

Publikationsserver des Leibniz-Zentrums für  
Zeithistorische Forschung Potsdam e.V.

Archiv-Version



Leibniz-Zentrum für  
Zeithistorische  
Forschung Potsdam

Rüdiger Graf

# Energy History and Histories of Energy

DOI: 10.14765/zzf.dok-2616



Archiv-Version des ursprünglich auf dem Portal **docupedia.de** am 29.08.2023  
erschienenen Textes:

[https://docupedia.de/zg/Graf\\_energy\\_history\\_v1\\_en\\_2023](https://docupedia.de/zg/Graf_energy_history_v1_en_2023)

Copyright (c) 2023 Clio-online e.V. und Autor, alle Rechte vorbehalten. Dieses Werk entstand im Rahmen des Clio-online Projekts „Docupedia-Zeitgeschichte“ und darf vervielfältigt und veröffentlicht werden, sofern die Einwilligung der Rechteinhaber vorliegt. Bitte kontaktieren Sie: <redaktion@docupedia.de> .

# Energy History and Histories of Energy

von Rüdiger Graf

## 1. Introduction

Energy is a comparatively new subject in historiography, and even the concept, as we use it today, is not very old. Denoting the “capacity for doing work,” energy became a fundamental concept in physics as the laws of thermodynamics were established in the middle of the nineteenth century. Since the theoretical formulation of these laws, the all-pervasiveness of energy has captured the attention of various academic disciplines and intellectuals. Indeed, every process on earth – and thus every human activity – can be described in terms of the energy it requires or converts.[1] Thus, energy can serve not only as a basic concept in the natural sciences, but also as a tool to describe and analyze economic, social, political, and cultural processes. Yet it was not until the energy crises of the 1970s, when governments started to develop comprehensive energy policies, that it became customary to describe societies in terms of “energy balances,” and to conceptualize people and systems as energy consumers.

In the 1970s, energy policy and environmental policy emerged in tandem.[2] While environmental degradation had been a topic primarily for natural scientists, the environmentalist movement and associated policy initiatives produced a surging interest in such issues in the social sciences and the humanities in the 1970s. The concept of energy played an important role in the ensuing debates on the environment for three reasons: First, certain forms of energy use were responsible for environmental damage; second, the predicted exhaustion of fossil fuels – and oil in particular – raised fears that resource-intensive lifestyles would become unsustainable; and, third, the most promising alternative energy of the time, atomic energy, had considerable risks, and thus triggered heated disputes. It was against this backdrop that anthropologists, social scientists, and academics in the newly emerging field of energy studies developed grand narratives concerning the sequence of different energy civilizations. By contrast, in historiography, interest in the production, conversion, and consumption of energy remained rather marginal. In general, energy was mostly treated as a subfield of either **environmental history** or the history of science and **technology**.[3]

While there were earlier advocates of energy history, an energy-centric approach to history did not gain traction until the new millennium, after the reports by the Intergovernmental Panel on Climate Change (IPCC) had clearly established that the energy regimes of industrialized economies, which largely depended on the burning of fossil fuels, were causing increasing temperatures worldwide and were projected to have increasingly devastating effects on planetary life. As global warming became the most important environmental – and, for many, political – problem of our time,[4] and many governments vowed to transition away from fossil fuels, historians tried to

Claiming affiliation with the newly emerging “energy humanities”[6] and often assuming an activist stance, such historians have argued that climate change makes it both necessary and urgent to concentrate historiographically on the ways in which energy has been produced, converted, and consumed. In this regard, they aim to explain how we have reached the current energy-environmental predicament, and sometimes even try to indicate how societies might mitigate or adapt to climate change.[7] If we subscribe to the notion of the *Anthropocene*, there is indeed a strong argument for historians to concern themselves with energy history.[8] While sharing many concerns, questions, and approaches with *environmental history*, energy historians not only concentrate on the most important driver of global warming, but can also claim the advantage of using a well-defined scientific term that allows for quantitative analyses. Whereas the environment can be defined in different ways and its quality is notoriously difficult to measure, energy comes in seemingly objective joules, calories, steel coal units, or tons of oil equivalent.

Reviewing the recently blossoming historiographical engagement with energy, I will distinguish between (a) *energy history* in the strict sense, which primarily tries to determine how energy systems evolved and changed, and (b) the multifaceted *histories of energy* that analyze the production and consumption of certain forms of energy, such as coal, oil, electricity or nuclear power. Dealing with important sources of energy, these studies are usually not conceptualized as energy histories in the strict sense. Rather, they are economic, political, social, technological, or cultural histories of the ways in which one form of energy was produced, converted, and/or consumed. In this connection, they elaborate the complex processes by which different energy sources gained or lost importance, as well as the intended and unintended consequences of their use. Hence, they contribute to our understanding of energy history in general.

After a brief conceptual history of “energy,” (section 2) which is necessary to understand how energy became central to understanding economies and societies, I will show in section 3 how energy history emerged as a transdisciplinary academic project, sketching its major themes, questions, and narratives. In section 4, I will present the various histories of energy, analyzing how they treat energy production, the economic and political dimensions of energy, and the social and cultural history of energy consumption. In conclusion (section 5), I will ask if energy history constitutes a subfield of historiography – such as the history of *sports*, education, or music – or whether it may be justifiably viewed as an indispensable historiographical category that needs to be considered in any historiographical study, such as *class*, gender, or race.

As the relevant literature is vast, this review cannot present all world regions equally, but will focus on the United States and (mostly Western) Europe. This seems justified, as these regions were the drivers of the current energy intensive lifestyles that have led to the current environmental

predicament, which some authors have suggested naming the “capitalocene.”[9] However, this<sup>4 of 48</sup> review does attempt to integrate perspectives from other parts of the world, in part because the effects of increasing energy consumption are being felt globally, but also because energy systems themselves have been globalized over the course of the twentieth and twenty-first centuries. Thus, the choice between regional, national, or global approaches is not arbitrary, but depends on the changing ways in which energy is produced and consumed.

## 2. The Concept of Energy: From Physics to Economics, Society, and Politics

As scientists in the 1840s and 50s investigated the conversion of power in physical systems in general and machines in particular, energy emerged as a fundamental concept in physics denoting the “capacity for doing work.”[10] Energy is governed by the laws of thermodynamics, which are often compared in importance to the principles of Newtonian mechanics. The first law of thermodynamics states that in a closed system, the amount of energy remains constant, and that the total input of energy equals the output, which means that a *perpetuum mobile* is impossible. By contrast, the second law states that in every conversion, some energy is transformed into waste or heat that cannot be converted back into higher forms of energy. While this second law of entropy gave birth to pessimistic visions of a coming “heat death,” energy became a key concept not only in physics but also in the life sciences, such as physiology and biology. Organisms were conceptualized as energy converting systems requiring a certain caloric input in order to function and perform work.[11] As capitalism expanded in the nineteenth century, there was a close cross-fertilization between the discourses of physics, engineering, economics and the life sciences; in this connection, energy served as a universal concept that freely crossed between hardening disciplinary boundaries.[12]

Aside from its colloquial meaning of “power,” “force,” “vigor,” or “strength of character,” at the beginning of the twentieth century, energy was mostly used as a technical and scientific term. Encyclopedias defined different types of energy (thermal, mechanical, etc.), its theory, units of measurement, and the principles that governed energy conversion, including above all the laws of thermodynamics.[13] As general energy consumption rose, and new energy sources became more important over the course of the twentieth century, encyclopedia entries on energy became longer, and contained more information on the different sources of primary energy and their use.[14] By the end of the twentieth century, it was commonly accepted that the energy sector fulfilled a crucial function in every economy, as it provided a good that was needed in all other sectors: without energy there could be no agriculture, no industrial production, no transportation, no service economy, and no consumer goods.[15]

While this was no less true in the first half of the twentieth century, it was usually not described as such. Rather, energy industry proponents and politicians talked about the importance of specific energy carriers, such as coal, electricity, or oil. Energy was a topic for experts from the natural sciences and, above all, engineering, who thought about the production of different types of energy, their technical conversion into other forms, and their efficient use in economic processes.

In 1924, the British Electrical and Allied Manufacturers Association (BEAMA) organized the First World Power Conference at Wembley in order to discuss energy-related questions and the future of energy resources.[16] At the second meeting, which was held in Berlin in 1930 and attended by more than 1000 delegates, the Italian engineer Giancarlo Vallauri bemoaned the conceptual confusion engendered by the decision to name the event the “Power Conference” in English and “Kraftkonferenz” in German, but “Conférence de l'Énergie” in French, as in Italian.[17] In the second half of the twentieth century, “energy” stabilized internationally as the generic concept, and the conference was renamed the “World Energy Conference” in 1968.[18] Experts at the World Power/Energy Conferences and elsewhere argued that, due to its vital importance for all economic activities, energy could serve as an alternative instrument for measuring economic performance at the national, regional, or global scales.[19]

Image



Third World Power Conference, Washington D.C., 1936. Official opening of the conference. Washington, D.C., Sept. 7, 1936. Photographer: Harris & Ewing. Source: [Library of Congress](#) / [Wikimedia Commons](#) [25.08.2023] public domain

The expansion of “energy” from its use in physics and engineering into the realm of the economy and politics can neatly be captured by looking at the energy-related compound terms that received entries in German encyclopedias. In the first half of the twentieth century, encyclopedias referred almost exclusively to the physical aspects of energy.[20] When energy production and consumption increased dramatically during the postwar boom, however, the *Brockhaus* started to include articles on “energy supply” (“Energieversorgung”) and the “energy economy” (“Energiewirtschaft”).[21] The latter was initially defined as “the economic usage of energy sources for lighting, heating, industry, and transport.”[22] In the 1960s, however, the German encyclopedia acknowledged that the increasing use of energy had engendered a special branch of scientific knowledge dealing with technical innovation, energy economics, and the assessment of future

supply and demand.[23] “Energiewirtschaft” now referred to a sector of the economy that consisted of the “production, import, conversion, storage, transport, and distribution of energy as well as of the conversion of energy by final consumers (households, industry, transport) into usable energy or energy services.”[24]

Due to its rising economic importance, the concept of energy also entered the realm of politics. As long as one source of energy was in oversupply, while no other source promised to deliver the same energy services at lower cost, there was no need to introduce the concept of energy. The concept translated the work capacity of different materials and machines into a common metric, enabling assessment of which option was cheaper, more efficient, or (later) more ecological. In general, energy became an economic and political issue when the dominance of one source of energy was challenged by another, or when its supply seemed to be threatened. The former was the case in Western Europe during the coal crisis of the late 1950s,[25] and the latter occurred worldwide in the 1970s during the oil crisis, which stoked general worries about limits to growth and impending peak oil.[26] Encyclopedias now defined energy policy as the “collection of state measures to secure the provision of energy in the face of the natural limits to the supply of energy sources (coal, oil, gas, water),” and devoted greater space to discussing the difference between depletable and “recurring” or renewable resources.[27]

While energy supplies had previously seemed abundant, energy policy emerged in the face of potential scarcity in the 1970s, and “energy security” became a crucial goal of national policy.[28] Once the IPCC reports had established that the burning of fossil fuels was the main reason for anthropogenic climate change, however, the official *raison d’être* of energy policy changed. Rising international calls for a transition away from fossil fuels to renewables were motivated not by a lack of coal, oil, or gas, but rather by the ecological consequences of their use.[29] Despite professed environmental goals, however, energy security continues to be the decisive concern when it comes to political decision-making, as could be observed following the outbreak of the Russian war against Ukraine in 2022.

