New Markets, Outmoded Manufacturing: The Transition from Manufactured Gas to Natural Gas by Northeastern Utilities after World War II

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For more than a century, large manufactured gas plants dotted the industrial landscape of the urban Northeast. Using a variety of technologies, these factories applied heat and pressure to coke, coal, and oil to produce a gas suitable for use in space heating and cooking. Yet this well-established, vital industry literally ceased to exist in the two decades after World War II, as natural gas transported from the southwestern United States replaced manufactured gas in all of the major markets in the Northeast.

This abrupt victory of a new product was a modern variant of "creative destruction" as described by Joseph Schumpeter in his classic study *Capitalism, Socialism and Democracy* [10]. While creating a more efficient fuel supply, the coming of natural gas also destroyed the existing system for the production and distribution of manufactured gas. Yet this mid-20th century case of creative destruction differed sharply from Schumpeter's descriptions of the same process during the era of high capitalism in the late 19th century. In that dynamic period, innovations took place in a largely unfettered marketplace, whereas the introduction of natural gas after World War II took place under the supervision of large public utilities and federal and state regulators. In an outcome not anticipated by Schumpeter, their creative management of this difficult industrial transition helped minimize the societal costs of the destruction of the manufactured gas industry without greatly delaying the widespread use of natural gas.

New Markets: The Rise of the Modern Natural Gas Industry

Natural gas was a superior fuel to the manufactured variety; it burned more efficiently and had approximately double the heating content. Thus, when natural gas became available in secure supplies at prices reasonably competitive with manufactured gas, it was assured new markets. Cities near existing gas fields in Appalachia, the Southwest, and California converted to natural gas in the early 20th century, but the large cities of the Northeast remained outside the natural gas distribution system until after World War II. By that time, this advanced industrial region was one of the last strongholds of manufactured gas in the entire United States (see Table 1). Its conversion awaited the completion of long distance pipelines from the prolific gas fields of the southwestern states. Such pipelines were the physical link between supply and demand, but their construction could not be undertaken until the development of new technologies for the transmission of natural gas over longer distances and the creation of an investment climate capable of

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generating the hundreds of millions of dollars required to finance such ambitious undertakings.

TABLE 1
NATURAL GAS AND MANUFACTURED GAS SALES OF UTILITIES IN THE UNITED STATES AND THE NORTHEAST, 1935-1959
(millions of therms)

	Natural Gas		Manufactured Gas		
Year	U.S.	Northeast	U.S.	Northeast	(% of Total)
1935	10,635	1,155	1,611	969	(60)
1937	13,480	1,478	1,535	999	(65)
1939	13,576	1,310	1,580	1,058	(67)
1941	16,358	1,469	1,726	1,145	(66)
1943	20,325	1,766	1,967	1,308	(66)
1945	22,563	1,647	2,088	1,382	(66)
1947	26,022	1,974	2,319	1,617	(70)
1949	32,234	2,219	2,274	1,696	(75)
1951	44,718	3,304	1,763	1,374	(78)
1953	52,800	4,273	838	608	(73)
1955	63,008	5,504	457	283	(62)
1957	74,649	6,887	215	120	(58)
1959	85,518	8,495	143	76	(53)

Note: "Northeast" includes CT, ME, MA, NH, RI, VT, NJ, NY, PA.

Source: American Gas Association, *Historical Statistics of the Gas Industry* (Arlington, 1964).

The years immediately before the Great Depression witnessed an impressive boom in gas pipeline construction, as the introduction of seamless pipe facilitated the laying of much longer pipelines of larger diameters capable of transporting natural gas under higher pressures. The late 1920s boom tied the large gas fields of the Texas Panhandle and central Oklahoma to the urban markets of Wichita, Denver, St. Louis, Atlanta, Salt Lake City, Minneapolis, Chicago, and Indianapolis. One enterprising new company, Panhandle Eastern, pushed forward with construction of a 1,000 mile pipeline from the Texas Panhandle toward Detroit. But the coming of the Great Depression stalled pipeline construction, suspending for a time the race to new markets [11, pp. 33-45].

During the lull of the 1930s a wave of new regulations fundamentally altered the conditions under which future expansion would occur. No longer

would the gas pipeline industry go forward with little effective government supervision. The combination of the creation of the Securities and Exchange Commission and the passage of the Public Utility Holding Company Act shaped a new investment climate in which the nationally-active utility holding companies which had financed much of the 1920s pipeline construction boom gave way to new forms of financing. The Natural Gas Act of 1938 further altered conditions in the industry by giving the Federal Power Commission (FPC) broad new powers to regulate the interstate shipment of natural gas [9]. The FPC's authority to grant certificates of public convenience and necessity gave it the power to decide which companies would serve which markets and on what terms.

