

PUBLIC POLICY FOR THE

# Private sector

Note No. 137

March 1998

## Competition in the Natural Gas Industry

The emergence of spot, financial, and pipeline capacity markets

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**Countries in Asia, Europe, and North and South America are introducing reforms to boost efficiency and attract new private investment in their natural gas industries. The trend has been to unbundle along vertical and horizontal lines and to open wholesale gas markets to new entrants. These new entrants stimulate competition and the development of new markets—in gas supply, in financial gas contracts, and in pipeline capacity. Such has been the success of these new markets—especially in the United States and the United Kingdom—that it has prompted a search for other potential markets in the industry. This Note, part of the broad effort to aid reformers by disseminating knowledge from early reforms, describes the underlying structural and trading arrangements in the gas and pipeline markets. Two companion Notes examine these markets in the United Kingdom and the United States.**

### The emergence of gas and pipeline markets

Government's traditional control of gas companies and intervention in their operations and investment decisions often led to distorted prices, inefficient operation, and deteriorating infrastructure. Thus reforms have aimed at limiting government's role in the industry's day-to-day operations and establishing an effective regulatory framework under which market forces would balance demand and supply in segments of the industry where competition is feasible, and only those segments where competition is not feasible would remain subject to economic regulation.

A traditional, vertically integrated gas industry typically has only one market, where natural gas and transportation services are sold as a "bundle" to final consumers (figure 1). Introducing open access to pipeline transportation or unbundling supply from transportation creates two distinct markets: the gas market, where

participants trade natural gas as a commodity and minimize price and supply risks, and the transportation market, where participants trade transportation services for shipping gas through the pipeline system (figures 2 and 3).

The increasing complexity of transactions in both markets calls for the use of intermediaries and for spot markets that promote efficient pricing and minimize transaction costs. Well-functioning spot markets concentrate trading in a central location where gas supplies and pipeline capacity are easily accessible. Spot market trading typically arises first in natural gas because of the viability of competition in the gas market. As deregulation of the gas industry continues, however, markets may also emerge in other segments, such as natural gas storage, metering and meter installation, pipeline construction, and system balancing.

But markets cannot be created in all segments of the gas industry, so reformers must consider the viability of competition and markets in each



segment separately. The market for natural gas has great potential for competitive supply and demand because economies of scale are relatively unimportant in natural gas production and trading. Multiple firms can operate in the market unless it is extremely small, and prices of natural gas can be freely determined by market forces. By contrast, the natural monopoly characteristics of pipeline transportation prevent efficient operation of multiple pipeline firms in the same market unless it is

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extremely large. As a result, tariffs for pipeline transportation must be subject to economic regulation to prevent an incumbent pipeline company from exercising its market power.

Both structural and regulatory changes have generally played an important part in reforms of the natural gas industry. In the United States, however, reform has focused on gradual regulatory changes, since the industry was already vertically unbundled. The government created a competitive wholesale gas market by deregulating wholesale gas prices and unbundling the supply of natural gas from transportation on interstate pipelines. And it promoted flexibility in pipeline transportation services by allowing resale of firm transportation contracts in a secondary market. Under way for more than ten years, the deregulation process has now shifted its attention to the retail gas market.

Gas reform in the United Kingdom did involve both structural and regulatory changes, but in an inappropriate sequence. Gas supply to large consumers was liberalized and opened to competition in 1986, but the government failed to vertically unbundle British Gas, the former monopolistic gas company. Independent supply companies could not compete effectively with British Gas, which controlled access to transportation and thus gas supply. Only after repeated regulatory interventions in the gas market in the early 1990s and an intricate separation of British Gas into two companies in 1996 could competition flourish in the wholesale gas market. Correcting the initial failure to decentralize the industry structure took ten years. But the new industry structure offers better conditions for liberalizing the retail gas market.

Argentina and several other countries in Latin America adopted a more radical approach to reform, vertically unbundling the industry and deregulating the wholesale gas market in one quick stroke. In these countries gas reform was part of a larger economic reform package to enhance efficiency and investment in all major infrastructure sectors.

