NATURAL GAS IN NONTECHNICAL LANGUAGE

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Introduction

Since its discovery thousands of years ago, natural gas has become an indispensable energy resource throughout most of the industrialized world. Many countries are fortunate enough to possess at least some domestic supplies of natural gas, while others such as Japan must import nearly all of the gas they need. Most areas that contain a wealth of oil resources are also rich in natural gas.

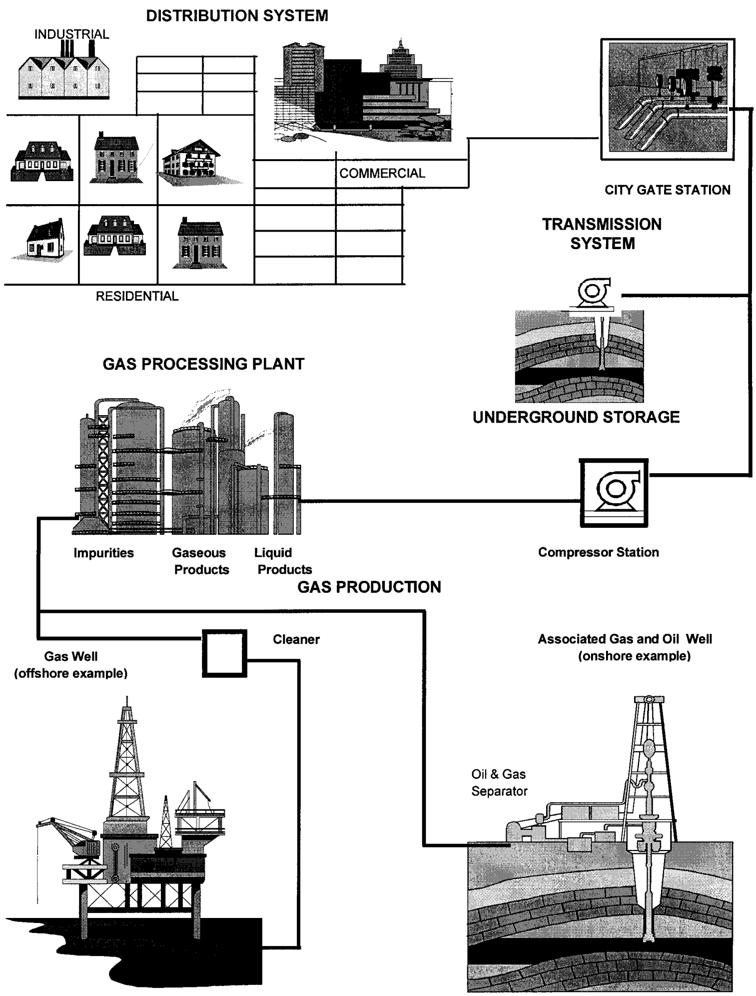

Figure I. **Path of Natural Gas from the Well to the Consumer**

CHAPTER

3 Drilling, Production, and Processing

Basic Steps of Drilling and Production

Drilling for natural gas begins after a prospect has been identified as having geological and economic conditions favorable for gas production. After getting legal permission to drill, operators begin by spudding the well, or breaking ground. Once the hole is drilled, measurements called well logs are performed to identify the gas-bearing formations. These tests also evaluate the porosity and permeability of the rock.

If the well looks promising, the bottom of the bare hole is cased, or lined with metal pipe to seal it from the rock. Completion of the well also involves setting its foundation underground with cement or other materials. Then holes are shot through the casing and cement to allow gas to flow into the well. Finally, smaller diameter tubing is run down the hole to conduct the gas to the surface.

For gas wells that target formations having a low permeability, extra steps might be required, such as fracturing. Also, different types of drill rigs and procedures are needed for offshore wells, especially those in deeper waters.

Pipeline Operation

Transmission lines are costly to build because of the investment in land rights, very large compressors, and huge amounts of high-strength, large-diameter pipe. Because of the size of the investment committed, pipeline companies strive to operate as close to maximum capacity as possible throughout the year. This spreads out the fixed costs of the pipeline investment over a greater volume of gas.

Nevertheless, the demand for gas varies greatly according to the season of the year because large amounts are used for heating during the winter. Also, the market for gas as a power generation fuel is growing, which will change traditional patterns of gas demand.

