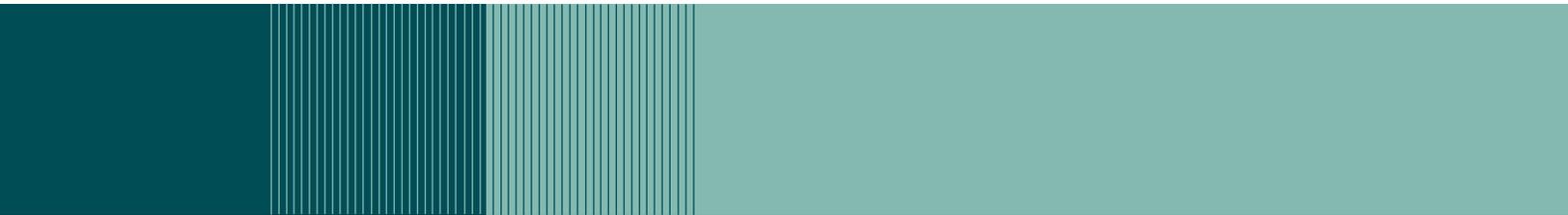


June 13, 2007

Seeking Competition and Supply Security in Natural Gas: The US Experience and European Challenge



NERA

Economic Consulting

Seeking Competition and Supply Security in Natural Gas The US Experience and European Challenge¹

Jeff D. Makholm, Ph.D
National Economic Research Associates, Inc. (NERA)
200 Clarendon Street, Boston, MA 02116 USA
Email: Jeff.Makholm@nera.com

I.	Introduction.....	2
II.	The Central Role of Institutions	3
III.	The Two Gas Pipeline Structures	4
A.	American Gas Pipelines.....	5
1.	Growth of the American Gas Pipeline Network.....	5
2.	Independence of Gas and Oil Markets.....	7
3.	The US Pipeline Market Handles (and Learns From) Stress.....	8
B.	Gas Pipelines in Europe.....	11
IV.	The Institutional Divide in the US and European Gas Pipeline Networks.....	14
A.	Private Carriers, Without TPA Obligations	15
B.	Gas Pipelines Divorced from Distributors	18
C.	Gas Pipelines Subject to a Single Regulatory Authority.....	21
D.	Pipeline Property and the Regulation/Administration of Rates.....	23
E.	Structural Separation for US Gas Pipelines (the “Commodities Clause”).....	24
F.	Provision of Information on Pipeline Transport.....	26
G.	Crystallizing Property Rights in Gas Pipeline Capacity: Regulating Rents	28
V.	Summary.....	30

I examine how the growth of market and regulatory institutions creates the conditions for gas supply security in the United States and what this experience may mean for Europe. The American gas market, until recently dominated by long-term gas commodity contracts and costly gas shortages, now exhibits robust and independent markets in both gas and transport capacity on the interstate network. The growth and development of a number of institutions, over many decades, all contributed to these markets. Europe has embarked on the development of its own institutions, some of which have some slight parallels to those in the US. Nevertheless, great differences remain in the institutional foundation for the gas trade and pipeline capacity markets in Europe, and it is the challenges of further developing these institutions that ultimately will promote, either through competition or more meticulous and predictable regulation, gas supply security in Europe.

¹ Preliminary version, not to be quoted without permission; comments welcome. Prepared for the 1st CESSA Conference, Berlin University of Technology, Berlin, Germany, 31 May 2007. Helpful comments were given by Fabrizio Hernandez and Wayne Olson.

I. Introduction

Many economists and policy makers acknowledge that liberalization in gas and electricity markets is consistent with energy supply security—but only with the important caveat that industry structure and underlying institutions in those markets support genuine competition. The structural questions for natural gas seem easy to assess. Gas is a natural resource (not a manufactured product like electricity), with well-defined production and import sources and major consumers, all interconnected by a highly predictable pipeline network. The institutions that create conditions necessary for efficient and competitive gas markets, however, are not so easy to assess.

The contrast between the American and European gas systems is a case in point. In the 21st century, both display continent-sized pipeline networks connecting various major sources of supply with large gas distribution, power generation and industrial gas customers. And yet, America displays a freely competitive gas market typified by vigorous spot trading at many hubs nationwide, including and a robust forward/futures trading market. That market has dispensed with the long-term gas contracts typical through the 1980s. The American market also exhibits an unregulated, *Coasian* (what we also call “contractualized”) market in gas transport to any part of the existing network—the entirety of which remains, paradoxically, subject to cost-of-service regulation by the Federal Energy Regulation Commission (FERC).² Parallel to the growth of an independent, contractualized transport market, the job of the FERC has shifted away from just rate setting to include overseeing the property rights and information flows that make the contractualized gas transport market work.

The institutional foundation for gas trade on the European pipeline network is radically different. Even through there is a little bit of gas trading at a few points on the network (all constituting less than 1 percent of gas consumption), the European gas trade remains dominated by long-term contracts and vertically integrated pipelines in the various member states. It has nothing remotely like the American spot market in gas or the unregulated, contractualized market in pipeline capacity.

What does this spell for security of supply? In the American gas market, security comes in the form of a large array of sellers and buyers transacting in highly liquid and competitive markets for both for gas and gas transport. The American gas market did not always have supply security in gas—within memory it saw gas

² “Coasian” markets refer to Professor Ronald Coase. In his classic 1960 article, Coase argued that if property rights are clearly specified, parties have an incentive to negotiate a mutually beneficial trade. Coase also recognized that transaction costs matter. The initial allocation of property rights matters because of the transaction costs associated with reallocating those rights via the market. See: Coase, R.L., “The Problem of Social Cost,” *Journal of Law and Economics*, Vol. 3 (1960), pp. 1-44.

shortages that cost Americans billions of dollars yearly in social costs.³ But the market has learned to deal successfully with extreme winter weather, California energy crises and natural disasters.⁴ Europe, in contrast, worries about the potential dominance of Russia, Algeria or Norway as gas suppliers, despite the fact that none has much more than a 20 percent share Europe's gas sales, either now or in the foreseeable future.

The answer to gas security lies in the *pipelines*—those inanimate, sunk, steel, low-technology assets. The treatment of the pipelines defines the possibilities for the creation for gas security in Europe based on market liberalization. And with respect to those pipelines, the answers lie in the analysis of the *institutions*.

II. The Central Role of Institutions

In order to explain a particular industry's market structure, economists in the field of industrial organization traditionally examine the cost structure of firms. For major gas pipelines this style of economic analysis does not go far enough. The most basic economic analysis would appear to paint pipelines as almost classic natural monopolies, but the pipeline business is much more complex and difficult to categorize. To most policy makers, the structure of pipeline markets, for both oil and gas, remains something of a mystery.

There are two reasons for the mystery. First, the world's major pipelines make rather lousy natural monopolies.⁵ On first examination pipelines do exhibit one traditional indicator of a natural monopoly, namely declining unit costs (larger pipelines will have lower unit costs than smaller ones). It is less clear if declining

³ See Pierce, R. J., "Reconstituting the Natural Gas Industry from Wellhead to Burnertip," *Energy Law Journal*, Vol. 9, No. 1. (1988), p. 10.

⁴ Hurricanes Katrina and Rita disrupted the gas supplies from the Gulf of Mexico in 2005, and the latter left the principal American gas trading hub—the Henry Hub—under water.

⁵ Professor Alfred Kahn put his finger on the weakness of the natural monopoly idea with respect to pipelines:

As far as the actual carriage of gas is concerned, economies of scale could not possibly require a single chosen instrument for the entire national market. Pipelines travel from one point to another; in consequence there is ample room for a large number of criss-crossing lines, with ample resultant possibilities of competition both in areas between lines and their points of junction. The main potential economies of scale are to be found in employing pipe of the maximum diameter available.... [note omitted] But these economies taper off sharply once the largest possible pipe available is used and even more sharply when the limits of further expanding capacity in the manner indicated are reached. (Kahn, A.E., *The Economics of Regulation: Principles and Institutions, Volume II*, John Wiley & Sons, New York (1971), pages 153-154.)

Professor James Nelson of Amherst College put the whole "natural" concept brilliantly into context:

One of the most unfortunate phrases ever introduced into law or economics was the phrase "natural monopoly." Every monopoly is a product of public policy. No present monopoly, public or private, can be traced back through history in a pure form.... Roads? The "King's Highway" was usually more an easement than a facility until well into the eighteenth century, except where the admittedly monopoly-minded Romans had done their work; the highway was lifted from its literal morass only by private turnpike companies, sometimes on a quasi-competitive basis. ... So "natural monopolies" in fact originated in response to a belief that some goal, or goals, of public policy would be advanced by encouraging or permitting a monopoly to be formed, and discouraging or forbidding future competition with this monopoly. (Nelson, J.R., "The Role of Competition in Regulated Industries," *The Antitrust Bulletin*, Vol. 11 (1966), p. 3).

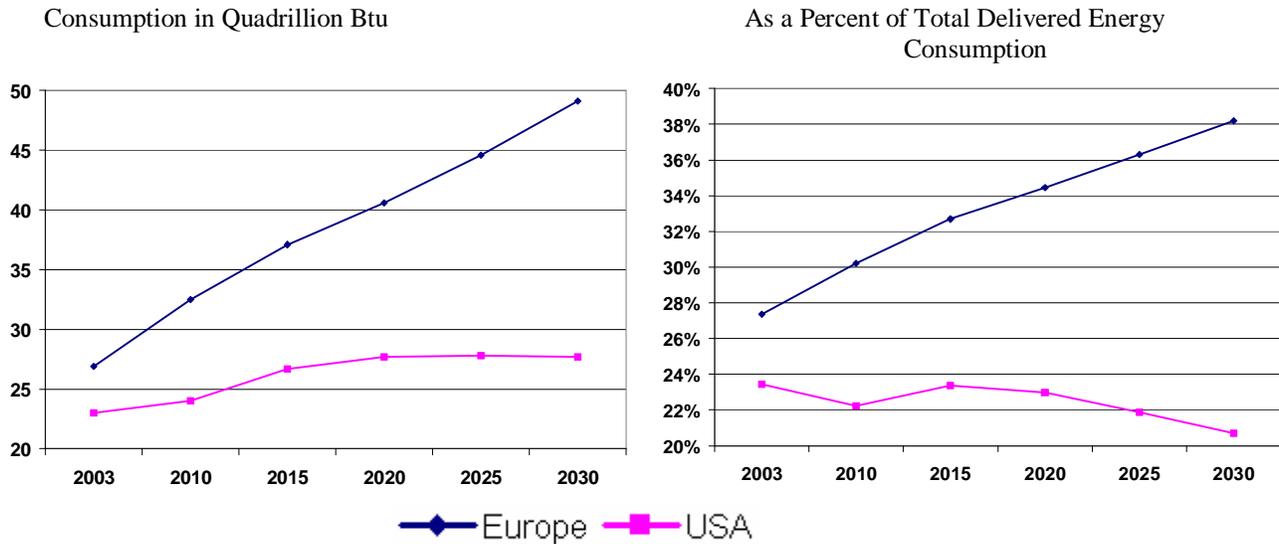
unit costs (or natural monopoly) plays a significant role in the structure of actual pipeline markets. The second problem concerns economists' preoccupation with analyzing the pipeline industry in isolation. Pipelines themselves have utterly no value on their own—they are part of a larger, tightly interconnected supply chain that transports fuel from production wells and gathering systems to distributors (and from there to households, power generators and commercial establishments).

