreements**" (OBAs) or other arrangements at system interfaces. Progress was being made on the development of rules that could be adopted more widely.
- Operational regimes based upon delivering shippers' gas nominations. These tended to be similar in structure but varied in the restrictions placed on nominations.
- Development of flexibility services based upon line-pack and storage facilities.
- The table below summarises the features of each system:

Member State/TSOs	Balancing Charges Separate from Transportation?	Balancing Period	Free of charge imbalances allowed?	Flexibility Service Offered?
Austria/OMV	Yes	Hourly	Yes	Yes
Belgium/Distrigas	Yes	Hourly	Yes	Yes
Czech Republic/ Transgas	No	To be defined	No	No
Denmark/DONG	Yes	Hourly	Yes	Yes
France/GdF, CFM, GSO	Yes	Daily	Yes	Yes
Germany/BEB, Ruhrgas, VNG, Wingas	Yes	Hourly	Yes	No
Germany/Thyssengas	Yes	Hourly	No	Yes
Ireland/BGE	Yes	Daily	No	No
Italy/Snam, Edison	No	Daily	N/A	N/A
Luxembourg/Soteg	Yes	Daily	Yes	Yes
Netherlands/Gasunie	Yes	Hourly	Yes	Yes
Spain/Enagas	No	Daily	N/A	N/A*
Sweden/Energi	Yes	Daily	Yes	No
UK/Transco	Yes	Daily	No	No

*Whilst Enagas does not operate a flexibility system as such, it requires shippers to deliver and maintain an inventory of gas within its transmission system.

5. Areas of Concern

As might have been expected, a wide variation of practice amongst TSOs has generated a number of areas of concern, which were identified in the working group discussions. These concerns were as follows:

- Differences in structure of cash-out and flexibility services can make it difficult for customers to compare charges between systems. This is important for shippers who desire transportation across system boundaries but have some discretion on where any imbalance might occur.
- Different approaches to unbundling of storage from trading and transportation. This resulted from differing perspectives of how storage might be owned and managed in order to provide the supply security that customers might require and partly reflected the different regulations applying in each member state. To some extent this reflect a perceived tension between allowing third party access to storage whilst recognising the need to provide an adequate level of strategic storage.
- Taking into account the physical differences between transportation systems, the group members were concerned that any moves to harmonise elements of the regimes, such as the

balancing period, might inhibit safe and efficient operation of the separate systems. This would not be in the interest of customers, as they would need to pay higher transportation charges in order to provide an appropriate return to the TSO on the likely additional investment.

6. Harmonisation and Subsidiarity

The working group considered two models of harmonisation as they might apply to balancing and storage:

- Establishment of one regime covering all the member states
- Retention of several regimes throughout Europe but with each group operating by the same basic principles.

It was agreed that a single integrated regime was impracticable at present, but also that it may not even be desirable as a long-term goal. For example, would it be useful to have a single imbalance and cash out price for the whole European market, even if it were possible to agree on a common balancing period?

The second harmonisation model might be more practicable. Systems could join the harmonised group once they had met objective "**convergence criteria**". In the meantime, a policy of subsidiarity would allow some diversity of rules providing the principles in the gas directives were followed. This should not prevent development of some common principles and rules and some examples of these were discussed. In fact, it was recognised that some aspects of the separate balancing and storage regimes should be harmonised without delay in order to further encourage gas flows across system boundaries.

Convergence criteria prior to harmonisation might include, for example:

- Conformity to a common template for flexibility services and imbalance charging.
- Consistent application of imbalance rules to all system users.
- Subject to fair rules that ensure supply security is maintained, allocation of storage owned and operated by TSOs is fair and open to all system users on the same terms.

7. Suggestions for Development

It was therefore concluded that the following common principles should be developed within the member states.

- Standardised OBAs should be encouraged in order to facilitate access for transportation of gas across system boundaries. Models already existing between neighbouring regimes, both within Europe or North America, with the same or different balancing period could be applied more generally.
- The concept of customer choice should be retained for gas that traverses system boundaries. For example, customers should be able to nominate in such a manner that they can effectively choose which system's flexibility or cash-out regime should apply where an imbalance cannot be avoided.
- Greater structural consistency of cash-out regimes and flexibility regimes should be sought in order to assist transparency and customer choice. This would also tend to reduce balancing charging differences between systems. The working group has already begun work on a common template to facilitate this process. Ultimately it is intended that the GTE web site would contain comparative prices based upon this template and possibly a "ready reckoner" for potential customers.
- Although, following discussion of the relevance of storage to security of supply, complete consensus was not reached on arrangements for access; three options are identified for consideration, which will facilitate competition whilst retaining supply security.
- The three options are as follows:
    - Rely exclusively on market forces to meet security of supply obligations placed on the parties.

- Combine market forces with "**Top Up**" agency roles, where these roles have been established in the member state.
- Allocate storage to shippers on the basis of their market share within defined customer categories. Where customers change shipper, this would be reflected in revised allocations.

- Development of consistent rules depends to some extent on the consistency of regulation in the member states, not least the obligations placed on TSOs and suppliers. The working group would support efforts to improve information on storage availability.
- Opportunities should be taken to apply consistent balancing rules to gas contracted under legacy arrangements particularly prior to any adoption of harmonised balancing rules.

8. The Way Forward

This working group requests comments on this report not only from the Madrid Forum working group and the European Institutions but also from shippers and other interested groups within the member states. It looks forward to a constructive debate on its suggestions and intends to involve customers in further consultation.

PART 1: THE PRESENT REGIMES

1.0 Obtaining Information

The working group relied upon its members in order to gain the information it required to do its analysis. The companies or organisations were as follows:

Company/Organisation	Member State	Participants
OMV	Austria	Gerhard Siegl, Erich Juranek
Distrigas	Belgium	Marc Vanaeken, Pascal De Buck
GTE Secretariat	Belgium	Philippe Mannoni
Transgas	Czech Republic	Lubomìr Novácek
DONG	Denmark	Jacob Pedersen
Gasum OY	Finland	Christer Paltschik
Gaz de France	France	Philippe Le Bitoux
BGW (BEB, Ruhrgas, Thyssengas, VNG, Wingas)	Germany	Ulrich Richstein, Andreas Kost
BGE	Irish Republic	Pat O'Riordan
Edison Gas	Italy	Valentina Infante
SNAM	Italy	Marco Cabri
Gasunie	Netherlands	Willem Mensink, Peter Sterkenburgh
Enagas	Spain	Guillermo Moncó Martínez, María Jesús Harráez Plaza
Transco	United Kingdom	Brian Withington, Paul Auckland, John Bradley
Interconnector UK	United Kingdom/Belgium	Roger Cornish

In addition to the above that attended meetings of the group the following companies participated by correspondence: CFM (France), GSO (France), Soteg (Luxembourg), Energi Vattenfall (Sweden)

1.1 Establishment of Questionnaires

Through questionnaires, the working group agreed to obtain from its members, comparative information that covered the following areas of interest:

- Part 1: Present Practice
  - Balancing Period
  - Imbalances
  - System Boundaries
  - Operational Procedures
  - Storage and Flexibility Services
- Part 2: Views on System Design and Development
  - Appropriate design principles
  - Common features in connected systems

- Overcoming differences in neighbouring regimes
- Views on issues raised by various parties (including the Madrid Forum)

Seventeen TSOs or TSO groups drawn from every EU country except Greece, Finland and Portugal, plus Transgas of the Czech Republic, completed questionnaires. In reviewing these responses it became clear that its value would be enhanced if a more detailed questionnaire were completed in the areas of Nominations and Allocations. This was then prepared, circulated and completed by a number of TSOs.

Appendix A includes the specimen questionnaires plus the matrix that summarises the responses to Part 1. The working group reviewed these responses.

1.2 Further Information

In addition to the completed questionnaires, working group members who had particular expertise, or in some cases the whole of the working group, were asked to complete information papers. These were as follows:

Subject/Action	Responsibility	Transporter/Country
Obtain typical Operational Balancing Agreement	Philippe Le Bitoux	Gaz de France, France
Prepare summary of statutory/regulatory requirements on transporters/shippers to hold storage (All asked to participate)	Brian Withington Lubomìr Novácek	Transco, UK Transgas, Czech Republic
Prepare summary of the interface issues between an hourly and daily balancing regime	Philippe Le Bitoux Roger Cornish	Gaz de France, France IUK, UK/Belgium
Prepare analysis of the general rationale for daily balancing	Philippe Le Bitoux Marco Cabri	Gaz de France, France SNAM, Italy
Prepare analysis of the general rationale for hourly balancing	Willem Mensink Gerhard Siegl	Gasunie, Netherlands OMV, Austria
Prepare a description of the services that should be offered to a shipper in an hourly balancing regime	Mark Vanaeken Pascal De Buck	Distrigas, Belgium
Prepare scenario for a three country system balancing model	John Bradley Mark Vanaeken	Transco, UK Distrigas, Belgium
Prepare a business case model for TSO representatives to chart shipper charges within each balancing regime	Mark Vanaeken	Distrigas, Belgium

With the exception of the typical OBA, these papers are attached as Appendix B

The review that follows this Section is based upon the questionnaire answers, the information papers and the discussion within the working group.

2.0 Key Features and Differences

2.1 Balancing Periods

An obvious difference between regimes is the balancing period.

- Seven member states have a **daily** balancing regime and five member states have an **hourly** balancing regime.

In addition, the UK/Belgium Interconnnector operates an hourly balancing regime and Transgas of the Czech Republic also responded that it saw benefits in an hourly balancing regime but it has not firmly decided which balancing period to apply when it begins to permit third party access.

Where a daily or hourly regime operates, it is generally recognised that, if storage or line-pack is not plentiful, limitations need to be placed on hourly variation. A number of approaches are used including requirements on shippers to:

- flow at constant hourly rates, or
- notify hourly profiles and/or observe ramp rate limitations at exit points of large consumers, or
- flow within an hourly-booked capacity limit.

Some TSOs recognised that where a daily regime applies, in a commingled stream, these requirements can be difficult to enforce in the absence of mechanisms to allocate at Entry and Exit on an hourly basis.

Where an hourly regime operates, the TSO often provides a "**flexibility service**" that is separate from the transportation service and allows shippers some fluctuation in their hourly imbalances without incurring cash-out. Additionally, most of the TSOs allow limited imbalances to be carried over from one balancing period to the next free of charge. This "**out of balance gas**" may be stored or taken up as line-pack by the TSO. Similar arrangements apply to certain of the daily balancing regimes.

The following table illustrates the position on balancing periods, free of charge imbalances and flexibility services:

Member State/TSOs	Balancing Charges Separate from Transportation?	Balancing Period	Free of charge imbalances allowed?	Flexibility Service Offered?
Austria/OMV	Yes	Hourly	Yes	Yes
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2.2 Shipper Incentives

Incentives are required for shippers to balance. This arises from the fact that:

- Each transmission system has physical constraints due to its design and this limits its ability to absorb physical imbalances between entry and exit, without prejudicing the safety of that system.

- The TSO has limited means to support system imbalances, which arise from shipper's imbalances, without incurring costs.

Two basic forms of shipper incentives are in place to assist the economic balancing of transportation systems. These are "**imbalance**" charges and "**scheduling**" charges.

Imbalance charges are calculated from the difference between allocated inputs and allocated outputs. These inputs and outputs may be aggregated at the shipper, entry point aggregate or shipper contract level.

Scheduling charges are calculated from the differences between scheduled nominations and allocations at each nomination point or occasionally over a group of nomination points in a geographical area. Where shippers have to balance entry and exit nominations, scheduling charges essentially function as imbalance charges. This is described in greater detail in Section 6.5 below. Taking into account this effect, all TSOs levy imbalance charges and some levy a form of scheduling charge.

As detailed in the table above, with both imbalance and scheduling charges, there is often an inner "free" band where no charge is levied, a middle band where a charge is levied at a "low" rate and an outside band where a charge is levied at a "high" rate. For imbalance charges, this free band will usually be subject to a cumulative maximum.

Approximately half of the TSOs offered flexibility services that reduce a shipper's cash-out exposure. This is discussed in more detail in Section 3.2 below.

2.3 System Boundaries

The two types of boundaries that need to be considered are:

- Between transmission and distribution systems.
- Between systems operated by different TSOs including National Frontiers.

The TSO's allocation of gas is normally the basis on which distribution companies operate their own procedures. No issues were reported in the questionnaire. Between TSO systems the largest potential issues might be expected to apply where gas flows from a daily regime to an hourly regime or vice versa. In fact, methodologies have been adopted which allow these interfaces to be handled without difficulty. This is mainly through the use of OBAs and is discussed in more detail in Section 3.5 below.

2.4 Operational Regimes

The two concepts that apply to all the TSOs' regimes are "**Nomination**" and "**Allocation**". The shippers express their intended gas flows by the nominations that they make. After the gas day commences, shippers may be permitted to "**renominate**" due to changes in intention or circumstances. After the day, the TSO will allocate the gas flows at each entry point and exit point to each shipper concerned.

Approximately half of the TSOs require nominations to be made towards the end of the previous week. These fulfil two purposes:

- The TSO is enabled to plan its weekly operation of the system and identify any likely constraints.
- The shippers' nominations effectively serve as defaults that will stand unless modified at the day-ahead stage.

The crucial phase of nomination is at the day-ahead stage. A shipper will be required to make a nomination by the early afternoon. The TSO will check the following:

- That the shipper has a contractual service in place which allows it to nominate at the relevant point;
- In the event of an OBA operating that the nominations on both sides of the interface are consistent; and
- That physical capacity is available

After carrying out these checks, the TSO will either confirm the shippers' nominations, or lower "**scheduled**" nominations, by late afternoon. These will then have a "**scheduled and confirmed**" status. This day-ahead process allows the TSO to set up the system in order to operate it in a safe, reliable and efficient manner.

Whilst there is consistency amongst TSOs on the day-ahead process, some differences apply to renominations. One TSO does not allow any renominations, some have no restrictions, one allows only one opportunity at a specific time, some allow four opportunities and one allows one opportunity per hour. In some cases a standard handling charge may be levied by the TSO for each renomination received. Usually renominations are accepted on a reasonable endeavours basis and particularly with large sites, "**ramp rate**" restrictions may apply. Nomination restrictions are necessary to maintain safe and efficient operation within the balancing period and to inhibit behaviour which would benefit the party concerned to the detriment of the other users of the system.

After the end of the balancing period, the TSO will obtain, at each entry or exit point, the metered quantity and allocate this to all shippers who made nominations at that point.

Allocations are of six general types:

- Individual agreements struck between the shipper and the TSO.
- Agency agreements where all the shippers at a particular entry or exit point employ an agent to make consistent allocation claims on their behalf.
- OBAs where shippers are allocated their nomination. Any discrepancy between the sum of these nominations and the metered quantity is allocated either to one of the shippers (the "**swing shipper**") or more generally to an inter-TSOs account.
- Pro-rated to nominations. This is where the metered quantity is allocated in proportion to the shippers' scheduled and confirmed nominations. This may also apply to OBAs where there is a major difference between the metered quantity and the sum of the nominations.
- Pro rated in accordance with a fixed percentage.
- In accordance with a priority order. Each shipper is allocated its nomination in turn until there is no measured quantity left to allocate.

2.5 Storage and Flexibility Services

These are of two types:

- Line-pack storage where the transmission system has some flexibility in the pressure to which it operates.
- Specific storage facilities such as LNG storage, salt cavities, depleted fields or aquifers

One of the relevant distinctions between the two types of storage is that specific storage might be owned by the TSO, one of the shippers or a separate storage provider. Using the access that they have to line-pack and/or specific storage, the majority of TSOs either operate a flexibility service or intend to do so. In addition, around half of the TSOs either operate or provide access to storage services, which shippers can use, for other reasons such as meeting peak day demands. It is important to note that the location of specific storage facilities may be determined by geological restrictions. In some cases TSOs do not offer specific flexibility services because imbalance tolerances exist which allow shippers to be out of balance without incurring substantial cash-out charges. Such services give the shippers an additional method of managing risk so avoiding the payment of imbalance charges.

3.0 Rationale for Different Approaches

As the results of the questionnaire were discussed and further papers were produced, it became clear that different approaches had been developed as a result of different circumstances.

3.1 Hourly and Daily Balancing Regimes

Gasunie and OMV produced a paper that outlined the reasons behind their adoption of an hourly balancing regime. Gaz de France produced a similar paper that compared the two regimes. The discussion is summarised below.

Hourly Balancing Justification

The two arguments are:

- More pipeline capacity is needed in order to provide both peak hourly flow capacity and line-pack. An hourly balancing regime would match pipeline capacity to the peak hourly flow without requiring any additional capacity for line-pack. A daily balancing regime, particularly if shippers profiled their inputs, would require this additional capacity.
- The shipper is able to reap benefits from profiling its flows either into or out of the system but the daily costs borne in meeting this flow profile are borne by all shippers and/or the TSO.

In the table below the effect of profiling on the transportation capacity of a single pipeline (750 mm, inlet pressure 67 bar (abs), outlet pressure 50 bar (abs)) is presented. The assumed imbalance within the day is 10%. The imbalance is modelled as follows: for the first 12 hours the demand is 10% higher then the supply; for the last 12 hours the supply is 10% higher then the demand.

Length (km)	Capacity (Stationary)	Capacity (With profiled input)	Capacity loss (%)
50	1080	360	67
100	760	460	40
150	620	450	27
200	530	420	21
250	470	390	17

It is clear from this that designing a system to allow profiling, without loss of daily capacity, may mean that part of the transportation capacity of that system is lost due to the necessity of line-pack storage. It is also clear that this effect declines with increasing pipeline length. These single pipeline calculations do not necessarily give a representative picture of systems which are highly networked or where compression is used. For these, a more complex treatment would be appropriate.

