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History's Greatest Public-Private Infrastructure Partnership: The US Gas Market and Its Role in a Low-Carbon Continent

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Industry Economics Series

As Chair of NERA's Energy, Environment, Communications & Infrastructure Practice, it is my pleasure to share the next installment in the Industry Economics paper series, which highlights how we leverage our industry expertise to provide robust and uniquely rigorous economic analysis. Our second paper pairs natural gas markets experts NERA Managing Director Dr. Jeff D. Makholm and Associate Director Dr. Laura T. W. Olive to address the topical and timely subject of the US natural gas market and the role the industry has played—and will continue to play—in reducing US carbon emissions. Enjoy this paper and keep an eye out for more to come.

Dr. Christian Dippon, Managing Director

Introduction

The gas market in the United States defies worldwide comparison in the following ways:

- It is more than a half-century older than any other gas market in the world.
- More than 70% of the world's major gas pipelines are in the United States.[1]
- Investors built every gas pipeline.
- Commercial shale gas production happens only in North America.[2]
- US gas commodity prices are one-half to one-third of those anywhere outside North America.
- The Henry Hub in Louisiana is the only working gas futures market.[3]
- The regulatory burden for the industry is small compared with the US electricity sector or other countries' gas sectors.

The US gas market has saved US consumers more than $1.5 trillion over the past decade (in gas costs and associated lower electricity costs) compared to what the rest of the world pays for gas and electricity, places no burden on US public budgets, and serves to displace coal-fired generation faster than gas does in any other country (based simply on cost, not government mandate). In 2001, President George W. Bush declined to adopt the Kyoto Protocol, fearing its effect on the economy—but the US met the Protocol anyway, without any government action, simply because of the increasing competitiveness of natural gas in electricity markets.[4]

That US energy consumers and industries alone enjoy such benefits is a profound paradox. Natural gas (primarily methane, CH_4) exists in geological formations throughout the world, and shale gas technology is widely known. Gas pipelines are an unexceptional technology that has remained essentially unchanged for decades. Modern combined-cycle gas turbines (CCGTs), a great advance in the efficiency of electricity generation, have been available worldwide since the 1990s. Why cannot countries outside of North America (many with ample domestic gas resources, modern infrastructures, and technologies) emulate the successes of an open and transparent US gas market that delivers gas at one-half to one-third the cost of other countries?

The answer has nothing to do with geology or technology—engineering provides no answer for why the US gas industry is so unique. The answer also has nothing to do with neoclassical economics (focusing on demand, supply, and marginal cost). Rather, the answer lies in the US gas market's governing institutions: US politics (including the US Constitution), the uniquely vibrant US capital market, and a group of farsighted mid-20th-century economic and legal scholars who formed the foundation for effective US regulation of an investor-owned, competitive gas supply industry.

In other words, the unique nature of the US gas market is a reflection not of a special resource base or energy economic policy, but of how the United States governs itself, promotes competition, and protects the private property of investors. The success of the US gas market is the result of a long evolution of uniquely American institutions. Viewed this way, it is less of a mystery that no other nation (except Canada, which has largely mimicked those US institutions) has emulated the US gas market. Because gas requires pipelines to transport economically (the oceangoing trade in liquefied natural gas—LNG—is many times more expensive than overland pipeline transport), overseas gas markets have built-in entry protection from US imports.

President Biden Calls for New Infrastructure

In March 2021, President Joe Biden released the American Jobs Plan—his proposal to invest nearly $2 trillion in infrastructure over the next decade. President Biden's plan includes funding for transportation infrastructure—highways, bridges, rail, airports, public transport, electricity transmission, and electric vehicle charging stations as well as investments to ensure clean drinking water, widen broadband coverage, and improve the electric grid. In his speech to a joint session of Congress on 28 April 2021, Biden said:

> Throughout our history, if you think about it, public investment in infrastructure has literally transformed America, our attitudes as well as our opportunities. The transcontinental railroad, interstate highways, united two oceans and brought a totally new age of progress to the United States of America.[6]

Notably absent from this list is the nationwide gas pipeline system—built and maintained competitively without any public investment. How so? Why is upgrading electricity transmission in the proposed infrastructure legislative package but nothing at all about gas pipelines?

