

Coal, Smoke, and History

It will be a task for the future social historian to explain why the English of our time were content to live in dirty and gloomy air.
—*John W. Graham, 1907*¹

To millions of our town-dwellers smoke is just what comes out of the chimney, as coal is just what goes on the fire. The idea that smoke is a “problem,” something to be prevented, simply does not exist.
—*Arnold Marsh, 1947*²

Around the world, a growing number of people are asking questions about how technology is affecting the natural world, human health, and society. Fierce debates rage over whether current levels of consumption and pollution are sustainable, and whether it is possible to both protect the environment and create material prosperity. These vital questions, which will become even more pressing in the decades ahead, have a forgotten history. Of all the challenges that confront the world today, few threaten as many people as the pollution that results from burning fossil fuels. Three billion people—half of the world’s population—now live in cities, many of which contain air that is unfit to breathe. Two hundred years ago, however, only one city on the planet used significant quantities of fossil fuels and experienced the pollution that such consumption entails. In 1800 Londoners burned one million tons of coal—an amount that was equivalent to a ton for every resident. From that year forward, fossil fuel consumption skyrocketed throughout the country, literally fueling Britain’s rise as the most powerful manufacturing, trading, and imperial power that the world had ever seen.

Many substances that are now viewed as serious pollutants, including asbestos, lead, and CFCs (chlorofluorocarbons), were once considered innocuous. The same was long true of the products of coal combustion. By the middle of the nineteenth century coal smoke filled many British cities, yet few people saw it as detrimental to either human health or to the wider environment. In their view, pollution came not from energy use or industry, but from natural biological processes. They blamed disease on miasma, an invisible gas thought to be given off by decaying plant and animal matter. Thus, the most polluted environments were those in which the greatest quantities of decomposing biomass were found: marshes, jungles, graveyards, cesspools, and sewers. Many people not only considered coal smoke to be harmless, but actually thought of it as an antidote to pollution. According to miasma theory, the acids and carbon in smoke were powerful disinfectants.

The notion that coal smoke was beneficial to health began to change during the late nineteenth century. As the air of British cities and towns filled with ever-denser smoke, scientists coined new terms such as acid rain and smog, and physicians blamed smoke for a range of health impairments, including respiratory diseases, rickets, decreased stamina, and even “racial degeneration.” At the same time that these changes were occurring, the new science of bacteriology was leading many to abandon the belief that disease came from miasma. The conceptual disappearance of miasma not only changed attitudes and policies toward public health; it also removed a major justification for coal smoke.

Britain, the “first industrial nation”³ and the first to become predominantly urban, was also the place in which the modern idea of pollution was invented. During the nineteenth and first half of the twentieth centuries, people in Britain came to understand coal smoke as pollution and came to understand pollution as an entity that should be regulated by the state, a state that would eventually—through the Clean Air Act of 1956—reach into people’s homes and extinguish the coal fires that had warmed their hearths for generations. This book tells that story.



People in Britain began using coal well before the industrial revolution. In contrast to the situation in many other parts of the world, where coal can be found only deep underground, in Britain substantial quantities of coal lay near the surface. Nearly two thousand years ago, during the Roman occupation of Britain, people dug shallow pits to remove the min-

eral from the ground, but the rudimentary nature of early mining techniques long restricted the amount that could be extracted. Another limiting factor was transportation. In an age before canals and railroads, the difficulty and cost of transporting coal over land was enormous. Starting in the thirteenth century, however, coal began to be mined near the port city of Newcastle-upon-Tyne in northeastern England. From there it could be transported via ship to other coastal cities. By far the largest market, for coal and all other commodities in Britain, was London. Because of how coal from Newcastle reached them, Londoners long referred to it as sea-coal.

