

LESLIE TOMORY, *Progressive Enlightenment: The Origins of the Gaslight Industry, 1780–1820*. Cambridge, MA and London: MIT Press, 2012. Pp. xii+348. ISBN 978-0-262-01675-9. £19.95 (hardback).

doi:10.1017/S0007087412000891

'Gas' as fuel these days conjures images of controversial 'fracking' procedures for extracting gas from coal seams, or of large 'natural' gasfields. The gas industry with which Leslie Tomory is concerned in *Progressive Enlightenment* is easily forgotten. That industry was built upon the production of gas by the distillation of coal, initially for lighting purposes, although its use in cooking and heating subsequently became important. It produced the conspicuous gasometers that still loiter as living industrial archaeology on the outskirts of many towns and suburbs in Britain.

Tomory traces the industry's origins to the science and instrumentation of pneumatic chemistry, to the technological activities of the Birmingham firm Boulton & Watt and a number of European pioneers, and to the entrepreneurial enterprise that produced the London-based Gas Light and Coke Company (GLCC). Thanks to wide-ranging scholarship, Tomory's account addresses a number of larger thematic issues in the history of science and technology: the science–technology relationship; the history of networked, or infrastructure, technologies; and the importance of users as agents of technological change.

The investigation of flammable and other airs by late eighteenth-century pneumatic chemists, which was so central to Lavoisier's new chemistry, involved important technological innovations in the instruments of inquiry. In particular, 'gasometers' were developed to collect, measure and control delivery of gases for experimental or other purposes. Tomory expertly traces the origins of the large-scale gasometers of the early gaslighting industry back to these instruments of Enlightenment.

The production, storage and delivery of gases for practical purposes was pioneered by the firm of Boulton & Watt, much of the scaled-up technology being a further development of the apparatus designed by James Watt for his venture into pneumatic medicine with Thomas Beddoes in the 1790s. But within that firm, the name usually associated with the invention of gaslighting is that of William Murdoch. Tomory acknowledges Murdoch's undoubtedly important work but also reveals how Boulton & Watt constructed Murdoch as a heroic individual inventor of gaslighting out of a more complex situation of collective invention. Watt Jr wrote a paper on gas lighting under Murdoch's name that was published in the *Philosophical Transactions*, and he arranged for Murdoch to be awarded the Rumford Medal of the Royal Society, all in order to put the authority of science behind the firm's early ventures in the gaslighting of industrial enterprises. This was part of promoting the technology and also of dealing with emergent competition. But science was more than a symbol here. Tomory finds in the development of gaslighting ample evidence for Joel Mokyr's thesis concerning the importance of an industrial enlightenment to industrial revolution. Both the invention of gaslighting and the many collateral inventions and innovations attendant on its use drew upon the science of the time and upon systematic scientific inquiry.

Thus one of the reasons why Britain pioneered in gaslighting, as in steam technology, was because of the size and effectiveness of its scientific and industrial networks of communication. But also important was its increasingly coal-based economy. Continental gaslighting investigations relied much more on the distillation of wood rather than of coal, and Tomory makes a convincing case that this had much to do with the relative lack of success of gaslighting in Europe.

In the event, Boulton & Watt's large-scale, but stand-alone, industrial applications of gaslighting were overtaken by a grander scheme for the central generation and networked distribution of gas, to which the second half of the book is devoted. Frederick Winsor, an entrepreneur and showman with visionary flair and an uncanny ability to recruit investors, promoted that scheme. The resulting GLCC, established by Act of Parliament in 1812, was a

limited-liability joint-stock company of the sort previously used in canal development and to become crucial in the establishment of the railways. Tomory recounts the halting development of the GLCC. Winsor's grand scheming, which often promised more than could be delivered both to customers and to investors, became a liability, and more sober heads, but above all a structure of corporate management, took over the difficult job of implementing the technology on a large and expanding scale.

Considering the role of users as agents of change places gaslighting in the larger framework of earlier lighting regimes. Tomory shows how users' habits in the use of candles and oil lamps, when transferred to the use of gas lamps, continually frustrated the company's attempts to restrict the timing and extent of gas usage (a move necessary in order to keep demand within deliverable limits). This is a nice example of the networked and tightly coupled character of the technological system. It shows how events in one aspect, in this case users' habitual lighting practices, had ramifications throughout, and through adaptation shaped the eventual nature of, the technological system.

Additional complexity derived from the founding legislation, under which the GLCC could not itself supply gaslighting equipment to the final user. Independent gas fitters, who sought to maximize their own advantage, often at the expense of the quality and efficiency of the lamps supplied, had to be engaged by the company. The GLCC eventually disciplined this recalcitrant component of the system by ensuring the supply of standardized equipment and by instituting workable regimes of inspection and control over the fitters.

Overall, Tomory's excellent book enables historians to see behind the misleading accounts of heroic inventors of gaslighting to a technology with roots in pneumatic chemistry and in the prior traditions of wood and coal distillation. Tomory brings to life the complexities of designing and implementing the initial stages of one of the pioneering networked technologies of the modern era, one that in many ways anticipated important features of the later nineteenth-century 'glamour' technologies of rail, electrification and telephony.

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KARIN REICH and ELENA ROUSSANOVA (eds.), *Carl Friedrich Gauss und Russland: Sein Briefwechsel mit in Russland wirkenden Wissenschaftlern*. Berlin and Boston: De Gruyter, 2012. Pp. xxiii + 905. ISBN 978-3-11-025306-1. €149.95 (hardback). doi:10.1017/S0007087412000908

Carl Friedrich Gauss (1777–1855) was famous in his lifetime as a great mathematician and scientist at the University of Göttingen who hardly ever travelled anywhere but maintained a massive (inter)national scientific correspondence. There are over a dozen volumes of the exchanges with his principal correspondents; this one extends the range somewhat in reproducing his letters with scientists who spent at least part of their careers in a university in Russia. About eighty letters were written by seventeen correspondents and around forty by him; they date right across his career.

Quite often the subject matter was mathematics, but two other topics were prominent. One was astronomy, for Gauss's post at the university was as director of the astronomical observatory, not as professor of mathematics. The other, from the 1830s onwards, was the project that he directed with the physicist Wilhelm Weber to produce a geomagnetic map of the Earth (for which Alexander von Humboldt was the initial inspiring figure). The letters themselves seem usually to be typical in content for their respective concerns; exceptional is the manner of their editing, in the second part of the book. Each correspondent has his own chapter, which starts with a likeness and a timeline, continues with career information and details of the contacts with Gauss, and ends with a transcription of the letter(s). One may feel at times a surfeit of information: for example, the