Such changes prepared the way for the revitalization of the natural gas industry, but not until the mobilization for World War II did the industry again begin to surge outward toward new markets. Government policy aimed at winning the war had a lasting impact on the evolution of the natural gas industry. In response to submarine attacks on oil tankers, the government financed the construction of two of the longest pipelines in the U.S.: the 24" diameter Big Inch to transport crude oil from Texas to the East and the 20" Little Big Inch to carry petroleum products from the refining centers of the Gulf coast to the major eastern ports. These two lines were the first direct pipeline connections between the oil and gas supplies of the Southwest and the markets of the Northeast, and their conversion to natural gas shipment after the war shaped the emergence of competition in the cross country shipment of natural gas. Post-war developments also were influenced by the government's decision to allow Tennessee Gas Transmission Company (Tenneco) to construct a natural gas pipeline from Texas to Appalachia, where shortages of natural gas in the declining producing fields of Pennsylvania and West Virginia threatened the continued operation of factories vital to the war effort. This line gave Tenneco an advantage over its potential post-war competitors in the race to reach major northeastern markets [5, p. 101].

After the war, Tenneco joined other southwestern gas companies in the renewed quest for broader markets. One focus of competition was the two-year debate on the government's disposal of the Inch Lines. Because the peacetime use of these pipelines promised to have far-reaching effects on the nation's energy industries, intense interfuel competition surrounded the series of government debates over their disposal. Many of the major oil companies lobbied hard to prevent the use of the Inch Lines in shipping petroleum since they feared the disruption of pre-war patterns of competition. Spokesmen for the natural gas industry offered a politically attractive alternative, the conversion of the Inch Lines for use in transporting natural gas. But this proposal brought strong, well-organized opposition from representatives of the coal and railroad industries, who argued that natural gas shipped through the Inch Lines would seriously damage a segment of their own business, the mining and shipment of coal to northeastern utilities for the operation of manufactured gas plants.

In various public hearings (including those before the U.S. Congress, the Surplus Property Administration, the FPC, and various state utility commissions) coal and railroad lobbyists mounted a determined campaign to

block the conversion of the Inch Lines to natural gas. They repeatedly voiced fears about the loss of jobs and the potential damage to the coal-based economy. But their concerted efforts succeeded only in slowing the pace of change by tying up the natural gas companies in protracted public hearings. Such political lobbying perhaps gained these coal and railroad interests several years of protection from the loss of markets to natural gas, but it could not ultimately stop the advance of the new fuel into the big cities of the Northeast.

The debate over the disposal of the Inch Lines also called forth intense interfuel competition among numerous groups hoping to become important suppliers of natural gas to the East. The public auction for the Inch Lines attracted the attention of many oil and gas companies, including the three Houston-based concerns which came to dominate the transmission of natural gas from the Southwest to the Northeast: Tennessee Gas Transmission Company (Tenneco), led by Gardiner Symonds; Texas Eastern Transmission Corporation (Texas Eastern), led by George Brown; and Transcontinental Gas Pipe Line Company (Transco), led by Claude Williams. Representatives of these and other companies pursued every possible political advantage that might enhance their chances of winning the bid. Washington was a city ripe for influence peddling and even corruption in the rush to demobilize the economy. The government owned an estimated 25% of the nation's industrial capacity at the end of the war, and most officials seemed eager to dispose of this property rapidly. The Inch Lines were among the largest individual properties being sold by the government, and well-placed public officials such as Jesse Jones of the RFC, the young Senator Lyndon Johnson, former Secretary of Interior Harold Ickes, and FDR confidant Tommy Corcoran all became embroiled in the controversy surrounding the bid. The issue was not decided until 1947, when Texas Eastern won the Inch Lines with a bid of more then $143 million dollars, thus gaining control of the only existing pipelines connecting Texas and the northeastern states.

As the winner of the Inch Lines, Texas Eastern took the early lead in the competition for northeastern markets. The company moved quickly to convert the lines to natural gas. Despite frustrating regulatory delays, by the fall of 1948 Texas Eastern had begun supplying gas to the two largest utilities in the Philadelphia area. These utilities had not previously enjoyed access to a significant supply of natural gas, and their city became the first in the Northeast to move away from manufactured gas in the post-war era. Tenneco later joined Texas Eastern as a supplier of Philadelphia, and the two companies began a series of heated competitive battles that shaped the pace, timing, and tone of the introduction of natural gas throughout the Northeast.