Nevertheless, the 1970s were the crucial watershed in the conceptual and intellectual history of energy. While the natural scientific and colloquial meanings of the term remained stable, energy related knowledge exploded, as governments in industrialized countries developed new energy policies and the “energy crises” dominated headlines. International organizations such as the World Bank and the International Energy Agency (IEA) internationalized energy as a political concern.[30] Despite the co-evolution of knowledge concerning economics and energy in the nineteenth century, neoclassical economists had largely eliminated energy from their analysis. However, this began to change in the 1970s with the rise of environmental and energy economics.[31]

Moreover, with the founding of journals such as the *Annual Review of Energy* (1976) and *Energy Policy* (1978) an interdisciplinary field of energy studies developed to which natural as well as social scientists contributed. The mainstream social sciences also recognized this surging interest in energy: while in 1968, the *International Encyclopedia of the Social Sciences* did not contain an entry on “energy,” its second edition in 2008 contained articles on “energy,” the “energy industry,” and the “energy sector.” In his article on energy, John Gowdy explained that energy – understood as the “ability to do work” – had been a “crucial factor in human cultural evolution. The development of increasingly complex human societies had been driven by a capacity to harness energy.”[32] A similar change also occurred between the sixth and seventh editions of the German *Staatslexikon*, of 1958 and 1987, respectively.[33] The shifting attitude to energy in the social sciences in the 1970s may also be illustrated by Daniel Bell’s famous study on “The Coming of Post-Industrial Society.” In its first edition, published in 1973, Bell defined energy as a crucial resource for industrial society, yet he argued that it would play no important role in post-industrial society, which would be based on knowledge.[34] In the foreword to the second edition in 1976, however, he acknowledged that a lack of energy could impede the rise of post-industrial society, and that energy would continue to be important, as it was necessary to run communication technologies and knowledge infrastructures.

Hence, apart from its colloquial everyday use, over the course of the twentieth century in the German and English speaking worlds, energy evolved from a basic concept in the natural sciences and engineering to a crucial category of economic and political thinking and decision-making. Especially since the 1970s, when governments in the United States, Western Europe, and, arguably, worldwide began to implement explicit “energy policies,” it has become customary to think about economies and societies in terms of energy, and to describe human beings as energy consumers. With the IPCC reports on climate change, energy also became an important concept for social and cultural reflection. Accordingly, energy has entered historiography and the humanities as an important category of analysis.

### 3. Major Trends in Energy History

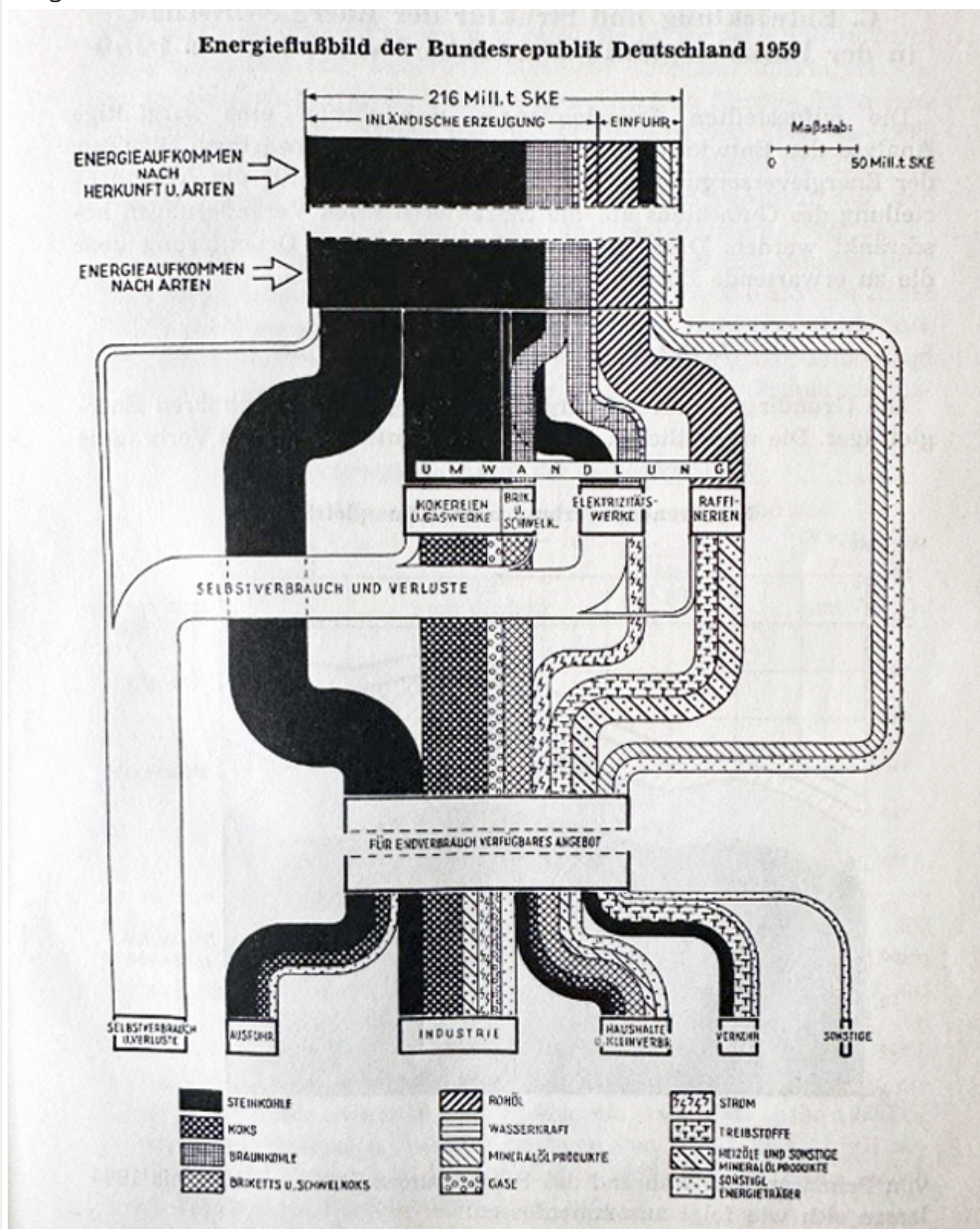
#### 3.1 Describing Societies and Civilizations in Terms of Energy

While energy history in the strict sense did not flourish until the 1990s, there are prior examples of historical **narratives** framed around energy. Even before the laws of thermodynamics were formulated, scholars had argued that energy might provide a lens for understanding societies as a whole.[35] Moreover, some early sociologists such as Herbert Spencer expressed the idea that the development of societies depended crucially on energy availability.[36] At the beginning of the twentieth century, natural scientists such as Wilhelm Ostwald and Frederick Soddy, both winners of



the Nobel Prize in Chemistry, argued that the concept of energy united the natural and social<sup>9 of 48</sup> sciences, and that historical ages could be distinguished by their use of different forms of primary energy.[37] As an attempt to naturalize the social sciences, Wilhelm Ostwald's *Energetik* met with strong criticism from sociologists, including most prominently Max Weber, who savaged Ostwald's theory. As a result, the notion of making energy a fundamental concept in sociology remained marginal for large parts of the twentieth century. Yet it did not lose its lure for some social scientists, and was particularly attractive to anthropologists.[38]

Analyzing societies in terms energy was inspired or at least facilitated by engineers and economists developing energy balances for countries or regions. As energy consumption rose, they tried to capture the total input of different forms of primary energy, their conversion in different economic sectors, and their final use within national economies. In order to present a "clear and well-arranged" overview of a country's energy balance, as the director of the East German Institute for Energetics put it, they often used so-called Sankey diagrams. The Sankey diagram was originally devised to visualize the flow of energy within a machine or factory.[39] Applied to national economies, they depicted the whole of society as an energy converting system, thereby revealing the different points at which energy policies could intervene, while also disclosing issues in need of closer analysis. Still in use today, energy balances, which are often presented in the form of flow charts, make it possible to compare national economies or regions synchronically, and to describe them diachronically in terms of their changing energy use.[40]



Energy flow chart for the Federal Republic of Germany in 1959, measured in tons of coal equivalent, drafted by a group of economic research institutes at the request of the German Bundestag as a consequence of the coal crisis.

Source: Arbeitsgemeinschaft deutscher wirtschaftswissenschaftlicher Forschungsinstitute, Untersuchung über die Entwicklung der gegenwärtigen und zukünftigen Struktur von Angebot und Nachfrage in der Energiewirtschaft der Bundesrepublik unter bes. Berücks. des Steinkohlenbergbaus: Auf Beschluß des Deutschen Bundestages vom 12. Juni 1959 durchgeführt (Berlin: Duncker & Humblot, 1962).

For the most part of the twentieth century, there was a broad consensus that more energy meant an improved standard of living and thus a higher degree of “civilization.” In 1949, the US anthropologist Leslie White argued that “culture evolves as the amount of energy harnessed per capita per year is increased, or as the efficiency of the instrumental means of putting the energy to work is increased,” emphasizing the historical importance of the agricultural and fossil fuel revolutions.[41] A few years later, the sociologist Fred Cottrell distinguished between the “high-energy society” of his time, which was based on coal, and earlier low-energy agrarian societies.[42] As the supply of energy seemed threatened in the 1970s, the energy-centric interpretation of societies and their history flourished.[43] For example, in 1971, *Scientific American* published an issue on energy, in which scholars from various disciplines analyzed the flow of energy in hunting, agricultural, and industrial societies, thereby developing a grand narrative of (western) civilization as a history of increasing energy consumption.[44] Using graphical charts, the geologist Earl Cook distinguished between “primitive,” “hunting,” “primitive agricultural,” “advanced agricultural,” “industrial,” and “technological man,” according to per capita energy consumption.