### **The natural gas market**

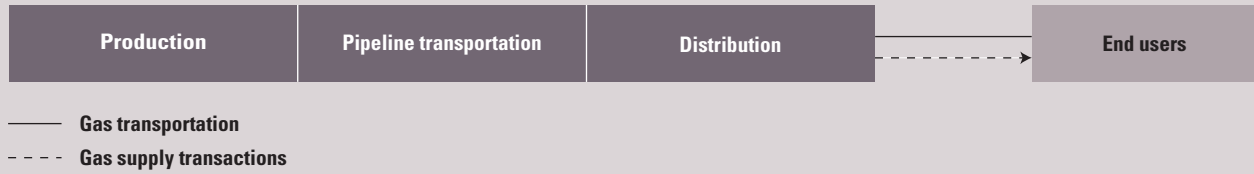
In the natural gas market, where natural gas is traded as a commodity separate from transportation services, participants typically trade natural gas under contracts. These contracts are of two main types, physical and financial, traded in different markets. The main participants in both the physical and the financial gas markets may include producers, traders, suppliers, pipeline companies, and distribution utilities, depending on the industry's degree of vertical and horizontal unbundling.

### **The physical gas market**

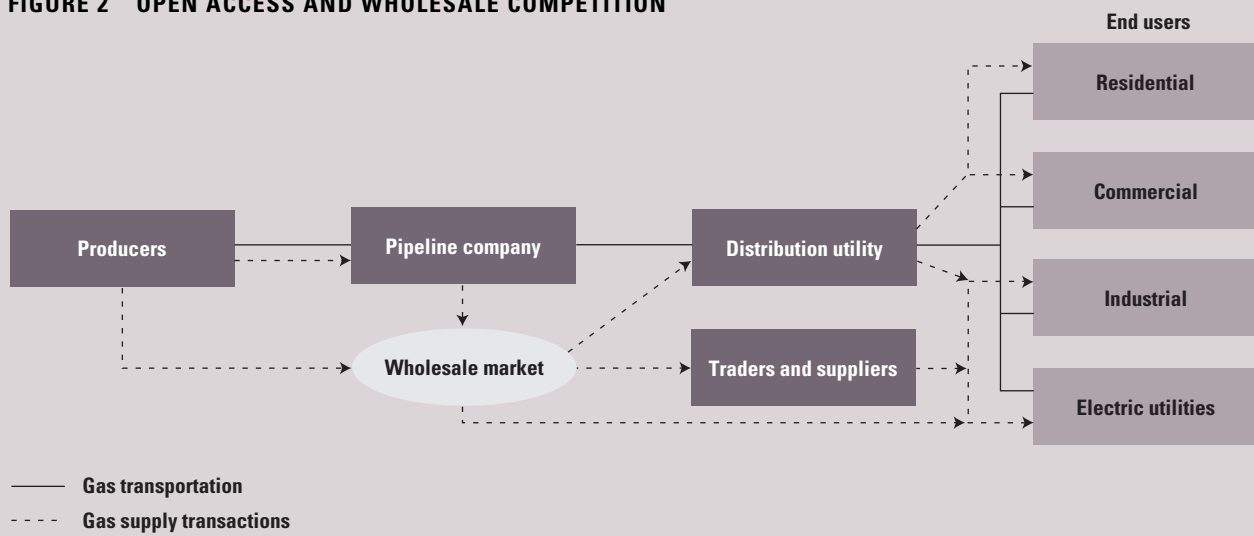
Participants in the physical gas market trade contracts for the physical delivery of natural gas—physical gas contracts (sometimes referred to as cash gas contracts). These contracts differ in two main dimensions, the purpose of the