Yet as these two rivals fought for competitive advantage in Philadelphia and elsewhere, a third company, Transco, laid claim to New York City, the largest market in the region. Under the direction of Houston entrepreneur Claude Williams, Transco had been a serious bidder for the Inch Lines. But even before placing his bid, Williams had hedged his bet by applying for FPC permission to construct a new, large diameter pipeline from Texas to New York. Thus, when he learned in February of 1947 that his bid was the second highest for the Inch Lines, Williams already had begun preparations for the public hearing on his application for the new pipeline. For almost eighteen

months Transco responded to the inevitable challenges from the coal and railroad industries in extended hearings before the FPC. Yet despite this delay Transco's early start in planning its new line enabled it to enter the large New York market before its rivals. As the "first mover" into this major market, Transco gained a permanent position as the most significant supplier of the most attractive market on the East Coast.

Texas Eastern and Tenneco ultimately gained small shares of the New York City market, but their primary objective in the early 1950s was the last remaining virgin territory for natural gas in the East, New England. Both companies sought to become the primary supplier to Boston and other New England communities, and their battle for supremacy in this area was fought primarily in various regulatory arenas and courts. As the two companies extended their systems toward New England, they looked for legal and regulatory tactics to impede each other's progress. The result was a protracted, five-year long series of FPC hearings and court challenges that slowed the coming of natural gas while the two competitors found new ways to harass each other. By the mid-1950s the battle had ended in a draw, as the FPC allowed each company to share the New England market through subsidiary pipelines [1, pp. 22-43].

With the conclusion of the fight for New England, natural gas had almost completely banished manufactured gas from northeastern cities. Despite the repetition of tedious and at times frustrating public hearings before the FPC and state utility commissions, the triumph of natural gas had taken little more than a decade. Regulation had no doubt slowed the introduction of natural gas in the Northeast, but only momentarily in historical terms. After intervenors had had their say-- again and again-- regulators allowed the economic logic of the marketplace to override the political maneuvering of intervenors.

Unfettered competition no doubt would have made natural gas available more quickly, particularly in New England. But the primary concern of the FPC and the state utility commissions in regulating the introduction of natural gas was a legitimate one: were there sufficient supplies of natural gas to assure continued service long after the region's manufactured gas plants had been dismantled? The observed experience of numerous midwestern cities which had confronted supply problems with the decline of the Appalachian gas fields raised realistic questions that could not be ignored by regulators. In practice, regulators sought security of supply in requiring twenty-year supplies of natural gas before approving most new sales contracts. This requirement was neither onerous nor misguided. Nor did it prove particularly constraining to those in charge of natural gas transmission companies. Despite recurring complaints from these executives that the regulatory process was unnecessarily time-consuming and often frustrating, the outcome of regulated competition was essentially the same as that which would have occurred with unfettered competition: the superior new fuel replaced the traditional fuel as soon as consumers recognized that they could obtain relatively secure supplies for comparable prices.

Outmoded Manufacturing: The Case of New York City

Even before the coming of natural gas, the manufactured gas industry was a troubled one [4, 8]. The production processes for making gas from coke, coal, or oil required heavy investments of capital and often back-breaking labor. The plants themselves polluted badly while occupying expensive tracts of land in the middle of large cities. Illumination had once been an important market for manufactured gas, but electricity had captured this market in the early 20th century. In subsequent years electricity began to challenge manufactured gas for other uses. The competitive position of manufactured gas declined dramatically in the decade after 1939, when production costs almost tripled due primarily to rising prices for oil and coke. In the same years recurring strikes by coal miners raised uncertainties regarding the availability of coal for the gas plants.

Against this economic backdrop, the utilities hesitated to make the substantial new investments which would be required to expand manufactured gas capacity. The only way to meet increased demand for manufactured gas was to invest in the construction of expensive new plants and to hire new workers to staff them. Natural gas supplies by contrast could be expanded without additional investment simply by negotiating new contracts with suppliers. In the late 1940s, for example, Brooklyn Union Gas Company undertook a three-year, $25 million construction program to expand its peak capacity for manufactured gas by approximately 10%. Yet during these years the company could not even keep pace with growing demands for gas in its service territory. Greatly expanded outlays of capital to build manufactured gas plants were not particularly attractive to all-gas companies such as Brooklyn Union; to electric, gas, and steam companies such as Consolidated Edison of New York, such outlays were an unacceptable drain on investment funds sorely needed to expand electric generating capacity [4, 8].

