The State of Competition in the Natural Gas Industry

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I. Introduction:

Over the past fifty years the natural gas industry as undergone dramatic changes as it has attempted to transition from being a non-competitive and highly regulated industry to a more competitive less regulated industry. While quite a bit of research has been done, many questions remain unanswered. Have the changes in regulation been successful? How is the industry changing today? How will the industry change in the future? These are all important question that need to be answered when analyzing the state of competition in the natural gas industry.

This paper will start by presenting the history of natural gas regulation since the creation of the Natural Gas Act in 1938 (Figure 1). It will then analyze the competitiveness of each natural gas sector using concentration ratios and the Herfindahl-Hirschman Index. These sectors include exploration and extraction, pipeline transportation, distribution, and marketing. Finally, conclusion will be drawn and policy recommendations made.

II. History:

In order to better understand the state of the natural gas industry in the present and how it is likely progress into the future, it is important to understand the past and how the present state of things came to be.

In 1938, Natural Gas Act (NGA) put pipeline transportation under the regulatory authority of the Federal Power Commission (Now knows as the Federal Energy Regulatory Commission). This was done because Natural Gas Industry was believed to be a natural monopoly industry. Therefore, all gas transported in interstate shipment were

regulated. Operating authorization was awarded to only those pipelines that showed supply reserves of 30 years and contracts with suppliers for 15 years. These conditions led to long-term contracts between pipeline transportation companies and local distribution companies (LDCs). Any cost changes were passed along the supply chain.

In 1958, the case Phillips Petroleum v. Wisconsin established the FPC's responsibility for regulating natural gas prices (Figure 1). To keep things simple the FPC implemented cost of service regulation. Since there were thousands of gas producers that required regulation, the country was divided into 5 regions and prices were determined. By the time prices were set by the FPC, market dynamics changed considerably due to inflation, demand surge, and high drilling costs. As a result, prices in 1968 were set according to the market characteristics of 1960. These artificial prices discouraged natural gas exploration and shortages occurred. The OPEC embargo worsened to the point that in 1976-77 supply was shut off from schools and stores to keep supply running for residential customers (Figure 1). A lot of companies became bankrupt, and the ineffectiveness of regulatory boards was shown.

In 1978, the deregulation of gas prices began. Since there were no price controls for new gas, exploration was encouraged. What was once a shortage transformed into a glut. In the early 1970's, suppliers had signed contracts at higher prices expecting those prices to continue. When this glut happened pipelines were stuck with higher priced contracts but LDCs were selling at lower prices. Many "take or pay" contracts were signed (Figure 1). These contracts forced pipelines to take a certain percentage or pay the amount due. Furthermore, these contracts did not allow any renegotiations at a later date.

By 1981 the oil embargo was easing and the oil prices were dropping. Consumers were shifting to oil instead of gas. The current U.S. recession and exogeneous factors such as warm winters decreased gas demand. Pipelines that were trapped by "take or pay" contracts passed their costs onto LDCs. At the same time suppliers established Special Marketing Programs (SMP) in order to retain large customer by offering cost savings. These services enabled customers to purchase gas directly while pipeline transported said gas at prices set by FERC. This was done upon FERC's approval, and it helped some of the pipelines regain a portion of their lost sales.

New transportation tariffs and contracts were set by the state regulatory boards as a means to circumvent shortages due to regulated prices. Starting in 1984, FERC initiated a series of orders intended to restructure the buy-sell relationship among production, transmission, and distribution companies. For half a decade, gas and its transportation was packaged as a single product by pipelines and sold to distributors at the city gate.

In 1984, FERC order 380 released local distribution companies from their obligation under existing long-term supply contracts to pay pipeline companies for a certain amount of natural gas even if the gas was not received. Next, FERC order 436 made possible the unbundling of gas and transportation (Figure 1). This allowed open access for consumers to ship their own gas and buy space in the pipeline. In 1989, Congress passed the Decontrol Act of 1989 which removed the requirement that outer continental shelf gas be sold to pipelines under long-term contracts of 15 years. This allowed consumers to contract at the wellhead on an open, unregulated market and entirely bypass ownership by pipelines.