**MARKETS IN THE NATURAL GAS INDUSTRY**

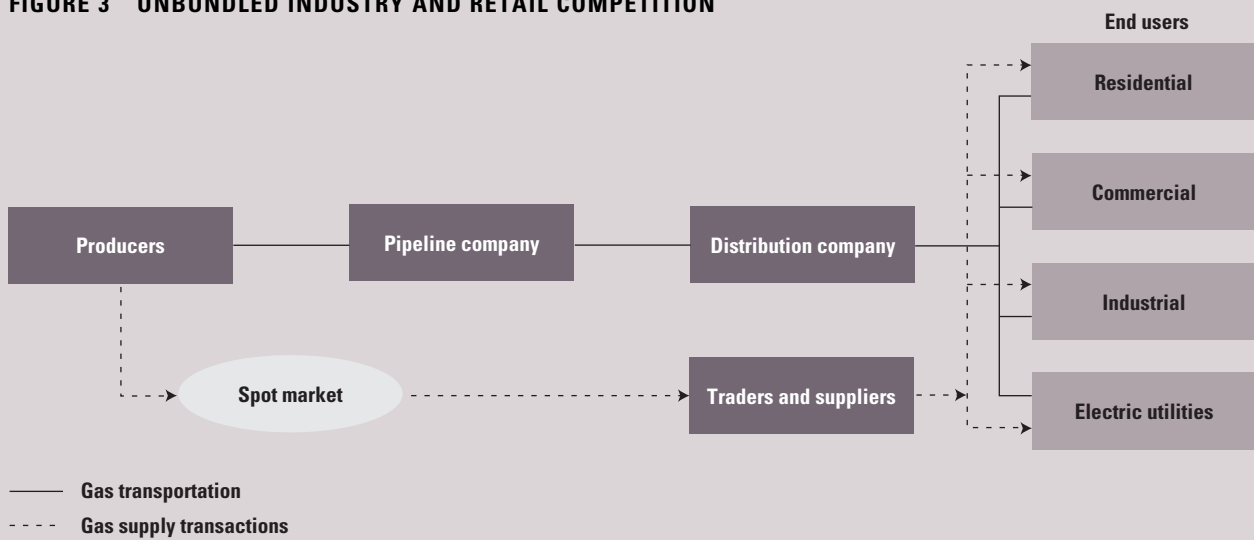
**FIGURE 1 VERTICALLY INTEGRATED NATURAL GAS INDUSTRY**



**FIGURE 2 OPEN ACCESS AND WHOLESALE COMPETITION**



**FIGURE 3 UNBUNDLED INDUSTRY AND RETAIL COMPETITION**



transaction and the duration of supply, and thus divide the physical gas market into several segments. A purchase of gas for resale takes place in the wholesale gas market, and a purchase for end use in the retail gas market. Wholesale transactions are concluded among producers, traders, suppliers, pipeline companies, and distribution firms, while retail transactions occur between suppliers and industrial or residential consumers.

Differences in the duration of gas supply divide gas contracts into three classes:

- Short-term gas contracts, for supply of up to one calendar month.
- Medium-term gas contracts, for supply of one to twelve months.
- Long-term gas contracts, for supply of more than one year.

Natural gas transactions were traditionally based on long-term supply contracts between integrated gas companies and their customers. Because these contracts fixed the price and volume of gas to be supplied over a specified period, they reduced supply and price risks. But they provided little flexibility to reflect the economic value of natural gas under changing

market conditions. For example, the economic value of natural gas tends to be high during extremely cold weather, when gas supply and transportation capacity are generally constrained. If the contract price of natural gas is fixed, supply and demand do not adjust in response to the higher value. Demand may ex-

ceed supply, and gas shortages may occur. In such a situation demand must be rationed by administrative rules—an interruption of supply—rather than prices.

Deregulation of the gas industry and greater flexibility in natural gas supply change the importance of long-term supply contracts. Participants in deregulated gas markets need to balance their supply and demand in both the long and the short term so they can react to changing market conditions. Short-term balancing can be achieved by trading in the short-term (spot) market, where producers, traders, suppliers, distribution utilities, and large end users enter into daily trades. Spot market participants can acquire natural gas supplies relatively quickly and choose the time and quantity of supply based on needs and price. That flexibility allows them to form a portfolio of long- and short-term contracts that minimizes supply and price risks in both the long and the short run.