The utilities in the Northeast found an acceptable alternative, the transition to natural gas. The case study of New York City illustrates the planning process by which the major utilities carried out this difficult transition. In general they succeeded quite well in using organizational resources and personnel developed in the manufactured gas era to smooth the transition to a new fuel. In this sense the existing utility companies, with the assistance of regulatory authorities, managed the introduction of natural gas and the destruction of manufactured gas in a creative way which minimized the costs to consumers, workers, and investors.

The New York metropolitan area contained the largest concentration of gas users in the nation, and utility managers in the city had a strong incentive to monitor the progress of natural gas from at least the 1920s. As early as 1929, Consolidated Edison (then named Consolidated Gas) employed consultants to examine the feasibility of building its own natural gas pipeline from its service district to the Appalachian gas fields. This study concluded that gas supplies in the near-by producing region were insufficient to justify the costs of the pipeline, but the company remained interested in exploring the prospects for receiving natural gas when larger, more secure supplies became available [2, pp. 153-4].

When Texas Eastern, Tenneco, and Transco began to push toward the East after World War II, Con Edison and Brooklyn Union established planning committees to monitor developments and prepare for the coming of natural gas. The key questions for these planners were security of supply, cost, and the technical problems of the transition of existing distribution system to a new fuel. As they went about their work, the focus of debate moved to FPC hearings on Transco's application to serve New York City with natural gas.

The New York State Public Service Commission (PSC) took the lead at these crucial hearings in encouraging all gas companies in the state to press for the expansion of natural gas transmission from the Southwest. This state regulatory agency forcefully argued the logic of the rapid adoption of the new fuel. It went so far as to recommend that all utilities in the state not already negotiating with Transco for gas supplies intervene in the FPC hearings to attempt to gain a portion of the company's gas shipments. The state commission's strong arguments in favor of natural gas helped the FPC push aside the complaints of intervenors from the coal and railroad industries.

While leading the praises for natural gas, state and federal regulators also required assurances of a twenty year supply before approving contracts. They sought in addition to protect utilities from future disruptions of supply by assuring that more than one transmission company would serve each major market. This policy was clear in the case of New York City. Texas Eastern intervened in the FPC hearings on Transco's entry into New York with the protest that "the granting of such certificate to Trans-Continental would have a disruptive effect on the orderly and economic development of Texas Eastern's system to meet the market requirements of the Eastern Seaboard area and would have a detrimental effect on the potential natural gas consumers in the area to be served" [3]. The FPC responded sharply: "We can not subscribe to the thought that Texas Eastern is entitled to preempt such markets or that recognition of such prospective monopoly is in the public interest." The FPC did not consider the cross country natural gas transmission industry to be a "natural monopoly"; instead, it sought to use regulatory powers to encourage competition and to enhance security of supply by assuring multiple suppliers to major markets.

The FPC's approval of Transco's application led New York area utilities to contract with the pipeline company for future supplies and to begin to prepare for the introduction of natural gas into their existing systems. The five major New York area utilities-- Con Edison, Brooklyn Union, Brooklyn Borough Gas, Kings County Lighting Company, and Long Island Lighting Company-- then began joint planning to avoid confusion of purpose and unnecessary expenditures in the construction of natural gas mains from a common receiving point at the terminus of Transco's line to their respective systems.

Planners within each utility faced the prospect of adapting existing facilities to accept natural gas. Most of the utilities planned initially to mix natural gas with manufactured gas for extended periods, but further experience with natural gas convinced them to move as quickly as possible toward the delivery of straight natural gas. This decision carried with it a difficult, but

essential, task: the conversion to natural gas of every gas burning appliance in the city. Thus, in addition to purging their distribution system of manufactured gas and preparing them to handle natural gas, the utilities had to determine how best to undertake the adaptation of appliances.

At Con Edison the System Engineering Department prepared studies to guide conversion while the Gas Planning Division implemented these plans. The first priority was to determine the logical order for conversion to natural gas. After evaluating the layout of gas mains, patterns of gas demand, and the availability of manufactured gas, the company's Commercial Operations Center and System Engineering Department decided to convert the system in the following order: Westchester County, Riverdale in the Bronx, the Third Ward of Queens, the First Ward of Queens, the East Bronx, the West Bronx, and then, finally, Manhattan. In all, Con Edison faced the task of converting about 1.4 million customers, each of whom operated an average of two gas appliances.

