GAS TRANSIT TARIFFS
in selected Energy Charter Treaty Countries

January 2006
GAS TRANSIT TARIFFS

IN SELECTED ECT COUNTRIES

ENERGY CHARTER SECRETARIAT

JANUARY 2006
Access to and reliability of energy transit is becoming ever more important with the increase in energy trade and the growing integration of energy markets. The Energy Charter offers the instruments to address the resulting challenges by establishing common legal principles to secure established transit flows for hydrocarbons and electricity on the basis of non-discrimination.

The increasing volume of natural gas trade among Energy Charter member countries often involves transportation over large distances and multiple national borders. Transit conditions for natural gas have therefore become a topic of great interest for the Energy Charter and its fifty one member countries. Events at the beginning of 2006 regarding gas deliveries involving Russia and Ukraine, where transit conditions were a major issue, have illustrated the important role of gas transit tariffs and access conditions to gas transit infrastructure.

This study reviews and compares existing tariffs and methodologies across the relevant EC countries and assesses their consistency with the Energy Charter principles on transit tariffs, in particular, ensuring transparent, cost-based and non-discriminatory transit tariffs and national treatment for energy in transit.

The study has been prepared by the Directorate for Trade, Transit and Relations with Non-Signatories of the Energy Charter Secretariat, headed by Ralf Dickel. The main authors are Janusz Bielecki and Gürbüz Gönül using input from a report prepared by Michael Prior. The study benefited greatly from two discussions among Energy Charter member states in meetings of the Energy Charter’s Group on Trade and Transit.

This study is published under my responsibility as Secretary-General and is without prejudice to the positions of Contracting Parties or to their rights or obligations under the Energy Charter Treaty or the WTO Agreements.

André Mernier
Secretary General
Brussels, 31 January 2006
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1 Executive summary

This report reviews transit tariff methodologies and resulting tariffs for existing and new gas pipeline systems across selected Energy Charter Treaty (ECT) countries and compares transit tariff regimes with those for domestic transport in the same countries. It also analyses the overall consistency of gas transit tariffs with main provisions of the ECT and the final text of the draft Transit Protocol (CC 251), which include in particular the obligations to ensure transparent, cost-based and non-discriminatory transit tariffs and national treatment for energy in transit.

The gas flow pattern between the EU and FSU described in chapter 3 shows the importance of transit for gas supply of the EU. Ukraine and Slovakia are by far the most important transit countries, with the 2003 volumes of 115 bcm and 88 bcm respectively. Also of significance for gas transit are such countries as: the Czech Republic, Belarus, Germany, Belgium, Austria or Poland, each with transit volumes of more than 20 bcm. Most transit lines were built for large import projects often also supplying the transit countries. However, the emergence of a single gas market in the EU raises new aspects of transit as transit through member states increasingly becomes part of an integrated system.

There are two crucial steps for designing transport tariffs: the calculation of total revenue requirement and the allocation of that revenue requirement to system users. The total revenue requirement depends predominantly on the valuation of the asset base plus its depreciation and on the rate of return, which together determine about 90% of overall costs. The valuation of the asset base is challenging for past investment, especially in countries which have gone through a period of high inflation. Even for the valuation of new systems (a model tariff for a new system is developed in chapter 4.4), which are often taken as a yardstick for existing systems, there can be large variations in specific costs due to different designs and other parameters of the pipeline (e.g. diameter or pressure regime), but also due to variations in steel prices, currency exchange rates and allowed rates of return.

In the second step, the total revenue requirement is allocated to system users. Chapter 4.3 identifies four types of tariff methodologies currently in use: postal; point-to-point; entry/exit and distance-based. The latter two are commonly used for the high-pressure gas transit systems in Europe and the FSU.

Distance-based tariffs are most useful for systems in which gas moves in one direction over long distances, with rather few intermediate takeoff points. Such tariffs have become the standard for deliveries of Russian and CIS gas to Western Europe, usually taking the form of a commodity charge. In the EU countries, distance-based tariffs have been popular in the form of a capacity charge. The entry-exit tariffs are particularly suitable for highly meshed systems with numerous points of injection and delivery. They have first been introduced in the UK, and more recently for most gas pipelines in Germany and Slovakia. The entry-exit tariffs have two advantages in the eyes of many regulators: they allow charges to be based much more closely on marginal costs and allow for the development of a much more flexible market in capacity contracts.

The review of transit tariffs across the selected ECT countries in chapter 5 reveals a great variety of tariff setting methodologies for gas transit. The distance-based methodology is the most commonly used, but it comes in many variations of commodity and capacity charges. In
Executive summary

In several CIS countries, it is obscured by complex financial and other arrangements, including barter.

It should be noted that the ECT or the draft Transit Protocol do not prescribe any specific methodology for setting transit tariffs. Consequently, it is at the discretion of the Contracting Parties to design methodologies that are most suitable for their transport and transit systems as long as they fulfil the conditions of transparency, cost-reflectiveness and non-discrimination.

The comparisons in chapter 6.2 show a wide variation in tariff levels; for a model case of transportation over 350 km tariffs range from as low as €19/m³/h/y in Belarus to as high as €96/m³/h/y in Austria (for Penta West). This is explained partly by methodological differences and partly by differences in technical design factors such as pipeline diameter and pressure or by such economic factors as the year of construction and changes in exchange rates. This illustrates that a comparison of tariffs calculated with different methodologies is often very difficult (for instance, entry/exit tariffs are independent of the distance and therefore not easily comparable with distance-based tariffs) and is meaningful only for specific cases (e.g. specific volume, distance and pipeline diameter).

The analysis suggests large differences in tariff levels between the EU and non-EU countries. Transit tariffs charged in the CIS countries are generally significantly lower than nearly all EU transit tariffs. Within the EU, the distance-based capacity tariffs in Austria, Belgium, and Germany are at the high end of the range.

Based on available data, transit tariffs are compared in chapter 6.3 with domestic transport tariffs. Any such comparison is difficult for the reasons described above. In this study the comparison is made for one specific case of transport over 350 km and an utilisation rate of 91.3% (8,000 hours per year). In five of the six countries considered - Austria, Belgium, Germany, Poland, Slovakia and Russia - the comparison shows that transit tariffs tend to be higher than domestic transport tariffs under the above assumptions, sometimes by significant margins.

Nearly all countries surveyed herein retain some form of special treatment for gas transit. In the CIS countries in particular, there exists almost no specific legislation in relation to gas transit over national territories.

Among the countries examined in this study, only in three - Germany, Slovakia and the U.K (where transit is of minor importance so far) - tariff principles for transit and domestic flows are based on the same tariff principles. In all three cases, the regulated tariffs are of the entry/exit type. In Germany, this results in identical treatment and tariffs for transit and domestic transport.

Chapter 7 of the study attempts to assess the degree of consistency of gas transit tariffs with the ECT principles of transparency, cost-reflectiveness and non-discrimination on the basis of origin, destination, ownership or pricing and the principle of national treatment of transit.

Concerning transparency, the general conclusion is that the situation is far from satisfactory. In many of the countries examined, transit tariffs are either not published at all or published only as indicative tariffs that are subject to negotiations and difficult to obtain. This problem is particularly acute in some CIS countries relying on complex and opaque intergovernmental arrangements for gas transit. Even some EU countries seem to be not immune to this problem, despite the legal requirements within the EU to ensure full transparency.
The degree of \textit{cost-reflectiveness} of gas transit tariffs is difficult to assess for several reasons. Firstly, this is due to lack of transparency with regard to the transit tariffs and the underlying cost for the pipelines. Secondly, there are several alternative methods of determining the asset base, including the book value and the replacement cost value. Thirdly, there are various methods of setting the depreciation charges and of determining the allowed return on capital which reflects all kinds of investment risks (including sector-specific and country risks). Fourthly, cross-country comparisons, which have to assume a standardised case, provide limited basis for solid conclusions due to the differences in methodologies and technical parameters of the pipelines and utilisation rate and in some cases also substantial changes in exchange rates.

Nonetheless, a comparison with a model tariff for a new large-diameter long-distance pipeline system (developed in chapter 4.3) shows that transit tariffs in the EU countries are within the range of replacement cost. In many CIS countries, by contrast, transit tariffs are set at the levels that are below the range defined by replacement cost of the model tariff, also below the costs of a half depreciated system. This may be partly due to the effect of steep depreciation of the Russian, Ukrainian and Belarussian currencies against the US Dollar and other Western currencies at the end of the 1990s. While tariff rates expressed in local currency have remained at the same level or even increased, their value expressed in Western currencies has dropped substantially.

Domestic transport tariffs are often below the transit tariffs for equivalent gas movements. Transit tariffs at higher levels than tariffs for domestic transport for equivalent gas movements are not unique for CIS countries and can also be observed in some EU countries.

There is no evidence of \textit{discrimination} in transit tarification on the basis of origin, destination, ownership or pricing. However, this may be due to the low number of pertinent cases and also due to the general lack of transparency. Transit tariffs negotiated on a bilateral basis with confidential results imply a potential scope for unjustified discrimination among various transit shippers as to the pricing of transit services.

\textit{National treatment} of energy in transit requires that energy in transit should be treated no less favourably than energy originating in or destined for the transit country itself. There is a practical difficulty of comparing these two types of tariffs given that the transit lines are often not integrated with the domestic transport systems and design and other parameters tend to differ.

Further in-depth analyses could provide a more solid basis for conclusions on the above aspect, but would require more transparency concerning the tariffs and the underlying cost structures and methodologies.

The last part of the study (chapter 8) provides some recommendations with a view to ensure compliance and consistency with the transit tariff related provisions of the ECT. Given that the ECT and the draft Transit Protocol do not require, or give preference to, any specific transit tarification methodology, it is for individual governments to adopt tariff methodologies that best reflect the specifics of their country’s gas sector regarding transit and transportation, while being in accordance with the relevant ECT principles.

Improving the degree of transparency of transit conditions is the most immediate challenge throughout the entire ECT constituency. This will reduce risks perceived by investors, system users, operators and other players in the market. In addition, more transparency will help to
minimise future misunderstandings and resulting disputes. Possible measures include clarification of applicable tariffs / tariff methodology for each transit cases, clearer institutional setup to deal with gas transit issues, preferably a one stop shop to deal with all relevant administrative issues, and more transparency in systems where transit conditions are determined through negotiations.

In the presence of the large variety of technical, economic, regulatory and financial characteristics leading to variations in the applicable methodology and the resulting tariffs, a generally applicable methodology would neglect these important differences and, in that regard, be discriminatory. With regard to cost recovery, transit operations should not result in losses nor in excessive profits. The methodology chosen should ensure financial sustainability of the system. The cases in the CIS and Western Europe where consistency with the requirement of cost-reflectiveness is not clear suggest a careful review.

With respect to non-discrimination and national treatment of transit tariffs, countries should, first of all, ensure transparency for all transit tariffs as well as for domestic transportation tariffs to allow for an assessment of the origin of different tariff methodologies and tariff results. Given the insufficient transit tariff data in most cases reviewed under this study, such a comprehensive analysis can be based not only on a comparison of tariffs charged but also on the relevant legislation/regulation and practical implementation.
2 Introduction

2.1 Objectives and scope

One of the strategic aims of the Energy Charter process is to promote and facilitate efficient and uninhibited transit of energy materials and products across the ECT constituency. The Energy Charter process has recently been focusing its attention on the issues related to the transit of natural gas due to the increasing reliance on gas imports into Europe and other regions from more distant sources and across more borders. The transit tariffs (including their levels, structures and associated conditions) are, in addition to the terms of access to the transit infrastructure, one of the key factors affecting the cross-border gas flows.

The main objectives of this study are to:

- review transit tariff methodologies for existing and new gas transit pipeline systems across selected ECT countries;
- compare transit tariff regimes for gas with those for domestic gas transport\(^1\) in the same countries; and
- assess the overall consistency of these transit tariffs with main provisions of ECT and draft Transit Protocol.

The scope of this study is limited to transit tariffs for natural gas\(^2\). Furthermore, the study does not address the issue of access to gas pipelines which sometimes is a more important hurdle for gas flows than the levels of transit tariffs.

Geographically, the study covers the following key gas transit countries:

- EU-25 plus Switzerland: Austria, Belgium, Czech Republic, Germany, Poland, Slovakia, Switzerland and the UK; and
- Non-EU: Belarus, Bulgaria, Georgia, Morocco, Tunisia, the Russian Federation, and Ukraine.

The provisions of the ECT related to transit tariffs are contained primarily in Article 7 of the ECT and Article 10 of the draft Transit Protocol\(^3\):

ECT

Article 7 - Transit

(1) Each Contracting Party shall take the necessary measures to facilitate the Transit of Energy Materials and Products consistent with the principle of freedom of transit and without distinction as to the origin, destination or ownership of such Energy Materials and Products or discrimination as to pricing on the basis of such distinctions, and without imposing any unreasonable delays, restrictions or charges.

(2) .....
(3) Each Contracting Party undertakes that its provisions relating to transport of Energy Materials and Products and the use of Energy Transport Facilities shall treat Energy Materials and Products in Transit in no less favourable a manner than its provisions treat such materials and products originating in or destined for its own Area, unless an existing international agreement provides otherwise.

**Draft Transit Protocol (CC 251)**

**Article 10 - Transit Tariffs**

1. Each Contracting Party shall take all necessary measures to ensure that Transit Tariffs and other conditions are objective, reasonable, transparent and do not discriminate on the basis of origin, destination or ownership of Energy Materials and Products in Transit.

2. Each Contracting Party shall ensure that Transit Tariffs and other conditions are not affected by market distortions, in particular those resulting from abuse of a dominant position by any owner or operator of Energy Transit Facilities used for Transit.

3. Transit Tariffs shall be based on operational and investment costs, including a reasonable rate of return.

4. ....

Accordingly, the above Articles require:

(a) non-discrimination of shippers as to the origin, destination, ownership and pricing of energy in transit;

(b) national treatment of energy in transit; and

(c) that transit tariffs must be objective, reasonable, transparent, non-discriminatory and cost-based.

These three obligations (in points (a) to (c)) will be used in this study as the benchmarks for assessing the consistency of transit tariffs with legal obligations contained in the Energy Charter’s legal framework.

**2.2 Outline**

The study is organised as follows.

Chapter 3 describes the existing flows of gas trade and transit across the ECT countries and points out potential deviations between physical and contractual flows.

Chapter 4 reviews the theoretical approaches used for setting transit tariffs, including:

- Typical costs for new gas pipelines: construction costs, financing, operation and maintenance costs, country/project risks and their impact on costs;
- Valuation approaches for existing pipelines; and
- Treatment of system expansion.

Chapter 5 compares the theory and the practice by describing various transport/transit tariff methodologies (i.e. cost-plus, incentive tariff regulation, negotiated tariffs as well as distance-related, stamp, exit/entry model) that are used in the countries examined.
Chapter 6 compares available information on transit tariffs by country and by methodology used. It also compares these tariffs with domestic transport tariffs, where appropriate and possible\textsuperscript{4}.

Finally, chapter 7 attempts to evaluate the consistency of transit tariffs with the obligations of the Energy Charter framework and highlights the areas requiring further analysis.

\textsuperscript{4} The main volumetric unit used is 1000 m\textsuperscript{3}. The tariffs are quoted in euro (€). Other currencies have been converted at the rates indicated in the study. The euro/dollar conversions are made at a rate of €1=$1.30.
3 Trade and transit flows

3.1 Transit flows for supplies to the EU

The cross-border European grid was based on single large pipeline projects which were driven by import projects and implemented jointly by the companies involved. Even the Interconnector between the UK and the Continent was economically driven by several export projects. In general, such pipelines were tailor-made to serve the import projects and their expansion, allowing spare capacity mainly during the build-up phase of the project, and with the option to adapt capacity by successfully adding compression or looping the systems. The increasing interconnection of these pipelines meant that more trade and more optimisation of flows inside the European system became possible. However, the physical flow inside the European system is very much determined by the inflows of the main suppliers, Russia, Algeria, Norway and the Netherlands, which are characterised by different qualities of gas.

Table 3.1 shows pipeline trade in 2003 between European countries without physical common borders i.e. gas flows which must have crossed at least one country in transit, excluding intra-Former Soviet Union (FSU) trades. The data in the table come from British Petroleum’s (BP’s) Statistical Review of World Energy and reflect physical, rather than contractual, flows. It can be seen that some smaller volumes of trade are shown between Algeria, Belgium, France, Germany and Norway and countries in central and south-eastern Europe, including Poland, Hungary, Romania, Slovenia and Czech Republic. These trades are based on known supply contracts between national gas companies.

It should be noted that in practice contractual flows may differ in some cases from physical flows due to the existence of swap and counter flow arrangements. One well known example of a swap is the delivery of Liquefied Natural Gas (LNG) contracted by ENEL from Nigeria to Montoir in France in exchange for deliveries of Russian gas contracted by France in Baumgarten to SNAM for transport to ENEL. The examples of counter flow deals are the supplies of German/French gas to Hungary (about 1 bcm/a each) or the supplies of Norwegian gas inside the Czech Republic. Nonetheless, both types of arrangements are rather marginal in volumetric terms and cannot be considered as an important feature of the current gas trade in Europe. Consequently, in general, the physical and contractual flows coincide very closely.

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5 Counter flows involve flows of gas in opposite directions that are netted out without changing delivery risks for the parties involved.
Table 3.1: Gas trade flows by pipeline between countries without common border: 2003 (bcm)

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<th>Belgium</th>
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<th>Norway</th>
<th>U.K.</th>
<th>Russia</th>
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<td>0.4</td>
<td>1.8</td>
<td>15.7</td>
<td>16.2</td>
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<td>0.8</td>
<td>10.3</td>
<td>42.2</td>
<td>68.4</td>
<td>15.2</td>
<td>131.8</td>
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<tr>
<td>Transit %</td>
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<td>18.8%</td>
<td>51.9%</td>
<td>17.3%</td>
<td>37.3%</td>
<td>23.7%</td>
<td>35.5%</td>
<td>94.8%</td>
</tr>
</tbody>
</table>


While Table 3.1 shows initial and final countries in the supply chain, Table 3.2 provides estimates of the transit flows required in these trades. Some of the figures reflect the estimates that may be rather somewhat imprecise.

Table 3.2 shows that Ukraine is by far the most important gas transit country, accounting for more than a quarter of total volume of gas transited in 2003. This importance increases further when intra-FSU flows are also considered. Slovakia is the second most important transit country. Another ten countries have transit flows of more than 10 bcm annually.

Another observation is that the transit volumes have varying degree of importance vis-à-vis overall gas flows in the transit country (including domestic supplies). Among the major transit countries, Ukraine emerges as a major consumer country besides its well-known transit role. Transit volumes are larger by around a factor of two than domestic volumes in Ukraine, Belarus, Belgium and Poland. Moreover, in Slovakia and the Czech Republic, transit volumes are also quite substantial relative to domestic supplies. By contrast, in certain EU transit countries (e.g. Germany, France, Spain) domestic supplies are considerably larger than the transit volumes.
Trade and transit flows

Table 3.2: Estimated transit flows (excluding intra-FSU) in 2003

<table>
<thead>
<tr>
<th>Domestic Supplies</th>
<th>Transit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ukraine</td>
<td>68</td>
<td>115</td>
</tr>
<tr>
<td>Slovakia</td>
<td>7</td>
<td>88</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>9</td>
<td>40</td>
</tr>
<tr>
<td>Belarus</td>
<td>16</td>
<td>30</td>
</tr>
<tr>
<td>Germany</td>
<td>86</td>
<td>28</td>
</tr>
<tr>
<td>Belgium</td>
<td>16</td>
<td>28</td>
</tr>
<tr>
<td>Austria</td>
<td>9</td>
<td>27</td>
</tr>
<tr>
<td>Poland</td>
<td>13</td>
<td>20</td>
</tr>
<tr>
<td>Tunisia</td>
<td>3*</td>
<td>21</td>
</tr>
<tr>
<td>Romania</td>
<td>18</td>
<td>17</td>
</tr>
<tr>
<td>Switzerland</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>3</td>
<td>14</td>
</tr>
<tr>
<td>Morocco</td>
<td>2*</td>
<td>9</td>
</tr>
<tr>
<td>France</td>
<td>44</td>
<td>3</td>
</tr>
<tr>
<td>Spain</td>
<td>24</td>
<td>2</td>
</tr>
<tr>
<td>Total:</td>
<td>319</td>
<td>457</td>
</tr>
</tbody>
</table>

* 2002 figures

3.2 Intra-FSU transit

In addition to the flows discussed above, there is a considerable volume of intra-FSU gas movement, which involves some degree of transit. The main supplier is Russia, but the Central Asian countries, Turkmenistan, Kazakhstan and Uzbekistan are also involved.

