



Appendix 4

The Transportation System

A4.1 Key Statistics

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Appendix 4: The Transportation System

A4.1 Key Statistics, 1997

A4.1.1 Length of mains in use

- Distribution System (up to 7 bar): 252,000 km
- Local Transmission System: 11,928 km
- National Transmission System: 6,087 km

A4.1.2 Mains & services laid

- New mains laid: 1,741 km
- Replacement mains laid: 2,016 km
- New services laid: 254,000
- Replacement services laid: 165,000

A4.1.3 Terminals

- St. Fergus
- Theddlethorpe
- Easington
- Bacton
- Barrow
- Teesside
- Burton Point

A4.1.4 Compression

- Number of sites: 21
- Total installed power: 855 MW

A4.1.5 Gas Sendout

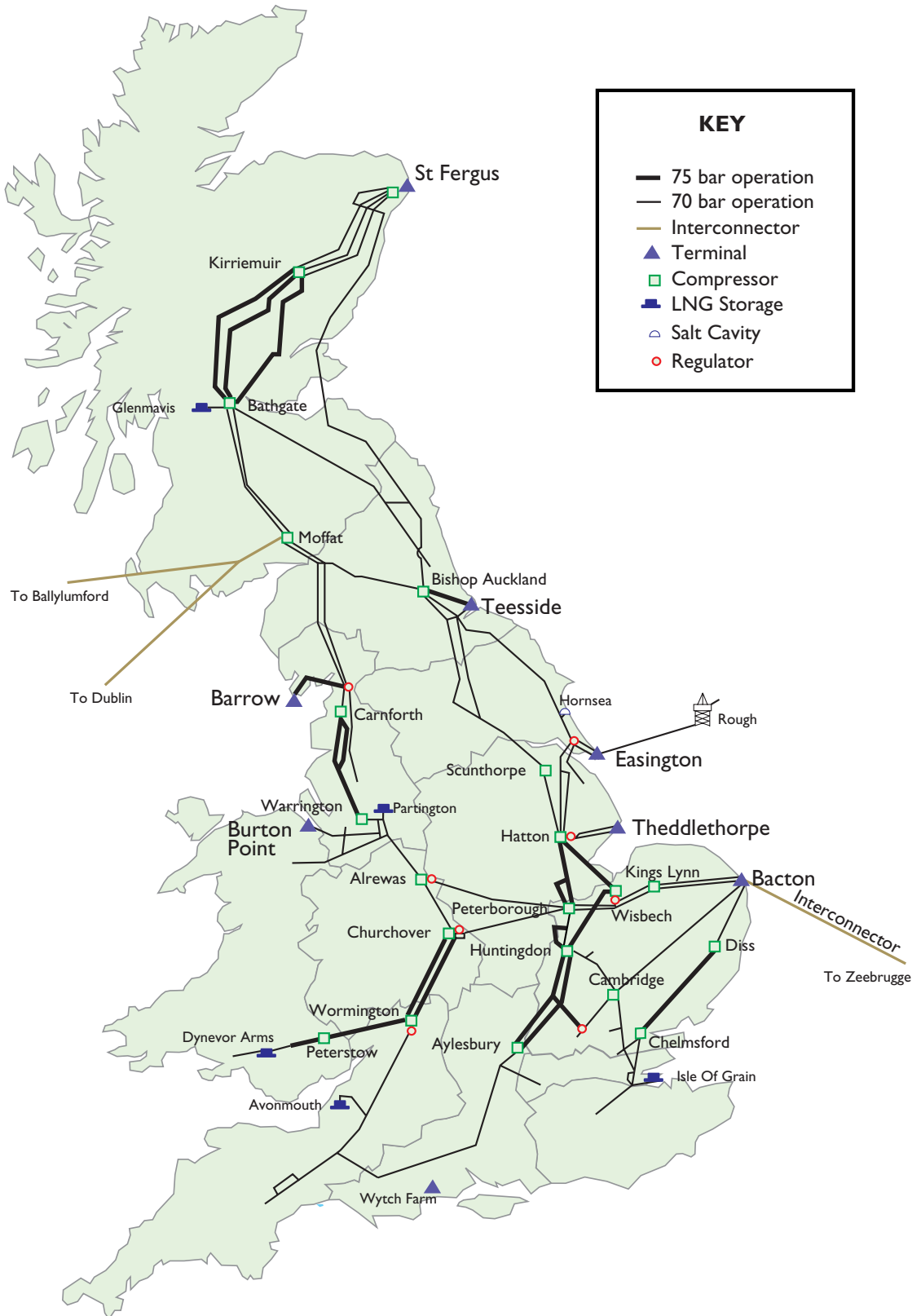
- Average actual daily sendout in 1997 calendar year: 212.3 mcm
- Highest daily sendout in 1997: 369.2 mcm on 16 December 1997.