The world's actual gas pipeline markets are shaped by how pipelines *transact* with those suppliers and customers to whom they are physically connected. The risk of stranding invested capital, or “hold up,” is extreme for gas pipelines. For privately-owned pipelines, the transaction requires a meticulous form of long-term contract to motivate investor-supplied capital. Those in the capital markets who finance major investor-owned pipelines (in reality a small and specialized corner of the larger capital markets) know well the mutuality of contractual obligations required to commit major blocks of capital to sunk costs and immobile assets. Without such a contract, there are only three alternative approaches to building a pipeline: vertically integrate into production and/or end-use, regulate the pipe as a large-scale public utility monopoly, or have the government build and operate gas pipelines. For jurisdictions wishing to tap competitive rivalry in the creation, expansion and use of gas pipeline networks, as an element in providing for long-term, market-oriented security of supply, none of the three choices are particularly attractive.

III. The Two Gas Pipeline Structures

The United States and Europe have fully formed gas pipeline networks that supply between 20 and 30 percent of the energy needs in each market, with a higher growth projected for Europe. In both markets, the sources of gas are relatively distant from the major market centers, requiring the extensive pipeline transport system. This section describes the development of and the characteristics of the US and European markets for natural gas.

Figure 1. Delivered Natural Gas Consumption, Europe and US, 2003-2030



Source: US Energy Information Administration, *International Energy Outlook 2006*. June 2006 (DOE/EIA-0484, 2006).

A. American Gas Pipelines

The American gas pipeline networks connect various gas basins and market areas in the country. There are a few important points, from Canada and from a handful of existing LNG terminals (with many more on the drawing board).

1. Growth of the American Gas Pipeline Network

Gas pipelines in the United States move gas from a few major fields, the principal ones in the Gulf of Mexico, to the market areas in the upper Midwest, the Northeast and the West Coast. The system developed in three stages:⁶

1. The unregulated, vertically integrated era (1889-1937). Gas pipelines existed generally as entities integrated either with gas producers or gas distributors. When gas pipelines crossed state lines, they left the jurisdiction of the various state regulators. There was no federal licensing or rate regulation. Vertical integration was forcibly broken with federal legislation in 1935.
2. The era of delivered gas (1938-1983). Authority over entry (licensing) and rates was assigned in 1938 to a federal commission (the FERC).⁷ Vertically-separate gas pipeline companies sold delivered gas to distributors purchased under long-term contracts in the gas fields.⁸

⁶ See: Makhholm, J.D., "The Theory of Regulation-Specific Investments, Long-Term Contracts and Gas Pipeline Development in the United States." Paper presented at the ENERDAY, Dresden University of Technology (April 21, 2006).

⁷ Section 7 of the 1938 Natural Gas Act provides for Commission licensing authority. Such licensing does not apply to the extensive oil pipeline network in the United States, under that controlling legislation (the 1906 Hepburn Amendment to

3. The era of contract-based gas pipeline transport (1985-present). By 2000, after 15 years of development, an unregulated market for gas pipeline capacity exists in its own right. Gas pipeline companies are not permitted to own the gas they transport in their trunk pipelines. The FERC still licenses new pipeline capacity projects and “primary” pipeline prices, according to the 1938 legislation, but it does not regulate “secondary” capacity prices.

Throughout all of these eras, consumption of natural gas in the United States grew rapidly, as did pipeline construction. In the first period, pipelines were financed through vertically integrated firms, and an extensive pipeline network appeared throughout the East Coast and from the major gas basins in Kansas/Oklahoma to the upper Midwest. Gas distributors and petroleum producing companies owned both the interstate pipelines and the gas in them. In the second period, the American life insurance industry developed a new lending method that would accept federal Commission regulation as security in long-term pipeline loans.⁹ Gas pipeline companies owned large block of gas producing properties, but federal accounting treatment for gas costs encouraged the purchase of gas from third parties. Nevertheless, most of the gas flowing through the interstate gas pipelines was purchased in the producing area and owned by the pipeline companies as it flowed through the major trunk pipelines.

During the third era, conflict developed regarding unfair competition between pipeline-owned gas and that owned by third parties. As a result, the Commission imposed rules in 1992 to divorce the ownership of gas within the pipeline. Thereafter, all the gas flowing in the major trunk gas pipelines was owned by third parties; mostly the gas distributors and power generating companies (and some gas marketers as the gas market became more liquid and competitive).

the 1887 Interstate Commerce Act) nor do we believe it is true for gas pipelines in Europe. Hence we know of no such central repository of European gas pipeline expansion projects as exists for US pipelines.

⁸ Some gas was transported, under individual licenses, to industrial customers.

⁹ Hooley R.W., *Financing the Natural Gas Industry*, AMS Press, New York (1968). This volume constituted Professor Hooley's doctoral thesis at Columbia University in 1958 under Professor James C. Bonbright, a major contributor in the economics of public utility ratemaking.

Figure 2. U.S Gas Volume Movements, 2004

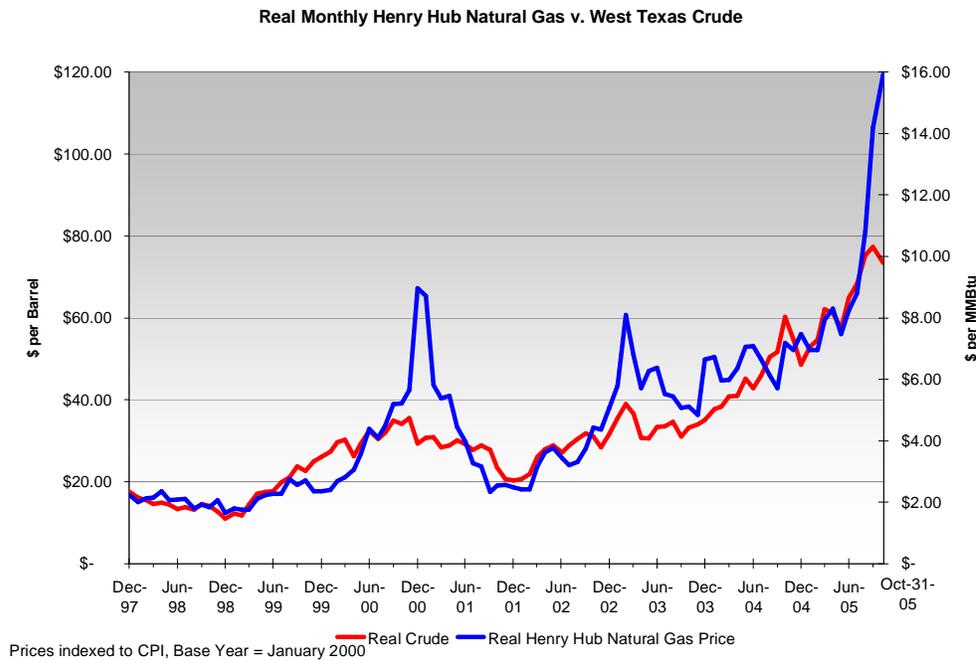


Source: EIA, Natural Gas Annual 2004

2. Independence of Gas and Oil Markets

One of the distinguishing features of the modern gas market in America is its independence from the oil market. Gas and oil trade on independent exchanges, based on the demand and supply of each at the various locations. Due to the liquidity of the trading at the hubs, there are generally no gas contracts indexed to oil, or vice versa—a feature of less liquid gas markets. Figure 3 below shows prices at the largest trading hub, the Henry Hub. Prices at the various other trading hubs are often significantly different, reflecting the availability of firm transport between them.

Figure 3. Gas and Oil Prices, Dec98-Oct05



3. The US Pipeline Market Handles (and Learns From) Stress

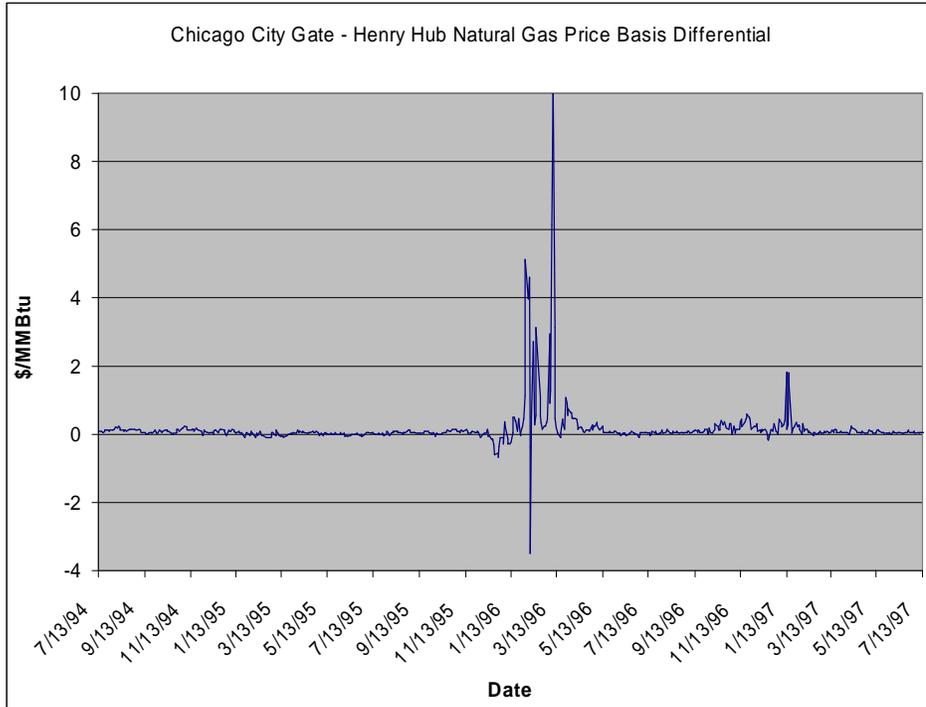
Liquid and competitive markets should adjust to stress and exogenous shocks to the supply and demand for the underlying product. After each shock to the market, those operating in the market should be able to anticipate a response to any similar event in the future and the market disruption should dissipate more readily. Natural gas markets should be no different. Three recent market stresses highlight the response the US market for natural gas has had to the following events:

- § a localized, weather-related spike in demand in the Chicago area during the winter of 1995-1996,
- § a confluence of supply and institutional constraints leading to massive electricity supply shortages during the California energy crisis of 2000–2001, and
- § the large supply disruption resulting from a natural disaster in an area of natural gas production during the hurricane season of 2005.

