Appendix 1

Actual Flows 1997

Appendix 1: Actual Annual & Peak Flows

This Appendix describes annual and peak flows during the calendar year 1997. Where relevant, we have also included more up to date data from the subsequent winter period. Annual flow is used to calculate the revenue which Transco is allowed to recover in accordance with its price control formula, whilst peak flow is used to determine if capacity expansion is required on the network.

A1.1 Annual Flows

Transco's annual forecasts assume that the weather will be "average". Therefore, when comparing actual demand with forecasts, we have adjusted the demand by a factor to take account of the difference between the actual weather and the seasonal normal weather. The result of this calculation is the weather corrected demand. The following table compares actual system throughputs in 1997 with weather corrected demand and the forecasts given in the 1997 Ten Year Statement.

Weather corrected and forecast demands are based on the equivalent of a 10 year average of weather conditions which takes account of global warming effects, rather than the full 65 year weather database used historically. This approach was agreed with Ofgas and the MMC during the recent formula review and is equivalent to a 2% reduction in LDZ demand compared to that which would be expected if weather data from the last 65 years was used. No change has been made to Transco's peak forecasts as there is no evidence to suggest that the probability of severe weather occurring has changed.

Table A1.1a Annual Demand for 1997 by LDZ & NTS Split (TWh)

	Actual Demand	Weather Corr Demand	Forecast for 1997	% Variance
LDZ Loads				
0 - 73 MWh	333	361	366	-1.3%
73 - 732 MWh	58	62	64	-2.5%
>732 MWh Firm	134	140	118	18.6%
Interruptible	118	123	97	26.4%
LDZ Total	**643**	**686**	**645**	**6.3%**
NTS Loads	176	179	158	13.2%
Total Demand	**819**	**865**	**803**	**7.7%**

Table A1.1b Annual Demand for 1997 by Business & Domestic and Large User Split (TWh)

	Actual Demand	Weather Corr Demand	Forecast for 1997	% Variance
Business and Domestic				
0 - 73 MWh	333	361	366	-1.3%
73 - 732 MWh	58	62	64	-2.5%
>732 MWh Firm	130	136	113	20.0%
Interruptible	104	109	87	26.0%
Business and Domestic Total	**625**	**668**	**630**	**6.1%**
Large Users				
LDZ Large Loads	18	18	15	16.2%
NTS Loads	176	179	158	13.2%
Large Users Total	**194**	**197**	**173**	**13.4%**
Total Demand	**819**	**865**	**803**	**7.7%**

Note:

- NTS figures include one industrial load (6 TWh per annum) that formerly was not included in the Transco annual volumes for determining allowed revenue under the price control formula
- Total system demand excludes shrinkage
- The forecast for 1997 is as reported in the 1997 Ten Year Statement
- % variance is the difference between weather corrected demand and the 1997 forecast calculated using un-rounded figures

The data confirms that 1997 was a warm year, resulting in a loss in demand of 46 TWh. Table A1.1 shows the higher than expected growth in the >732 MWh Firm and Interruptible markets brought about by the favourable economic climate and highly competitive gas prices within these sectors. Growth in NTS loads was due to the higher utilisation of Transco's network by dual supplied power stations, the build up of new power station loads and increased exports to Ireland. Dual supplied power stations are those which are connected to the NTS and also have their own dedicated pipeline and so are able to choose the source of their gas.

A1.2 Compressor Usage

The following table shows the gas used at each of the compressor stations during 1997, and the usage on the maximum demand day in the 1997/98 winter period.

Table A1.2 Compressor Usage for 1997 (mcm)

Compressor	Total 1997	Max. Demand Day 16 Dec. 1997
Alrewas	6.60	0.08
Aylesbury	4.61	0.07
Bathgate	8.10	0.00
Bishop Auckland	11.94	0.14
Cambridge	0.18	0.08
Carnforth	22.12	0.15
Chelmsford	3.24	0.07
Churchover	14.56	0.12
Diss	11.92	0.14
Hatton	5.19	0.12
Huntingdon	7.26	0.12
Kings Lynn	0.54	0.00
Kirriemuir	41.19	0.18
Moffat	41.12	0.17
Peterborough	18.24	0.17
Scunthorpe	0.71	0.00
Warrington	28.06	0.14
Wisbech	16.47	0.11
Wormington	9.05	0.10
Sub-total	**251.10**	**1.96**
St.Fergus	55.55	0.22
Total	**306.65**	**2.18**

The highest usage is at St Fergus, which runs all year round to boost the pressure of gas from the low pressure Total Oil Marine sub-terminal up to NTS pressure.