For many observers, the diagnosis that an advancing civilization consumed ever more energy seemed to suggest that increasing energy use actually drove historical **development and progress** – or was at least a necessary precondition. Yet this notion was not unique to the capitalist West. In Communist ideology, increasing energy consumption was considered a means to free people from physical labor and to realize a classless society.[45] Moreover, the expansion of the energy sector played a crucial role as a prerequisite for economic development in the Soviet Union and the planned economies of the East.[46] Vulgarized as the “energy-civilization equation” – implying, as it did, that economic growth depended on the parallel expansion of energy use – this idea was particularly influential in the decades of the postwar economic boom.[47]

From the end of the Second World War to the early 1970s, world energy use tripled and increased even greater in the industrialized countries of Eastern and Western Europe.[48] State planners emphasized the need for secure and stable energy supplies,[49] while advocates of the coal, oil, and atomic energy industries tirelessly stressed that energy fueled economic growth and improved living standards, thus stabilizing the social and political order.[50] Such stabilization seemed particularly important in the Cold War, which was not only a global power struggle between the United States and the Soviet Union, but also a conflict between two opposing social and economic systems. Both power blocs seemed equally dependent on rising energy consumption, given their competition in the domain of economic prosperity and the provision of consumer goods. While some scholars had long questioned the notion of a simplistic relationship between energy, economic growth, and civilization, criticism became more widespread in both the East and West in

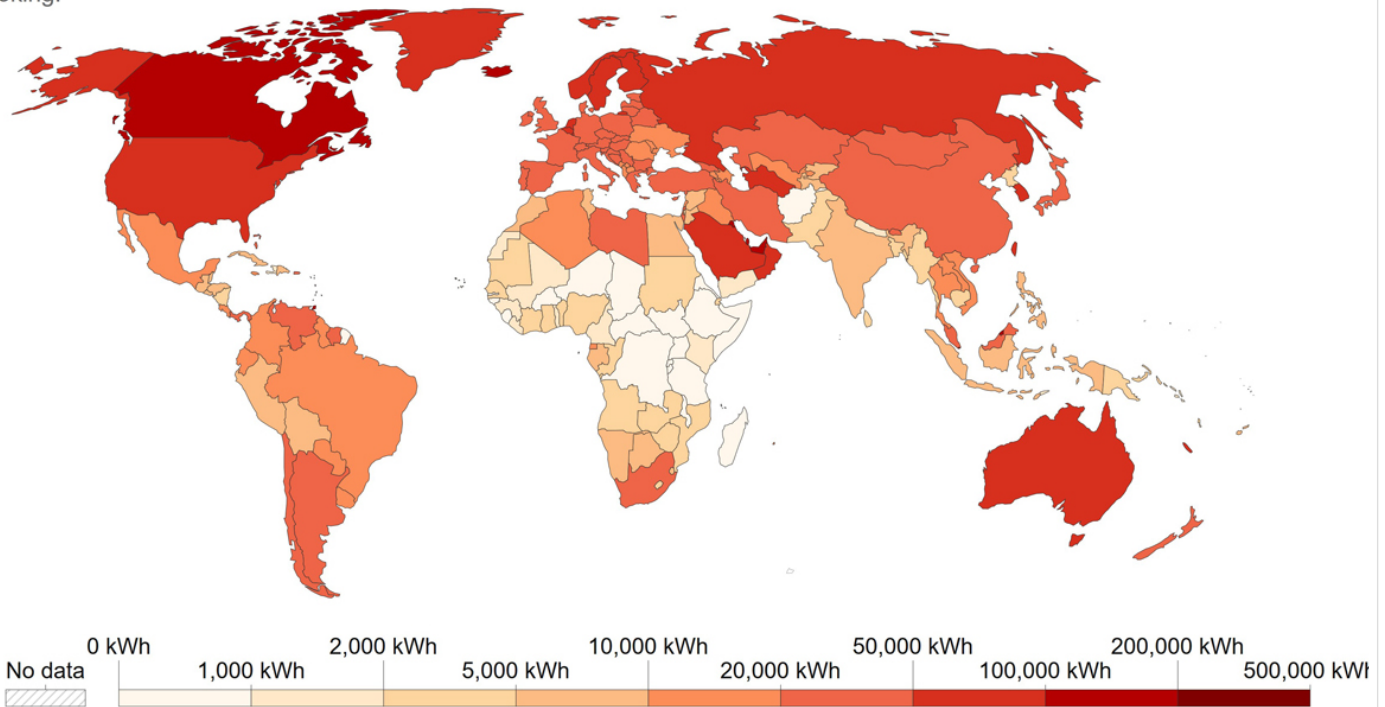
the 1970s in the face of energy supply problems, growing environmental concerns, and debates on the limits to growth. It was in this context that environmental and energy economics arose.[51]

Image

## Energy use per person, 2022

Our World in Data

Energy use not only includes electricity, but also other areas of consumption including transport, heating and cooking.



Source: U.S. Energy Information Administration (EIA); Energy Institute Statistical Review of World Energy (2023)

Note: Energy refers to primary energy – the energy input before the transformation to forms of energy for end-use (such as electricity or petrol for transport).

OurWorldInData.org/energy • CC BY

Energy Use per Person, 2022. Source: U.S. Energy Information Administration (EIA); Energy Institute Statistical Review of World Energy (2023), [OurWorldInData.org/energy](https://OurWorldInData.org/energy) CC BY 4.0

### 3.2 Themes, Questions, and Narratives in Energy History

The postwar boom in energy consumption and environmental concerns of the 1970s motivated a growing interest among social scientists to interpret society from the perspective of energy. Under the influence of the environmentalist movement, their analyses were increasingly critical of the energy-civilization equation. In energy history today, the postwar decades appear as a crucial threshold between epochs: the unprecedented economic growth of the so-called Golden Age (Eric Hobsbawm) or *Trente Glorieuses* (Jean Fourastié) have been re-interpreted as the “Great Acceleration”: a dramatic and continuing increase in human activity that has adversely impacted living conditions on planet earth.[52]

In the 1990s, the Swiss historian Christian Pfister described this period in terms of a “1950s syndrome,” drawing attention to this decade’s uniquely dramatic increase in energy use, economic output, land use, waste production, and environmental degradation.[53] Energy is a crucial if not the most important measure of both the Great Acceleration and the 1950s syndrome. As Pfister notes, “the takeoff in energy use began in the United States during the 1940s, in Western Europe and the Soviet Union during the 1950s, and in East Asia and the Pacific area during the 1960s,” fundamentally changing the way humans live as well as the impact they have on the environment.[54] Opinions diverge whether the cheap and abundant availability of energy, above all oil, was just a “nutrient” of the economic boom or actually one of its driving factors.[55]

While there had been earlier attempts to develop long-term histories of energy by scholars such as Fernand Braudel, Carlo M. Cipolla, and Rolf Peter Sieferle, who emphasized the importance of the Neolithic and the Industrial Revolutions, energy history has only boomed over the last four decades.[56] This newer energy history, however, has not only been written by professional historians but also by natural scientists and scholars from the environmental sciences. As a rule, the latter assume a broader scale and have a greater affinity for quantitative methods.

A prime example is the environmental scientist Vaclav Smil, whose many books have been influential both in academic circles and among the broader public.[57] Smil argues that after the “first deliberate extrasomatic energy conversion as early as nearly 800,000 years ago by mastering the control of fire,”[58] the agricultural revolution, and the use of wind and water, in the last two hundred years, shifts in major primary energy sources have become more frequent: “From wood and charcoal to coal and then to hydrocarbons, followed by transitions to a higher share of primary energies consumed in a secondary form as electricity.”[59] These significant changes in the energy system are commonly called “energy transitions,” forming a major focal point of energy history, not the least due to current political circumstances.

Smil defines energy transitions as “shifts in the shares of individual fuels and in the origins of electricity generation as well as the adoption and diffusion rates of new prime movers and as new patterns of final energy uses.”[60] This definition sketches the main aspects energy historians usually focus on: the generation of primary energy and the changing economic shares of different forms of fossil and renewable energy (sun, wind, water, biomass, coal, oil, gas, atomic), its conversion into secondary energy, such as electricity, heat, or kinetic energy, the converting technologies (prime movers, such as the diesel engine or the gas turbine), and the final use or consumption of energy.[61] In the 1970s, the physicist Cesari Marchetti argued that different primary energy sources competing for market shares led to a neat sequence of substitutions from wood to coal, to oil, to gas, and to atomic power.[62] By contrast, more recent historiographical studies have complicated this overarching narrative as well the general understanding of energy

While examining the dynamics and driving forces of energy transitions in greater detail, recurring questions in energy history include the following: How did the material qualities of primary forms of energy, their caloric values or their aggregate states, affect their utilization as energy sources? Did energy transitions mainly result from the discovery and supply of new forms of energy or, rather, from an increasing demand? What were the roles of technological innovation and increasing energy expertise? How important were changes in infrastructure? How did state and private actors influence energy transitions, and what was the role of national and international organizations? Did certain energy regimes produce determinable economic, political, social, and cultural effects, or were energy transitions merely an epiphenomenon of these changes? While such questions are hotly debated, it is unlikely that any of them will be settled definitively, even for a single transition.

The questions energy historians address as well as the ways in which energy history is told are diverse but not unlimited. Rather, the narratives resemble each other no matter the time and place in which they are set. Following Hayden White, the historian David Nye distinguishes five energy narratives that generally determine the popular and academic writings on energy history: “(1) natural abundance, (2) artificial scarcity, (3) human ingenuity, (4) man-made apocalypse, and (5) existential limits.”[64] In the first, romantic narrative, human beings simply use the ample resources provided by nature. Told as a comedy, the second and the third narratives emphasize how human decisions lead to either resource scarcity or innovation and the discovery and development of new sources of energy. Environmentalist stories about a coming apocalypse, which have flourished since the late 1960s, usually take the form of tragedies, while existential limits tend to be presented as satire.