The first example of a stress on the natural gas system occurred when the beginning of the heating season of 1995-1996 began with below normal temperatures. This resulted in large natural gas storage withdrawals that could not be readily replaced with storage injections because the low temperatures and thus high natural gas demand persisted for an extended period of time. When temperatures again dropped dramatically across the Midwestern US, there was not enough available gas in storage to meet the spiking demand. Accordingly, the local price of natural gas spiked. **Figure 4** below displays the price differential (a.k.a. the price basis) for the Chicago city gate pricing point relative to the Henry Hub pricing point located near much

of the country's natural gas supply in Louisiana.¹⁰ Indeed, in the case of cold weather in Chicago, **Figure 4** shows how the market learned to deal with the relatively new contractualized regime. The cold snap in 1997 was much like the one in 1996, but market and traders had learned from the year before, and the temporary rise in basis differentials was only one fifth as high.

Figure 4. Chicago Cold Snap of Winter 1996



Source:

Natural Gas Intelligence Press

The second stress on the US natural gas markets occurred during the highly publicized California Energy crisis of 2000-2001. Supply constraints, among other factors, resulted in wide spread electricity shortages across the Western US. Accordingly, the price of natural gas spiked because of the increased value of

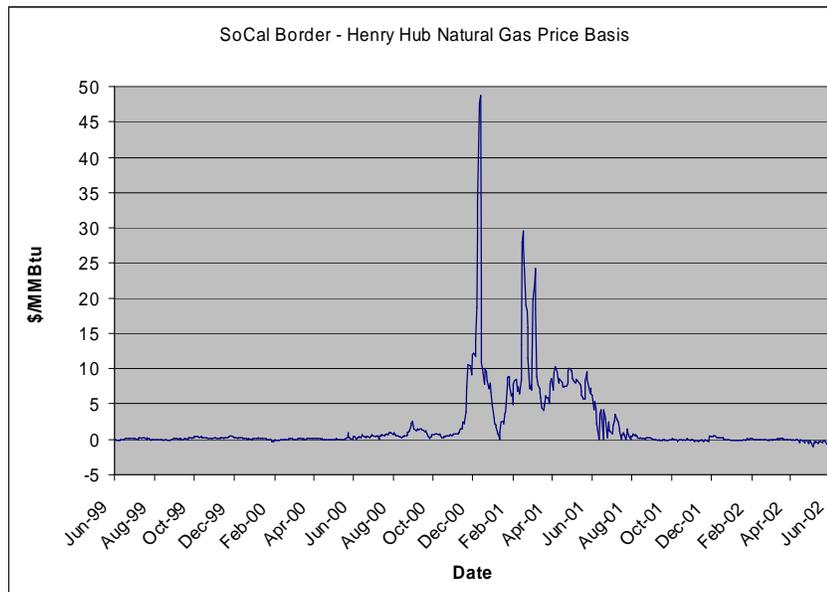
¹⁰ An EIA report on the “Natural Gas Residential Pricing Developments During the 1996-97 Winter” concluded:

Competition is increasing in US gas markets. The overall nature of the market outcome — prices and volumes — depends on the interaction of the entire set of participating entities: producers, consumers, and infrastructure operators (e.g., storage, transportation, and hubs). The system seemed to perform better in 1996-97 than in the prior heating season. Although prices were higher, the system avoided the extreme price spikes that occurred in some localities (e.g., Chicago) during the 1995-96 season. The 1996-97 price pattern reflects the improved interconnectedness of the system, which supports effective competition between regions of the Lower 48 [states]. Storage utilization during the past heating season may be questioned in light of subsequent events, but the strategy does not appear to be unreasonable. The early reliance on storage gas in 1995-96 left lower-than preferred levels of gas as inventory, which became a critical factor when the severe temperatures persisted in major consuming locations. On the other hand, the lesser reliance on storage gas in early 1996-97 greatly contributed to increased prices for marketed production.

See: William Trapmann and James Todaro, Natural Gas Residential Pricing Developments During the 1996-97 Winter, Energy Information Administration, Natural Gas Monthly, August 1997, <http://tonto.eia.doe.gov/FTP/ROOT/features/trapman.pdf> (Accessed May 16, 2007).

electricity generated in natural gas burning power plants. **Figure 5** below shows the basis price for the SoCal Border natural gas pricing point relative to the Henry Hub price.¹¹

Figure 5. California Energy Crisis of 2000-2001



Source: Natural Gas Intelligence Press

The third and most recent stress on the US natural gas system occurred in the summer of 2005, during hurricane season in the Gulf of Mexico. **Figure 6** below shows the range and average of the 84 basis differentials relative to the price at Henry Hub in Louisiana between April 2005 and April 2006. During this period of already tightening energy supplies, two hurricanes disrupted a large portion of the US natural gas supply and production. In addition to completely shutting down the Henry Hub for a day and week,

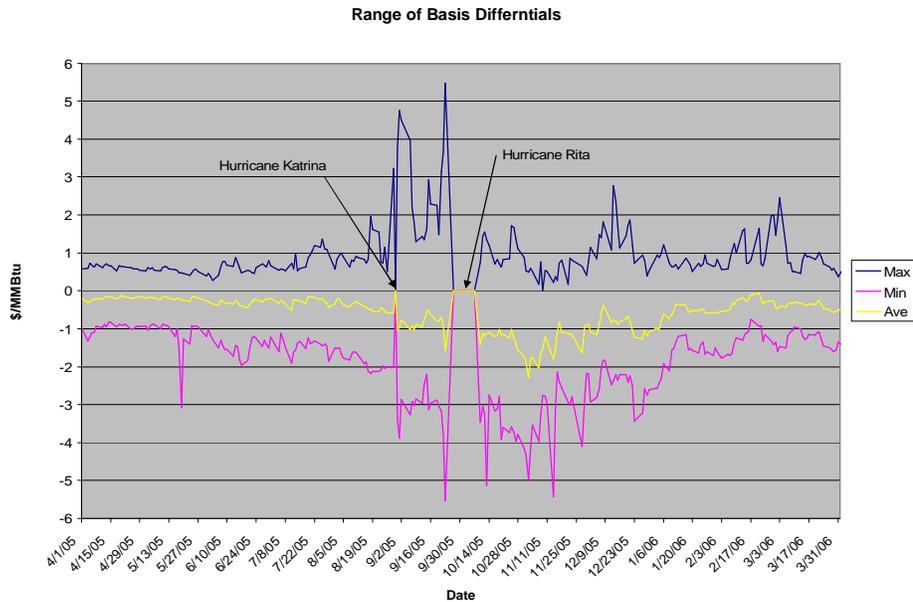
¹¹ The EIA's Natural Gas Weekly report described the events of December 2000 in the following way:

Variability was the order of the day for spot prices at the Henry Hub last week. After beginning the week with spot prices reaching double-digit highs of \$10.17 per MMBtu, prices dropped sharply to \$7.52 per MMBtu by Thursday, then gained over \$0.30 to end Friday at \$7.83... The past week was highlighted by unprecedented prices in the large California market where contributing energy problems include: long-delayed maintenance at several nuclear facilities in California, reduced generating capacity, low availability of hydroelectric power, unseasonably cool temperatures, below average natural gas stock levels, and reduced transmission capacity to southern California. This resulted in midpoint prices at California's PG&E and SoCal citygates of \$44.00 and \$59.42 per MMBtu, respectively, on Monday with prices reaching a high of \$72.00 for a period of time on SoCal. In response to this situation, the US Department of Energy imposed its authority to require independent electricity generators to continue to operate and the Federal Energy Regulatory Commission re-imposed rate controls on electricity generation. These governmental actions along with moderating temperatures appear to have calmed the markets for the time being. The prices at the California border on Friday ranged from \$10.85 in the north to \$17.06 in the southern parts of the state.

See: Energy Information Agency, Natural Gas Weekly Update, December 18, 2000, http://www.eia.doe.gov/pub/oil_gas/natural_gas/data_publications/natural_gas_weekly_market_update/historical/2000/2000_12_18/pdf/ngweek.pdf (Accessed May 16, 2007).

respectively, Hurricanes Katrina and Rita led to different and larger than normal supply-demand imbalances across the country, and thus larger basis spreads.¹²

Figure 6. The Hurricane Season of 2005



Source: Natural Gas Intelligence Press

These events illustrate how the flexible, well-informed and contractualized US gas pipeline market facilitates supply security. In each of the three cases above, the market responded to an exogenous shock to supply and/or demand, the spot price moved according to the local supply and demand for natural gas, and the market was able to clear. In order for this to occur, adequate pipeline capacity must be available as well as able to respond to changing market conditions.

B. Gas Pipelines in Europe

Gas transmission pipelines in Europe developed first to connect various smaller gas fields to market in the early part of the 20th century, such as in Poland and Romania. But the first significant gas pipeline

¹² The EIA's Natural Gas Weekly describes the events of Hurricanes Katrina and Rita and their impact on the natural gas market as they unfolded, including the following:

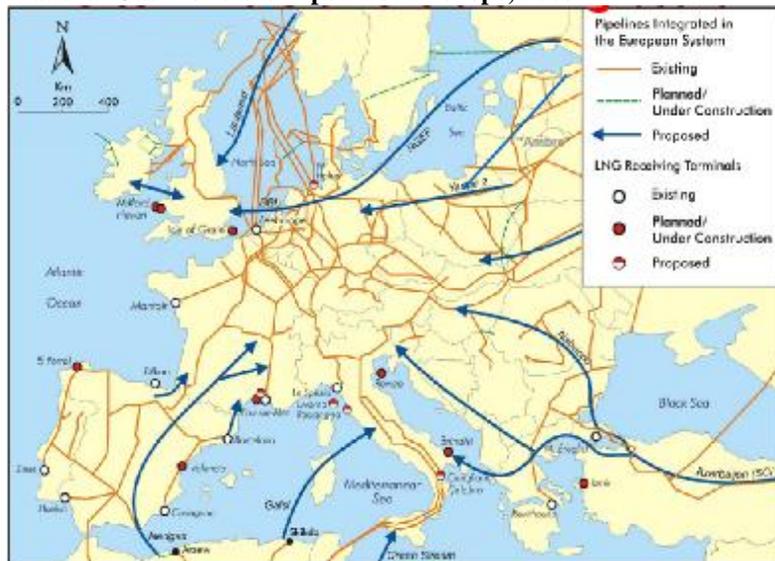
For the week covered by this report (September 21-28), prices have declined largely owing to Hurricane Rita weakening as it reached major gas supply areas in the Gulf of Mexico. Nonetheless, the combination of Hurricanes Katrina and Rita has disrupted natural gas supplies and continued to prop up prices at near-record highs around the nation... The Henry Hub is not operating, but large price decreases prevailed in other Louisiana spot markets and East Texas. The average price in the two trading regions yesterday was \$12.60 per MMBtu, a decline of \$1.67 on the week. Prices also declined in major consuming regions in the Northeast and Midwest... Prices decreased significantly in the Rockies and the West Coast as well, albeit slightly less so than in the East.