The restructuring of the industry was required universally in 1992 with FERC Order 636 (Figure 1). It mandated that interstate pipelines offer transportation only. In effect, the pipelines had to remove themselves from the provision of merchant service, and instead provide space in their systems to producers, local distributing companies, or end- use consumers. The commission continued to regulate transportation, but now only as charges for firm space. With the development of secondary markets for space previously committed, transportation could be obtained from sources besides the pipelines. The commission set new limits on secondary prices as well.

Wellhead purchasers bargain for spot, short term and long term contract gas production at various rates. These brokers and dealers bargain with transmission companies for transportation, based on being able to switch their gas from pipeline to pipeline through market hubs to destination.

The focal point of transactions has changed from contract reserves to spot current and future production. Higher prices bring forth greater wellhead supplies and more pipeline firm transport capacity. Markets no longer operate on long term contract obligation to provide service but rather on firm versus interruptible delivery of spot gas on a contract by contract basis. Marketers with firm gas and transportation contracts specify monthly shipments, and other marketers with spot gas take interruptible transportation. Using electronics bulletin formats for offers and bids of gas and pipeline space, the marketer has access to current prices and commodity exchange future prices (MacAvoy, 2000).

In effect, gas was unbundled from transportation, at each level by new regulatory actions. FERC Order 637 in 2000 allowed capacity holders to trade their rights in

secondary market transactions. It suspended price caps for the sale of short term (less than one year) released capacity until September 30, 2000, refined regulations for segmenting capacity to give shippers more flexibility, and expanded pipeline reporting requirements on market transactions to increase market transparency.

In 2003, FERC passed two orders. Order 2004 established combined standards of conduct for electric public utilities and interstate natural gas pipeline companies. It broadened the definition of an energy affiliate to include both physical and financial transactions by marketing and non-marketing pipeline affiliates. Order 644 addressed standards of ethical behavior applicable to buying and selling natural gas and reporting data. It also prohibited actions that were without a legitimate business purpose and could manipulate market prices or conditions. Gas sellers were not required to report trade data to index publishers, but if they did, they had to provide accurate, complete and factual information.

In 2004 there was second hearing on Order 2004 and that resulted in FERC reaffirming the need for the rule and clarifying that it does not apply to affiliate gatherers, processors, and intrastate pipelines that have interactions with transmission pipelines but do not engage in nor are involved in transmission transactions. FERC upheld the rule's provisions that allow shared employees, such as officers and directors, to receive non-public operational information as long as they do not act as a conduit for sharing that information. The date for full compliance was extended from June 1, 2004 to September 1, 2004.

In the entire restructuring process, FERC did not design or clearly communicate a restructuring plan. Instead, it adopted evolving strategies and never interfered directly to

address problem contracts. Instead, it created market pressures to force pipelines and utilities to figure out the best solutions. For instance, FERC took no initiative to start gas exchanges or dictate the behavior of utilities. Still, the policies achieved their goals. Well-functioning markets developed for gas, transportation, and storage. FERC's focus was on removing regulatory impediments that might hamper direct and voluntary contracts between pipelines, customers, and interested third-party participants (Leitzinger and Collette, 2002). This thorough understanding of the history of the natural gas industry will help lend insight in to the state of competition in the industry today.

