

Boom and Bust in Pittsburgh Natural Gas History: Development, Policy, and Environmental Effects, 1878–1920

PITTSBURGH AND WESTERN PENNSYLVANIA have a rich energy history focused on the development and utilization of the resources of coal, oil, and natural gas. Within the last ten years the region has experienced a boom in natural gas production from the Marcellus Shale deposit that extends throughout the state. The drivers of this boom have been a rise in gas prices and the application of the technology of hydraulic fracturing (nonconventional horizontal drilling). Thousands of wells have been drilled throughout Pennsylvania, and thousands more are projected. Extensive discussions are taking place in the state about controversial issues such as regulatory policy, extent of drilling, duration of supply, and environmental impacts.

This natural gas boom, however, is not the region's first. It mirrors in many ways a boom that began in the late nineteenth century and extended intermittently for several decades. This article will sketch out the history of this period of natural gas exploitation, emphasizing issues of policy, risk, and environmental impacts. Many similar issues have arisen from the current Marcellus natural gas boom, suggesting that closer attention to history might have helped avoid some of the environmental and governmental policy problems currently being encountered. For the purposes of clarity, the article is separated into two sections: the first presents the history of natural gas developments in the region, while the second discusses in a topical fashion issues relating to environmental impacts.

A Brief History of Gas in Pittsburgh

Before natural gas consumption began in Pittsburgh in the late 1870s and 1880s, five manufactured gas companies supplied gas made from coal

The Carnegie Mellon Steinbrenner Institute generously supported research for this paper. We are grateful for the helpful comments on an earlier version of this paper by reviewers for the *Pennsylvania Magazine of History and Biography*.

(also known as town gas) to the city. The process that manufactured gas from organic fuels such as coal was first developed in Europe and was transferred to the United States at the beginning of the nineteenth century. In 1816, Baltimore became the first American city to develop a gas lighting system, and Pittsburgh followed in 1837. This manufactured gas was used primarily for streetlights and for domestic purposes such as lighting and cooking. Its high production costs limited both its domestic market and its use for industrial purposes. When natural gas entered the city in the late nineteenth century, the manufactured gas companies found it increasingly difficult to compete with it because of natural gas's lower cost and higher energy content.¹

Drillers seeking oil and salt in the northwestern corner of Pennsylvania had discovered natural gas in the 1860s and occasionally used it to heat boilers and to power drilling equipment. Mostly, however, it was flared, or burned off, because of a lack of demand. In the mid and late 1870s, however, drillers found substantial gas supplies in Butler, Armstrong, and Clarion Counties, close to potential industrial consumers. Two iron manufacturers located north of Pittsburgh—Spang, Chafant, and Company in Etna and Graff, Bennett, and Company in Millvale—were pioneers who began bringing gas into their mills by pipeline.² The use of natural gas rather than coal to provide heat had obvious advantages in regard to fuel costs, ease of handling, and consistency of temperature, and other mills soon followed.³

¹ Joel A. Tarr, "Pittsburgh and the Manufactured Gas Industry," *Pittsburgh Engineer*, winter 2006, 12–14; *Progressive Age*, Feb. 15, 1898, 60. In 1898, the manufactured gas companies combined with the Philadelphia Company and other natural gas companies to form the Consolidated Gas Company of the City of Pittsburgh. The manufactured gas company was increasingly unprofitable.

² John B. Pearse, "Natural Gas in Iron Working," appendix D of Pearse and Franklin Platt, *A Report on the Use of Natural Gas in the Iron Manufacture*, in Platt, *Second Geological Survey of Pennsylvania, 1875: Special Report on the Coke Manufacture of the Youghiogheny River Valley in Fayette and Westmoreland Counties* (Harrisburg, 1876), 183, notes that pipelines were forced to follow a winding route "due to the hostility of the farmers, who, fearing conflagrations, refused the right of way, and compelled the location of the line along the township roads."

³ In September 1883, Andrew Carnegie, the largest iron and steel manufacturer in the region, contracted with the Acme Gas Company to provide natural gas from its Murrysburg wells, about twenty miles east of the city, to his three Pittsburgh-area plants: the Edgar Thomson Bessemer Works, the Homestead Steel Works, and the Union Mills. The use of gas at the Edgar Thomson Works resulted in the reduction of four hundred tons of coal a day. *Annual Report of the Geological Survey of Pennsylvania for 1886*, part 2, *Report on the Oil and Gas Region*, John F. Carll (Harrisburg, 1887), 676 (hereafter *Geological Survey, 1886*); Pearse and Platt, *Report on the Use of Natural Gas*, 161–216; George B. Hill & Co., *Pittsburgh: Its Commerce and Industries, and the Natural Gas Interest* (Pittsburgh, 1887), 8–9. Natural gas also became the preferred fuel for the making of glass, giving rise to firms such as Pittsburgh Plate Glass and the Rochester Tumbler Company. See "Glass: Pittsburgh as a Center," in

Natural gas did not enter the city itself until the early 1880s. While gas had been discovered in the Murrysville region (the “Haymaker Well”) in the late 1870s, entrepreneurs were initially reluctant to pipe it to untested markets because doing so required investment in expensive and untried infrastructure.⁴ Risk of explosions and the dangers involved in piping gas under high pressure into residential markets also constrained natural gas adoption.⁵ Additionally, the manufactured gas companies, fearing competition for the residential and street lighting markets, tried to block the entrance of natural gas into the city.

In 1882, two gas firms, the Fuel Gas Company and the Penn Fuel Company, were incorporated under the Pennsylvania Corporation Act of 1874. This act gave gas companies permission to provide heat and light to municipalities without specifying that either manufactured gas or natural gas be used; the Pittsburgh City Council proceeded to award the two firms charters to distribute the fuel.⁶ The Fuel Gas Company had originally thought it would bring coal gas into the city from mine-mouth coal processing plants. The record-breaking natural gas output of the Haymaker Well in Murrysville, however, convinced them to drill their own well, and in 1882 the company began piping gas into Pittsburgh’s South Side from its Murrysville well. In the same year, the Penn Fuel Company, which had acquired the Haymarket Well, began distributing natural gas by pipeline to customers in Pittsburgh’s East Liberty and Lawrenceville neighborhoods.⁷

Controversy erupted in the courts between the two companies over who had the exclusive right to distribute natural gas in the city. On February 2, 1885, in the case of *Emerson and the Penn Fuel Company v. the Attorney General*, the court ruled that neither company had the right, because the Corporation Act of 1874 only authorized the distribution of manufactured

Pittsburgh, Engineers’ Society of Western Pennsylvania (Pittsburgh, 1930), 365–74; Albert Williams Jr., *Mineral Resources of the United States, Calendar Years 1883 and 1884* (Washington, DC, 1885), 242. Hereafter cited as *Mineral Resources, 1883–84*.