Energy Information Agency, Natural Gas Weekly Update, September 29, 2005, http://tonto.eia.doe.gov/oog/info/ngw/historical/2005/09_29/ngupdate.asp (Accessed May 16, 2007).

development began in the 1950s and 1960s to connect internal fields to local consumers. For example, two gas pipelines in the centre-south of Italy were constructed to take gas discovered in the province of Chieti to Terni and Rome. Similarly, the first international pipelines in Europe were built to supply the Netherlands (and later to Belgium, France, Germany and Italy) with gas from the Groningen field upon its discovery in 1959. Since this discovery, natural gas pipeline deliveries in Western Europe grew at an average rate of 10.8 percent.¹³

Until the 1970s, imports from the Soviet Union came via small pipes to Poland (dating back to 1949) and also by a small pipeline from Ukraine into former Czechoslovakia and Austria. The period between 1970s- and 1990s was one of rapid growth for trans-European pipeline networks. In the early 1970s two pipeline systems began to deliver gas from Western Siberia, namely Transgas and the Orenburg pipelines. Transgas included the Trans Austria Gas Pipeline “TAG”, which delivers gas to pipelines to Czechoslovakia, Austria and Italy (built in 1974), and the MEGAL pipelines to Austria (1974) Germany (1976) and France (1979). The Orenburg pipelines delivered gas to Hungary, Romania and Bulgaria (1975). Also in that period, the Trans Europa Naturgas Pipeline (TENP) began operations in 1974. The TENP is a 968 km long natural gas pipeline, which runs from the German-Netherlands border near Aachen to the German-Swiss border near Schwörstadt, where it is connected with the Transitgas Pipeline. It carries North Sea natural gas from the Netherlands to Italy and Switzerland. Also from the North Sea, Norpipe has delivered natural gas to Germany since 1977. Algerian gas was connected to Europe through Italy via the Transmed pipeline (1983) and Spain (1996) Also in 1996, the Interconnector linked UK gas to Continental Europe. **Figure 7** and **Table 1** below summarize the flows of natural gas throughout the European continent and the data on the gas pipeline infrastructure currently in place.

Figure 7. Natural Gas Flows and Pipelines in Europe, 2006



Source: Geert Joosten, *Regulation of Natural Gas Markets*. Gas Infrastructure, January 2006

¹³ Zhao, Jimin. *Diffusion, Costs and Learning in the Development of International Gas Transmission Lines*. International Institute for Applied Systems Analysis. December 4, 2000.

Table 1. Gas Pipelines in Europe

Name (Ownership)	Length (Km)	Principal Origin	Principal Destination	Diameter (Inches)	Date of Operation
Transgas (RWE)	3,763	Russia	Europe	32,36,48	1968
Transitgas Pipeline (Transitgas AG)	291	Netherlands and Germany	Italy	10, 12, 16	1972
Trans Austria Gas Pipeline (ENI and OMV)	380	Slovak-Austrian Border	Austrian-Italian	34, 36	1974
Trans Europa Naturgas Pipeline (1)	968	German-Netherlands border	German-Swiss	35, 37	1974
Norpipe (Gassco)	440	North Sea	Germany	36	1977
Vesterled (Gassco)	361	North Sea	UK	32	1978
Megal (Ruhrgas and Gaz de France)	1070	Russia	Germany, France	36, 48	1980
Trans-Mediterranean Pipeline (2)	2475	Algeria	Italy	48, 42, 26, 20	1983
STEGAL (Wingas)	320	Czech Republic	Germany	31	1992
MIDAL (Wingas)	702	North Sea	Germany	31, 35, 39	1993
Zeepipe (Gassled Partners)	814	North Sea	Belgium	40	1993
Rehden-Hamburg gas pipeline (3)	132	Rehden	Hamburg	31	1994
NOGAT Pipeline System (4)	257	Dutch continental shelf	The Netherlands	24-36	1994
Netra (5)	341	Coast of the North Sea	Eastern Germany	48	Mid 1990's
Europipe I (Gassco)	670	North Sea	Germany	40	1995
HAG Pipeline (OMV)	45	Austria	Hungary	28	1996
Maghreb-Europe Gas Pipeline (6)	1450	Algeria	Spain, Portugal,	48, 8, 22	1996
JAGAL (Wingas)	111	Yamal-Europe pipeline	Wingas grid	47,55	1997
Yamal-Europe natural gas pipeline (7)	4196	Russia	Germany	56	1997
Interconnector (8)	235	UK	Belgium	40	1998
Wedal (Wingas)	320	MIDAL Pipeline	Belgium	31	1998
Franpipe (9)	840	North Sea	France	42	1998
Europipe II (Gassco)	658	Norway	Germany	42	1999
Green Stream (10)	520	Lybia	Italy	32	2004
Blue Stream (Gazprom and ENI)	1213	Russia	Turkey	55	2005
Iran-Armenia Natural Gas Pipeline	140	Iran	Armania	27	2006
BBL Pipeline (11)	235	Netherlands	UK	36	2006
South Caucasus Pipeline (12)	690	Caspian Sea	Turkey	42	2006
Turkey-Greece pipeline (BOTAS and DEPA)	296	Turkey	Greece	36	Expected 2007
South Wales Gas Pipeline (National Grid UK)	316	Milford Haven	Pembrokeshire	48	Expected 2007
Langed pipeline (13)	1200	Norway	UK	42, 44	Expected 2007
Nabucco Pipeline (14)	3300	Turkey	Austria	56	Expected 2008
Baltic Gas Interconnector (15)	200	Germany	Sweedeen (through	28-32	Expected 2009
Medgaz (16)	747	Algeria	Spain	24-48	Expected 2009
Balticconnector (17)	80-120	Finland	Estonia		Expected 2010
Nord Stream (Gazprom, BASF and E.ON)	1113	Russia	Germany	48-56	Expected 2012

Notes:

- (1) E.ON Ruhrgas and Eni
- (2) Sonatrach, Sotugat, ENI
- (3) Wingas E.ON Hanse
- (4) 45% Energie Beheer Nederland B.V. and 23% by Total S.A.
- (5) E.ON Ruhrgas, BEB Erdgas und Erdöl, Norsk Hydro and Statoil Deutschland
- (6) Sonatrach, the Moroccan State, Enagas, Transgas
- (7) PGNiG, Gazprom (both 48% of shares) and Gas-Trading S.A.
- (8) BG Group (25%), E.ON Ruhrgas (23.59%), Distrigas (16.41%), ConocoPhillips (10%), Others (25%)
- (9) Gassled partners (65%) and Gaz de France 35%
- (10) Agip North, Africa BV, NOC- Tripoli
- (11) N.V. Nederlandse Gasunie 60%. E.ON Ruhrgas and Fluxys both 20%.
- (12) BP (UK) 25.5%, Statoil (Norway) 25.5%, others 49%
- (13) the Ormen Lange licensees, ConocoPhillips and Gassco
- (14) OMV, MOL, Transgaz, Bulgargaz, BOTAS Each 20%
- (15) DONG Energy, HNG, VNG, E.ON Sverige AB, Göteborgs Energi, Lunds Energi and Öresundskraft.
- (16) CEPSA 20%, Sonatrach 20%, BP 12%, Endesa 12%, Gaz de France 12%, Iberdrola 12%, Total 12%
- (17) Gasum, Eesti Gaas of Estonia, Latvijas Gāze of Latvia and Gazprom of Russia

Sources: Gas pipeline companies' websites and other publicly available sources

As the information above shows, a great deal of natural transport infrastructure has been developed on the continent as well as between Europe, North Africa and Russia in the past four decades. Currently, the European pipeline network stretches from the Atlantic Ocean to Russia and from the North Sea to the Baltic Sea. Further investment in the European pipeline network may be required to meet higher levels of demand in the future; however, supply security concerns, such as fears of Russian, Algerian or Norwegian market influence,¹⁴ may not be a simple matter of greater investment levels, but instead a function of the institutional governance of the European gas market.

IV. The Institutional Divide in the US and European Gas Pipeline Networks

Transacting is uniquely difficult for gas pipelines, perhaps more so than for any other major business. The heavy cost and risk of contracting caused virtually all major pipelines outside America to be built by governments. Only within the United States were pipelines built by investor-owners based on the idea that the individual pipeline projects would pay for themselves. The worldwide privatization wave of the late 20th century placed a number of those pipeline systems in the hands of new investor-owners and government regulators, a change that has generated a morass of new, highly dissimilar, and often unsuccessful regulatory arrangements for gas pipelines. During this period, the rest of the world viewed the institutions that govern gas pipelines in the United States as mysterious, archaic, inefficient, and both impossible and undesirable to emulate. The United States viewed other global pipeline regulatory efforts as largely built on sand—with few of the institutions that support credible regulation and credit-worthy pipelines. The transactions-based analysis of the new institutional economics helps to sort through the mutual failure of understanding.

There are a number of elements of the gas pipeline market that differ importantly from the market in Europe and are critical to support contractualization. I present them generally in the order that the institutions arose in the American gas market:

1. Gas pipelines are private carriers for their customers, without common carriage or third party access (TPA) obligations (1906).
2. Gas pipelines are divorced, by unusually strong legislation, from gas distributors (1935).
3. Gas pipelines are subject to a single regulatory authority that licenses all new capacity and sets regulated pipeline prices based on its own new and meticulous accounting rules (1938).
4. Gas pipeline tariff cases follow specific administrative procedures with the value of their property that is constitutionally protected from expropriation by the regulator (1944-1946).

¹⁴ Russia is the source of 29 percent of the natural gas consumed in the EU. Source: European Commission DG TREN, Eurostat. Note that other sources indicate that this figure was 19 percent in 2003.

5. Gas pipelines “volunteer” to transform gas delivery contracts to pipeline transport contracts after an unscripted series of events in the domestic and world energy markets puts their finances in jeopardy (1986).
6. Gas pipelines ordered to ship only gas owned by others in their trunk lines, an application of the age-old “commodities clause” for US rail transporters (1992).
7. Gas pipelines forced to cede to contract shippers the control of property rights inherent in the value, in excess of cost, of the capacity on their trunk lines (2000).

It is impossible to overstate the importance of each of these events in the development of the institutions support competition on American gas pipelines. Each was accompanied by vigorous legislative debate, Supreme Court action, regulatory litigation or complex regulatory rulemaking procedures. In each case there was vigorous and essential conflict between private interests, whose business profitability, or ability to serve their own customers economically, depended on the outcome of the proceedings.

The problem with understanding the institutions that support the competitive American gas markets, and particularly the role of competitive pipelines in it, is that the institutional foundations are so old. To a large extent, the institutional memory is shaky and many of the economists who were important in its development are long dead.¹⁵ But the institutional history of the industry is so critical to its present competitiveness that a brief review of these landmarks is essential to describe how the market came to be.

It may not be completely fair to perform a straight comparison of the institutional foundations for gas markets in the US and Europe according to the list above. Unfair or not, it is instructive to do so. The comparison serves to illustrate the great divergence from the necessary institutional foundations, namely a contractualized network and a competitive gas market, that would confront supply security fears and prevent any supplier, especially ones like Russia or Norway that holds as little as one fifth of the market, from profitably withholding supplies or constraining the market.