The answer starts with the Erie Canal—the first major interstate publicly funded infrastructure project. The canal was a financial flop, but dealing with that 19th-century failure set the stage for America's gas industry's successes of the 21st century.

The Erie Canal: The First Large-Scale Public Infrastructure Project

The Erie Canal—completed in 1825—connected the "Northwest Territory" (Illinois, Indiana, Michigan, and Ohio) to East Coast markets through its connection to the Hudson River and New York City. The canal opened development throughout the Great Lakes region and made New York the world's premier city for trade, banking, and investment. Because of the project's size and uncertainty, the infancy of large-scale US capital markets during that period, and the then nonexistent nature of the agricultural markets that the canal was designed to promote, government involvement in financing the project was critical.[7]

But the 1839–1842 depression caused widespread commercial failures. Those problems affected the Erie Canal when the New York legislature chose to default on its canal bonds rather than raise taxes. That experience raised the risk and cost of public borrowing in the eyes of investors, who turned to more reliable private capital for future transportation infrastructure projects (including the transcontinental railroads).

Reconfirmation of Private Financing for Local US Utilities

Among the utilities in the United States in the 21st century, local gas companies are by far the oldest. The first coal-manufactured gas lighting companies appeared in major US cities starting in Baltimore in 1818, New York in 1823, and Boston in 1829. Those city gas companies—largely unregulated—remained a dominant force in the local lighting business in major US cities throughout the rest of the century. In the very early 20th century, however, local public service companies were growing to represent major industries tending naturally toward monopoly and requiring some form of public intervention—either through regulation or public ownership.

The National Civic Federation—a privately funded group based in Chicago, comprising industrialists, labor interests, and consumer advocates—launched a major study in 1905–1906 regarding public involvement in local utilities. The study sought to determine the wisdom of continuing to rely on investor capital for building and operating US utilities. Major players in the development of future US utilities and regulation were part of the effort, including future Supreme Court Justice Louis Brandeis, utility holding company pioneer Samuel Insull, and economist John R. Commons (who wrote the nation's first state regulatory law in 1906). They spent six months studying dozens of publicly owned and investor-owned utilities in the United States and United Kingdom, with an eye toward settling the issue of whether private or public ownership was in each nation's best interest.

Walton Clark, of the gas utility in Philadelphia and a member of the study, summed up the opinion of those favoring continued private infrastructure ownership with government regulation, saying:

> Any government that is too feeble or corrupt to control with justice the conduct of a [privately owned] public service company, has little prospect of being able itself to supply such public service with efficiency and justice.[10]

The study cemented the role of investor-owned, regulated US public service firms in energy and transportation in the United States, even while it noted the successful operation of publicly owned firms in the UK.

US Regulation Stumbles

Utility regulation was little more than a general concept at the time. Much of the half-century that followed the National Civic Federation study witnessed the inability of the US legal system to find a workable method of regulating prices that respected the reasonable value of investor private property—protected under the US Constitution. The Supreme Court was a major part of the problem. Economist James Bonbright thought the Court's failure to resolve such issues could result in the end of US investor-owned utilities and leave no choice but for government ownership. He wrote in the mid-1930s:

> Had the [Supreme] Court deliberately set out to defeat the whole purpose of regulation and to make public ownership inevitable, it would hardly have pursued this objective more effectively than by its rulings and dicta on [property] valuation.[11]

Economists of the day were withering in their criticism of the inability of US courts to frame a workable method for squaring public interest regulation with private capital formation.