Transco is undertaking studies to measure and monitor compressor usage to try to optimise efficiency and operation. However as shippers are responsible for daily nominations from terminals, Transco has to run compressors for longer periods to move gas based on actual sourcing, rather than optimum sourcing.

A1.3 Peak Flows

Transco managed a record demand of 388 mcm on 20 February 1996. The entry and exit flows on that day were described in the 1996 Ten Year Statement.

The maximum demand of 365 mcm/d during the 1997/98 winter was on 16 December 1997. The peak flows on that day are described here.

A1.3.1 Entry Peak Flows

This following table shows peak flows into the system on the maximum demand day of the 1997/98 winter, compared to the previously forecast 1 in 20 peak. The distribution of terminal deliveries was different from expected, with higher than anticipated deliveries at Bacton and lower deliveries at St. Fergus. To accommodate this situation, additional compression was used to move gas around the system and away from Bacton.

The table also shows the potential maximum flows at each terminal. However, all terminals cannot operate at maximum at the same time because of NTS design flow limits and the need to balance to actual demand. This effect is described in more detail in Appendix 9.

Table A1.3.1 Entry Peak Day Flows (mcm per day)

Terminal	Actual Max. 16 Dec. 1997	1 in 20 Peak for 1997/98	Potential Max. for 1997/98
Bacton	100.43	96.72	110
Barrow	66.27	61.00	61
Easington (exc. Rough)	21.39	28.95	33*
St. Fergus	93.55	104.20	125
Teesside	23.57	26.28	40
Theddlethorpe	32.43	36.73	50
Sub-total	**337.64**	**353.88**	**419**
Storage	27.13	92.32	
Total	**364.77**	**446.20**	

Note:

- Actual max. refers to flows on 16 December 1997. These flows are not necessarily commensurate with current forecasts or with maximum flows at individual terminals
- 1 in 20 Peak refers to the 1998 Base Plan Assumptions, published in December 1997
- The potential maximum flows are based on the lowest of either the maximum available physical capacity (Barrow, St Fergus), or the maximum expected delivery with an allowance to accommodate some additional gas if delivered (Bacton, Easington, Teesside, Theddlethorpe). The figures do not reflect Transco's reinforcement to accommodate higher capacities beyond 1998/99.
- The potential maximum for Easington (marked *) excludes deliveries from Rough (maximum 42 mcm/d).

A1.3.2 Exit Peak Flows

The following table shows actual peak flows out of the NTS on the maximum demand day of the 1997/98 winter, compared to the previously forecast 1 in 20 peak flow.

Table A1.3.2 NTS Exit Peak Flows (mcm per day)

LDZ	Actual Max. 16 Dec. 1997	1 in 20 Peak for 1997/98
East Midlands	25.53	31.19
Eastern	33.84	40.72
North East	18.29	23.69
North Thames	16.62	19.90
North West	37.51	45.44
Northern	39.58	50.44
Scotland	21.80	27.21
South East	35.38	45.72
South West	23.44	32.76
Southern	18.88	24.06
Wales North	30.89	40.16
Wales South	3.62	4.35
West Midlands	13.19	14.99
LDZ Total	**318.57**	**400.63**
NTS Loads	50.58	45.62
Total	**369.15**	**446.25**

Note:

- Actual max. refers to flows on 16 December 1997, however it was an exceptionally mild winter overall and peak conditions were not experienced. This was the highest overall demand day, but individual LDZs may have seen higher demands on other days.
- NTS loads consumed more gas on this day than the forecast 1 in 20 peak day as some interruptible loads were supported due to capacity being available with low LDZ throughputs.
- 1 in 20 peak demands are from the 1998 Base Plan Assumptions and are firm demands only. They have been converted to volume using a CV of 39 MJ/m^3.
- The difference between total demand and total supply on the day was due to changes in linepack.

A1.4 System Utilisation

Transco has two obligations under its licence regarding system design and operation. The first requires that Transco should operate an efficient and economic system and the second that the system should be designed to deliver a 1 in 20 peak day demand.