Intra-FSU trade is complicated by the fact that all FSU countries use a gas grid system which was built to serve a single national entity under a uniform management. The result is that after the break-up of the Soviet Union the system was split too and came under management of several different countries and gas supplies followed the exiting routes that often do not take into account national boundaries. For example, some Russian gas supply to parts of south-Western Russia involve a short transit across Ukraine, whilst the main supply route for Russian gas to Romania cuts across Moldova for a short distance. Consequently, metering stations and processing plants do not exist or are often not situated where they might have been, had they been built originally by existing national entities. This means that it is not always clear whether dispatch is handled by the country in which a pipeline is located.
The main intra-FSU transit routes are as follows:

- All Turkmen gas exports (apart from those to Iran) must pass through Uzbekistan and Kazakhstan before delivery into the Russian system. Onward delivery requires transit through Russia into Ukraine;
- Gas delivery to the trans-Caucasian countries requires transit through Ukraine, then back into Russia before reaching Georgia, Azerbaijan or Armenia\(^6\);
- Gas delivery to Moldova requires transit through Ukraine.

### 3.3 New gas import pipeline projects

Several new pipeline routes into Europe are currently being considered.

Most advanced is an interconnector between Turkey and Greece with an ultimate annual capacity of 11 bcm. This line may turn Turkey and, potentially Iran, into major transit countries. A tender award for this project is expected in 2005.

When the Azeri/Turkish gas line (the South Caucasus Gas pipeline, which is under construction) is complete, the exports of Azeri gas to Turkey will transit through Georgia.

Two other projects are planned, but are not yet firm:

- the so-called Nabucco project to move gas from Turkey northwards through Bulgaria and Romania and Hungary into Austria. This would enable Iranian, Azeri, and possibly Iraqi and other Middle Eastern, Turkmen and even Russian gas to move through Turkey; and
- an under-water Baltic route to move Russian gas into northern Europe\(^7\).

### 3.4 Types of transit systems

In general, four kinds of transit system can be distinguished:

- a pipeline crossing sovereign territory and carrying transit gas without any connection to the gas supply system of the transit country. This provides the clearest definition of a transit line, but is rare in practice. The transit lines across Kazakhstan and Uzbekistan from Turkmenistan, the transit through Moldavia and the lines from Algeria across Morocco are examples of this case, as no or only small amounts of transit gas are delivered to these transit countries.
- a transit pipeline which is owned by a separate entity and which is predominantly used for gas transit, but also used to supply gas of the same origin to the transit country. Most of the transit lines for Russian gas (in the former Comecon states) are examples, but also the import project pipelines in from EU-15, such as TAG and WAG lines taking Russian gas across Austria to Italy and Germany respectively and MEGAL taking Russian gas further across Germany, or the TENP taking Dutch gas to Switzerland and Italy. With the new regulation in the EU, some of these lines with regard to the single European market become subject to EU regulation, however with long-term transport commitments reflecting their original purpose.

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\(^6\) There is also Turkmen, Kazakh and Uzbek gas to the trans-Caucasian countries via Russia that does not cross Ukraine.

\(^7\) According to an announcement by Wintershall/Gazprom the construction of this line may start in 2006.
− a transit pipeline system which is integrated into the domestic supply system and which is owned and operated by the main national transmission operator, where the transit gas flow can still be traced. The Ukrainian and Belgian systems are examples of this type of system.

− Systems where transit volumes commingle with a highly meshed national grid, (e.g. in UK, Germany and France, and to a lesser extent Italy), which are working like a tub, where additional inflow just raises the overall level and will be compensated by corresponding output volumes.

A certain indication about the type of transit is also provided by comparing the transit volumes and the domestic consumption, as shown in Table 4.2. These four transit systems imply different methods and approaches to the transit tariffs and eventually require that gas transit should be treated differently from domestic flows. This is investigated further in this study.
4 Gas transit tariff methodologies

4.1 Differences between transit and domestic pipelines

This describes the national approaches to tariff setting in selected ECT countries. Within the EU attempts are being made to develop uniform rules for gas tariffs across member states in order to create a single market (also with a form of supra national authority).

In many cases the transit volumes are far in excess of domestic consumption so that a scale up of the national transportation tariffs to the transit volumes would be questionable. Here the distinction provided in this chapter may be a helpful illustration of how far national tariffs could be applied to transit.

Moreover, the natural monopoly argument justifying the regulation of national systems may not fully apply to transit projects when there is some competition – although on another scale – by other gas suppliers (including other pipelines or LNG deliveries) or by other energy sources (especially for power generation).

Many transit arrangements are subject to intergovernmental agreements which are not subject to the authority of national regulators, but subject to dispute resolution defined in those agreements and in the ECT. These agreements are then complemented by private agreements which are not subject to regulation and where a consortium needing a transit capacity builds it and allows third-party access only on a negotiated basis.

Before describing the methodological debate on tariffs, it is necessary to make a distinction between a tariff and a government charge as there is sometimes a practical confusion between these two kinds of payment. A tariff is a fee paid by the customers to a pipeline operator for the use of the pipelines. It covers the costs of investment and financing, operating and maintaining the pipe and includes an element of profit for the operator. These costs may include such items as local taxes levied on commercial entities. A government charge is a tax levied by a transit country essentially as a fee for the right of way through that country’s territory and as compensation for taxes not levied and for service rendered by the country (e.g. protection of pipeline). It is not related to costs of transport itself (see section 5.4.3 discussing the South Caucasus Gas Pipeline).

The difference between the two types of payment is that a tariff is charged based on real costs, whilst a government charge is a tax the size of which is based on political judgments and negotiations. Such government charges are uncommon; the known cases are Tunisia and Morocco for the transit of Algerian gas and Georgia for the transit of Azeri gas to Turkey. In all cases the fee is between 5% and 7% of gas throughput. However, in a number of important cases in the ECT area in which pipeline tariffs were originally set by intergovernmental negotiations, it is not always clear whether or not tariffs and government charges are bundled together.

4.2 General principles of domestic tariff setting

4.2.1 Institutional and procedural framework

The setting of domestic gas tariffs is based on the premise that gas pipelines are often natural monopolies, thereby requiring some form of external control to regulate tariffs and access
conditions. In principle, it is possible for competing pipelines to be built and for tariffs to be set by market forces or by negotiations, but in practice throughout ECT countries some form of external control exists which regulates, or at least oversees, the formation of gas pipeline tariffs. The degree of transparency of a particular national process varies widely and different procedures are used to develop national transportation tariffs.

In the first step the overall tariff income of a Transmission System Operator (TSO) is set. In a second step, it is required to develop a procedure to allocate this cost among various system users. The main method of tariff setting across the ECT countries is the cost-based one. In that method tariffs are based on the costs incurred by a TSO in transporting gas. These costs include costs derived from the fixed investment in pipeline networks, including financing and some level of commercial profit as well as operational charges inclusive of the gas for compression. This total cost base is usually set by a regulator or negotiated with the TSO.

Another more recent method is the incentive tariffication which entails setting a tariff target designed to induce the TSOs to become more efficient and to cut costs by allowing them to retain additional profits, if they beat the target. In practice, the distinction as it relates to transmission pipelines is rather blurred. Fixed investment costs are very dominant in the total cost structure and, as these are treated in a standard fashion, it is difficult to devise incentives which substantially reduce total costs. Regulatory focus tends to be the treatment of new investment and how this is included into the regulatory base.

The procedure for tariff setting depends crucially on whether or not a country has set up a specialised regulatory agency for the gas sector or whether control is undertaken by some direct government control. It also depends on the extent to which transport contracts can be negotiated between the parties (e.g. in the case of new interconnectors of other new infrastructure). There now exist regulatory agencies in most ECT signatory states, though some are at relatively early stages of development and may have a limited degree of independence. In some important gas transit countries, the transit of gas is governed by intergovernmental agreements which largely bypass national regulatory agencies.

The methodology for setting transport and transit tariffs comprises two stages; (a) the calculation of total allowable costs for the operation of the system in order to determine the revenue requirement; and (b) the allocation of these costs to individual shippers. This overall process is shown in Figure 4.1.

**4.2.2 Total revenue requirement**

The total revenue requirement is the fundamental element in any rate-setting exercise. It is an annual revenue that covers all costs of operation, plus an element of profit calculated as an allowed rate of return on the asset value of the operation.

*Figure 4.1* shows three elements in this calculation:

- The cost of amortising the pipes as represented by a depreciation charge on the original capital asset;

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8 One possible exception to this is in Germany where the new version of its energy law as adopted by the Bundestag (First Chamber) on 15 April 2005 provides that tariffs for transmission can be set by market competition instead of cost-based regulation. However, after the Bundesrat (Second Chamber) raised several more generic objections to the draft law in its session of 29 April 2005 it will be subject to the conciliation procedures between Bundestag and Bundesrat, which may also address this provision.
A financing and profit element calculated as a return on the asset value of the pipeline system. This involves two parts; the regulated asset value of the pipeline system and the allowed capital return on this value.

Annual operating costs which can include both fixed and variable elements. The former would normally include the staff required to keep the pipeline running, including administrative operations. The main element of the variable costs is the cost of the fuel gas required to operate the compressors. In many cases, the operating costs of gas pipelines are reduced to this single element, with customers being required to pay a fixed percentage of gas transported (often provided in kind).

The variable operating cost element is a small and relatively straight-forward aspect of the rate-setting procedure and therefore will not be discussed further in this study.

### 4.2.3 Regulated asset value (RAV)

The core of the tariff for a domestic gas pipeline system is the RAV according to the regulatory rules of a country as agreed by the appropriate regulatory body with the TSO. This value derives from the asset base originally set when the tariff-setting process was initiated to which may be added subsequently approved investments in the system. Such new investment is normally added to the asset base at its full cost and offers no methodological problems. The difficulties arise with the valuation of the original assets. A number of alternative methods exist for setting the asset base, including:

a. the actual real investment cost in the case of a new facility operated separately from any other system;

b. the book value of the system as it appears in the accounts of the TSO;

c. the replacement value of the system;

d. the replacement value depreciated for a notional period; and

e. the value placed on the system when privatised or otherwise sold.
Operating costs

Variable

Fixed

Depreciation

Cost of capital

X

Regulatory asset value

Capital Charges

Total capacity charges

Commodity charge

Commodity charge

Annual revenue requirement

\[ \text{Operating costs} = \text{Variable} + \text{Fixed} \]

\[ \text{Depreciation} = \text{Variable} + \text{Capital Charges} \]

\[ \text{Cost of capital} = \text{Capital Charges} \]

\[ \text{Annual revenue requirement} = \frac{\text{Total capacity charges}}{\text{Commodity charge}} \]

\[ \text{Commodity charge} = \frac{\text{Annual revenue requirement}}{\text{Variable}} \]

* Normally, the balance between capacity and commodity charges is about 90/10. Sometimes, 100% capacity charges are used.

* Setting capacity charges:
  - Postage stamp
  - Entry/exit
  - Distance-based path systems
  - Various hybrids

Unit: €/m³

Unit: €/m³/hr/yr
Method (a) is the only case which does not have any methodological or practical problems during the depreciation period. After the depreciation period there would be no depreciation element and the basis for applying the cost of capital would be zero, so that the overall tariff would practically be zero. This dichotomy is due to a discrepancy between the economic lifetime of a pipeline – its depreciation period – and its technical lifetime which is often much longer. But it is used primarily only for new interconnectors between national systems operated as a separate entity or an entirely new transit line, with little or no connection to the supply system of the country.

Method (b) has two associated problems. Firstly, in an integrated operation, the value of the transmission system may not be easily separable from other activities, such as production and storage. More importantly, past inflation not registered in accounting practice may have seriously distorted book values to the point where they have little relation to current costs. It is also possible that either the system was subsidised or that non-market prices were used in initial valuation. In all these situations, the consequence is likely to be that the book value of the assets is too low to provide an adequate revenue return for system renewal or expansion. Book values based on historic real costs are most likely to be useful in the case of systems which are relatively new.

The remaining three approaches are based on using a form of objective market-based, external valuation of the system in question.

Approaches (c) and (d) are seen as essentially versions of the same fundamental approach, where the cost of a new system with the same characteristics is used to determine the replacement value of the system. While all elements of that calculation can be market-based, some crucial elements of pipeline costs, such as the dollar exchange rate and the steel prices may be subject to strong variations, resulting in a volatile replacement value.

The value placed on the system by a privatisation process (option (e)) is an appealing methodology in those situations where such valuation is possible.

However, there are two major problems with such a methodology. First, it is often the case that in privatisation a lot more than a pure transmission network is sold. It is likely to be very difficult to separate the value of physical pipeline infrastructure from the value of financial assets such as a gas purchase contract portfolio and matching supply contracts; and also intangible assets such as the know-how of company employees and company goodwill. Second, in many cases privatisation process will reflect the knowledge of the regulatory regime under which the company will be required to operate. If there is a commitment to equate the initial RAV with the price paid for the pipeline system, then there is a clear incentive to bid high for the system knowing that excessive bids will be rewarded with automatic pass-through of the successful bid to the RAV.

In the final analysis, it is difficult to see how an initial RAV for a complex and well-established system can be constructed without the use of some form of replacement cost valuation, depreciated by the period that the system has been in operation, as at least a

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9 For instance, in Russia the Rouble was devalued by a factor of 600% in the aftermath of the 1998 economic crisis.

10 One example is the Irish system. The tariff methodology for that system is available at www.cer.ie/cerdocs/cer03172.

11 It formed, for example, the original basis for asset valuation of the British Gas network in the U.K.
benchmark by which other valuations can be assessed. However, although this procedure has the advantage of being objective in the sense that it can be carried through by independent specialists with no stake in the outcome, it will also be contentious with the views of one expert being challenged by another and inevitable resort to some form of arbitration process. Factors such as the relevant price of steel pipe at different times or physical, rather than depreciated, lifetime of pipelines and compressors are, in practice, as much subject to dispute as the impact of past inflation on the book value of assets.

The initial RAV evolves over time as new investment is made and existing plant is depreciated. There is likely to be a continual process of negotiation between regulatory agency and operator on the extent to which new plants can be included in the asset base. On the one hand, there is the well-known tendency of operators to include as much new equipment possible in the rate-base; on the other hand there must be an incentive for investment to eliminate bottlenecks. As the justification for much new investment will be a perceived need to meet future demand, it will be necessary for the regulatory agency to become involved in what are, in effect, decisions about planning a future system as much as regulating an existing one. This complex issue is discussed further below.

When determining the regulated asset base, the regulators would go for the book values and allow an interest rate commensurate with international financing conditions which would ensure the financial viability of the system. Allowing for a replacement value and a market based interest rate would create large windfall profits for the pipeline owner. Taking a replacement value of the system and defining an interest rate which is correspondingly lower than the market rate, is again arbitrary but looks good to the public. However, the artificially low interest rate will not allow financing new investment, or will result in a much higher tariff, when a competitive interest rate is applied for new investment.

The use of the above methodology to develop a stream of future allowable revenues can take slightly different paths. This has been described in some detail in a report by the Brattle Group for the European Commission (see Appendix 1). The various approaches rest upon different ways of combining depreciation and capital charge flows so that new pipelines are not disadvantaged relative to established ones. The central point is that the RAV for a fixed investment declines over time as its depreciated value falls and, therefore, the annual allowable revenue declines over time as the capital charge falls. A mature pipeline will therefore appear to have lower charges than a new one. The latter may, therefore, be uncompetitive even when it has the same full lifetime charges. The problem may, in practice, not be serious as pipeline lifetimes are much longer than the examples shown in Appendix 1 and therefore charges fall quite slowly, whilst ongoing investment by the mature system will tend to keep the charges high. However, the choice of methodology will have some impact on the final tariff level derived from the annual allowable revenue.

4.2.4 Return on capital

The RAV is linked to the level of required annual revenue in two ways; the depreciation allowances granted to the TSO and the return on capital which the TSO is granted. Although, strictly speaking, this return on capital is not the same as the profits of the TSO, in the public eye there is likely to be little difference. Given the status of a TSO as a utility monopoly, the level of the regulated return on capital has an important political as well as economic importance. Calculation of the allowed return on capital (often called the weighted average cost of capital or WACC) varies slightly under different methodologies, but essentially involves setting a debt/equity ratio for the TSO, setting a cost of debt finance, estimating a
normal equity return, adjusting this by a factor for the risk category of the enterprise and, finally putting together a weighted average of these two rates of return. Published WACC levels vary quite widely across Europe; from 5.75% in Ireland to 6.25% in the UK and 8.3% in the Czech Republic. These are real rates that are adjusted for inflation in setting actual financial flows in future years.

As noted above, the use of rate-of-return (ROR) regulation has been widely criticised over the entire field of regulation for failing to provide any incentive to reduce costs and for the inherent tendency for operators to increase their RAV unnecessarily. As an alternative, price-capping regulation has been introduced in many other sectors to prevent this and offer incentives to reduce costs. The price cap is often set as an overall revenue cap for five years, after which time it is open for a review. However, in a sector that is as capital-intensive as gas transmission, large parts of the cost are fixed and not subject to cost saving. Therefore, some form of rate-of-return regulation always appears to be necessary even if various kinds of price-capping mechanisms are introduced around the margin to induce reductions in the relatively small area of operating costs.

### 4.2.5 Rate-of-return regulation and transit pipeline usage

If ROR regulation is accepted as the method of choice for tariff setting in the gas sector, there are two inherent issues with it which have particular relevance for transit gas tariffs.

First, ROR always contains an implicit assumption about the future level of pipeline use; typically that it works at full capacity or as close to it as can be managed given operational flexibility needs. Historically, if a TSO has invested in a pipeline which turns out to be used only at a fraction of its capacity, then no allowance is normally made in setting an initial RAV for this mistake as the TSO is allowed to take the full revenue charge for the unused capacity from existing customers. This tariff increase may lead to further reductions in pipeline usage.

The ROR regulation is often criticized for creating an incentive for padding of the RAV that is, further investments in under-utilised capacity. This can be prevented by the negotiations of future allowed system expansion usually for at least five years ahead, often longer. However, there is a difference, if the system utilisation is more driven by short-term market forces (e.g. in UK and partly around the new hubs in Zeebrugge, Bunde and in the Netherlands) or by more long-term booking driven mainly by long-term supply contract with corresponding transport commitments. The issue that is relevant for transit is that in countries which have, or expect to have, transit flows which are significant relative to domestic flows, such planning will have to take into account such factors as forecast demand and alternative supplies in other countries, sometimes quite far afield. To take a concrete example, the Slovak regulator may well be asked in the next decade to allow investment in Slovak lines into the RAV of a Slovak TSO based, at least in part, upon demand projections in Belgium or the U.K. and prospective competing supplies in these countries. This is because in Slovakia, the volume of gas transited far exceeds local demand. In principle, such issues can be resolved by the same process of negotiation and joint planning between regulator and system planner, though this introduces new dimensions of complexity in national regulation and, ultimately, tariff setting if cross-subsidisation between local and transit gas tariffs is to be avoided.

An extension of this planning problem is that forecasting likely capacity requirements across the continent will be made much more problematic by the fact that capacity utilisation and the

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12 The best developed of these is the U.K. TSO, Transco’s, annual *Ten-Year Forecast*. 
risks of investment in under-utilised lines are going to be seriously affected by legal and regulatory intervention aimed at improving market liberalisation.

As noted above, the basis for much transmission line investment in the past has been long-term transportation contracts based on take-or-pay (TOP) supply contracts. This reliance is illustrated, for instance, by the financing for the Blue Stream pipeline across the Black Sea being financed on the basis of an off-take from the supply contract between Gazprom and Botas, formalized by a transportation contract with the company which actually owns and operates the line.

A second and quite separate issue relates to the adequacy of the WACC as estimated by European regulators compared to commercial opportunity costs. As noted above, the WACC used by European regulators, ranges from a little below 5% to above 8%. These rates may be in line with empirical studies of debt finance and equity returns, but they are well below the rates of return normally used by commercial energy companies which commonly set benchmark ‘hurdles rates’ for the return on new projects to at least 12% and often 15%. It remains to be seen how much new investment in long-distance pipelines will be induced by the current WACC rates. It may be relevant that the U.K. regulator has recently conceded that Transco will be allowed a return of 12.5% on new entry capacity at U.K. beachheads, double the rate allowed for the overall RAV, whilst the French and Spanish regulators have allowed a similar return on a new pipeline between France and Spain, again well above the normal rate allowed. This is presumably because the normally allowed ROR was simply too low in both cases to attract new investment as compared with other opportunities. The existing ROR allowed for TSO’s tend to be based on those applied to national monopolies. However, new capacity in gas transmission (particularly interconnectors) cannot be seen as risk-free in the same way as internal investment.