Louis Brandeis Saves the Day

Associate Justice Louis Brandeis solved the Court's problem, essentially preserving the role of private capital for US infrastructure. As a private lawyer in Boston in the late 19th and early 20th centuries, Brandeis had been deeply involved in dealing with many details of the governance and accounting of local public service firms, including the manufactured gas companies.[12] He took this experience with him to the Supreme Court, defining the "prudent investment" principle, first with a minority of justices in dissent but eventually paving the way for its adoption for US regulation generally. He made regulated infrastructure property values a secure legal fact, rather than the subject of never-ending expert inquiry, argument, and litigation. He wrote:

> The adoption of the amount prudently invested as the rate base and the amount of the capital charge as the measure of the rate of return would give definiteness to these two factors involved in rate controversies which are now shifting and treacherous, and which render the proceedings peculiarly burdensome and largely futile. Such measures offer a basis for decision which is certain and stable. *The rate base would be ascertained as a fact, not determined as matter of opinion.*[13]

Brandeis's prudent investment principle is only part of regulation in the United States (and Canada). Coupled with the 1944 *Hope* decision written by Justice William O. Douglass (Brandeis's protégé, who took his seat when he retired), US regulation took a path for effective infrastructure regulation.[14] In particular, gas pipeline investors (mainly US insurance companies with a long-term perspective) took the solidity of the Brandeis-inspired regulatory system as security on their 40-year pipeline bonds.[15]

Interstate Gas Pipelines as the Ultimate Public-Private Partnership

While the US Supreme Court was solidifying the foundation for regulation generally, pipeline interests were battling it out in Congress. Interstate gas pipelines avoided any federal regulation in 1906 when Congress moved to regulate Standard Oil's crude oil pipelines. By the 1930s, the Cities Alliance—a group of 100 Midwestern city and town governments representing millions of gas consumers that organized to lobby for gas pipeline regulation—found a Congress willing to remedy a vacuum in federal authority over what had become large-scale interstate commerce that was frustrating state regulators. Part of Congress's response to the problems with then-unregulated gas pipelines was the Public Utility Holding Company Act of 1935, which prohibited common ownership of unregulated interstate pipelines and state-regulated gas distributors.

Turning to regulating interstate gas pipelines for the first time, Congress dealt with two strong competing interests. Existing interstate pipeline companies sought a measure of protection from the entry of new competing lines by granting federal licenses ("certification"). The Cities Alliance argued that any certification requirement would merely protect powerful entrenched pipeline monopolies from competition. In the pluralistic political balance of interests between existing pipelines and gas consumers, each side got only part of what it wanted from Congress in the Natural Gas Act of 1938 (NGA). The pipelines got their licenses for existing lines, and the Cities Alliance ensured that interstate pipeline companies would have to compete for licenses for new lines.[16]

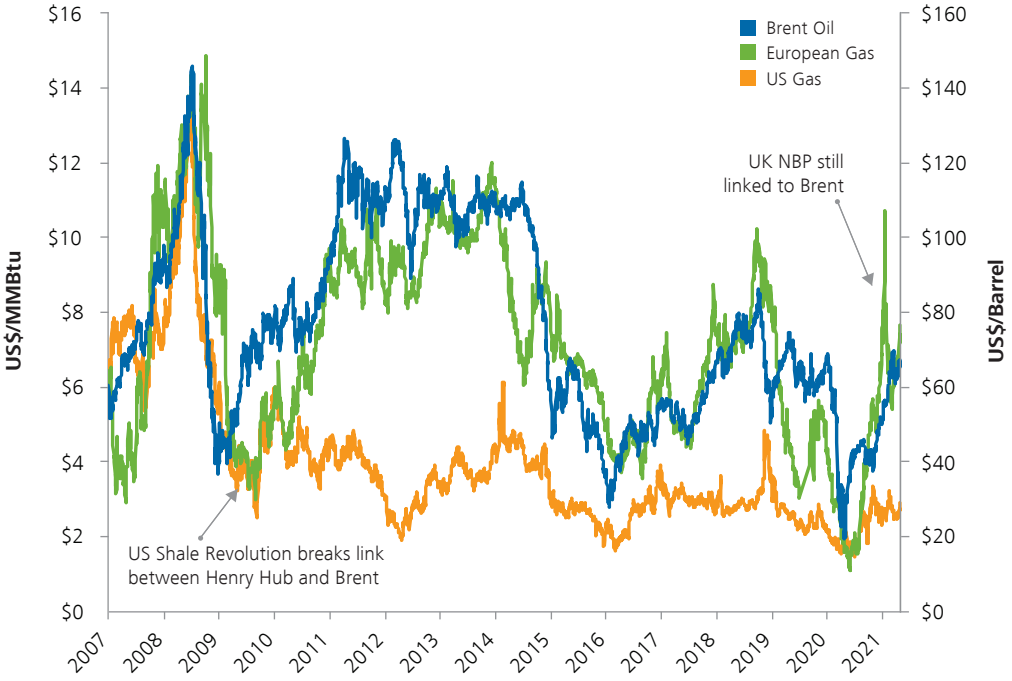
Viewed from 80 years later, the negotiated deal between pipeline interests and the Cities Alliance made the unique success of the US gas market possible. Combined with other institutions of federal regulation created in the 1930s and 1940s, the NGA opened gates for large-scale interstate pipeline investments in the 1950s and 1960s. Local utilities remained firmly regulated by state regulators, but the NGA alone dealt with the rapidly expanding interstate pipeline network.