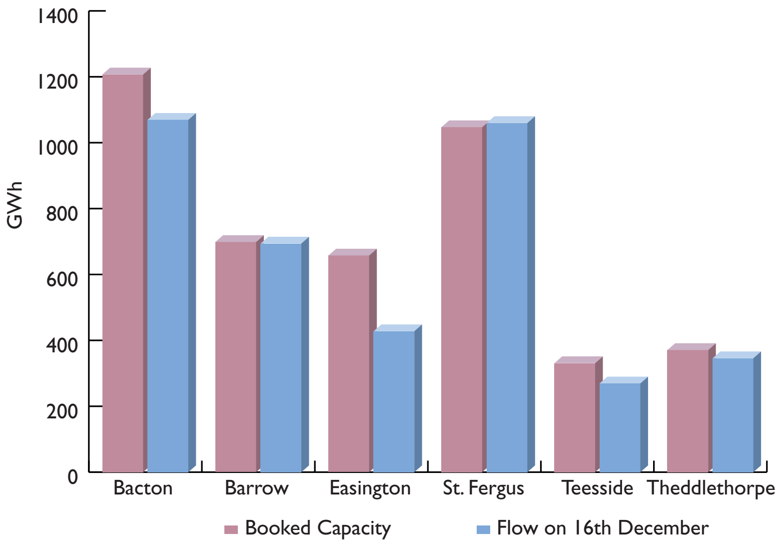
The NTS and LTS are designed to transport a 1 in 20 peak demand and under such circumstances are fully utilised. However the weather conditions associated with this demand level occur very rarely and under milder conditions the transportation system is under utilised. One method of measuring the level of system utilisation is using a load factor, this is defined as:

$$\text{Load factor} = \frac{\text{Annual Demand}}{\text{Peak Day Demand x 365}}$$

The operational load factor for 1997 was 45.6%, based on actual annual demand and forecast 1997/8 peak. For comparison, if weather conditions had been closer to seasonal normal the factor would have been 49.1%. The load factor is expected to increase in the future as the European Interconnector and more gas fired power generation become operational. However domestic consumers, with a load factor of approximately 36%, are expected to account for about half of annual demand for the foreseeable future. Consequently, it is unlikely that the total load factor will ever increase to much more than 60%. Some of Transco's market development initiatives are aimed at increasing summer utilisation by promoting gas fired air conditioning and natural gas vehicles and hence increasing the load factor.

Another measure of efficiency of utilisation of Transco's system is a comparison of booked capacity against usage. The graph below shows booked and used entry capacity for the 16th December, the highest demand day of winter 1997/8:

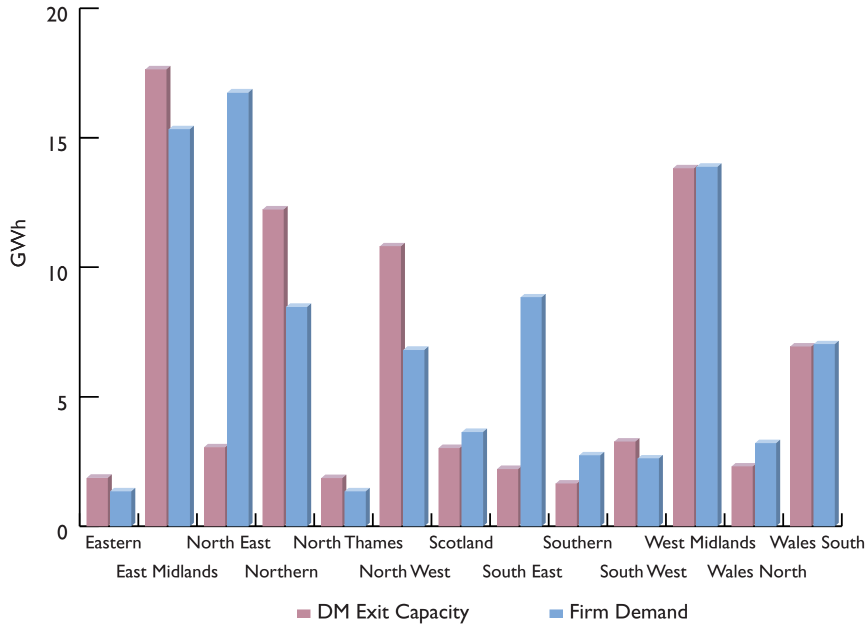
Figure A1.4a - Entry Capacity Usage For Beach Terminals On 16th December 1997



As can be seen, booked capacity and usage are very similar for St. Fergus and Barrow; these terminals have high entry prices which may encourage efficient use of booked capacity. The largest discrepancy is seen for Easington and is due to the inclusion of bookings for Rough, which was not fully utilised on the 16th December. This was because demand levels were not high enough to require it and due to the "V Factor". This rule prevented the use of interruptible Rough deliverability when the day ahead demand forecast was greater than 85% of the peak day, it has now been removed from the Network Code. More entry capacity was booked at Bacton than was required, this may be influenced by the low entry price.