A. Private Carriers, Without TPA Obligations

From the first natural gas pipeline constructed in 1872—from white pine, stretching 25 miles from West Bloomfield to Rochester, New York—the most defining characteristics of American pipelines (either in oil or gas) is that they have all been financed by investor-owners under the assumption that each pipeline individually would pay for itself.¹⁶ No piece of legislation, or new regulation, was ever introduced for any pipelines in America without having to deal with the interests of those investor-owners.

¹⁵ Among them are Professors Emory Troxel, of Wayne University, Walter Splawn of the University of Texas, Joel Dirlam of the University of Rhode Island, James Bonbright of Columbia University, and Law Professor Eugene Rostow of Yale University (who first investigated the principles of pipeline contract carriage in 1952).

¹⁶ Castaneda, D.J., *Invisible Fuel, Manufactured and Natural Gas in America, 1800-2000*, Twayne Publishers, New York (1999), p. 43.

A case in point happened in the year 1906. It was then that Congress, fed up with the rail and pipeline abuses of the Standard Oil Company, decided to try to constrain the market dominance of that company by regulating oil pipelines. Congress responded to the ineffectiveness of state regulation of railroad and pipelines with a bill to give the Interstate Commerce Commission (ICC) ratemaking expanded authority over those elements of interstate commerce. The legislation was called the Hepburn Amendment.¹⁷ Pages of Senate debate concerned whether gas pipelines (which were not owned by Standard Oil) ought to be included in the legislation along with oil pipelines (which were generally owned by Standard Oil). The most vocal and effective proponent for excluding gas pipelines from the jurisdiction of the ICC was Senator Joseph Foraker of Ohio. Foraker argued on the floor the Senate, again and again, that gas pipelines were not common carriers and that trying to regulate them as such would kill the business, which depended on the ability of the pipeline to be committed to a particular enterprise. At the critical point of the Senate debate in 1906, Foraker argued:

[N]obody is interested in that [gas pipeline] enterprise, except only the people who are building the line with the idea of bringing the gas to Cincinnati, to do a great public service, and they have had trouble enough to set the enterprise on foot. They are just now in the midst of their trouble, trying to raise the money. They have not yet been able to raise it all. If it should go out, after they have raised the money to build the line, that any man can take possession of it to bring gas there for his own purposes, and that the line is to be under the charge of the Interstate Commerce Commission, I think it will be the end of the enterprise.¹⁸

That was enough for the Senate—it excluded gas pipelines from the Hepburn Amendment, which is still the defining statute for regulating American oil pipelines. That exclusion ensured a 32-year reprieve from regulation for the gas pipeline industry. During those 32 years, American regulators made great advances in the principles of regulatory accounting and licensing. By the time it came finally to impose federal regulation on the gas pipeline industry, Congress would avoid the common carriage (or TPA) model entirely and turn to utility regulation.

It is impossible to predict how the industry would have developed had Senator Foraker not pushed to exempt gas pipelines from the ratemaking and routing jurisdiction of the ICC, which over the following 70 years made a complex mess of regulating oil pipelines.¹⁹ In any case, it is no understatement to call Senator Foraker the father of the modern American competitive gas pipeline markets. He might have been amused by the title.²⁰

¹⁷ The full name is the Hepburn Amendment to the Interstate Commerce Act of 1887.

¹⁸ Congressional Record—Senate, 59th Congress, 1st Session (May 4, 1906), p. 6371.

¹⁹ When Congress handed the Federal Energy Regulatory Commission jurisdiction over oil pipelines, one industry observer called every essential ratemaking issues for those oil pipelines, “open, arguable and shrouded in obscurity.”

²⁰ Senator Foraker, who was then in his second term, was an ironic champion for modern, competitive gas pipeline markets. Elected to the Senate in 1896, he was the only Senate Republican (Theodore Roosevelt’s party) who voted against the Hepburn Bill, a position that may have been related to payment he received from the Standard Oil Company for legal advice he provided during his first term. When news of this involvement became public in 1908, exposing a seeming conflict of interest, Foraker was forced to retire from Congress.

The US never had third party access for gas pipelines, as such. In contrast, Europe starts from the requirement of third party access for all of the national networks. The Second EU Gas Directive, adopted in June 2003 to be effective in July 2004, required regulated third party network access on gas pipelines in the European Union.²¹ The directive states:

Member states shall ensure the implementation of a system of third party access to the transmission and distribution system, ... applicable to all eligible customers ... applied objectively and without discrimination between customers.²²

Further, the Second Gas Directive states: “Further measures should be taken in order to ensure transparent and non discriminatory tariffs for access to transportation. Those tariffs should be applicable to all users on a non discriminatory basis.”²³

Mindful of the different legal basis for most of Europe and the common law in America, this provision has similarities to the following passage in the Interstate Commerce Act in the US:

Every common carrier subject to the provisions of this act shall, according to their respective powers, afford all reasonable, proper and equal facilities for the receiving, forwarding and delivering of ... property, ... and shall not discriminate in their rates and charges....²⁴

A common carrier, or TPA provider, holds itself ready to serve the general public to the limit of the facilities that the carrier is prepared to offer. By contrast, the private carrier transports only a narrowly defined clientele—it discriminates in favor of those with contracts, affording a secondary service to those without.²⁵ Gas pipelines in Europe are directed, by Article 18 of the Gas Directive, to be TPA providers. Gas pipeline in the US escaped that responsibility in 1906. When Congress passed gas pipeline legislation in 1938, it rejected common carriage (after having considered it) and made pipeline private carriers, who would not be obliged to carry any gas for any customer without a multi-year pipeline company contract.

This is a very large difference between the two regimes. Contract carriage would not work in the US, and the contracts for capacity would be of little value, except capacity rights are scarce commodities and only

²¹ Directive of June 2003, replacing the First Gas Directive of June 1998.

²² 2003 Gas Directive, Article 18.1.

²³ Ibid, preliminary paragraph 22.

²⁴ Interstate Commerce Act of 1887, Section 3.

²⁵ The DG Competition Report of January 2007 discusses the issue of “contractual congestion” where access to pipelines is denied on the basis that all capacity is already reserved. (Section II.3.3). Such “contractual congestion” is of course an essential element of US gas pipelines, for the property rights in capacity are what motivates gas distributors, power generators and others to commit to long-term payments (which is the support for pipeline financing). Such “contractual congestion” is not considered a problem in the US, however for two reasons: (1) a market exists with sufficient information to make any attempt to monopolize a pipeline route utterly and instantly discoverable and obvious; and (2) the pipeline company profits through marketing “interruptible” pipeline capacity (which is essentially firm for 30 days) to the extent that it has the ability to do so given firm contract holders’ use of their lines.

obtainable in the primary market through long-term, contractual commitments.²⁶ It has been the value of these capacity rights which has allowed US pipelines to be financed on a stand-alone basis. Common carriage, or TPA, was created for oil pipelines in the US, and it caused their vertical integration and joint venture structure throughout the 20th century, and the lack of a contractualized capacity market in the 21st century.

To be sure, the entire European gas pipeline network is not bound by TPA rules. A distinction exists between the national networks for which no contractualization exists in the US sense, and the large international supply pipelines (called “interconnectors”) that transport gas from producing countries that do have long-term contracts.²⁷ No common carrier rights apply to these basic supply routes, as the pipelines were developed through contracts between the pipeline owners and shippers, and any requirement of open access would impair capacity availability for those shippers. Any new shipper would need to have capacity built on request and enter into a bilateral contract with the pipeline company on negotiated terms. The elements of carriage by contract evident on these basic European supply lines do not embrace the range of requirements (information requirements, tradability, segmentations, etc.) that accompany contractualization in the US. A major difference is that the exemption from TPA granted in Article 22 remains within the discretion of the Commission, whereas the US has no TPA whatsoever on its interstate pipeline network.

B. Gas Pipelines Divorced from Distributors²⁸

The decisive federal regulation of gas pipelines in the 1930s was intertwined with the simultaneous federal investigation of the manifest abuses of multi-state utility holding companies. The holding company structure adopted by electric and gas utilities during the 1920s and 1930s enabled a number of financial abuses that state regulators could not effectively control.²⁹ Many of the types of abuses recognized at that time can be solved by though modern accounting regulations and meticulous scrutiny of affiliate transactions in experienced regulatory jurisdictions. But in the 1930s, however, American regulatory methods were not equipped to handle them.

²⁶ In the secondary market, freed of direct responsibility to the pipeline company to underwrite the pipeline venture, firm capacity contracts come in any variety of time periods, configurations and prices. No matter, the primary capacity holder is obligated to the pipeline company through the underlying long-term, multi-year contracts that support pipeline financing.

²⁷ 2003 Gas Directive, Article 22.

²⁸ To be clear, this section deals with the split between transportation pipelines and local gas distributors. This split in the US did not require that the transportation pipelines divorce themselves from the ownership of the gas in the pipelines (referred to as the “commodities clause” in legislative circles pertaining to transport regulation). I deal with the split between pipeline transport and gas ownership in Section E, below.

²⁹ Those abuses included, among other things, the writing up subsidiary property values and charging excessive service fees through affiliates. Professor Phillips provides an excellent discussion of those abuses perpetrated by US utility holding companies. See: Phillips, C.F., *The Regulation of Public Utilities*, Public Utilities Reports, Inc., Arlington, Virginia (1993).

In February 1928, the Senate asked the Federal Trade Commission (FTC) to conduct an investigation of the public utility holding companies. The FTC produced a comprehensive and massive report in 1934 and 1935, which ultimately comprised 96 volumes. The report showed that over half the gas produced and more than three-fourths of the interstate gas pipeline mileage in America was controlled by 11 vertically-integrated holding companies. The FTC called the abuses of the unregulated, integrated gas pipeline companies a “positive evil.”³⁰

Congress dealt with the abusive market behavior of the holding companies by passing the Public Utility Act in 1935, Title I of which was called the Public Utility Holding Company Act.³¹ The act gave the Securities and Exchange Commission (SEC) jurisdiction over public utility securities. As part of their new jurisdiction, the SEC was given great powers to simplify the holding company structures of gas and electric utilities. Professor Emory Troxel wrote in 1947:

The Holding Company Act was a severe law. It was the most stringent, corrective legislation that ever was enacted against an American industry. Yet forceful actions were needed to straighten out the corporate organization and control of the electric and gas industries. The remedy was suited to the patient. Many holding companies were dissolved, partially liquidated, or reorganized. Unified, technically related systems replaced conglomerate financial arrangements that served the interests of financiers. Investment banker control of electric and gas industries was eliminated or modified; and the engineers became more important.³²

Like the Hepburn Amendment before it, the Holding Company Act was a legislative assault on the existing structure of private American businesses. In both cases, however, abusive and acquisitive practices by those businesses, and the resulting public outcry, overcame Congress’ normal aversion to dealing with the complex internal structure of American corporations.