Spot markets typically develop where buyers and sellers are concentrated, such as at a pipeline interconnection near a large metropolitan area or at a major terminal in a gas-producing region. The Henry Hub in Louisiana and the Bacton terminal in the United Kingdom, for example, are both located at the entry point to a major pipeline network in a large producing region. By aggregating supply and demand, spot markets offer industry participants the benefits of intensive competition among buyers and sellers, high liquidity, and greater efficiency in the pricing of natural gas.

In a well-functioning spot market short-term (spot) prices reflect the economic value of natural gas. Gas industry participants use spot prices to value supply contract portfolios and make decisions about the size and timing of consumption. Thus spot markets in natural gas serve the same function as other commodity or stock exchanges—they reveal the market value of the commodity traded. In the United States spot prices of natural gas at Henry Hub are a common indicator of market value.

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Spot prices tend to be volatile, however, responding to changes in underlying factors of supply and demand such as the weather, available pipeline capacity, or consumption patterns. Participants in spot markets, unable to predict the future prices of natural gas, are exposed to price risk. Their demand for tools to minimize this price risk leads to the development of a financial gas market.

### **The financial gas market**

The contracts traded in the financial gas market serve two main purposes: they minimize the price risk in the natural gas spot market, and they minimize the basis risk resulting from the changing price differential between physical and financial gas contracts. Financial gas contracts also serve as an instrument for speculation and price arbitrage in the gas market. They are seldom used for physical delivery of natural gas.

The most common financial gas contracts are forward contracts, swaps, futures, and options. Forward contracts and swaps are typically custom-tailored, with every aspect negotiated by the parties to the contract. Futures and options are standardized contracts typically traded in established commodity exchanges such as the New York Mercantile Exchange (Nymex) in the United States.

Transactions in the financial gas market involve the transfer of risks between market participants with different risk characteristics and risk management skills. For example, a distribution company with an obligation to serve final customers tends to be exposed to price risk because it cannot adjust its demand in response to changes in spot prices. Intermediaries such as traders or brokers tend to be experts in managing risk and can therefore better absorb the price risk. A transfer of price risk from the distribution utility to intermediaries minimizes the overall exposure to price risk and the costs of risk management.

A financial gas market will emerge in countries where the physical gas market has reached a

certain level of maturity and a large share of natural gas is traded under short-term contracts. Since only a few countries have a mature spot market, the financial gas market is a relatively new concept. Only the United States and the

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United Kingdom have active financial gas markets today. Nymex, in the United States, developed and actively trades three natural gas futures and options contracts for delivery in three major spot markets in the United States and Canada. The International Petroleum Exchange, in London, trades a natural gas futures contract for delivery at the National Balancing Point, a notional balancing point in the pipeline system of BG (the pipeline transportation spin-off of British Gas). Financial gas markets are likely to emerge in other countries as deregulation continues.

### **The transportation market**

Contracts traded in the transportation market cover transportation services, the supply of pipeline capacity and movement of natural gas needed to deliver gas to a desired location. Pipeline companies sell transportation contracts to shippers—any industry participants that want to move natural gas—in the primary transportation market. In some instances holders of firm transportation contracts may resell them to other market participants in the secondary transportation market.

#### **The primary transportation market**

The contracts purchased by shippers in the primary transportation market give them the right

to transport natural gas under specified conditions. The most important distinctions among transportation contracts are the duration and the reliability of the services provided. Contracts can be long, medium, or short term. And they can provide firm or interruptible service, a distinction that determines the priority given to a shipper during capacity shortages. Transportation contracts also specify the location, timing, and volume of natural gas shipments.

The natural monopoly characteristics of pipeline transportation require that the primary transportation market be regulated to limit the market power of pipeline companies and promote efficient allocation of resources. A pipeline company must incur substantial fixed costs to

with a corresponding portfolio of transportation contracts. Thus pipeline companies need to offer medium- and short-term transportation contracts and flexibility in the choice of injection and delivery points. Such services are typically preceded by the development of a more flexible regulatory environment for pipeline companies and the creation of a secondary transportation market.