### 3.3 Periodizing and Spatializing Energy History

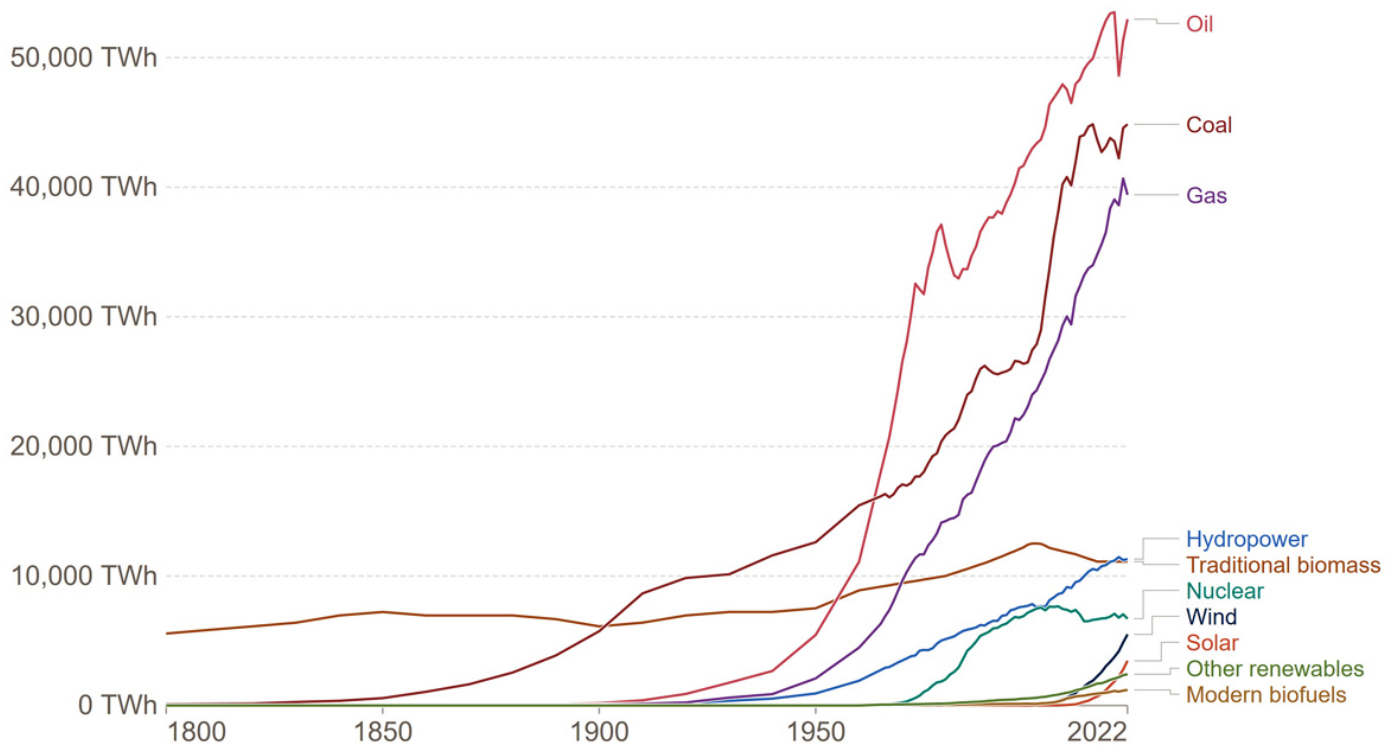
Despite many issues of controversy and debate, the overall periodization of energy history is rather uncontroversial from a material perspective: After human beings had for centuries relied on renewable forms of energy – such as biomass, wood, water, and wind – there were two “key shifts” on a global scale, as identified by Smil: first the transition to coal in the Industrial Revolution and, then, to oil and electricity in the twentieth century.[65] While new forms of primary energy substituted older forms in some areas – for example, atomic energy or natural gas partly replaced coal in the generation of electricity – it is important to note that old forms of energy remained essential, and their use even increased globally, as the following figure shows.

## Image

## Global primary energy consumption by source

Global primary energy consumption here is measured by the 'substitution' method which takes account of the inefficiencies of fossil fuel production.

Our World  
in Data



Source: Energy Institute Statistical Review of World Energy (2023); Vaclav Smil (2017)  
OurWorldInData.org/energy • CC BY

Global Primary Energy Consumption by Source. Energy Institute Statistical Review of World Energy (2023); Vaclav Smil (2017), [OurWorldInData.org](https://www.ourworldindata.org) [25.08.2023] CC BY 4.0

While underlining the crucial importance of the Great Acceleration, the figure demonstrates that energy transitions to date have predominantly involved adding new sources of energy rather than substituting one form with another.<sup>[66]</sup> It highlights that the current political project of decarbonizing the energy system and achieving a transition from fossil fuels to renewables on a global scale, commonly referred to as the *Energiewende* in German, has no historical precedent.<sup>[67]</sup>

Integrating the perspectives of production and **consumption**, Smil suggests that the period from the late nineteenth century, when the internal combustion engine began its ascent and the first electrical systems were created, to the oil crisis of 1973, was a “distinct energy era of fundamental innovations and rapid growth:”<sup>[68]</sup> This seems justified because “the twentieth century was [...] the first era dominated by fossil fuels, and the 16-fold rise of their use since 1900 created the first high-energy global civilization in human history.”<sup>[69]</sup> Whereas coal was the dominant source of fossil energy in the first half of the twentieth century, its share declined in comparison to oil, which became dominant in the second half, first in the United States and then in Europe and

worldwide.[70] As the oil price increased and oil supplies seemed threatened in the early 1970s,<sup>16 of 48</sup> industrialized countries diversified their energy supplies.[71] As a result, natural gas and atomic energy became more important, but oil still remained crucial.[72] It was not before the beginning of the twenty-first century that renewable forms of energy started to contribute significantly to the energy mix. Yet on a global scale they are still negligible, as developing economies rely heavily on fossil fuels, and industrialized countries have failed to achieve their climate targets.

To speak of a global “high-energy civilization” is reasonable, as fossil fuels power the ships, trains, trucks, and planes that have enabled processes of (economic) **globalization** while the energy economy itself globalized (see below). Accordingly, energy history has to be written from a global perspective, but it is crucial to acknowledge the vast regional differences in energy consumption that persist to this today. For most of the twentieth century, the United States led in energy consumption per capita, followed by the OECD countries and then the countries of the Eastern bloc. In 2021, however, Canada, Norway, Kuwait, Bahrain, Qatar, and the United Arab Emirates used more than 100,000 kWh per capita; the United States 76,000; Germany and France around 40,000; and China 30,000 kWh. This stands in sharp contrast to less than 7,000 kWh per capita used in India and less than 500 kWh per capita used in Niger, Chad, and Congo.[73]

Analyses of changing energy production and consumption therefore need to be regionally specific while also incorporating a global perspective. Focusing on Europe since 1500, for example, economic historians Astrid Kander, Paolo Malanima, and Paul Warde highlight the dramatic increases in energy consumption as well as energy supply shifts that have occurred over the past 200 years.[74] Distinguishing three phases, they show that from 1500 to 1800, when renewables still dominated, overall energy consumption grew very little and even decreased per capita. For the industrial age from 1800 to 1970 they discern “explosive expansion in energy use, except during the World Wars and interwar period.” Since the 1970s, however, they see a period in which energy consumption per capita has stabilized, while economic growth has continued, albeit at a lower level.[75]

To explain this pattern, they suggest that economies cluster around certain “development blocks” consisting of specific technologies and forms of energy, and that these development blocks may be either energy expanding or energy saving. They argue that the Industrial Revolution was shaped by an energy-expanding block based on coal and the steam engine, while the first two-thirds of the twentieth century were marked by an energy-expanding development block based on oil and an energy-saving development block around electricity. As the latter represents the development block of the so-called Third Industrial Revolution since the 1970s, it has been possible to decouple economic growth from growing energy consumption.[76] While illuminating with reference to Europe, this analysis does not account for the relocation of heavy industry from Europe to other



parts of the world, which has intensified since the 1970s. In general, expanding national energy sectors has been a crucial element of the economic growth strategies pursued by developing countries, further increasing global energy demand.<sup>17 of 48</sup>[77]

Apart from the overall increase in energy use, two other trends characterize energy history since the Industrial Revolution, trends that have been particularly pronounced in the twentieth and twenty-first centuries: (1) the “dematerialization” of energy in everyday life and (2) the globalization of energy networks.

With regard to the first trend: In general, human beings are not interested in consuming energy, but rather in the services energy can provide, namely heat, light, or motion. In contrast to earlier ages, fewer people need to move physical energy carriers – such as wood, wax, or coal – on a daily basis, in order to heat or illuminate their homes.[78] With electrification and central heating, flipping a switch is now sufficient. Moreover, feeding and maintaining horses is no longer required for farming or transportation. With electric vehicles, energy becomes even more abstract, as electricity is odorless and invisible, unlike the pungent and caustic fuels that run combustion engines.

The growing economic, political, and social interest in energy over the course of the twentieth century thus stands in stark contrast to the gradual disappearance of material energy carriers from everyday life. In this way, energy has become ever more invisible and intangible as society has used more and more of it. Against this backdrop, climate protection advocates have been striving to make the consequences of energy consumption visible once again.[79]

With regard to the second trend: Before the rise of fossil fuels and electricity grids, renewable forms of energy were generally used locally.[80] Wind, water, and solar energy had to be used where they were found, while only wood could be transported over long distances. While the Industrial Revolution started in places where there were large coal deposits, coal was soon transported over great distances, to supply places without coal reserves. Railways needed coaling stations and so did navies with the emergence of steam-powered ships. The globalization of energy further intensified with the rise of oil as the most important energy source. Apart from the United States and the Soviet Union, none of the major industrialized countries in the twentieth century possessed significant domestic petroleum reserves. This led to the rise of a global oil economy; at the beginning of the twenty-first century, nearly 50 countries exported and almost 150 countries imported crude oil, while gas, coal, and uranium were also traded globally.[81] As energy autarky became inconceivable for all but a few countries, “energy governance” became important not only nationally, but also in the international and global arena.[82]

## 4. Histories of Energy: Studying the Technologies, Economies, Politics, and Cultures of Production and Consumption

Historians were analyzing the history of specific energy carriers long before energy history became a research paradigm. Coal production, for example, has been an important topic in “new social history” since its emergence in the 1960s. Historians of **technology** and the **environment** interested in atomic energy have generally considered its specific problems independently from coal, oil, and renewables. Scholars of international relations and historians have analyzed the role of oil in international conflicts. Electricity generation became an autonomous subject of historiography, and not just in France, where Électricité de France sponsored large research projects. While historiographies on coal, oil, wind, water and atomic energy, as well as on electricity, often developed independently from each other, they addressed common issues of relevance for a more comprehensive approach to energy history.[83]

As energy is all-pervasive, histories of energy may be written as social, economic, political, or cultural histories. While this field of inquiry is large and multifaceted, most studies can be located primarily within one of the following three clusters, which are based on how energy flows in societies. They focus on: (1) energy production and its technological, social, or environmental dimensions; (2) the implications of energy for the economy and politics at the local, national or international levels; or (3) the social and cultural history of energy consumption.