In the commercial regimes being developed within Europe, in the context of a daily balancing regime, a shipper that is able to provide additional gas at a point within the gas day is at an advantage through its use of "**arbitrage**" opportunities. It might trade this additional gas with another shipper or use the gas for electrical power generation taking advantage of the markets that have developed there. However, it might be able to source gas more cheaply at a different point in the same gas day and can do so in such a way as to retain a supply/demand balance as a whole. Under these circumstances the TSO finds that gas input to the system is following a totally different profile from gas output from the system. If insufficient line-pack is available to support these swings, the TSO incurs costs in moving gas into or out of storage or from buying or selling gas on any within-day gas market. Costs of these transactions under certain regimes fall upon the shippers as a whole and the non-profiling shippers subsidise the profiling shippers. In addition, if the TSO installs additional system capacity in order to accommodate profiling behaviour this has a direct impact on capital costs. Both from the standpoint of reducing capital and operating costs it is clear that an hourly balancing regime has advantages.

Daily Balancing Justification

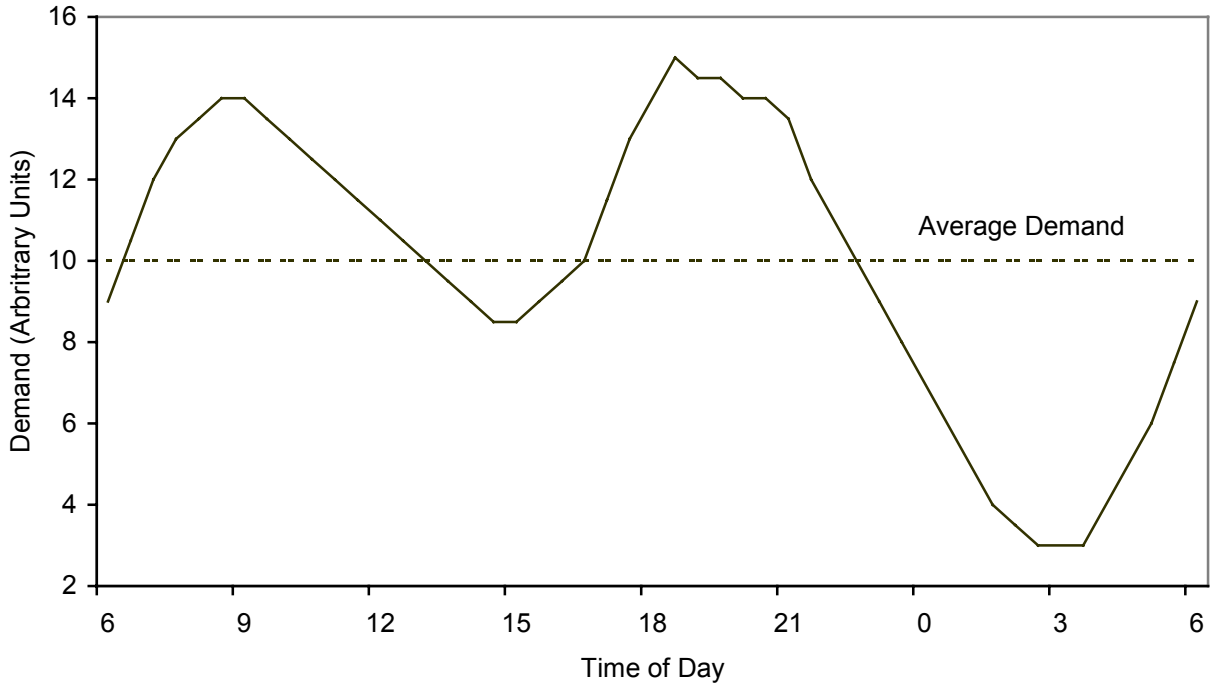
The first argument is:

- Attempting to replicate at entry the profiles that apply at supply points, could lead to major capital costs in providing the increased transmission capacity at entry.

The graph below demonstrates this point and shows a typical within-day ("**diurnal**") profile obtained from the United Kingdom Institution of Gas Engineers. It can be observed that, in this case, peak hourly demand is around one and a half times average. There is, however, a range of diurnal profiles that can be developed for different days in the year, weather conditions and locations some

of which show an even greater variation. Where sufficient local storage is available, the transmission system can be designed for the average flow rather than the peak. If an hourly balancing regime were associated with this profile, additional capacity would need to be provided to the extent that the hourly peak flow exceeds the average.

Typical Half-Hourly Demand Variation



Two further arguments are:

- A simple hourly balancing regime, that doesn't recognise residence times of gas within transmission systems, might lead to excess of line-pack in some geographical locations and deficiencies at other locations. In the absence of measures available to the TSO to remedy these deficiencies, this might prejudice system security.
- As systems tend to develop in incremental stages, a certain amount of line-pack tends to be available in any event particularly where pipeline systems are long and highly networked. The use of compressors also tends to boost the availability of line-pack.

These tend to be arguments against precisely matching supply against demand during the day. They don't address the issue of profiling at input that has been shown to lead to daily operational costs. It can be argued that long and highly networked systems could be split up into smaller simpler systems and that these elements could successfully be operated under hourly regimes. This however, removes the advantages of simplicity and transparency that present daily balancing regimes deliver.

If a system is designed to accept a flat entry profile, the commercial regime should be targeted at incentivising compatible behaviour. One way in which this might be done is through an hourly capacity regime. A shipper would in these circumstances bear the costs of meeting the peak hourly entry or exit profile and the scale of subsidies from shippers who deliver to a flat profile would be reduced.

A flat entry profile is generally compatible where gas flows from a transmission system to distribution systems that have their own storage, such as holders, or that have their own line-pack. Continuing to develop pipeline systems on the basis that this storage provision would continue might often be the most economic way of developing and operating the particular transmission system. In fact if the storage within these distribution systems ceased to be used the high-pressure transmission systems would have to be designed to reflect a diurnal profile which would have a direct impact on capital costs.

Common Ground

The working group concluded that there were systems and operational regimes that favoured daily balancing and others that favoured hourly balancing, although the reasons may not have always been obvious from a shipper's point of view. An hourly balancing regime for example might be the optimum solution where:

- The pipeline system is short in length and is not highly networked.
- There is very little storage close to the demand.

Where the opposite applies, a daily balancing regime may be satisfactory, particularly if there are measures, such as hourly capacity limits, that discourage profiling. Indeed, depending upon the degree of tolerances in an hourly-based regime, and any hourly restrictions in a daily-based regime, it can be argued that there is some blurring of distinctions between the two extreme positions.

It has also been demonstrated that a change from one regime to another would have a direct impact on capital costs. Whilst this may appear a surprising outcome, it should be recognised that different pipeline and storage configurations result from economic capital investment made within the context of different balancing periods.

3.2 Imbalance Rules and Tolerances

Two types of balancing pricing regime have been identified that can be characterised as "**pro-active**" and "**reactive**".

In a pro-active regime the shipper can anticipate an imbalance position and purchase from the TSO some imbalance flexibility. This would relax the imbalance tolerance that would otherwise apply. Flexibility is normally offered on a cumulative basis so that imbalances can be carried forward from day to day until the booking level is reached. Once this level is exceeded the excess would be cashed-out.

In a reactive regime no flexibility is sold by the TSO so a shipper with an imbalance quantity may be cashed-out. One variant is that a strictly limited imbalance quantity might be carried forward to the following balancing period but outside these limits, cash-out would still apply.

In general, the rules identify up to three bands that have been described in Section 3.2 above. Where a flexibility regime is offered there is some justification in making the bands smaller or increasing the incentive element on cash-out prices. Conversely, where a flexibility regime is not offered there is some justification in making the tolerance bands wider.

A pro-active regime increases the risk management tools available to both the TSO and shippers and therefore attracts wide support. It also provides an environment where strong financial balancing incentives are justified for shippers who choose not to buy flexibility.

3.3 Cash-Out Processes

There are two kinds of cash-out process:

- "**Cash-out in kind**" by exchange of gas between the shipper and the TSO at different points agreed in advance but conducted in a following balancing period.
- Monetary cash-out where a charge is made for gas bought or sold in the cash-out process.

Cash-out applies when an imbalance limit, which may be for a single balancing period or cumulative over several balancing periods, is exceeded. Either the whole of the imbalance may be cashed-out or just the quantity which exceeds the imbalance limit. Where cash-out in kind applies an incentive charge still applies.

Cash-out revenue in some cases goes to the TSO but in other cases to the shippers. Where the shippers receive the revenue, it is normally on the basis that they also bear the TSO's costs in maintaining a physical balance within the transmission system. In the majority of cases, cash-out revenues go to the TSO; the Irish Republic and the UK are the only present examples of the shippers receiving the revenue but in some regimes this whole subject is under review.

The argument for cash-out revenue passing to the TSO, along with the physical balancing costs, are based on the efficiency incentives that these would apply to the TSO. Where both costs and revenues apply to the shippers, there is no incentive on the TSO, unless specific incentive regimes are agreed with the member states' regulators.

The counter argument is that a TSO is a monopoly supplier of the balancing service and that its profits on balancing may reflect unreasonably high imbalance charges rather than efficiency.

It is difficult to reconcile these two arguments but the working group did identify that:

- Competition between TSOs would occur if shippers were able through their nominations to select the transmission system in which to be cashed-out, where an imbalance was unavoidable. This would reduce any potential for excessive profits.
- Where a regulated TPA regime applies, it is likely that any substantial cash-out revenues and costs would be included in any tariff setting process. The difference then becomes in **how** the funds are distributed to the shippers. A neutrality type mechanism would clear the profits or losses on balancing each day, a revenue adjustment mechanism would do it whenever transportation tariffs where adjusted.
- Cash-out itself is not viewed by any TSO as a major source of income. The general preference is that shippers should balance or use services provided by the TSO to reduce the cash-out risk

3.4 Cash-Out Prices

The arguments that applied to cash-out revenue equally apply to the rates that are set. Three practices have been established:

- Fixed rates that are published alongside transportation tariffs.
- Rates that are related to relevant gas markets.
- Rates that are related to the relevant capacity charges.

In addition, some TSOs are still developing their cash-out regimes.

The working group believed, however, that the crucial issue was not the mechanism by which the prices were obtained but instead whether they were "**cost reflective**" or "**market reflective**". Prior to discussing the advantages and disadvantages of either approach, some definition is required.

- Cost reflective pricing is setting prices to a level by which TSOs can cover the costs of balancing but no more than this. Under cost reflective pricing it is difficult for the TSO to justify a more punitive price than the extreme prices of gas bought or sold within the balancing period concerned. A slight modification is to adjust for any loss of capacity revenue in so far as the shipper may have elected to be out of balance to avoid paying capacity charges. Cost reflective pricing does not necessarily have to be tied to a gas market price but if a fixed rate leads to over-recovery then a downward rate adjustment would be indicated when the rates change.
- Market reflective pricing is normally setting prices to a level at which the market may reasonably be expected to pay as an incentive based charge. This stems from the fact that shippers are able to buy gas or flexibility services from a variety of sources of which only one is cash-out.
- If the TSO does not wish to be involved in the market and shippers are able to both predict their inputs and outputs and participate in a gas market, it is justifiable for it to set cash-out prices which are more adverse than the extremes of that market. Such prices might, however, be considered punitive by the shippers involved. In most market reflective pricing systems, there is neither a concept of over-recovery being returned to the shipper nor a concept of under-recovery being charged to the shipper, although this is not an essential feature of market reflective charging.

It is recognised that market reflective prices have been viewed by some as excessive. Any conclusion, however, on this issue could only be reached when the following have been considered:

- How well is the shipper able to predict its imbalance? Developments in OBAs at interface points and in methods of predicting demand have reduced this uncertainty.

- How well are the gas markets developed? Shippers who are able to predict their imbalance will be able to manage their risk through use of such markets.
- Does the TSO offer a flexibility service or allow imbalances to be carried over free of charge? Shippers using such services would reduce their risks by doing so and in fact all TSOs who apply market reflective prices offer either flexibility or free of charge services or both.

The working group did not achieve a consensus on whether cost reflective pricing or market reflective pricing was appropriate. In terms of the advantages and disadvantages of cost reflective pricing over market reflective pricing, the following were discussed:

Advantages of cost reflective charging

- In cost reflective charging the TSO is protected against allegations of misuse of monopoly power.
- The role of the TSO becomes that of an independent balancing operator and is seen to be neutral by all parties involved.
- Shippers in distressed positions have some protection against excessive costs.

Disadvantages of cost reflective charging

- Even an extreme market price may be insufficiently punitive to discourage shippers from establishing imbalances. Such imbalances may have cost impacts on the TSO and/or other shippers.
- As the TSO is neutral, it is not incentivised to reduce the costs that are met by the shippers as a whole. It is recognised, however, that incentives on TSOs should be targeted towards encouraging efficient system balancing on the part of the TSO so a simple retention of balancing income by the TSO may not be entirely appropriate.
- Whilst it is possible to ensure recovery of daily balancing costs it is more difficult to account for other costs such as capital costs in designing a transmission system that permits a higher level of shippers' imbalances.

There have been recent developments in charging regimes that can be characterised as "cost plus" where there will always be a difference between cash-out prices and average prices on the relevant market but the basic principles of cost reflective pricing remain. Developments such as this will lead to a convergence between prices calculated under the two different methodologies.

3.5 Network Boundaries

At the boundaries of a transmission network, agreements are required to ensure that all gas travelling across the interface is properly accounted for. As the gas quality and interoperability working group was responsible for addressing any relevant metering consistency issues, the starting point for this working group was that there would be an agreed measured flow that needs to be allocated. It is most instructive here to consider two examples of processes that have been adopted by neighbouring TSOs

Example 1: Gasunie and Distrigas OBA at Zelzate

Gasunie and Distrigas are currently testing an OBA at Zelzate.

Distrigas and Gasunie exchange details of the nominations they have received from shippers in respect of Zelzate. This allows both TSOs to ascertain that there is a match between the pair of nominations received from each shipper. In case of a mismatch, the relevant shippers are informed and requested to revise their nominations until a match is obtained. If no match is obtained by the agreed deadline, the lesser nomination of the pair is confirmed by the TSOs in accordance with their normal nomination confirmation procedure.

During the balancing period, the flow is controlled by one of the TSOs so that it equals the sum of all confirmed nominations at that interface point. It is inevitable in this process that small discrepancies arise between the measured flow and the sum of the nominations. The procedure allows discrepancies to within a tolerance limit to be allocated to the TSOs so keeping the shippers' nominations whole. When the limit is breached, mutually agreed actions are taken to bring the

balance within tolerance. This is confirmed in a nomination from Gasunie to Distrigas and this allows shippers nominations to be kept whole.

The main purpose of this OBA is to prevent small operational differences complicating the allocation and nomination procedures. In general the allocation is equal to the nominations confirmed by the TSOs.

This process works because:

- There is agreement on measured quantities.
- There is a common balancing period.
- The two TSOs share nomination information with each other.
- There is an agreed fallback in the event of discrepancy.
- There is an agreement in place by which shippers are allocated their nomination.
- One of the TSOs is able to control the flow to an acceptable tolerance

This OBA is also referred to as a "**steering agreement**".

Example 2: Gaz de France and Distrigas OBA at Taisnières/Blaregnies

This differs from the previous example in that an hourly regime is interfaced with a daily regime. This additional complexity is addressed by introducing a further stage in the matching process. Nomination information is transferred from the "hourly TSO" (Distrigas) to the "daily TSO" (Gaz de France). The principle followed here is the same as with example 1 in that where there is an unresolved discrepancy, the lower nomination applies. For the two cases:

- If the sum of the 24 hourly nominations is less than the daily nomination, then the daily nomination is reduced to equal this sum.
- If the sum of the 24 hourly nominations is greater than the daily nomination, then each hourly nomination is amended pro rata

  i.e. $HN_h = HN_h * \frac{DN}{\sum_{i=1}^{24} HN_i}$

  where: HN_h is the hourly nomination for hour "h" and

  DN is the daily nomination

Gaz de France then examines each hourly nomination in order to apply the restrictions on profiling. The peak hourly nomination may not exceed 1/23 of the daily nomination. If this does occur, the hourly nomination is set to equal 1/23 of the daily nomination. The daily nomination is reduced accordingly and the adjustment to the hourly nomination is repeated as necessary.

At the end of the gas day, the measured flow is compared to the sum of the daily nominations. If the two agree to within a set tolerance, any discrepancy is carried forward to the following gas day on an inter-TSO account. Where the tolerance is exceeded, an agreed pro-rating method is applied. With the exception of the common balancing period, the procedures stated in example 1 above are applied. Whilst this process is more complex than the Zelzate process described above, it has worked in practice without the shippers experiencing difficulty.

Other Examples

Interconnector UK operates two interfaces at Bacton and Zeebrugge. Thus at one end there is a daily balancing regime and at the other an hourly balancing regime. The procedure relies on the assumption of a constant hourly flow and matching occurs on this basis.

Gaz de France and GSO operate an OBA. Once more the procedure allows the shippers the opportunity of adjust their nominations in order to match. Where nominations are unmatched, the lower of the two nominations applies. One difference with this agreement is that it assumes that flow might occur in either direction. If the nominations have the opposite sign and this cannot be

resolved by contacting the shipper, a zero nomination is assumed. For allocation, the same principles apply that are described in example 2 above.

The use of OBAs is not confined to Europe. In North America they are used widely and form part of pipeline companies' "**tariffs**" which broadly equate to European TSO's Network Codes. Such tariffs in the USA are regulated by the Federal Energy Regulatory Commission (FERC) and this body produces "Standards For Business Practices Of Interstate Natural Gas Pipelines" which are modified from time to time. These standards made OBAs mandatory at "**interconnect points**" and in 1998 FERC identified that OBAs were in operation at 91% of these points. In July 1998 the US Gas Industry Standards Board (GISB) published a model OBA which was adopted by FERC and the pipeline companies and remains the industry standard. This model OBA embodies the same basic principles as those describe above.