Initially, much of the coal burned in London was used to heat kilns that converted limestone into lime, an essential ingredient in mortar. Over time, other industrial activities, such as metal smithing, also began to use coal. Wood continued to dominate the market for household fuel, not only because the smoke it produced was considered more pleasant than that from coal, but also because wood could be brought indoors without scattering dust and grime. Between 1540 and 1640, the price of firewood in London nearly tripled relative to the cost of other goods, while the price of coal rose no faster than the overall rate of inflation. By the middle of the seventeenth century, coal was the dominant fuel in London for domestic as well as industrial uses.⁴

The English inventor Thomas Newcomen (1663–1729) produced a working steam engine at the beginning of the eighteenth century. Although it was incredibly inefficient and produced little power, the Newcomen engine revolutionized coal mining by making deep mines possible. For in addition to providing mechanical power to hoist heavy loads of coal to the surface, steam engines drove pumps that prevented mines from becoming flooded with seeping groundwater. The chemical energy stored in coal, when transformed into heat and mechanical energy by the steam engine, made it possible for miners in Britain to reach and extract a seemingly endless supply of coal from the earth.

During the last quarter of the eighteenth century the Scottish inventor James Watt (1736–1819) greatly improved the efficiency and power of the steam engine.⁵ Watt's innovations, and those of other engineers who made further improvements, made steam power an attractive source of power in industry and thus boosted demand for coal. By the early nineteenth century steam engines were sufficiently compact and powerful to become mobile; the steamships and railroad locomotives that followed not only consumed enormous quantities of coal, but also allowed coal to

be transported to places that previously had been forced to rely on renewable sources of energy.

Neither the presence of coal nor the existence of steam engines was alone sufficient to make Britain the wealthiest and most polluted country in the world during the nineteenth century; together, they changed everything. As mill owners adopted steam in place of animal and water power, demand for coal rose sharply. In 1800 approximately 15 million tons of coal were burned in Britain. Coal use increased dramatically during the nineteenth century and continued rising until the eve of the First World War, when Britain's coal consumption reached an all-time high of 183 million tons.⁶

At the beginning of the twentieth century Britain remained the largest producer of coal in Europe, with an annual output of 229 million tons. As its neighbors industrialized, their coal production rose rapidly. The German lands, which had extracted just 6 million tons of coal in 1850, produced 43 million tons in 1871, the year of German unification. In 1900 Germany produced 150 million tons, followed by France (33 million tons) and Belgium (24 million tons). Although British fears of industrial decline—or at least loss of predominance in coal—focused on Germany, the greatest challenge came from across the Atlantic. The United States, which had mined just 8 million tons of coal in 1850, produced 245 million tons in 1900, making it the world's leading coal country.⁷

The adoption of coal-burning steam engines not only made it possible for factories to increase production; it also freed them from the geographical and seasonal constraints inherent in the use of water power. Instead of remaining dispersed across the countryside, factories became concentrated near coal mines and coal transportation routes, creating urban centers where workers and consumers lived. At the start of the First World War over one million people worked in coal mines in Britain, and the work of transporting, distributing, and loading it into boilers, furnaces, fireplaces, and kitchen ranges involved millions more.⁸ People relied on coal to fuel industry, to power railroads and ships, to keep warm, and to cook. Coal was also used to make gas, which was the primary source of indoor and street lighting in the nineteenth century. Some, including the English economist and logician William Stanley Jevons (1835–82)—famous for his 1865 prediction that Britain would run out of coal within decades—claimed that the nation's industrial and imperial ascendancy came not so much from hard work and sound government as from its coal.⁹

The burning of coal released not only energy, but also large quantities of smoke, soot, and acidic vapors. Bituminous coal, the most prevalent form of coal found in Britain, contains a large proportion of impurities. On average, 20 percent of its weight consists of sulphur, volatile hydrocarbons, and other chemicals. Even under ideal conditions the burning of bituminous coal produces toxic ash, sulphur dioxide (a key ingredient in acid rain), and the greenhouse gas carbon dioxide. Optimal combustion requires a high temperature and a precise ratio of oxygen to fuel. These conditions rarely existed in practice.¹⁰

Much of Britain's coal consumption, and the smoke that accompanied it, was concentrated in urban areas. Industrialization caused the air of large towns and cities—already heavily polluted by household coal use—to deteriorate much further. By 1851 more people in Britain lived in towns and cities than in the countryside—something unprecedented in world history. As a result of this urbanization, many cities experienced population growth that was substantially higher than the national average. Glasgow, Leeds, and Sheffield, for example, each grew nearly tenfold during the nineteenth century.¹¹ The growth of London was proportionately smaller, but in numerical terms its expansion vastly exceeded that of all other cities in Britain, increasing from approximately one million inhabitants in 1800 to over six million a century later.¹² Describing London in the 1830s, one writer was struck by the “dense canopy of smoke that spread itself over her countless streets and squares, enveloping a million and a half human beings in murky vapour.”¹³ In 1913 Londoners burned over 15 million tons of coal—an average of two tons for every man, woman, and child. Other cities also burned mountains of coal. Manchester, with less than a tenth of the population of London at the start of the twentieth century, used nearly half as much coal per year.¹⁴