### 4.1 Energy Production: Technology, Work, Infrastructure, and Space

How different types of energy are generated or converted for various purposes has long been a concern of the history of technology. In the domains of resource extraction and electricity generation, technological innovation is crucial, as it allows for greater quantities of energy to be converted and utilized.[84] Older histories focusing on technological innovation usually narrate these histories as success stories in which humble beginnings culminate in the latest engineering achievements; in the case of oil, for example from William Drake’s legendary first oil well in Titusville, Pennsylvania in 1859 to the technically demanding deep-sea drilling of today.[85] Moreover, they often explain energy transitions in terms of the superiority of one technology and/or source of energy over another, with a view to efficiency and material quality. As a fluid, for example, oil is easier to extract, easier to transport, and has a higher caloric value per unit of weight than coal.[86]

By contrast, many newer studies follow David Edgerton’s influential thesis of the “shock of the old,” emphasizing the persistence of older technologies and the incremental nature of change.[87] Others have been inspired by concepts of **material history** and the sociology of scientific knowledge as well as by science and technology studies that consider social and cultural aspects

of energy production.[88] In her work on atomic energy in France, for example, Gabrielle Hecht<sup>19 of 48</sup> demonstrates how even highly technical questions, such as the decision between different types of reactors, depended on social factors as well as cultural values among the designing engineers.[89]

The traditional perspective taken by the history of technology has been prominent in the historiography of the renewables, as well, which focuses, among other things, on the political and infrastructural factors that contributed to or (more frequently) prevented the adoption of wind, water, and solar power. As Thomas Hughes has shown in his seminal study of electrification in Europe and the United States, a complex interplay of technological, political, legal, economic, and social factors led to the construction of large electricity networks that were supplied by large, centralized power plants.[90] These large technopolitical systems created path dependencies that encouraged the construction of atomic power plants but for a long time prevented the rise of wind energy.[91]

More recently, scholars have emphasized the importance of **infrastructure** for the history of all types of energy.[92] For example, Christopher Jones showed how the construction of canals, pipelines, and electric grids in the US between 1830 and 1920 shaped the transition to a high-energy society, which then became self-reinforcing: “As people reconstructed their built environments around these energy landscapes, they began to depend on continuous supplies of mineral energy. By the turn of the twentieth century, dense clusters of homes and factories in cities like Philadelphia and New York could no longer be supported with organic energy sources.”[93] Hence, the history of energy production to some extent converges with the history of large-scale infrastructure projects, which require large financial investments and often bring together public and private actors.[94] As pipelines frequently cross national borders, and thus have political implications, their construction has received particular scholarly attention.[95]

Once in place, energy infrastructures shape the environment as well as economic and social opportunities. Their often adverse consequences for local populations and influences on the distribution of power have recently been discussed under the label of “extractivism,” particularly with a view to Latin America.[96] Due to the importance of coal miners and their strikes for the rise of the workers’ movement and Social Democracy, mining has formed an important subject in social history.[97] However, research in this vein has not been directed at coal as a form of energy but rather at other aspects of coal production, including working and living conditions, the politicization of the miners, the relationship between large coal companies and the state, and, more recently, political, social, and environmental processes following the closure of mining sites.[98]

In a controversial study, the political scientist Timothy Mitchell offers a divergent perspective, arguing that coal, by virtue of its physical attributes, actually empowered workers, thus laying the

foundation for mass democracies. However, these mass democracies were then undermined by the rise of oil. The production of coal required a larger workforce, and the associated subterranean working conditions fostered the formation of collective identities. Oil, by contrast, often flowed naturally from the ground; the nature of oil as a fluid diminished workers' opportunities to interrupt the production process and exert political pressure: "Whereas the movement of coal tended to follow dendritic networks, with branches at each end but a single main channel, creating potential choke points at several junctures, oil followed along networks that often had the properties of a grid, like an electricity network, where there is more than one possible path and the flow of energy can switch to avoid blockages or overcome breakdowns."<sup>[99]</sup> While the factual accuracy of Mitchell's theses on "Carbon Democracy" has been criticized from various perspectives, his ideas have nevertheless been instructive for newer studies examining how different forms of energy production influence political mobilization and associated structures, a point to which I will return in the next section.<sup>[100]</sup>

Historians have also examined the effects of energy production on local populations and environments.<sup>[101]</sup> For example, the construction of dams to produce hydroelectricity, which boomed worldwide in the middle of the twentieth century, not only changed landscapes dramatically, but also had environmental and social costs, often triggering local protests.<sup>[102]</sup> Similarly, at first, the construction of nuclear power plants was considered a local environmental problem that called forth NIMBY protests ("not in my backyard"), not unlike the construction of wind farms today.<sup>[103]</sup> It was only later that the anti-nuclear power movement emerged, which drew attention to its regional and even global risks. This, in turn, influenced historiographical engagement with nuclear energy.<sup>[104]</sup> Histories of coal mining and oil production have also emphasized the often devastating local environmental and social effects that have ensued following the discovery of economically viable coal or oil reserves, while also chronicling the bust that can occur following their depletion.<sup>[105]</sup>

While not denying the social and environmental costs of coal and oil extraction in Europe and the United States, the literature suggests that the negative consequences of energy production have been much more severe in other parts of the world.<sup>[106]</sup> The Chernobyl nuclear disaster stands out as a particularly well-researched human and ecological catastrophe.<sup>[107]</sup> Conflicts surrounding oil production in Nigeria, which culminated in the conflict between the indigenous Ogoni people and Shell in the 1990s, is yet another case of resource extraction that has received extensive public and scholarly attention.<sup>[108]</sup> In other African and Latin American countries similar developments have produced an activist historiography that criticizes the politics and economics of "extractivism" on both ecological and moral grounds.<sup>[109]</sup> Moreover, there is a wealth of regional studies looking at the effects of mineral resource exploration and energy production in many countries and areas.<sup>[110]</sup> Apart from the academic literature, more recently there has been a surge in artistic

engagement with the environmental and social costs of energy production in general, and oil<sup>21</sup> of 48 production in particular. This has even ushered in a literary genre of its own, aptly labeled petro-fiction.[111]

Image



Environmental Degradation in Nigeria. Photographer: Ucheke, Nigeria, 30. May 2019. Source: [Wikimedia Commons](#) [25.08.2023] CC BY-SA 4.0

## 4.2 The Economic and Political Dimensions of Energy

As wind and solar energy have become important in the energy mix of industrial societies only recently, **economic** and business historians have predominantly focused to date on electricity, coal, and oil companies. In general, the history of mining has been written mostly from the perspectives of social, economic, and business history.[112] By way of example, Henning Türk and Stephen Gross recently examined the history of West German energy use in the second half of the twentieth century, which saw the decline of coal and a corresponding rise in oil, despite the lack of a significant domestic oil industry.[113] There has also been a long-standing interest in the history of the major oil companies, the so-called seven sisters, due to their economic prowess as well as

scandals related to corruption and illegal business practices. These companies have only recently<sup>22 of 48</sup> granted limited access to their archival resources.[114]

With respect to both coal and oil, however, research has concentrated on the relationship between public and private actors – or, more specifically, on national security and private economic interests.[115] Due to the nationalization of coal production in Britain and France as well as the creation of the European Community of Coal and Steel after the Second World War, the history of coal is deeply connected to the political history of Europe and **European integration** in the second half of the twentieth century.[116] Moreover, the historiography of electricity, which had illuminated the complex interplay between state and private actors that gave rise to large networks at the beginning of the twentieth century, examined the nationalization as well as deregulation of electricity production after 1945.[117] It has analyzed the global spread and the transnational integration of electricity networks and their importance for economic exchange.[118]

States and international institutions played a pivotal role in the development of nuclear energy not only because it had extremely high production costs, but also because it could be used for civilian and military purposes. The associated risks were thus enormous, and could not be borne exclusively by private companies.[119] In the wake of the US Atoms for Peace initiative, governments developed research reactors; EURATOM controlled the use of nuclear energy use in Western Europe; and the International Atomic Energy Agency (IAEA) monitored it worldwide.[120] Early criticism of the “Atomic State” led historians to scrutinize the political history of atomic power in Germany and the world.[121] In France, the use of nuclear energy was deeply connected to the attempt to restore French power and prestige after 1945, but received less criticism.[122]

Moreover, the social movement against the use of atomic power has received considerable scholarly attention, particularly with a view to Germany. Scholars have explored the extent to which this movement not only gave the rise of the Green party but also transformed politics, reconfiguring relationships between citizens, experts, and the state.[123] There has also been a strong interest in the history of nuclear accidents and catastrophes.[124] In comparison, literature on renewable energy is still rather limited, though increasing.[125] Motivated in part by the desire to explain the recent politics of the *Energiewende* (energy transition), this strand of the literature has concentrated on the political conditions necessary for expanding wind and solar energy.[126]

While states, international organizations, and protest movements have been key players in the history of nuclear energy, historians have also analyzed the effects that other forms of energy have had on domestic as well as international politics. Apart from Timothy Mitchell’s already mentioned thesis on “Carbon Democracy,” there has been a long debate among political and social scientists on the political impacts that result from national economies relying heavily on energy resource extraction. The popular “resource” or “oil curse” thesis suggests that governments depending on

the export of a single resource – particularly oil – for their revenues not only encounter economic problems but also tend to be less democratic and egalitarian domestically, preventing emancipation, and more belligerent internationally.[127] Political scientist Michael L. Ross, for example, expresses this thesis as follows: “Since about 1980, oil-producing countries in the developing world have become less democratic and more secretive than similar states without oil. These countries have grown more likely to suffer from violent insurgencies, and their economies have provided women with fewer jobs and less political influence ... [M]ost have not grown as quickly as they should, given their natural resource wealth.”[128] By contrast, newer studies on oil production in Latin America have shown how oil resources may also foster democratic practices, encouraging both left-wing resource nationalism and grass-roots anti-extractivism.[129]

With respect to energy and international relations in the twentieth and twenty-first centuries, oil has been of primary importance. After the Royal Navy switched from coal to oil, and with the emergence of aerial and tank warfare in the First World War, it became obvious that without sufficient oil supplies, it would be impossible to wage war. This fact, in combination with oil’s rising importance for national economies over the course of the twentieth century, compelled many scholars to argue that oil was the most important strategic commodity, one that decided both outbreak and outcomes of major wars.[130] Historical narratives that ascribe to oil an all-determining role have been met with justified criticism.[131] Yet it may be no coincidence that the European powers of the nineteenth century had no significant oil reserves at their disposal, in sharp contrast to the two countries that dominated the twentieth century, namely the United States and Soviet Union.[132] While the **Cold War** was an ideological, political, and economic conflict between the superpowers, and this conflict was partially defined by nuclear weapons, many historians emphasize the important role played by oil in its development.[133] During the Cold War, however, energy was not a crucial instrument of confrontation, but rather flowed with surprising ease across the so-called Iron Curtain, as a recent historiography on the East–West energy trade has shown.[134]

Beyond the conflict of the Cold War, oil played an essential role in the process of decolonization as well as in the ensuing so-called “North-South conflict,” as newly independent countries demanded “permanent sovereignty over their natural resources” at the United Nations in the 1960s.[135] Founded in 1960, OPEC was the first international organization that lacked any members who were great powers in the nineteenth century, but which nevertheless was successful in confronting the “West” or “North.”[136] Despite its loss of power since the 1980s, OPEC remains an influential international player, arguably even more important than other international organizations dedicated to energy, such as the IAEA, IEA, or International Renewable Energy Agency.[137]