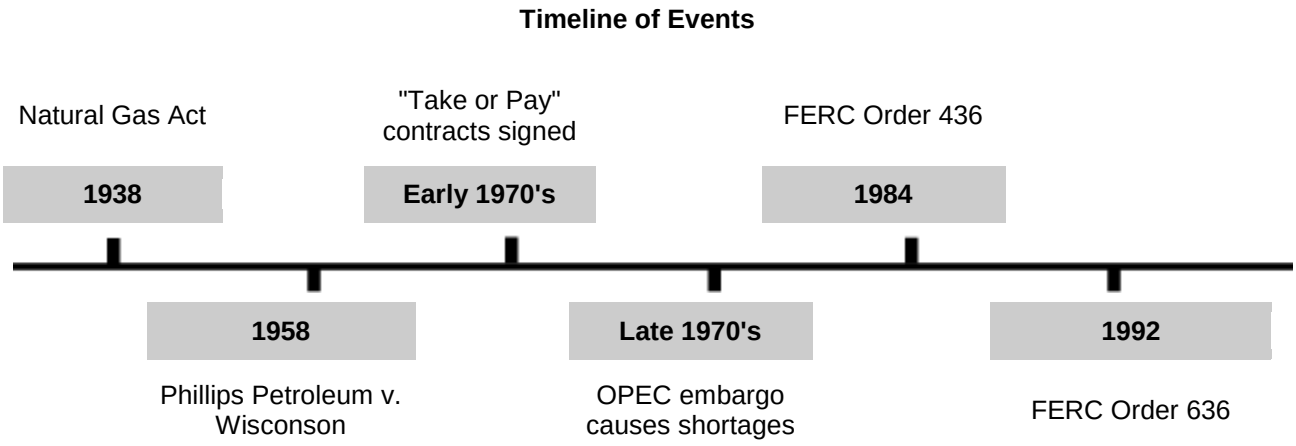

Figure 1

III. Analysis of Industry:

The natural gas industry can be divided into four distinct sectors. The exploration and extraction sector deals with findings and extracting natural gas. The pipeline transportation sector deals with transporting gas via pipelines from wellhead to local distribution company. The local distribution company distributes natural gas to the end users. Natural gas marketers are buy gas from the wellhead, purchase and sell pipeline capacity, and sell gas to end users through the distribution network of LDCs (Figure 2).

These marketers can engage in some or all of this process. The exploration and extraction sector is discussed first.

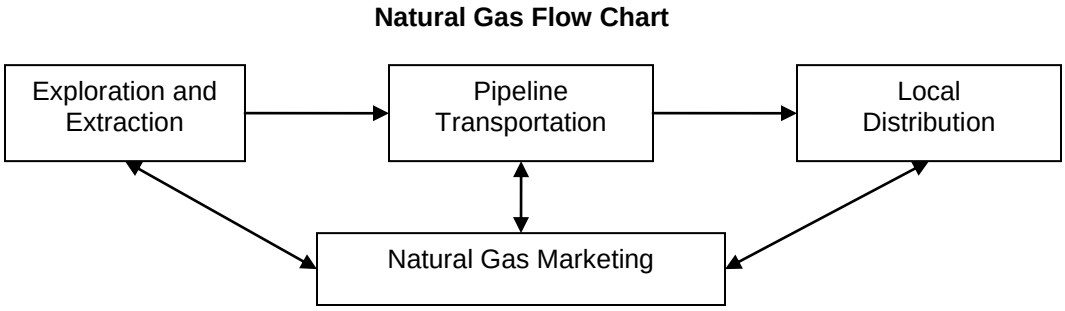

Figure 2

Exploration and Extraction

One way to measure competition in a particular industry is to look at market shares and concentration ratios. A firm's market share is the percentage of industry revenues that can be attributed to a particular firm. For example, if the sales in the entire industry were 200 million and a single firm's sales were 20 million then that firm would have a 10% market share (200 million divided by 20 million). The four firm concentration ratio is the sum of the market shares of four largest firms in a market. For example, if the market shares of the top four firms in the sector were 40%, 30%, 20%, and 10% then the four firm concentration ratio would be 100%.

The US market for natural gas exploration and extraction is very competitive with a four firm concentration ratio of 28% (IBISWorld, 2006). However, the world market is highly concentrated, and this lack of competition could have an effect on the North American market as imports are expected to increase by more than 700%. This will account for a quarter of US consumption by 2025 (Coy, 2005). This could lead to reduced output and higher prices as these oligopolists exert their market power to

increase profits. However, this sector looks to remain mostly competitive in the near future. Conversely, the pipeline transportation sector is highly concentrated.

Pipeline Transportation

The four firm concentration ratio in the pipeline transportation sector is over 80% (IBISWorld, 2006). It would seem that such a sector could benefit from increased competition. However, the pipeline transportation sector is unique in that it is believed to be naturally monopolistic due to subadditivity. Subadditivity in the case of natural gas is the fact that fewer firms can provide service more cheaply than many firms.

