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Industrial Revolution truly revolutionary. His analysis also leads him to a corollary conclusion: "The mechanized textile industry was in its material and natural aspects not so much a pioneer of the industrial system as an outgrowth of the agrarian mode of production" (p. 134).

It is important to add that Sieferle is not engaging in an either/or line of argument. He recognizes that coal had been used by societies for many centuries without fueling an industrial revolution, and he recognizes that the social and cultural settings in eighteenth-century England were ripe for change. But he also asserts that, absent coal, the changes under way in England's textile industry could not have led to something so monumental as to be called revolutionary. Ideas like these make Sieferle's book an engaging source for anyone grappling with the history of the Industrial Revolution. This English edition features a new preface by Sieferle locating his work within the literature of environmental history.

FREDRIC L. QUIVIK

Dr. Quivik is a consulting historian of technology living in St. Paul, Minnesota.

Energy and the Rise and Fall of Political Economy.

By Bernard C. Beaudreau. Westport, Conn.: Greenwood Press, 1999. Pp. xiv+219. $65.

In this book, Bernard Beaudreau argues that energy was a primary driver of industrialization and contends that economists should incorporate energy as a separate variable in modeling production because much of the growth seen from beginning of the era of industrialization onward was due to energy rents. He also holds that incorporating energy into the standard production function would explain a significant portion of the "Solow residual" that is the estimate of technological change.

Beaudreau divides his book into five chapters. In the first he describes his analytical framework, which changes the inputs in standard economic production models to energy inputs instead of labor, capital, and technology. Chapter 2 focuses on steam power and discusses the works of classical political economists: "I maintain that Adam Smith's *An Inquiry into the Nature and Causes of the Wealth of Nations* was largely an attempt at identifying and analyzing the problems associated with moving to the higher growth path defined by fire power" (p. 59). Beaudreau is completely incorrect in this interpretation of Smith's work. Smith wrote the *Wealth of Nations* over several years before its publication in 1776, and by the time of his death in 1790 British industrialization was still isolated in a few locations. Beaudreau's inability to reconcile the timing of increased energy intensity and industrialization with Smith's working life makes this point unpersuasive.

Chapter 3 covers the development of electricity in the early twentieth century. Chapter 4 advances the chronology past the World War II era, with its increasingly intensive use of energy. This chapter is the best in the book, because Beaudreau focuses on estimating the role of increasing electrification and energy deepening in shaping U.S., German, and Japanese manufacturing and production processes.

Chapter 5 focuses on the post-energy-crisis period, which Beaudreau argues is characterized by "the continued widespread use of theoretically and empirically irrelevant models of production and exchange" (p. 157). He focuses on growth theory and makes some trenchant critiques of the assumptions underlying these models and their inability to explain long-run growth patterns. Beaudreau's analysis is premised on the distinction between energy and capital. Though true, this distinction is somewhat obvious. Capital changes over time, but those changes are a result of technological change. How can he separate energy from technological change and expect to have a sensible model? The two are so intimately intertwined that I am not surprised when Beaudreau claims that energy explains most of the Solow residual. These variables—labor, capital, technological change—are abstractions. Furthermore, they are abstractions that capture embodied time and energy.

Beaudreau's model is too beholden to Newtonian physics and his argumentation too divorced from abstraction to be persuasive. He also engages in poor economic history. The economically useful steam engine developed through an evolutionary process. Coal existed before the steam engine, but industrialization amounted to a gradual evolution of technologies that could harness the energy density and burn properties of coal for the purpose of production. A similar point holds for metallurgy, which also evolved symbiotically with coal—better metallurgy meant better blast furnaces that could better harness coal's heat, which produced better metal, and so on. Most importantly, steam engines and water power coexisted for almost sixty years, with the steam engine not becoming the dominant form of power until the 1840s. Early steam engines did not provide much improvement in efficiency over water power. Once Watt's patents expired and innovators could manufacture high-pressure engines, steam outpaced water power to become the dominant power source. Steam power did not actually burst onto the scene and create industrialization single-handedly in the eighteenth century.

Beaudreau asserts that we are no closer to understanding the wealth of nations than Smith was in 1776. Yet the wealth of nations is a moving target, and its causes change across time and place. He is correct in saying that mainstream economics marginalizes many alternate approaches. But it has also incorporated approaches that have contributed to the explanatory power of economic models. Recent work in transaction-cost economics

and new institutional economics illustrates this evolution. Such approaches are providing more persuasive models of economic growth than Beaudreau does here with his physics-based model.

LYNNE KIESLING

Dr. Kiesling is visiting associate professor in the Department of Economics at Northwestern University in Evanston, Illinois.

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Wealth, Waste, and Alienation: Growth and Decline in the Connellsville Coke Industry.

By Kenneth Warren. Pittsburgh: University of Pittsburgh Press, 2001. Pp. xix+297. $32.

Kenneth Warren has been remarkably productive in recent years. His oeuvre now includes a business biography of Henry Clay Frick (*Triumphant Capitalism*, 1996), a business history of the U.S. Steel Corporation (*Big Steel*, 2001), and this more modest but important study of the region that fed the fires of big steel and made Frick his fortune. *Wealth, Waste, and Alienation* is a well-crafted study of how an industry made a region and how capitalists wrested massive profits from land and workers.

This book makes a number of contributions to the history of technology, business and industrial history, and labor history. It is the first comprehensive, modern study of the U.S. coke industry and is likely to stand as definitive. Warren clearly explains how the physical qualities of coal and coke affected their suitability for particular smelting technologies and the significance of changes in coke-making technology. His consideration of how the technology of logistics was crucial to the coke industry finally explains why it took so long for the Connellsville region to develop, a question Peter Temin raised almost forty years ago. I was struck by the quality of Warren's writing about technologies that are deeply familiar to him after long years of research. I got bogged down in the more drawn-out discussions of management and labor relations, where Warren interrupts his own crisp language too often with lengthy quotations from business correspondence.

As a cautious historian, however, Warren relies upon the gradual heaping up of literary evidence to nail the characters of his key players. Henry Clay Frick, the industrial magnate chiefly responsible for the development of the Connellsville coke region, was not a nice man. His ability to remain calm and calculating when others panicked served him well in the 1870s and 1880s as he acquired one failing or marginal coke works after another. During the region's sometimes violent strikes, Frick did not flinch when company guards shot and killed workers; it was, he wrote, what troublemakers deserved.

Warren's most severe judgment of Frick and his fellow coke manufacturers comes in an exceptional chapter on the physical and social implica-