3.6 Transparency and Non-Discrimination

The respondents to the first questionnaire were invited to express an opinion on whether the balancing regimes were sufficiently transparent. Most commented that their own systems were transparent but felt unable to comment on other systems. An analysis of the various pricing regimes revealed the following examples of non-transparent pricing and potentially discrimination:

- In Italy, Spain and the Czech Republic the TSOs still bundle their balancing costs within an overall balancing charge. This is usually characteristic of a regime that is only beginning to offer TPA.
- Some TSOs who operate under negotiated TPA arrangements or are at an early stage in offering TPA do not publish standard rates for flexibility services and a few of these do not even publish cash-out rates.

A number of systems still transport gas under legacy transportation arrangements. Two types of long-term arrangements have been identified.

- International contracts for gas produced in countries such as Russia, Algeria and Norway.
- Contracts with "**public gas suppliers**" in areas not yet open to competition. Often this public gas supplier would have been part of a vertically integrated company from which the present TSO had been unbundled.

The rates of these are not always published and therefore it is impossible to prove either discrimination or non-discrimination. Distrigas operate a system that overcomes the issue by operating separate pipes for transit and TPA gas. In many cases, however, such separation could reduce efficiency and flexibility.

In the discussions above, certain features of established TPA arrangements can lead to discrimination particularly where shippers take advantage of the flexibility provided by the regime. Examples already discussed have been:

- Profiling of inputs within day where a daily balancing regime exists
- Deliberately taking an imbalance position where insufficient incentives are in place to balance
- Inaccuracies in nomination information supplied by shippers. Some TSOs overcome this by requiring entry and exit nominations to balance and/or by restricting the renomination opportunities.

One aspect not previously discussed but still relevant here, is that systems that rely upon allocation claims made after the day, by implication, permit after the day trading. This then allows shippers to reduce their imbalance charges arising from actions that have caused the TSO to incur costs.

In all these examples shippers who are operating within the spirit of the rules subsidise those who are not.

Summary of Good Practice

The main characteristics of a regime that is non-discriminatory and transparent are therefore:

- The same rules and prices apply to all users of the transportation system.
- Balancing charges are unbundled from transportation and other charges

- Standard published rates or methodologies are applied for cash-out and flexibility charges.
- "Free of charge" profiling of inputs within day is effectively limited.
- Balancing incentives are set at an appropriately high level which are designed to prevent actions which give rise to major physical balancing costs or prejudice system security.
- Shippers are incentivised to nominate accurately and with sufficient notice to allow the TSO to plan its physical balancing in an economic manner.
- Balancing rules should not be undermined by allowing too much scope for after the day trading. OBAs may assist in providing appropriate controls.

4.0 Summary of Concerns

From its knowledge of areas of concern already raised, the working group looked at the present regimes from three different standpoints. The European Union, the TSOs and their Customers.

4.1 The European Union – Competition and Choice

Historical Background

In most cases competing transmission systems have not been built in the past and therefore do not exist at present. This contrasts with the situation at the transmission level in North America. There are two main reasons for this:

- Vertically integrated gas companies, often in public ownership, developed the physical systems.
- The principle of operating a natural monopoly for the public good has been accepted.

One example of transmission system competition that does exist is Germany. In other member states there are a number of TSOs but these do not compete in the same geographical location. With regard to international transit, however, it has to be noted that there is competition between transit systems (e.g. Belgium and the Netherlands)

Focus of Activity

Lack of competition in gas supply and its perceived consequences has been the concern of both the EU and in some cases of individual member states. However, the main effort has been expended in tackling the consequences by doing the following:

- Unbundle transportation from gas supply and possibly storage. Even in North America, where competition existed in gas supply, this route has been followed.
- Set target percentages for the introduction of gas supply competition and take steps to meet these targets.
- Ensure the TSO's charges are not unreasonably high and that there is a clear incentive to improve efficiency.
- Ensure that open access to shippers is provided on a non-discriminatory basis.

Taking each of these in turn:

Unbundling of transportation accounts from gas supply is accepted. There is, however, no consensus among TSOs on whether storage should be unbundled from transportation. This aspect is discussed below within the context of supply security.

The best way in which TSOs can influence the development of gas supply competition in order to meet competition targets is by providing a "**level playing field**". The environment that provides this has been discussed in Section 3.6 above.

In the areas of balancing and storage, publishing of charges and transparent methodologies contribute to the process whereby TSOs' rates of return are limited to reasonable levels. In some systems cost reflective charging can provide further protection although this might be at the expense of efficiency.

The conclusion of the working group is that development of the transmission regimes is increasingly addressing the concerns of the EU.

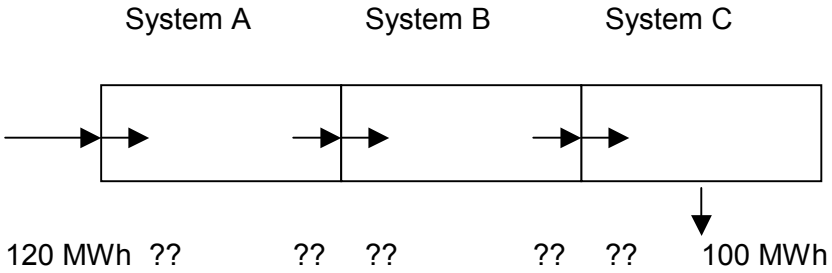
Competition between TSOs

There are already examples where shippers can select the path their gas can take between source and demand and this involves choosing between pipelines operated by different TSOs.

In addition, even shippers who do not have the choice of path are increasingly being given the opportunity to select beforehand which system should provide services such as flexibility. A simple "**three system model**" was discussed in detail by the working group and is outlined here:

Example 3: The Three System Model

A shipper lands 120 MWh of gas at the entry point of System A in order to supply a customer with gas in System C. Once the TSO for System C has carried out the allocation, it is established that 100 MWh was supplied to the customer. Where should the imbalance of 20 MWh be registered?



Allocation of energy needs to be carried out at the Entry Point and Exit Points of each system. In this example, the Exit Point of System A can be considered as one side of a flange and the other side of the same flange will be the Entry Point of System B. The same applies to the flange between Systems B and C.

Rules could be agreed among the TSOs that might, for example, ensure that the entire 20 MWh imbalance was deemed to occur in System C or System A. The working group concluded that a distinction should be made between "ex ante" and "ex post" imbalance positioning by the shipper.

Ex Ante Selection

Where the shipper had anticipated the imbalance prior to the gas day, the working group believed that the shipper should be able to choose from a number of options. These would include:

- Selecting the least cost option from the range of cash-out prices and flexibility services offered amongst the three systems
- Trading with another shipper at one of the flanges

Giving the shipper the ability to select between TSO services brings competition into the balancing and storage activity. If TSOs do not discriminate between "**International**" and "**National**" gas, the benefits of this competition will apply to all shippers. This example also illustrates the fact that TSO services may be in direct competition with those offered by traders or other shippers.

Ex Post Procedures

Where the imbalance had not been anticipated by the shipper and reflected in nominations on the TSOs, one or more of the TSOs might have incurred unexpected costs in balancing their system. A "rule" based approach is therefore indicated. It is suggested that at the interfaces between systems the allocations, which under OBA rules are normally equal to the relevant nominations, are retained. In the above example if the shipper had made nominations of 120 MWh at each interface then the imbalance of 20 MWh would be accounted for in System C. If the shipper had made nominations of 100 MWh at each interface, then the imbalance would be accounted for in System A.

4.2 The TSOs – Ability to Balance and Recover Costs

Most of the balancing and storage regimes reviewed by the working group provide incentives for shippers to balance. Theoretically this should ensure that a physical balance is retained in the transmission system. Practically, however, operational experience of the TSOs is that such incentives do not always keep the physical system in balance and the TSO therefore needs a "**tool kit**" by which a physical balance is retained. Examples of tools in the kit might be:

- Storage – either through use of specific storage facilities or through use of line-pack
- Interruption of demand or cessation of interruption
- Access to off-shore or on-shore supplies of gas

In the vertically integrated companies that preceded unbundling, these tools were for the most part available and allowed a physical balance to be readily obtained. Some members of the working group were concerned that unbundling activities might inhibit the TSO from obtaining the same tools at a competitive price.

There is a trend within the member states for these tools to be provided to the TSOs by operation of gas markets and the working group supports this, in principle. Shippers would offer to interrupt or bring in further beach supplies at stated prices and the TSO or another shipper would select the least cost option. Relying on one market, however, could lead to the TSO becoming a "**distressed buyer**" on certain gas days. TSOs should therefore be able, in addition, to negotiate long-term "**option**" contracts or use storage in order to manage their risks effectively.

Some TSOs had encountered concerns amongst the shippers or regulators in terms of access to information. It has been argued that TSOs hold a privileged position they could use unfairly to their advantage when they participated in the same market as shippers. This, however, could be overcome by release of relevant information by the TSOs to the shippers.

The key message here is that unbundling of transportation and storage accounts is consistent with the establishment and maintenance of appropriate balancing services for the TSO.

4.3 The Customers – Provision of Security and Economic Services

The working group recognised that initial development of competition would often be in the areas of non-domestic gas supply. These are areas where interruption of demand is possible without any adverse consequences for public safety. Offering storage to these new players should, however, not be considered where that storage is required by the domestic sector to meet security obligations.

It must also be recognised that the TSO might need access to storage to retain the ability to run-down the transmission system in an orderly manner if there was a supply problem or incident on part of the system. In this type of scenario, quantity available, delivery rate and location may all be essential components of the service the TSO would require.

Certain members of the working group felt that in order to maintain the security standards expected or required by statute in their own member state, it was legitimate for either a shipper or a TSO to retain storage as part of its business and that unbundling should not be imposed. In the non-domestic market, competition would be available in the form of interruption and there would be nothing to prevent development of competition where there was a surplus of storage available.

Whilst the TPA environment is developing it is recognised that some shippers do not believe they have access to a competitively priced range of balancing services. The establishment of inter TSO competition described in Section 4.1 above, together with the development of gas markets should contribute to these concerns being addressed in the future.

PART 2: FUTURE DEVELOPMENT

5.0 Obtaining Information

Part 2 of the first questionnaire circulated, invited TSOs to express opinions on issues raised at the Madrid forum and elsewhere.

5.1 Appropriate Design Principles

It is instructive at this point to compare the responses of the TSOs with the wording of the European Parliament and Council Directive 98/30/EC (22 June 1998) that states:

Each transmission, storage and/or LNG undertaking must:

- *Operate, maintain and develop secure, reliable and efficient facilities under economically acceptable conditions, with due regard for the environment;*
- *Avoid any discrimination between network users;*
- *Provide any other transmission undertaking of the same kind with sufficient information to ensure the secure and efficient operation of the interconnected system;*
- *Preserve the confidentiality of commercially sensitive information obtained in the course of carrying out its business and not abuse it.*

Many of these requirements are reflected in the responses. Arising from these, the respondents emphasised public service obligations, cost reflectivity, need for a level playing field, market responsiveness, OBAs to manage differences, transparency of pricing, compatibility with adjacent systems, no cross-subsidies, fairness and consistency of rules. In addition some believed that an hourly regime was the fairest environment to allocate flexibility costs. Some of the respondents were aware of the need to recognise and even encourage market activity not just with gas but also with electricity bearing in mind that in some member states a large percentage of electricity is generated from gas. In terms of balancing the consensus was that the TSO would play the physical balancing role and would need tools to do this.

These responses highlighted a broad consensus not only with the directive but also at a high level with the implications that arise from it. There was, however, the recognition that TSOs must be enabled to fulfil the requirements in that the business should show an economic rate of return and that TSOs should have the ability to fulfil their balancing role in an economic manner.

5.2 Common Features and Overcoming Differences

The key words used by a number or the respondents were "**consistency**" and "**compatibility**". This means that rules need not be uniform but they need to be compatible with each other. An hourly regime, for example can be compatible with a daily regime if attention is given to the design of the interface between the two systems. The need for standard agreements between TSOs was emphasised in areas such as allocation rules and measurement. Once again OBAs were promoted as a good method of overcoming differences.

5.3 Specific Madrid Forum Issues

The main value of the questionnaire was in gaining initial thoughts on the Madrid forum issues. Discussion in the work-group was then able to focus on differences expressed so that a higher degree of consensus could be obtained.

The Incumbent Trader

Whilst there was agreement that the incumbent trader should be subject to the same balancing rules, some of the respondents emphasised the transitional issues involved.

General Access to Storage Provided for the Incumbent Trader

A range of approaches on the subject of access to storage were outlined. The crucial issue in the ensuing discussions was the different supply security requirements of each member state. The

working group were able to crystallise these different approaches under four headings which are described in more detail in Section 6.2 below.

Unbundling of Storage

Most respondents supported the principle of unbundling storage from trading. Far less, however, believed it was necessary to unbundle storage from transportation.

Sharing of Information

There was agreement that the TSO should share balancing information with the shippers other than shipper specific information.

Cost Reflective Charging

Some respondents preferred a market reflective basis. A strong case for punitive charging for shippers outside a balance tolerance was made by some of these, particularly where flexibility or free of charge imbalance carry-over services were offered. Others favoured cost reflective charging but some of these added the qualification that this should still incorporate incentives on shippers to balance. Some respondents took a "**hybrid**" approach. These included:

- Market related pricing should apply where the TSO has surplus physical stock but cost related pricing should apply where the TSO has a deficit physical stock position,
- Cost related pricing should apply providing the shipper's imbalance was within tolerance but market related pricing should apply where the shipper's imbalance was outside that tolerance,
- Rather than take either a market related pricing approach or a cost related pricing approach, take a balanced approach that provides incentives whilst retaining the basic principles of cost reflectivity.

Section 3.4 above details the advantages and disadvantages of the two approaches as discussed by the working group. Section 4.1 above demonstrates the development of competition amongst TSOs which should lead to differences between market related and cost related charges diminishing with time.

Incentives on TSO

All respondents were in favour of the principle of balancing incentives applying to the TSO. One believed that allowing the TSO to run the regime like a normal business would provide the best incentive but was not the majority view of the group. One expressed the view that TSO incentives should be subject to the achievement of supply security.

Cross Border Agreements to Resolve Problems

Nearly all respondents believed that the TSOs should enter into agreements to resolve shipper problems with cross-border balancing.

Hourly versus Daily Balancing

Responses were requested on whether hourly balancing was appropriate at this stage of liberalisation.

The initial responses were aligned with the balancing period that already existed in the TSO's balancing regime. After discussion and analysis, the working group agreed that, taking into account the physical differences between systems, hourly balancing was appropriate in some cases but not in others. This analysis is further developed in Section 3.2 above. This assumes that satisfactory arrangements exist at the interface between hourly and daily balancing regimes but examples have been established of such arrangements.

Access to Flexibility Services

This question took the hourly/daily balancing debate a stage further. On the assumption that an hourly regime was introduced, respondents were asked whether shippers should be able to access flexibility services. All respondents believed that such access should be provided.

Charge Transparency

Respondents were invited to express views on whether balancing rules and charges were sufficiently transparent. Most of the respondents expressed a view on their own balancing and charging structures and believed that they were sufficiently transparent.

6.0 Areas for Further Discussion

The working group, whilst not able to make definite proposals in each area studied, nevertheless, achieved consensus in a number of areas. It therefore felt able to express views in the following areas to assist debate in the relevant European forums.

6.1 Harmonisation versus Subsidiarity

Prior to discussing the merits of harmonisation, the working group explored two potential meanings of the term. These were:

- Adoption of the same principles by every system but retaining separate commercial regimes
- Operating the entire European gas system as one commercial regime

However, the idea of creating a single regime was questioned on grounds of desirability not just practicality. Given the shear scale of the European Gas Market, a regime that ignores geography risks excessively misrepresenting physical reality and potentially creates perverse incentives.

For example, a shipper under-delivering on a severe cold day in the United Kingdom is not satisfactorily matching this under-delivery by over-delivering in Italy on the same day where the weather conditions happened to be mild.

As a result of discussing this and other factors relating to the two alternative harmonised models, the working group believed that the principle of subsidiarity was appropriate for the European balancing and storage regimes at this stage. The arguments expressed were as follows:

- For historical reasons gas companies have developed their systems in different ways. The most obvious difference is that some companies have designed transmission systems that reflect peak hour demands, whereas others have designed systems that assume flat input profiles.
- Legacy transit pipelines are one example of flat profile operation. Whilst unbundling separates transportation from trading, historic methods of operation may still be the most efficient in an unbundled environment. TSOs would therefore seek to adapt existing operations to a TPA regime and the final optimised result would vary from system to system.
- To implement the principles of the directive and those developed at Madrid, each TSO should be able to establish for itself the most appropriate means of doing so. A harmonised approach would have to reflect the fact that currently some systems are physically less able than others to implement these basic principles and this would create a brake on systems that presently have more ability to change.
- The general principle must be recognised that TSOs are entitled to a reasonable return on their assets. Depending on the progress that the TSO has made in the liberalisation process, harmonisation to a specific deadline might impact on the company's rate of return during any implementation phase. It is recognised, however, that this should not prevent implementation of certain standard features such as a non-discriminatory and transparent balancing charging regime.
- Advantage should be taken of the flexibility that presently exists in some systems such as the different provisions of storage and line-pack. The most practical way in which this can be achieved is by allowing TSOs or storage operators to develop, within reasonable limits, their own charging structures. If this principle were adopted, together with customer choice, alignment of prices would still occur naturally.
- If a single set of rules were developed these would prove to be unwieldy in practice. Changes to the rules, for example, would involve consultation with a number of interested parties throughout the member states and would potentially be a lengthy process. Experience of some TSOs

would suggest that due to rapid changes in the business environment, customers or national regulators might desire a responsive process for change in the balancing regimes.