⁴ Andrew Carnegie, “The Natural Oil and Gas Wells of Western Pennsylvania,” in *The Empire of Business* (Toronto, 1902), 264–80; *Geological Survey, 1886*, 601, 664–81; George H. Thurston, *Allegheny County’s Hundred Years* (Pittsburgh, 1888), 205.

⁵ Thomas P. Roberts, “Natural Gas,” *Proceedings of the Engineers’ Society of Western Pennsylvania* 2 (1884): 341–45.

⁶ The two firms combined in late 1884. See, “A Natural Gas Deal,” *Milwaukee Sentinel*, Nov. 19, 1884, 2. A third firm, the Chartiers Valley Gas Company, was organized on July 31, 1883, also receiving its charter under the Pennsylvania Corporation Act of 1874. See *Geological Survey, 1886*, 678–79.

⁷ *Mineral Resources, 1883–84*, 239; *Geological Survey, 1886*, 674–75; Roberts, “Natural Gas,” 331–46; and David A. Waples, *The Natural Gas Industry in Appalachia: A History from the First Discovery to the Maturity of the Industry* (Jefferson, NC, 2005), 44–47.

gas. This ruling also invalidated all city ordinances conferring legal rights in regard to natural gas distribution and left the standing of the companies formed to provide natural gas to customers in a legal limbo.⁸ The state legislature was the only body capable of solving the problem by enacting an act regulating the new fuel of natural gas.

In February 1885, the state house and senate held extensive discussions about issues involving risks of explosions, terms of incorporation, and eminent domain.⁹ Because of the novelty of natural gas, few precedents existed. As approved, the resulting Natural Gas Act of 1885 permitted the chartering of corporations “for the purpose of producing, dealing in transporting, storing and supplying natural gas.” It stipulated that gas companies could only enter a city with city council permission unless they had been supplying such gas prior to the Natural Gas Act’s passage. The act gave gas corporations the right of eminent domain “for the laying of pipe lines for the transportation and distribution of natural gas” and contained specific requirements regarding the sealing and plugging of abandoned wells, with a \$200 fine if the regulations were not followed. While no governmental agency was tasked with its enforcement, the act provided that if a well was left unplugged, an owner of adjacent lands or “in the neighborhood” of the well could plug it at the expense of the original owner. The motivation for this feature appears to have been both to avoid waste and to prevent flooding of adjacent wells. Governor Robert E. Pattison signed the act on May 29, 1885.¹⁰ Thus, the development and marketing of natural gas in the 1880s had resulted in unprecedented regulatory legislation (Act 32, 1885), a phenomena that was repeated again in regard to nonconventional drilling in the Marcellus Shale in the first decade of the twenty-first century (Act 13, 2012).

The first interpretation of the Natural Gas Act occurred in 1886 because of events relating to the distribution of natural gas in Pittsburgh. In the spring of 1884, while drilling for gas on his Pittsburgh estate (“Solitude”)

⁸ Emerson and the Penn Fuel Company v. Attorney General, Pennsylvania Supreme Court, *Weekly Notes of Cases*, vol. 15, no. 27 (Feb. 12, 1885): 425–31.

⁹ “Natural Gas,” *Daily Legislative Record*, Feb. 3, 1885, 142–43, Feb. 4, 1885, 166, 170, and Feb. 23, 1885, 311. On the same day, the senate approved a bill to prohibit damage to “oil, gas or water wells, tanks, pipes and machinery connected therewith” and imposing a fine or imprisonment if the perpetrator was found guilty.

¹⁰ Act to Provide for the Incorporation and Regulation of Natural Gas Companies, 1885 Pa. Laws 29. The act also required that pipelines be at least twenty-four inches below the surface if they passed over agricultural land.

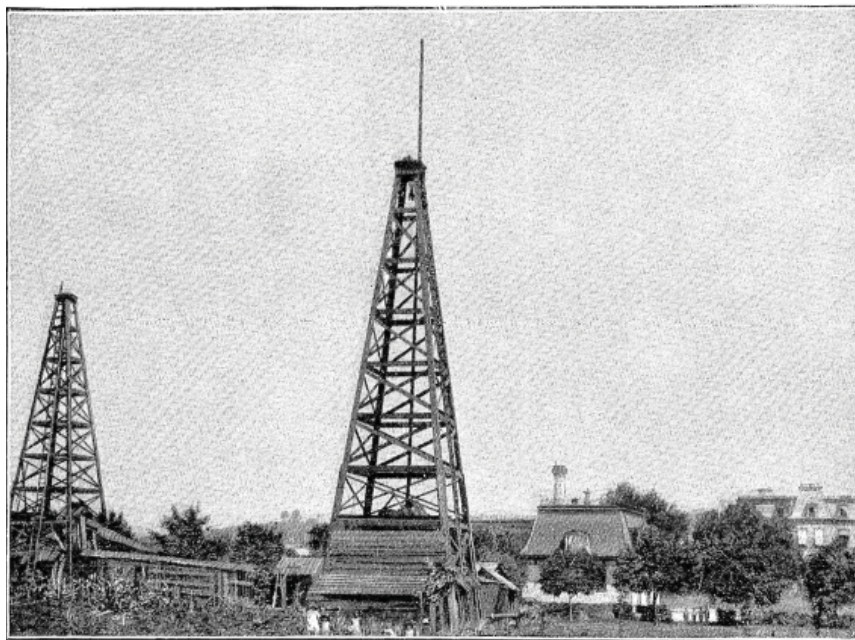


Fig. 1. The Westinghouse Well on His Estate, “Solitude,” 1884. Source: *Pittsburgh and Allegheny Illustrated Review: Historical, Biographical, and Commercial: A Record of Progress in Commerce, Manufactures, the Professions, and in Social and Municipal Life* (Pittsburgh, 1889), 32.

to heat his hot house and conservatory, the inventor and entrepreneur George Westinghouse hit a “roarer,” estimated to flow at about twenty million cubic feet per day (Fig. 1).¹¹ While the Westinghouse well was drowned out by water within several weeks, the realization that there was gas underground “started a perfect furore [*sic*] in gas drilling” throughout the city.¹²

Numerous derricks soon altered the Pittsburgh landscape, and gas stand-pipes flared through the night (Fig. 2). Westinghouse drilled seven more wells in Pittsburgh’s Point Breeze and Homewood neighborhoods and

¹¹The pressure of the gas was so great that a large wooden plug and drilling apparatus, weighing about 3,600 pounds, were blown many feet in the air. The gas ignited and burned for days, and a one hundred-foot-high torch lit the neighborhood until Westinghouse brought it under control with a stopcock. See, James H. Reed, “Pittsburgh and the Natural Gas Industry,” in *Pittsburgh and the Pittsburgh Spirit*, Pittsburgh Chamber of Commerce (Pittsburgh, 1928), 127–29.