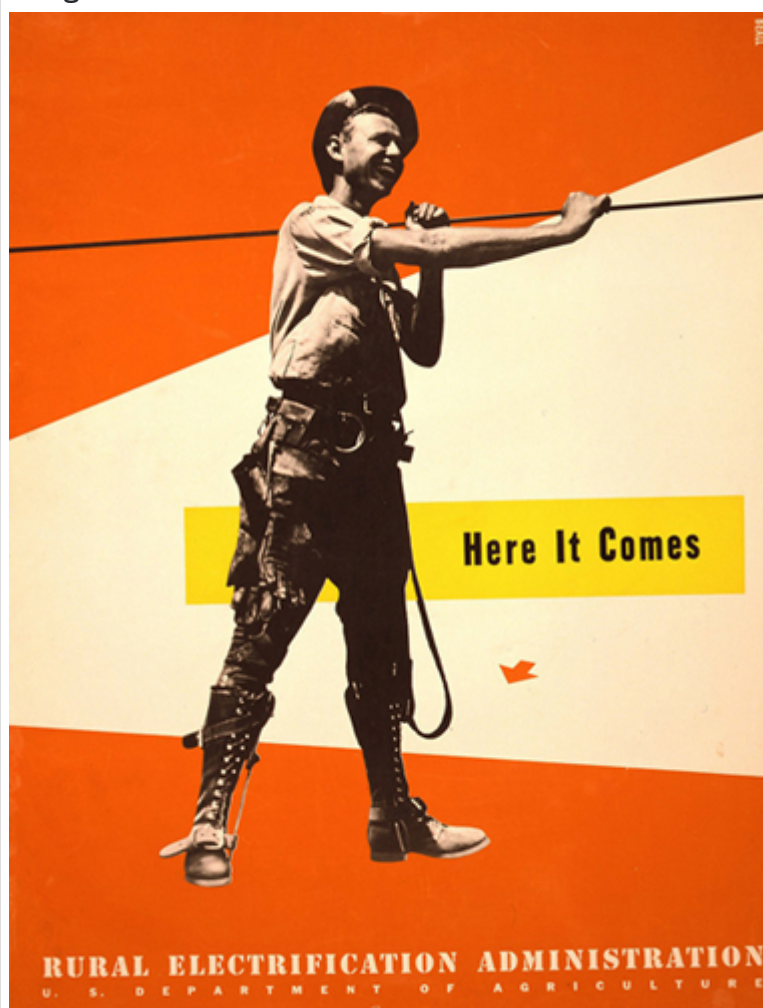
In terms of periodization, studies on the political and economic history of energy emphasize the crucial importance of the 1970s as the “energy decade.”<sup>24 of 48</sup>[138] After the unprecedented increases in energy and especially oil consumption experienced in the preceding decades, the energy crises in the wake of the actions by OPEC and OAPEC (Organization of Arab Petroleum Exporting Countries) in 1973 and the Iranian Revolution in 1979, together with the controversies surrounding nuclear energy, led to the emergence of new energy policies, first in industrialized countries, and then worldwide.[139] After previously pursuing policies dedicated to a specific source of energy – whether nuclear, coal, electricity or oil – governments now tried to develop comprehensive energy policies; to this end, they concentrated governmental competences, sometimes forming departments of energy. This institutional centralization of energy policy in the face of energy crises laid a crucial foundation for the more recent attempts to achieve an energy transition or “Energiewende” away from fossil fuels and toward renewables.

### 4.3 Social and Cultural Histories of Energy Consumption

During the energy crises of the 1970s, sociologists, political scientists, and anthropologists sought to recalibrate the discussion concerning energy and society. They emphasized that, although the concept of energy had been derived from physics, supplying modern societies with energy was by no means merely a technological problem that could be solved by engineers and scientists alone.[140] In their view, energy transitions required a change in the broader socio-technological system. Hence, they could not be fully understood in terms of energy sources and technologies. Rather, human attitudes and behavior had to be taken into consideration.[141] In line with this argument, the historiography of energy has long moved away from narrow histories of technological and quantitative accounts of material change toward broader social and cultural histories of energy use. While older histories of technology mainly focused on the production and conversion of energy, the advance of social and cultural history has shifted the interest toward consumption.



Image



Electrification: "Here it comes". Poster: Rural Electrification Administration, U.S. Department of Agriculture, USA 1930-1940. Graphic Designer: Lester Beall. Source: Library of Congress / Wikimedia Commons [25.08.2023] public domain

With regard to the United States, which for a long time was the most energy intensive society in human history, David Nye has shown how increasing energy consumption, particularly in the form of electricity and gasoline, transformed virtually every aspect of work and private life, as well as social and cultural imagination.<sup>[142]</sup> "In a single lifetime between 1880 and 1940," he argues, "the process of electrification transformed the landscapes of the city, factory, home, and farm. Americans built electrical devices into their lives, and [...] social reality by definition became electrified."<sup>[143]</sup> From the 1920s to the 1970s, electricity consumption nearly doubled every decade. In the United States and elsewhere, electricity was not only seen as a means of making life more comfortable, of providing light and heat, but was also imbued with almost utopian hopes, with the allure and promise of modernity.<sup>[144]</sup> Lenin, too, famously defined communism in 1920 as "Soviet power plus the electrification of the whole country."<sup>[145]</sup>

Image



Lenin and Electrification. Graphic Designers: Y. Shass and P. Kobelev.  
 Russia 1925. Source: [PropagandaHistory.ru](http://PropagandaHistory.ru) [25.08.2023] public domain

The supply of electricity and natural gas to households even transformed intimate practices of bodily hygiene. As Nina Lorkowski has shown in her examination of Berlin, the emergence of the bathroom and the change from the weekly bath to the more or less daily shower was deeply connected to the economic strategies of local electricity and gas providers.<sup>[146]</sup> The multiplication and spread of electric appliances, especially during the postwar economic boom, thoroughly changed housework and other domestic tasks.<sup>[147]</sup> While it is still a matter of debate if and in how far these developments affected gender relations, and whether they were driven by supply or demand, it has been established that increases in the energy efficiency of appliances did not

generally lead to decreases in energy consumption. According to the Jevons paradox, also known<sup>27 of 48</sup> as the “rebound effect,” increases in efficiency encouraged people to buy additional and ever-larger appliances.[148]

The second fundamental transformation of work and everyday life over the course of the twentieth century was based on the cheap and abundant availability of oil and its various products. The abundant availability of gasoline and diesel enabled the era of mass motorization, which started in the United States in the interwar period, before spreading to Western Europe and then to Eastern Europe and the rest of the world in the second half of the twentieth century.[149] Both the suburbanization of the postwar decades and the emergence of new consumption patterns, along with intensifying economic globalization, were possible because “multiple sources of energy were all in oversupply.”[150] Whereas older histories have described suburbanization and mass car ownership as almost natural processes caused by the attraction of the single family home and private vehicle, newer studies emphasize the role of economic and political actors in the destruction of public transport systems in the United States as “the most massive example of a technological and civilizational choice that is profoundly suboptimal and harmful.”[151]

Due to the all-pervasiveness of first coal and then petroleum and its products in modern, mobile lifestyles and consumption patterns, some historians describe the industrial societies of the twentieth century as “hydrocarbon societies.” Franz-Josef Brüggemeier, for example, starts his history of coal asserting that coal made the world we live in, that European **modernity** was deeply shaped by coal, and that the last 250 years can aptly be described as the “age of coal.”[152] Similarly, while focusing on oil, Daniel Yergin suggested in 1990: “It is oil that makes possible where we live, how we live, how we commute to work, how we travel – even where we conduct our courtships. It is the lifeblood of suburban communities. Oil (and natural gas) are the essential components in the fertilizer on which world agriculture depends; oil makes it possible to transport food to the totally non-self-sufficient megacities of the world. Oil also provides the plastics and chemicals that are the bricks and mortar of contemporary civilization.”[153]

Describing the United States as a “Carbon Nation,” Bob Johnson has drawn attention to an irony of the epoch, in which a “flood of prehistoric carbon calories” impresses “itself in both conscious and unconscious ways on the modern body and mind, on our ways of being and knowing, and sensing in the world as Americans of different classes, races, genders.”[154] The literary scholar Stephanie LeMenager interprets US cultural production in the twentieth and twenty-first centuries as a “petroleum culture” that is dominated by “objects derived from petroleum that mediate our relationship, as humans, to other humans, to other life, and to things.”[155] With an even broader scope, the Canadian “Petrocultures” study group suggests that oil is the “fulcrum around which many of today’s most pressing social, economic, and political issues must be analyzed and

understood.”[156] One scholar even sees a specific “petromasculinity” at work in the recent rise of authoritarian leaders.[157]

## 5. Conclusion: Energy as a Historiographical Object and Analytical Category

How should historians deal with these general claims? Energy is even more pervasive than specific energy carriers such as coal or oil; every human action can be described in terms of energy, and every important social process is somehow connected to the most dominant sources of energy. Hence, constructions such as the “Age of Coal,” “Hydrocarbon Societies,” or “Petrocultures” are intuitively plausible. Energy history seems to turn easily into a history of everything. However, the fact that everything is connected to energy does not mean that energy necessarily furnishes the best starting-point for its historiographical interpretation. Human beings need oxygen to survive and without a sufficient supply thereof, there could be no society or economy. However, it would not be particularly illuminating to interpret economic, social, or political processes through the lens of oxygen. The case for energy is different, as its use is intimately connected to processes of economic growth, social mobilization, and political conflict – arguably more intimately than any other natural resource, be it even as indispensable as water. Yet in order to develop a meaningful historiographical argument, we still have to establish why a specific form of energy production or consumption was relevant for a particular social, political, economic, or cultural development.

At the very least, the energy perspective may be useful in creating a “distancing” or “alienation effect” (“Verfremdungseffekt”) presenting well-known facts in a new light, for example when the energy provided by petroleum is likened to “human slaves.”[158] More generally, interpreting the way we live through the lens of the energy we use provides a new understanding of our life-world, in which even the seemingly most mundane activity can be related in a meaningful way to economic and political processes at different scales – from the local up to the global, and even to the planetary. This seems to have been hard to conceive in the decades when fossil fuels were cheap and abundant while the consequences of burning them did not seem worrisome. Following the geographer Andreas Malm, Melissa Büttner and Matthias Schmelzer even ask if this historically unique predicament created specific “fossil mentalities,” in which economic growth is conceived as unlimited.[159] Energy emerged as an important political and social category only when prices rose and its abundance seemed threatened in the 1970s. The concept flourished in historiography after scientists had established that the increasing use of fossil fuels was changing the climate system and would dramatically worsen living conditions worldwide.

In the face of these profound changes in the world, it seems to be problematic to neglect energy in our scholarly attempts to understand processes of **modernization**, as most historians did prior to the formation of the IPCC. While there is a certain political and historiographical longing for the

boom decades when prosperity rose, welfare states expanded, and emancipatory movements emerged, climate change puts the alleged Golden Age in a much gloomier light. Moreover, it questions emancipatory historiographies that subscribed to ideas of social progress and human freedom while neglecting energy. As Dipesh Chakrabarty critically observed, “the mansion of modern freedoms stands on an ever-expanding base of fossil-fuel use. Most of our freedoms so far have been energy-intensive.”<sup>[160]</sup> Insofar as the energy intensity of these freedoms leads to planetary collapse, we should seriously reconsider the emancipatory quality of the histories we have told so far.