To minimize transportation costs, the pipeline industry tries to level the rate of gas delivery as much as possible—in effect, to smooth out the winter peaks and summer valleys of gas demand. For example, computer modeling enables the pipeline to look ahead and extract gas from storage just in time when it is needed, rather than having extra unsold capacity built up in the pipeline ("linepack").

Compressor stations

Natural gas is compressed for transmission to minimize the size and cost of the pipe required to transport it. As gas flows through a pipeline, friction inevitably reduces its pressure and flow rate. Thus, the gas must be re-compressed in compressor stations placed at intervals along the pipeline (Fig. 4–5). Usually, stations are sited at intervals of 50 to 100 miles (80 to 160 kilometers). The gas pressure is boosted by compressors rated at several thousand horsepower (kilowatts) each. As of year-end 1995 in the U.S., pipeline compressor power totaled more than 14.0 million horsepower (10 megawatts, MW).

Pipeline compressor stations can use either reciprocating or centrifugal compressors. Reciprocating machines have relatively high compression ratios (the ratio of outlet to inlet pressure) and limited capacities. Typically, they are connected in parallel at a compressor station and are driven by two-stroke, internal combustion natural gas engines. However, some four-stroke gas engines, large electric motors, and in a few cases, steam engines are used to drive reciprocating compressors (Fig. 4–6).

Centrifugal compressors have relatively lower compression ratios and higher capacities. These machines rotate at top speeds of 4,000 to 7,000 rpm and are usually driven by natural gas turbines, though steam turbines and internal combustion engines are sometimes used. Because of their high capacity, compact have been adapted to residential use in expensive homes. Specialty gas cooking products for commercial restaurants include combination ovens, "clamshell" (double-sided) broiler/griddles, and convection ovens. Gas cooking appliances have also been developed especially for fast-food restaurants, including deep-fat fryers (Fig. 7–8) and griddles. The gas industry has made these appliances much easier to control so that fast-food employees need very little training to operate them.

Fig. 7–8 Frymaster Deep-fat Fryer (Photo courtesy of Gas Research Institute)

Gas cooling

Unlike the residential sector, many large commercial buildings use gas for air conditioning as well as heating. Central chilled-water systems are common in hospital complexes, university campuses, and office buildings. Most gas-powered chillers use an absorption process to produce cold water for air conditioning (Fig. 7–9). These chillers are recognized for their quiet, trouble-free operation. In contrast to electric chillers, gas absorption units use water as the refrigerant instead of chemicals that cause global warming. Because of government restrictions on the use of these chemicals, some electric chillers are being replaced with gas-powered units.

The other method of commercial gas air conditioning is the engine driven chiller. Natural gas engines have been used for years to power the cooling process, but only recently have compact, high-efficiency packaged systems become available and gained popularity. The concept of gas engine driven why the company should not reduce its rates to provide only those revenues necessary to produce the allowed rate of return.

Other routine activities

In addition to hearing rate cases and resolving unusual problems, commissions perform many other functions on a continuing, day-to-day basis, such as determining the standards of service. The commission prescribes an allowable pressure range for gas deliveries to the customer that assures proper operation of gas equipment. Commissions also set standards for the accuracy of meters that measure the volumes of gas delivered to customers and procedures for periodic testing of these meters to determine that they have functioned accurately. Commissions also may prescribe the method of billing for the service, whether by volume or by heating value (therms or Btus). Other billing matters relate to the frequency of meter reading and billing and the termination of service for nonpayment.

State regulatory commissions also prevent undue or unreasonable discrimination of a customer or class of customers. Discrimination exists not only when customers with identical requirements are treated differently, but also when a customers with dissimilar service characteristics or requirements are treated alike. To avoid discrimination, state commissions have the authority to determine the level of rates to each class of customer.

Other matters that arise – most frequently during a rate case, but also as a result of a customer complaint – relate to various discretionary operating expenses allocated in determining the cost of service. Issues relating to service on a customer's premises, such as appliance adjustment and repair, might be considered discriminatory because not all customers share equally in the service offered. Many commissions require companies to charge customers for these services as they are rendered.

Advertising and promotional expenses are also the subject of commissions' scrutiny and might not be allowed as a cost of service unless the company can show that these expenses benefit all customers. Treating charitable contributions as an operating expense has also been contested in some states.

Municipal Regulations

Gas distribution companies are also subject to regulation by the municipal governments in their service areas. Franchises granted by municipalities generally specify a time period in which the franchise is effective, after which it will