¹²*Ibid.*; *Mineral Resources, 1883–84*, 238–40; and Waples, *Natural Gas Industry in Appalachia*, 48–49. It was not unusual for western Pennsylvania wells to be drowned out by water.

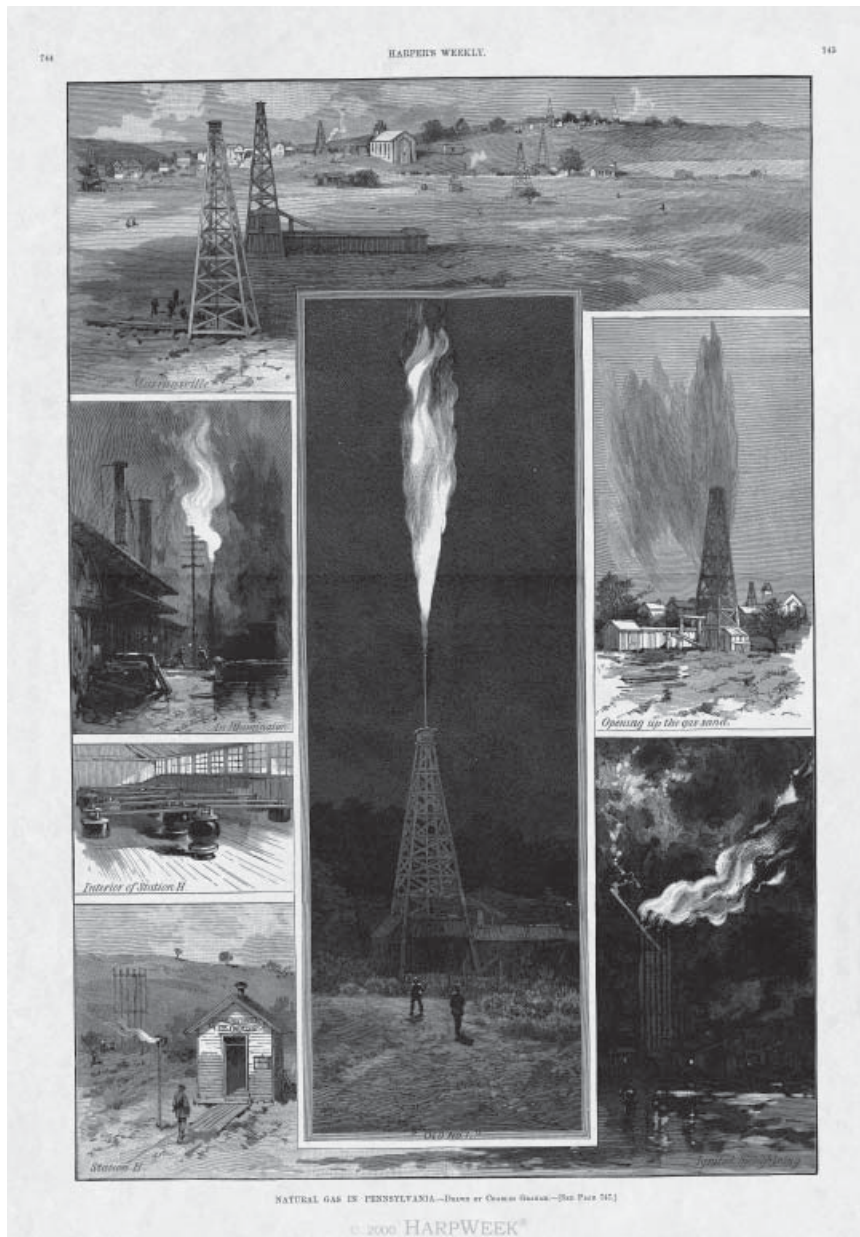


Fig. 2. Pittsburgh's First Natural Gas Boom. Source: "Natural Gas in Pennsylvania," *Harper's Weekly*, Jan. 14, 1885, 744–45.

acquired land in the Murrysville area, a proven gas reserve. He also organized the Philadelphia Company under an old state charter to supply gas to Pittsburgh residences and industries and its outlying area, aggressively acquiring industrial and domestic customers and competing firms.¹³ Using his technical skills, Westinghouse began developing and patenting innovations in the transport of natural gas, gas regulators, and meters.¹⁴ By the beginning of 1885, in addition to Westinghouse's Philadelphia Company, four other companies funded by various Pittsburgh banking interests were drilling wells in the city as well as in the ten-county region.¹⁵

In 1884 and 1885, while members of the state legislature in Harrisburg discussed the terms of the new state act, a number of natural gas explosions occurred throughout Pittsburgh and its region, increasing the urgency of securing new legislation. Natural gas pipelines and appliances were new technologies involving an explosive and volatile substance, and a number of technical questions existed about what was the best material for pipelines and what constituted safe gas pressure.¹⁶ The distribution of the fuel to city consumers, most of whom were inexperienced in its use and would not necessarily notice if there was a problem (the gas was odorless), raised problems of risk. Westinghouse emphasized the safety of his distribution system and developed a technology to prevent leakage from gas supplies under high pressure. He also arranged for his city council allies to introduce a general ordinance ("the Westinghouse Ordinance") that specified the use of his innovation involving the use of double pipes in gas distribution lines.¹⁷ Warning that "the extension of weak and imperfect pipes through the city" meant its inhabitants were "living on a powder magazine," the *Pittsburgh Post* demanded that the Westinghouse Ordinance be passed. On July 31, 1884, the council approved the ordinance and several

¹³ *Annual Report of the Board of Directors of the Philadelphia Company, 1885–86* (Pittsburgh, PA, 1886). For the early growth of the Philadelphia Company see George H. Thurston, *Pittsburgh's Progress, Industries, and Resources* (Pittsburgh, 1886), 13. Thurston claimed that by the late 1880s, three thousand families, thirty-four iron and steel mills, sixty glass factories, and three hundred small factories and hotels used natural gas. Stanley Paul Wagner, "Natural Gas Comes to Pittsburgh" (MA thesis, University of Pittsburgh, 1947), 50–56.

¹⁴ For a full list of Westinghouse's natural gas patents, see Henry G. Prout, *A Life of George Westinghouse* (New York, 1921), 362–65.

¹⁵ *Geological Survey, 1886*, 603–4; Roberts, "Natural Gas," 338.

¹⁶ For a discussion of these issues, see Roberts, "Natural Gas," 341–45.