Make no mistake about it: the Holding Company Act of 1935 was a gigantic step in the direction of ultimate supply security for the American gas market, even though it would take many more years, and many wrong turns, to realize it. Splitting gas distributors from gas pipeline companies created two powerful and sophisticated constituencies that worked to shape gas regulation going forward. Congress never forced such a structural split on the American *oil* pipeline system, despite almost continuous calls to do so in Congress over many decades, from the 1930s through the 1970s.³³ The oil pipeline industry thus continued to develop with a high degree of vertical integration, with more than three fourths of the industry’s pipeline capacity owned by the

³⁰ Final Report of the Federal Trade Commission to the Senate of the United States pursuant to S. Res. 83, 70th Cong., 1 Sess. (1935), p. 615.

³¹ 49 Stat. 803 (1935). The Act was only repealed in 2005 by the Energy Policy Act (EPACT) of 2005 (Section 1263), which replaced it with the Public Utility Holding Company Act of 2005, which provides for federal access to books and records of holding companies and their affiliates.

³² Troxel (1947), p. 172.

³³ See: Johnson, A.M., *Petroleum Pipelines and Public Policy*, Harvard University Press, Cambridge Massachusetts (1967).

18 major vertically-integrated oil companies, mostly interlocked with joint ventures, by the 1980s.³⁴ The US Department of Justice once lamented this interlocking of shipper ownership on that pipeline system, and the resulting lack of strong contending constituencies:

This level of customer/supplier dominance in the ownership of a regulated industry is perhaps unique to the petroleum pipeline industry [in the United States]. In other regulated industries, the clash between those regulated and their immediate customers provides the necessary tension to achieve effective and even-handed regulatory scrutiny. Here, however, the absence of adverseness requires the regulator to take affirmative steps to regulate effectively.³⁵

It is no overstatement to say that the Holding Company Act was the *sine qua non* in the future regulatory battles over liberalization and eventual contractualization of the gas pipeline market in the US.

Europe has never had the chance to confront the problems of investor-owned, unregulated and vertically-integrated utility holding companies. Its policies regarding the tie between pipeline companies and gas distributors are thus rather milder. The Second Gas Directive deals with vertically integrated gas companies as follows:

Where the transmission system operator is part of a vertically integrated undertaking, it shall be independent at least in terms of its legal form, organization and decision making from other activities not relating to transmission. These rules shall not create an obligation to separate the ownership of assets of the transmission system from the vertically integrated undertaking.³⁶

Despite the unbundling required by this directive, the European Commission has had strong words regarding the “vertical foreclosure” still inherent in the gas pipeline network:

The current level of unbundling of network and supply interests has negative repercussions on market functioning and on incentives to invest in networks. This constitutes a major obstacle to new entry and also threatens security of supply.³⁷

The connection between gas transporters and distributions, within the same ownership, was a corporate form utterly rejected in the Public Utility Holding Company Act of 1935, and an “uncommonly powerful” regulator, in the form of the SEC was charged with breaking them up. For reasons that those in Europe may consider manifestly obvious, the Directive never hints that public policy should include the structural separation

³⁴ About 60 percent of pipelines shipments were on pipelines owned jointly by groups of oil companies constituting their major shippers, primarily the major integrated oil companies. See: Anderson, R.E., and Rapp, R.T., *Competition in Oil Pipeline Markets: A Structural Analysis*, National Economic Research Associates Inc. (NERA), April 1983, p. 2.

³⁵ In the matter of Valuation of Common Carrier Pipelines, Docket No. RM-78-2, Statement of the Department of Justice (Donald A. Kaplan, Chief, Energy Section, Antitrust Division), October 23, 1978, p. 9.

³⁶ EU Gas Directive, Article 9. The Directive goes on to say (preamble paragraph 10): “It is important however to distinguish between such legal separation and ownership unbundling. ... However, a non-discriminatory decision-making process should be ensured through organisational measures regarding the independence of the decision-makers responsible.

³⁷ European Commission, DG Competition Report on Energy Sector Inquiry, 10 January 2007, p. 7.

of gas pipelines from gas distributors. The “clash between those regulated and their immediate customers [that provides] the necessary tension to achieve effective and even-handed regulatory scrutiny” divides the European and US gas markets.

C. Gas Pipelines Subject to a Single Regulatory Authority

Throughout the 1930s, Congress wrestled with how to regulate gas pipelines. It had become clear in the courts that crossing state lines exempted gas pipelines from state regulation, and no federal body had any jurisdiction over the business at all. The Supreme Court has said as much when it struck down an order issued by the Kansas Corporation Commission that fixed city gate rates charged by the Cities Service system, one of the largest multi-state holding companies. The Court stated:

The transportation, sale and delivery constitute an unbroken chain, fundamentally interstate from beginning to end, and of such continuity as to amount to an established course of business. The paramount interest is not local but national—admitting of and requiring uniformity of regulation. Such uniformity, *even though it be the uniformity of governmental non-action*, may be highly necessary to preserve quality of opportunity and treatment among the various communities and states concerned.³⁸ (emphasis added)

There was clearly a hole in regulatory authority that Congress had to fill. In drafting legislation to do so during the 1930s, however, Congress had to deal with two powerful constituencies. The first was the pipeline industry itself, which had strong representation in Congress. The second was the Cities Alliance, a group of 100 Midwestern city and town governments, which was organized in the mid-1930s to lobby for gas pipeline regulation.³⁹ In order to pass gas pipeline legislation, Congress had to satisfy both of these constituencies.

The bill that accomplished this delicate political balance was the Natural Gas Act of 1938.⁴⁰ The pipeline interests conceded that some form of federal ratemaking authority was inevitable, but they wanted to shield pipeline companies from competitive pressures. The Cities wanted to cap the price of gas delivered to the state-regulated gas distributors, but also wanted gas pipelines to be forced to compete with one another.⁴¹ What emerged from Congress was a utility-style regulatory statute that capped rates but required Commission licensing

³⁸ *Barrett v. Kansas National Gas Co.*, 265 US 298, P.U.R. 1924 E78. Troxel presents a very good discussion of all of these cases in the second of three survey articles on the gas pipeline industry he wrote in 1936 and 1937: Troxel, C.E., “II. Regulation of Interstate Movements of Natural Gas,” *The Journal of Land & Public Utility Economics*, Vol. 3, Issue 1 (1937), pp. 21-22.

³⁹ Sanders, M.E., *The Regulation of Natural Gas: Policy and Politics, 1938-1978*, Temple University Press, Philadelphia (1981), p. 40.

⁴⁰ Intra-state gas pipelines, which did not cross state lines, continue to be regulated by the various states.

⁴¹ American pluralistic politics—the desire to satisfy the greatest number of contenting interest groups—has a lot to do with the birth and structure of regulations applied to American industries. Professor Theodore Lowi is a key contributor to the body of political science on this subject. For a classic description of how the pluralistic exchange of benefits shapes particular Congressional legislation, see: Lowi, T.J., “How the Farmers Get What They Want,” *Legislative Politics U.S.A.*, 3rd ed., ed. T.J. Lowi & R.B. Ripley, Little, Brown, Boston (1973), pp. 184-191.

for any new line to a region already served by an existing line.⁴² The Cities objected to the licensing provision, which could limit pipeline competition. But the bill's sponsor disagreed, saying: "[t]hat is what regulation is, monopoly controlled in the public interest."⁴³

The United States has a multiplicity of state and federal regulatory authorities. But no issue is more important than the dividing line between them. Jurisdiction is not shared—it is meticulously divided on the basis of the requirements of the US Constitution.⁴⁴ Such a division in regulatory responsibility does not exist within the EU. The Second Directive States:

Member States shall designate one or more competent bodies with the function of regulatory authorities. They shall, through the application of this article, at least be responsible for ensuring non-discrimination, effective competition and the efficient functioning of the market, monitoring in particular [allocation of capacity, congestion mechanisms, publication of information, unbundling of accounts for transmission and distribution, the level of transparency and competition, etc.]⁴⁵

This provision has also provoked comment in the Competition Report of January 2007:

To ensure the implementation of the regulatory framework in this respect, the Second Gas Directive requires the creation of national energy regulators [note omitted]. ... Market integration is also hampered by limitations in the competences of national regulators. In the absence of any single cross-border regulator, national regulators must cooperate with each other in monitoring the management and allocation of interconnection capacity. ... Moreover, the matter in which Community rules have been implemented varies between Member States, and may in some cases even give rise to regulatory vacuum—especially in cross border situations. In addition to the requirements under Community law, there is also a considerable scope for Member States to apply their own specific national rules.⁴⁶

This type of overlapping of jurisdiction is abhorrent to regulators in the US. The existence of a single interstate pipeline regulatory authority, the FERC, simplifies greatly the where parties will “clash” to pursue regulatory remedies in their interests. It also manifestly simplifies the creation of a single “code” for shipping gas throughout the network.⁴⁷

⁴² The licensing provision was extended by Congress in a subsequent amendment to all new gas pipeline capacity additions, whether in new or existing pipeline markets, in the 1940s.

⁴³ Sanders, *op cit*, pp. 41-42. Before serving in Congress, Representative Clarence Lea had been a member of the California Public Utilities Commission, which would explain his confident recitation of the purpose of utility regulation and his sponsorship of such a utility-like statute.

⁴⁴ Article I, Section 8, Clause 3 of the United States Constitution, known as the “Commerce Clause,” empowers the United States Congress “To regulate Commerce with foreign Nations, and among the several States.”

⁴⁵ Article 25.

⁴⁶ European Commission, DG Competition Report on Energy Sector Inquiry, 10 January 2007, paragraphs 50, 59.

⁴⁷ A split of American regulatory jurisdictions exists for electricity transmission, and it greatly complicates the job of promulgating a single set of rules that could transform that business into a reliable inland transport network in its own right.

D. Pipeline Property and the Regulation/Administration of Rates

In the US, Supreme Court decisions define the legal limitations on regulators' ability to take action on charges that may damage the value of utility investors' property. The best known case is that of *Federal Power Commission v. Hope Natural Gas*, in which the Supreme Court set a standard for determining "just and reasonable" returns, a standard that has stood the test of time.⁴⁸ Even today, normal utility tariff reviews, as well as substantial changes in regulatory rules, reference this particular judicial precedent.⁴⁹ For the purposes of the future contractualized gas pipeline market, the *Hope* decision was critical. It sharply limited investor or shipper uncertainty regarding the ability of regulators to act in a manner that would damage the value of the assets that investors would devote to regulated enterprises.

The other pillar of certainty associated with American rate regulation is the Administrative Procedures Act of 1946. During the 1930s, considerable scholarly analysis was devoted to determining the legality of utility regulation's growing impact on the value of regulated property. At the time, regulators had the power to augment or shrink the value of their investors' property in their jurisdictions. Accordingly, legal scholars and the courts questioned whether utility regulators were acting within the confines of authority actually granted by legislatures. Existing regulatory statutes gave discretion to regulatory commissions that were not extended by specific legislative mandate and seemed to violate the US Constitution's prohibition of the taking of property without due process.

Congress addressed these issues by passing the Administrative Procedures Act of 1946, which laid out meticulous procedures to be followed by all regulatory commissions that would assure Constitutional due process.⁵⁰ It also specified timing limits, the need to act upon evidence, the ability of witnesses presenting that evidence to be cross-examined, and many other aspects of the work of regulators. The Administrative Procedures Act imparted much greater fairness, predictability, and transparency than had theretofore been the case in American regulation.