The disparity between European WACC rates and the returns on normal commercial investment has been highlighted (though not specifically in these terms) in a recent survey by Nitzov. This survey shows that the lowest risk-weighted return on investment is around 10% in the USA, 18% in Czech Republic, 23% in Slovakìa and 38% in Russia.

4.2.6 Unit tariff methodology

The second stage of deriving a regulated tariff involves spreading the allowed annual revenue across actual gas shipments to derive a unit tariff. In order to provide a stable framework for gas transport and trading, it is common to base tariff derivation upon forecast gas flows through a system for one or more years into the future and then to adjust TSO revenues up or down when actual flows are known. The tariffs are usually broken into commodity and capacity charges. Since the commodity charges are relatively small and derived in a simple manner, they will not be analysed further in this study.

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13 This has to be seen in conjunction with the RAV which is often based on replacement values and therefore is higher than the working capital in the respective company.
15 A common procedure is to take a standard percentage of the gas moved, say 2% per 1000 km, to recompense for the main operational cost that of the energy required to move the gas. This actually preferentially biases long-haul against short-haul movement, but the bias is small and not easily removed.
Capacity tariffs are intimately linked with capacity booking procedures. A simple summary of the process is as follows:

- A shipper will book capacity on a system in blocks which fit with the shipper’s expected needs and are allowed under the access rules of the system;
- The preliminary booking will be confirmed at some point before movement is physically required;
- The shipper will subsequently move gas through the system in volumes which may or may not conform to the original capacity bookings;
- There will be a regular settlement procedure under which the shipper will pay according to the set tariff for the gas actually moved and, additionally, any extra charges for costs incurred in moving gas volumes which are above or below originally contracted capacities.

The process is complicated if secondary markets in contracted capacity exist, but this set of basic steps will still provide the underlying dynamic of the system. The central feature which distinguishes gas trading from other physical commodities is that the gas the shippers receive at the exit point will never be the same as that which they provide at the entry point (though it will usually be indistinguishable within the quality limits set by the system) and that the TSO is usually obliged in the event of supply/demand imbalance to make up the difference rather than suspend the flow of gas out of the system to any particular shipper. The reasons for this situation are that (a) such imbalances are not only known after the event; (b) it is impossible to suspend delivery to a particular shipper through an exit point with multiple contracts; and (c) even if the shipper can be identified and isolated, security or public service obligations may prohibit supply suspensions.

The rules of access set by a TSO have important financial implications for shippers and should be included as part of the general tariff set by any TSO. However, the details of such issues are complex and difficult to compare systematically so they will not be considered further herein. The remainder of this section discusses the various methodologies for setting the direct transport tariffs.

4.3 Types of Tariff Methodologies

There are essentially four types of tariff methodologies currently in use to allocate the overall costs to the shippers:

- postal;
- distance-based;
- point-to-point; and
- entry/exit.

There are also various hybrid forms of these four types; for example zonal schemes which are broadly distance-based or entry/exit tariffs with postal charges inside the zone. However such complications do not significantly alter the underlying advantages and disadvantages of the four types but attempt to blend them to achieve a more desirable mix.

4.3.1 Postal tariffs

Postal tariffs use a single fixed fee for the transport of any volume of gas within the area covered by the tariff. Low-pressure distribution systems invariably use postal tariffs.
The advantages of postal tariffs can be seen precisely in their use in distribution or other highly meshed and concentrated systems; they are simple, transparent and are easy for new entrants to use. This simplicity means that they are often the first tool used by a new regulator when it sets about the complex task of overseeing the gas sector. Effectively, total allowed revenues can be divided by required system capacity, resulting in a unit is a tariff.

However, although postal tariffs continue to be used domestically in all non-EU countries (except Russia, which has a zonal system and by some EU member states, it is recognised that apart from some simple, small systems, postal tariffs have disadvantages. They are discriminatory between consumers in different parts of large systems, given that different amounts of investment have been required to serve different consumers. Moreover, they do not provide signals for efficient use of the system based on spare and tight capacity in different parts of the system. Postal systems may or may not be construed as a capacity charge.

4.3.2 Distance-based tariffs

Under distance-based tariffs, a shipper is required to pay a charge based on the distance between designated entry and exit points. They are usually expressed on a booked capacity basis in a dimension of € or $ / m³/h/100 km/year. In a number of Western European systems, the charge varies in relation to the diameter of the pipes used. This capacity charge would have to be paid regardless of utilisation. The only element reflecting utilisation would be the costs of fuel gas, which often would be supplied in kind. The specific transportation costs would then depend on the utilisation factor.

Where the load factor is high like in most long distance transportation (transit) systems serving long-term contracts with a high minimum pay (usually corresponding to at least 7000 hours of full utilisation, or a load factor of about 0.8) it may be practical to express the transport tariff in relation to the volumes transported. The unit used in the FSU is $/1000m³/100 km.

Distance-based tariffs are most useful for systems in which gas moves in one direction for long distances, with rather few intermediate takeoff points. In Europe, they have been used by a number of important systems, though recently they have often been supplanted by entry/exit tariffs for domestic transmission in some EU Member States. Outside the EU, distance tariffs are the norm, though they are usually presented in the form of a commodity charge rather than a capacity charge in view of the high utilisation factor for transit volumes.

Distance-based tariffs have the advantage of being rather simple, transparent and cost-reflective in an apparent way for one directional flows. However, they are criticised on a number of important counts. Notably, they may not be properly cost-reflective in systems where there is not one simple route between entry and exit points or where linear gas flows may be subject to some kind of displacement. They also favour incumbent users on the basis of the so-called portfolio effect under which shippers with multiple contracts based on several entry/exit points can minimise their transport charges by implicit swaps within their contract portfolio. New entrants with few contracts can only do this by engaging in open-market swaps with other shippers, something which is difficult to do in the early stages of market development. On the other hand, the use of a short distance of a system may also block the capacity of the system upstream and downstream.
4.3.3 Point-to-point tariffs

In this tariff system, a specific tariff is quoted for every entry/exit pair within the system. The advantage is that tariffs are explicit and should be cost-reflective, provided the system is physically modelled correctly. Nevertheless, this system is criticised for being very opaque. It can also become very complex, if there are a large number of entry and exit points. The method is also subject to criticism because of the portfolio effect and because it fails to provide any clear signals about capacity constraints at specific points in the system. The advantage for the operator is that he will have an overview of the flows requested and the required capacity to serve it.

4.3.4 Entry-exit tariffs

In this tariff system, a separate tariff is quoted for each entry and exit point. This can be seen as a specific form of point-to-point system, as a full point-to-point matrix can be constructed by adding together the two charges. Under the entry/exit tariff system, capacity booking can be done on the same basis\(^\text{16}\), that is, booking is done separately for each entry and exit point, with actual movements being based, ex-post, upon combining a shipper’s portfolio of capacity contracts. The split of entry and exit booking makes it difficult for the system operator to know whether entry capacity booked can be served, because it depends finally on the total balance between entry and exit capacity booked.

Entry/exit tarification almost inevitably requires detailed physical and financial modelling of system flows which can become rather complex and difficult to understand. Transco, the UK TSO, has provided a form of its system model so that interested outsiders can model their own flow patterns and see how this affects tariffs and other system factors.

- The entry/exit system allows for the development of a much more flexible market in capacity contracts, allowing new entrants easier access to the system without incurring the risk of onerous balancing charges\(^\text{17}\) (eventually at the expense of system operability). Ultimately, this market in capacity contracts can lead to a semi-regulated market in which some charges are set by the market, rather than by the regulator. This advantage is offered by the UK system of auctioning entry capacity, which nevertheless led to enormous scarcity rents in St. Fergus without triggering the investment to reduce the scarcity.
- This system allows charges to be based much more closely on marginal costs, rather than on historic costs. In practice, however, full-cost recovery based on historic investment usually takes priority.

In highly meshed systems operating with small transport volumes relative to the overall system capacity, the system may work like a tub where extra gas put into the system raise the overall level and can be taken out of the tub anywhere without causing any specific costs.

Entry/tariffs may gradually become the norm inside the EU, except for small and simple systems. However, in practice, there is a tendency for such tariff systems to resemble postal systems in that charges tend to become rather uniform for most entry or exit points. It is questionable whether that system is suitable for linear systems which are typical for long-
distance transit of Russian or Algerian gas as it could lead to cross-subsidisation of long-distance shipments by shorter distance.

In practice various hybrid systems have been developed which combine elements from two or more methods. The zonal systems in France and Austria, for example, have the elements of distance-based, postal and even entry/exit tariffication, while the Irish system combines postal and entry-based tariffs.

### 4.4 Model Calculation of Transit Tariffs

The previous chapters have been concerned with the theory rather than the practice of gas transit tariffs. In this chapter, initially, the cost of transportation for a pure transit pipeline with only one entry and exit point is discussed. Subsequently, the impacts of depreciation on the cost of transportation are presented through various sample cases for illustration purposes.

#### 4.4.1 Model for a new transit pipeline

The pipeline considered here is based on an actual line surveyed and cost in 2003 for a transit route. Since then pipe prices have increased quite sharply. Its length is 1500 km which includes 980 km of flat, 320 km of rolling and 200 km of hilly terrain with 6 major rivers, 100 paved roads and 24 canals or railways to be crossed. The pipeline was based on a capacity of 31.7 bcm with six compressor stations operating to inlet pressures of 90 bar (corresponding to outlet pressure of 120 bar). All SCADA (Supervisory Control and Data Acquisition), metering and isolation valve costs are included as are all land purchase and way-leave costs with crop compensation together with initial surveys, engineering and project management costs. Pipeline costs are essentially linear in terms of distance over similar terrain so these costs can be readily expanded to longer distances.

It should be emphasised that all long distance pipelines are unique and that it is not possible to provide any exact cost model for all contexts. The pipeline considered here is laid through some hilly, though not mountainous, terrain in central Asia. Land acquisition costs were relatively low, but the region was fairly remote. Pipeline construction would be easier than in Siberia, though more difficult than in Western Europe (where, on the other hand, land acquisition and environmental issues would involve higher costs). The pipe diameter used (56 inch or about 1600 mm) is the largest in current production and represents the lowest-cost way of moving large volumes of gas. Most of the existing transit lines are smaller. The use of this example is to provide a benchmark tariff level at the bottom end of the cost-scale.

The pipeline cost was estimated in US dollars. The current cost in € would be about 3.28 billion.

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18 Original pipe costs were $500/tonne; these have escalated to $1200/tonne by early 2005. The costs have been adjusted for these higher pipe costs.
Table 4.1: Capital cost of a model transit pipeline

<table>
<thead>
<tr>
<th>Item</th>
<th>$ million</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line pipe</td>
<td>1,874</td>
</tr>
<tr>
<td>Construction, incl. ROW &amp; land purchase</td>
<td>651</td>
</tr>
<tr>
<td>Compressor stations</td>
<td>765</td>
</tr>
<tr>
<td>Metering facilities</td>
<td>57</td>
</tr>
<tr>
<td>Block valve / launcher receiver stations</td>
<td>44</td>
</tr>
<tr>
<td>Associated infrastructure</td>
<td>148</td>
</tr>
<tr>
<td>Engineering &amp; project management</td>
<td>230</td>
</tr>
<tr>
<td>Insurance</td>
<td>30</td>
</tr>
<tr>
<td>Contingency (@ 12.5%)</td>
<td>471</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4,270</strong></td>
</tr>
<tr>
<td>Length/km</td>
<td>1,500</td>
</tr>
<tr>
<td>Pipe diameter</td>
<td>56 inches</td>
</tr>
<tr>
<td>Pipe capacity</td>
<td>31.7 bcma</td>
</tr>
</tbody>
</table>

Notes:  
i) Overall line pipe based on API 5L X70 at $1200/tonne plus 3 layer polyethylene external coating, internal coating and transportation to site.  
ii) Construction costs include factored installation costs per 100 km section, dependant on terrain.  
iii) Associated infrastructure includes roads, power distribution and housing required for new facilities operation, tunnels and bridges.  
iv) Taxes and duties are excluded.  
v) Price basis date: April 2003 adjusted for January 2005 pipe price.

Annual operating costs for this line are estimated to be $63 million, derived largely from the fuel gas for compression. The gas charge is based on a usage rate of 3% of throughput charged at $45/1000m³.

The allowable revenue for this pipeline for the first five years of its life is shown in Table 4.2 based on straight-line depreciation of capital (including interest during construction) over 30 years and a return on capital of 10%. This return is low by international hydrocarbon-company standards, though rather high compared with the WACC used by western European regulators.

Table 4.2: Allowable revenue on a model transit pipeline for first five years ($ million)

<table>
<thead>
<tr>
<th>Total depreciation</th>
<th>185</th>
<th>185</th>
<th>185</th>
<th>185</th>
<th>185</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPEX</td>
<td>63</td>
<td>63</td>
<td>63</td>
<td>63</td>
<td>63</td>
</tr>
<tr>
<td>Return on capital (10%)</td>
<td>536</td>
<td>517</td>
<td>499</td>
<td>480</td>
<td>462</td>
</tr>
<tr>
<td>Pipeline allowable revenue</td>
<td>784</td>
<td>765</td>
<td>747</td>
<td>728</td>
<td>710</td>
</tr>
</tbody>
</table>

Note: Interest during construction period is included.
This allowable revenue is based on the assumption that the line is used to capacity from its opening, something which in practice is unlikely. Lower capacity usage, at least in the initial years, would lead to higher unit tariffs if the full investment cost were allowed into the rate base. There are several ways in which this allowable revenue can be converted into a unit tariff to facilitate comparisons. It is assumed here that a single tariff is used rather than one that comprises capacity and commodity charges.

The three most common procedures would be (a) an entry/exit charge based on a single entry and exit point; (b) a distance-based tariff and (c) a commodity-based distance charge. The allowable revenue declines slowly with time as the non-depreciated asset base declines due to depreciation. A declining tariff can be avoided either by using some form of ‘economic’ depreciation as described in Appendix 1 or by adopting a 5-year average, but having then the same problem for the next five years. The second option is simpler giving an initial 5-year average of $746 million (€574 million). It is assumed that the pipeline is used to its full capacity. If lower load-factors were assumed, then calculated tariffs would rise. The results are shown in Table 4.3 for the first five years. A Euro tariff is used for the first two types, whilst a US Dollar rate is retained for the third as this is the usual currency for these cases.

Table 4.3: Initial 5-year unit tariff for a model transit pipeline

<table>
<thead>
<tr>
<th>Type</th>
<th>Tariff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance-based</td>
<td>0.11 €/m³/hr/km/a</td>
</tr>
<tr>
<td>Entry/exit</td>
<td>80 €/m³/hr/a for each point</td>
</tr>
<tr>
<td>Commodity</td>
<td>1.6 $/1000m³/100 km</td>
</tr>
</tbody>
</table>

In addition, a service fee of 4.3 €/m³/hr/a is charged. No commodity fee is payable.

**Costs and pipe diameter**

The costs quoted above are for a large-diameter pipe operating at the limit of current technology. It is likely that a new long-distance gas pipeline would be built on this scale. However, it is of interest to examine how much costs would change if smaller diameter pipe were to be used. There are a number of factors at work in such cost changes, but the major points are that:

1. At a given pressure, the volume of gas which can be carried through a pipe will depend upon diameter rising approximately as the square. The exact relationship according to the standard Panhandle formula is that flow-rate will rise as the power of 2.5 all other factors being equal. This means that if pipeline diameter in the example shown above fall from 56-inch to 28-inch its flow-rate will decrease by a factor of about 5.6 from 31.5 bcma to about 5.6 bcma.

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19 Based on an exchange rate of $1.3=€1.
20 €574 million/1500 km/3.618 million m³/hr peak booked capacity.
21 €574 million/3.618 million m³/hr peak booked capacity/2.
22 $746 million/15/31.7 million 1000m³
23 In the Panhandle formula, diameter, inlet pressure and temperature are the key design parameters, which have implications on economies of scale for capacity in the construction phase of pipelines.
24 The increase is greater than the power of 2 which might be expected from geometry alone.
2) At the same time, the costs of building the line will drop by a much smaller amount for a given route. The exact amount will depend upon location, but some costs such as wayleaves, design costs and infrastructure will remain largely constant. The cost of pipe itself will fall but at a rate closer to a linear than a quadratic relationship. Thus, the cost of 26-inch pipe will be little less than half that of 56-inch, whilst the flow-rate will fall by a factor of 5.6. This is illustrated by data from the annual Oil & Gas Journal gas-pipeline survey shown in Table 4.4. The data for 56-inch line is for the example discussed above as no line of this size was built in the USA in 2004.

<table>
<thead>
<tr>
<th>Pipeline diameter (in)</th>
<th>Cost ($/in dia/m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>56</td>
<td>24.42</td>
</tr>
<tr>
<td>36</td>
<td>27.5</td>
</tr>
<tr>
<td>20</td>
<td>47.9</td>
</tr>
<tr>
<td>16</td>
<td>67.2</td>
</tr>
<tr>
<td>12</td>
<td>176.9</td>
</tr>
<tr>
<td>8</td>
<td>125</td>
</tr>
</tbody>
</table>

Note: Data for 56-inch from report estimates using 2003 pipe costs.


If the new line were to be 36-inch, then according to the data in Table 4.4 its cost would be reduced to $3,019 billion, whilst its flow-rate would be reduced to only 10 bcm/a. In rough terms, this means that all the tariffs calculated above should be multiplied by a factor of about 2.1. It should be emphasised that the cost data for the smaller lines is based on US costs which means that some factors such as wayleaves and labour costs will be higher than in the report model.

The depreciation and rate-of-return assumptions can also be varied. Depreciation periods for as long as 40-years are commonly used which would decrease the depreciation flows shown in Table 4.3 by 25%. The 10% rate-of-return assumed is higher than that allowed by most western European regulators though, as noted above, exceptions allowing higher ROR have occurred recently with respect to new infrastructure. As Nitzov has noted, risk factors in some other gas transit countries would also lead to allowed ROR higher than 10%. This assumption was made to allow comparison with established tariff rates rather than to assess ROR required to construct an actual long-distance pipeline.

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25 The share of steel in the overall pipeline costs is about one third, so that the cost increase of 140% observed in the steel price in the last two years would translate into a cost increase of almost 50% for a laid pipeline.


27 Assuming compressor and engineering costs remain constant.

4.4.2 Impact of Depreciation in Cost of Transportation

In this section, the impacts of depreciation and of recent vs. old pipeline design on the average cost of transportation are presented through various sample cases, just for illustration purposes.

The following 4 different hypothetic pipelines are assumed in order to better illustrate the changing costs with a change in pipeline diameter and pressure:\(^{29}\):

**Table 4.5 Model Pipelines**

<table>
<thead>
<tr>
<th></th>
<th>Pipe A</th>
<th>Pipe B</th>
<th>Pipe C</th>
<th>Pipe D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter (in)</td>
<td>56</td>
<td>40</td>
<td>56</td>
<td>40</td>
</tr>
<tr>
<td>Pressure outlet (bar)</td>
<td>120</td>
<td>120</td>
<td>55</td>
<td>55</td>
</tr>
<tr>
<td>Pressure inlet (bar)</td>
<td>90</td>
<td>90</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>Nr of compressors</td>
<td>4</td>
<td>4</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Distance (km)</td>
<td>1500</td>
<td>1500</td>
<td>1500</td>
<td>1500</td>
</tr>
<tr>
<td>Optimized max throughput (bcm/y)</td>
<td>31.7</td>
<td>13.5</td>
<td>20.5</td>
<td>8.0</td>
</tr>
<tr>
<td>Utilization rate (%)</td>
<td>80</td>
<td>80</td>
<td>80</td>
<td>80</td>
</tr>
</tbody>
</table>

While Pipes A and B represent today’s state-of-the-art high-pressure pipelines, Pipes C and D are presented to take into account lower pressure pipelines, which have been already subject to certain level of depreciation.

Under the given pipeline diameters and pressures, optimized values are estimated for maximum throughput and compressors in each case.

The starting point for estimating a tariff is the current asset value of the system under consideration. Depreciated replacement value methodology is used for asset valuation. Using standard cost values for these:\(^{30}\), the replacement costs for 56 and 40 inch pipeline are estimated as $4.215 billion and $3.010 billion, respectively:\(^{31}\).

*Figure 4.2* provides a sample illustration of the impact of depreciation on the overall cost of transportation for different cases of pipeline diameter and pressure (from new pipe to 50% depreciation).

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\(^{29}\) Assuming all other technical data constant.