¹⁷ "Gas Pipes," *Pittsburgh Post*, Aug. 8, 1884. This article quotes the Westinghouse patent language. There is a description of the Westinghouse two-pipe system in David T. Day, *Mineral Resources of the United States, Calendar Year 1886* (Washington, DC, 1887), 193–94. Hereafter cited as *Mineral Resources, 1886*.

months later approved a more detailed ordinance providing a franchise for the Philadelphia Company.¹⁸

Continued gas explosions that resulted in injuries, deaths, and property destruction, however, stimulated protest meetings throughout the city. On February 2, 1885, the *Pittsburgh Post* ran an editorial entitled “Death in the Streets,” which warned, “Save in a state of war we don’t believe any large city in the world was ever in a more perilous situation than Pittsburgh is today owing to the dangers of natural gas explosions.”¹⁹ The city council appointed a Natural Gas Commission, and in March 1885 it took extensive testimony from gas company personnel, technicians, and city officials to determine the cause of the explosions.²⁰ Seeking to take advantage of the public outcry, Westinghouse ran newspaper ads throughout 1885 and 1886, boasting that his Philadelphia Company had “facilities equaled by no other company for the safe and economical use of this fuel” and possessed reserves that would guarantee uninterrupted gas supply.²¹

In August 1885, after the Pennsylvania legislature had enacted the Natural Gas Act, the Pittsburgh City Council passed a general ordinance for natural gas that made the transportation and supply of natural gas for public consumption a public service open to regulation. Later, the council passed an act setting specific standards for the laying and testing of pipe under the direction of the city engineer. A number of the features in this ordinance involved George Westinghouse’s patented improvements in gas transmission, giving him an advantage over his competitors. The passage of this ordinance, however, brought Pittsburgh into a legal collision with the state.²²

In June 1885, People’s Natural Gas Company sought to enter the city with a new pipeline carrying gas from its Murrysville wells.²³ The city, however, claimed that People’s had not followed the requirements of the

¹⁸The Westinghouse Ordinances are in W. W. Thomson, *A Digest of the Acts of Assembly Relating to, and The General Ordinances of the City of Pittsburgh, from 1804 to Sept. 1, 1886, with References to Decisions Thereon* (Harrisburg, 1887), 506–7. They also stipulated that Westinghouse would provide free gas to the city properties.

¹⁹Quoted in Wagner, “Natural Gas Comes to Pittsburgh,” 42.

²⁰*Ibid.*, 45–47.

²¹See, for instance, *Pittsburgh Daily Post*, Mar. 6, 1885, and the *National Labor Times*, May 15, 1886.

²²Thomson, *Digest of the Acts of Assembly Relating to, and The General Ordinances of the City of Pittsburgh*, 369–75. Discussions of the ordinances can be found in City of Pittsburgh’s Appeal, *Central Reporter . . . All Cases Determined in the Courts of Last Resort*, ed. Edmund H. Smith (Rochester, NY, 1887), 4:225–44.

²³Entrepreneurs Joseph N. Pew and Edward O. Emerson, formerly of the Penn Fuel Company, founded People’s Natural Gas. See Mary Brignano and Hax McCullough, *The Vision and Will to Succeed: A Centennial History of The People’s Natural Gas Company* (Pittsburgh, 1985), 15.

council's natural gas ordinance and refused to grant a charter. People's sued, charging that the city ordinance was in violation of the state Natural Gas Act. In 1886, the state supreme court agreed with that assertion and found sections of the Pittsburgh ordinance invalid.²⁴ Preemption of the local ordinance permitted People's Natural Gas to enter and distribute gas throughout the city under the state act.²⁵ A similar conflict between the regulations of a municipality and state law regarding natural gas arose in 2014 when the Pennsylvania Supreme Court held that the municipalities could use their zoning power to forbid drilling in certain areas.²⁶

By 1886 six companies had received municipal charters and were piping gas into the city as an industrial and residential fuel.²⁷ In addition, a number of iron and steel firms drilled wells on their own property.²⁸ Westinghouse's Philadelphia Company became the city's largest natural gas distributor, having consolidated with twenty other smaller natural gas firms, including the Acme Gas Company, the Allegheny Natural Gas Company, the Carpenter Natural Gas Company, the Penn Fuel Company, and the Fuel Gas Company. By 1888 it supplied seven hundred mills, factories, and commercial establishments and twenty-five thousand homes with fuel.²⁹

Pittsburgh had been known as the "Smoky City" for most of the century because of massive coal use by industry and residences and was closely identified with the mineral as a source of both industrial progress and atmospheric pollution. The substitution of cleaner natural gas as a fuel, however, caused a sharp decrease in the number of smoky days. The coal

²⁴ City of Pittsburgh's Appeal, *Central Reporter*, 4:225-44.

²⁵ See Thomson, *Digest of the Acts of Assembly Relating to, and The General Ordinances of the City of Pittsburgh*, 639-725; Hiram Schock, comp. and ed., *Digest of the General Ordinances and Laws of the City of Pittsburgh to March 1, 1938* (Pittsburgh, 1938), 728-37; see 729n1 for parts of the 1885 ordinance voided by the courts.

²⁶ Marie Cusick, "Pennsylvania Supreme Court Strikes down Controversial Portions of Act 13," *StateImpact Pennsylvania*, Dec. 19, 2013, <https://stateimpact.npr.org/pennsylvania/2013/12/19/state-supreme-court-strikes-down-act-13-local-zoning-restrictions/>.

²⁷ David T. Day, *Mineral Resources of the United States, Calendar Year 1885* (Washington, DC, 1886), 239-41 (hereafter cited as *Mineral Resources, 1885*); *Geological Survey, 1886*, 692-94.

²⁸ Day, *Mineral Resources, 1885*, 241; David T. Day, *Mineral Resources of the United States, Calendar Year 1888* (Washington, DC, 1890), 486 (hereafter cited as *Mineral Resources, 1888*); *Geological Survey, 1886*, 692-94.

²⁹ *Annual Report of the Philadelphia Company, 1885-86*; Thurston, *Allegheny County's Hundred Years*, 207. One contemporary report noted that "there was a rage for organizing natural gas companies, as is shown by the fact that over five hundred of such corporations secured charters." These were largely small operations intended to supply towns and boroughs, most of which never went into operation or were bought out by larger firms such as the Philadelphia Company. See Hill, *Pittsburgh*, 9.

industry suffered from reduced demand, and estimates of the amount of coal displaced by natural gas ranged from six to twenty million tons per year as unemployment soared in the minefields.³⁰ National as well as local publications applauded the benefits of natural gas and the disappearance of the “black pall-like cloud” that had hung over the city. *Harper’s Weekly* observed that a “peaceful revolution” had taken place in Pittsburgh due to natural gas; as a result, it had lost its “Smoky City” title (Fig. 3).³¹ City boosters lauded the benefits of natural gas and boasted about its “almost incomprehensible quantities” and “inexhaustible” nature.³²

Natural gas produced cleaner air, but it was not, contrary to popular belief, inexhaustible.³³ By 1890, fluctuating and declining supplies were negatively affecting industrial users, and some, including the Carnegie works, shifted back to coal.³⁴ In 1892 a speaker at a meeting of the Engineers’ Society of Western Pennsylvania woefully observed:

We are going back into the smoke. We had four or five years of wonderful cleanliness for Pittsburg, and we have all had a taste of knowing what it is to be clean. We all felt better, we all looked better, we all were better. But we are back into the smoke. It is growing worse day by day.³⁵

The depletion of natural gas supplies was a constant concern of utilities, and they unsuccessfully experimented with methods to produce man-

³⁰ Day, *Mineral Resources*, 1888, 482–83; *Geological Survey*, 1886, 18–19; and “Natural Gas vs. Coal at Pittsburg,” *National Labor Tribune*, July 24, 1886.