Gordon et al. (2003) examined whether the benefits of increased competition from removing a monopoly status granted to a pipeline firm would outweigh the forgone scale efficiencies. They focused their study on Trans-Canada Pipeline Ltd.

There is evidence of plant level subadditivity due to the following:

- Indivisibilities in production technology resulting in scale and scope economies. Doubling the diameter of the pipe increases volume by a factor of 4 and surface area by a factor of 2. While output is proportional to volume and in this case increases by a factor of four, cost is proportional to surface area, and it increases by a factor of 2. Large common costs and cost complementarities yield economies of scope as in the use of compressors and pipe in transmission of service.
- Economies of "rights-of-way" which allow pipeline companies to legally lay pipe in lands they do not own.
- Network economies. Organizing production within a firm is less costly than in the market. Since expansions are capital intensive, minimizing costs requires

expansions to be large and infrequent. Cooperative interaction amongst several firms in a network would impose additional transaction costs that can be avoided in the case of a single firm. Therefore, it is reasonable to assume firm level subadditivity in the natural gas transmission industry.

Gordon et al.(2003) estimated a translog cost function to test for natural monopoly within a multi-product framework. Translog cost functions are popular in the literature where they have been used to test for the existence of natural monopoly. The two products are deliveries within Canada and deliveries to the US. The cost function was defined over output and the input prices of labor, capital, and natural gas. Output is an exogenous variable since pipeline companies simply meet all demand and do not control the level of transport. Input prices are exogenous due to competition between the transmission industry and other industries. Gordon et al. (2003) show, using econometric techniques, that the estimated translog cost function is well behaved, proper, and regular and proceed with their test for natural monopoly. Calculations obtained using Baumol et al's (1982) testing procedure show evidence of decreasing ray average cost, a necessary condition for natural monopoly, as well as evidence of cost complementarities, a sufficient condition. The results supporting the existence of natural monopoly are further confirmed by a second test suggested by Evans and Heckman (1984).

Being a natural monopoly, the benefits from increased competition resulting from splitting up the natural gas transmission firm would not outweigh the benefits of scale efficiencies. Currently, there is no discussion of divesting pipeline companies. Thus, it seems that pipeline transportation will, and should, remain uncompetitive in the future.

Like pipelines, distribution is uncompetitive. However, unlike pipelines, there is potential for competition.

Distribution

Currently, natural gas distribution is not very competitive despite the four firm concentration ratio being less than 22% (IBISWorld, 2006). This is because local distribution companies only serve a specific geographical region. Most of these LDCs are the only provider in the region and have a regulated monopoly. In Illinois, there are two utility companies who dominate the sector despite geographical limitations. These two companies are Nicor and People's Gas. Combined, they have a market concentration ratio of 71.65%. The four firm concentration ratio for Illinois is 87.37% (ICC, 2006).

Another way to measure competitiveness is the Herfindahl-Hirschman Index (HHI). The HHI has been used in the study of mergers in which parties combine their productive capacities in a relevant market to operate as a single firm. The HHI squares the market shares of all firms in the relevant market to arrive at a statistical measure of concentration. For example, if the market contained four firms with market shares of 40, 30, 20, 10 percent respectively, the HHI would be:

$$40^2 + 30^2 + 20^2 + 10^2 = 3000$$

Critics have noted that, by giving bigger weight to the market shares of larger firms, the HHI may more accurately reflect the likelihood of oligopolistic coordination. According to the DOJ's 1992 Horizontal Merger Guidelines, a market in which the HHI is below 1000 is un-concentrated, between 1000 and 1800 is moderately concentrated, and above 1800 is highly concentrated. The HHI of the distribution sector is 2,931. This

level is considered to be very highly concentrated. These figures were calculated based on the data below.