Gas is input at high pressure into National Transmission System and, with the aid of compressors, is transported to major consumers and Local Distribution Zones (LDZs). Subsequently gas passes through tiers of the distribution system at reducing pressure levels to consumers' sites.

A4.2 National Transmission System

The National Transmission System (NTS) consists of gas reception terminals; compressor stations; a high-pressure pipeline system; and offtakes to the 13 LDZs and large industrial and power station loads.

The following map shows the main elements of the NTS:



A4.2.1 Gas Reception Terminals

The gas reception terminals receive gas from approximately 100 gas and oil fields in production in the UK Continental Shelf. The producer carries out the processing required to meet the NTS quality specification, whilst the functions carried out by the Transco reception terminal include:

- quality monitoring;
- filtering;
- mixing;
- control of gas flows into different pipelines leaving the Transco terminal;
- reception of gas metering signals from the producer;
- providing emergency shutoff facilities; and
- compressing gas (St Fergus only).

Transco operates seven terminals: St Fergus, Easington, Theddlethorpe, Bacton, Barrow, Teesside and Burton Point. There are also a number of small terminals at onshore gas fields, including Wytch Farm in Dorset that feeds gas directly into the Local Transmission System and Hatfield Moor in South Yorkshire which feeds the Distribution System.

A4.2.3 Compressor Stations

There are 21 compressor station sites, consisting of compressor units driven by gas powered Rolls Royce, General Electric and Orenda jet engines or electrically driven Mopico units. Their function is to boost pressure to increase transmission capacity and move gas through the pipeline network.

During 1997 gas year, compressors used 306 mcm of gas as fuel. One of Transco's major operational objectives is to minimise the use, and hence cost, of compression. However, use is increasing as additional volumes of gas are landed at St Fergus.

A4.2.4 National Transmission System Pipeline

The NTS receives gas from reception terminals and transmits it to 13 Local Distribution Zones (LDZs) and to a number of power stations and other large consumers. Gas also enters the NTS from salt cavity storage and LNG sites at various locations.

The system consists of 6,087 km of steel pipelines operating at pressures up to 75 bar. The pipelines are between 150 and 1,220 mm in diameter and are of relatively modern construction, the majority having been constructed in the 1970s and early 1980s. Transco ensures the integrity of the system by regular maintenance, aerial surveys and on-line inspection to detect any deterioration of the pipelines or external damage. Transco operates, controls and manages the system from the National Control Centre at Hinckley.

At various points on the NTS there are pipeline junctions, called Above Ground Installations, consisting of pipework, valves and pigging facilities (which facilitate maintenance of the system).

A4.2.5 Offtakes

Offtake installations are designed to supply gas from the NTS to Local Distribution Zones and some large consumers in a controlled manner. Currently there are 151 telemetered installations where gas passes from the NTS through independently metered systems, of these 121 supply gas to LDZs and the remaining 30 to power stations, large industrial loads and interconnectors.

Offtake installations consist of some or all of the following depending on the particular requirements:

- remotely operable valves;
- filtering and metering equipment;
- gas heating facilities;

- pressure or flow control regulator streams;
- over pressure protection systems; and
- odourising plant.

The installations have instrumentation and telemetry so that they can be monitored and controlled remotely.

A4.3 Local Transmission Systems

The Local Transmission System (LTS) transports gas from NTS offtakes towards and between urban areas, in addition, a number of large industrial gas users and power stations are supplied directly.

Gas from the NTS is fed into the LTS steel pipeline network at pressures typically in the range 38barg to 70barg. The LTS consists of 11,928 km of pipelines, which are of relatively recent construction, most having been laid since 1960 when gas began to be produced from petroleum.

There are approximately 2,400 Pressure Reduction Stations on the Local Transmission Systems. These installations reduce the pressure of gas from the transmission system to supply the Distribution System.

A4.4 Distribution System

The Distribution System consists of three pressure tiers:

- Intermediate pressure, operating between 7 bar and 2 bar
- Medium pressure, operating between 2 bar and 75 mbar; and
- Low pressure, operating below 75 mbar.