Over the rest of the 20th century, regulation of those gas pipeline investments shifted to a focus on facilitating a competitive gas commodity market by encouraging competition among pipelines.[17] Today, the interstate gas pipeline industry is overseen by federal regulators with rules that encourage competition in both new pipeline entry to serve new production fields and in effective trading of the gas commodity itself.[18]

Measures of the Unique Value of the US Gas Industry

Natural gas prices have traditionally followed oil-equivalent prices and still do in Europe and elsewhere.[19] But since 2009, US gas prices split from world oil prices, driven by the competitive entry of unconventional shale gas production. Figure 1 shows the result.

Figure 1. **Relative Gas and Oil Prices in the United States and Europe**
2007–mid-2021

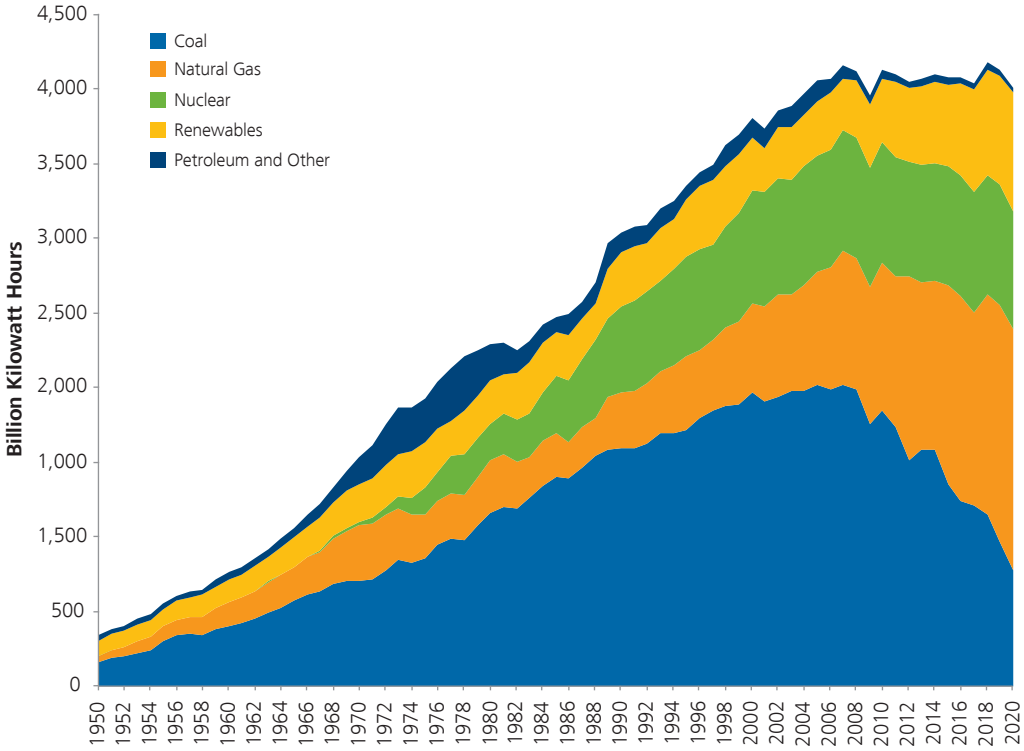


Sources and Notes: Bloomberg (NG1 Comdty; CO1 Comdty; NBPG1MON SPEC Index; downloaded April 2021). The Henry Hub (in Erath, Louisiana) is the principal trading point for US natural gas, and Brent is the major benchmark for worldwide oil prices.