Figure 1.4b compares shippers bookings of LDZ exit capacity to firm daily metered (DM) demand on the 16th December 1997.

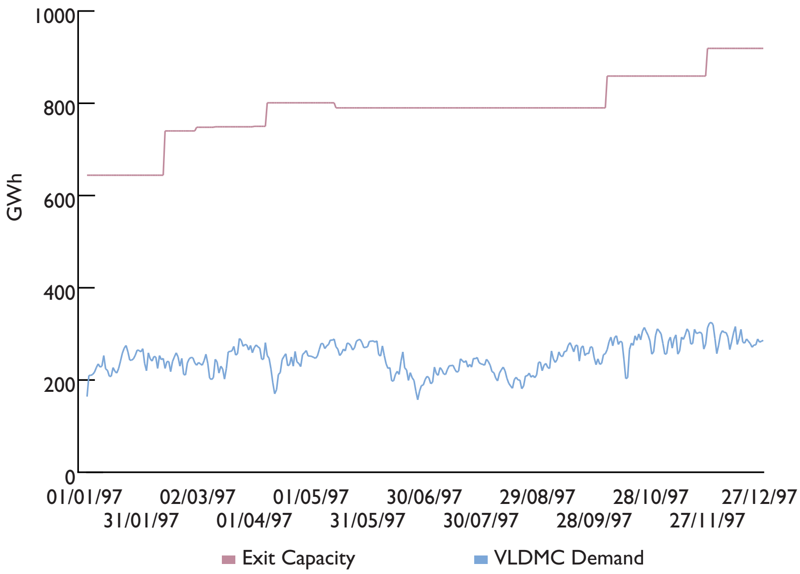
Figure A1.4b - DM Exit Capacity Usage For LDZs On 16th December 1997



In general there is a fairly close correlation, between exit capacity and demand on the 16th December. However for certain LDZs (North East and South East) the exit capacity is substantially higher than demand whereas for Northern and North West demand is greater than booked capacity. Both of these effects are due to the small number of daily metered loads, there are less than 2,000 across Britain. The Network Code anticipated that there would be more DM sites, therefore a “flying wedge” and the inclusion of an element of diversity was thought to be appropriate. The “flying wedge” increases the duration of all exit capacity booked by a shipper so that all tranches end on the same date and in some cases causes more exit capacity to be booked than necessary due to the same load being included in more than one shipper’s capacity booking. Conversely the inclusion of an element of diversity in a shipper’s capacity booking may result in overall too little being booked for an LDZ. However due to the small number of DM sites, these have had unexpected effects, which will be resolved by the implementation of Network Code Modification 164.

Figure 1.4c illustrates exit capacity bookings for Very Large Daily Metered Consumers (VLDMCs) e.g. power stations connected to the NTS. Both capacity and demand are relatively constant over time, however booked capacity is two to three times greater than demand. This is due to an assumption in the Network Code that all NTS loads take gas as a flat profile for 24 hours and therefore their maximum daily rate (SOQ) is twenty four times their maximum hourly rate (SHQ). As this is unlikely to be the case (most power stations do not operate at their maximum rate for more than eight to twelve hours a day) more capacity is booked than is required. Another cause of the discrepancy is Moffat, where substantially more exit capacity was booked than was actually used, possibly influenced by the low exit capacity charge and the competition between shippers to supply Ireland.