- After reviewing the development of transportation systems within the EU, it was clear that further development in order to adopt harmonised rules throughout the EU would be both costly and time consuming. However, it might be possible for certain interlinked TSOs with similar regimes to develop a common set of rules fairly quickly.
- If a consensus were achieved on the main features of a common regime a gradual harmonisation process might be considered. The concept of "**convergence criteria**" might be established so that TSOs not part of a harmonised structure would still be able to join a "**TSO Union**" once it was agreed that sufficient progress had been made in its own regime.
- Such convergence criteria might include:
    - Interconnection – there would be little benefit in harmonising systems that were not connected.
    - Availability of commodity market(s) to serve the harmonised system.
    - Size – cost reflectivity is more difficult to maintain over systems that are geographically widespread.
    - Internal consistency of rules.

This concept of subsidiarity is key to all the discussions that follow and represents the main principle agreed by the working group.

6.2 Security of Supply

Whilst it should not be assumed that there is an inherent conflict between the liberalisation of a gas regime and maintaining security of supply, the design of a balancing and storage regime should ensure that an appropriate level of security is not compromised. The key areas in which security has to be considered are as follows:

- A number of market mechanisms have been adopted so that shippers may purchase gas in order to balance their inputs against outputs. If these, however, are not robust in ensuring sufficient availability of gas, in severe weather conditions, they need to be adapted to ensure that this is the case. Two key principles need to be adopted to achieve this:
    - The cash-out price on imbalances should be at least as high as the highest price of gas traded on the peak day.
    - A price needs to be derived which at least reflects the total costs of making gas available on the peak day, taking into account the fact that such gas would rarely be fully used. This price would then effectively form a cap on the prices of gas available in the relevant market and encourage parties to make gas available knowing that it would attract a similar price.
- Within member states, "**strategic storage"** has been used historically, along with other means, to provide security of supply in severe winter conditions and on other non-routine days where there would otherwise be a crucial supply deficit. In the liberalised regime a similar level of security provision might need to be made. If there were more physical storage available than the required security volume, this "**surplus storage**" could be used for routine shipper balancing but only if there were such a surplus.
- Maintaining appropriate levels of strategic storage can be achieved by:
    - Allowing the TSO to retain ownership and/or control.
    - Placing regulations or incentives on shippers who supply domestic and other small customers that guarantee booking and appropriate restrictions on usage. Such shippers, however, might use such requirements as justification for ownership and/or control of storage assets.

- Strategic storage should not simply be viewed as volumes available to meet demand in a severe winter. Location and delivery rate can be just as important if storage is required to cover operational emergencies or to meet any peak-day requirement.
- It is assumed that obligations to procure storage or other security services will always be required but there is room for debate on where the obligation should be placed. Options that might be considered are TSOs, suppliers, shippers or even a public body. This is another area where subsidiarity is a key concept as it might reflect, for example, differing historical practice and/or ownership. Where that practice has gained the confidence of the wider community, within the member state, this in itself may be viewed as a reason for retaining the status quo. One principle that should be applied in each member state, however, is that the person with the obligation should have sufficient funding to meet that obligation.
- One of the benefits, however, of a liberalised market is that it allows systems to provide security support to each other. A system which is able to access surplus storage might support an adjacent system where a deficit in strategic storage might otherwise exist. By providing competition, it would also assist in the control of costs without affecting the level of security provision. In addition, adjacent systems could provide assistance in the event of a gas supply emergency.
- In designing a regime to address security of supply and use of storage there are a number of options:
    1. Rely on market forces exclusively – shippers decide whether or not to purchase any storage or other sources of peak supply;
    2. Combine market forces with an agency "**Top Up**" role – shippers still decide what to purchase but an agency, possibly the TSO, is then funded to compliment shipper purchases in order to achieve a planned security level;
    3. Allocate amounts of storage to certain classes of end customers which shippers pay for according to the size of their customer portfolio from time to time – any surplus storage can be purchased by shippers as per option 1; and
    4. Allocate storage to certain shippers on the basis of defined security of supply obligations
- Option 1 depends upon a strong signal from the balancing mechanism to encourage shippers to make adequate provision to meet peak customer demand. However, in a competitive market it is unlikely that shippers can justify voluntarily meeting security planning criteria based on extreme demands that may not occur more than once in many years.
- Option 2 is a compromise that still allows shippers full freedom but has a "**safety net**" provided on a communal basis. The appropriate allocation of the costs of such a scheme between shippers would need to be determined. Whilst this option is applied already in at least one member state, the group did not believe it was necessarily appropriate for all.
- Option 3 seeks to avoid arguments about how the costs of option 2 should be allocated by assigning appropriate levels of storage to the final customer based on their size and type. Such assignments would typically apply to smaller customers for whom it is not practical to interrupt supplies. The shipper who contracts with the customer would pick up and pay for the storage assigned to that customer. In this option where a supply point is transferred from one shipper to another the storage would move with the supply point from the releasing shipper to the acquiring shipper.
- Option 4 assumes that supply obligations are targeted on certain shippers – whilst this may be the case in the short term, it is probably not sustainable when market access is extended to all final consumers and for this reason the working group does not recommend this approach. Option 3 provides a more generic approach than option 4, since it could be applied before full market opening as well.

6.3 Different Treatment of Legacy and TPA Shippers?

There are examples where dedicated "**transit**" pipelines are used to transport gas originating in countries such as Algeria, Norway or Russia. For these pipelines delivery tends to be to a flat profile and theoretically the balancing pricing regime does not have to be the same as that used for

non-transit pipelines. There are, however, some concerns that need to be addressed even in these situations:

- Should transit pipelines be treated as discrete systems particularly if there are interface points with non-transit pipelines?
- Are there measures in place to ensure that shippers using both transit and TPA pipelines do not have arbitrage opportunities that are not available to shippers only using TPA pipelines?

- In the majority of cases, however, the same pipelines are used for transporting transit gas and TPA gas. A third type of pipeline user might be an "**incumbent shipper**" who continues to meet the majority of the domestic load. It was considered for both transit and incumbent shippers that:
  - Legacy arrangements would inevitably give these shippers different terms that could only be revoked by legislation or mutual agreement.
  - The existence of these legacy arrangements would not totally preclude progress towards non-discriminatory treatment of such shippers particularly if the terms in legacy arrangements were less beneficial to the shipper than terms in TPA agreements.
  - Principles such as transparency and non-discrimination might legitimately prevent services being provided to transit or incumbent shippers on the same terms as TPA shippers using the same system.
- It was considered by the working group that there should be no difference in terms offered to TPA shippers including incumbents and that effort should be expended to harmonising terms in legacy and normal TPA contracts where it becomes possible to do so.
- It was acknowledged that there may be different conditions in TPA contracts and transit contracts due to the specific services offered and specific commercial considerations but that should not of itself impede progress towards harmonising terms.
- The only realistic way that differences between legacy and TPA arrangements can be dealt with in detail is at the member state level. This principle of subsidiarity, however, may need to be reinforced by EU policy to assist in empowering the member states in taking action. Any objective convergence criteria for harmonisation would have to include assurances that differences between legacy and TPA contracts would not materially affect the operation and costs of balancing and storage in the harmonised system.

6.4 Development of Charging Principles

Even if for the long term the principle of harmonisation were accepted, individual TSOs should, in the interim, be able to develop, in consultation with their customers, innovative charging structures. This is another strength of the subsidiarity approach.

One example already being considered in the United Kingdom is the concept of selling flexibility services through an auction process. This is designed to encourage shippers to reveal their own valuation of such services and the TSO to plan any extension of physical storage or line-pack on the basis of a quantified return.

Where such approaches are developed there are some questions that need to be addressed. These are:

- Would the change improve the focus of charges? Parties taking actions that affect the system as a whole should bear the cost or reap the benefit to the system arising from that action.
- Would the change adversely affect parties who have no ability to mitigate any increased risk? Increased balancing charges, for example, might be justified if they were introduced in an environment where shippers were given an enhanced ability to control their balances.
- Would a change in one area adversely affect performance in another? There is the possibility, for example, that an increased incentive designed to improve behaviour in one area might unwittingly encourage perverse behaviour in a related area.

6.5 Potential for Standardisation of Imbalance Calculation

TSOs tend to incur costs where shippers' inputs or off-takes depart from the expected quantities that were notified in advance. These costs may be associated with operations such as use of storage or additional running of compressors or with more commercial activities, such as within day purchases of gas which cancel out in terms of quantity but not in terms of cost. This gives rise to the concept of scheduling charges. In its simplified form a single rate might be applied and the charges levied on the shipper would be:

Scheduling Charge = Scheduling rate * Abs (Allocated Quantity – Scheduled Nominated Quantity)

More sophisticated approaches have been developed which give, for example

- An inner tolerance band where the scheduling rate is set to zero
- A middle band where a "**standard**" scheduling rate applies
- An outer band where a higher scheduling rate applies

TSOs also incur costs where shippers have imbalances between their inputs into the system and their off-takes from the system, which give rise to a net imbalance on the system as a whole. Where the net position is one of "**deficit**" i.e. off-takes exceed inputs, the TSO may need to purchase additional gas; in "**surplus**" the TSO needs to sell gas. The normal experience is that the unit charge of gas purchased by the TSO is higher than that of gas sold by the TSO. This buy/sell range tends to be higher when there are incidences of supply shortage or high demand.

The simplest charging structure for imbalance charging would apply a standard rate that equates to the cost of gas:

Imbalance charge/(payment) = imbalance rate * (allocated off-takes – allocated inputs)

Where the result of this formula is negative, a payment by the TSO to the shipper is indicated.

This, however, does not recognise the buy/sell range and more sophisticated approaches are indicated which may incorporate for example:

- An inner tolerance band where the rate is set to zero but the shipper's imbalance is carried over to the following balancing period.
- A middle band where the rate is set to a value that represents average costs of gas during the relevant balancing period.
- An outer band where the rate is set to a higher than average value where the shipper has a deficit balance but a lower than average value where the shipper has a surplus balance.
- If a flexibility service were available, an "**overrun**" payment equal to the amount that the shipper would have paid for a year's (or part year's) flexibility service to cover that imbalance

In practice imbalance rates are much higher than scheduling rates as they represent both purchases or sales of gas and operational costs.

Where shippers are required to balance their nominations it is possible to combine the concepts of imbalance and scheduling charges. At entry, for example, a "**combined rate**" equal to the relevant scheduling rate plus the relevant imbalance rate could apply. Different calculations to derive this combined rate, would however apply depending upon whether the calculation applied at entry or exit and whether the allocated quantity exceeded the nominated quantity or vice versa. As not all systems require balancing of nominations, it would not be practicable to introduce a combined charging methodology at this stage.

A practicable **scheduling** charging structure might be:

- Based upon three bands; and
- The inner of these three bands would have a zero scheduling rate

A practicable **imbalance** charging structure might be:

- Based upon three bands; and

- The inner band would have a zero imbalance rate but the imbalance would be carried over to the next balancing period.
- This allows the TSO to make a flexibility service available to shippers
- The middle band would have a rate set at the average of a relevant gas commodity market or hub
- The outer bands would have rates set at levels which incentivised shippers to remain in the inner or middle bands
- Flexibility charge overruns might also apply where such a service was available but not sufficiently taken up by the shipper in order to cover the imbalance

The establishment of this structure would allow TSOs to set both tolerance levels and charging rates that reflected their own situation but would improve transparency. To meet local aspirations certain tolerance levels might, for example, decrease with time or be set to zero. It would also encourage a parameterised approach that would be flexible to evolutionary change.

To demonstrate these principles TSOs were requested to send details of their imbalance charging structure and an exercise was conducted to fit these structures into the standard template and develop objective comparisons. The results of this are summarised in Appendix C below.

6.6 Development of Interface Rules

Prior to harmonisation of the regimes there is a strong case for establishing common principles at the interfaces of connected systems.

- Some development might be required on the "**city gate**" interfaces with distribution systems. For example, the distribution company might essentially be using the same flexibility service as a shipper and should therefore be charged at the same rate. TSOs should, however, be free to develop their own practices in this area under subsidiarity.
- There is, however, a stronger argument for harmonisation at interfaces between transmission systems. Valuable progress has been made on OBAs including examples where a daily regime interfaces with an hourly regime. Where shippers nominate gas to transit across several interfaces, there is a benefit in having standard OBA rules not merely on both sides of each interface but across all interfaces. This would help ensure that gas is satisfactorily accounted for from source to destination.
- The requirement for standard OBA rules, which are based upon nominations, inevitably leads to standardisation of nomination practices. The main differences between systems relate to restrictions that some systems have on balancing nominations and making renominations. It should be possible to overcome these differences.
- There is scope for extending OBAs so that shippers can enact balanced trades between each other at interface points. One principle that should be observed is "**no retrospective trading**" as this can be shown to lead to avoidance of charges without corresponding reductions in physical balancing costs.
- Another benefit of an OBA is that it speedily establishes a shipper's balancing position. This has beneficial effects in that it reduces:
    - The opportunity for upstream retrospective trading, which cannot normally be proved by the TSO but none the less has the drawbacks outlined above. Such trades are not usually transparent.
    - The potential for shippers accumulating energy balancing debt in an unsecured manner.
- Adoption of standard OBA rules would minimise the impact of changes to the balancing period as they would still apply albeit over a shorter/longer period.

6.7 Development of TSO's Activities

As TSOs increase their range of services to shippers it is inevitable that the requirement arises for such services to be traded between parties. Examples of trading might include:

- Gas at hubs or at specific entry and exit points.
- Storage gas, space and deliverability.
- Flexibility services.
- Capacity – whilst this is not strictly within the remit of the working group there can be an interaction between capacity and gas trading.
- Electrical power – where electricity is generated from gas trading in electricity inevitably affects the gas balancing regimes

In principle, market mechanisms can be beneficial to customers and development should be encouraged. There are, however three qualifications to this:

- As outlined above, there should be restrictions to retrospective trading in any of the related markets.
- Restrictions may be necessary to trading in strategic storage. Essentially, alignment should be retained between shippers who supply domestic gas customers and their strategic storage bookings. Trading should not undermine this alignment.
- The potential for arbitrage between markets means that rules have to be reviewed to ensure that some customers do not take unfair advantage of these opportunities.

Not every customer has the resources to benefit from the development of related markets and different price regimes amongst TSOs. It is likely, therefore, that agents will emerge who will handle shippers' trading arrangements in order to manage their risks and optimise their return. The activities of these persons will lead to convergence in TSO balancing and storage charging regimes and this will contribute towards eventual harmonisation.

The working group recognised that TSOs should encourage development of gas markets by acting as agents between shippers or by facilitating the activities of other agents. Market liquidity of a system operated by an independent market operator would be encouraged by a TSO:

- Providing user-friendly computer interfaces between its balancing system and the trading system operated by the market operator.
- Minimising restrictions on trading transactions other than the prohibition of ex post trading.
- Participating in the market in order to purchase gas for physical balancing or for other purposes.

7.0 Response to Comments from DG TREN and CEER

Comments on the original draft report were received from the EU Commission's Directorate General, Energy and Transportation (DG TREN) and the Confederation of European Energy Regulators (CEER). This report has been amended in order to clarify certain issues raised but in addition this new section has been included in order to address these comments directly.

7.1 Issues Raised by DG TREN

DG TREN raised the following issues; following the statement of each issue the working group has given its initial response:

- *The conclusions of the GTE report require further development and deserve to be reinforced and translated into concrete recommendations, guidelines and actions.*
    - This report now reaches a firmer conclusion in promoting harmonisation of imbalance charging regimes and the working group has already begun work in improving transparency of these regimes.
    - The working group believes that progress has already been made in a number of areas such as encouragement of standardisation of OBA's, development of gas trading and demonstration of customer choice on imbalance charging as demonstrated in the three system model.
- *The conclusions of the report are both not concrete with regard to differences…. and weak with regard to the way forward e.g. with regard to how proposed convergence criteria could be*

implemented… and how greater structural consistency of cash-out regimes could be implemented.

- This report now gives three concrete examples of convergence criteria:
  - Conformity to a common template for flexibility services and imbalance charging.
  - Consistent application of imbalance rules to all system users.
  - Subject to fair rules that ensure supply security is maintained, allocation of storage owned and operated by TSOs is fair and open to all system users on the same terms.
- The working group recommends that these principles be embodied in the published rules adopted by members of a harmonised structure so that applicants for membership would be able to modify their systems and procedures accordingly.
- This report promotes the adoption of these three convergence principles as basic principles that encourage transparency and equitability.
- This report also supports the standardisation of OBAs, which is one concrete example of a way forward.

➢ *While different options are proposed (e.g….. in relation to storage and security of supply) no clear conclusions or recommendations are made.*

- The position on security of supply is partly clarified in that only three potential regimes are put forward as options for the future. This reflects the differing supply situations and policies in each member state, sometimes embodied in statute. DG TREN's views on the acceptability of these alternatives would be welcomed.

➢ *The penalty cash-outs for being out of balance differ considerably and do often not appear cost-reflective.*

- It should be recognised that cost-reflective charges may not provide a clear incentive for shippers to balance and therefore higher charges may be more appropriate. Cash-outs should also not be viewed in isolation. Regimes where cash-out rates are market reflective all offer either free of charge imbalance carry-over or flexibility services or both. The working group has already developed (Appendix C) some charge comparisons that show that differences between cost reflective and market reflective regimes are not necessarily all in one direction.

DG TREN then proposes the following:

➢ *Develop principles and binding guidelines for cost-reflective cash-out systems (a market-based charging system should only be accepted when certain minimum requirements with regard to flexibility market characteristics are fulfilled)*

- This has become a major activity for the working group. Appendix C demonstrates the outcome of the first workshop. It is intended that a standard template be adopted, the parameters for each system be clearly identified in consistent units and possibly a "ready reckoner" be developed. All this information would be placed on GTE's web site.

