

Zumbrägel, Christian: *„Viele Wenige machen ein Viel“. Eine Technik- und Umweltgeschichte der Kleinwasserkraft (1880–1930)*. Paderborn: Ferdinand Schöningh 2018. ISBN: 978-3-506-78746-0; 351 S.

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In recent years, a slew of environmental historians and historians of technology have looked at the history of hydropower in numerous global contexts. On the one hand, interest in water power has been spurred by present concerns about energy in the face of global warming. As one of the first forms of „renewable“ electricity, the development of hydroelectricity offers a potential historical test case for how such an energy form emerged in the past. On the other hand, histories of water power usage share one of the crucial advantages of good water history. Thanks to water’s essential importance for biological life, studying human conflicts over this resource provides useful windows on the workings of societies. With his book *„Viele Wenige machen ein Viel“: Eine Technik- und Umweltgeschichte der Kleinwasserkraft (1880–1930)*, historian Christian Zumbrägel has taken a unique approach to the theme that pays off with some important insights. Rather than follow the overwhelming majority of historians who have focused on the technological innovations shaping hydropower usage in the nineteenth and twentieth centuries, Zumbrägel’s history of „small-scale“ hydropower does something else entirely. It inquires instead about the continuity of older technologies, forms of knowledge, and expertise primarily in the German context. The work highlights the surprising persistence of waterwheels as prime movers in small German mills well into the first half of the twentieth century. Focusing on continuities in traditional water power usage at a time when gigantic hydroelectric dams began impounding global waterways, Zumbrägel’s study should find resonance in a number of audiences. Its challenging of dominant narratives of technological change will appeal to historians of technology, environmental historians, energy

historians, and even parties concerned with present-day energy policy.

Zumbrägel’s book represents the revised version of his dissertation. After an introduction laying out the structure of the work and historiography, the book is composed of two main parts. The first, „Diskurse, Praktiken und Techniken zwischen Groß- und Kleinwasserkraft“ takes a broad survey of debates surrounding the use of hydropower around the turn of the twentieth century. At this time, water power exploitation was in the process of being revolutionized by the invention of two new energy technologies: the turbine and electricity. The former was a reinvention of the water wheel using modern materials and design. With the ability to harness falls of thousands of meters, metallic turbines far outdid their predecessors. And under the right conditions—as Zumbrägel deftly demonstrates—they converted the energy of falling water much more efficiently than traditional wheels. While turbines opened up every drop of flowing water on earth to potential exploitation, electricity made it feasible. One of the traditional limitations to water power usage was that it was bound to the site of production. This usually meant the hillier regions where swift-flowing water was available. In creating a means of transporting hydropower over long distances, electricity allowed for remote water power to be utilized on grand scales and sent to centers of consumption. As Zumbrägel shows, this reality led a caste of academically trained engineers to push energetically for large-scale hydropower expansion in the pages of their rapidly multiplying trade journals. The author leaves no doubt that these efforts proved wildly successful. But by utilizing often neglected sources like manuals and the readers’ fora of trade journals devoted to the older technology of watermills, Zumbrägel excavates an equally lively parallel discourse being carried on about the continued merits of wheel-powered *Kleinwasserkraft* in certain situations, and how it might be updated in the new era.

How this played out on specific German rivers is the subject of the book’s second part „Grüne Kohle“. The title refers to a term coined by a German contemporary to de-

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scribe the water power of the lower mountain ranges (*Mittelgebirge*) in Germany. In contrast to the „white coal“ hydropower that sprang from the snowy glaciers of the Alps, „green coal“ was the water power that came from the wooded slopes of Germany's hill regions. For centuries, green coal had provided the basis for thriving, small mill-based industry. This was particularly the case in the regions that form the heart of this study: the Bergisches Land and the märkisches Sauerland. These two bordering areas of southern Westphalia in western Germany contained the watersheds of the Wupper and Ruhr rivers. At the turn of the twentieth century they contained the highest density of waterwheels in the German Empire. And up through the 1930s, small wire mills, forges, and grinding mills continued to outnumber turbine-driven hydroelectric plants there.

Why this was so is explained in this, the most engaging part of this book. Employing an *envirotechnical* analysis developed by environmental historians interested in the intersection between nature and technology, Zumbrägel considers the entire natural, technological, and social „ensemble“ of small-scale water power establishments. The persistence of small-scale watermills in this region in many cases was because mills and waterwheels remained better suited to the environmental and social conditions along the region's rivers and streams. Here, small-scale industrialists did not always require massive amounts of energy. Reliability counted most. In many situations, traditional waterwheels responded better than turbines to the at times substantial fluctuations in flow on these waterways. They could also withstand the presence of sediment and flotsam better. And waterwheels usually proved cheaper to repair and maintain when problems inevitably arose. In some cases, mill operators returned to using waterwheels after disappointment with the performance of modern turbines.

In explaining the persistence of small water power, the author does not romanticize these establishments. As he notes, their existence necessitated significant interventions into the hydrological cycle. And though the focus here is more on the technological than the ecological, there is some analysis of the environ-

mental impacts of mills. This includes the foul-smelling pollution created by millponds as described in contemporary novels such as *Pfisters Mühle*.

The book's execution leaves little to criticize. The author's narrower focus on Germany and specific German regions makes sense as it precisely the „small-scale“ approach that allows the tracing of this less-heralded continuity in water power usage. Though the volume is generally well-illustrated—including several useful colorful images—the book could have greatly benefited from a geographical map of the study's main area of focus and the corresponding watersheds of the Wupper and Ruhr rivers. Finally, most of the sources consulted here focus on the technological and economic arguments for or against traditional energy use. One wonders about the role played by culture. Just a few years after the end of this study, some voices within the National Socialist movement—including Adolf Hitler himself—waxed nostalgic about a German economy based on small-scale water power.

Still *Viele Wenige machen ein Viel* succeeds as a deep analysis of a subject that has received far too little attention amidst the fascination for the new and imposing. Particularly historians interested in energy will find that Zumbrägel's conclusions complicate the concept of a neat energy transition. And implicit within the book's title is an attitude toward energy that should find renewed popularity in the twenty-first century.

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