³¹ “The City of Pittsburg,” *Harper’s Weekly*, Feb. 27, 1892, 202–3; Angela Gugliotta, “Hell with the Lid Taken Off”: A Cultural History of Air Pollution—Pittsburgh” (PhD diss., University of Notre Dame, 2004), 129–39.

³² See, for instance, Thurston, *Pittsburgh’s Progress*, 6–8, wherein he repeats and reiterates optimistic comments about gas supply he originally made in 1876 and in Thurston, *Allegheny County’s Hundred Years*, 92–95, 202–9.

³³ The “rule of capture,” a common law principle that maintained that any gas that came into your well, even if it originated from a neighbor’s land, was yours, was upheld by the Pennsylvania Supreme Court in 1889 in the case of Westmoreland & Cambria Natural Gas Co. v. De Witt. The rule of capture produced an emphasis on digging multiple wells and pumping at a rapid rate lest your neighbor capture your gas.

³⁴ Wagner, “Natural Gas Comes to Pittsburgh,” 73–74. By 1891, Carnegie’s Edgar Thompson Works was using only coke for fuel, and in 1893 the Philadelphia Company terminated its contract with the firm. See Edgar P. Allen, “Natural Resources of Pittsburgh,” *Proceedings of the Engineers’ Society of Western Pennsylvania* 7 (1891): 11–13. In the 1891 edition of the gas industry publication *Brown’s Directory of American Gas Companies*, which had begun including information about natural gas several years before, noted that it had omitted natural gas companies for that year because of sharp changes in the industry and because “the gas is rapidly disappearing.” See E. C. Brown, comp., *Brown’s Directory of American Gas Companies* (New York, 1891), 1.

³⁵ William Metcalf, “On Smoke,” *Proceedings of the Engineers’ Society of Western Pennsylvania* 8 (1892): 42–43.

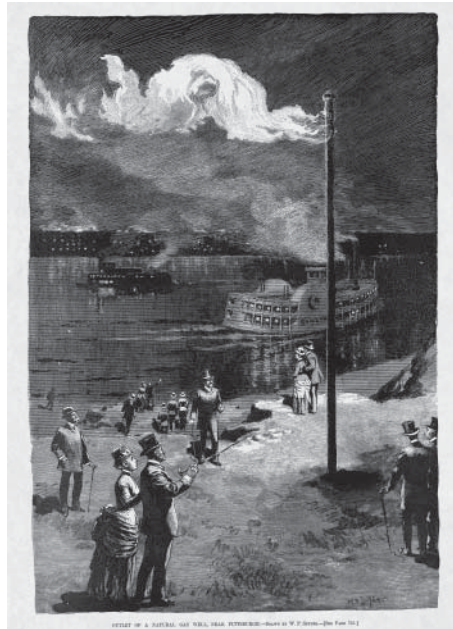


Fig. 3. A Pittsburgh Standpipe, 1885. Source: “Outlet of a Natural Gas Well Near Pittsburgh,” *Harper’s Weekly*, Nov. 7, 1885, 731.

ufactured gas from bituminous coal cheaply enough to compete with coal.³⁶

The return of the smoke caused the city’s first major smoke control effort. The Ladies’ Health Protective Association of Allegheny County, an organization composed mostly of upper-class women, drove the campaign. Recruiting allies from among the engineering and business communities, the antismoke forces pushed for effective regulatory legislation. During the following years the city council passed various smoke control ordinances. These ordinances were, however, generally ineffective or found by the courts to be unconstitutional.³⁷

By 1900, while the productivity of local wells had sharply diminished, natural gas supplies available in the region had increased due to the dis-

³⁶ By 1892 George Westinghouse was suggesting to his board of directors that the Philadelphia Company acquire property for manufacturing coal gas. See *Annual Report of the Philadelphia Company*, 1892, 6.

³⁷ Angela Gugliotta, “How, When, and for Whom Was Smoke a Problem in Pittsburgh,” in *Devastation and Renewal: An Environmental History of Pittsburgh and Its Region*, ed. Joel A. Tarr (Pittsburgh, 2003), 110–25.

covery of new well fields, pipeline delivery of gas from West Virginia, and the development of compressing stations and metering. However, supplies were still inadequate to meet growing industrial and residential demand.³⁸ Between 1897 and 1913, the number of domestic gas consumers in Pennsylvania increased from a little over two hundred thousand to more than four hundred thousand, or about 30 percent of total gas consumption, while the number of industrial consumers rose from a little over one thousand to over four thousand.³⁹ Increasingly, gas supplies had to be imported from out of state (largely West Virginia) by pipeline; in 1913, for instance, the value of gas consumed in Pennsylvania was about 33 percent in excess of the value of gas produced in state. In addition, rises in the cost of producing gas from operations, well drilling, and transportation had increased the average price per thousand cubic foot from 13.4 cents in 1906 to 18.15 cents in 1913.⁴⁰ In 1918, Samuel S. Wyer, conservation chief of the US Fuel Administration, warned of a continuation of the supply problem, noting that 43 percent of Pennsylvania's gas consumption was imported from other states, that fewer new wells were being drilled, that the gas land reserves were declining, and that costs for all gas services were rising.⁴¹

Reduced production, price rises, and higher demand, however, were not the only causes of the crisis. The natural gas industry was well known for its wasteful practices. In 1913, for instance, the Bureau of Mines noted that the history of the natural gas industry was "an appalling record of incredible waste."⁴² In its initial decades, gas for domestic use was often sold at flat rates by fixture, and low rates encouraged unnecessary use. Wells were drilled and gas erupted, but weeks of delay would occur before the wells were connected to pipelines or plugged. Pipelines often leaked badly, and both manufacturers and household appliances used gas ineffi-

³⁸ David T. Day, *Mineral Resources of the United States, Calendar Year 1900* (Washington, DC, 1901), 630–31.

³⁹ John H. Herbert, *Clean, Cheap Heat: The Development of Residential Markets for Natural Gas in the United States* (New York, 1992), 8–9; Samuel S. Wyer, *Natural Gas: Its Production, Service, and Conservation* (Washington, DC, 1918), 37. Industry paid on average 60 percent of what domestic users did; gas companies maintained that this resulted from the higher cost of servicing them. Because of the higher price paid by domestic consumers, gas companies were inclined to reduce industrial supplies before domestic in times of supply shortages. They also argued that domestic needs should have a higher priority than industrial.