➢ *Propose guidelines for transparency and unbundling of storage and balancing costs and charges.*

- The issue on transparency of balancing charges has been identified above. It can be considered that free of charge imbalance carry-over is an example of a bundled charge. Some of the TSOs that operate such a service are considering replacing it with a flexibility service.
- The storage issue is discussed below.

➢ *Develop guidelines for how to ensure that the same rules apply to all system users.*

- The working group is looking to progress this issue but would wish to point out there is no simple solution to resolving differences between TPA and Transit contractual arrangements.

- Another issue that could complicate the development of such guidelines is the possibility that incumbent shippers have special obligations relating to security of supply and whether special arrangements are applicable with the TSO in this event.

➢ *Develop transparency in available storage capacities (ASCs) based on transparency in security of supply policies applied and quantification of storage used to fulfil strategic security of supply requirements; public service obligations etc*

- It should be borne in mind that various companies, not just TSOs, presently own storage and therefore any information made public by GTE members would only reveal part of the picture and if made in isolation might be commercially damaging to TSOs. GTE members would, however, co-operate with other storage owners and customers in seeking to explore how information could be made available more generally.
- The working group intends to identify for each member state the obligations applying to TSOs and suppliers in the area of supply security and has commented about this issue to DG TREN in the context of the Draft Directive. Progress on this should lead to better identification of strategic storage requirements.

➢ *Develop recommendations and model agreements for OBAs*

- This working group supports the efforts of the Interoperability working group in this respect. This includes the potential adoption of a "European GISB". The relevance of this to OBAs is that GISB has, amongst other standards, developed a model OBA that might form the basis of a European Model.

7.2 Issues Raised by CEER

CEER supported the report's conclusions on harmonisation vs convergence and daily balancing vs hourly balancing but some of the wording on these issues has been clarified in this report. The following issues, however, are raised.

➢ *CEER believes that the report misses the critical point that shippers are only aware of their cash-out exposure ex post and there are typically no other sources from which shippers will be able to secure gas more cheaply. It further proposes that cash-out prices should reflect the prices of short-term gas.*

- The working group understands the point being raised here and agrees that cash-out rates should be reviewed accordingly.
- It is worth pointing out, however, that whilst shippers will only know the **exact** magnitude of their potential exposure ex post, from a risk management perspective, the shipper has tools available with which to manage this risk. For example:
  - Adoption of OBAs on all cross border flows will considerably reduce a shipper's uncertainty providing that shipper nominates its inputs and outputs in a balanced manner.
  - In many cases, the shipper already has means at its disposal to improve the forecasting of inputs and outputs such as the ability to monitor these within the balancing period and re-nominate accordingly.
  - TSOs are already providing free of charge imbalance carry-over services and selling flexibility services typically at a price which is effectively lower than the marginal price of gas available for that balancing period. This is demonstrated in Appendix C.
- The connection with the price of short-term gas is more valid in some member states than others. Gas markets are more established in some member states than others and underlying costs promote different balancing solutions as far as the TSO is concerned. For example some TSOs will use storage to balance as no local gas market has been established.

➢ *CEER believes that the TSO should be cash neutral to balancing activities although does acknowledge the benefit of an incentive on the TSO.*

- The working group members that operate under regulated TPA regimes acknowledge that any significant revenue from balancing would normally be considered in their regulatory regime. It is, however, open to debate whether this would indicate a clearing arrangement with shippers or an adjustment to transportation tariffs. It might be argued, for example, that provision of a flexibility service potentially involves investment in pipelines or storage and therefore should be treated in the same way as transportation tariff setting. On the other hand, cash-out revenue may be more of a candidate for clearing.
- CEER rightly raises the issue of incentives. The working group contends that an incentive based upon balancing performance is appropriate and that complete neutrality removes that incentive.

➢ *CEER believes that there is as clear a justification for third party access to storage as for transportation itself.*

- In principle most members of the working group support this position. However, there are important issues to be resolved including appropriate funding and the security of supply framework in which storage operates.

8.0 Conclusions

Based upon its surveys and discussions, the balancing and storage issues working group has arrived at the following conclusions.

a) Due to historical, geographical and technical factors there is a considerable variation in design and operation of transmission regimes. In the near future complete harmonisation of regimes is therefore impracticable and may not even be desirable.

b) There is, however, agreement to the principles of the EU gas directive and progress has been made in implementing these objectives as regimes have developed.

c) It must be acknowledged that one of the key differences between regimes is the definition of the balancing period. Both hourly and daily balancing periods exist and to a large degree this diverse approach reflects optimum practice for the individual transmission systems as designed. There would be substantial costs involved if a decision was made to change the balancing period of individual regimes and such a change would have a considerable effect on shippers and end-customers. This has led to the working group concluding that, at this stage, implementation of a uniform balancing period is inappropriate.

d) Considerable quantities of gas already flow across a number of transmission system boundaries and have done for many years. In addition market based trading arrangements continue to develop and such developments are to be encouraged. These two factors taken together may lead naturally to an increasing alignment of balancing and flexibility charges across the transmission systems.

e) In addition the working group does recognise the need for greater transparency and standardisation of imbalance charging structures. Work has already commenced on this process. It is hoped that this work will lead to details being placed on the GTE web site and recommendations for simplification and standardisation being made to GTE members companies.

f) Development of balancing regimes needs to address the maintenance of appropriate levels of supply security. It should not be assumed, however, that maintenance of appropriate security levels is necessarily the sole obligation of the TSO. For example whilst the working group recognised that provision of transmission and balancing services to meet severe cold weather conditions was the responsibility of the TSO responsibility for gas reserves was the responsibility of suppliers. Once an obligation of this nature has been established, the body taking on that obligation should be adequately funded. Whilst it need not be the sole means of providing supply security, the role of strategic storage should be acknowledged to ensure that appropriate security levels are maintained. Three options were identified which would meet the essential requirements and these are compatible with developing TPA.

- Rely exclusively on market forces to meet security of supply obligations placed on the parties.
- Combine market forces with "**Top Up**" agency roles, where these roles have been established in the member state.
- Allocate storage to shippers on the basis of their market share within defined customer categories. Where customers change shipper, this would be reflected in revised allocations.

g) There is a strong case for transparent OBA arrangements that standardise the accounting of customers' gas flow between different systems. This working group therefore supports the work being conducted by the Interoperability working group which would facilitate the development of a standard OBA. Such a standard would need to accommodate differences in balancing periods and have rules for allocating gas flows where the aggregate flows have not been maintained within an accepted operational tolerance.

h) The present physical differences between systems indicate that a subsidiarity principle should apply to gas balancing and storage regimes at this present stage of liberalisation. Such subsidiarity should, however, only operate within the context of the principles of the EU gas directive.

i) Any harmonisation, whether by adoption of common principles or rules or by establishment of a single regime, should be by mutual consent and would need to reflect the attainment of convergence criteria by the parties seeking to be involved.

j) One of the crucial convergence criteria would be that the same balancing rules apply to all shippers using the same transmission systems. In some member states the continuation of different arrangements applying to legacy agreements, particularly in relation to transit across national borders, may delay convergence. Other convergence criteria identified are:

- Conformity to a common template for flexibility services and imbalance charging.
- Subject to fair rules that ensure supply security is maintained, allocation of storage owned and operated by TSOs is fair and open to all system users on the same terms.

Appendix A: Questionnaires and Responses

Outline Questionnaire from Balancing & Storage Group

Section 1

In completing the questionnaire, please could you make it clear whether arrangements apply to all shippers; or to new entrants only; or to incumbents only

1. Balancing Period
    a. Please confirm frequency of balancing period
    b. If daily (or monthly), how are variations of flow (input and offtake) dealt with within day?
2. Imbalances
    a. Which imbalances do you consider? (e.g. prior nominations versus allocations; or measured inputs versus measured outputs; other?)
    b. In what units are imbalances expressed? (e.g. energy or volumes)
    c. For each type of imbalance, please provide:
        i. The size of any allowed tolerances provided "free of charge" (i.e. bundled in the transportation charge):
        ii. The basis of pooling of imbalances (e.g. per individual shipper, per entry point, net for all shippers etc):
        iii. The level of any extra flexibility which can be purchased in advance:
        iv. The charges for such flexibility and their basis:
        v. The charges for such imbalances outside of free or purchased level of tolerance and their basis:
        vi. To whom are the charges for flexibility and imbalances paid? (e.g. to transporter, or shared between shippers).
3. System Boundaries
    a. How are imbalances dealt with between transmission and regional or local transmission systems?
    b. Please describe any Operational Balancing Agreements which you have with other connected system operators? What is their purpose? How do they work?
    c. How do you deal with any differences between the balancing regime in your system and that of your neighbours?
    5. Operational Procedures
        a. Please summarise the operational arrangements relevant to system balancing: e.g. nominations; allocations; metering; timing of gas day; information flows.
        b. What information is provided by the transporter and what by the shipper?

5. Storage & Flexibility Services
    a. Do you provide direct access to physical storage to shippers?
    b. If so, what are the main commercial terms and tariffs for access? (e.g. injection, withdrawal, space, deliverability, overruns)
    c. And what are the main operational procedures (e.g. nominations)
    d. If not, are you planning to provide access and by when?
    e. Do you provide other flexibility services (e.g. gas banking)?

f. If so, please summarise the main terms and basis of charging?

Summary of Answers to Questionnaire Section 1 – First Eight TSOs

Source	OMV	Distrigas	Transgas	DONG	CFM	Gaz de France	GSO	BGW
Country	Austria	Belgium	Czech Republic	Denmark	France	France	France	Germany
1.a	Hourly	Hourly	Daily	Hourly	Daily	Daily	Daily	Hourly
1.b	N/A	N/A	N/A	N/A	Operational	Max hourly variation	Max hourly variation	N/A
2.a	Imbalance, scheduling and nomination variation	Imbalance	Imbalance	Imbalance and scheduling	Scheduling	Imbalance (daily and cumulative) and scheduling at Exit	Imbalance and scheduling	Imbalance
2.b	Volume	Energy	Energy	Energy	Energy	Energy	Energy	Energy
2.c.i	2% of booked capacity	2%	N/A	Imbalance 20% of capacity, scheduling 10% of nomination	Lesser of 25% of capacity 5% of capacity + .25 GWh/day	20% for capacity < 1000 MWh/day, 5% for above that	Lesser of 15% of capacity 5% of capacity + 1500 MWh/day, for scheduling 20%, 10% and 5% for capacities <1000, 1000<> 10,000, >10,000	15% of daily volume and 15% of hourly capacity under special circumstances
2.c.ii	Per shipper	Per shipper per entry point	N/A	Per shipper	Per contract	Per shipper	Per shipper	Per contract
2.c.iii	Negotiated	Hourly rate, park and use	N/A	Up to 48 times hourly capacity	None	Modulation and flexibility services	None yet	Individually offered
2.c.iv	Negotiated	18.0 €/Nm3/h + 3.22 €/Nm3	N/A	32.9 €/MWh/yr	None	Fixed annual reservation plus rate based on quantity	None yet	Individually offered

Source	OMV	Distrigas	Transgas	DONG	CFM	Gaz de France	GSO	BGW
Country	Austria	Belgium	Czech Republic	Denmark	France	France	France	Germany
2.c.v	Twice SAP, half SAP	Commodity and flexibility based on hub	Commodity and capacity charge to regional distributors covers transportation, storage, balancing and gas purchase	54.9 €/MWh neg, 2.15 €/MWh pos, scheduling 0.27 MWh/MWh	1.5 times, Zeebrugge based price neg, 0.5 Zeebrugge based price pos	1.5 times, Zeebrugge based price neg, 0.5 Zeebrugge based price pos	1.5 times, UK OCM based price neg, 0.5 UK OCM based price pos	Individually agreed
2.c.vi	Transporters	Transporters	Transporters	Transporters	Transporters	Transporters	Transporters	Transporters/ storage operator
3.a	Not yet addressed	Flexibility provided by transmission	Distribution defined to equal transmission	Distribution defined to equal transmission	N/A	By transporters using underground storage	Managed globally	Pre defined allocation
3.b	None yet	Tolerance established with predefined allocation outside tolerance	N/A	Under negotiation	Storage only negotiated with Gaz de France	Intention to sign with each CSO	Individually agreed	Individually agreed
3.c	Identical rules	As 3.b	N/A	Under negotiation	No answer	Transporters develops commercial rules	No major differences	Individually agreed
5.a	Yes	Not yet	Not being considered	Not yet	No	No	No	Yes, to 5 storage operators on the supra-regional level

Source	OMV	Distrigas	Transgas	DONG	CFM	Gaz de France	GSO	BGW
Country	Austria	Belgium	Czech Republic	Denmark	France	France	France	Germany
5.b	Under development	N/A	N/A	N/A	N/A	N/A	N/A	Various
5.c	Under development	N/A	N/A	N/A	N/A	Nominations for flexibility points	N/A	Individually agreed
5.d	N/a	Oct-06	N/A	Not known	No	No plans	No	N/A
5.e	Under development	Under development	Under development	Balancing Storage Agreement and cash-out	Yes	Not at present	Under development	Various
5.f	Under development	No response	N/A	32.9 €/MWh/yr	Capacity type charges	N/A	Under development	Various

Summary of Answers to Questionnaire Section 1 – TSOs Nine to Seventeen

Source	BGE	Edison Gas	Snam	Soteg	Gasunie	Enagas	Energi	Transco	IUK
Country	Ireland	Italy	Italy	Luxembourg	Netherlands	Spain	Sweden	UK	UK/Belgium
1.a	Daily	N/A	Daily/monthly	Daily	Hourly	Daily	Daily	Daily	Hourly
1.b	Hourly profiles requested	N/A	Line pack and storage	Max hourly variation	N/A	Unclear	Restricted to max capacity	Max hourly variation	N/A
2.a	Imbalance	Imbalance	Imbalance	Imbalance and scheduling	Imbalance	Imbalance	Exit scheduling	Imbalance and scheduling	Imbalance
2.b	Energy	Volume	Energy	Volume	Energy	Energy	Volume	Energy	Energy
2.c.i	None	N/A	None	3% winter, 5% summer	2%	Ten days demand can be stored in advance	20% of daily capacity	None but different price bands	Under review
2.c.ii	Per shipper if within tolerance	N/A	Per contract	Per shipper	Per contract	Per shipper	Aggregate at entry and exit	Per shipper	Under review
2.c.iii	None	N/A	Bundled in transportation charge	Negotiated	All requested up to physical limit	None yet	None yet	None	Under review
2.c.iv	N/A	N/A	Bundled in transportation charge	Negotiated	40 NLG per m3/h + 7NLG per m3	None yet	Undecided	None	Under review
2.c.v	Cost reflective within tolerance, penal outside	N/A	Bundled in transportation charge	% Imbalance and imbalance	Twice reserved incidental capacity	Not established	Oil price based but not yet established in detail	SAP on OCM, SMP outside tolerance	Under review
2.c.vi	Shippers	N/A	Shippers?	Transporters	Transporters	Not established	Transporters	Shippers	Under review
3.a	Tolerance (unlimited for non TPA if nominates as per transporters instructions)	N/A	Bundled activity	Transmission only	Hourly measured off takes	Imbalance allocated	Matter between broker and transporters	Allocation formula	N/A
3.b	Presently under	N/A	Balancing agreements	None	Experimenting	Not established	OBA for entry for deliver to	None	"Steering differences" to

Source	BGE	Edison Gas	Snam	Soteg	Gasunie	Enagas	Energi	Transco	IUK
Country	Ireland	Italy	Italy	Luxembourg	Netherlands	Spain	Sweden	UK	UK/Belgium
	negotiation, for minor variations at interconnection points						equal nomination		deliver nominations
3.c	Allocation agents - to be superseded by OBAs	N/A	Upstream operators rules followed	No experience	Agreed allocation	Independent assumptions	N/A	N/A	Pragmatic approach
5.a	No	No	Yes	No	No	Yes	No	Yes	Not yet
5.b	N/A	N/A	Space and deliverability	N/A	N/A	Working gas capacity based	N/A	Space, deliverability, constrained service and over-runs	N/A
5.c	N/A	N/A	Shippers nominate, transporter allocates by formula	N/A	N/A	Under development	N/A	Shippers nominate except for constrained where transporter nominates	Nominations
5.d	N/A	Yes when regulator decides	N/a	No	Under consideration from 2001	N/A	N/A	N/A	End 2001
5.e	Allow profiling up to max HQ	No	No	No	Three types	Not yet	No answer	Not yet	No
5.f	No charge	No	N/A	N/A	Capacity type charges	N/A	No answer	Inventory probably auctioned	N/A

Section 2

5.1 What are the design principles which you consider appropriate to a system-balancing regime?

5.2 What common features should connected systems share in their balancing arrangements?

5.3 How should any differences between neighbouring regimes be overcome?

5.4 What is your response to the following issues and concerns raised by various parties including the Madrid Forum:

a. Any balancing arrangements applicable to a new shipper should also apply to the incumbent/integrated trader.

b. If the incumbent trader has access to storage then so should all shippers.

c. Storage should be unbundled from trading (and transportation?)

d. All shippers should have access to the same information regarding the condition of the system and its balancing.

e. Services and imbalances should be charged on a cost reflective basis.

f. Transporters should be incentivised to maximise the efficient use of the network.

g. Connected transporters should enter into agreements to resolve shipper problems with cross border balancing.

h. Hourly balancing is inappropriate at this stage of liberalisation.

i. If hourly balancing is necessary, then shippers need access to appropriate flexibility services at fair charges.

j. Balancing rules and charges are not sufficiently transparent.

Nominations and Allocations Questionnaire

Introduction

The GTE Balancing and Storage Workshop has circulated a questionnaire to its members and as a result answers have been received from fourteen organisations. Transporters were invited to describe their operation regime and as a result Transco has completed a matrix. To make the document more useful, as a summary of operations, it has become clear that the group members need to answer more specific questions. These questions cover the areas of Nominations and Allocations.