Illinois Utilities	**Revenues 2005**
Ameren CILCO (AEE)	348,349,790
Ameren CIPS (AEE)	224,135,273
Ameren IP (AEE)	530,474,493
Atmos Energy Corp.	29,988,391
Consumers Gas	7,580,847
Illinois Gas	14,691,587
Interstate Power	6,878,510
MidAmerican	127,232,806
Mt. Carmel	4,476,542
Nicor Inc. (GAS)	2,546,689,350
NorthShore Gas	280,036,744
Peoples Gas (PGL)	1,460,827,661
South Beloit	11,351,507
Total	5,592,715,506
Four Firm Concentration Ratio	87.37
Herfindahl-Hirschman Index	2,931
Two Firm Concentration Ratio	71.66
One Firm Concentration Ratio	45.54

Source: (ICC, 2006)

In some regions, consumer choice programs have been instituted in a limited fashion in hopes of creating more competition. These programs allow consumers to choose from whom they purchase their natural gas. The gas is distributed by the LDC's local network, but the seller of the actual gas can either be a subsidiary of the LDC or another natural gas marketer. The certified alternative suppliers in Illinois are:

- Corn Belt Energy Corporation
- Direct Energy Services, L.L.C.
- Dominion Retail, Inc.
- Interstate Gas Supply of Illinois, Inc.
- MxEnergy, Inc.
- Nicor Advanced Energy, LLC (Prairie Point Energy, LLC d/b/a)

- Nordic Energy Services, LLC
- Peoples Energy Services Corporation
- Santanna Energy Services
- U.S. Energy Savings Corp. [Energy Savings (Illinois) Corp.]
- Utility Resource Solutions, L.P.
- WPS Energy Services, Inc.

Source: (ICC, 2006)

Whether such programs will create competition and be beneficial to social welfare is still uncertain. Giulietti et al's (2005) findings suggest that opening natural gas distribution to competition will not have positive welfare benefits. Consumers are unlikely to switch from the incumbent provider because they perceive high switching costs. A public awareness campaign could be undertaken to inform consumers of low switching cost, but the cost of such a program would likely offset any welfare gains from competition.

In the paper, Giulietti et al presents optimistic and pessimistic scenarios. The optimistic scenario suggest that new entrants will charge a price equal to marginal cost and the incumbent will match the new price in order to retain customers. In this scenario it doesn't matter how many customers switch because they will all be charged the marginal cost. This will create great gains in consumer surplus. Unfortunately, these gains will be offset by the loss of producer surplus to the new entrant as they bear the cost of marketing themselves to customers in order to convince them to switch providers. In the pessimistic scenario, the majority of consumers (55%) will be unwillingly to switch unless the savings are significant. The incumbent will use this knowledge to set a price above marginal cost but not so high as to convince these consumes to switch providers. "In such an equilibrium the majority of customers, who stay with the incumbent, would

pay a price around 33% above the competitive level, hardly the hallmark of a strongly competitive market" (Giuleitti et al, 2005, 963). The welfare losses will be great as the incumbent makes monopoly profits and new entrants incur the costs of soliciting new customers. These welfare losses will greatly outweigh the gains to the 45% of consumers who choose to switch providers.

The data seems to support Giueitti et al's findings. Since consumer choice programs were instituted in 2002, the number of participants has increased every year. However, the number of participants is still a very small fraction overall customers. 73.77% of residential and 79.6% of commercial customers were eligible as of January 1, 2006. Only 6.2%t of eligible residential customers participated and 23.7% of eligible commercial customers participated (EIA, 2006). Even though many competitors are entering the market, customers are not switching providers. Furthermore,

"A December 2004 study by the State's consumer advocacy group, the Citizens Utility Board, concluded that most Illinois consumers who participated in choice programs paid higher prices in 2003 and 2004 than if they had continued to purchase gas from their local distributor. According to the report, marketers generally offer either a fixed rate for a period of 1 to 3 years, or a variable monthly rate tied to an index. The report also noted that many marketers affiliated with utilities had similar names and logos as the utilities, which could lead consumers to think they are regulated entities" (EIA, 2006).

This seems to suggest that consumers are buying gas from the marketers affiliated with the LDCs and are paying a higher price due to the market being unregulated. Since

marketers are having such a profound impact on all sectors of the natural gas industry, it is important to gain a better understanding of their influence.