⁴⁰ Richard R. Rice, *Oil and Gas Map of Southwestern Pennsylvania* (Harrisburg, 1916), 16–19.

⁴¹ Samuel S. Wyer, *Present and Prospective Supply of Natural Gas Available in Pennsylvania* (Washington, DC, 1918), 3–4.

⁴² Wyer, *Natural Gas*, 52–57.

ciently. Standpipes illuminated towns and cities with light throughout the night, and open flame or flambeaux torches were common.⁴³

In 1916–20, as the United States confronted a fuel crisis based on increased defense and wartime demands, reduced natural gas availability became an area of major concern.⁴⁴ Fears about loss of supply and higher prices caused thousands of domestic and industrial users to shift to coal. Some demanded that industrial use of natural gas be ended to ensure domestic supplies. The gas companies, in conjunction with the state and federal governments, carried on an educational campaign focusing on the need for gas conservation and urged domestic consumers to reduce usage. In the 1917–22 period, the Equitable Gas Company, the largest Pittsburgh supplier, moved to preserve its natural gas supplies by constructing a plant near Pittsburgh to produce gas from coal and mix it with natural gas.⁴⁵

In 1920, Pennsylvania state geologist George H. Ashley warned of an uncertain future for natural gas production in Pennsylvania and a need to prevent waste, explore new sources, and balance industrial and domestic uses to meet future needs. His implication was that unless these steps were taken, Pennsylvania's natural gas industry would follow the path of decline experienced by its petroleum industry a half century before (Fig. 4).⁴⁶ It is clear that the predictions concerning unlimited supplies of natural gas made when the gas boom began in the 1880s were misguided, as Ashley's warning confirms.

The Environmental Effects of Natural Gas

The rapid expansion of drilling in the Marcellus Shale for natural gas has raised a number of environmental issues related to air, water, and land contamination. In the period of the first natural gas boom, approximately 1880–1920, many similar environmental issues arose. The Natural Gas Act of 1885 set the framework for natural gas development in the state

⁴³ Reed, "Pittsburgh and the Natural Gas Industry," 130.

⁴⁴ John G. Clark, *Energy and the Federal Government: Fossil Fuel Policies, 1900–1946* (Urbana, IL, 1987), 48–127.

⁴⁵ On options for conserving natural gas supplies, see George H. Ashley, *Future of Natural Gas in Pennsylvania* (Harrisburg, 1920), 4. Also, see F. F. Schauer, "A Resume of the History, Organization, Operation, and Present Day Problems of the Equitable Gas Company, Pittsburgh & West Virginia Gas Company, & Philadelphia Oil Company" (unpublished document in author's possession, Feb. 15, 1932), 6–7. The Elrama plant was shut down in 1927. The Equitable Gas Company was founded in 1888 as a separate company and was acquired by the Philadelphia Company in 1900.

⁴⁶ Ashley, "Future of Natural Gas in Pennsylvania."

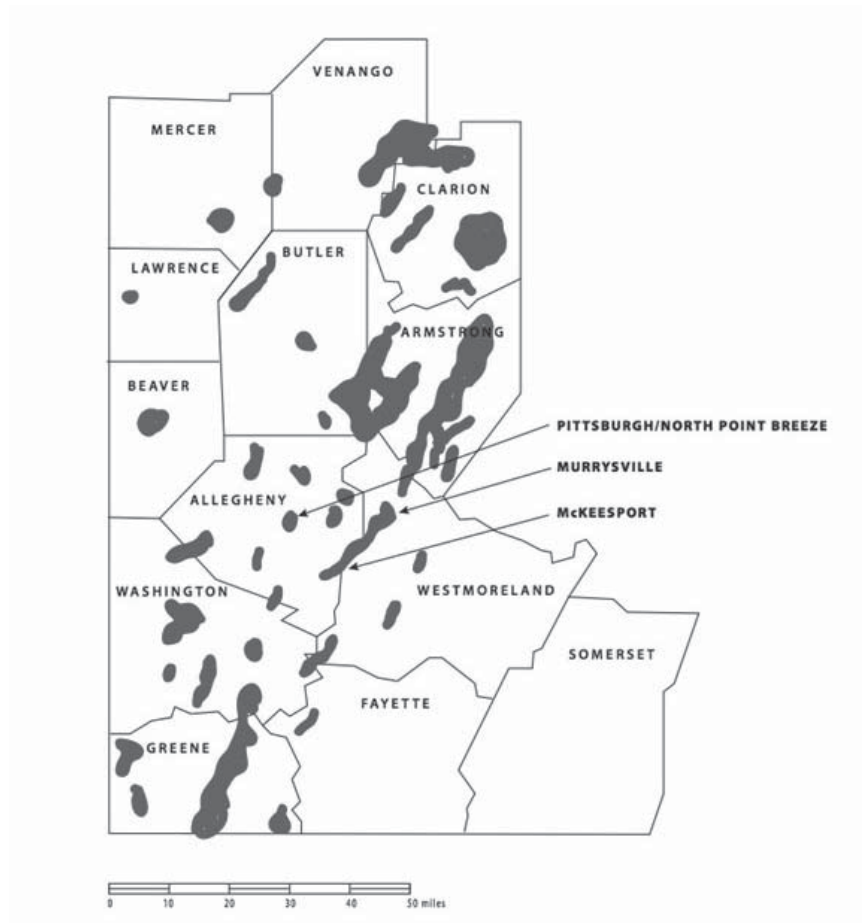


Fig. 4. Location of Natural Gas Fields in Western Pennsylvania, 1920. Source: George H. Ashley and J. French Robinson, *Oil and Gas Fields of Pennsylvania*, vol. 1, *Pennsylvania Geological Survey*, 4th ser. (Harrisburg, 1922).

during this period, and the only new laws enacted by the legislature into the 1920s involved gas conservation measures and environmental issues. This section of the essay will focus on the similarities of the environmental effects that occurred in the earlier period of natural gas development and the recent era of exploitation of the Marcellus Shale.