From 2007 through 2019, US gas consumers paid about $1.132 trillion less than they would have if gas prices had remained linked to the world oil price. In those states that make up the seven regional US electricity markets, the price of electricity is set by the variable cost of the most expensive of the electricity generation facilities—often gas-fired units—necessary to meet rapidly changing electricity demand. Electricity consumers in those seven markets would have incurred an additional cost of $405 billion after 2008 if gas prices reflected those in Europe, shown in Figure 1.[20]

Such low gas prices are fast displacing coal in the merit order of competitive US power markets. The result so far is striking. In 2000, coal's share in US power generation was three times that of gas. By 2020, the fuels' shares flipped: gas generation more than doubled that of coal.

Figure 2. **Coal-Fired Generation Displaced by Natural Gas**
1950–2020



Sources and Notes: US Energy Information Administration, *Monthly Energy Review,* Table 7.2a, January 2021, and *Electric Power Monthly*, February 2021, available at https://www.eia.gov/energyexplained//electricity/charts/generation-major-source.csv. Preliminary data for 2020.

Without any government action to remove coal from US power generation, its share declined from more than half to less than one-fifth of total generation in those 20 years.[21] There has been no similar displacement of coal by only market forces anywhere else in the world.

The Role of Gas in US Carbon Reductions

Famously, Ernest Moniz, director of the MIT Energy Initiative, spoke in 2013 about shale gas as a "bridge to a lower carbon planet."[22] What Moniz did not foresee was that such gas development would only be America's bridge—spreading to no other part of the world.

There is little debate that tackling carbon reduction problems depends on both government action and innovation. There is proof of concept in cap and trade and carbon tax policies in pursuing carbon reductions at lowest cost—permitting those with the greatest stake in carbon reductions, and greatest chance to innovate profitably, to benefit through such means.[23]

This is where the US gas industry stands apart from the rest of the world. The April 2021 European gas import price was $7.21 and the April 2021 US Henry Hub price was $2.95—a typical spread over the past decade. In any reasonable mix of future actions to eliminate carbon, US gas manifestly has a different role than European gas. It is easy to see that even with the most advanced and effective carbon reduction policies governments are able collectively to adopt, gas will have a role in the US energy mix long after it has been economically displaced in Europe and elsewhere by other technologies or fuels, such as hydrogen.[24]

In the meantime, it would be counterproductive and unduly costly to treat the US gas industry like that of other nations and seek to shut down an industry that has supported significant carbon reductions without any particular overarching policy. In a democracy, the path to reducing carbon emissions depends on more than just resource endowments and command and control policies. It depends on governing institutions and a pluralistic balance of interests that embrace broad public opinion. The US gas industry has played—and will continue to play—an important role in reducing US carbon emissions.

Notes

[1] "World Pipeline Mileage," *World Factbook*, CIA, http:// www.cia.gov/the-world-factbook/.

[2] Canada mirrors the US gas pipeline development and shale gas production and regulation. As such, the nature of our discussion also applies to Canada.

[3] Jeff D. Makholm, "There Is But One True Hub, and His Name Is Henry," *Natural Gas and Electricity*, 32, no. 11 (2016), 27–30.

[4] Russell Gold, "Rise in US Gas Production Fuels Unexpected Plunge in Emissions," *Wall Street Journal*, 18 April 2013, https://www.wsj.com/articles/SB10001424127887324763404578430751849503848. Claire Parker, "Biden Wants to Restore US Role in Fight against Climate Change. Here's How the US Shaped Past Efforts," *Washington Post*, 23 April 2021, https://www.washingtonpost.com/world/2021/04/23/biden-climate-summit-past-efforts/.

[5] "Fact Sheet: The American Jobs Plan," whitehouse.gov, 31 March 2021, https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/31/fact-sheet-the-american-jobs-plan/.