\(^{30}\) $25000/inch diameter/km pipeline cost

\(^{31}\) Cost of financing excluded
Figure 4.2 Average Cost of Transportation Index vs. Depreciation

Table 4.6 shows the change in average cost of transportation for new and depreciated (25% and 50%) pipelines:

<table>
<thead>
<tr>
<th>Depreciation (%)</th>
<th>Pipe A</th>
<th>Pipe B</th>
<th>Pipe C</th>
<th>Pipe D</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>20.7</td>
<td>31.5</td>
<td>35.2</td>
<td>56.3</td>
</tr>
<tr>
<td>25</td>
<td>16.8</td>
<td>24.9</td>
<td>28.7</td>
<td>44.3</td>
</tr>
<tr>
<td>50</td>
<td>12.8</td>
<td>18.1</td>
<td>22.2</td>
<td>32.1</td>
</tr>
</tbody>
</table>

The following observations could be made out of the figure and table above:

- As regards high pressure pipelines with 120 bar outlet pressure, the average cost of transportation increases by 55% with a reduction in pipeline diameter from 56 to 40 inch. This figure is almost 60% with lower pressure pipelines.
- High pressure pipeline technology has considerable positive impacts in the reduction of pipeline costs. A decrease in the external pressure from 120 bar to 55 bar will increase the average cost of transportation by a factor of 1.7-1.8.
- Transportation costs are directly proportional to the level of depreciation of pipelines. Concerning lower pressure pipelines, the average cost of transportation drops down to 0.57 of the original cost figure at 50% depreciation.
4.4.3 The impact of inflation / exchange rates

Throughout the life of pipelines, there may emerge various external factors that would affect the level of transport tariffs, such as, changes in currency rates, inflation in the country, but also variations in world steel prices.

Variations in world steel prices would affect the replacement cost value of an existing system, without any additional costs incurred by the system operator; the value of the overall system would just fluctuate in parallel with the share of steel costs in the costs of a new pipeline. A similar effect for the replacement cost value will be caused by fluctuations in the value of the currency in which major components of pipeline construction are priced, predominantly the US Dollar, in some cases the Euro.

A different effect is the translation of a tariff priced and expressed in local currency into an international currency, if such local currency is subject to substantial inflation and finally a corresponding impact on the exchange rates. A case in point is the dramatic change of the exchange rate between the Rouble and the US Dollar (Figure 4.4) or other Western currencies, which happened in 1998 in Russia (and similar effects for the currencies in Belarus and Ukraine). Figure 4.3 gives an illustration of this effect for Russian transportation tariffs. While the tariff expressed in Roubles increased, the tariff expressed in US Dollar dropped in line with the collapse of the Rouble.

Figure 4.3 Transport Tariffs in Russia (1000m^3/100km)
Figure 4.4  Exchange Rates (Rouble per US Dollar, end of year)
5 Actual transit tariffs

5.1 EU Tariff Methodologies

The obligations to ensure cost-based, transparent and non-discriminatory transit tariffs are imposed on the EU countries also through the Gas Market Directive of 2003. These obligations are stipulated in Articles 8 and 18 which read as follows:

Article 8

Tasks of system operators

…

2. Rules adopted by transmission system operators for balancing the gas transmission system shall be objective, transparent and non-discriminatory, including rules for the charging of system users of their networks for energy imbalance. Terms and conditions, including rules and tariffs, for the provision of such services by transmission system operators shall be established pursuant to a methodology compatible with Art. 25(2) in a non-discriminatory and cost-reflective way and shall be published.

Article 18

Third Party Access

1. Member States shall ensure the implementation of a system of third party access to the transmission and distribution system, and LNG facilities based on published tariffs, applicable to all eligible customers, including supply undertakings, and applied objectively and without discrimination between system users. Member States shall ensure that these tariffs, or the methodologies underlying their calculation shall be approved prior to their entry into force by a regulatory authority referred to in Article 25(1) and these tariffs — and the methodologies, where only methodologies are approved — are published prior to entry into force.

These provisions will be further strengthened and clarified by currently negotiated EU Regulation which is largely concerned with the access to grids, but also proposes the following rules for the setting of domestic transport tariffs.

Art 3: Tariffs for access to networks

Tariffs, or the methodologies used to calculate them, applied by transmission system operators and approved by the regulatory authorities pursuant to Art 25(2) of Directive 2003/55/EC, as well as tariffs published pursuant to Art 18(1) of that Directive, shall be transparent, take into account the need for system integrity and its improvement and reflect actual costs incurred, whilst ensuring appropriate incentives with regard to efficiency, including appropriate return on investments, and where appropriate taking account of the benchmarking of tariffs by the regulatory authorities. Tariffs, or the methodologies used to calculate them, shall be applied in a non-discriminatory manner.

[…]

32 Directive 2003/55/EC
33 Common position adopted by the Council with a view to adoption of a Regulation of the European Parliament and of the Council on conditions for access to the natural gas transmission networks 11652/2/04, 12 November 2004
Inside EU countries, two forms of tariff setting and grid access were originally envisaged in the first EU Gas Market Directive — regulated and negotiated. In the latter, no published tariffs or access conditions were provided but, in principle, each transport contract was negotiated separately. Negotiated access was required to operate with a set of published guidelines as to tariffs which might be expected and, over time, these essentially developed into rather rigid tariffs. Under the new directive, it is expected that regulated access will become the norm.

The growth of regulated access has stimulated a wide-ranging debate over appropriate methodology, much of which can be seen in the successive Madrid Forums carried out every six-months under the auspices of the European Commission which brings together EC officials and regulators together with industry and consumer representatives to elaborate on the application of the Gas Market Directive as it applies to the EU gas sector.

The basic function of a tariff is to ensure a revenue flow to the owners of a pipeline that is sufficient to cover operating costs (including maintenance and refurbishment) and provide a reasonable return on the capital invested. A rather wider set of aspirations for pipeline tariffs has been developed at the Madrid Forum. These include the consensus that tariffs should:

- be cost reflective and based on robust modelling of flows and the network;
- facilitate efficient gas trade, facilitate market liquidity and gas-to-gas competition;
- ensure high levels of transparency;
- provide effective and timely signals encouraging efficient long-term investment in transport infrastructure;
- take into account the specificities and market characteristics of different networks;
- provide a fair return on investment for TSO’s and appropriate oversight; and that
- be differentiated among various customers only on the basis of differences in underlying costs.

These principles essentially rest upon two broad needs: that the tariff should be transparent, fair to all customers and reflect costs and that they should also encourage the development of gas trade and market development. Although these broad aspirations are not controversial, it should be noted that they are not necessarily without contradictions in practice. It can be argued, for example, that in situations where pipelines are congested, the operator should base tariffs on prospective costs, that is the costs providing additional capacity so that future consumers can benefit from a more competitive gas supply. However, the possibility that at some point in the future consumers inside another supply system will be able to obtain gas at a lower price because their supply choice is wider is not necessarily a benefit either to the operator making the investment or to his own customers, unless tariff design is able to pinpoint transport charges specifically to these future consumers.

There is little controversy that postal tariffs do not meet these criteria, only in the case of small and simple grid-like systems or in low-pressure distribution systems. In the EU, Ireland, Denmark, Luxembourg, Spain, Sweden, Poland and the Czech Republic do use some form of postal tariffs, though the latter two countries are likely to adopt more complex methodologies in the near future.

34 All papers and presentations at these are available for inspection in the web-site of the EC Energy Directorate. The two appendices on aspects of tariff methodology contained in this report are both taken from reports presented to the Madrid Forum.
The main alternatives inside the EU are distance-based and entry/exit tariffs, with a tendency to move to the latter. The Council of European Energy Regulators is firmly in favour of entry/exit tariffs and has summarised its conclusions on the general methodological choices as follows:

**Competition and flexibility:** The primary benefit of an entry-exit model is that it promotes competition and provides flexibility. The separation of entry and exit point for capacity allocation is a key feature that contributes to improving tradability of gas, which in turn can help to facilitate the development of gas-to-gas competition and the development of hubs. In addition, the separation of tariffs, irrespective of the capacity booking regime, may have benefits where the “portfolio effect” is significant. Similar findings on competition and flexibility were presented in the Brattle’s 2002 report.35

**Cost reflectivity:** In terms of cost-reflectivity, on very meshed networks where locational differences and predominant flows are very important, a point-to-point tariff based on incremental cost modelling possibly provides a fairly cost-reflective approach. By contrast, distance-related charges tend only to be cost reflective for unidirectional flows on relatively linear networks. On the other hand, any tariff regime will necessarily be an approximation to cost-reflectivity. There is a balance to be struck in relation to the degree of cost-reflectivity against other objectives. In any case, entry-exit tariffs are capable of providing a greater degree of cost reflectivity, in particular as compared to distance related tariffs.

**Simplicity (transparent):** Entry-exit tariffs provide a degree of simplification in terms of the number of tariffs that need to be published. However, in terms of simplicity, it seems reasonable to argue that one of the benefits of distance related tariffs on very simple networks is that it is easy to understand the link between distance travelled on a particular gas network and the associated cost. Where network maps are published and where the physical routes are known, it is quite simple to derive such a tariff. However, on more complex networks where contractual and physical flows do not necessarily coincide and “backhaul” calculations are required, distance-related tariffs will necessarily become more complex. At the very least, distance-related tariffs will offer fewer benefits in terms of simplicity compared to the case where contractual and physical flows coincide.

**Adaptability:** In order to take into account the specificities and market characteristics of different networks, it is important that any tariff regime be adaptable. The discussion of entry-exit tariffs in this paper highlights that this regime can accommodate a range of network “problems”, in particular those that have been highlighted by GTE. Although, for example, internal constraints on networks represent a possible difficulty, there are various tools available to TSO’s. In addition, entry-exit tariffs can be applied in a number of ways including incremental cost approaches capable of signaling locational differences to other solutions that might be aimed more at ensuring recovery of average costs where, for example, locational differences are less important than other objectives. The conclusion in this area is that entry-exit tariffs are capable of accommodating the most important national differences highlighted.36

This description of the advantages of entry/exit tariffs underestimates the difficulties in terms of ensuring transparency. Complex modelling of the system is required to develop fair entry/exit tariffs. Such tariffs may be difficult to predict because of the separation of entry and exit bookings and may not provide adequate incentives for investment to remove bottlenecks. Distance-based tariffs in systems with predominantly unidirectional flow characteristics with little counter flow do have the strong advantage of relating a simple test of costs and distance moved, with the actual charge.

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The following section reviews the actual transit tariffs in some key gas transit countries within the EU and in Switzerland.

5.2 Tariffs in EU countries and Switzerland

5.2.1 Austria

Austria provides important transit routes to Italy, Germany, Hungary, Slovenia and Croatia. The TSO responsible for gas transit and for the bulk of local gas supply is OMV Erdgas. Although some gas for local supply comes across the German border, all transit and most local gas is of Russian origin and is received at the Baumgarten interconnection point located at the Slovak border. From Baumgarten, the Trans-Austria-Gasleitung (TAG) runs south; the March-Baumgarten-Gasleitung (MAB) north-east; the West-Austria-Gasleitung (WAG) west; and the Hungaria-Austria-Gasleitung (HAG) south-east. The Süd-Ost-Leitung (SOL) branches off TAG at Weitendorf. TAG moves gas to Italy and, via SOL, to Slovenia and Croatia. MAB is a short link to gas storage on the Austro/Slovakian border which is capable of bi-directional movement. WAG is the main transit line west to Germany via the Penta-West line and onward to France. HAG is a short (46 km) line which moves gas Hungary. A little more than 40 bcm is shipped annually through Baumgarten.

Austrian local gas supply is regulated by the Energie Control, the recently established regulatory energy, which has introduced a system of zonal tariffs for domestic supply. However, the transit lines are not regulated and operate under different tariff regimes. The main transit lines, TAG and WAG, although still owned by OMV, have had their transportation rights transferred on an exclusive basis to two private companies in which OMV shares ownership with external companies. Neither of these has yet published any tariff schedules. The only transit line for which OMV have published tariffs is the 94.4 km long PENTA West line which is part of the system moving gas into Germany. The tariff for this line is distance-based with an additional commodity charge and is set at:

- \[ 5.275 \text{€}/m^3/hr/a + 0.258 \text{€}/m^3/hr/km/a \]

Furthermore, “the transit customer shall make available the required fuel for the hydraulic compression of the gas flow, if necessary”\(^{38}\).

A wheeling\(^{39}\) service is available for transit flows at a cost of:

- \[ 1,021.00 \text{€}/month + 0.41 \text{€}/Nm^3/month \]

Available capacity on the TAG line is published and shows that the line is fully booked until at least 2006, apart from some limited capacity at Weitendorf where the Slovenian line branches. A TAG III loop line is likely to relieve this congestion in the coming years.

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\(^{37}\) www.omv.com/smgr/portal/jsp

\(^{38}\) No further information is available on what this might entail.

\(^{39}\) That is minimization of travel distance by internal swaps of transported gas inside the OMV system.
5.2.2 Belgium

The Belgian TSO Fluxys operates all high-pressure lines. Belgium is an important transit country carrying gas from the hub at Zeebrugge, where pipelines from Norway and the UK and an LNG terminal all come ashore, eastward to Germany at Eynatten. East-west transit to the U.K./Belgium Interconnector is also possible. The second transit route goes south from the Netherlands to France. This route carries both high-calorific gas compatible with most other supplies and also the low-calorific gas from the Groningen field which has its own transmission systems in Belgium, France and Germany.

Local gas transport in Belgium is regulated and based on an entry/exit tariff system. However, transit of gas is at the moment unregulated and based on negotiated access for which indicative tariffs are published (proposals by Fluxys for the regulation of transit gas are at present before the Belgian regulator). These tariffs are based on a simple distance-based methodology and are set at:

\[ 8 \text{ €/m}^3/\text{hr}/\text{a} + 0.20x(900/D)^{1.5} \text{ €/m}^3/\text{km}/\text{a} \]

(D=900 for all pipes larger than 900 mm)

A commodity charge will be added to these indicative capacity charges on a case-by-case basis. The normal booking period for transit contracts is one year. Transit gas is subject to more restrictive access conditions than local gas movement, as no flexibility services are offered and transit shippers are required to balance their flows on an hourly basis.

5.2.3 The Czech Republic

The Czech Republic is the main route for the movement of Russian gas to Germany at Waidhaus. This position is now being challenged by the expansion of the Yamal line through Poland. About 28 bcm of gas is moved through this route managed by the Czech TSO, Transgas. No transport tariffs for gas inside the Czech Republic are currently published either for domestic or for transit gas, although to comply with the requirements of EU membership such publication is required and may be expected shortly.

The transit of Russian gas is based on the long-term partnership arrangements made with the Soviet Union when the Yamburg field was being developed and a pipeline was being built to supply the Western European market. Former Czechoslovakia participated in this project along with most other Eastern European states by providing the funds and the equipment in exchange for gas supplied by Gazprom. These deals expired in the mid-1990s and were replaced by long-term gas supply and transport contracts (the one with the Czech Republic was signed in 1998). These provided for a 15-year supply of 8-9 bcm annually. A 22-year transit transport contract was also agreed at the same time. Transgas also moves gas to St. Katharini (at the border with former East Germany) for Wintershall and Verbundnetz Gas AG under West European type transport contracts.

No terms for the Gazprom transit contract have been revealed. Moreover, it is not known whether the price at which gas is supplied to Transgas is in any way linked to this contract. It appears that Gazprom in earlier times used to pay transit fees in the form of gas made available to Transgas. In 2000, about 1.8 bcm was provided in return for transiting 27.2 bcm to Germany that is approximately 6.6% of the gas moved. It is not clear whether this volume

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is linked to the border price of gas or if it is based on a fixed proportion of gas moved. The distance between Landshot and Waidhaus is about 350 km, so at current prices of $120/1000m³ the effective tariff would be 2.1 $/1000m³/100 km.

In 2003, Transgas earned 7.46 billion Czech krona (CZK) (or about $287 million), in ‘foreign transport’, presumably providing transit/transport services. Assuming that 28 bcm were shipped, this would imply an effective tariff of 2.7 $/1000m³/100 km on a commodity/distance basis or 0.195 €/m³/km/a at an assumed load factor of 85%. This compares with the distance-based element of the Fluxys tariff of 0.2 €/m³/km/a and 0.23 for Wingas in Germany. In both cases, a non-distance related service charge is added. It should be emphasised that these tariffs are imputed indirectly and are not based on any published tariffs.

5.2.4 Germany

Germany is almost unique amongst ECT countries in having a number of significant competing TSOs. But there is also a significant element of regionalisation which means that many transport movements and their associated contracts are complicated by having to be arranged simultaneously with more than one operator. There are only two TSOs which have any significant role in gas transit: Ruhrgas and Wingas. Their primary role in transit is the movement of Russian gas westward, though Ruhrgas is also involved in the transit of Norwegian and Dutch gas from entry points in the north-east of Germany to destinations in the south and east.

Gas tariffs in Germany have until now been based on negotiated access and all TSOs published indicative tariffs based on a capacity-distance methodology. The German energy law was substantially changed and entered into force in July 2005. A specific energy regulator, the Federal network agency, was established. According to the new legal framework the domestic tariffs will be regulated by an ex-ante approval of the regulator and an incentive-regulation is foreseen. Furthermore an entry-exit system was introduced. Some TSOs, including Ruhrgas, have already made the switch, though some still publish distance-based tariffs.

The Wingas tariffs are published and comprise a distance-based charge and a capacity-based charge. They are also a function of pipeline diameter and vary as follows:

- 0.18 €/m³/hr/km/a for pipes over 1000 mm diameter
- 0.23 €/m³/hr/km/a for pipes 700-1000 mm diameter
- 0.74 €/m³/hr/km/a for pipes 350-500 mm diameter

In addition, there is a service fee of 4.34 €/m³/hr/a.

In 2004 Ruhrgas switched to an entry/exit tariff methodology. Table 5.1 shows these charges for entry and exit points. Only high-calorific entry points are included as no low-calorific gas is transited by Ruhrgas.

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42 www.wingas.de
Table 5.1: Entry and exit charges for external Ruhrgas points (in €/m3/hr/a)

<table>
<thead>
<tr>
<th>Entry points</th>
<th>From</th>
<th>Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waidhaus</td>
<td>Transgas (Czech Republic)</td>
<td>32.10</td>
</tr>
<tr>
<td>Oberkappel</td>
<td>OMV (Austria)</td>
<td>42.72</td>
</tr>
<tr>
<td>Ellund</td>
<td>DONG (Denmark)</td>
<td></td>
</tr>
<tr>
<td>Eynatten</td>
<td>Fluxys (Belgium)</td>
<td>34.78</td>
</tr>
<tr>
<td>Emden</td>
<td>Gassco (Norway)</td>
<td>30.05</td>
</tr>
<tr>
<td>Bocholz</td>
<td>Gas Transport (Netherlands)</td>
<td>35.09</td>
</tr>
<tr>
<td>Oude Statenzijl</td>
<td>Gas Transport (Netherlands)</td>
<td>26.99</td>
</tr>
<tr>
<td>Dormum</td>
<td>Gassco (Norway)</td>
<td>35.84</td>
</tr>
<tr>
<td>Keibaum</td>
<td>Wingas (Poland)</td>
<td>67.86</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Exit points</th>
<th>To</th>
<th>Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eynatten</td>
<td>Fluxys (Belgium)</td>
<td>29.80</td>
</tr>
<tr>
<td>Medelsheim</td>
<td>GdF (France)</td>
<td>29.94</td>
</tr>
<tr>
<td>Oberkappel</td>
<td>OMV (Austria)</td>
<td>29.94</td>
</tr>
<tr>
<td>Wallbach</td>
<td>Transitgas (Switzerland)</td>
<td>29.94</td>
</tr>
</tbody>
</table>

It can be seen from Table 5.1 that the Ruhrgas transit charges do not vary much with distance. The highest transit charge would be for Russian gas via Poland from Keibaum to France, Austria or Switzerland at 97.8 €/m³/hr/a and the lowest Dutch gas from Oude Statenzijl at 56.79 €/m³/hr/a. This is significantly lower than the model charges derived above for a transit line and for two TSOs in Italy and France, even though the previous distance-based tariff of Ruhrgas had the opposite bias.

Exact comparisons between the two tariff systems are not possible, but it is possible to make a reasonable comparison between movements from the Polish border to Belgium. Wingas would charge €2.223 million for an annual capacity booking of 10,000 m³/hr plus 2.34% of the gas moved. The Ruhrgas charge for a similar movement would be €0.977 million. This is a specific example of the bias in entry/exit systems in favour of shipments over longer distances.