Sporadic complaints about coal smoke began soon after coal first arrived in London; in the 1280s two royal commissions were appointed to investigate the matter. As a result of cheaper firewood becoming available—and people becoming accustomed to coal smoke—complaints about smoke soon subsided and remained at a low level until the upsurge in coal use that occurred in the late sixteenth and early seventeenth centuries.¹⁵ In 1661 the diarist John Evelyn (1620–1706) published *Fumifugium, or the Inconvenience of the Aer and Smoake of London Dissipated*, a strongly worded tract that remains one of the most famous denunciations of air pollution ever written.¹⁶ Despite Evelyn's forceful attack on coal smoke, his position remained an isolated one for the following two hundred years.

Although numerous cities in Britain were extremely smoky by 1800, few people at that time viewed coal smoke as a problem, and no one used the word pollution to describe it.¹⁷

During the second half of the nineteenth century, however, public health experts, urban reformers, and journalists redefined coal smoke, transforming it from an accepted part of the urban environment into a problem. The redefinition of smoke as pollution was both a scientific and a social process. At the same time that researchers were analyzing the particles and vapors that issued from smokestacks and chimneys, others were talking about the subject in meeting rooms, newspapers, and magazines. What caused this transformation? According to some, the amount of smoke in the air had simply reached an intolerable level. This claim served an important rhetorical purpose for smoke abatement activists who sought to place it at the center of problems that ought to be corrected, but it fails to explain why smoke was considered undesirable. The reimagining of pollution reflected changes not only in the natural environment, but also in scientific understanding, political ideology, and popular culture.

Many people in Britain believed that industrialization and urbanization were causing serious social, health, environmental, economic, and strategic problems. Technology had re-created the world through developments such as railroads, massive bridges, and transoceanic telegraph cables, but it also provoked great anxiety. A contradiction seemed to exist between the capacity of humanity to transcend formerly insurmountable environmental limitations and people's inability to anticipate or control the consequences of their new technologies. By 1900 many viewed coal smoke as the embodiment of these concerns. Britain was increasingly unable to grow enough food to feed its people, remote rural places were becoming coated with urban grime, the amount of sunlight was declining, particular varieties of animal life were disappearing, and trees were becoming stunted by a nightmarish new substance: acid rain.¹⁸ The latter was discovered in the 1850s by the chemist Robert Angus Smith (1817–84), who spent the final twenty years of his life as the director of the Alkali Inspectorate, the world's first national pollution control agency. Although this agency initially had responsibility for only a single industry (and a single chemical), its purview eventually expanded to cover many other trades and substances. For roughly a century, the Alkali Inspectorate functioned as Britain's primary environmental regulatory agency.¹⁹

Concerns about environmental degradation were also connected to anxieties about cultural decline.²⁰ Idealizing Britain's medieval past, some

urged a return to a simpler form of society, closer to nature and free from smoke. Inverting the notion that urbanization and industrial development were proof of progress, radical artists and writers such as John Ruskin and William Morris asserted that England was sacrificing its connections to nature and the past in a misguided quest for material gain.²¹ They maintained that the whole country was becoming subordinated to the demands of cities and industry, and that rural areas were losing their “natural” character. Others argued that environmental degradation was causing the people of Britain—particularly the urban poor—to degenerate both physically and morally. According to the proponents of this view, inadequate sunlight and fresh air would lead not only to individual degeneration, but also to national decline. Strong, healthy, and hardworking citizens, they argued, were essential to Britain’s industrial and imperial power.²² Another group maintained that coal smoke was a dangerous contributor to social and political unrest. Air thick with smoke seemed to provide an ideal cloak for crime, immorality, and mob activity. And because prevailing winds concentrated smoke in particular districts, smoke accentuated the residential segregation of different classes. In addition to making it difficult for members of the middle and upper classes to monitor what the “masses” were up to, it also created resentment among poor people who lived in polluted areas that they could not afford to leave.²³