In line with these thoughts, and considering the well-established importance and all-pervasiveness of energy, we may ask whether energy describes a subfield or an analytical category of historiography. More specifically, is energy an indispensable category of historical analysis, as has been suggested for **class**, race, gender, and **disability**? At first sight, energy differs from such categories, as it is not used to structure and describe social inequalities. Yet many of these inequalities may easily be reconceived with reference to the use of energy resources. To be sure, both the capitalist and socialist states of the “Global North” have done much more to damage the planet than the “Global South,” and the owners of large houses and cars, not to mention of private jets and yachts, consume much more energy, and correspondingly produce more carbon emissions, than those who have less.

However, answering the question whether energy is an indispensable historiographical category depends on extra-historiographical assumptions and convictions. The same is true for race, class, and gender. Historians arguing that one of these categories is essential in any historical analysis are usually working in pursuit of a political goal, e.g. to combat social inequality, gender hierarchy, or racism. If one is not pursuing such emancipatory goals, integrating race, class, or gender perspectives into one’s analysis would appear optional and dependent on the topic in question. Similarly, the necessity of incorporating energy into our analyses of political, economic, social, and cultural history (at least) since the Industrial Revolution depends on how serious we take climate change as a problem. But, even if we agree that we live in the **Anthropocene** and that global warming is the largest threat faced by societies worldwide, this does not mean that we all have to write energy history. Yet, when the dire predictions concerning impending climate catastrophe come true, many of our histories of the present and its more recent past that failed to reflect on energy issues may look grotesquely incomplete and hopelessly outdated.

- [1] See Anson Rabinbach, *The Human Motor: Energy, Fatigue, and the Origins of Modernity* (Berkeley: Univ. of California Press, 1990); Wilhelm Ostwald, *Energetische Grundlagen der Kulturwissenschaft* (Leipzig: Klinkhardt, 1909); Robert Bruce Lindsay (ed.), *Energy: Historical Development of the Concept* (Stroudsburg, Pa: Dowden, Hutchinson & Ross, 1975); Cara New Daggett, *The Birth of Energy: Fossil Fuels, Thermodynamics, and the Politics of Work* (Durham, NC: Duke University Press, 2019).
- [2] See Joachim Radkau, *Die Ära der Ökologie: Eine Weltgeschichte* (München: Beck, 2011); Patrick Kupper, “Die ‘1970er Diagnose’. Grundsätzliche Überlegungen zu einem Wendepunkt der Umweltgeschichte,” in: *Archiv für Sozialgeschichte* 43 (2003), 325–348, online [https://zeithistorische-forschungen.de/sites/default/files/medien/material/2012-1/Kupper\\_2003.pdf](https://zeithistorische-forschungen.de/sites/default/files/medien/material/2012-1/Kupper_2003.pdf) [25.08.2023].
- [3] See John Robert McNeill, *Something New Under the Sun: An Environmental History of the Twentieth-Century World* (London: Penguin Books, 2001); Thomas Parker Hughes, *Networks of Power: Electrification in Western Society, 1880-1930* (Baltimore: John Hopkins Univ. Press, 1993).
- [4] See, e.g., Anthony Giddens, *The Politics of Climate Change* (2nd ed., Cambridge: Polity Press, 2011); Dipesh Chakrabarty, “The Climate of History. Four Thesis,” in: *Critical Inquiry* 35/2 (2009), 197–222; Franz Mauelshagen/Christian Pfister/Sam White (eds.), *The Palgrave Handbook of Climate History* (London: Palgrave Macmillan, 2018).
- [5] See the new *Journal of Energy History* and for an overview: Geneviève Massard-Guilbault, “From the History of Sources and Sectors to the History of Systems and Transitions. How the History of Energy Has Been Written in France and Beyond,” in: *Journal of Energy History* 1 (2018), 2, online [https://www.energyhistory.eu/sites/default/files/pdf/06\\_%20From%20the%20history%20of%20sources\\_0.pdf](https://www.energyhistory.eu/sites/default/files/pdf/06_%20From%20the%20history%20of%20sources_0.pdf) [25.08.2023]; Stephen Gross/Andrew Needham, “Toward a New Energy History,” in: Stephen Gross/Andrew Needham (eds.), *New Energies. A History of Energy Transitions in Europe and North America* (Pittsburgh: University of Pittsburgh Press, 2023), pp 3–24.
- [6] Imre Szemmann/Dominic Boyer (eds.), *Energy Humanities. An Anthology* (Baltimore: Johns Hopkins University Press, 2017).
- [7] Massard-Guilbault, “From the History of Sources,” 2.
- [8] See, e.g., Paul J. Crutzen, “Geology of Mankind,” in: *Nature* 415 (2002), 23, <https://www.nature.com/articles/415023a> [25.08.2023]; Christophe Bonneuil/Jean-Baptiste Fressoz, *The Shock of the Anthropocene: The Earth, History and Us* (London/New York: Verso, 2017); Jürgen Renn, *Die Evolution des Wissens: Eine Neubestimmung der Wissenschaft für das Anthropozän*, (Berlin: Suhrkamp, 2022).
- [9] Jason W. Moore (ed.), *Anthropocene or Capitalocene? Nature, History, and the Crisis of Capitalism*

[10] “Energy,” in: *The Encyclopaedia Britannica. A Dictionary of Arts, Sciences, Literature and General Information*, 29 vols. (Cambridge, 1910), 398; see Ernst Müller, “Energie,” in: Annika Hand/Christian Bermes/Ulrich Dierse (eds.), *Schlüsselbegriffe der Philosophie des 19. Jahrhunderts, Archiv für Begriffsgeschichte, Sonderheft 11* (2014), 127–143.

[11] See Müller, “Energie,” 134.

[12] See Daggett, *The Birth of Energy*; Jeremy Walker, *More Heat Than Life: The Tangled Roots of Ecology, Energy, and Economics* (Singapore: Springer Singapore Pte. Ltd., 2020); Marco P. Vianna Franco/Antoine Missemmer, *A History of Ecological Economic Thought* (Milton: Taylor & Francis Group, 2023); Rabinbach, *The Human Motor*.

[13] “Energie,” in: *Meyers Großes Konversations-Lexikon*, 24 vols. (6. Aufl., Leipzig/Wien, 1908), 774–781, here 774; “Energetics,” in: *The Encyclopaedia Britannica. A Dictionary of Arts, Sciences, Literature and General Information*, 29 vols. (Cambridge, 1910), 390–398; “Energy,” in: *Encyclopaedia Britannica. A New Survey of Universal Knowledge*, 30 vols. (14.th ed., London, New York, 1929), 437–440; “Energie,” in: *Meyers Lexikon*, 12 vols. (7th ed., Leipzig, 1925), 1619–1625.

[14] “Energie,” in: *Brockhaus Enzyklopädie*, 24 vols. (20th ed., Leipzig/Mannheim, 1996–2001), 366–367, here 366; “Energy Sources,” in: *The New Encyclopaedia Britannica. Knowledge in Depths* (Chicago 1973), 854–858; “Energy Conversion,” in: *The New Encyclopaedia Britannica. Knowledge in Depths* (Chicago, 1997), 332–413.

[15] “Energiewirtschaft,” in: *Brockhaus Enzyklopädie*, 24 vols. (20th edn., Leipzig/Mannheim, 1996–2001), 374–375, here 375.

[16] See Rebecca Wright/Hiroki Shin/Frank Trentmann, *From World Power Conference to World Energy Council: 90 Years of Energy Cooperation, 1923–2013* (London: Regency House, 2013), 7, online <https://www.worldenergy.org/assets/downloads/A-Brief-History-of-the-World-Energy-Council.pdf> [25.08.2023]; C. von Gruenewaldt, *Die I. Welt-Kraft-Konferenz zu London: Bericht des Sonderberichterstatters der “Wasserkraft”* (München: Richard Pflaum, 1924).

[17] Giancarlo Vallauri, “Elektrizität und Energie,” in: *Gesamtbericht zweite Weltkraftkonferenz* (Berlin 1930), 40–51, here 40.

[18] Wright/Shin/Trentmann, *From World Power Conference to World Energy Council*, 8.

[19] See Daniela Russ, “Speaking for the ‘World Power Economy’: Electricity, Energo-Materialist

Economics, and the World Energy Council (1924-78),” in: *Journal of Global History* 15 (2020), no. 2,<sup>32 of 48</sup> 311–329, here 320, online [http://danielaruss.net/wp-content/uploads/2020/08/speaking\\_for\\_the\\_world\\_power\\_economy\\_electricity\\_energomaterialist\\_economics\\_and\\_the\\_world](http://danielaruss.net/wp-content/uploads/2020/08/speaking_for_the_world_power_economy_electricity_energomaterialist_economics_and_the_world) [25.08.2023].

[20] “Energie,” in: *Meyers Großes Konversations-Lexikon*, 24 vols. (6. Aufl., Leipzig/Wien, 1908), 774–781.

[21] “Energie,” in: *Der große Brockhaus in zwölf Bänden* (16th edn., Wiesbaden, 1952-1957), 557–558.

[22] “Energiewirtschaft,” in: *Der große Brockhaus in zwölf Bänden* (16th edn., Wiesbaden, 1952-1957), pp. 559–5560, here 559.

[23] “Energiewirtschaft,” in: *Brockhaus Enzyklopädie*, 20 vols. (Wiesbaden, 1966-1981), 513–514, here 513.

[24] “Energiewirtschaft,” in: *Brockhaus Enzyklopädie*, 24 vols. (20th edn., Leipzig/Mannheim, 1996-2001), 374–375, here 374.

[25] See OEEC Oil Committee, *Europe's Need for Oil: Implications and Lessons of the Suez Crisis* (Paris: Organisation for Economic Co-operation and Development, 1958).

[26] Rüdiger Graf, *Oil and Sovereignty: Petro-Knowledge and Energy Policy in the United States and Western Europe in the 1970s* (New York: Berghahn, 2018).

[27] “Energiepolitik,” in: *Meyers Enzyklopäisches Lexikon*, 25 vols. (9th ed., Mannheim, Wien, Zürich, 1971–1974), 776–767, here 776; “Energiepolitik,” in: *Brockhaus Enzyklopädie*, 20 vols. (Wiesbaden, 1966-1981), 511–512; “Energy Sources,” in: *The New Encyclopaedia Britannica. Knowledge in Depths* (Chicago 1973), 854–858; “Energy Conversion,” in: *The New Encyclopædia Britannica. Knowledge in Depths*, 30 vols. (Chicago, 1987), 448–548.

[28] Rüdiger Graf, “Between ‘National’ and ‘Human Security.’ Energy Security in the United States and Western Europe in the 1970s,” in: *Historical Social Research* 35 (2010), no. 4, 329–348.