#### **The secondary transportation market**

Holders of unused firm transportation contracts can resell these contracts in the secondary transportation market. Buyers and sellers in this market may be almost any participant in the primary transportation market, though pipeline companies are excluded because of their market power. Secondary transportation markets came into existence in the United States in 1992, when the Federal Energy Regulatory Commission introduced a capacity release program requiring interstate pipelines to allow holders of firm transportation contracts to release, or sell, any unused portions of their reserved pipeline capacity to other network users. The United Kingdom introduced a similar program of pipeline capacity resale in 1996 under the Network Code of British Gas.

The resale of transportation contracts promotes efficient allocation of transportation capacity. As a result of short-term changes in supply and demand, some pipeline users will not utilize all their contracted capacity, while others will lack capacity to ship their gas. In the absence of a secondary market holders of unused capacity cannot sell it to those who need it and pipeline capacity may go unused. A pipeline company can use spare capacity for interruptible services, but efficiency may be compromised because interruptible tariffs tend to undervalue available capacity. By contrast, the resale of firm transportation contracts allows contract holders to realize market value for unused pipeline capacity. Thus it can lead to optimal allocation of transportation capacity among market participants, based on their willingness to sell or pay. The efficiency of capacity allocation is sometimes

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construct the pipeline system before it can provide transportation services. And these fixed costs dominate the company's cost structure because the variable costs of shipping natural gas through the system tend to be relatively low. Pipeline transportation exhibits economies of scope as well as scale. Once the pipeline is constructed, a company typically uses the same facilities to offer different transportation services.

Deregulation of natural gas markets creates a need for flexible transportation services. Market participants need to be able to match their gas supplies with transportation services. And they often require short-term balancing of natural gas supply and demand to optimize the cost and reliability of natural gas deliveries. They can achieve such balancing only if they can match their portfolio of gas supply contracts

constrained, however, by regulation of the resale price, which tends to be capped to reduce the potential for exercise of market power.

To promote efficiency in the secondary transportation market, it is important to assign property rights to transportation capacity to a large number of shippers. If transportation contracts establish transferable property rights to pipeline capacity, contract holders can trade the contracts freely and the secondary market can flourish. But if transportation contracts establish property rights that are not transferable, the resale of contracts is impossible unless it is intermediated by the pipeline company. Contract holders may still engage in side-dealing by using their spare capacity for delivery of third-party gas, but these deals often involve high transaction costs. Firm capacity contracts that give their holders the right to reserved pipeline capacity typically establish property rights. But the transferability of such contracts depends on prevailing regulation.

The resale of transportation contracts can take several forms. Auctions in which shippers bid by price can be used for trading both long- and short-term transportation contracts, although they may be too time-consuming for resale of short-term contracts. Transactions in which shippers mutually agree on the conditions for contract resale give the parties a great deal of flexibility and so are well suited for all types of transportation contracts. But this form of trading may be too costly for smaller and less informed participants that have to shop around for the best deal.

Short-term transportation contracts may be traded in a transportation spot market. To promote liquidity and efficient pricing in this market, transportation contracts need to be standardized in all important dimensions. The resale of short-term transportation contracts not only promotes efficient allocation of contracts. It also facilitates the simultaneous clearing of gas and transportation markets by enabling market participants to match their spot gas transactions with short-term transportation con-

tracts. Spot markets in transportation contracts are developing in the United States, where electronic systems for trading natural gas and transportation contracts link large numbers of buyers and sellers.

## Market prospects

Having achieved considerable success in wholesale market competition, the United Kingdom and the United States are moving toward competition in retail gas supply to small consumers, under arrangements that will allow consumers to choose among gas suppliers and reap efficiency gains like those in the competitive wholesale gas market. The services needed to support retail competition, such as metering and billing, are also targets for the introduction of competitive provision. The unbundling of pipeline transportation has led to marketlike operation of natural gas storage facilities, with storage operators taking advantage of seasonal and daily price variations in nearby spot markets. Active trading of short-term transportation contracts will eventually give rise to a financial transportation market where participants can minimize the price risks in the physical transportation market. And with continued advances in technology and in the understanding of how the natural gas industry operates, more opportunities for competitive provision of goods and services will surely emerge.

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