Figure A1.4c - VLDMC Exit Capacity Usage For 1997

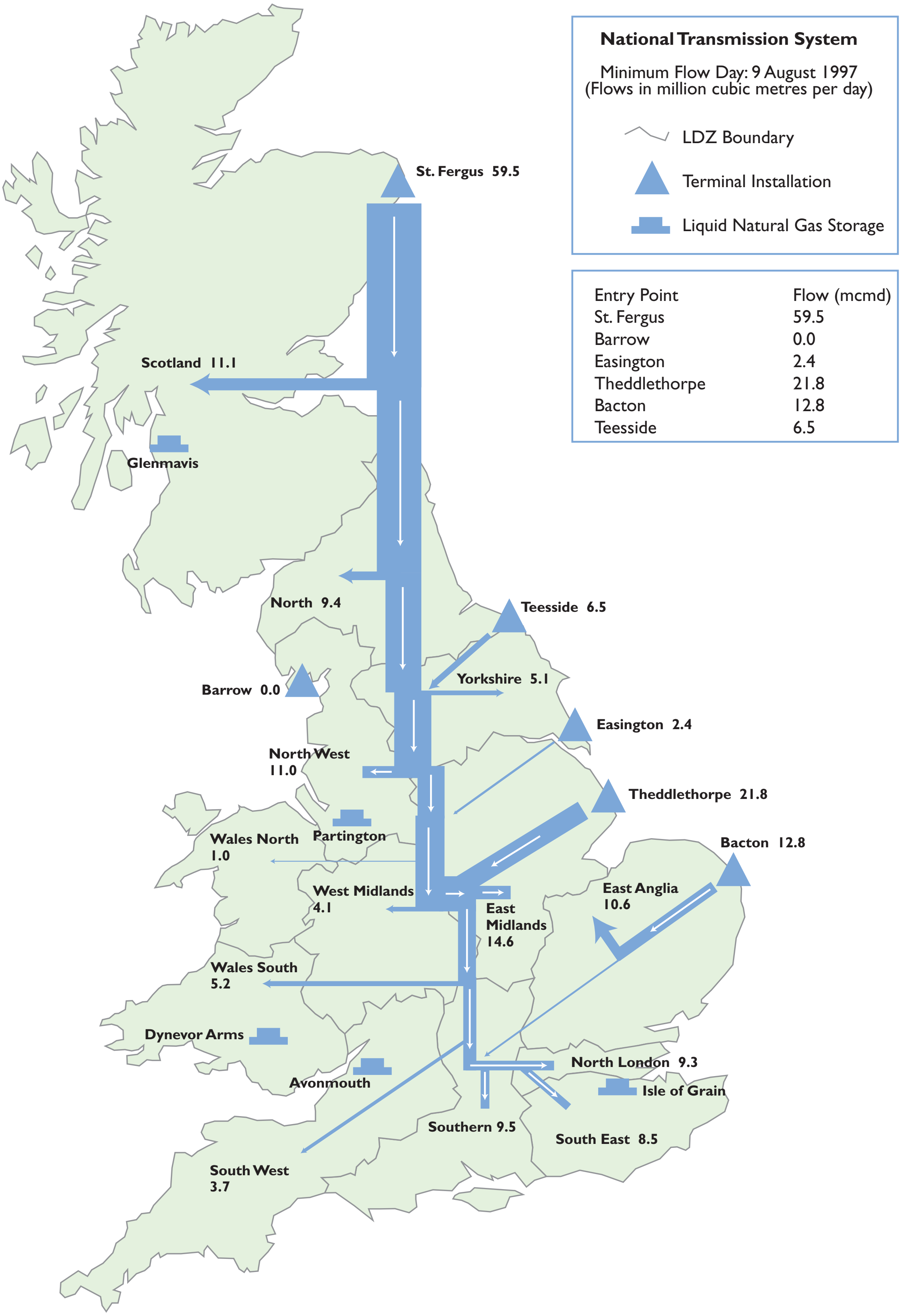


The following diagrams show the directions of flow (not the actual NTS pipelines) and total NTS flows on the days of maximum and minimum demand. The NTS flows include exit flows to NTS loads, changes in NTS linepack, own use gas and injection into storage.

The diagrams show the change in the proportions of total demand that are met by the different terminals between winter and summer, as well as indicating the scale of the difference between maximum and minimum flows. The most striking feature is the change in the relative importance of St Fergus in supplying total demand: on the maximum flow day St Fergus supplied 26% of total demand, whereas on the minimum flow day it supplied 51% of the reduced total demand, this leads to increased operating costs during the summer months.