Other tariffs charged by German operators are similarly distance-based and set at the following rates:

- **Ruhrgas**: 0.273 €/m³/hr/km/y
- **Bayerngas**: 0.22 €/m³/hr/km/y for pipes >900 mm
- **BEB**: 0.18 €/m³/hr/km/y > 1000 mm
- **RWE**: 0.19 €/m³/hr/km/y >1000 mm
- **VNG**: 0.18 €/m³/hr/km/y > 1000 mm

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43 These tariffs all refer to mid-2004. Since then, German operators have been moving to use entry/exit tariffs in anticipation of the new German Energy Law. The draft of the new law was adopted by the Bundestag (First Chamber) on 15 April 2005, providing for entering into force on 1 July 2005. The Bundesrat (Second Chamber) in its session of 29 April 2005 has raised several objections so that the draft law will become subject to the mediation procedure between the two Chambers.
5.2.5 Poland

Poland has become an important transit country since the opening of the Yamal pipeline which brings gas from Russia via Belarus. Initially intended as part of the development of the huge gas reserves of the Yamal Peninsula, the pipeline now acts as an alternative transport route to Ukraine for the movement of Western Siberian gas to Western Europe.

The Yamal line crosses 680 km of Poland and will have a capacity of 32 bcma, once all compression stations have been installed. It is owned and operated by a private company, EuRoPol Gaz, which is 48% owned by the Polish state-company Polish Oil and Gas (POGC), 48% by Gazprom and 4% by a Polish-registered company which has both Russian and Polish shareholders. The transit tariffs for the line are in practice determined by negotiations with Gazprom. These negotiations have been conducted, at least in part, on a state-to-state basis and have been connected both with the investment required to complete installation of the remaining three compressor stations and with a desired reduction in take-or-pay contracts signed between POGC and Gazprom at a time when expectations of growth in gas demand were rather optimistic. As a consequence, POGC persuaded Gazprom to cut immediate gas supply volumes by as much as one-third.

The line delivers some gas to Poland and tariffs charged for this are regulated by URE. In principle, the line should be open for third party access (TPA) for deliveries into Poland, though POGC reports that no applications for this have been received outside of the basic Gazprom contract.

The transit tariff for Yamal line has been set at:

$$\text{2.74 }\$/1000\text{m}^3/\text{100 km in 2004, and falling to 1.00 }\$/1000\text{m}^3/\text{100 km by 2016.}$$

If it is assumed that a simple annual base-load capacity booking is made, then this charge is equivalent to $0.24 or €0.18/m³/hr/km/a. This is comparable to the lowest Wingas charge.

A comparison with the Ruhrgas tariffs is possible only without taking into account distance factors.

The Polish domestic transmission tariff is set by URE at:

$$0.858 \text{€/1000m}^3/\text{100 km} \, + \, €4.73-8.79/1000\text{m}^3 \, \text{(depending upon the diameter of pipe).}$$

5.2.6 Slovakia

Slovakia is one of the most important gas transit countries in Europe. All gas for Western Europe from Ukraine is transited through Slovakia (from Velke Kapuszany on the Ukrainian border either to Baumgarten on the Austrian border or to Lanzhot on the Czech border). Available capacity of 90 bcm is split equally between Austria and the Czech Republic. In 2003, Slovensky Plynarensky Priemysel (SPP), the Slovak TSO transited about 67.5 bcm. This is down from 83.4 bcm transited in 2000 as the Slovak route has been affected by the opening of an alternative route for Russian gas through Poland. SPP owns 51% of the system and the remaining 49% is held by a group comprising Gaz de France (GdF) and Ruhrgas with Gazprom having an option to buy a packet of 16.33% (or alternatively 12.25%) of the shares.

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44 European Gas Markets 31 March 2003 p. 8 confirmed by personal communication with POGC.
45 €1 = 4.3PLN.
Currently held by these two. The total length of four transit lines with loopings of a fifth is almost 2270 km.

Most transit gas is moved under long-term transport agreements signed with Gazexport (the export arm of Gazprom), Wintershall (a joint-venture between Gazprom and Wintershall a subsidiary of BASF a German chemical company), VNG and Transgas. Contracts are also held to move gas for GdF, Ruhrgas, OMV and SNAM presumably for Russian gas delivered to the Ukrainian border. It has been reported\(^\text{46}\) that all available capacity in Slovtransgaz’ (the transport arm of SPP) pipelines has been booked under long-term take-or-pay contracts and that no spare capacity is available once the flexibility requirements of these contracts are taken into account.

The Slovak regulator has recently published details of a new transmission tariff regime which will cover without any distinction both transit and domestic shippers.\(^\text{47}\) The methodology used is an entry/exit regime based on three border points and a virtual domestic exit point which covers all physical points. The entry/exit price is determined by a combination of the maximum daily booked capacity and the duration of the contract, with customers booking larger volumes and for longer periods paying lower tariffs.

The basic entry/exit tariffs are shown below in Table 5.2.

**Table 5.2: Slovak entry/exit tariffs**

<table>
<thead>
<tr>
<th>Tariff (maximum daily booked capacity)</th>
<th>Initial rate at entry point (€)</th>
<th>Initial rate at exit point (€)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lanžhot</td>
<td>Baumgarten</td>
</tr>
<tr>
<td>&lt;25 million m³</td>
<td>0.2799</td>
<td>0.5046</td>
</tr>
<tr>
<td>&gt;25 million m³</td>
<td>0.2239</td>
<td>0.4037</td>
</tr>
<tr>
<td></td>
<td>Lanžhot</td>
<td>Baumgarten</td>
</tr>
<tr>
<td>&lt;25 million m³</td>
<td>1.4377</td>
<td>1.7312</td>
</tr>
<tr>
<td>&gt;25 million m³</td>
<td>1.1502</td>
<td>1.3850</td>
</tr>
</tbody>
</table>

The annual fee (\(P_f\)) is determined from this table as follows:

\[
P_f = (P_0 \ast (1-\alpha/1\,000\,000\ast C)\ast I)\ast C
\]

Where: \(\alpha =\) a daily capacity factor set at 0.008 for users below 25 million m³ maximum daily capacity and zero for others and

\(C = \) the contracted maximum daily capacity.

\(I = \) duration factor of contract set at 0.946 for contracts over ten years and at 1.006-0.006*D where D is the duration of the contract for those less than 10 years.

\(^{46}\) *European* *Gas Markets* 15 March 2004, p.1.

\(^{47}\) Office for Regulation of Network Industries, Decision No 003/2004/05/P.
It is difficult to compare this tariff with other tariffs except on a specific case-by-case basis. For a contract of more than 10 years with a yearly load of 100 million m³ and a 90% load-factor the Baumgarten exit tariff would be €421,613 annually, equivalent to a charge of €33.24 m³/hr/year. A comparison with Table 5.1 shows that this is broadly the same as the Ruhrgas entry/exit tariffs shown there. The use of a single rate for all internal transfer points amounts to the use of a postal tariff for domestic shippers, a reasonable simplification given the huge preponderance of transit movement in the Slovak system.

5.2.7 Switzerland

Switzerland has an important gas transit pipeline from Wallbach on the German border to Passo Gries on the southern Italian border. This line is 165 km long, partially looped. Its original purpose was to move Dutch gas south to Italy. In 2001 the ability to move Norwegian gas from Zeebrugge through Belgium and France to Italy was added with the completion of a 55 km branch from Rodersorf on the French border and the looping of the downstream part of the Swiss system to Italy. The line is owned by a company called Transitgas which is, in turn, 51% owned by Swissgas which procures approximately 75% of the Swiss natural gas consumption for its shareholders (four regional gas companies), 46% by ENI and 5% by Ruhrgas. The line is operated by Transitgas, with capacity rights split between ENI and Swissgas.

Switzerland is not an EU member and therefore is not subject to compulsory TPA. Access to the Transitgas line by third-parties is negotiated with the two partners. Originally, all transit gas flowing to Italy was contracted by ENI. However, pressure by the Italian regulator to reduce ENI’s share in the Italian market has led to the company selling off a part of its contract portfolio as well as some capacity rights to transit pipelines. ENI’s Swiss subsidiary manages transport contracts for 2.41 million m³/hr capacity between Wallbach and Passo Gries (approximately 21 bcm/a). It is in the process of auctioning almost 7% of this capacity to third-parties. The results of this will be announced during 2005. General Terms and Conditions are available on their web pages (www.enich.ch; www.swissgas.ch).

Third-party trading does take place both at the two entry points to Transitgas and at Passo Gries, suggesting that capacity has been available.

5.2.8 The United Kingdom

The U.K. is not an important transit country. Small quantities of Norwegian gas may be moved to Ireland via a pipeline under the Irish Sea or to the continent. The transits to Ireland may become more common once the U.K. is established as a major gas importer. However, it is unlikely that such trades will ever be large.

The importance of the U.K. is that its tariff methodology and access procedures have achieved gas market opening and established the national balancing point as a well working gas market place. The basis for U.K. methodology is an entry/exit model for the high-pressure system developed by Transco, the U.K. TSO, which is available for inspection and analysis by interested parties. The procedure has two important aspects. The first is that capacity bookings of entry and exit are completely separate. Shippers are required to balance their physical movements over a period, but this balancing is based on the portfolio of individual capacity contracts held by the shipper. Each capacity contract can be traded in a secondary market with licensed agents. The second aspect is that entry capacity is booked by an auction procedure (de facto where there is congestion, mainly in St. Fergus) without any set regulated tariff,
though Transco is allowed to set floor prices for each entry point. Exit point booking is undertaken by regulated tariffs.

The result of this system is that the U.K. has developed a very liquid secondary gas trading market based on a notional national balance point without any necessary reference to actual physical gas movement. It is this development of a secondary market which has attracted other regulators and the European Commission towards entry/exit tarification as a preferred methodology for other EU countries. One relevant aspect of the U.K. system is that it effectively removes the concept of ‘transit gas’. Although it may physically happen that Norwegian gas transits the U.K. transmission system into Ireland, separation of entry and exit point capacity booking removes this as a useful concept. However, four points should be made with respect to the U.K. practice.

First, the physical basis for U.K. gas supply and transmission is very different from that in other European countries. Gas comes into the U.K. from an increasing set of entry points a proliferation which is likely to increase further in the future as entry from Belgium and the Netherlands develops. This means that entry/exit tarification is almost inevitable given the lack of any clear directional flows.

Second, U.K. gas comes from a rather large number of offshore fields owned by a variety of operators. Included in this is a considerable volume of associated gas which has to be landed and disposed of to prevent interruption to oil production. This means that, once the onshore institutional barriers to movement and sale were removed, it was relatively easy for a large numbers of agents to enter the market both as suppliers and as shippers. The supply problems associated with very long-distance movements from single giant fields which characterize much of continental Europe are not present.

Third, the use of entry/exit tarification has not prevented problems with regard to investment to increase capacity at important entry points or complaints about market rigging, particularly with regard to the northern entry point of St Fergus. Also the southern cross-Channel Interconnector experienced a number of price spikes and unexplained price movements. No definite answers about these have emerged from various investigations, but it is clear that regulatory capacity has been strained by them and that the introduction of auctions has not resolved the need for effective regulation to foster new investment to remove bottlenecks.

Fourth, a considerable part of the entire U.K. gas supply system is unregulated, including offshore pipelines and the cross-Channel Interconnector, though there have been some recent efforts to include at least the latter inside the regulatory umbrella.

In summary, although the U.K. system has been very effective in developing a well functioning market place inclusive of a large and liquid secondary market, it is still unclear to which extent it can be replicated in the different environment other national gas systems in other countries.
**Box 1: Interconnectors**

In the EU Gas Market Directive of 2003, an interconnector is defined as “a transmission line which crosses or spans a border between Member States for the sole purpose of connecting the national transmission systems of these Member States”. In general, interconnectors are owned and operated by one of the TSOs in the countries connected and fall under the regulatory authority of this country. Handover arrangements between systems are mutually agreed and handover costs, where applicable, are included in the tariffs for movement to and from the national entry/exit border stations. This can include subsea interconnectors as well as land crossings.

The 235 km-long Interconnector connects Bacton in the U.K. and Zeebrugge in Belgium. It links with important beach landings in the two countries and as with an LNG terminal at Zeebrugge. Originally built primarily as an export line for a surge in U.K. supply in the North Sea, the line can move 20 bcm/a into Belgium, but only 8.5 bcm/a into the U.K. This imbalance is being rectified and the line will probably begin to operate largely as an import line into the U.K. in 2006, with a capacity of over 23 bcm/a.

The pipeline was built by a private-sector consortium and is operated by a private company, Interconnector (UK) Ltd. Access to the line was originally based on equity rights in proportion to the stakes held by the founding members of the consortium. The major company involved was BG, which holds a 25% stake. Other companies involved included: Amerada Hess (5%), BP (10%), Conoco Phillips (10%), Distrigas (10%), ENI (5%), E.ON Ruhrgas (10%), International Power (5%), Gazprom (10%) and Total (10%).

The capacity rights can be traded in various ways on a negotiated basis with the companies concerned. Equity capacity can be assigned to another company which can then itself trade or use the capacity, or sub-let to a shipper registered with Interconnector (UK). There is now an online software system, ISIS, which enables approved users to trade Interconnector capacity. The line is not regulated by either the British or the Belgian regulators. Although the British regulator is currently attempting to bring the company under some form of U.K. regulatory control, this is being resisted by the company.

Interconnector (UK) is funded by tariffs paid under long-term contracts until 2018 by the participating companies. The effective market tariff is set by market negotiation and is not publicly available. BG provides indicative tariffs for a minimum capacity of 2681 m³/hr which at the end of December 2004 were as follows:

<table>
<thead>
<tr>
<th>Period</th>
<th>Direction</th>
<th>Available capacity (m³/hr)</th>
<th>Price (p/therm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q2/Q3 2005</td>
<td>Forward</td>
<td>10 593</td>
<td>0.7</td>
</tr>
<tr>
<td>Q2/Q3</td>
<td>Reverse</td>
<td>10 593</td>
<td>3.0</td>
</tr>
<tr>
<td>Q4/05 Q1/06</td>
<td>Reverse</td>
<td>10 593</td>
<td>14.0</td>
</tr>
</tbody>
</table>

*Note: Forward direction means from the UK to Belgium. 1 therm = 0.105506 GJ.*

The large price differential between forward and reverse flows indicates the current tendency to use the Interconnector to import gas into the U.K. and the limited capacity available for this purpose. The differential may drop when flow capacities are equalized.

It is difficult to compare the Interconnector tariff with any other tariff. Given that the pipeline is 235 km long, 1 p/therm equates to 3.03 $/1000m³/100 km which means that the indicative BG tariffs shown above range from a low of 2.12 $/1000m³/100 km to a high of 42.36 $/1000m³/100 km.
5.3 Tariff Methodologies outside the EU

Outside the EU, European and Central Asian ECT States\(^{48}\) have transmission systems built under the Soviet financing system and face a number of challenges related to developing market-based pricing. In general, energy prices were, historically, kept at a very low level particularly to households. Since the mid-1990s, energy prices, including those for gas, have been rising in real terms, but in many countries are still subsidised either explicitly or implicitly. As a result, the transmission and distribution components of the gas price are often set below the full-costs.

Secondly, past investment costs for constructing the pipelines are often uncertain because of Soviet accounting practices and because there were often important elements of barter payments, sometimes on an international scale. An example of the latter is the Yamburg project in which a number of central European countries helped to build and finance a pipeline from Western Siberia and were subsequently paid in free gas supplies.

Thirdly, inflation in the 1990s has effectively broken any link between original investment in real terms and the current book value of gas utilities.

Outside the EU, in particular in the CIS countries, despite the existence of varying level of regulation for domestic gas transport, there exists almost no specific legislation in relation to gas transit over national territories, which is mostly regulated through regional and bilateral intergovernmental agreements.

At the CIS level, a number of regional agreements attempt to set up a detailed framework for gas transit activities within the region; however, none of them until now has gone beyond setting rather broad principles for cross-border flows:

- The principle of freedom of transit is one of the most important provisions of the Agreement on Establishment of a Free Trade Zone (1994), which also stipulates that transit should not be interrupted for unjustified delays or restrictions.
- The Agreement on the Coordinated Policy in Transit of Natural Gas (1995) refers to the Energy Charter Treaty as one of the guiding instruments in this field. “Transit” of natural gas is defined in this Agreement based on the definition in the ECT. Within the framework of this Agreement, the Parties commit to take necessary measures, including joint measures, in order to prevent the risk of disconnection from the sources of gas supply, and not to damage the interests of supplier and transit states. In case of a dispute, the Parties undertake not to interrupt or reduce the gas transit deliveries until the resolution of the dispute. The Parties ensure the observance of all previously agreed commitments regarding natural gas transportation until the final settlement of the dispute (limited with the duration of the contract). In addition, the Parties must take necessary measures to ensure timely payments for the purchases and transit of gas.
- The Agreement on Creation of Uniform Conditions for Transit through the Territories of the Customs Union’s Member States (1998) lays down general terms and conditions of transit.

Furthermore, establishment of a new multilateral legal framework regulating energy transit in more details is at present under discussion among some CIS countries.

The following section reviews actual transit tariffs in key gas transit countries outside the EU.

\(^{48}\) Apart from the Swiss Confederation and Turkey
5.4 Transit Tariffs in selected non-EU countries

5.4.1 Belarus

Belarus provides transit for Russian gas via three routes. The older of these routes moves gas down to the Ukrainian system through the Soviet-built Northern Lights pipeline where it meets other Russian and Central Asian supply routes. The most recent Yamal pipeline moves gas from Western Siberia to Poland. A smaller volume is supplied to Lithuania and to the Russian enclave of Kaliningrad through subsidiary lines. In 2003, about 25 bcm of gas was reported transited. In 2004, Gazprom was planning to transit 33 bcm of gas, including 23 bcm through Yamal. The expansion of Yamal means that by 2005 as much as 28 bcm could be moved on this line alone. The Belarus sign lines are important in that they offer the only alternative to Ukraine for Russian supply to much of Western Europe.

All pipelines in Belarus are owned by Beltransgas, a state-owned company, which during the first half of 2004 was in dispute with Gazprom, the sole transit shipper, over access and transit tariffs. Beltransgas imports some 18.5 bcm for internal use, a supply which mainly comes from Gazprom (though independent Russian suppliers such as Itera have also provided some gas). The dispute with Gazprom was complex and concerned both the price paid by Beltransgas for its imports and Gazprom’s role in a possible privatisation of Beltransgas as well as the transit tariff. In early 2004, Gazprom reduced supply to Belarus due to the lack of a supply contract and even cut off all flow through the Yamal line for a day. The dispute, now resolved, illustrates how difficult it is to sort out some of the legacy of the FSU.

The agreement reached in June 2004 stipulates that Gazprom will supply Beltransgas with 10.2 bcm at a price of $46.68/1000m³, with transit fees of $0.75/1000m³/100 km on Ukrainian transits and $0.46/1000m³/100 km on the Yamal line. The gas price is considerably higher than that paid in 2003 (reported at $30.10), and is in line with the price paid to independent suppliers. The Yamal line is 575 km long in Belarus so the overall transport tariff to the Polish border is now $2.64/1000m³. This agreement for 2004 has recently been renewed on the same terms for 2005, with gas supplies rising to 19.1 bcm.

The Belarussian transit fees are clearly low by international standards. However, the Yamal fee in particular should not be viewed as a genuine cost-based tariff. Beltransgas did not finance the Yamal line so it has little claim to any return on capital invested. The negotiated fee is more akin to a government charge than to a tariff. The transit fee for the older Northern Lights system is genuinely a part of the Beltransgas asset base. As information on the Belarus system is limited, it is hard to estimate whether the transit fee for this line is fully cost-based. The price at which Gazprom supplies gas to Belarus is also an important issue. The price of $46.68 is now higher than the price paid by Russian consumers in the neighbouring oblast of Smolensk, the previous benchmark for Belarus supply, but is far below the current price in the EU countries supplied by the Yamal line. The extent to which the agreed supply price is subsidised is difficult to resolve given that the independent Russian gas suppliers to whom Beltransgas has turned in the past are themselves denied access to the higher-price countries of Western Europe. However, it is probably close to the true marginal cost of supplying gas from Russia’s Siberian fields.

49 World Gas Intelligence, 16 June 2004 p.5.
50 This is discussed further in the section below on Russia.
It is of interest to relate the total transit fee to the volume of gas which it would purchase. If 23 bcm is transited through the Yamal line, then this would yield a revenue of $60.7 million which would buy about 1.3 bcm of gas at the Gazprom sales price. This is equivalent to 5.7% of the gas transited which is very similar to government charges paid for transit of Algerian gas.

5.4.2 Bulgaria

Bulgaria is an important transit country for Russian gas shipped to Turkey, Greece and Macedonia. Bulgaria currently transits about 13.5 bcm to these countries and will be transiting 18 bcm by 2010 according to a long-term transit contact signed in 1998 following the lapse of the Yamburg agreement. The transit distance to Turkey is relatively short - under 300 km - though distances to Greece and Macedonia are considerably longer.