It would be helpful if respondents could indicate in their answers any difference in treatment that applies to categories such as shippers solely in the domestic market, incumbent trader(s), long term international gas supply contracts or general TPA shippers. Explanations would also be appreciated if the answers give in any way a misleading picture of the operating regime.

Nominations

1. General Nomination Constraints
    a. Are shippers required to balance their total entry and exit nominations?
    b. Are shippers prevented from making nominations that exceed their capacity bookings?
    c. If so, is this excess of nomination over capacity calculated on a daily or hourly basis?
    d. Are there any exceptions to the rule that shippers or their agents make the nominations and if so what?
2. Week-Ahead Nominations
    a. Are shippers required to make initial nominations in the week prior to the gas day concerned?
    b. If so, what is the day of the week and time at which these week-ahead nominations are required?
    c. If the transporter has to confirm these nominations, by which day of the week and time?
3. Day-Ahead Nominations
    a. What restrictions are there any on day ahead nominations? (i.e. variation between day-ahead and week-ahead nominations)
    b. By what time are day-ahead nominations required?
    c. By what time does the transporter confirm these nominations?
4. Within-Day Profiling
    a. Are all shippers required to submit an hour-by-hour profile of their nominations at the day-ahead stage or does this requirement only apply to some shippers? (If so, state criteria)
    b. If shippers are not required to submit an hour-by-hour profile how do they reflect their hourly variations in expected flow?
    c. What restrictions, if any, are there between nominations for adjacent hours?
5. Renomination
    a. What general restrictions are imposed? (e.g. maximum number per hour/day, minimum variation, any relation of restrictions to size)
    b. How much advance notice is required of a renomination?
    c. How much advance notice does the Transporter give of acceptance or rejection of a renomination?

d. Is there a closeout on the gas day and if so what time?

Allocations

6. Entry
    a. What is the general rule for allocations (e.g. pro rata to nomination, nominated/scheduled quantity left whole by operation of an OBA, other formula, agency agreement, individual agreements with shippers)
    b. On what day/time are shippers informed of initial allocation.
    c. On what day/time is the allocation closed out.
7. Exit
    a. What is the general rule for allocations (e.g. pro rata to nomination, nominated/scheduled quantity left whole by operation of an OBA, other formula, agency agreement, individual agreements with shippers)
    b. On what day/time are shippers informed of initial allocation.
    c. On what day/time is the allocation closed out?

Summary of Answers to Nominations and Allocations Questionnaire – First Seven TSOs

Source	OMV	Distrigas	DONG	CFM	Gaz de France	GSO	BGW
Country	Austria	Belgium	Denmark	France	France	France	Germany
1.a	Yes		Yes	Yes	Yes		Yes
1.b	Yes		Yes	Yes but possible to negotiate	Yes but possible to negotiate		Yes
1.c	Hourly		Hourly	Daily	Daily		Hourly
1.d	No		Yes when capacity is reduced or there is an emergency	No but for non-eligible customers the transporter provisions for nominations	No but for non-eligible customers the transporter provisions for nominations		Yes, shipper to provide flexibility tools
2.a	Voluntary		No	Yes	Yes		No
2.b	09.00 Fri		N/a	14.00 Thu	14.00 Thu		N/a
2.c	15.00 Fri		N/a	No	No		N/a
3.a	None		Must balance, match connected system and be within capacity	No restriction	No restriction		No restriction
3.b	12.00		12.00	13.00	13.00	13.00	TBD
3.c	17.00		14.00	18.00	18.00	18.00	N/A
4.a	Yes	Yes	Yes in TPA market, no nominations in PSO market	None	None		Yes
4.b	N/A	N/A	TSO manages PSO flows	None	None		N/A
4.c	None		None	None	None		Ramp rates may apply
5.a	None		One opportunity	Four renomination cycles	Four renomination cycles		TBD
5.b	2 hrs		4 hrs	4 hrs	4 hrs		Varies with TSO
5.c	30 min		2 hrs	2 hrs	2 hrs		N/A
5.d	No		16.00	18.00	18.00		Varies with TSO

Source	OMV	Distrigas	DONG	CFM	Gaz de France	GSO	BGW
Country	Austria	Belgium	Denmark	France	France	France	Germany
6.a	Individual agreements	Pro rate	Use scheduled quantities	Use scheduled quantities	Use scheduled quantities		Individual agreements
6.b	N/A	Next month?	D+1	11.30 D+1	11.30 D+1		Individual agreements
6.c	End of month	Next month?	M+18	11.30 D+1	11.30 D+1		End of month
7.a	Individual agreements	Pro rate	Use scheduled quantities	Common agreements with shipper and end consumer	Common agreements with shipper and end consumer		Individual agreements
7.b	N/A	Next month?	D+1	11.30 D+1	11.30 D+1		Individual agreements
7.c	End of month	Next month?	M+18	11.30 D+1	11.30 D+1		End of month

Summary of Answers to Nominations and Allocations Questionnaire – TSOs Eight to Fourteen

Source	BGE	Soteg	Gasunie	Enagas	Energi	IUK	Transco
Country	Ireland	Luxembourg	Netherlands	Spain	Sweden	UK/Belgium	UK
1.a	Yes		Yes	Yes		Yes	No
1.b	No	Yes	No	Yes		Yes	No
1.c	Daily	Hourly	Hourly	Daily		Hourly	N/A
1.d	No but Transporter informs non TPA shippers of required quantity		No but discussions with NDM consumers in progress	No		No	Yes, transporter makes non daily metered (NDM) nominations
2.a	Yes	Yes	Yes	Yes	No	No	No
2.b	10.00 Wed	11.00 Fri	16.00 Thu	12.00 Fri	N/A	N/A	N/A
2.c	No confirmation	15.00 Fri	16.00 Fri	17.00 Fri	N/A	N/A	N/A
3.a	None		None	None	N/A	None	N/A
3.b	10.00	12.00	13.00	12.00	12.00	13.00	13.00 Exit
3.c	No time limit, acceptance assumed	15.00	16.00	17.00	14.00	15.00	17.00
4.a	Large shippers only	No	Yes	Large loads only	No	None	No but operational arrangement for large loads
4.b	Assumed flat		N/A	Renoms	Renoms	Subsequent renominations	Renoms
4.c	5 hrs notice of >50%, 3 hrs 25%-50%, 2 hrs <25%		None	No restriction		None but transporter only commits to reasonable endeavours	Ramp rate limits on large sites
5.a	Once per hour max, change 3% min	None permitted	No restriction	No restriction	No restriction	Within capacity limit	Implied negative hourly rate not permitted

Source	BGE	Soteg	Gasunie	Enagas	Energi	IUK	Transco
Country	Ireland	Luxembourg	Netherlands	Spain	Sweden	UK/Belgium	UK
5.b	5 hrs notice of >50%, 3 hrs 25%-50%, 2 hrs <25%	N/a	> 1.5 hours plus hour bar	No restriction		2 hrs	Before hour bar
5.c	Assumed accepted	N/a	1.5 hours plus hour bar following receipt	ASAP		Validated on creation	Before hour bar
5.d	01.45	N/A	No	No	18.00		04.00
6.a	Pro rate	To nominations	Pro rate but subject to agreements	Use scheduled quantities		Pro-rated to nomination	Agency agreement
6.b	16.00 D+1		M+7(b)	16.00 D+1		08.00 D+1	06.00 D+2 (pro rated estimate)
6.c	16.00 D+5		M+7(b)	16.00 M+3(b)		Hourly	06.00 M+ 15 (business day)
7.a	Pro rate	To nominations	Pro rate but subject to agreements	Final quantities		Pro-rated to nomination	Various formulae
7.b	16.00 D+1		M+7(b)	16.00 D+1		08.00 D+1	11.00 D+1
7.c	16.00 D+5		M+7(b)	16.00 M+3(b)		D+30	06.00 D+6

Appendix B1: Transco's and Transgas' Response on Storage Regulatory Regime

Transco

All public gas transporters in Great Britain, including Transco, are required to plan and develop a pipeline system to transport the firm load that would occur at peak day levels that would be exceeded in one day out of twenty years (known as the 1 in 20 peak day).

Public gas transporters are also required to provide within their Network Codes reasonable incentives to encourage Gas Suppliers to meet "**domestic supply security standards**". These are defined as meeting domestic demand on the 1 in 20 peak day defined above and the aggregate domestic demand that would occur in a winter of 1 in 50 severity.

Transco operates a daily gas-balancing regime which cashes out shipper imbalances using prices derived from an On the Day Commodity Market (OCM). Transco uses the OCM to take balancing actions and when needed. Being based on a market mechanism, cash out prices could become very high at times of abnormal demand, thereby encouraging shippers to make appropriate gas supply provision.

However, Transco is also currently required to monitor overall shipper provision for a severe winter.

It does this by estimating the aggregate supply/demand position for the coming winter, and considering aggregate storage bookings.

If Transco judges that there is insufficient storage booking to meet the severe winter planning criteria than Transco "tops up" the level in its capacity as Top Up Manager.

The whole Top Up regime is currently under review with the safety and economic regulators.

TRANSGAS

1.1 Security of supply

During past years, the public service obligation was determined by Czech law as an obligation to provide a supply of natural gas for Czech gas market above contracted volume in case of need. This obligation was imposed on state company, Transgas, by Ministry of Industry and Trade.

A new Energy Act has been in effect in the Czech Republic since 1 January 2001. The Energy Act exactly assigns power over the Czech market between Ministry of Industry and Trade and a new Energy Regulatory Office which was established on 1 January 2001.

The Energy Regulatory Office can impose an obligation to supply above the volume of energy given by licences or to offer gas transmission systems for the above-mentioned supply to gas companies.

- The Energy Regulatory Office can impose the obligation only in the public interest;
- The obligation can be imposed only for limited period (maximum for 12 months);
- Any proved income loss that arises from the imposed obligation is to be covered by Energy Regulatory Fund;
- The Energy Regulatory Fund is to be supported by all energy companies;

Up to opening of the Czech Gas Market on 1 January 2005, Transgas is responsible for secure and reliable supply.

After opening the market, Transgas - as transmission system operator - would be responsible for supply of all non-eligible customers. Therefore, Transgas is also obliged by law to provide a supply of natural gas for the Czech gas market.

All costs of the above-described security of supply are included in gas tariffs for end customers. The costs of security of supply are subject to negotiation with the Energy Regulatory Office.

1.2 Other Public Service Obligations

Additional public service obligations that are given by the new Energy Act and are as follows:

- The transmission system operator, operators of distribution systems and natural gas storage are responsible for secure and reliable operation of their gas equipment;
- The above mentioned gas operators are obliged to work out a Contingency Plan;
- In case of an emergency, Transgas is obliged to steer the whole Czech Gas Network;

The costs associated with secure and reliable transmission, storage and distribution are to be included in tariffs for the above-mentioned services, subject to the prior approval of the Energy Regulatory Office.

Appendix B2: Gaz de France Note on Interface between Regimes

Note about the operation of an interconnection point between two transmission systems with daily & hourly balancing regimes

This short note presents a possible operation of an interconnection point between a transportation system with an hourly balancing and a transportation system with a daily balancing. The principle and the method presented hereafter are applied for the interconnection Taisnières/Blaregnies between the Belgian and the French gas systems.

The aim of this note is to show that the cohabitation between two balancing regimes is perfectly possible and transparent for the shippers, with a cooperation of the two system operators.

Before the gas day, at the time of nominations, the shipper sends simultaneously its 2 nominations :

- One nomination composed of 24 hourly quantities, is sent to the system operator with the hourly balancing,
- The other one composed of 1 daily quantity, is sent to the system operator with daily balancing.

The system operator with hourly balancing transmits the 24 hourly quantities to the other operator, who controls successively two constraints.

The first constraint is the **equality between the sum of the hourly nominations and the daily nomination.** To verify it, the system operator with daily balancing calculates the difference between the daily quantity directly received from the shipper and the sum of 24 hourly quantities (after having converted these quantities into its own system units) transmitted by the other transporter.

- If the difference is positive, the hourly quantities are kept and the daily quantity is reduced by this difference,
- If the difference is negative, the daily quantity is kept and the 24 hourly quantities are reduced by this difference allocated among them with prorata of their values.

At the end of this first step, there is an equality between the sum of the hourly quantities and the daily quantity.

The system operator with daily balancing does a second control to verify **the respect of hourly modulation at the entry of its system** (defined as the ratio between the daily quantity and the peak hourly quantity which is equal to 23 hours for the French system). To verify it, the system operator with daily balancing examines successively each hourly quantity and verifies that the quantity is lower to the daily quantity divided by 23 hours. If yes, he kept the hourly quantity. If not, he cuts off the hourly quantity to this upper threshold. At the end, he updates the daily quantity (which is the sum of the 24 new hourly quantities) and repeats the procedure to satisfy the respect of the hourly modulation.

At the end of this second step, the sum of the hourly quantities is equal to the daily quantity and the hourly modulation is respected. The system operator with daily balancing transmits the result of the calculations to the system operator with daily balancing and each system operator communicates directly to the shipper the quantities concerned. These quantities become scheduled quantities.

This process is quick, simple and can become automatic.

During the gas day, the operation of the interconnection point is based on the sum of the shippers nominations calculated previously. It's possible to review it, in case of requests for revision from shippers. In this case, the precedent process is applied with the new quantities, but only the hourly quantities which are staying from the

effective hour of the revision to the end of the gas day can be modified. If they are modified, the daily quantity is updated.

At the end of the gas day, during the allocation of the quantities, several methods are possible.

The three main methods are the following:

- The first method named "**method with swing**" allocates to each shipper, the scheduled daily and hourly quantities, except for one shipper duly named to which is always allocated the difference

between the measured quantity and the sum of scheduled quantities for all others shippers. This method is used by default by Gaz de France with internal shipper.

- The second method named "**method with prorata**" allocates to each shipper its scheduled quantity corrected by a part of the difference between the measured quantity and the sum of scheduled quantities for all shippers. This difference is allocated among all shippers, with a prorata based on their capacities, or their nominations, or their scheduled quantities or any other values
- The third method named "**method with preciput**" allocates to each shipper the scheduled daily and hourly quantities and updates an account between the two system operators with the difference between the measured quantity and the sum of scheduled quantities for all shippers. The position of the account is compensated the day after by the operation of the interconnection point. The operation of this account is made with an OBA. This method is applied at the Dunkerque interconnection between Statoil and Gaz de France.

Distrigas and Gaz de France have decided to apply a mixed-method for the Taisnières/Blaregnies interconnection point. The OBA sets an inter-operators account followed each hour by the two operators. When the position of the account stays inside limits, a method with preciput is applied. When the position of the account is near the limits or is outside the limits, a method with prorata is applied to come back inside the limits. This type of OBA is applied for all shippers and will be communicated to all shippers using the Taisnières/Blaregnies interconnection point.

Appendix B3: Interconnector UK Paper on Interface between Daily and Hourly Regimes

Management of balancing process between the UK and Belgian Systems

Two different balancing regimes exist at either end of the Interconnector pipeline. At the UK end balancing is daily which is managed by Transco for the National Transmission System and at the other it is hourly which is managed by Distrigas. Interconnector UK (IUK) manages the physical and commercial operations of the Interconnector pipeline, which interfaces with both systems. The processes involved in managing the balance of the pipeline include Capacity, Matching, Nominations, Inventory and finally Allocations between the two balancing regimes

1. Capacity

Shippers have capacity rights in the forward flow and reverse flow directions, which are defined as volume rates in Nm^3/h. The capacity of an individual shipper for each hour determines the maximum nomination which can be made for any given hour. In accordance with IUK's contract with its shippers (the Transportation Agreement, or TA) IUK is required to offtake quantities of gas made available at the Delivery Point by the IUK shipper and simultaneously make available to the IUK shipper at the Redelivery Point the same amount of energy reduced by any fuel gas and adjusted to take account of any inventory effects. Although, IUK shippers make end of day nominations, they are deemed to flow at equal rates across the day. This flow rate is checked against their capacity, which is applied equally across the day.

2. Matching

IUK operates a weekly and daily "matching" procedure to facilitate the alignment of gas flow requirements through the Interconnector interfaces at Bacton and Zeebrugge. The balancing period for Interconnector is hourly and is handled such that delivery and redelivery matching data has to be matched at either end of the pipeline on an hourly basis. The matching data is submitted before the D –1 deadline by IUK shippers for each end of the pipeline. At the Bacton end NTS Shippers match with IUK shippers and at the Zeebrugge end IUK shippers match with DTS (Distrigas Transit System) shipper. The matching process is also broken down to an hourly basis during the gas day. During the gas day as renominations are entered matching is on an hourly basis for future hours. IUK cheeks that individual IUK shippers' hourly capacity rights have not been exceeded.

3. Nominations

Once matches have been verified for each trade the shippers' nominations are confirmed There is a constant hourly nomination rate throughout the day at the delivery point and a constant hourly nomination rate throughout the day at the redelivery point and planned deliveries to and redeliveries from Transportation system are balanced such that inventory is maintained within an Operating band.

4. Inventory

IUK currently employs a fixed inventory regime, which ensures that inputs are balanced with outputs. This enables IUK to balance on an hourly basis which is in line with the regime at the Belgian end of the pipeline.

IUK maintain an account in which IUK shippers' individual inventory entitlements are continuously accounted on an hourly basis. The account is where each IUK shipper's share in Pipeline Inventory is adjusted as deliveries and redeliveries are allocated to that shipper. If an IUK shipper's share in Pipeline Inventory reaches prescribed maximum or minimum limits, IUK will constrain that IUK shipper's deliveries (or redeliveries) so as to ensure that the delivery and redelivery rights of other IUK shippers are not impaired. IUK shippers are required to have balanced nominations (i.e. Inputs = Outputs + Fuel). This balancing process is hourly and any imbalances.