Smoke provided reformers who had divergent goals with a unifying symbol of the need for change. These concerns led to vocal antismoke activism in many British cities, most prominently by the Coal Smoke Abatement Society, which focused on London, and by the Smoke Abatement League of Great Britain, which sought to clear the air in industrial districts. During the late nineteenth century many of these reformers concluded that something more than education and gentle persuasion was needed to rid the air of smoke. Shaped in part by the ideology of the “new liberalism,” which envisioned a much more active role of the state in economic matters, a growing number of reformers advocated the passage of comprehensive national legislation on smoke, coupled with vigorous (and perhaps national) enforcement. Some went so far as to call for restrictions on smoke from private houses, which had always been exempted from regulation. Despite the efforts of some in Parliament, the majority of MPs long resisted these arguments.

Reformers achieved greater success, however, in getting the national government to recognize air pollution as an important subject of research. During the First World War the Meteorological Office began funding the

Committee for the Investigation of Atmospheric Pollution, an independent group established in 1912 to coordinate the measurement of soot deposits in many of the smokiest cities in Britain. In 1927 the committee was absorbed by the Department of Scientific and Industrial Research and renamed the Atmospheric Pollution Research Committee. Although soot deposits provided only a rough approximation of air quality, they made it possible to compare different places and to track changes over time.²⁴

The solutions that smoke abatement activists proposed depended on the ways in which they conceived of pollution. Those who disliked coal smoke because of an antipathy to modernity or industrialism were apt to focus their attention on smoke that came from factory smokestacks rather than household chimneys. Despite the prominence of industrial smoke, however, a large proportion of the smoke that filled the air of Victorian Britain came from the familiar domestic fireplace. As a result of their ideological predisposition against industry, many activists failed to recognize that smoke would not be banished by either rejecting or reforming the industrial system, but would require people like themselves to modify the ways that they used coal. Industrialists and their supporters, on the other hand, often agreed that smoke was a problem but denied causing it. They pointed out that factories, in contrast to private houses, already faced legal restrictions on smoke emissions, and they argued that further mandatory reductions in industrial smoke were unfair and impossible to achieve. When confronted about the smoke that their factories produced, owners often shifted the blame to their employees.

Many historians have written about the ways in which industrialization and urbanization transformed the economic and social life of Britain, but far fewer have examined how they affected the environment, reshaped ideas about nature, or stimulated the rise of environmental activism.²⁵ Yet the histories of country and city, of natural and built environments, are in fact deeply interwoven. Cities are concentrations not only of people and production, but also of consumption. Without outside supplies of air, water, food, and energy, urban life would be unsustainable.²⁶

In contrast to the large and impressive body of scholarship on the history of air pollution in the United States by Joel A. Tarr, Martin V. Melosi, and numerous others, relatively few books have been published about Britain's experience with air pollution.²⁷ Eric Ashby and Mary Anderson's *The Politics of Clean Air* (1981) focuses on Parliament and has relatively little to say about either cultural attitudes or municipal enforcement of the

law. Peter Brimblecombe's *The Big Smoke: A History of Air Pollution in London since Medieval Times* (1987) provides an important analysis of changes in the quantity and concentration of coal smoke over time, but it does not examine how the meaning of smoke changed over time. Stephen Mosley's *The Chimney of the World: A History of Smoke Pollution in Victorian and Edwardian Manchester* (2001), although an excellent study of both popular and elite understandings of coal smoke in that city, does not address what happened in London or the rest of Britain, and it ends in the early twentieth century.²⁸

In his classic essay, "Ideas of Nature," Raymond Williams observed that the ways in which people think about the environment reveal a great deal about how they interact with each other and with the natural world.²⁹ This book examines not only the tangible reality of pollution, but also its place in people's minds. In attempting to understand the history of air pollution, it is not enough to know what substances, in what quantities, entered the environment in the past. Equally important are the attitudes, ideologies, and perceptions that led to the creation of these pollutants and that structured people's understanding of their effects.