Until 1998, negotiations between Gazprom and Bulgargas, the transmission monopoly company, were complex and difficult. Previously, as payment for Bulgarian contributions to the Yamburg field and pipeline development project, Bulgaria received over 4 bcm of gas. Since then, Bulgaria has been receiving Russian gas partly under a residual Yamburg agreement, partly in lieu of transit fees and partly by purchases from another company Topenergy (in effect Gazprom’s agent in Bulgaria). There were various disputes over the role of Topenergy inside Bulgaria, concerning the price paid for gas at the border, the way in which these payments were to be made, how much should be invested in the transit lines and from where the funds for this investment should come.

The final outcome of the negotiations and the various changes made since are far from clear. Reportedly Gazprom pays a basic transit fee of 1.66 $/1000m³/100 km. It can be seen that the theoretical transit tariff for a new pipeline is around one-half that charged by Fluxys and most German operators and almost one-third that which was charged in the past by Ruhrgas and OMV. This result is not surprising given that most of the systems of these companies comprise lines with diameters often much less than 1600 mm. The strong variation of the Wingas charges with diameter is a reflection of this and there are similar variations for the other companies. The variation of costs with diameter was discussed in chapter 4. On the other hand, the systems considered are not new and will be partly depreciated whilst the regulatory WACC applied may be less than 10%. Both these factors would reduce the tariffs.

5.4.3 Georgia

Georgia is already a transit country in the north-south direction for Russian gas for Armenia. It will shortly become a transit country also in the east-west direction upon the completion of the South Caucasus Pipeline (SCP) which will supply gas from the Azeri Shah Deniz field to Turkey. The commissioning date for the SCP, which will have a capacity of 7 bcm, remains uncertain although the agreement with Turkey is due to start in 2005.

The line will be owned by a private-sector consortium, with Statoil acting as the operator. Georgia will receive a minimum payment from this consortium set at 5% of the gas

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51 Gazprom has insisted that no one but Gazprom shall use certain sections of line, so the Bulgarians have agreed on the condition that Gazprom pays for the entire capacity, whether used or not.
52 This role of Topenergy has been taken over by Overgas (Gazprom 51%) as of 1998.
53 None of the three tariffs quoted are currently regulated.
transported either in the form of a fee or in kind, at the annual choice of Georgia as a minimum income from taxation which is fixed and as compensation for the obligation to secure the pipeline. In case of damage to the pipeline (e.g. due to a sabotage) Georgia is liable for damages up to the total of its revenues from the government charges. In addition, Georgia will be entitled to buy a further volume of gas at a concessionary price during a 20-year period. These volumes will gradually increase from 200 million m$^3$ in year 1 to 500 million in years 6–20 of the agreement. No information is available on the level of this concessionary price.\textsuperscript{54}

The components of the arrangements in the Georgian HGA and the Agreement for Gas Sales (AGS) to Georgia are as follows:

- Under the HGA, the government charges for gas transported via Georgia are made by the investors to the state (2.5 $ per Mm$^3$ of gas transported);
- Under the AGS, the payments for gas deliveries to Georgia are made by the state to the investors (up to 5% of the transport capacity at 50 $/Mm^3$ for 60 years);
- This arrangement allows for the payment of such transit fees to Georgia in-kind, which amount to 5% of the gas transported via Georgia.

### 5.4.4 Morocco and Tunisia

Morocco and Tunisia have very similar transit regimes. Both countries are used for the transit of Algerian gas to Europe. In both cases, Sonatrach, the Algerian gas concern, is responsible for moving gas to its borders from gas-fields in the deep Sahara. At the Algerian border, SNAM, a subsidiary of ENI, in the case of Tunisia, and Metragaz, a company owned mostly by Spanish Gas Natural and Portuguese Transgas, in the case of Morocco own and operate the pipelines which move the gas overland and thence under the Mediterranean Sea. In both cases, it is this company which operates and maintains the line without more than symbolic participation from a local gas company. Each nation receives a payment in the form of a percentage of the gas moved which in both cases is reportedly set at between 5 and 7% paid either in cash or in kind at the choice of the transit country.

### 5.4.5 The Russian Federation

Russia is the key non-EU country both because of its future importance as a transit country and because, in its role as a major exporter, it plays an essential part in negotiating transit tariffs in other non-EU countries. The Russian gas transmission system is very large and complex and is owned by Gazprom, the major domestic producer. Legally, it is open to third-party access from other Russian gas producers. In addition to supplying around 25% of gas consumption in other European countries, it is also the sole route currently available for shipping from the Central Asian republics of Turkmenistan, Kazakhstan and Uzbekistan. Access to Russian lines by foreign shippers is not covered by domestic third-party access rules.

Access by domestic producers to the Russian system is the subject of much internal controversy. Gazprom asserts that the only constraint to third-party access to its system is that of available capacity, whilst independent producers claim that, as it is up to Gazprom to decide when and where capacity is ‘available’, their rulings on individual requests are often arbitrary and opaque. It seems that currently about 15% of gas moved internally comes from

independent producers, though there is some doubt as to whether or not this includes gas imported from Central Asian sources. There is, however, general agreement on the need to establish a mechanism to set transmission tariffs at levels which allow existing capacity to be properly maintained and new capacity to be built.

The great distances over which gas is moved inside Russia mean that transmission is usually the dominant cost in gas pricing. A recent World Bank survey\textsuperscript{55} estimated that the long-run marginal cost of new gas supplies was in the range $35-40/MCM, including the transmission cost of $22/MCM and field development costs of only $8/MCM. This estimate appears to be based on a marginal transmission cost of about $1/1000m\textsuperscript{3}/100 km\textsuperscript{56}. The regulated transmission cost to independent producers for transport within Russia and member states of the Customs Union is set by the Federal Tariff Service and in 2004 was raised to about 0.71 $/1000m\textsuperscript{3}/100 km\textsuperscript{57}. A tariff of 0.92 $/1000m\textsuperscript{3}/100 km has also been set for independent producers\textsuperscript{58} supplying gas outside of the Customs Union, but in practice this is inoperative as Gazprom retains a monopoly over such exports. Gazprom has suggested that a tariff of about 1.1 $/1000m\textsuperscript{3}/100 km would provide an adequate rate of return of 5-6% on new pipeline investment.

These tariffs only apply to domestic supplies. Access to capacity for transit gas has not in the past been made available directly to non-Russian producers or consumers. The established procedure is for a third-party intermediary to negotiate transport access with Gazprom as well as contracting to purchase gas from the producer. The best known of these intermediaries has been the Florida-based company Itera, which had taken on the role of supplying many CIS countries from both Russian and Central Asian sources. Itera is now a significant Russian gas producer in its own right and its relations with Gazprom have been strained and other intermediaries have emerged. The common feature of all these intermediaries is that specific transport fees for transport across Russia are not disclosed.

The actual distance for Russian transit from the point at which the Central-Asia-Centre (CAC) line enters Russia at Aleksandrov Gay to merge with the east-west pipelines from the Orenburg field is about 1100 km. The 2004 protocol signed between Russia and Ukraine for gas supply and transit reportedly sets the transit tariff for Turkmen gas to Ukraine across the Russian territory at 1.09 $/1000m\textsuperscript{3}/100 km, the same as for Russian gas transit through Ukraine.

In respect of regulation of gas transport tariffs, gas tariffs are set by the Federal Tariff Service (FTS). The most important role of the FTS is to set consumer gas prices for gas which is sold by Gazprom through its regional subsidiaries to consumers. Gas may be bought on an unregulated market either from Gazprom, if it has gas available, or from independent producers. One point about the prices charged under the regulated allocation which is relevant to transmission costs is that the quotas are administered on the basis of even consumption patterns, without regard for load variations.

There is no division of the regulated consumer price charged by Gazprom into any components of transport or production, although FST does set distribution charges for the

\textsuperscript{55} Reform of the Russian Gas Sector, World Bank, May 2004.
\textsuperscript{56} OECD Working Paper No 42, p.27.
\textsuperscript{57} FEC Decision Nr 49-e/4, 25 June 2003.
\textsuperscript{58} FEC Decision Nr 44-e/2 17 July 2002.
oblasts and city administrations which operate local networks. Under the basic law governing gas regulation,\textsuperscript{59} gas companies were obliged to separate their accounts into basic categories of production, processing and transport as of 1 January, 2001. Gazprom is undergoing a restructuring process, which is supposed to result in full unbundling of financial flows and transparency in the gas and liquid hydrocarbon production, transmission, processing, underground storage and marketing. The restructuring process envisages legal unbundling of certain core businesses and even selling out of certain non-core businesses. With respect to gas transportation, an independent gas transmission business was already established in 2004.

The charge for system access is, in principle, set by FTS on a general methodological basis set out in the initial law.\textsuperscript{60} This allows for tariffs to be based on cost recovery, including not only operating costs but also necessary costs for system refurbishment and for some profits. This total allowed revenue is then allocated over total gas flow in an unspecified fashion.

It is unclear how this data is supplied by Gazprom to the FST, given the lack of separation of Gazprom accounts. Some cost information is used by the agency to produce zonal consumer prices in which consumers in the zone closest to the main production centre of Western Siberia pay the lowest prices with increases as distance to production increases. However, there is no obvious way to relate increasing distance to allowed transport costs as the increase varies between different classes of consumer. In January, 2004, the difference in the regulated gas tariff between an industrial customer in Zone 0\textsuperscript{61} and one in Zone 6 was $14.25/1000m\textsuperscript{3} whilst for household consumers the difference was only $5.06/1000m\textsuperscript{3}. It seems likely that even for the industrial tariffs the differential was too small. Gazprom has claimed that a tariff of $1.1/1000m\textsuperscript{3}/100 km is required to obtain a ROR of 6% on new investment. The highest tariff differential of $14.25 would suggest a transport distance of less than 1300 km for this tariff, much less than the actual distance of 5000 km and more.

The regulated transmission charge for grid access\textsuperscript{62} for independents is based on a distance-related methodology in units of Rb/1000m\textsuperscript{3}/100 km. The use of such a commodity-based charge, that is related to the volume moved rather than the capacity-based charges usual inside the EU, suggest that the practice of assuming even flows adopted in the allocation of regulated gas to consumers is carried over into transmission charges. No information is available on just how the FST or Gazprom establish the regulated tariffs.

\subsection*{5.4.6 Ukraine}

Ukraine is the most important transit country in the world. It transports at least 120 bcm of Russian gas into western and southern Europe as well as to several Caucasian countries and a considerable volume of Russia-to-Russia gas. Its importance as the transit country for Russian gas has lessened slightly in recent years with the opening of a trans-Poland line. However, in the future Ukraine could also be involved in the transit of Central Asian gas.

The entire Ukrainian system is owned and operated by state-monopoly Naftogaz Ukrainy which functions as a vertically-integrated domestic gas company. The company is controlled by the National Energy Regulatory Commission, deriving its regulatory powers from general laws rather than one specific to gas. Draft Gas Law which includes a provision for full TPA

\textsuperscript{59} Government of Russian Federation Decree of 29 December, 2000, No 1021.

\textsuperscript{60} ibid, Art. IV(13,14,15).

\textsuperscript{61} The Yamalo-Nenets Autonomous District in which most Russian gas is produced.

\textsuperscript{62} Current charges are discussed below in the country section.
and other explicit regulatory control has been presented but has yet to go through the process of Parliamentary approval.

Gas transit through Ukraine into Western Europe is based entirely on agreements with Gazprom as no other company has any access to the system. At present only gas handled by Gasexport, Gazprom’s export arm, moves across Ukraine, including small quantities of Kazakh gas sold into Western Europe.

The tariff basis for movement of Russian gas is a simple distance-based commodity charge set on an annual basis by what are effectively government-to-government negotiations. The 2004 protocol is based on a tariff of 1.09 $/1000m$^3$/100 km. However, this is not a simple financial transaction; most of the total fee is paid in the form of gas (24 bcm in 2004, valued at $50/1000m$^3$), and some part is paid in cash (an advance payment reported to total $1.25 billion for transit from 2005 to 2009). Some or all of this will be offset against debts owed by Naftogaz Ukrayiny for gas supplied in the 1990s. Additionally, Naftogaz Ukrayiny will be allowed to export up to 6 bcm of Russian gas to Western Europe at prices expected to be well in excess of $100/1000m$^3$. Up to now, Russian gas supply to Ukraine has always contained rigid restrictions with regard to re-exports, though recently Ukrainian companies have sold gas to Poland, allegedly from domestic Ukrainian production. This relaxation of destination restrictions will be financially beneficial to Naftogaz Ukrayiny, yielding perhaps as much as $300 million if one assumes a net profit of $50/1000m^3$ after transmissions costs.

In 2002, negotiations begin to pass operational management and, possibly, ownership of that part of the Ukrainian system responsible for gas transit over to a consortium. The initial partners in this consortium were Gazprom and Naftogaz Ukrayiny, though later Ruhrgas and Gaz de France were invited to participate. The intention of this was to allow foreign investment in the system to ensure its long-term sustainability and to add new transit capacity. A large study of this scheme was financed by Inogate, an EU-funded agency set up to assist the development of energy links between the former-FSU and the EU. This study was completed in June 2003 and, although the resulting report remains confidential, it is believed to have concluded that no physical separation of the transit lines from domestic transmission was possible. However, some form of ‘virtual’ transit system could be set out by investment in appropriate metering and control equipment. This plan has serious political implications and there does not seem to have been any further development in finalising it. The negotiations on establishing the consortium have not yet been finalised.

The overall pattern of tariff setting in Russia is followed by Ukraine. A national regulator, the National Energy Regulatory Commission, sets tariffs for consumer prices which are often below full-costs, particularly for households. The national gas utility is a state-owned vertical monopoly which has a separate transport division. The regulator sets an overall postal transport charge which includes distribution costs by local energy companies. This charge is nominally cost-based, but is set at artificially low levels and is mostly taken by the charges allowed to local energy for distribution costs. No separate transmission charge is published as TPA does not presently exist in Ukraine. Large volumes of gas are transited, the charges for which are non-regulated and are set by high-level negotiations. These charges are commodity-based distance tariffs.
6 Overall Tariff Comparisons

6.1 Review of transit tariffs by type

The previous chapter discussed transit tariffs in selected ECT countries. In two of these countries – the Czech Republic and Switzerland – no tariffs are published for the gas transit pipelines.

The tariffs in other countries may be divided into the following categories:

1) Distance-based capacity tariffs: Austria (one line), Belgium and Germany (some TSOs);
2) Distance-based commodity tariffs: Belarus, Bulgaria, Poland, Russia (domestic only), Ukraine and UK Interconnector (inferred);
3) Entry-exit tariffs: Germany (some lines), UK and Slovakia;
4) Government charges: Georgia, Morocco and Tunisia.

In the case of the Czech Republic, a distance-based commodity charge can be inferred from the accounts of the pipeline operator. The regulated and transparent tariffs may soon be established there to conform with the EU legislation.

In the following sections, these tariffs are compared category by category\textsuperscript{63}.

6.1.1 Distance-based capacity tariffs

The tariffs in this category are:

- Austria - OMV\textsuperscript{64} $0.258 \text{€}/m^3/hr/km/a + 5.275 \text{€}/m^3/hr/a$
- Belgium - Fluxys\textsuperscript{65} $0.20 \text{€}/m^3/hr/km/a + 8 \text{€}/m^3/hr/a$
- Germany - Wingas base fee of $4.34\text{€}/m^3/hr/a$ plus:
  - $0.18 \text{€}/m^3/hr/km/a$ for diameter over 1000 mm
  - $0.23 \text{€}/m^3/hr/km/a$ for diameter 700-1000 mm
  - $0.74 \text{€}/m^3/hr/km/a$ for diameter 350-500 mm
- Germany - Ruhrgas\textsuperscript{66} $0.437 \text{€}/m^3/hr/km/y$ (until mid-2004)
- Model tariff for new 56” line $0.11 \text{€}/m^3/hr/km/a$
- Model tariff for new 36” line $0.23 \text{€}/m^3/hr/km/a$

6.1.2 Distance-based commodity charges

The tariffs in this category include:

- Belarus $0.75 \$/1000m^3/100 km for Ukrainian transit
  $0.46 \$/1000m^3/100 km on the Yamal line transit
- Bulgaria\textsuperscript{67} $1.66 \$/1000m^3/100 km$
- Czech Republic\textsuperscript{68} $2.9 \$/1000m^3/100 km$

\textsuperscript{63} On the basis of the information provided by the Consultant
\textsuperscript{64} For one-year contracts on PENTA line
\textsuperscript{65} For pipe diameter of 900 mm or greater
\textsuperscript{66} For a full one-year contract
\textsuperscript{67} Inferred from gas supplied by Russia plus possible transit fee
Overall Tariff Comparisons

- Poland 2.74 $/1000m³/100 km in 2004 (falling to 1.00 by 2016)
- Russia 0.71 $/1000m³/100 km
- Ukraine\textsuperscript{69} 1.09 $/1000m³/100 km
- Interconnector\textsuperscript{70} 2.12 $/1000m³/100 km

- Model high pressure transit line 56” 1.6 $/1000m³/100 km
- Model high pressure transit line 36” 3.3 $/1000m³/100 km

6.1.3 Entry-exist tariffs

Amongst major transit system operators of the countries considered in this report, only Slovak SPP and Ruhrgas have switched to an entry/exit tariff methodology for gas transit. It is difficult to compare entry/exit tariffs between countries as there are usually a large number of entry/exit pairs which can be chosen. As noted in chapter 5, there is some tendency for entry/exit tariffs to be almost postal in practical derivation, with a limited number of deviations from this generally uniform tariff. Thus Ruhrgas transit tariffs are almost all set at around 60 €/m³/hr/a, except for the Poland/France movement which is just below 100 €/m³/hr/a. The Slovak entry/exit system is comparable with that for Ruhrgas, but has a number of complicating factors relating to contract size and length. Overall, a combined entry/exit tariff in the range 50-60 €/m³/hr/a could be considered as normal. These levels can be compared with the entry/exit tariff of 158 €/m³/hr for model transit line and with similar length movements in the Italy, UK and France of about 100 €/m³/hr/a.

6.1.4 Government charges

Government charges are taxes exacted by a state from the company which operates a pipeline crossing its territory as distinct from tariffs charged by the company for use of the line to cover the costs linked to operating the pipeline. Such fees are usually charged by host states from private pipeline investors demanding right of way, security protection as well as various legislative and administrative state guarantees from host governments. They may also cover corporate taxes levied on pipeline investors and often frozen at a level agreed in the host government agreement. It is the choice of the transit country to take the fee in cash or in kind.

Such fees are rather unusual in ECT countries; they exist in the following three countries:

- Georgia – 5% of the gas transported as minimum taxation income (see section 5.4.3); and
- Tunisia and Morocco – between 5 and 7% of gas transported.

The Belarussian transit tariffs also have the characteristics of a ‘government charge’, and are equivalent to about 5% of gas volumes transited. Like in the cases of Morocco, Tunisia and Georgia, the investment, financing and operating costs are directly borne by the project sponsors of the transit pipeline.

6.2 Cross-country comparison of transit tariffs

A comparison of tariffs calculated with different methodologies can usually be done only for specific cases. It may be impossible to compare entry/exit tariffs with distance-based tariffs as

\textsuperscript{68} Inferred from 2003 Transgas accounts
\textsuperscript{69} Plus various financial and commercial concessions
\textsuperscript{70} Indicative price given by BG for UK to Belgium capacity in 2005
distance plays no part in entry/exit tariffs. Pipeline diameter and pressure are often important elements of tariff design.

On this basis, Table 6.1 compares transit tariffs having different underlying methodologies in selected ECT countries for the case of a movement of gas over a 350 km pipeline.