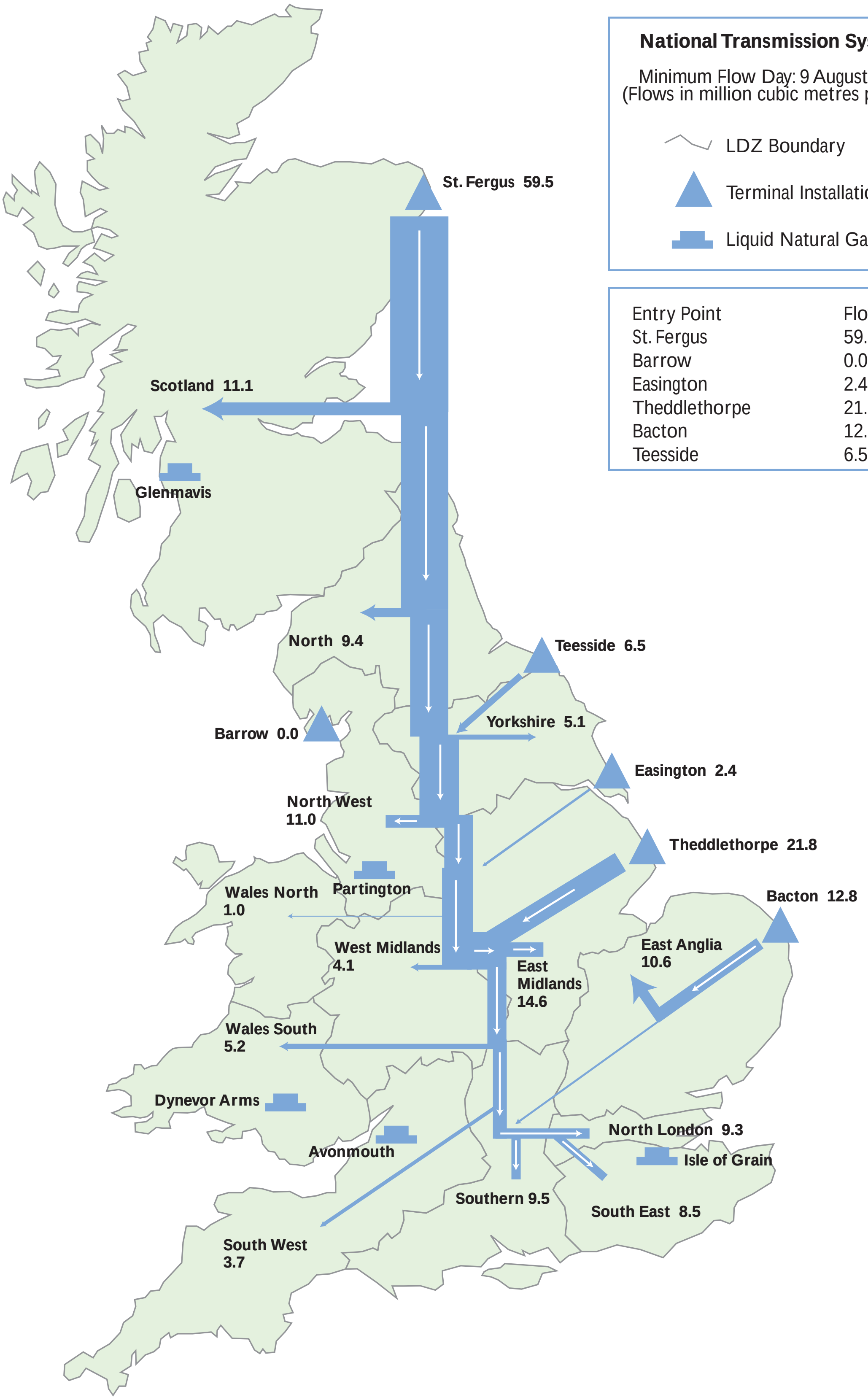
Further information on system utilisation can be found in Appendix 2, which discusses interruption, capacity constraints and entry capacity trading.

Figure A1.4e Minimum Flow Day (21 July 1996)



Entry Point	Flow (mcmd)
St. Fergus	59.5
Barrow	0.0
Easington	2.4
Theddlethorpe	21.8
Bacton	12.8
Teesside	6.5

Figure A1.4e Minimum Flow Day (9 August 1997)



National Transmission System

Minimum Flow Day: 9 August 1997
(Flows in million cubic metres per day)

- LDZ Boundary
- Terminal Installation
- Liquid Natural Gas Storage

Entry Point	Flow (mcmd)
St. Fergus	59.5
Barrow	0.0
Easington	2.4
Theddlethorpe	21.8
Bacton	12.8
Teesside	6.5