⁴⁸ *Federal Power Commission v. Hope Natural Gas*, 320 U.S. 591 (1944).

⁴⁹ Those who wrestled with utility valuation during the early decades of the 20th century knew the potential power of the *Hope* decision. When the ink was barely dry in 1947, Troxel summed it up elegantly:

Judged by its legal history, the reasonable valuation of public utility property is a tough old bone on which many have chewed without getting good and satisfying results. ... The meaning of reasonableness, which is always something less than perfectly clear and conclusive in a democratic society, is more confused than crystallized by so many gnawings on the valuation bone. ... The Supreme Court has, I think, the elements but not the refinements of reasonable regulation in the *Hope* decision; at least it centers attention on the primary question of reasonable earnings rather than reasonable property values, and it is in a good position to reorient commission behavior in future decisions. (Troxel (1947), pp. 283-284.)

⁵⁰ See: Moynihan, D. P., *Secrecy: The American Experience*, Yale University Press, New Haven, Connecticut (1998). Former Senator Moynihan (Democrat – New York) discussed the historical and political origins of the Administrative Procedures Act.

These two limitations on the discretion of regulators were no academic exercises. They were fundamental to the further financing of the investor-owned gas pipeline business in the US. Prohibiting vertical integration after 1935 effectively closed off vertical sources of equity funding for gas pipelines. With these two limitations, and other features of FERC regulation, investors could know that pipeline loans would be reliably repaid over the 30-50 year lives of major pipelines. Seeing this, the American life insurance industry created new loan instruments specifically for gas pipeline financing. With those new loan instruments life insurers underwrote the industry. During the gas industry's six-fold expansion of interstate gas shipments between 1946 and 1959, approximately 78 percent of natural gas pipeline bonds were held by life insurance companies. The remaining 22 percent of bonds were funded by "trustee investments" such as private pension funds and personal trusts that looked to the life insurance industry for guidance.⁵¹ Without the strong restrictions on the discretionary power of the FERC over private property, such long-term financing, at low interest rates, would not have been forthcoming.

In Europe, the administration of regulated rates is a more recent, and less exacting and consistent, affair. The Second Gas Directive calls for "published tariffs, applicable to all eligible customers,"⁵² but does not further describe the ratemaking formula or rules on the level of permissible revenues. Compared to the restrictive rules on what can constitute an element of regulated pipelines tariffs in the US, the rules for gas pipelines in Europe, as a regional pipeline market, are not so well defined. The licensing powers of the FERC allow it to define a cost of service for new pipelines relating predictably to its book investment cost, a cost that will predictably be returned to investors over the life of the new pipelines in regulated rates, through the standard FERC cost-based ratemaking formulas. That kind of predictable licensing, accounting and regulated rate administration does not exist for new pipelines in Europe. As such, it is much more likely that new pipelines will be built by vertically integrated firms, or joint ventures of such firms, in order to spread the investments risk.

E. Structural Separation for US Gas Pipelines (the "Commodities Clause")⁵³

For the 30 years that passed between 1950 and 1980, there was deliberate and seemingly endless litigation between American gas producers and distributors, and later between gas pipelines and distributors, over the delivered price of gas on the nation's pipeline network. The tug of war between producing interests,

⁵¹ Hooley (1968), pp. 13, 45.

⁵² Article 18, Section 1.

⁵³ The "Commodities Clause," which would forbid common carriers to own the product they shipped was imposed as part of the Hepburn Act in the US in 1906. Oil pipelines were exempted from the clause after considerable Senate debate, mostly because of the highly vertically integrated nature of the US oil business at the time. Many bills proposing to enforce the commodities clause for oil pipelines were debated in Congress over the decades, but none ever passed. The commodities clause was not a part of the Natural Gas Act (as gas pipelines were regulated as utilities in 1938), but in essence the commodities clause was accepted by gas pipelines as part of concessions extracted from those pipelines with FERC Order No. 436 in 1986.

who favored complete gas price deregulation, and consuming interests, who favored limiting the shift of economic rents that deregulation would cause, never ceased. Economists were stalemated on the issue, as Professor Alfred Kahn told the American Economic Association in 1960.⁵⁴ The difficulty lay in the fact that the institutions employed to regulate the pipelines were created to regulate naturally monopolistic utilities, not inherently competitive and relationship-specific inland transport companies. Indeed, during the battle over gas prices the proposal to have pipeline companies exit the business of buying and selling gas never appears to have come up at all.

What prompted institutional change in that direction was an accidental side effect of the struggle to deregulate gas prices. Both the FERC and Congress failed to anticipate the destructive economic incentives that their partial gas deregulatory policies would place on pipeline companies. The menu of old and new gas prices combined with the method of regulating pipeline re-sale rates sent pipeline companies on an expensive gas buying spree during the late 1970s and early 1980s that ultimately crippled their finances. It was then, when it was given the power to extract concessions from a weakened industry, that the FERC, extracted the “voluntary” institutional concessions from pipeline companies that created the contactualized gas pipeline market of the 21st century.

The FERC found that open access was not enough to foster competitive gas markets if pipelines owned the gas that they shipped. It was at this point, in 1992, that the FERC required that pipelines transfer title to their own gas supplies by the time the gas entered the main trunk pipelines. In his way, all of the gas in their trunk lines was owned by others, and no gas supplier could claim an operational advantage over any other (as the pipelines had theretofore successfully been able to do). In essence, the FERC imposed the “commodities clause” that congress had declined to apply to oil pipelines in 1906 or to gas pipelines in 1938.

As far as the Second Directive and more recent publications are concerned, there is a considerable amount of discussion about fair access to networks, but almost no discussion on the competitive problems that may arise when pipeline network owners ship their own gas. The lack of structural separation creates problems, as the DG Competition Report pointed out:

The Commission has also gathered indications that one TSO grants its affiliated supply company substantive rebates for the transportation fees as compared to non-affiliated network users. In doing so, the TSO directly supports the competitive position of the related supply company. This appears to be an overall business strategy carried out by some integrated companies despite the formal Chinese Walls created by the Second Gas Directive. The introduction of ownership unbundling would make this competitive advantage of the affiliated suppliers disappear, given that the transport tariffs would follow market principles and thus tend to be the same for all suppliers. If the ownership link is broken the incentives facing the

⁵⁴ Kahn, A.E., “Economic Issues in Regulating the Field Price of Natural Gas,” *The American Economic Review, Papers and Proceedings*, Vol. 50, No. 2, (May, 1960), pp. 506-517.

network operator will change. It will seek to optimise its network business as opposed to acting in the overall interest of the vertically integrated group.⁵⁵

There are a number of cases of discriminatory behavior cited in that report, all seemingly stemming from the lack either of ownership separation or the lack of separation between transport and gas sales. Within many gas companies, trading names, brands and logos are still shared, and there is no application of what is known in the US as the commodities clause, which would prevent transport pipelines from owning the gas shipped in their trunk pipelines.

F. Provision of Information on Pipeline Transport

A critical element of the competitive pipeline market in the US is the free and transparent flow of information. In its far-sighted Order No. 637 in 2000, the FERC dealt with this issue squarely:

The Commission finds that the disclosure of detailed transactional information is necessary to provide shippers with the price transparency they need to make informed decisions, and the ability to monitor transactions for undue discrimination and preference. Shippers need to know the price paid for capacity over a particular path to enable them to decide, for instance, how much to offer for the specific capacity they seek. ... The disclosure of all transactional information without the shipper's name will be inadequate for other shippers to determine whether they are similarly situated to the transacting shipper for purposes of revealing undue discrimination or preference. ... Finally, to be meaningful, for decision making purposes, the transactional information must be reported at the time of the actual transaction.⁵⁶

Basically, while the FERC acknowledged that some shippers thought that its information reporting requirement may cause some burdens, and also that it may “give shippers knowledge of their competitors general marketing strategy,”⁵⁷ it was more than swayed by the need for the market to be fully informed to operate efficiently and to uncover undue discrimination or market manipulation when it would appear. Thus the FERC chose to require the most comprehensive and immediate provision of all information on the identities and quantities, locations, etc. of all shippers.

For the FERC there are no “trade secrets” with respect to the use of the regulated pipeline network—it is an open book. If it erred, the FERC erred on the side of transparently and full disclosure of data. In contrast, the Second Gas Directive says the following:

Without prejudice to Article 16 or any other legal duty to disclose information, each transmission, storage and/or LNG system operator shall preserve the confidentiality of commercially sensitive information obtained in the course of carrying out its business, and shall

⁵⁵ European Commission, DG Competition Report on Energy Sector Inquiry, 10 January 2007, p. 58 (paragraph 155).

⁵⁶ Order No. 637, pp. 184-185.

⁵⁷ *Ibid*, p. 183.

prevent information about its own activities which may be commercially advantageous from being disclosed in a discriminatory manner.⁵⁸

The greatest contrast between this provision and that of the FERC's is that the latter admits to no "commercially sensitive" information on the use of the network that outweighs the need for the market to be fully informed, in order to prevent undue discrimination and market manipulation. The DG report echoes a frustration about the provision of information on the European gas network:

The Sector Inquiry confirms that gas wholesale operators have contrasting views on the question whether the amount of information available on network capacity is sufficient. Incumbents are usually satisfied, whereas most new entrants find that information is lacking, suggesting that vertically integrated incumbents have privileged access to information.⁵⁹

The DG Reports says:

It may be a concern that excessive transparency could facilitate collusion between the major market players, particularly on an oligopolistic market. A balance must certainly be found as to what data is published and how it is published, in order to improve transparency without enabling collusion.⁶⁰

There is a considerable contrast between the market information required in the US and Europe. For the US gas pipeline market, the issues are considered virtually black and white by the FERC—users of the regulated pipeline network have no right to secrecy.⁶¹ Such a point of view is entirely consistent with the FERC's firm, decades-old control over regulatory accounting. In Europe, where regulatory accounting is yet an unsettled and controversial issue, the issue of transparency and information provision on the pipeline network is far from resolved.⁶² As the DG Competition Report said "the large number of different pipeline systems and the high number of operators controlling the capacity on these routes [note omitted] render the access conditions to these transit pipelines opaque...."⁶³

⁵⁸ Second Gas Directive, Article 10.1.

⁵⁹ European Commission, DG Competition Report on Energy Sector Inquiry, 10 January 2007, p. 90 (paragraph 253).

⁶⁰ *Ibid*, paragraph 252.

⁶¹ See: Olson, W.P., "Secrecy and Utility Regulation," *The Electricity Journal*, Vol. 18, Issue 4 (2005), pp. 48-52.

⁶² The gulf between European and American conceptions of accounting regulation is apparent in the various efforts in European regulatory jurisdictions to pursue "cost benchmarking" as a tool for creating tariffs for regulated companies instead of the accounting costs of the particular company in question. Such "cost benchmarking" is fundamentally antithetical to the American regulatory accounting rules and administrative procedures developed in the 1930s and 1940s, which emphasize objectivity, transparency and the protection of private property under the US Constitution.