[6] "Biden's Speech to Congress," *New York Times*, 28 April 2021, https://www.nytimes.com/2021/04/29/us/politics/joe-biden-speech-transcript.html.

[7] Lance E. Davis and Douglass C. North, *Institutional Change and American Economic Growth* (Cambridge: Cambridge University Press, 1971), pp. 77–79 and 139–43.

[8] A. R. Tussing and C. C. Barlow, *The Natural Gas Industry: Evolution, Structure and Economics* (Cambridge, MA: Ballinger,1984) p. 13.

[9] See *Municipal and Private Operation of Public Utilities,* 3 vols. (New York: National Civic Federation, 1907).

[10] *Ibid*., volume 1, p. 443.

[11] James C. Bonbright, *The Valuation of Property*, vol. 2 (New York: McGraw-Hill),1937, p. 1154.

[12] Alpheus Thomas Mason, *Brandeis: A Free Man's Life* (New York: Viking, 1946), pp. 127–40.

[13] *Southwestern Bell Tel. Co. v. Public Svc. Comm'n*, 262 US 276 (1923). Emphasis added.

[14] *Federal Power Commission v. Hope Natural Gas*, 320 US 591 (1944). Canada has its own version of the *Hope* decision: *Northwest Utilities v. City of Edmonton*, SCR 186 (NUL 1929).

[15] See R. W. Hooley, *Financing the Natural Gas Industry* (New York: AMS Press, 1968).

[16] See Jeff D. Makholm, *The Political Economy of Pipelines* (Chicago: University of Chicago Press, 2012), pp. 121–29.

[17] In *Phillips Petroleum Co. v. Wisconsin* (1954), the Supreme Court required regulation of gas prices. In 1989, the Wellhead Decontrol Act removed that regulation, freeing gas commodity prices from federal oversight and thus allowing competition in the commodity market. Key rulemaking in this period included FERC Order No. 636, 59 FERC ¶ 61, 030; FERC Order No. 637, 90 FERC ¶ 61,109. Also see Makholm, *Political Economy of Pipelines*, pp. 140–49; FERC Docket No. PL99-3-000 (1999).

[18] For example, in 2008, to enhance competition in the secondary capacity release market, FERC removed the rate ceiling on short-term capacity release transactions of one year or less. See FERC Order No. 712, 123 FERC 61,286 (2000).

[19] In traditional European commercial gas negotiations, prices are generally set on the basis of oil product prices in the preceding six to nine months. See Jonathan Stern and Howard Rogers, "The Transition to Hub-Based Gas Pricing in Continental Europe," Oxford Institute for Energy Studies, NG49, March 2011, https://www.oxfordenergy.org/wpcms/wp-content/uploads/2011/03/NG49.pdf.

[20] These are NERA computations attached to various US court filings in 2020–21. See, for example, Declaration of Jeff D. Makholm, PhD, *Before the United States Bankruptcy Court Southern District of Texas Houston Division*, Case No. 20-35562-11, 3 February 2021, Appendix B.

[21] Energy Information Administration, "Electricity Explained," updated 18 March 2021, https://www.eia.gov/energyexplained/electricity/electricity-in-the-us-generation-capacity-and-sales.php.

[22] Brad Plumer, "Is Fracking a 'Bridge' to a Clean-Energy Future? Ernest Moniz Thinks So," *Washington Post*, 4 March 2013, https://www.washingtonpost.com/news/wonk/wp/2013/03/04/is-fracking-a-bridge-to-a-clean-energy-future-ernest-moniz-thinks-so/.

[23] Richard Schmalensee and Robert N. Stavins, "Lessons Learned from Three Decades of Experience with Cap and Trade," *Review of Environmental Economics and Policy*, 11, no. 1 (2017), pp. 59–79.

[24] In 2018, Bloomberg New Energy Finance estimated the cost of producing hydrogen from renewable sources at approximately $18–$33/MMBtu and production from fossil fuel sources at about $7–$13/MMBtu. Congressional Research Service, "Hydrogen in Electricity's Future," 30 June 2020, https://fas.org/sgp/crs/misc/R46436.pdf.

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