The conversion of Westchester County began in April of 1950 and was completed in the summer of the next year. To complete the vital job of adapting individual appliances to the new fuel, Con Edison hired North American Conversion Company, which had grown to carry out such conversions throughout the country. Most utilities used such outside firms to avoid training their own work forces, but Con Edison changed its initial decision after its experience in Westchester County and completed the conversion using its own workers. This choice proved excellent, since it allowed the company to establish better quality control while providing temporary employment for many workers whose jobs at the manufactured gas plants were in jeopardy.

Con Edison had a long tradition of selling and servicing appliances, and this experience proved quite helpful in solving the difficulties presented by the conversion of particular appliances. Con Edison's workers also had a stronger incentive to preserve good customer relations than did the temporary workers employed by the conversion companies. The permanent employees of the utility were also more attuned to the need for great care in preventing accidents. The use of more than one thousand Con Edison employees during the five-year conversion process helped ease the adjustment to the decline in the number of workers needed to staff the manufactured gas facilities. In a company with a long tradition of job security, this was an important factor in reducing labor disruptions during the transition to natural gas. Indeed, Con Edison managed the transition to natural gas in a way that required no lay-offs; as jobs in the manufactured gas plants steadily declined, the work force was reduced through retirement while younger workers were transferred to other activities such as the conversion team.

Executives at Con Edison used inherited resources of a well-established company to manage the "destruction" of the manufactured gas industry in a way which minimized the disruption of traditional patterns of work and consumption. By carefully directing the conversion process, they reduced the uncertainties felt by workers, the inconvenience to consumers, and the dangers of accidents to residents of their service area. Given the success of regulatory authorities in minimizing the risks of supply shortages and the price of natural

gas to consumers, the "managed destruction" of the manufactured gas industry in Con Edison's operations provides an example of the successful handling of the introduction of a new product in a way which minimized the societal costs of the transition. Manufactured gas had become by the late 1950s a relic of a by-gone era in New York (see Table 2). Con Edison for a time kept several manufactured gas plants in working order in case they were needed in an emergency, but the closing of the last such stand-by plant in 1968 marked the end of the company's long involvement in what was now an outmoded manufacturing industry.

TABLE 2
CONVERSION FROM MANUFACTURED GAS TO NATURAL GAS:
TWO NEW YORK UTILITIES (BCF)

	The Brooklyn Union Gas Company[1]		Consolidated Edison Company of New York[2]	
Year	Manufactured Gas Produced	Natural Gas Purchased	Manufactured Gas Produced	Natural Gas Purchased
1948	35	--	58	--
1949	33	--	57	--
1950	36	--	62	--
1951	38	14	58	3
1952	43	22	50	29
1953	--	25	29	52
1954	--	31	39	57
1955	--	31	15	57
1956	--	38	4	60
1957	--	47	--	69
1958	--	55	--	82

[1]Brooklyn Union began its conversion during early 1952.
[2]Consolidated Edison began its conversion during April 1950.

Source: *Moody's Public Utility Manual*.

The replacement of manufactured gas by a more efficient fuel in the major markets of the Northeast after World War II went forward with the sort of creative energy that had been so evident in late 19th century America. Unlike in this earlier period, however, large corporations such as Con Edison and powerful regulatory agencies such as the FPC helped manage the process of change in the case of the introduction of natural gas. The result was a

more orderly, though less rapid process which allowed for the release of the entrepreneurial energies of the natural gas companies while cushioning the impact on those tied to the declining manufactured gas industry.

Several factors help explain this outcome. The FPC was a relatively new agency with no strong ties to the manufactured gas industry; natural gas was easily substitutable for manufactured gas and was a clearly superior product; utilities such as Con Edison were much more concerned with the expansion of electricity in this era than with the protection of the gas industry. Yet whatever the underlying reasons for the relatively smooth transition to natural gas, this study suggests a measure of hope for those who seek reassurance that the introduction of new products and technologies can be managed so as to reduce the costs of transition while retaining the benefits of new products. "Creative destruction" that is almost as creative and considerably less destructive than its counterpart in the days of Rockefeller is a process worth seeking both in our history and in our present quest for greater competitiveness.

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