Air Pollution

As previously discussed, natural gas development in Pittsburgh was a major factor in reducing smoke and improving air quality during the 1880s and into the 1890s. Its increasing unavailability, however, and the return to coal by many users, especially industrial users, restored the smoke burden. In Pennsylvania today, many environmentalists view the substitution of natural gas for coal, especially by coal-burning utilities, as a major step toward cleaner air and reduced health costs from coal consumption. The major emissions concern involving natural gas today, however, relates to leakage of methane—a potent greenhouse gas—from well sites, pipelines, and other gas appliances.⁴⁷ Past concern over emissions related primarily to the fact that, as the 1927 *Natural Gas Handbook* noted, “gas leaking into the atmosphere means a continual loss in money,” although gas explosions and fires were also an issue.⁴⁸ A description of an 1883 Butler County well, for instance, observed that the “flame of this natural torch is about 40 feet long and fifteen feet wide, and keeps at these dimensions night and day with striking regularity.”⁴⁹ Regular leakage from site operations occurred because of excessive blowing of water from wells, lowering of rock pressure from rapid production, and the flaring of gas to secure oil from a well. According to one expert writing in 1919, this latter factor was “the principal cause of the depletion of many gas fields, and is responsible for a greater volume of gas waste than probably all other causes put together.”⁵⁰ In addition to the waste from wells, considerable leakage occurred along pipelines. The Bureau of Mines conducted numerous studies of pipeline leakage; summaries of their findings can be found in their reports in natural gas publications.⁵¹

Leakage had also proven to be a serious problem in natural gas fields located near or in residential areas. From 1919 to 1921, a natural gas boom occurred in what was known as the McKeesport Gas Field, drawing

⁴⁷ A recent National Academy of Sciences report concludes that in Pennsylvania 4 to 7 percent of anthropogenic methane emissions come from orphan wells. Mary Kang et al., “Direct Measurements of Methane Emissions from Abandoned Oil and Gas Wells in Pennsylvania,” *Proceedings of the National Academy of Sciences* 111 (2014): 18173–77.

⁴⁸ John C. Diehl, *Natural Gas Handbook* (Erie, PA, 1927), 330.

⁴⁹ Pearse and Platt, *Report on the Use of Natural Gas*, 183–84.

⁵⁰ Wyer also noted that the amount of natural gas wasted from the state’s over sixteen thousand oil wells was an amount “equivalent to about one-third of all the natural gas used for domestic consumption in the United States.” Wyer, *Natural Gas*, 53–54.

⁵¹ See section on “Leakage,” in Diehl, *Natural Gas Handbook*, 330–41.

from the Speechley Sandstone at a depth of about three thousand feet. Supposedly over a thousand wells were drilled, often on small residential lots. Wildly exaggerated predictions had been made about the extent of the field, but, as state geologists predicted, production rapidly declined. Many well bores that were never properly plugged were covered over by structures or filled by landowners. Some surface methane leakage occurred in the 1930s, but the most serious problems occurred after World War II as a result of scavengers removing many well casings during the war to sell as scrap metal. Methane, according to a 2007 National Energy Technology Laboratory study, leaked into buildings from “abandoned and improperly plugged wellbores, creating air pollution and explosion hazards.”⁵²

Wells were especially dangerous in coal mining areas because methane could leak into mines and cause explosions. In 1913 the Bureau of Mines held a conference in Pittsburgh to discuss this issue. The report of the conference warned that leakage from abandoned gas wells had caused many coal mine explosions and suggested a number of regulations in regard to well drilling, abandonment, and plugging to reduce the risk. It also concluded that “it would be useless to enact laws without a special officer to carry them into effect” and recommended that states create well inspection departments. Surveyors who drew surface maps for coal companies were careful to indicate the presence of gas and oil wells on them.⁵³

Landscape Effects

The extensive drilling that took place in western Pennsylvania damaged and fragmented the landscape through deforestation and the construction of well pads, roads, pipelines, surface reservoirs, and other structures.

⁵² National Energy Technology Laboratory, “Methane Emissions Project Borough of Versailles, Pennsylvania, Executive Summary” (report, Pittsburgh, Oct. 31, 2007), 1–2. The McKeesport boom actually covered a much larger area than Versailles but methane leakage appears to have been not as problematic in other locations because wells were more distant from each other. For the state geologist’s perspective on the boom see George H. Ashley, *The McKeesport Gas Pool* (Harrisburg, 1920).

⁵³ George S. Rice et al., *Oil and Gas Wells through Workable Coal Beds: Papers and Discussions* (Washington, DC, 1913). The Consol Energy Collection at the University of Pittsburgh Archives Center contains many maps drawn by surveyors of surface conditions, including gas and oil wells above coal mines. In 2013 the Bureau of Oil and Gas Planning and Program Management of the Pennsylvania Department of Environmental Protection began using such maps to locate historic oil and gas well locations. See Pennsylvania Department of Environmental Protection, Office of Oil and Gas Management, *Historic Oil and Gas Well Locations from Bureau of Oil and Gas Planning and Program Management PADEP—WPA Mines, K Sheet, H Sheet* ([Harrisburg], 2013), http://www.pasda.psu.edu/uci/MetadataDisplay.aspx?entry=PASDA&file=PADEP_HistoricOilGasWells.xml&dataset=1137.

Between 1880 and 1920, the number of productive wells rose rapidly, reaching almost fifteen thousand in 1917. The total number drilled was higher, because some wells were nonproducing.

The extent of these landscape disturbances in the past was not recorded, but recent US Geological Survey (USGS) studies have devised a set of landscape metrics using geographic information systems (GIS) and other instruments to estimate the effects of today's drilling for both conventional and nonconventional natural gas wells. In Allegheny County between 2004 and 2010, conventional (non-Marcellus) wells took up 0.4 hectares per site, and the disturbed hectares were 0.7 per site. Further, each well was associated with 0.3 kilometers of road. In Washington County, which is also in western Pennsylvania and was an early producer, conventional wells took up 0.8 hectares, disturbed 2.0 hectares, and were associated with 0.3 kilometers of road.

These metrics can be used to provide an order of magnitude estimate of the effects of past drilling. Existing records note that over seventeen thousand wells were drilled in western Pennsylvania over the period from about 1878 to 1920. If the values in the recent USGS study for landscape disturbance for Allegheny County are extrapolated to the region for the earlier period, seventeen thousand acres were used for drilling, thirty thousand acres were disturbed, and 3,100 miles of road were constructed. If the values for Washington County are extrapolated to the region for the earlier period, thirty-four thousand acres were used for drilling and eighty-five thousand acres were disturbed. Even these numbers may be conservative. By 1917 gas companies controlled 2.5 million acres in Pennsylvania through lease and outright ownership, and their impact may have extended well beyond the acres suggested by modern studies.

