of the secret police, to Stalin's inner circle. Kosior, Chubar, and Postyshev were executed during the Great Terror; Ordzhonikidze almost certainly committed suicide in early 1937 after a blazing row with his Georgian compatriot; and Kirov, as is well known, was assassinated in December 1934 under mysterious circumstances, although no solid proof exists that Stalin plotted his death. Fitzpatrick offers no fresh overarching interpretations of the Terror, but she does suggest that the best explanation for Stalin's pitiless assent to the arrest and even execution of some of his family relations was his desire as a team player not to be seen by the others "to be saving his people, while letting theirs perish." This would have been a gross political error and "a major sacrifice of moral authority" (139). The scale of the internecine carnage was toned down after the war, but an increasingly capricious Stalin was still capable of turning on his erstwhile friends—in the late 1940s and beyond he endeavored to exclude Molotov and Mikoyan from his inner cohort. However, the others, no doubt to Stalin's chagrin, displayed "passive resistance" (227) and protected their threatened associates. In doing so they may have ensured Molotov's and Mikoyan's very survival.

Of the team members, Beria emerges as the most intelligent, complex, and ambitious. Renowned as a sadist, sexual predator, and longtime chief of the murderous secret police, he was also by the early 1950s something of a budding reformer. Almost immediately after Stalin's death, Beria "set in motion the release of more than a million prisoners from Gulag," advocated "an astonishing tempo of de-Russification in the republics," and intervened in foreign policy, breathtakingly recommending that the East German party should abandon its attempts to construct "socialism" (230–32). But Beria had overstepped the mark, and his perceived challenge to the embryonic post-Stalin "collective leadership" meant that he was arrested, falsely accused of being a foreign spy, and executed in December 1953.

Thanks in no small measure to this elegantly written book, historians should no longer regard "Stalin's men" as mere also-rans. Collectively, they played a major role in shaping and managing a vast country from the late 1920s through to the 1960s, in the process helping to transform it into a global superpower.

Kevin McDermott

Sheffield Hallam University

Producing Power: The Pre-Chernobyl History of the Soviet Nuclear Industry. By *Sonja D. Schmid*. Inside Technology Series. Edited by *Wiebe E. Bijker*, *W. Bernard Carlson*, and *Trevor Pinch*.
Cambridge, MA: MIT Press, 2015. Pp. xxxii+362. $38.00.

The history of nuclear power continues to fascinate the public and scholars alike, and its historiography is diverse. The book's coverage is synoptic but well chosen, reminiscent of an expanded version of the history of the British nuclear industry provided in R. F. Pocock's *Nuclear Power: Its Development in the United Kingdom* (1977), and notably complementing Paul Josephson's *Red Atom: Russia's Nuclear Power Program from Stalin to Today* (1999).

Sonja Schmid successfully synthesizes the approaches of previous accounts of nuclear energy, portraying the Soviet nuclear complex as an evolving sociotechnical system in the style familiar to contemporary historians of technology and interdisciplinary scholars of science and technology studies. This helps to select a rich variety of historical details and fruitful analytical themes to assess them.

The coverage focuses—as much as it is possible to do so for this ambivalent technology—on nonmilitary application of atomic energy, and mainly on electric power generation. Also, like most prior histories, it focuses on a single national context. This is a good choice, given the particular political and economic context of the Soviet Union and the country's relatively independent trajectory of nuclear development.

In places, readers would benefit from a more explicit comparison of other national and temporal contexts. Schmid hints that the Soviet exploration of dissimilar reactor technologies was unusually long and culminated in nationally specific design choices. Yet a similar development strategy was pursued in both the United States and the United Kingdom in the postwar decades.