A4.4.1 Intermediate and Medium Pressure Distribution Systems

The intermediate-pressure systems comprise some 5,000 km of (mostly) steel mains. In the past few years, polyethylene has been developed to the extent that it is now suitable for operation at pressures up to 7 bar. Intermediate-pressure mains take over the role of bulk transmission from the LTS, carrying gas to smaller towns and villages.

There is about 30,000 km of medium-pressure mains of which about 25 per cent is polyethylene. These mains carry gas to centres of population for low pressure distribution.

There are 14,000 Pressure Reducing Stations on the Intermediate and Medium Pressure Distribution Systems; these installations, also known as district governors, generally supply gas into the Low Pressure Distribution System. There are a further 11,500 governor stations that supply gas directly to non-domestic gas users.

A4.4.2 Low Pressure Distribution System

Low pressure mains constitute most of the pipeline system, with a total of about 217,000 km in use. The low-pressure network in any area is likely to be a complex structure and it is from these mains that the vast majority (98 per cent) of service connections are taken.

Just over 44% per cent of low-pressure mains are cast iron. However, Transco has used Polyethylene for distribution mains since 1969 and about 42% per cent of the low-pressure mains population is now polyethylene. Virtually all new low-pressure mains are constructed of polyethylene.

Transco uses electronic control of the low pressure networks to optimise capacity and minimise leakage. This technology is under development and Transco plans for wider applications at the earliest opportunity.

The final part of the supply system, connecting the distribution main to the customer's meter, is referred to as the service. Until the advent of polyethylene, most services were laid in steel. As a result of the

extensive replacement programme, 60 per cent are now polyethylene. Replacement has also removed a large proportion of the older and small diameter mains, either because of condition or for safety reasons.

The Local Transmission and Distribution systems comprise the largest element of the Transco asset base. The maintenance and safe and efficient operation of these systems are fundamental to the success of the organisation.

A4.5 Diurnal Storage

Demand for gas varies through the day, following consumers' patterns of usage. Demand at night is much lower than during the day, however gas is supplied from offshore producers at a constant rate. It is cheaper (and more secure) to provide diurnal storage within the system than to meet instantaneous demand from the production wells. Therefore, the gas supply system is designed to provide diurnal storage to meet the variations in demand during a 24-hour period.

In principle, the NTS supplies gas into the Local Distribution Zones at a constant rate, and the diurnal swing of demand is absorbed by diurnal storage in the LDZs. However, some LDZs supplement their diurnal storage from the NTS. The different types of diurnal storage are described below.

A4.5.1 Low-pressure Gasholders

Low-pressure gasholders provide approximately 43% of available LDZ diurnal storage. Some 24.5 mcm is contained in 473 operational holders, ranging in capacity from 0.014 mcm to 0.28 mcm.

No new holders have been constructed since 1975, and there is a policy to decommission holders where the cost of maintenance makes their continued operations uneconomical, and the storage can be made available from elsewhere.

A4.5.2 High-pressure storage

A few high-pressure storage installations provide about 3 mcm capacity. The installations are of two types: buried pipe arrays and storage vessels (bullets).

A4.5.3 Line-pack and storage mains

The LTS is designed, where appropriate, to provide diurnal storage by pressure cycling of the pipelines which also provide the transmission capacity. LDZs generate some 26 mcm of storage by this means. Line-pack is generally the least-cost method of providing diurnal storage and has enabled the decommissioning of some gasholders to be considered.

A4.5.4 Salt cavity storage

Two salt cavity installations in the North and North West of England provide 3.2 mcm of diurnal storage. These cavities are at relatively shallow depths and operate at much lower pressures than those at Hornsea. Pressure cycling (withdrawal or injection) is on a daily, rather than seasonal, basis.

A4.5.5 Diurnal storage from the NTS

The NTS has no storage facilities dedicated to providing diurnal storage. The pipeline system is, however, designed to provide some line-pack storage by increasing the pressure above that required purely for transmission. Pressure cycling of NTS pipelines in this way allows the generation of significant quantities of storage for diurnal use.

Diurnal demand variations are met in the first instance by use of storage available in the LDZ and subsequently, if required, by linepack in the NTS.

Transco plans to provide the LDZs with a total of about 7.5 mcm of diurnal storage support from the NTS in 1998/9.