5. Allocations

Allocation of deliveries at any particular Delivery Point or redeliveries at any particular Redelivery Point are independent of deliveries or redeliveries at any other Delivery Point or Redelivery Point. The allocation process is carried out every hour during the day. Allocation is based on measured physical deliveries and redeliveries and on confirmed nominations. When there are nominations in both directions, nominations counter to the prevailing flow direction are deemed to be delivered and redelivered as long as the deliveries and redeliveries in the prevailing flow direction are greater than or equal to the contra-flow nominations. The nominations in the prevailing flow direction are subject to any under-or-over delivery or redelivery.

6. Time Zones

IUK shippers have to make their own commercial arrangements in the two time zones. For operational purposes, all IUK input and output nominations and capacity entitlement always refers to the local time at the particular Delivery or Redelivery Point. Thus, nominations and allocations at Bacton will always refer to UK time and nominations and allocations at Zeebrugge will always refer to Belgian (CET) Time.

Summary

Although the Interconnector pipeline operates between two different commercial regimes across different time zones IUK have managed to develop contractual terms with customers to overcome these differences. Shipper capacity entitlements and the gas flow regimes are linked directly to the physical capability of the asset which leads to an hourly regime. The connections to the two systems are managed by matching processes between NTS shippers, IUK shippers and Distrigas shippers all on an hourly basis with fixed inventory rules requiring Interconnector inputs to match outputs.

Appendix B4: Rationale behind Hourly Balancing

Hourly versus daily balancing

Differences in design

Whether hourly or daily balancing is physically possible for a gas transmission system depends on the design of the gas transmission system. In general two different types of gas transmission systems can be described:

1. A design based on the principle that all demand is met with gas from flexible supply sources. In this case demand, transmission capacity and supply capacity are matched and the transmission system cannot be used for diurnal storage. Also no other means for diurnal storage such as gas low-pressure gasholders are available.

2. A design based on the principle that supply is not flexible and that the transmission system is used not only for transporting gas from the supply sources to the end-users but also as a balancing mean between the fluctuations within the day on the demand side and the steady supply. Beside the use of this so-called line-pack other means for diurnal storage can be added to complete the transmission system.

The first design is suitable for a situation where flexible supply is available and the distance between this supply and the end-users is relatively small. The best example for such a system in Europe is the Groningen gas system, with the most flexible supply source in Europe located close to areas with both a big residential and industrial market: in the West of Holland, the Ruhr area and the area Antwerpen - Brussels in Belgium.

The second design is suitable for a situation where gas demand is met with inflexible sources located further away. An excellent example of such a system is the UK where all gas is produced offshore, many of this as associated gas. Also the biggest supply terminal in St. Fergus is far away from the main market in the south and middle of England. Diurnal storage, mainly line-pack in the LDZ and low-pressure gasholders, is available close to the end-users.

In the first design the transporter can only balance his system with the gas from the flexible sources. Therefore hourly balancing between supply and demand is essential in such a transmission system.

In the second design the transporter has diurnal storage which he can use to balance its system. Therefore traders/shippers can be out of balance for a short period of time as long as they balance again on a longer time-scale. When balancing is required on a daily basis, the transporter needs enough diurnal storage to meet the “within the day imbalances”. In this system hourly balancing could even lead to capacity problems in the transmission system, because the system is not designed to take-in the peak demand flow.

Daily balancing and design 1

If a transporter with a gas transmission system according to the first design is forced to accept daily balancing, he has to use part of its available pressure for diurnal storage. This reduces the available pressure drop for transportation, and thus the transmission capacity of the system.

In the table below the effect of daily balancing on the transportation capacity of a single pipeline (750 mm, inlet pressure 67 bar (abs), outlet pressure 50 bar (abs)), without other flexibility measures is presented. The assumed imbalance within the day is 10%. The imbalance is modelled as follows: the first 12 hours the demand is 10% higher then the supply and the last 12 hours the supply is 10% higher then the demand. The message is clear: daily balancing assumes that a lot of the transportation capacity of the pipeline is lost due to the necessity of storage.

Length	Capacity (Stationary)	Capacity (With daily balancing)	Capacity loss (%)
50	1080	360	67
100	760	460	40
150	620	450	27
200	530	420	21
250	470	390	17

Solving the problem of reduced capacity

The transporter has to build additional pipelines in the gas transmission system to replace the capacity lost due to the daily balancing concept. The alternative is to build other means of diurnal storage to solve the balancing problem. These means can be low-pressure gasholders, high-pressure storage (Röhrenspeicher in German) or caverns but also a flexible gas supply source at the right location or interruptible costumers. These means are then used to physically balance the system in an hour and so solve the problems of the "within the day imbalances".

Instead of this the transporter can also try – subject to liquidity in the market - to solve the "within the day imbalances" to trade gas at the right location. By buying gas when demand is higher then supply and selling gas when demand is lower then supply the transporter can also keep the transmission system in balance. Even Transco who has diurnal storage available has to trade in this way to keep the system in balance.

The investment in additional pipelines or diurnal storage and the trading to solve the "within the day imbalances" are extra cost for the transporter without extra revenues from sold transmission capacity. These costs will have to be paid by all the shippers using the gas transmission system. The shippers who use the system as it was designed don't cause "within the day imbalances" but pay for the imbalances caused by other shippers.
Shippers who use the full flexibility of the daily balancing regime, by using gas with high swing (e.g. power plants for peak electricity production) and supplying gas with an inverse swing, cause the "within the day imbalances" but don't pay the full cost for it.

Conclusions

- Transmission systems have been developed depending on the local situation of the gas market. Some are physically more suitable for hourly balancing, some for daily balancing.
- When a transmission system, designed for a match of supply and demand on a hourly basis, is forced to accept daily balancing, it will lose transportation capacity unless extra measures are taken to solve the "within the day imbalances".
- With daily balancing, in a transmission system designed for hourly balancing, the cost of flexibility measures, both diurnal storage and trading by the transporter, to handle the "within the day imbalances" are not properly allocated to the shippers.
- With hourly balancing each shipper can decide for itself how to solve the "within the day imbalances" of its portfolio at its own costs.

Appendix B5: Justification of Different Balancing Periods for European Gas Systems

Gaz de France Paper

This note proposes an explanation of different balancing periods imposed to european shippers from :

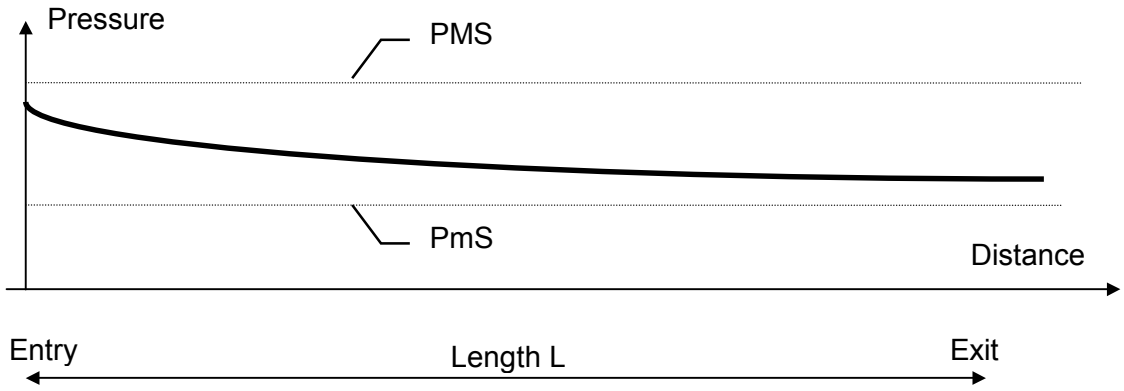
- considerations about physical characteristics of each gas system,
- considerations about physical situation of modulation facilities inside the gas system operated by the transporter.

We examine successively these two points.

1. Effect of design features of a gas system on the balancing period

To understand the effect of design features of a gas system on the balancing period, we are going to reason about a very simple model of gas system composed of a single pipe with a diameter D and a length L, with a constant gas flow Qm.

Due to the pressure losses, the pressure is a decreasing function all along the pipe. Besides, the operation of a such gas system imposes that the pressure is bounded by a maximal pressure (PMS) and by a minimal pressure (PmS) as represented hereafter :



If we consider that the gas flow is at a steady state, the quantity of energy which goes into the pipe, is equal during any time period, at the quantity which goes out the pipe during this same period. There is no accumulation of gas inside the pipe.

The time period in the balancing regime is a flexibility bought by each shipper to equilibrate its entry and exit quantities. That means that for any period lower than this balancing period, the shipper may not respect this constraint and may cause a temporary disruption of gas flow, the maximal disruption being defined by an entry quantity without a simultaneous exit quantity (disruption of delivery) or by an exit quantity without an entry quantity (disruption of offtake).

These disruptions of gas flow are tolerable by the gas system, if they satisfy two upper constraints :

- a **statical constraint** caused by the line-pack of gas system,
- a **dynamical constraint** caused by the transit time of these disruptions along the gas pipe.

For the first constraint, we have the intuition that a “big” pipe can support a disruption of delivery or offtake during a time period (we call it the “life period” of gas system) which is upper than the life period of a “small” pipe.

This life period is directly connected to the line pack of the gas pipe which is proportional to the product of volume of gas pipe and average pressure :

$$\Delta LP = KD^2 L\overline{P}$$

If we admit that the average pressure is almost the same for different European gas pipes (because the technical quality of iron or possibilities of compression facilities are technical characteristics common to all transporters)[1], we can integrate the average pressure into the constant K and write that the line pack is proportional to D^2 and to L :

$$\Delta LP = K' D^2 L$$

Consider two transmission systems A and B with the same diameter, but the length of gas system A is supposed 10 times longer than the longer of system B. With the previous formula, we can admit that the life time of gas system A is ten times upper to the life time of gas system B. If the gas system B had a diameter twice upper than the diameter of gas system A, the life time of gas system A would be four times upper than the gas system B. That means that the effect of diameter is more important than the effect of length. Regarding to the line pack effect, a gas system can "compensate" its small length by a big diameter.

But this constraint of the line-pack is not alone. We have the intuition that with the same line-pack, a "threadlike" or "filiform" pipe can support a disruption upper than a "stocky" pipe. That is the effect of what we call the "transit time", which is connected to the length of the gas pipe.

Actually any disruption of gas flow has to propagate along the gas pipe. Without calculating this propagation by a dynamical approach (more exact, but not useful here), we can show that the transit time is bounded by a minimum quantity which is directly proportional to $L^{3/2}$ and $D^{1/2}$ (see the demonstration in appendix). That means that more the length is important and more the diameter is small, more the transit time is important that confirms the previous intuition, but it means too that the effect of length is more important than the effect of the diameter.

Consider the two same gas systems A and B, with the same diameter but a length for gas system A which is 10 times upper than the length of gas system B. In that case, the time transit of gas system A is $10^{3/2} \cong 30$ times the time balancing period of gas system B.

Suppose now that the gas system B has a diameter twice the diameter of gas system A, then the balancing period of gas system A is reduced (by comparison with the balancing period of gas system B) but stays $10^{3/2} / 2^{1/2} \cong 22$ times more important than the balancing period of gas system B.

That means that a gas system with small length cannot support a balancing period important, even if its diameter is clearly upper than diameter of others gas systems.

On the contrary, that means too that a very long gas sytem can support a balancing period important, even if its diameter is lower than the diameter of other gas systems. That's the case for the interstate pipelines in the United States which are operated with monthly balancing period.

The balancing period imposed to each shipper, cannot exceed the transit time, otherwise the balancing period prevents to correct the disruption insides the gas system.

To conclude, the balancing period is limited by two upper limits :

- **a limit connected to the life time of the gas system which is proportional to the L and D^2 for a single pipe and**
- **a limit connected to the transit time of the gas system which is proportional to $L^{3/2}$ and $D^{1/2}$ for a single pipe.**

[1] This is not completely exact because the transporter can manage the operation of its gas system to maintain this average pressure at a upper or at a lower level. Certain transporters sell this service to the shippers who need.

We could try to apply these considerations based on a single pipe, to the real design features of main gas systems in Europe.

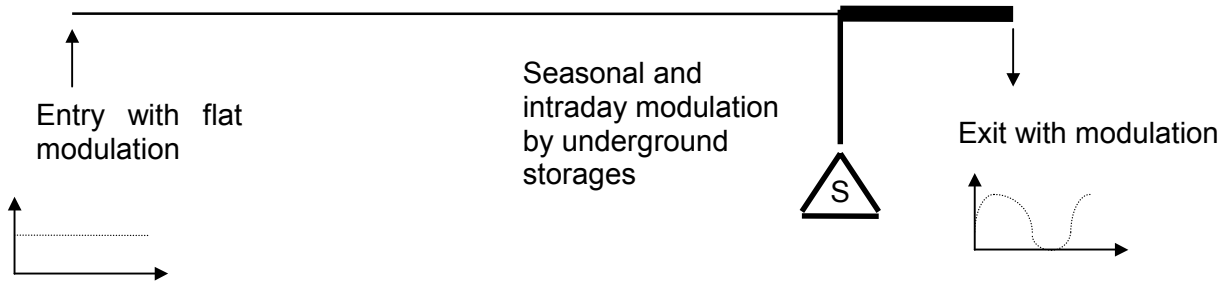
2. Effect of geographical situation of modulation facilities inside the gas system on the balancing period

The second reason that can justify a balancing period for a gas transmission system, is the localisation of the modulation facilities (if such facilities exist) to operate the system.

To understand this effect, consider two very simple models, that can represent the operation of two European gas systems: the French and the Dutch systems.

2.1 The French model

We can represent the operation of the French gas system by this very simple linear model :



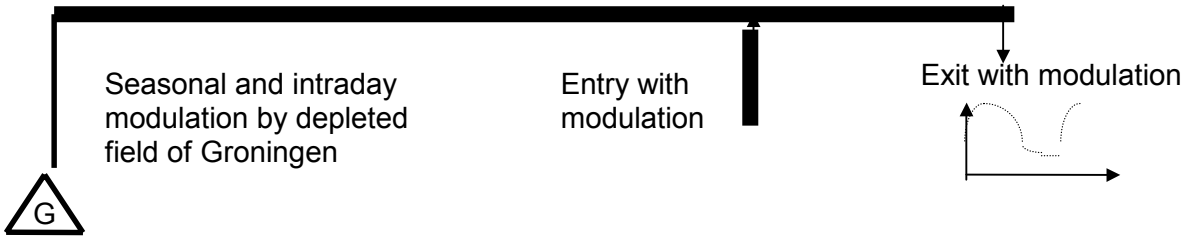
The French gas system has been designed from underground storages that are located (because geological reasons of underground) near consumptions areas. These zones are connected to the storage by big pipes with small length (to allow the transmission of peak of hourly and daily consumptions). On the contrary, the left part of the gas system is composed of long pipes with lower diameters which are full-up during the day.

A daily balancing period between entry and exit points with flat hourly modulation at the entry point, allows to stay saturated the pipe between entry and the storage.

An hourly balancing period would force the operator to be able to transport peak hourly consumptions from entry point, and then to invest into big pipes on long distances (without accounting the expenses for instrumentation and information systems). Without investments, the hourly balancing in that case, would reduce the capacity available to the shippers.

2.2 The Dutch model

On the contrary, we could represent the Dutch gas system by this simple following model:



The physical balancing on the Dutch system is assured by the operation of the depleted field of Groningen which is located at the extremity of the gas pipe. That's the reason why the Dutch system has big pipes, compatible with small distances. The hourly balancing allow to respect the operation of gas systems. The daily balancing regime would occur perturbation for physical operation.

The Belgian gas system is comparable to the Dutch system without any modulation facility. That justifies a small balancing period.

To conclude, these simple models show that besides the design features presented in the first paragraph, the balancing period can be determined by the physical operation of the gas system imposed by the localisation of modulation facilities near or not the consumptions areas.

Detail of simplified calculation for the transit time

Let consider a constant gas flow Qm into a single pipe. For each point along the pipe, the velocity v is proportional to the volumetric flow and inversely proportional to the square of the diameter D.

The volumetric flow is proportional to the ratio between the gas flow Qm and the pressure P as expressed hereafter.

$$v = a\frac{Q_m}{D^2 P}$$

where a is a constant.

The transit time between the entry and the exit points is defined by :

$$T = \int_{entry}^{exit} \frac{dx}{v} = \frac{D^2}{aQ_m}\int_{entry}^{exit} P dx = \frac{D^2 \overline{P}}{aQ_m}$$

with $\overline{P}$, the average pressure into the pipe.

The equation of pressure losses between the entry and the exit points allows to express the two extremal pressures with the gas flow by :

$$P1^2 - P2^2 = b\frac{Q_m{}^2}{D^5}L$$

The transit time is minimal, when the gas flow is maximal, i.e. when P1 = PMS and P2=PmS,that gives :

$$Qm = \left[\frac{D^5(PMS^2 - PmS^2)}{bL}\right]^{1/2}$$

By replacing this expression into the minimum transit time, we have :

$$T\min = cLD^2\frac{L^{1/2}}{D^{5/2}} \qquad \Rightarrow \qquad \boxed{T\min = c\frac{L^{3/2}}{D^{1/2}}}$$

We suppose that the maximum and minimum pressures are the same for all european transporters, that allows to integrate these pressures into the constant c.

Appendix B6: Hourly Balancing and Associated Services/Facilities – A Distrigas Paper

Where grid users are asked to respect an hourly balancing system, several services and facilities offered by the transporter can facilitate the overall working of the system.

1. Advice to determine the subscription of flexibility services

- Analysis of the past (realised) load profiles, combined with an assessment of future consumption behaviour of the end-consumer and based upon several load profiles (e.g. flat) at entry can lead to fair estimations of the "amount" of flexibility to subscribe (always in mind that these estimations are based on certain hypotheses).
- At least during an initial phase of the execution period of the agreement, the possibility could exist to adapt subscription levels (if initially insufficient).