⁶³ European Commission, DG Competition Report on Energy Sector Inquiry, 10 January 2007, paragraph 213.

G. Crystallizing Property Rights in Gas Pipeline Capacity: Regulating Rents

In 2000, in order to cement the property rights that pipeline firm shippers could exercise with their capacity contracts, and to facilitate the market in which pipeline capacity could trade, the FERC implemented the following five changes into its regulations:⁶⁴

1. Removal of the price cap on secondary pipeline capacity sales.
2. Requiring pipeline companies to permit shippers to “segment” capacity for their own use or release. Segmenting broke up capacity into separate segments in a complete chain, to facilitate using some and releasing others.
3. Limiting imbalance management and penalty provisions only to those needed to protect system reliability.
4. Consolidating and enforcing pipeline reporting requirements to improve price transparency and more effectively monitor the exercise of market power
5. Requiring “incremental pricing” for all new pipeline transport capacity.⁶⁵

Without realizing it, and certainly without referencing Professor Coase, the Commission’s changes settled the ability of contract shippers to trade and profit from marketing their capacity. It was a key step in creating durable property rights in shippers’ contracts for cost-based interstate pipeline capacity. In his 1960 article, Coase argued that if property rights are clearly specified, parties have an incentive to negotiate a mutually beneficial trade. Coasian markets have been created in pollution rights, carbon allowances, radio bandwidth, and other commodities through the creation and clear specification of property rights.⁶⁶ This kind of market for gas pipeline capacity now exists in the United States—and only there.

The new era has made new pipeline construction a straightforward affair, rather than a political or public relations battle between interests contending for regulatory favor. The FERC has jurisdiction over pipeline

⁶⁴ The FERC said in its own summary (90 FERC 61,109, CFR Parts 154, 161, 250, and 254 (Order No. 637), February 9, 2000):

In this rule, the Commission is revising its current regulatory framework to improve the efficiency of the market and provide captive customers with the opportunity to reduce their cost of holding long-term pipeline capacity while continuing to protect against the exercise of market power.

⁶⁵ Incremental pricing requires all new capacity projects to support their own regulated cost of service, preventing incumbent pipeline companies from subsidizing new capacity by drawing on the economic rents (between cost of service and market value) in existing contracted capacity. See *Policy Statement on Determination of Need*; 1902-AB86, FERC Docket No. PL-3-000.

⁶⁶ See: Ellerman, A.D., Joskow, P.L., and Harrison, D. Jr., “Emissions Trading in the US: Experience, Lessons and Considerations for Greenhouse Gases,” The Pew Center on Global Climate Change, May, 2003; Kwerel, E.R., and Rosston, G.L., “An Insider’s View of FCC Spectrum Auctions,” *Journal of Regulatory Economics*, Vol. 7, No. 3, (May 2000), pp. 253-289.

licensing under the Natural Gas Act, under a “public interest” standard.⁶⁷ Pipeline developers once engaged in two forms of competition to meet the FERC’s public interest requirement: (1) they worked to get distribution companies to favor them; and (2) they tried to out-manuever rival pipeline projects to demonstrate the economic necessity of their own project. If a particular pipeline company or consortium won that test, they received the Commission’s approbation the form of a “certificate of public convenience and necessity,” which was required to build.⁶⁸ The new market cut through this regulatory tangle when it successfully dealt with the issue of pricing new capacity on an incremental basis.

In 2000, again after some wrong turns, the FERC mandated that pipeline companies price new or expanded services on an incremental basis. Setting incremental pricing as the default rule for new pipeline construction put an end to the fight over traditional certification. If a pipeline company approached the Commission with a new proposal, it was no longer required to demonstrate connected gas supplies. With a portfolio of letters of intent from committed incremental shippers, the Commission had virtual *prima facie* evidence of economic need. The typical time period needed to plan and construct a typical large-scale pipeline expansion project dropped from five years to two.⁶⁹

In the US, property rights for independent shippers are founded on the long-term contracts under which the entirety of the network since 1944 was built.⁷⁰ Except for the exemption under the 2003 Gas Directive for “interconnectors,” the European gas network was not built with such long-term shipper contracts. As such, the ready-made basis for contractualizing the pipeline capacity does not exist in Europe. That being the case, the rest of the elements of contractualization (incremental pricing, segmenting of capacity, the market for secondary trades, etc.) is generally inapplicable.

⁶⁷ The FERC does not have such authority over oil pipelines under the Hepburn Amendment, a key problem in its regulation of that pipeline sector in America.

⁶⁸ For instance, the “Northeast U.S. Pipeline Expansion Projects” proposal from the late 1980s involved expanding gas pipeline service to the Northeastern US. The FERC received dozens of applications from competing transport companies; by March 1988, the Commission had made a preliminary determination that 20 of the projects appeared to be entitled to consideration in a hearing. In June 1988, the Commission limited consideration to nine discrete proposals, requiring 13 others to be consolidated into a single investigation. By November, most of the parties settled with each other, agreeing to form three new proposals, the first of which, the Iroquois Gas Transmission System, L.P., was eventually awarded a certificate by the Commission in 1990. Iroquois entered service on 28 January 1992, more than five years after the original project inquiries reached the Commission. See: FERC, *Iroquois Gas Transmission System L.P.*, Docket No. CP89-634-000 *et al*, Order Making Preliminary Determination and Establishing Procedures, 52 FERC 61,091, at 61,344 - 61,345 (July 30, 1990).

⁶⁹ For example, it took only two years for Kern River Gas Transmission Company to plan and construct its \$1.27 billion 2003 Expansion Project to add 906 million cubic feet per day (approximately 26 million cubic meters per day) of gas pipeline capacity between the Rockies and Southern California. The project was announced on March 22, 2001 and completed on May 1, 2003.

⁷⁰ From 1936 to 1944, during which time the Natural Gas Act was passed into law, no major gas pipelines were constructed in the US.

V. Summary

It is not a ridiculous overstatement to call the regulation of American gas pipelines the Stradivarius of inland transport regulation schemes pertaining to pipelines. The use of the network is freely competitive with a robust secondary market in capacity rights. New capacity is independent and competitively constructed and relatively easy to license and finance on the basis of long-term capacity contracts with shippers. Those pipeline users in areas served only by one or two pipeline companies are protected from price gouging or denial of availability by traditional cost-based regulation. While those rate cases were once hugely contentious, they are now largely perfunctory. Long term gas commodity contracts—once typical—have evaporated on the network, with most gas traded through predictable and reliable physical hubs and established markets. The pipeline market has shown great robustness to bad weather and environmental disasters, clearing the transport market through the price mechanism in each case. Even with the administrative and market meltdown of the California electricity market in 2000-2001, the gas market cleared, facilitated by a market-sensitive and flexible pipeline network.

But lest any users, owners or regulators of that American pipeline network try to claim too much credit, one only has to look at the similarly vast American crude oil and oil products pipeline network to see a broken-down country fiddle of an inland transport market by comparison. That latter network has no capacity rights, no such independent and competitive market for new pipeline capacity, obscure tariffs and access restrictions and grotesquely lengthy tariff cases.

The difference between the American Stradivarius and the broken down country fiddle, on pipeline networks that otherwise look the same, is a function of the development and growth of economic institutions over the past 101 years. Largely because of Ohio's Senator Joseph Foraker, the unsung hero of the modern gas market in the US, the two pipeline networks took different evolutionary institutional paths in 1906. Today, the two networks are institutionally so completely unlike one another that very few Americans in the legal, economic or regulatory spheres have experience with both. That fact is odd in and of itself. Perhaps even odder is that the final institutional development of contractualization evident in the 21st century American gas pipeline market was largely unscripted.

What does the US experience hold for security of supply on the gas pipeline network in Europe? More than anything else, the US experience points to the critical nature of a number of regulatory, contractual and ownership institutions that are new or untested in Europe. This paper has briefly touched on seven of the critical institutional building blocks for the contractualized gas pipeline market in the US. In only a few cases have similar institutions developed in Europe (often for reasons that will appear quite obvious to Europeans).

What are the choices for competition and security of supply on the European gas pipeline network? The contractualization route in Europe would require the definition and distribution of property rights and the

imposition of meticulous accounting regulations currently foreign to European regulators. It would require the synchronization of pipeline capacity across national borders within Europe and a single regulatory jurisdiction for the major trunk gas pipeline companies that requires vastly enhanced market information requirements. It would also perhaps require the structural separation of pipeline companies (critical in the US, virtually impossible to foresee in Europe) and the imposition of the “commodities clause.” To say that this is a challenging administrative, legal and political job would be a crass understatement. And to be sure, any Americans who would suggest otherwise should simply be reminded of that broken down, 101-year-old fiddle yonder in their oil pipeline market.

The other choices? The other choices look more like command and control. One choice could be the UK’s system that treats the network like a large integrated vessel, with notional trading points—sort of like a large natural gas tank into which suppliers inject gas and from which distributors, power generators and others withdraw it. It could be a remedy for an uncompetitive gas commodity market, but it would overlook the achievement of competitive efficiency on the pipeline network itself. One of the great advantages of contractualization in the US was that the market identified regions of unexpected excess capacity, and highlighted the demand for capacity in others. Pursuing the UK’s system would ultimately require the network to be an administered—not a competitive—affair, much like electricity transmission in the US.

Another similar choice is to continue to treat the great national pipeline systems like national utility monopolies, with reciprocal agreements with others for reliable and well-informed trans-border shipment rules. Again, this removes many competitive pressures from the pipelines themselves, but it may be a reasonable option nonetheless, given the evident challenge of creating an institutional basis for Europe-wide pipeline contractualization.

It would not be fair to conclude without emphasizing again the great difference in regulatory certainty between the US and Europe. The growth of federal regulatory institutions for the interstate gas network has been evolving for more than a century in the US. The body of legislation, case law (under the legal principles of common law precedent) and collaborative work of regulators,⁷¹ all developed through the dogged efforts of adverse interests working through the administrative and civil law courts to pursue and retain their rights, makes the FERC regulation of gas pipelines a highly predictable affair. Pipeline developers in the US can take that predictability to the bank—literally—and the bankable nature of an independent, contractualized network makes supply security a reality. It takes time, adversarial effort and judicial review to develop such predictable institutions, and in this area Europe has only just begun.

⁷¹ I refer to the National Association of Regulatory and Utility Commissioners (NARUC) that creates well-researched guidelines for regulators, such as for the critical definition and role of depreciation as a component of regulated rates.

Ultimately, security of gas supply in Europe will come through a more flexible and transparent transport system, increased flexibility in the current supply contracts,⁷² and a lower cost for the use of the network itself. Either competition or efficient regulation could advance this goal, for which the number of viable sources of gas rises and the ability of any supply to constrain the market shrinks. Which path will Europe follow? As far as the inland gas transport violin in Europe is concerned, the luthier is still at work.

⁷² These contracts in Europe are largely long-term and linked by formula to oil, which is the best evidence of a lack of a robust independent market in gas. The length of this paper prevents a review of those commodity contracting methods.