Natural Gas Marketing

The most recent major development in the natural gas industry has been the emergence of natural gas marketing. No longer does natural gas flow straight from well-head, to pipeline, to LDC, to end user. Instead, natural gas marketers are buying gas from the wellhead, purchasing and selling pipeline capacity, and selling gas to end users through the distribution network of LDCs. These marketers can engage in some or all of this process. A very important characteristic of these marketers is that they may benefit from economics of scale[1] and that can have a significant impact on competition in the market.

"Most prominent is the ability of large marketers to take advantage of geographical differences in demand and to arbitrage price imbalances across various supply regions. For example, a marketer with customers in Florida and Chicago can contract with producers for a steady volume of gas throughout the year, sending a greater proportion of its supply to Chicago in the winter and a greater proportion to Florida in the summer (to produce electricity for air-conditioning). This marketer, by assuring producers of a steady year-round market, may be able to negotiate better price and supply terms than one whose customers are located only in Chicago or only in Florida" (Barcella, 1996, 4)

Another major consequence of the emergence of natural gas marketers is the integration of various forms of energy. These markets are also buying and selling

[1] For more information see http://en.wikipedia.org/wiki/Economies_of_scale

electricity from the deregulated market. "For example, deals have been reported in which a marketer bought power that had been generated from coal and traded this power to an electric utility for gas that the electric utility now did not need for its own generating plant. The marketer took that gas and sold it to another gas consumer, making a profit on the entire series of transactions" (Barcella, 1996, 5). Because marketers allow the integration of various forms of energy, natural gas now has to compete against coal, hydro, and nuclear power. This increase competition could lead to lower prices, efficiency in allocation, and the complete integration of the natural gas and electric utility industries (Barcella, 1996, 5). This conclusion forces us to evaluate the state of competitiveness of the commodity trading market.

Currently, the commodity trading market is not highly concentrated. The four firm concentration ratio is less than 40% (IBISWorld, 2006). However, if traders merge in order to take advantage of economics of scale, this market could become highly concentrated. This would have a detrimental impact on competition and social welfare. The regulatory bodies that approve these mergers would have to decide if a few larger lower cost firms or numerous higher cost firms would be best for social welfare.

Gabriel et al (2005) did study to determine the effects of an oligpolistic market structure on social welfare. They compared a perfectly competitive market structure to an imperfect one in which marketers are Nash-Cournot players[2]. They found that output decreased by 4.2% and average price increase by 16%. Profits rose from zero to $39,050,713. Social welfare decreased by 36%. Changes in prices varied widely depending on the sector. Prices for the residential and commercial sectors rose by 52.70%

[2] For more information see http://en.wikipedia.org/wiki/Nash_equilibrium and http://en.wikipedia.org/wiki/Cournot_competition

and 30.99% respectively, while they dropped by 5% for the industrial sector. The price decrease for the industrial sector can be explained by the ability of marketers to use their market power to receive lower input prices.

"For example, the (average) wellhead prices dropped from $4.39 to $3.49, the storage price from $5.08 to $4.96, and peak gas from $5.20 to $4.22 (Gabriel et al, 2005, 651). The marketers can then add a mark-up based on the elasticity of demand of each sector. The industrial sector has a lower mark-up due to its ability to substitute alternative fuel sources. On the other hand, residential and commercial customers face significantly higher mark-up due to their inability to substitute.

IV. Conclusion:

Despite some setbacks, the natural gas industry has successfully transitioned from non-competitive and highly regulated industry to one that is mostly competitive and less regulated. The extraction and exploration sector is highly competitive and prices are no longer regulated at the wellhead. The pipeline transportation sector is still highly regulated, but rightfully so because of its naturally monopolistic characteristics. The distribution sector is increasingly becoming more competitive as more states are choosing to allow the unbundling of natural gas sale and distribution. Finally, the natural gas marketing sector was found to be competitive.

However, the research indicates that consumer choice programs do not maximize social welfare. Few consumers choose to switch suppliers, and those who do end up paying higher prices. Additionally, market power may exist in the natural gas marketing sector due to economies of scale. Therefore, it is recommended that consumer choice

programs be terminated and any mergers in the natural gas marketing sector be highly scrutinized.

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