2. Access to relevant data by the grid user

Adequate and user-friendly information systems could make the following data timely available to the grid user:

- hourly nominated quantities
- hourly allocated quantities (at entry and exit points)
- the hourly status of flexibility parameters / characteristics (e.g. amount of gas in the flexibility volume)

Access to such data will enable the grid user to monitor inputs and off-takes and if necessary to take actions towards the transporter (e.g. renominations) or his customer (end-consumer).

3. Renominations

Because off-takes by industrial consumer-sites or distribution companies are not fully predictable and can vary due to unforeseen events, the grid user should have the possibility to renominate at any time during the day. These renominations should become effective as soon as reasonably feasible for the transporter.

Therefore also, nomination (and renomination) procedures should be ease in use for the grid user, using standard tools and reliable communication protocols.

4. Invoicing

Invoicing of flexibility services should be transparent and contain all (hourly) data, necessary for control of adequacy with contractual elements of the agreement.

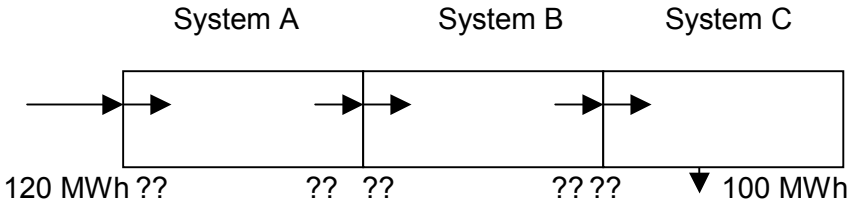
Appendix B7: The Three System Model

Introduction

On the European Gas System it is possible that shippers may require their gas to travel through several transmission systems from source to supply point. This note summarises some of the implications and is based upon a three system model.

Basic Scenario Description

A Shipper lands 120 MWh of gas at the beach of System A in order to supply a customer with gas in System C. Once the TSO for System C has carried out the allocation it is established that 100 MWh was supplied to the customer. Where should the imbalance of 20 MWh be registered?



Allocation Principles

Allocation of energy needs to be carried out at the Entry Point and Exit Points of each system. In this example, the Exit Point of System A can be considered as one side of a flange and the other side of the same flange will be the Entry Point of System B. The same applies to the flange between Systems B and C.

Allocation can be done in a variety of ways including:

- Claims by an allocation agent, who is employed for this purpose by all the shippers involved, using rules agreed by the parties.
- Pro rata to nomination.
- An OBA with all but one party allocated their nomination with the other party or the TSO taking the swing.
- A variant of the OBA, where the TSO "**steers**" the flow to within a tight tolerance of the nomination totals.

After taking into account any swing absorbed by a TSO in an OBA, allocations in total need to equal the measurement at the point concerned, assuming that a meter is placed at that point. At a boundary between transportation systems, not least at a national boundary, meter readings need to be agreed by the two TSOs concerned. Present experience at national boundaries would indicate that agreement on measurements is readily agreed.

Assuming this is the case discontinuities could, however, still arise if:

- The allocation rules are different on the two sides of the flange.
- The allocations rules are the same but the nominations are different.

The normal way in which these discontinuities could be overcome would be by giving the "**steering TSO**" access to nominations on both sides of the flange and information on the allocation rules. This TSO would then able to highlight any discrepancy to the shipper. If the shipper does not remedy the situation, then the steering TSO would then adjust the flow to correspond with the lower of the two nominations.

Another way in which such discontinuities could be resolved would be by trading between shippers. This assumes that there are agreements in place that determine the price at which gas is traded.

For gas travelling through a system without offtake, even if there were no discontinuities at the flange, it would be possible for a shipper's energy at the Entry of a system to be different from that at the Exit. This

is most likely to occur where the shipper has made a different nomination at Entry from that made at Exit. The difference in energy in these circumstances could be:

- Cashed-out at a price determined by the TSO's contract
- Added to or taken from a shipper's line-pack or storage inventory, where such flexibility services have been made available by the TSO.

Scenario Variants

The following scenarios come to mind, although this is not an exhaustive list:

1. "**With Flow Scenario**" where a rule is made that any discontinuity is absorbed by cash-out in the last system. A variant which would produce the same result is if the shipper elected to be cashed-out by the last system, because of advantages in cash-out price or the shippers use of storage or line-pack service.
2. "**Against Flow Scenario**" where a rule is made that any discontinuity is absorbed by cash-out in the first system. A variant which would produce the same result is if the shipper elected to be cashed-out by the first system, because of advantages in cash-out price or the shippers use of storage or line-pack service.
3. "**Mid System Scenario**". One would not expect a rule to be made for any discontinuity to be absorbed by the system in the middle. A shipper, however, might still elect to be cashed-out by the middle system, because of advantages in cash-out price or the shippers use of storage or line-pack service.
4. "**Flange Trading A/B**". Because of differences in allocation rules, nominations or allowance of trades, the discontinuity is absorbed at the national boundary between System A and System B.
5. "**Flange Trading B/C**". Because of differences in allocation rules, nominations or allowance of trades, the discontinuity is absorbed at the national boundary between System B and System C.

The results are as follows:

Scenario	Beach of A	Exit of A	Entry of B	Exit of B	Entry of C	Supply Point C
A	120	120	120	120	120	100
B	120	100	100	100	100	100
C	120	120	120	100	100	100
D	120	120	100	100	100	100
E	120	120	120	120	100	100

Questions

The following questions arise from this three system model study:

- Consistent measurements at interface points. How can this be achieved? There are precedents for achieving this consistency through agreements between transporters.
- Consistent nominations and allocation rules at interface points. How can this be achieved? Or failing this, how can "**trading rules**" which reconcile differences in allocated quantities on different sides of the flange be agreed? "**Steering Agreements**" are an established method of achieving this consistency.
- How much should cash-out and inventory management within systems be the subject of rules made by transporters and how much should be left to shippers' choice? It can be argued that leaving it to shipper's choice would be beneficial in promoting competition between TSOs.

Appendix B8: Imbalance Business Cases – Questionnaire for TSOs

This exercise was commenced in order that balancing charges could be compared for the various regimes that existed amongst GTE members. Work is continuing as part of the exercise conducted and reviewed in Appendix C below.

Suppose: - nomination at entry = allocation at entry = flat profile (8000 m3/h) = *"Allocated (entry)"* - allocation at supply = *"Allocated (supply)"*

1. What is the minimal transportation capacity and flexibility to subscribe (with zero penalties)? Cost (in €) for one year?
2. Suppose above subscription of transport capacity and flexibility, what would be the penalties / incentives / additional prices(in €) if:
   - 2.a. for one day: - allocation at entry = flat = 8000 m3/h - allocation at supply = *"Allocated (supply) + 10 %"*
   - 2.b. idem 2.a. but for 31 consecutive days of a month
   - 2.c. idem 2.a. but for 365 consecutive days of a year
   - 2.d. for one day: - allocation at entry = flat = 8000 m3/h - allocation at supply = *"Allocated (supply) - 10 %"*
   - 2.e. idem 2.d. but for 31 consecutive days of a month
   - 2.f. idem 2.d. but for 365 consecutive days of a year

Appendix C: Generic Imbalance Charging Model

Introduction

In order to assist the development of consistency between imbalance charging regimes, the working group studied in detail imbalance charging principles as they were applied to the following transmission systems:

Member State	TSO
Austria	OMV
Belgium	Distrigas
Denmark	DONG
France	CFM
France	Gaz de France
France	GSO
Germany	BEB
Germany	Ruhrgas
Germany	Thyssengas
Germany	VNG
Germany	Wingas
United Kingdom	Transco

Summary of Imbalance Regime Features

These systems embody some or all of these features:

1. "**Free of Charge**" band where imbalances are carried over from one balancing period to the next.

   The following limits apply to the quantities carried over:

   - A single balancing period limit – usually expressed as a percentage of booked capacity.
   - A cumulative limit – also expressed as a percentage of booked capacity.
   - A periodic cut-off (eg end of the month) at which all remaining balances are cashed-out.

2. "**Flexibility Service**" where, providing the service is purchased in advance by the shipper, additional imbalances are carried over from one balancing period to the next.

   This can be viewed as a "**virtual storage service**" for which shippers buy:

   - "**Space**" which is the cumulative quantity of gas which can be injected or withdrawn into or out of the virtual store over a number of balancing periods.
   - "**Deliverability**" which is the quantity which can be injected or withdrawn into or out of the virtual store over a single balancing period.

3. "**Cash-out**" of imbalances that exceed those covered by Free of Charge and Flexibility Services. Surplus imbalances are bought by the TSO from the shipper; deficit imbalances are sold by the TSO to the shipper. The common features are:

   - A reference price is used as a basis for the rates applied to cashing-out surpluses and deficits
   - For the same balancing period the cash-out price for deficit imbalances will be higher than the price for surplus imbalances. This ensures that there is a clear incentive for shippers to balance.
   - Step increases in price for deficits and reductions for surpluses are sometimes used to "penalise" severe out of balance behaviour.

4. "**Flexibility Service Overrun**" charges are made where a Flexibility Service is offered but either not taken up by the shipper or taken up but exceeded in terms of Space or Deliverability. This is therefore triggered whenever cash-out is triggered. This overrun charge is part of the monthly invoice and is based on both the highest imbalance and the total volume of imbalance gas in that month that exceeded the space or deliverability entitlement. The features are:
    - The overrun is a multiple of months at the standard Space and Deliverability tariffs.
    - The multiple is lower for surplus than deficit.
    - For deficit, the multiple is higher in severe weather conditions.
    - For surplus, the multiple is higher in certain summer months.

Review of Scope for Simplification

Some of the questions that need resolving were as follows:

- Is a free of charge band tenable in the long term? It essentially bundles the cost of balancing with other transportation services. As balancing costs are then carried by shippers as a whole, shippers who balance can be considered as subsidising shippers who do not.
- Does a multi-price cash-out structure have any real benefits over a two-price structure?
- What is the best market to use as a reference for calculating cash-out rates? Evidence was presented that the UK OCM can be very volatile. On the other hand, Zeebrugge based prices whilst less volatile appeared from European Spot Gas Markets to be derived from relatively small volumes of gas traded. German and Austrian prices were based upon gas import prices averaged over the month. These do not therefore reflect gas prices "on the day" but how important is this?
- Whilst the principle of an overrun is valid as it ensures that the cost of providing a service, is paid for even where the customer does not book it in advance, does this unnecessarily complicate an imbalance charging regime? TSOs who have an overrun charge tend to have lower cash-out rates than those who do not. This would indicate that such cash-out rates include an overrun element within their charges.

Price Comparison Scenario

The working group studied some price comparisons and agreed to work on a scenario where a shipper had an imbalance deficit of 10% for 1st January 2000, for the whole month of January and the whole year using the imbalance charging rules applying to each TSO. Similarly the case of a surplus of 10% for the same time periods was agreed.

Since the meeting, Transco has been working on a different scenario which demonstrates the different effects of a regime which only operates cash-out (Transco), two regimes which operate free gas then cash-out (BEB) and one regime which operates simple free gas, flexibility and cash-out (DONG). The assumptions were as follows:

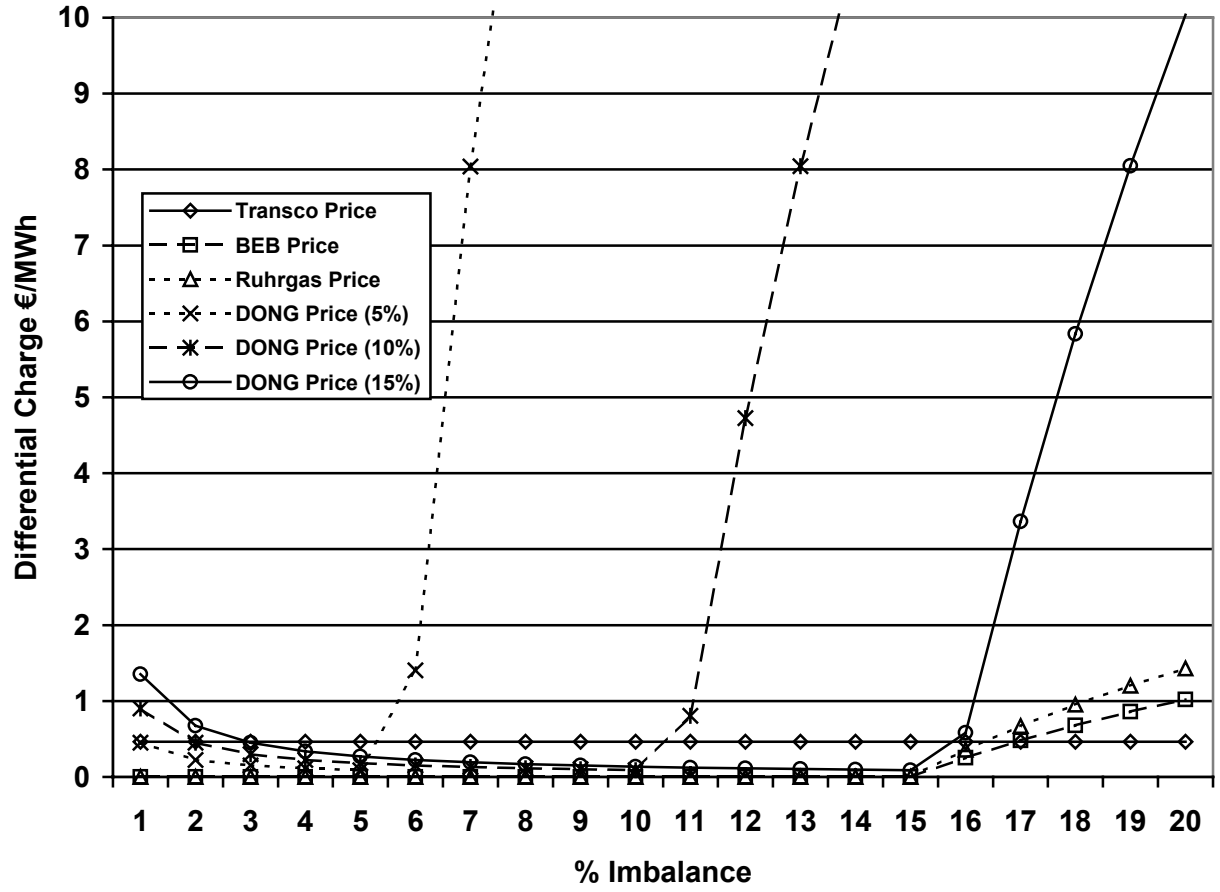
- Prices are those which would have been applied at 1st January 2000
- The imbalance rules are those that apply at present.
- All within day imbalances are considered to be flat – this is to ensure that the daily and hourly balancing regimes are considered on the same basis.
- At the beginning of the gas day there was no accumulated imbalance.
- The cost of gas at the local market rate is subtracted in order to reveal the incentive element of the charges.
- Three flexibility purchase scenarios are considered for DONG (5%, 10% and 15%)
- The plot will demonstrate the average charge in €/MWh to the shipper for balances in the range 1% to 20%
- The daily quantity at entry was equal to the shippers booked capacity

- Transco's NDM forecast was equal to the NDM allocation so no compensation for forecasting errors applied.

The basic rules of each gas regime applying to that day were as follows;

- In the UK on that day, the cash-out price would have exceeded the average price on the day by 0.465 €/MWh. The whole imbalance is therefore essentially charged at that rate. This reflects a relatively recent change to Transco's price structure that ensures a minimum difference between the average price of gas and the cash-out rate.
- In Denmark, the free imbalance band is equivalent to 0.83% per day and as it allows up to 20% per hour is mainly of advantage to shippers with a significant diurnal profile. The flexibility service is sold at 32.9 €/MWh/annum or 0.0901 €/MWh/day. The cash-out differential is 45.206 €/MWh based on a German border price of 10.609 €/MWh.
- In Germany, the first 15% is free of charge but a shipper with a daily imbalance of that scale would use up the whole of that cumulative balance in one day. The incentive element of the cash-out is 0.5 with BEB and 0.7 with Ruhrgas

The average charge in €/MWh is plotted below. As previously stated this is a differential charge as the reference price has been subtracted from the cash-out price.



This demonstrates the following:

- Charges are lower than Transco's in both German examples providing that the imbalance is less than 17%. Above that level, however, the charges begin to rise steeply.
- Charges rise even more steeply in Denmark. However if a shipper can always control the imbalance to lower than 5% on a cumulative basis the charges are lower than Transco's in the 1% to 5% band. For the other two scenarios, the bands where prices are lower than Transco's are 2% to 10% and 3% to 15%.

- Transco's charge is the minimum that would apply. There was one occasion in 2000 where due to volatility in the OCM, Transco would have charged 18 €/MWh. This by no means represents the maximum that could be encountered.
- Both the Danish and German systems do not pool shippers' balances so they apply on a point to point basis. In the UK, the imbalance is pooled at the shipper level. It is likely therefore that shippers would encounter higher imbalance exposures in Denmark and Germany. How much higher is however open to conjecture.

Further Work

The working group intends to progress the following:

- Produce charge comparisons for all systems that publish details of imbalance charges. These will be in the form of:
  - Parameter lists in consistent units eg €/MWh
  - Graphs similar to the above
  - Comparison of within-day charges applying to hourly balancing regimes.
  - Further scenarios that demonstrate differences and similarities.
  - All this information plus a "ready reckoner" to be on the GTE web site
- Make recommendations to GTE members on how regimes might be developed concentrating on:
  - Demonstrating how balancing charges may be further unbundled from transportation
  - Realising the potential for simplifying regimes.
  - Rationalising market base of prices
  - Rationalising "pooling"
- Review related topics including:
  - Scheduling and nomination charges
  - Interactions between capacity and balancing charging