**Table 6.1: Comparison of transit tariffs**

<table>
<thead>
<tr>
<th>Country</th>
<th>Tariff (€/m³/h/y)</th>
<th>Pipeline Diameter (in)</th>
<th>Methodology</th>
<th>Source / Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model new 56”</td>
<td>37</td>
<td>56</td>
<td>Distance-based capacity</td>
<td>Estimate (Sec 4.4)</td>
</tr>
<tr>
<td>Model new 36”</td>
<td>78</td>
<td>36</td>
<td>Distance-based capacity</td>
<td>Estimate (Sec 4.4)</td>
</tr>
<tr>
<td>Austria (Penta West)</td>
<td>96</td>
<td>28</td>
<td>Distance-based capacity</td>
<td>Published-indicative</td>
</tr>
<tr>
<td>Belgium (Fluxys)</td>
<td>78</td>
<td>&gt;36</td>
<td>Distance-based capacity</td>
<td>Published-indicative</td>
</tr>
<tr>
<td>Poland (Yamal)</td>
<td>71</td>
<td>&gt;36 (56)</td>
<td>Distance-based commodity</td>
<td>Estimate</td>
</tr>
<tr>
<td>Germany (Wingas)</td>
<td>63</td>
<td>&gt;40</td>
<td>Distance-based capacity</td>
<td>Published</td>
</tr>
<tr>
<td>Slovakia (SPP)</td>
<td>62</td>
<td>&gt;36</td>
<td>Entry-exit</td>
<td>Published</td>
</tr>
<tr>
<td>Interconnector</td>
<td>55</td>
<td>&gt;36 (40)</td>
<td>Distance-based commodity</td>
<td>Estimate</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>43</td>
<td>&gt;36</td>
<td>Distance-based commodity</td>
<td>Estimate</td>
</tr>
<tr>
<td>Russia</td>
<td>28</td>
<td>&gt;36</td>
<td>Commodity</td>
<td>Estimate</td>
</tr>
<tr>
<td>Ukraine</td>
<td>28</td>
<td>&gt;36</td>
<td>Distance-based commodity</td>
<td>Published</td>
</tr>
<tr>
<td>Poland (Yamal-future)</td>
<td>26</td>
<td>&gt;36 (56)</td>
<td>Distance-based commodity</td>
<td>Estimate</td>
</tr>
<tr>
<td>Belarus (Yamal)</td>
<td>19</td>
<td>&gt;36</td>
<td>Distance-based commodity</td>
<td>Estimate</td>
</tr>
<tr>
<td>Belarus (N. Lights)</td>
<td>12</td>
<td>&gt;36</td>
<td>Distance-based commodity</td>
<td>Estimate</td>
</tr>
</tbody>
</table>

The table shows that:

- The distance-based methodology is the most commonly used for the setting of transit tariffs;
- There are large variations in tariff levels due partly to the methodological differences and partly to differences in such factors as pipeline diameter, pressure, or year of construction;
- The commodity-based distance tariffs used in CIS countries and Poland are much lower than nearly all EU domestic tariffs (only the lowest UK entry/exit tariffs are comparable with tariffs in CIS countries and Poland);
- The distance-based transit tariffs used by Belgium, Austria and by Wingas in Germany are at the high end of the range for EU domestic tariffs; and
- In general, entry/exit tariffs tend to favour longer movements (usually reflecting a certain amount of counter flow transport which means that the costs are distributed over a larger volume and tend to be lower than those for the theoretical model.
- The two model tariffs developed - one for a new line and one for an existing system mark the ends of the range. The model system tariffs are based on current pipe costs, which are very high and may reflect a lower valuation of existing systems than might be justified by using some form of replacement costing.
Box 2: A model long-distance movement

Another form of comparison of transit tariffs is to estimate relative tariffs for a single long-distance gas movement across several countries. One of the longest shipments currently feasible would be to move Turkmen gas to the U.K. Such a movement would be through Uzbekistan and Kazakhstan (CAC line) to meet with the east-west Russian lines at Aleksandrov Gay; then to the west across Russia, Ukraine and Slovakia and further west into Germany and Belgium (through either the Czech Republic or Austria) and finally to the UK (via the Interconnector).

The table below shows the costs of these separate movements, both as the totals and in unit terms per 100 km. It is assumed that the desired movement is of 50 million m$^3$ annually at a load factor of 85%.

<table>
<thead>
<tr>
<th>Country</th>
<th>Distance (km)</th>
<th>Total cost (€/1000m$^3$/a)</th>
<th>Unit cost (€/1000m$^3$/100 km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uzbekistan$^1$</td>
<td>200</td>
<td>1.7</td>
<td>0.8</td>
</tr>
<tr>
<td>Kazakhstan$^1$</td>
<td>820</td>
<td>6.8</td>
<td>0.8</td>
</tr>
<tr>
<td>Russia$^1$</td>
<td>1100</td>
<td>9.2</td>
<td>0.8</td>
</tr>
<tr>
<td>Ukraine$^1$</td>
<td>950</td>
<td>7.9</td>
<td>0.8</td>
</tr>
<tr>
<td>Slovakia</td>
<td>350</td>
<td>9.0</td>
<td>2.6</td>
</tr>
<tr>
<td>Czech Republic$^1$</td>
<td>380</td>
<td>11.0</td>
<td>2.9</td>
</tr>
<tr>
<td>Germany</td>
<td>450</td>
<td>8.3</td>
<td>1.8</td>
</tr>
<tr>
<td>Belgium</td>
<td>250</td>
<td>6.7</td>
<td>2.7</td>
</tr>
<tr>
<td>Interconnector?</td>
<td>235</td>
<td>5.4</td>
<td>2.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4,770</strong></td>
<td><strong>66.0</strong></td>
<td>--</td>
</tr>
<tr>
<td><strong>New line</strong></td>
<td><strong>4,500</strong></td>
<td><strong>49.0</strong></td>
<td>1.1</td>
</tr>
</tbody>
</table>

Notes: (1) Based on Russian/Ukrainian tariff of $1.09/1000m$^3$/100km; (2) Inferred tariff; (3) Based on 3 p/therm/1000m$^3$ of BG indicative price of 21.4 €/1000m$^3$/a for the UK-Belgium direction. Indicative price for the reverse direction movement is only 1/4 of this. (4) Based on 12% ROR

This table shows large price differentials between tariffs in the CIS and the EU countries. If the Interconnector is excluded, CIS movement is 67% of the total distance and only 42% of the total cost. If it is assumed that the EU tariffs have a consistent relationship with pipeline costs, including capital replacement, then this emphasises that CIS tariffs are probably too low to sustain the present pipeline network in those countries.

For a comparison of these costs with that for a completely new pipeline; if the Interconnector were excluded, a line of about 4500 km would be required from the Turkmen border to Zeebrugge which would cost about €8.3 billion to move about 31 bcm of gas (excluding interest charges during the construction and higher costs of land acquisition and right-of-way in Western Europe). The revenue requirement for such a line would be €43-58/1000m$^3$ for a rate of return between 10-15%. This suggests that new high-volume pipelines could move gas from Central Asia to Western Europe at a cost lower than that for the existing networks.

### 6.3 Comparison with domestic tariffs

An intra-country comparison of transit and domestic transport tariffs is presented in Table 6.2. The data on domestic tariffs is based primarily on a 2004 study developed for Gas Transport Services (formerly Gasunie) by A. D. Little. The study compares gas transport tariffs across EU Member States for a large number of cases and is published on the GTS web-site.\textsuperscript{71} The

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comparison with transit tariffs is made for one specific case only (i.e. on the basis of 350 km of distance at 8000 hours load factor); different distances, volumes moved and annual load factors would give somewhat different results.

In the case of German domestic transport tariffs, the high case is based on the highest tariffs for pipelines between 700 and 1000 mm diameter, coupled with the highest regional company charge (either from the supra-regional companies or regional companies). The low case is based upon on the lowest tariff for pipelines above 1000 mm diameter, coupled with the lowest regional charge. In the case for the UK, the high and low cases represent the highest and lowest entry-exit pairs, respectively.

**Table 6.2: Comparison of transit and domestic tariffs**

<table>
<thead>
<tr>
<th>Country</th>
<th>Type</th>
<th>Tariff</th>
<th>Pipeline Diameter (in)</th>
<th>Methodology</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria (Penta West)</td>
<td>transit</td>
<td>96</td>
<td>28</td>
<td>Distance-based capacity</td>
<td>Published-indicative</td>
</tr>
<tr>
<td>Austria</td>
<td>domestic</td>
<td>50</td>
<td>&gt;36</td>
<td>Published</td>
<td></td>
</tr>
<tr>
<td>Belgium (Fluxys)</td>
<td>transit</td>
<td>78</td>
<td>&gt;36</td>
<td>Distance-based capacity</td>
<td>Published-indicative</td>
</tr>
<tr>
<td>Belgium (Fluxys)*</td>
<td>domestic</td>
<td>28</td>
<td>&gt;36</td>
<td>Distance-based capacity</td>
<td>Published</td>
</tr>
<tr>
<td>Germany (Wingas)</td>
<td>transit</td>
<td>63</td>
<td>&gt;40</td>
<td>Distance-based capacity</td>
<td>Published</td>
</tr>
<tr>
<td>Germany (Wingas)</td>
<td>domestic</td>
<td>63</td>
<td>&gt;40</td>
<td>Distance-based capacity</td>
<td>Published</td>
</tr>
<tr>
<td>Germany (high)</td>
<td>domestic</td>
<td>96</td>
<td>28&gt;D&gt;40</td>
<td>Various</td>
<td>Published</td>
</tr>
<tr>
<td>Germany (low)</td>
<td>domestic</td>
<td>60</td>
<td>&gt;40</td>
<td>Published</td>
<td></td>
</tr>
<tr>
<td>Poland (Yamal)</td>
<td>transit</td>
<td>71</td>
<td>&gt;36</td>
<td>Distance-based commodity</td>
<td>Estimate</td>
</tr>
<tr>
<td>Poland (Yamal-future)</td>
<td>transit</td>
<td>26</td>
<td>&gt;36 (56)</td>
<td>Distance-based commodity</td>
<td>Published</td>
</tr>
<tr>
<td>Poland</td>
<td>domestic</td>
<td>30</td>
<td>&gt;36</td>
<td>Distance-based commodity</td>
<td>Published</td>
</tr>
<tr>
<td>Slovakia (SPP)</td>
<td>transit</td>
<td>62</td>
<td>&gt;36</td>
<td>Entry-exit</td>
<td>Published</td>
</tr>
<tr>
<td>Slovakia (SPP)</td>
<td>domestic</td>
<td>48</td>
<td>&gt;36</td>
<td>Commodity</td>
<td>Estimate</td>
</tr>
<tr>
<td>Russia</td>
<td>transit</td>
<td>28</td>
<td>&gt;36</td>
<td>Distance-based commodity</td>
<td>Published</td>
</tr>
<tr>
<td>Russia</td>
<td>domestic</td>
<td>18</td>
<td>various</td>
<td>Distance-based commodity</td>
<td>Published</td>
</tr>
</tbody>
</table>

* in €/m³/h/y for thousand m³ moved over 350 km distance at 8000 hours load factor
* for 250 km distance

The intra-country analysis shows that:

- Austria, Belgium, Russia and Slovakia have lower tariffs for domestic transport than for transit.
- A fully integrated entry/exit system has been adopted in Slovakia with exit charges for all domestic points set at a considerably lower level than the two border exit points.
- In the case of Austria and Belgium, two quite different systems are being compared. Transit charges are unregulated and, in case of Austria, revealed only for one minor line. They are derived from a distance-based methodology. Domestic tariffs are now regulated and based on a form of entry/exit methodology.
- In Russia, domestic transport tariffs are believed to be set below real cost-recovery levels so the transit tariff included in Table 6.2 may well be closer to a cost-reflective level. It should be emphasised that no general transit tariffs are published in Russia and that the value provided here comes from secondary sources reporting on specific trades.
• The Polish case is rather complicated as the current level of transit tariffs are more than twice the domestic tariffs; however, they will fall even below the domestic tariffs by 2016.

• There exists no distinction between the published tariffs of Wingas, as other TSOs in Germany, for domestic transportation and for transit. In general, domestic transportation tariffs of all TSOs are a function of pipeline diameter and also comprise a regional company charge component. The Wingas tariffs are close to the lower end of the tariff range.

The complete ADL data on domestic transport tariffs is shown in Annex 2. It should also be noted that tariff methodologies in EU countries are shifting towards the use of entry/exit tariffs. The results presented in the ADL Report for Germany, in particular, may now be somewhat supplanted by these new tariffs.
7 Transit Tariffs in Light of the ECT

7.1 Transit Tariff Principles of ECT and Draft Transit Protocol

With a view to assessing the overall consistency of transit tariffs with the main provisions of the ECT and of the draft Transit Protocol, the following principles are taken into consideration as the basis of this analysis:

ECT – Article 7:
- **Non-discrimination** as to the origin, destination, ownership of energy in transit or as to pricing on the basis of such distinctions. This means that member countries cannot refuse transit solely on the basis of the origin, destination or ownership of the energy.
- **National treatment** of energy in transit. This requires energy in transit to be treated no less favourably than energy originating in or destined for the transit country itself.

Draft Transit Protocol – Article 10:
- Transit Countries must ensure that Transit Tariffs and other conditions are **objective**, **reasonable**, **transparent** and do **not discriminate** on the basis of origin, destination or ownership of energy in transit.
- **Cost-based** transit tariffs. Tariffs need to be based on operational and investment costs, including a reasonable rate of return.

It should be underlined that no provisions in the ECT and the draft Transit Protocol require, or give preference to, any specific transit tariffication methodology. Therefore, it is for governments to adopt tariff methodologies that best reflect the specifics of their country’s gas transportation and transit system, while being in accordance with the above principles.

7.2 Survey Findings

7.2.1 General Observations

A general observation from this survey is that the situation with regard to transit tariffication methodology is very complex and the resulting tariffs show a wide range of variation.

The discussion on tariffication for gas transit and transport is still at its infancy, which is no surprise given that gas market reform is still at an early stage in many ECT countries. Especially, gas transit issues are often not yet addressed sufficiently, as transit pipelines are often driven by specific export projects and, therefore, usually have limited connections to the domestic transport system (apart from their use for deliveries to the transit country itself).

The situations with domestic transport and transit could differ substantially, which may justify application of different tariffication methodologies. For the part of assessing the costs (or the RAV), different approaches may be employed due to different technical design, different history and valuation methodology of the assets as well as differences in financing conditions. Regarding the method of allocating the costs to the system users, there are differences in the degree of integration of the transit segment into the domestic transport system (or vice versa), resulting in different allocation methods. Postal tariffs for smaller domestic systems, and entry/exit systems for larger and meshed domestic systems with feed-in points from different directions, seem to be appropriate methods to reflect the meshed counter-flow of gas in the
system (tub-type) and their competitive situation in the system. The cost structure of unidirectional transport of large volumes of gas from the production point to the final market place is different and may be better reflected by a distance-based tariff.

Since the methods applied to domestic transport and to transit differ, the resulting tariffs are also different.

Outside the EU, there is a clear tendency to use distance-based tariffs with either commodity or capacity charges. Even inside the EU, distance-based tariffs dominate and the move towards entry/exit tariffs is rather slow in the case of gas transit.

Only three of the ECT countries examined in this study, namely Germany, Slovakia and the UK, have a system that is based on the same tariff principles for transit and domestic flows. In each case, the regulated tariffs are of the entry/exit type.

For countries having diverging tariffs for transit and domestic transport, each case requires detailed assessment of particular transit to determine the extent to which such different approach is due to differences in circumstances for domestic transport as compared to transit.

In several important transit countries, no tariffs are published and in most countries published tariffs are set through high-level negotiations between state utilities. A new transit system is often built as a project-driven tailor-made pipeline owned and operated by private project sponsors who cover all costs of the project and pay a charge to the transit country in lieu of taxes and as compensation for guaranteeing the security of the pipeline.

There are various technical, economic, financial, geographical and regulatory parameters that have to be taken into consideration in the analysis of tariffs in the light of the Energy Charter tarification principles, including:

i. **Pipeline design parameters** (capacity, diameter, length, pressure, etc) and **actual utilization** (load factor, etc);

ii. **All cost elements**, including financing cost (premium for political/country risks);

iii. **Existing systems vs. new investments**, in particular cost/asset calculation (including, different methodologies used in asset valuation of existing systems) and the impact of high inflation;

iv. **Type of transit system**: Pure transit line with no supply to transit country; transit line with some supply to transit country; meshed system of transit/domestic transportation; meshed system involving bi-directional flows and swaps;

v. **Gas volume transited** through **vs. imported** by the transit country;

vi. **One unidirectional vs. bi- or multi- directional gas flows**: Use of a transit pipelines in both ways where the flows would cancel each other out represents economies of scope which should be reflected in the tarification;

vii. **Regulatory framework**: Negotiated systems (inclusive of pipelines owned by gas sellers or buyers) **vs. regulated systems**;

viii. **Pipeline ownership**: Ownership and operation by state/state companies vs. by private investors; and

ix. **Other legal and regulatory issues** (e.g. transparency rules, network access regime, access to congested pipelines, cost allocation in case of additional capacity establishment).
These aspects may be reflected in a wide range of tariffs that are compatible with efficient system operation and adequate (i.e. not excessive) profits. The principles of the ECT, in particular the principle of cost-reflectiveness, should not be interpreted as requiring uniform benchmarks for transit tariffs. The study shows that transit tarification entails a rather detailed assessment of the details which are often not available to the public.

7.2.2 Transparency

As regards transparency of transit tariffs, the situation in the ECT area is far from satisfactory: in many of the countries examined transit tariffs are either not published at all or published only as indicative tariffs that are subject to negotiations and difficult to obtain. Several countries do not yet publish the transit tariffs or underlying methodologies, although they may publish tariffs for domestic transportation. Even though gas sector reform is still under development in many ECT countries, this is clearly a deficit concerning the transparency requirement.72

For project-driven transit pipelines which are built by private companies, a system of negotiated access is predominant. There is some dichotomy between cost–based tariffs and negotiated access, except that the cost category covers several specifications which would range from marginal costs to replacement cost (with or without sharing economies of scale and taking into account different risk premiums for financing the pipeline). This would result in a range of possible cost-reflective tariffs. Such outcome is avoided in systems with mandatory regulated access where the regulator takes a decision on the RAV and the rate of return, which will also be necessarily arbitrary, but is applied to all cases. The minimum transparency requirement in case of negotiated access would be that all framework agreements which involve the governments concerned are made public.

In many countries, transit tariffs are determined through negotiated procedures at intergovernmental level. Such negotiations are often conducted under strict confidentiality and the outcomes are very rarely (and partially) revealed to public. However, to the extent that the governments are involved in transit tariffs negotiations, the results of such negotiations should become part of public knowledge in line with transparent governance. This problem is particularly acute in some CIS countries which rely on complex and opaque intergovernmental arrangements for gas transit, often as a heritage of the Soviet Union. Even some EU countries seem not to be fully transparent, despite the additional clear legal requirements within the EU to ensure full transparency.

7.2.3 Cost-reflectiveness

The degree of cost-reflectiveness of gas transit tariffs is difficult to assess, given the lack of transparency described above. Even where transit tariffs are public, it is not always clear what methodology was used to determine the value asset base and the resulting tariff. Each transit case requires a comprehensive analysis of the basis of above-mentioned technical, regulatory and financial variables, including:

− particularities of existing and new transit facilities with respect to cost structure;
− main details of the methods applied to determine the asset base, such as the book value or the replacement cost value, even when the original investment costs are known;

72 The transparency requirements of the Energy Charter should not be necessarily interpreted as making public of all elements of tariff calculation (including all internal accounts which are the basis for tariff findings).
Transit Tariffs in Light of the ECT

− methods of setting the depreciation charges and of estimating the allowed return on capital which reflects all kinds of investment risks (including the sector-specific and country risk);
− cost structure depending on state or private ownership of the pipeline (including such special elements as government charges as a cost element in privately owned pipelines);
− main technical parameters of the pipelines (e.g. diameter, pressure) and their utilisation rate.

Nevertheless, the comparison of tariffs presented in chapters 5 and 6 with the model costs of a new system presented in chapter 4.3 seem to indicate that transit tariffs determined through various methodologies in the EU countries are generally within a frame defined by a replacement value approach and are in that sense cost-reflective (though the appropriateness of the rate of return applied is questionable).

In many CIS countries, by contrast, transit tariffs are set at levels that fall short of fully covering the replacement costs. This suggests a high degree of depreciation as a basis for the tariff definition. This is also the case with domestic transport tariffs which are often even below the transit tariffs for equivalent gas movements. This tendency is not unique for the CIS countries and can also be observed in some EU countries. This result requires more detailed analysis and more transparent access to the underlying facts and approaches.

7.2.4 Non-discrimination and national treatment

In light of the above considerations and in the absence of sufficient transit tariff data in most cases, an analysis of non-discriminatory treatment and national treatment for transit cannot be based solely on a comparison of tariffs charged.

Addressing non-discriminatory treatment requires a review and analysis of both legislation/regulation and practical implementation. More specifically,

− in their domestic legislation, the countries should have rules and procedures for (i) non-discriminatory transit tarification as to origin, destination and ownership of the gas, and (ii) transited gas to be treated no less favourable than the gas originating in, or destined for, the transit country;
− such non-discriminatory and national treatment principles should be respected in practice in all transit operations.

The first point is being addressed by the Energy Charter Secretariat through the reports on domestic gas transport legislation of seven transit countries. This report focuses on the latter question which is indeed rather difficult to address given the insufficient data on transit tariffs and underlying methodologies. Existing transportation systems used for transit in the non-EU countries are mostly the systems dedicated to a specific gas supplier country. Gas deliveries by other supplier countries through the same systems are a rare exception. For these cases, no discrimination can be demonstrated given the absence of transparent information. It is an open question whether the absence of such situations of competing use of a system is due to economic and geographical facts or just a reflection of barriers for a competing project to access a transit system built for a specific export project.