Surface and Water Well Pollution

The reports of the Department of Health (DOH) and of the Sanitary Water Board note various complaints about gas and oil pollution of water supplies from drilling site runoff. In 1906, for instance, the Clarion Water Company in Clarion County complained that the development of natural gas and oil wells in the watershed had polluted the sources of water from which they supplied the town and asked for permission to extend their water-gathering area to a clean source. The DOH investigated, finding the company's supplies indeed to be polluted and "prejudicial to the public health." The department reported that the "waste material produced in the

operation of drilling the wells, in shooting them, and in cleaning them out, is deposited on the surface of the ground round about and eventually gets into the main stream of the water supply.” The DOH ordered the water company to either filter the water or find a new source. It also ordered the company not to allow any gas or oil drilling on its lands and to regularly inspect the wells in the vicinity of the borough in order to prevent salt water from the wells from contaminating water supplies.⁵⁴

In addition to ruling on the statutes relating to natural gas and oil, the courts considered nuisance cases generated by gas and oil pollution of private drinking water wells. In an 1890 case, the state supreme court affirmed damages against a natural gas company for permitting salt water to contaminate a private drinking water well because of inadequate casing, noting that “when the salt water is allowed to mingle with the fresh, it will spoil the whole neighborhood.”⁵⁵ The gas companies appear to have settled other pollution cases of private wells out of court. The Pew Papers at the Hagley Museum and Library, for instance, contain several letters to Joseph N. Pew, president of People’s Natural Gas Company, from attorneys representing clients complaining of injuries to their water supplies and livestock from gas well and pipeline leaks. These complaints appear to have been settled.⁵⁶ People’s Natural Gas Company was aware that problems ensuing from poor casing could cause water pollution. It required that contractors ensure that casing be inspected and that if water was found “the well . . . be thoroughly drained and sand pumped until all drillings and sediments are removed.”⁵⁷ It is unknown, however, if other gas companies—especially smaller and fly-by-night drillers—followed the regulations.

Many wells that were drilled came in dry, were quickly exhausted, or were flooded by water within a short time. Gas experts and engineers were aware that unless wells were plugged, they could become conduits for brine and water that would overwhelm neighboring wells and pollute

⁵⁴ See, *Second Annual Report of the Commissioner of Health of the Commonwealth of Pennsylvania* (Harrisburg, 1908), 486–88 (Google Books, accessed Nov. 10, 2011, <http://books.google.com/books/about/Report.html?id=0xdNAAAAMAAJ>).

⁵⁵ *Nannie R. Collins v. Chartiers Valley Gas Co.*, 139 Pa. 111 (1890–91).

⁵⁶ J. M. T. Carpenter to J. N. Pew, Nov. 17, 1892; E. T. Bouser to People’s Natural Gas Company, July 19, 1900; E. Robbins to People’s Natural Gas Company, Nov. 22, 1894; and Moorhead and Head to People’s Natural Gas Company, May 19, 1899, J. Howard Pew Papers, Hagley Museum and Library, Wilmington, DE. The Pew Papers also contain a “Proposal and Specifications for Drilling Wells,” dated July 22, 1901.

⁵⁷ People’s Natural Gas Company, “Proposal and Specifications for Drilling Wells,” July 22, 1901, Pew Papers.

nearby surface waters and groundwater.⁵⁸ The 1885 Natural Gas Act had a requirement that wells be plugged after the gas was exhausted, but it appears to have been poorly enforced. In 1891, the state legislature again passed an act requiring the plugging of wells that were abandoned or not operating. The requirement had an environmental focus; plugging was required “in such manner as to prevent water from any such well injuring or polluting any spring, water well or stream” used for domestic, steam making, or manufacturing purposes. Violation of the act was made a misdemeanor.⁵⁹ A 1921 law provided more specific information about the manner in which wells were to be plugged and existing wells protected from water entering the gas strata from new well drilling, but plugging methodology remained relatively ineffective until after 1940 or so.⁶⁰

Conclusions

This article has focused on the evolution of the Pittsburgh region’s first natural gas boom and its environmental effects. As noted earlier, similar policy and environmental issues have arisen during the current Marcellus Shale natural gas boom. These include predictions concerning longevity of supply, policy initiatives to accommodate a new energy source, reductions in demand for coal with resulting unemployment, and regulatory clashes between state and local authority. In regard to environmental effects, issues relating to air quality and methane leakage, ground and surface water pollution, and landscape alterations have been present in both periods of natural gas development.

From the ongoing public and legislative discussions today regarding the Marcellus Shale boom, its effects, and the proper means of regulating

⁵⁸ For a discussion of groundwater pollution from early oil and gas wells see, Damian M. Zampogna et al., “Historic Oil and Gas Development, Mineral Extraction, and Contemporaneous Water Quality Data in Northeastern Pennsylvania,” *Oil-Industry History* 14 (2013): 33–42.

⁵⁹ Act to Prevent the Pollution of Springs, Water Wells and Streams by Water Escaping from Abandoned Oil Wells and Gas Wells, 1891 Pa. Laws 122.

⁶⁰ See, Act for Plugging Oil Wells, 1878 Pa. Laws 57; Act for Plugging Abandoned Oil Wells, 1881 Pa. Laws 110; Act for Oil Pipeline Regulation, 1883 Pa. Laws 61; Act for the Incorporation and Regulation of Natural Gas Companies, 1885 Pa. Laws 29; Act to Protect Oil, Gas and Water Wells, 1885 Pa. Laws 145; Act on the Right of Companies to Eminent Domain, 1887 Pa. Laws 310; Act to Prevent the Pollution of Springs, Water Wells and Streams, 1891 Pa. Laws 122; and Act to Regulate the Drilling, Operating, and Abandoning of Oil and Gas Wells, 1921 Pa. Laws 912. S. Taku Ide et al., “CO₂ Leakage through Existing Wells: Current Technology and Regulations” (paper presented at the Eighth International Conference on Greenhouse Gas Control Technologies, Trondheim, Norway, June 2006), available at http://sequestration.mit.edu/pdf/GHGT8_Ide.pdf. See, also, Blakely M. Murphy, ed., *Conservation of Oil & Gas: A Legal History, 1948* (Chicago, 1949), 429–35, for a discussion of numerous attempts to enact legislation regarding the conservation of natural gas in Pennsylvania.

them, it is clear that little attention has been paid to policy or environmental lessons that could be learned from the historical record regarding natural gas. Exploration of this history could help provide policy makers, regulators, and the public with perspectives on potential problem areas and help Pennsylvania avoid another legacy of environmental damage from energy development.

Appendix

Fig. 1A: The Number of Wells Drilled and the Number of Productive Wells in the State. The number of productive wells rose rapidly, reaching almost fifteen thousand in 1917. Roughly 20 to 25 percent were dry or otherwise unproductive. Source: *Mineral Resources of the United States*.

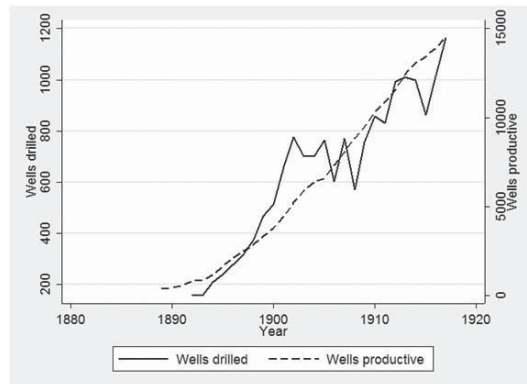


Fig. 2A: Domestic and Industrial Natural Gas Customers, 1890–1917. Source: *Mineral Resources of the United States*.