The Soviet-centric analysis does not help to explain, either, why other countries took different technological routes. The book suggests that most adopted pressurized water reactors, and that this represented a design solution superior to one of the favored design options adopted in the Soviet Union (known by the Russian acronym RBMK, or "Chernobyl-type" reactor). The RBMK design is similar to the graphite-moderated, water-cooled reactor complex constructed in Hanford, Washington, for plutonium generation during the Second World War and in use until the late 1980s. Yet as nuclear engineer Alvin Weinberg argued, the American choice of power plant technology was largely the outcome of an early funded application (submarine propulsion), a political context (US Navy collaboration with particular US national laboratories), and, later, government-directed licensing and export policy. Indeed, such a design is similar to that embodied in the Fukushima reactors and licensed from General Electric. Canada, by contrast, adopted heavy-water reactors as a result of its own national contingencies. The country-by-country approach may obscure such geopolitical and economic dimensions, while suggesting in hindsight that peculiarities of Soviet bureaucracy explain seemingly imperfect technical choices.

The book's discussion of working cultures complements the narrative on technical matters and the evolution of ministries, institutes, and procedural systems. It provides tantalizing overviews of the dissimilar cohorts of nuclear engineers and nuclear plant operators, while suggesting that the working lives of both groups were intensely motivated by shared national pride and sense of collective responsibility. This belies the common impression in Western nations of inattentive and careless operators, and again raises the question of how distinctively Soviet expertise and training was packaged compared to contemporaries elsewhere. More on this would be valuable, along the lines of Gabrielle Hecht's study of the French nuclear industry, *The Radiance of France: Nuclear Power and National Identity* (1998).

Chernobyl provides an initial "hook" for readers in the introduction, as well as the culminating event and "historical and conceptual window" (161) for the author's discussion of the industry in the final half decade of the Soviet Union. Wider readerships will be drawn to Schmid's summary of the Chernobyl accident, and her refusal to pigeonhole it as either a case of operator error, design inadequacies, or procedural errors.

The author discusses the wider implications of Chernobyl, showing that in the three years following the accident, Soviet activist movements increasingly challenged media censorship, opposed nuclear plant projects, and destabilized the industry. The planning and construction of around a dozen nuclear plants was canceled, and the RBMK design was abandoned. The wider consequences were equally problematic, particularly where reliance on nuclear power was high. In Armenia, for example, the closure of the nuclear power plant after a severe 1988 earthquake resulted in widespread decimation of the national forests for fuel the following winter, forcing the authorities to restart one of the reactor units.

A major focus of the book concerns the management of the Soviet nuclear industry. Schmid discusses how the industry was restructured during Nikita Khrushchev's leadership, and then again after Chernobyl. Khrushchev oversaw the reorganization of the national ministries, which allied military expertise and procurement with design and management of civilian nuclear reactors, to devolve responsibilities to regions. This shift toward decentralized autonomy was reversed by his successors. And after Chernobyl, while technical design changes took some five years to implement—indeed, until the last years of the Soviet Union—the accident caused the Soviet government to immediately consolidate nuclear design, construction, and operation under one managerial roof, the new Ministry of Atomic Energy.

The final pages of the book sketch the early post-Soviet period, during which Boris Yeltsin's government inherited the systems and management structures of his predecessors. Ukraine—one of the New Independent States of the 1990s—undertook management of its five nuclear power plants, including the Chernobyl reactors. Collaborating closely with the International Atomic Energy Agency and the US Department of Energy, it also continued an arrangement with the Russian Federation, which supplied and dealt with fresh and spent nuclear fuel.

This book is a worthy addition to the large library of studies on the history of the nuclear experience. It updates and diversifies the coverage of modern industrial and organizational histories, while revealing both familiar and nation-specific features of the Soviet experience that are still too little known to Western scholars.

In the conclusion, the author underlines that, unlike the conventional narrative of Cold War fallacies, the Soviet state achieved remarkable success in managing its nuclear industry as a large and evolving sociotechnical system. The ultimate failure of Chernobyl and the subsequent unraveling of the Soviet nuclear organization had much to do with the sensitivity of the technology to complex and ultimately uncontrollable variations in management, economics, and political apparatus. As she notes, "we find expert hubris, conflict between military and civilian organizations, supply problems in frontier science, mismanagement, and ambitious individuals in other political-economic contexts as well" (166). This is a careful and well-balanced account, then, of a national experience that provides general insights about ambitious human-built systems and their long-term sustainability.

Sean F. Johnston

University of Glasgow