73 Only Turkmen gas to Ukraine utilizing Uzbek, Kazakh and Russian network.
The fact that transit tariffs are normally negotiated on a bilateral basis and are often confidential creates a potential scope for discrimination among various transit shippers as to the pricing of transit services.

As regards the ECT’s provisions on national treatment of transit, the study has illustrated the practical difficulty of comparing transit and domestic transport tariffs, as the transit lines are often not integrated with the domestic transport systems.

There are only few cases where transit and domestic transportation are comparable and tariffs are publicly available. In most of these cases, transit tariffs tend to be higher than tariffs for comparable domestic transport. The use of different methodologies for the two types of tariffs may be justified, but may also lead to discriminatory practices for transit shippers vis-à-vis domestic shippers.
8 Recommendations

The absence of sufficient and eventually updated data on transit tariffs and methodologies in many ECT countries has been a major obstacle in conducting a thorough analysis of each transit case and achieving solid conclusions with respect to the level of compliance with the relevant ECT principles in single countries. Under these circumstances, recommendations have to be based on clearly obvious observations and to be kept at a more abstract level.

The following recommendations are suggested with a view to ensure compliance and consistency with the transit tariff related provisions of the ECT and of the draft Transit Protocol within the ECT constituency:

**General**

Given that the ECT and the draft Transit Protocol do not require, or give preference to, any specific transit tarification methodology, it is for individual governments to adopt tariff methodologies that best reflect the specifics and the stage of development of their own country’s gas sector regarding transit and transportation, while being in accordance with the relevant ECT principles.

**Transparency**

Improving the degree of transparency of transit conditions, including in particular the access conditions to transport facilities and the transit tariffs (and/or underlying methodologies), is the most immediate challenge throughout all the ECT constituency. This is in the interest of all parties involved and will reduce risks perceived by investors, system users, operators and other players in the market. In addition, more transparency will help to minimise future misunderstandings and resulting disputes. In particular, the following is recommended:

- Countries should make clear which tariffs / tariff methodology applies to gas transit.
- A clear institutional set up to deal with gas transit issues is necessary for transparency. A one stop shop to deal with all gas transit related administrative issues will help to further improve transparency.
- The transparency question is particularly relevant for systems, where transit conditions are determined through individual negotiations.
  - Where governments are involved in transit tariff negotiations - directly or indirectly via state owned companies - the methodological approach and the results of negotiations should become part of public knowledge in line with transparent governance.
  - In negotiations between pure commercial actors transparency may be in conflict with business confidentiality. However, governments should ensure transparency with regard to the process of negotiation, e.g. via a system of open season both for use of existing and creation of new capacity.
Cost-Reflectiveness

Due to the large variety of technical, economic, regulatory and financial characteristics, the applicable methodology and the resulting specific tariffs will vary substantially from country to country but even within a country from case to case. The methodology applied may also have to change over time to reflect the development of sector reform, but also in cases of strong inflation. A uniform methodology would neglect these important differences and, in that regard, be discriminatory. With that caveat the following recommendations are suggested:

− With regard to cost recovery: transit operations -when looked at in isolation from other operations - should not result in losses (allowing especially for depreciation) nor in excessive profits (beyond a reasonable rate of return, inclusive of compensation for risks taken).

− The two approaches at the opposite ends of the scale (i) replacement value and (ii) historic book value may often lead to widely differing results. In any case, the methodology chosen should ensure financial sustainability of the system.

− There are some cases, where consistency with the requirement of cost-reflectiveness is not clear: for some tariffs in CIS countries, it can be disputed if they would meet the above criteria of financial sustainability, while some tariffs in the Western part of the ECT constituency are at the higher end of replacement costs. Both cases suggest a careful review.

Regarding the allocation of costs to location and to the system users, the specific characteristics of the geography of the country and the characteristics of the users have to be taken into account. They may require different methodologies regarding cost allocation or result in different tariffs. However, differentiation must be based on objective criteria and not be based on origin, destination or ownership of the gas, in order to be non-discriminatory.

Non-Discrimination and National Treatment

The principles of non-discrimination and national treatment are crucial pillars, not only of the ECT transit provisions, but also of the overall ECT concept.

In the cases where tariffs for domestic transportation differ from transit tariffs or from other tariffs for cross-border flows, the differences between the two tariffs may well be justified based on special technical and economic characteristics, however, a thorough case-by-case analysis should be done to ensure non-discrimination and national treatment.

To ensure non-discrimination, countries should, first of all, ensure transparency for all transit tariffs as well as for domestic transportation tariffs to allow for an assessment of the origin of different tariff methodologies and tariff results.

Given the insufficient transit tariff data in most cases reviewed under this study, such a comprehensive analysis should not only be based on a comparison of tariffs charged but also on the relevant legislation/regulation and practical implementation.
Annex 1  Alternative Methodologies for Regulatory Rate-Making

From Brattle Report to European Commission, 2000 (Appendix 6)

Table A 1 provides an example of historical cost rate-making. The cost of the asset is assumed to be €100, and the asset has a useful life of five years. The "NPV test" is satisfied by calculating capital charges as the sum of depreciation and a competitive return on the net book value of the investment. In the first year, for example, total capital charges are €30, calculated as €20 in depreciation plus an assumed competitive 10% return on the €100 value. In the second year, total capital charges of €28 are explained by €20 in depreciation plus a 10% return on the €80 net book value of the asset. The total present value of these charges over five years, when discounted at the competitive rate of return, is exactly €100.

<table>
<thead>
<tr>
<th>Table A 1.: Historical Cost Accounting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of Capital [1]</td>
</tr>
<tr>
<td>Year</td>
</tr>
<tr>
<td>EOV Asset Value [2]</td>
</tr>
<tr>
<td>Depreciation [3]</td>
</tr>
<tr>
<td>EOV Asset Value [4]</td>
</tr>
<tr>
<td>Rate of Return [5]</td>
</tr>
<tr>
<td>Return on Capital [6]</td>
</tr>
<tr>
<td>Total Capital Charges [7]</td>
</tr>
<tr>
<td>Present Value [8]</td>
</tr>
</tbody>
</table>

[1]: Assumed.
[2]: Initial investment of 100. Thereafter, \[4\]. \[3\]: Fixed amount to depreciate by year 5
[8]: PV of revenues in \[7\], discounted at \[1\].

Table A 2 provides an example of "trended cost" rate-making using similar assumptions. An inflation rate of 5% is applied to the asset's original cost over the relevant time period. Inflation generates an annual "write-up" in the value of the asset, and produces higher depreciation charges than historical cost rate-making. To satisfy the NPV test, the write-up must be applied as an offset to the depreciation charge in each year. In the first year, the write-up of 65 must be subtracted from the €21 depreciation charge to produce a net figure of 616. In conjunction with a 10% return on the initial €100 asset value, the total capital charge is €26. This is lower than produced by the historical cost methodology, but the "trended cost" procedure generates higher charges in subsequent years. Over the life of the investment, the present value of charges is exactly 100.
### Table A 2.: Trended Costs

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
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<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>Cost of Capital</strong></td>
<td>10%</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100</td>
</tr>
<tr>
<td><strong>Inflation</strong></td>
<td>5%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100</td>
</tr>
<tr>
<td><strong>Year</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>EOY New Asset Cost</strong></td>
<td>100</td>
<td>105</td>
<td>110</td>
<td>116</td>
<td>122</td>
<td>128</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>% of Useful Life Remaining</strong></td>
<td>100%</td>
<td>80%</td>
<td>60%</td>
<td>40%</td>
<td>20%</td>
<td>0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>EOY Asset Value</strong></td>
<td>[3]x[4]</td>
<td>100</td>
<td>84</td>
<td>66</td>
<td>46</td>
<td>24</td>
<td>0</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Annual Write Up</strong></td>
<td>[3][t+1]-[3][t]</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Cumulative Depreciation</strong></td>
<td>[7][3]-[5]</td>
<td>0</td>
<td>21</td>
<td>44</td>
<td>69</td>
<td>97</td>
<td>128</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Annual Depreciation</strong></td>
<td>[7][t+1]-[7][t]</td>
<td>21</td>
<td>23</td>
<td>25</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rate of Return</strong></td>
<td>[9]</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Return on Capital</strong></td>
<td>[10][5][9]</td>
<td>10</td>
<td>8</td>
<td>7</td>
<td>5</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Capital Charges (Real)</strong></td>
<td>[8]+[10][9]</td>
<td>26</td>
<td>26</td>
<td>26</td>
<td>27</td>
<td>27</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Present Value</strong></td>
<td>[12]</td>
<td>100</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

This is the method used in the United Kingdom for the British Gas pipeline system, although the published calculations are cast in real terms rather than nominal ones, and the inflation write-up therefore does not appear explicitly. Table A 3 shows that recasting the analysis in real terms produces identical capital charges over time.

### Table A 3.: OFGAS Methodology

<table>
<thead>
<tr>
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<tbody>
<tr>
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<td></td>
<td>100</td>
</tr>
<tr>
<td><strong>Inflation</strong></td>
<td>5%</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100</td>
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<td>5</td>
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<tr>
<td><strong>EOY Asset Value (Real)</strong></td>
<td>[3][4][5][3][4]</td>
<td>100</td>
<td>2080</td>
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<td>60</td>
<td>40</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td><strong>EOY Asset Value (Nominal)</strong></td>
<td>[3][4][5][3][4]</td>
<td>100</td>
<td>2080</td>
<td>80</td>
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<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td><strong>Real Rate of Return</strong></td>
<td>[6][7][3][6]</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
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<td>5%</td>
</tr>
<tr>
<td><strong>Real Return on Capital</strong></td>
<td>[6][7][3][6]</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td><strong>Total Capital Charges (Real)</strong></td>
<td>[8][4][7][9]</td>
<td>25</td>
<td>26</td>
<td>24</td>
<td>26</td>
<td>23</td>
<td>26</td>
<td>22</td>
<td>27</td>
<td>21</td>
<td>27</td>
<td>27</td>
</tr>
<tr>
<td><strong>Present Value</strong></td>
<td>[10]</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[1]: Assumed.
[2]: Assumed.
[3]: Initial investment of 100. Thereafter, [5][4]
[4]: Fixed amount to depreciate by year 5.
[6]: ([4]+[1])/([4]+[2])-1.
[9]: [8][t+1][2][year]
[10]: PV of revenues in [9], discounted at [1].

Table A 4 provides an example of "economic depreciation". Here regulation is designed to reproduce the price pattern that would prevail in equilibrium in a competitive market, i.e., prices would stay constant in real terms. In our example, which assumes that the prevailing rate of inflation is 5%, this gives annual 5% increases in nominal terms.
The depreciation allowed under the "economic depreciation" methodology is derived implicitly. One begins by finding a schedule of prices that is constant in real terms over time, and satisfies the NPV test.\(^4\) Depreciation in each year is then derived by taking the desired total capital charges, and subtracting a 10% return on the investment's net book value.

When this methodology is applied in a situation where volumes are expected to increase over time it may produce depreciation that is less than zero in one or more years. However, total depreciation charges over time will be equal to the original cost of the asset.

From a technical point of view, this is achieved by finding the first year total capital charge which, when escalated at 5% per year, produce a present value of €100. Modern spreadsheet software makes this a simple procedure.

### Table A 4.: Economic Depreciation

<table>
<thead>
<tr>
<th>Cost of Capital Inflation</th>
<th>10%</th>
<th>5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Total Capital Charges</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Present Value</td>
<td>100</td>
<td>24</td>
</tr>
<tr>
<td>EOY Asset Value</td>
<td>50</td>
<td>28</td>
</tr>
<tr>
<td>Rate of Return on Capital</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Return on Capital</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>[6]</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>Depreciation</td>
<td>[8]</td>
<td>[3]-[7]</td>
</tr>
<tr>
<td>EOY Asset Value</td>
<td>[9]</td>
<td>[5]-[8]</td>
</tr>
</tbody>
</table>

\(^{[1]}\): Assumed.  
\(^{[2]}\): Assumed.  
\(^{[3]}\): Year 1 set to return PV of 100. Thereafter, \([3]_{10\times(1+0.05)}\).  
\(^{[4]}\): PV of revenues in \([3]\), discounted at \([1]\).  
\(^{[5]}\): Initial investment of 100. Thereafter, \([9]\_m\)

Finally, Table A 5 provides an example of "depreciated replacement costs". The replacement cost of the asset is assumed to follow an irregular pattern over time. As with the "trended cost" methodology, the "NPV test" is satisfied as long as any increases in the asset's value are deducted in calculating total capital charges for the year. Note that, if the replacement cost of the asset were assumed to increase at a steady 5% per year, then the "depreciated replacement cost" methodology would be identical to the "trended cost" methodology.
Table A 5.: Depreciated Replacement Cost

<table>
<thead>
<tr>
<th>Cost of Capital</th>
<th>[1]</th>
<th>10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Inflation</td>
<td>[2]</td>
<td>1</td>
</tr>
<tr>
<td>BOY New Asset Cost</td>
<td>[3]</td>
<td>100</td>
</tr>
<tr>
<td>% of Useful Life Remaining</td>
<td>[4]</td>
<td>100%</td>
</tr>
<tr>
<td>BOY Asset Value</td>
<td>[5]</td>
<td>3x[4]</td>
</tr>
<tr>
<td>Annual Write Up</td>
<td>[6]</td>
<td>3x(1+2)</td>
</tr>
<tr>
<td>Cumulative Depreciation</td>
<td>[7]</td>
<td>3x(1+2)</td>
</tr>
<tr>
<td>Annual Depreciation</td>
<td>[8]</td>
<td>7x(1+2)r</td>
</tr>
<tr>
<td>Rate of Return</td>
<td>[9]</td>
<td>1+2</td>
</tr>
<tr>
<td>Present Value</td>
<td>[12]</td>
<td>100</td>
</tr>
</tbody>
</table>

[1]: Assumed.
[2]: Assumed.
[4]: Fixed amount to depreciate by year 5.
[12]: PV of revenues in [11], discounted at [1].

In some cases, owners of infrastructure have advocated charges based on replacement costs without recognising asset write-ups as an offset against capital charges. The argument is that "efficiency" requires prices that provide a competitive return on new assets. This methodology can provide a present value of capital charges that exceeds the initial cost of the investment. The argument that efficiency somehow requires such prices is mistaken. Efficient markets in equilibrium follow the properties of "economic depreciation" which, as shown in Table A 6 above, is not anticipated to exceed the "NPV test". Rather, financial economists view any pricing methodology that can be expected to exceed the "NPV test" as an exercise of market power.

Owners of infrastructure have also attempted at times to switch from one rate-making methodology to another. Care must be taken to prevent the switch from generating windfall gains or losses. An example is provided at the end of this appendix.

In addition to meeting the "NPV test" for basic services, the choice of tariff methodology should seek to avoid economic distortions in the use of different pipelines or the construction of new capacity. The figures and tables illustrate the potential for methodologies to provide different capital charges for assets of different ages. For example, imagine that a pipeline regulated pursuant to "historical costs" competes with a pipeline regulated pursuant to "economic depreciation". Table A 1 illustrates the tension: in the first few years the "economic depreciation" pipeline will have lower charges, but in the last few years the "historical cost" one will have lower charges. If the two pipelines compete by serving the same customers or gas supply sources, then the discrepancy in charges can provide distorted economic signals. Users will be motivated to use the "economic depreciation" pipeline more heavily at first, and then switch to the "historical
cost" one. In addition, the tariffs of the "historical cost" pipeline in its last few years may be so low as to prevent the economic construction of a new pipeline using either the "historical cost" or "economic depreciation" methodology. Such distortions can be avoided by the use of "economic depreciation". Greater discretion over the selection of tariff methodology exists for those pipelines that do not face competition from other pipelines, or where the decision to add new capacity does not depend on the charges of existing pipelines.

Of the various methodologies described above, the "economic depreciation" approach has several advantages. First, if the methodology is designed to track inflation in pipeline construction costs over time, then it has the merit of producing charges that should not vary between old and new pipelines. Second, it can be designed to produce charges that stay stable even as throughput changes over time. For example, if low volume is anticipated in the first few years of a pipeline's life, then the "economic depreciation" method can be designed to ensure that those volumes do not pay higher prices. Rather, the methodology can ensure that charges per unit volume remain steady in inflation-adjusted terms over time, by postponing a portion of capital recovery until higher volumes materialise. Prices in competitive markets behave similarly. We note that other techniques, such as a five-year "RPI-X" system, can also contribute to steady prices over time. The regulatory formula adopted in the most recent British Gas price control provides an example.

Switching Rate-Making Methodology

Care must be taken when switching rate-making methodology to avoid generating windfall gains or losses. Table A 2 shows how the capital charges produced by historical cost rate-making decrease over time relative to those associated with "economic depreciation". Therefore, if historical cost accounting is used to determine pipeline charges for the first two years, and the system then switches to "economic depreciation", the pipeline owner receives a windfall. Such a switch allows it choose "the best of both worlds", using each system for the period when it produces the highest charge. The net effect is that total charges over the life of the pipeline are too high, and the pipeline owner can expect to earn a profit that is in excess of its cost of capital.

In this case total capital charges have a present value of €108 on an initial investment of €100, as shown in Table A 6. Any switch in methodology must therefore be factored in to the regulatory calculations to avoid such windfalls.

74 If capacity is traded on secondary markets then the market price of capacity in the two pipelines will be equalised. However, this will not prevent the misallocation of resources, which will occur in the primary market. The primary market will see excess demand for capacity on the cheaper pipeline, which will therefore be fully booked, while demand for capacity on the more expensive pipeline will be just sufficient to serve the unfulfilled demand for the cheaper pipeline.
Table A 6.: Inappropriate Switch from HCA to Economic Depreciation in Year 3

<table>
<thead>
<tr>
<th>Cost of Capital [1]</th>
<th>10%</th>
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</thead>
<tbody>
<tr>
<td>Year</td>
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<tr>
<td>Historical Cost Accounting [2] Table A 2</td>
<td>30</td>
</tr>
</tbody>
</table>

[1]: Assumed.
[4]: Years 1 and 2, row [2]. Thereafter, row [3].
[5]: PV of revenues in [4], discounted at [1].

In practice this is achieved by ensuring that any new methodology takes as a starting point the depreciated net book value of the previous methodology.

Table A 7.: Appropriate Switch from HCA to Economic Depreciation in Year 3

<table>
<thead>
<tr>
<th>Cost of Capital Inflation</th>
<th>[1]</th>
<th>[2]</th>
<th>10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>BOY Asset Value Depreciation</td>
<td>EY Asset Value</td>
<td>[3][4][5]</td>
<td>[3]-[4]</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>20</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>Total Capital Charges</td>
<td>[8]</td>
<td>30</td>
<td>28</td>
</tr>
<tr>
<td>Present Value</td>
<td>[9]</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

[1]: Assumed.
[2]: Assumed.
[3]: Initial investment of 100. Thereafter, [4].
[4]: Years 1 and 2: Fixed amount to depreciate by year 5. Thereafter, [8]-[7].
[8]: Years 1 and 2: [4]+[7]. Year 3: Set to return PV of 100. Thereafter, [8]x(l+[2]).
[9]: PV of revenues in [8], discounted at [1].
### Annex 2  Domestic Transport Tariffs

<table>
<thead>
<tr>
<th>Case</th>
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<th>3</th>
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<tbody>
<tr>
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<td>350</td>
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<tr>
<td>LF, 000h</td>
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<td>5</td>
<td>8</td>
<td>5</td>
<td>8</td>
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<td>33</td>
<td>59</td>
<td>56</td>
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<td>75</td>
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<td>96</td>
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<td>107</td>
<td>114</td>
<td>107</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UK high</td>
<td>31</td>
<td>24</td>
<td>28</td>
<td>21</td>
<td>46</td>
<td>39</td>
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<tr>
<td>UK low</td>
<td>24</td>
<td>16</td>
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<td>27</td>
<td>25</td>
<td>33</td>
<td>30</td>
<td>35</td>
<td>33</td>
</tr>
</tbody>
</table>

Source: “West European Gas Transmission Tariff Comparisons”, A.D. Little, May 2004

**Notes:**
- Tariffs are in €/m3/h/y at 35.17MJ/m3 with 0 RTL and for 100 million m3
- HTL = distance on the high pressure network
- RTL = distance on the regional network
- LF = load factor

In the study, in total 45 cases are evaluated with various combinations of transport volumes (1, 10 and 100 million m3), transport distances (HTL from 50 to 350 km and RTL from 0 to 30 km) and load factors (from 2500 to 8000 hours). All results could be viewed at the website of Gas Transmission Services (GTS).