Energy: A Human History by Richard Rhodes

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ENERGY

The titans of power (The triumphs and tragedies in energy history)

Roger Fouquet weighs up Richard Rhodes's survey of the inventors who fuelled civilisation.

Richard Rhodes, renowned for his magisterial 1987 history *The Making of the Atomic Bomb*, has chosen an even broader landscape for his new book. *Energy* is a chronicle sweeping from the end of the sixteenth century to the pre-1970s oil shocks, charting the challenges of engineering power, light, warmth and low-polluting technologies. Focusing on the West's rise to energy supremacy through its mastery of technologies from steam to nuclear power, Rhodes explores the individual choices that led us to a present threatened by climate change.

Most of Rhodes's history centres on creative individuals, and less on the economics or broader social and cultural implications of their inventions. As he shows, most of these engineers were not hermit geniuses, but often collaborated with peers, benefited (in 'shoulders of giants' mode) from earlier inventions, and absorbed ideas from friends and relatives. Thus, in re-enacting the build-up to pivotal events in energy history, Rhodes brings us into the eureka moments behind them.

Rhodes is effective at capturing both the limitations of technologies and the improvements inventors offered. In the 1760s**,** for instance, master instrument-maker James Watt improved steam engines' efficiency by separating cylinder from condenser. Rhodes also deftly portrays on-going intellectual debates. We read, for instance, the correspondence of electrical experimentalists Luigi Galvani and Alessandro Volta in the late 1700s, which revolved around electrically shocking frogs' legs; and the battle of the alternating and direct currents in letters exchanged by Thomas Edison and George Westinghouse.

Rhodes portrays the innovators and entrepreneurs as obsessively dedicated to their endeavours, often at the expense of health and prosperity. For instance, engineer Richard Trevithick, inventor of the high-pressure steam engine, abandoned his family in 1816 for Peru when his machines were deployed there to dredge silver mines. He made and lost fortunes, and returned to see others (such as George and Robert Stephenson) develop the first steam railways, while he died a pauper. Society, Rhodes shows, rarely repaid the debt it owed to its technologists**.**

Political intrigue figures large in this story. Many inventors squabbled over patents, or lobbied government through intermediaries to introduce laws protecting their interests. Thomas Savery's experience is a fascinating example. The Enlightenment engineer's connections with The Royal Society enabled him to extend the patent on his early steam

pump an extra 21 years, through the introduction of the 1699 Fire Engine Act. As a result**,** in 1712, Thomas Newcomen — who had designed a more powerful engine using atmospheric pressure rather than high-pressure steam — was forced to go into partnership with Savery. The engines could raise water, a major problem with deep mines.

Rhodes also stresses the harm energy exploitation has triggered, such as the whaling industry's devastating toll on cetacean populations in pursuit of their oil, used for lighting. He highlights disasters from London's Great Smog of 1952, which killed thousands, to the ongoing threat of climate change.

Rhodes's discussions about environmental damage are welcome and his tour of bold innovators is well told. Regarding the latter, however, he fails to mention the women who helped to revolutionise the field — from nuclear-fission discoverer Liese Meitner to solar-power pioneer Maria Telkes**.** Nor does he devote much space to renewables. His history is uneven in other ways: the latter third of the book is a critique of the anti-nuclear lobby that in my view skews the overall message.

Rhodes believes that the protesters have effectively stymied our transition to nuclear power, as has the general adoption of a "linear no-threshold" model of radioactivity effects on populations, which proposes that even low levels of radiation are potentially harmful. There is evidence to question this model; but it is interesting how, through much of the book, Rhodes reminds us that the energy industry has a history of denying damage it wreaks in the interest of profit. At the same time, he appears to believe that the nuclear industry is immune to this practice.

Rhodes argues for the commercial viability of the technology. He calls a project to build an early pressurized-water reactor in the 1950s "a godsend"; (p.287) and by 1954, he claims, "it was already competitive with non-nuclear power in Western Europe and Japan". (p.285).In my opinion, this ignores the full costs. No nuclear power station in the 70-year history of the technology has won a competitive tender anywhere. Despite huge subsidies over decades, private companies still refuse to invest in the technology without massive government support. With a lack of significant investment in Europe and the United States, today's nuclear power industry is focused in China, where subsidy is a given and cost issues are less key. I feel that instead of blaming protesters, Rhodes should acknowledge that the failure of nuclear power is down to the fact that the economics haven't worked.

From this perspective, the prime conclusion of the book is highly optimistic. Rhodes asserts that humanity will be able to continue to produce power on demand for hundreds of years into the future. Despite his concern about climate change, Rhodes points to his panoply of innovators and entrepreneurs and believes low-carbon energy sources (including renewables and nuclear power) will solve the problem. This may well be true – perhaps even ITER and its successors will finally manage to provide cost-effective nuclear fusion. But

these future innovators will need to create not just new kit, but spur the need for new policy levers and patterns of behaviour — and even new social and political systems.

Energy is packed with good stories, but ultimately, I see it as like a Thomas Savery engine: it generates a lot of heat, but loses steam. A scholar of Rhodes's stature should have offered a deeper understanding of our struggle to improve our energy capacity —one of our most globally pressing challenges as the human population rises.

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