[29] Bundesministerium für Wirtschaft und Energie (ed.), *Die Energie der Zukunft: Zweiter Fortschrittsbericht zur Energiewende. Berichtsjahr 2017* (Berlin: BmWi, 2019), [https://www.bmwi.de/Redaktion/DE/Publikationen/Energie/zweiter-fortschrittsbericht-zur-energiewende.pdf?\\_\\_blob=publicationFile&v=20](https://www.bmwi.de/Redaktion/DE/Publikationen/Energie/zweiter-fortschrittsbericht-zur-energiewende.pdf?__blob=publicationFile&v=20) [25.08.2023].

[30] See World Bank, *Energy in the Developing Countries* (Washington, 1980); Henning Türk, “Reducing Dependence on OPEC-Oil. The IEA's Energy Strategy between 1976 and the mid-1980s,” in: Duccio Basosi/Giuliano Garavini/Massimiliano Trentin (eds.), *Counter-Shock. The Oil Counter-*



- [31] See Vianna Franco/Missemer, *A History of Ecological Economic Thought*; Robert M. Solow, “Richard T. Ely Lecture: The Economics of Resources or the Resources of Economics,” in: *The American Economic Review* 64 (1972), no. 2, 1–14; Bertram Schefold, “Energy and Economic Theory,” in: *Zeitschrift für Wirtschafts- und Sozialwissenschaften* 97 (1977), no. 3, 227–249; Herman E. Daly/Alvaro F. Umana (eds.), *Energy, Economics, and the Environment: Conflicting Views of an Essential Relationship* (AAAS selected symposium, 64, Boulder, Col.: Westview Pr., 1981).
- [32] John M. Gowdy, “Energy,” in: *International Encyclopedia of the Social Sciences* (2nd ed., Detroit, 2008), 587–588; Faye Duchin, “Energy Sector,” in: *International Encyclopedia of the Social Sciences* (2nd ed., Detroit, 2008), 591–592; David Walls, “Energy Industry,” in: *International Encyclopedia of the Social Sciences* (2nd ed., Detroit, 2008), 588–591.
- [33] Peter Koslowski, “Energie,” in: Görres Gesellschaft (ed.), *Staatslexikon. Recht, Wirtschaft, Gesellschaft* (7. Aufl., Freiburg/Basel/Wien, 1986), 247–253, here 249.
- [34] Daniel Bell, *The Coming of Post-Industrial Society: A Venture in Social Forecasting* (New York: Basic Books, 1973).
- [35] See Dolores Greenberg, “Energy, Power, and Perceptions of Social Change in the Early Nineteenth Century,” in: *American Historical Review* 95 (1990), no. 3, 693–714; Vianna Franco/Missemer, *A History of Ecological Economic Thought*.
- [36] Eugene A. Rosa/Gary E. Machlis/Kenneth M. Keating, “Energy and Society,” in: *Annual Review of Sociology* 14 (1988), 149–172, here 150.
- [37] See Ostwald, *Energetische Grundlagen der Kulturwissenschaft*; Frederick Soddy, *Matter and Energy* (New York: Henry Holt and Company; London; Williams and Norgate, 1912); Frederick Soddy, *Cartesian Economics: The Bearing of Physical Science upon State Stewardship* (London: Hendersons, 1922).
- [38] See Richard Newbold Adams, “Man, Energy, and Anthropology. I Can Feel the Heat, but Where's the Light?,” in: *American Anthropologist* 80 (1978), no. 2, 297–309; Rüdiger Graf, “Von der Energievergessenheit zur theoretischen Metonymie. Energie als Medium der Gesellschaftsbeschreibung im 20. Jahrhundert,” in: Hendrik Ehrhardt/Thomas Kroll (eds.), *Energie in der modernen Gesellschaft. Zeithistorische Perspektiven* (Göttingen: Vandenhoeck & Ruprecht, 2012), 73–92.
- [39] H. Almers u.a., “Energiebilanz. Grundsätze für Aufstellung und Auswertung,” in: Institut für Energetik (ed.), *10 Jahre Institut für Energetik, 1953-1963*, Festschrift zum 10-jährigen Bestehen des

[40] See International Energy Agency <https://www.iea.org/data-and-statistics/data-sets> [25.08.2023].

[41] Leslie A. White, *The Science of Culture: A Study of Man and Civilization* (New York: Grove Press, 1949), 369.

[42] W. Fred Cottrell, *Energy and Society: The Relationship between Energy, Social Change, and Economic Development* (New York: Mc-Graw-Hill Book Company, 1955). For a critique of the focus on energy consumption per capita see: Bonneuil/Fressoz, *The Shock of the Anthropocene*, p. 106: “What we lack is a history of energy services, which would show the energy actually used by different classes of consumers.”

[43] See Graf, *Oil and Sovereignty*.

[44] William B. Kemp, “The Flow of Energy in a Hunting Society,” in: *Scientific American* 225 (1971), no. 3, 104–115; Roy A. Rappaport, “The Flow of Energy in an Agricultural Society,” in: *Sci Am* 225 (1971), no. 3, 116–132; Earl Cook, “The Flow of Energy in an Industrial Society,” in: *Sci Am* 225 (1971), no. 3, 134–147.

[45] “Energetisierung,” in: *Meyers Neues Lexikon in achtzehn Bänden* (Leipzig, 2<sup>1972</sup>), 265; Wilhelm Riesner/Werner Sieber (eds.), *Wirtschaftliche Energieanwendung* (Leipzig: Deutscher Verlag für Grundstoffindustrie, 2<sup>1981</sup>); Daniela Russ, “‘Socialism is not just Built for a Hundred Years’: Renewable Energy and Planetary Thought in the Early Soviet Union (1917–1945),” in: *Contemporary European History* 31 (2022), no. 4, 491–508, online <https://www.cambridge.org/core/services/aop-cambridge-core/content/view/CA62022B93AA99B939AED582B43E8520/S0960777322000431a.pdf/socialism-is-not-just-built-for-a-hundred-years-renewable-energy-and-planetary-thought-in-the-early-soviet-union-19171945.pdf> [25.08.2023].

[46] Robert C. Allen, *Farm to Factory: A Reinterpretation of the Soviet Industrial Revolution* (Princeton: Princeton University Press, 2003); Jeronim Perović, *Rohstoffmacht Russland: Eine globale Energiegeschichte* (Köln: Böhlau, 2022); R. W. Davies/Mark Harrison/Stephen G. Wheatcroft (eds.), *The Economic Transformation of the Soviet Union: 1913–1945* (Cambridge: Cambridge Univ. Press, 1994); Rainer Karlsch, “Energie- und Rohstoffpolitik,” in: Dierk Hoffmann (ed.), *Die zentrale Wirtschaftsverwaltung in der SBZ/DDR. Akteure, Strukturen, Verwaltungspraxis* (Wirtschaftspolitik in Deutschland 1917–1990, Band 3, Berlin: De Gruyter Oldenbourg, 2016), pp. 249–362.

[47] See Karin Zachmann, “Past and Present Energy Societies. How Energy Connects Politics, Technologies and Cultures,” in Nina Möllers/Karin Zachmann (eds.), *Past and Present Energy Societies. How Energy Connects Politics, Technologies and Cultures* (Bielefeld: Transcript, 2012), pp.

7–41, online <https://doi.org/10.14361/transcript.9783839419649.7>



[25.08.2023]; George Basalla, “Energy and Civilization,” in: Chauncey Starr/Philip C. Ritterbush (eds.), *Science, Technology and the Human Prospect. Proceedings of the Edison Centennial Symposium* (New York u.a.: Pergamon Press, 1980), pp. 39–52.

[48] See Jean Fourastié, *Les trente glorieuses ou la révolution invisible de 1946 à 1975* (Paris: Hachette, 1979); Eric J. Hobsbawm, *The Age of Extremes: The Short Twentieth Century 1914-1991* (London: Abacus, 1995), 248-286, online [https://archive.org/details/ageofextremeshis00hobs\\_0](https://archive.org/details/ageofextremeshis00hobs_0) [25.08.2023].

[49] OEEC Oil Committee, *Europe's Need for Oil*.

[50] See Rüdiger Graf, *Öl und Souveränität: Petroknowledge und Energiepolitik in den USA und Westeuropa in den 1970er Jahren* (München: De Gruyter Oldenbourg, 2014).

[51] See Kenneth E. Boulding, “The Economics of Energy,” in: *The Annals of the American Academy of Political and Social Science* 410 (1973), 120–126; Herman E. Daly (ed.), *Toward a Steady-State Economy* (San Francisco: W. H. Freeman, 1973), online <https://archive.org/details/towardsteadystat0000daly> [25.08.2023]; Nicholas Georgescu-Roegen, *The Entropy Law and the Economic Process* (Cambridge Mass.: Harvard Univ. Press, 1971); Laura Nader/Stephen Beckerman, “Energy as It Relates to the Quality and Style of Life,” in: *Annual Review of Energy* 3 (1978), 1–28, online <https://www.annualreviews.org/doi/pdf/10.1146/annurev.eg.03.110178.000245>



[25.08.2023]; Amory B. Lovins, “Energy Strategy. The Road Not Taken?,” in: *Foreign Affairs* 55 (1976), 65–96; Dennis Meadows/Donella H. Meadows et al., *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind* (New York: Universe Books, 1972), online [https://collections.dartmouth.edu/teitexts/meadows/diplomatic/meadows\\_ltg-diplomatic.html](https://collections.dartmouth.edu/teitexts/meadows/diplomatic/meadows_ltg-diplomatic.html) [25.08.2023].

[52] See Will Steffen/Wendy Broadgate/Lisa Deutsch et al., “The Trajectory of the Anthropocene: The Great Acceleration,” in: *The Anthropocene Review* 2 (2015), 81–98, online [https://www.bpb.de/system/files/dokument\\_pdf/Steffen2015TheTrajectoryoftheAnthropoceneTheGreatAcceleration.pdf](https://www.bpb.de/system/files/dokument_pdf/Steffen2015TheTrajectoryoftheAnthropoceneTheGreatAcceleration.pdf) [25.08.2023]; John Robert McNeill/Peter Engelke, *The Great Acceleration: An Environmental History of the Anthropocene since 1945* (Cambridge, Mass., London: The Belknap Press of Harvard University Press, 2014).

[53] Christian Pfister u.a., “Das ‘1950er Syndrom.’ Zusammenfassung und Synthese,” in: Christian Pfister/Peter Bär (eds.), *Das 1950er Syndrom. Der Weg in die Konsumgesellschaft* (Bern: Haupt, 1996), 21–48, here 23.

[54] Christian Pfister, “The ‘1950s Syndrome’ and the Transition from a Slow-Going to a Rapid Loss of Global Sustainability,” in: Frank Uekötter (ed.), *The Turning Points of Environmental History* (Pittsburgh: Univ. of Pittsburgh Press, 2010), 90–118, here 97, online [https://www.hist.unibe.ch/unibe/portal/fak\\_historisch/dga/hist/content/e11168/e52524/e69145/e186327/e188603/5\\_Pfister-1950-syndrome-10\\_ger.pdf](https://www.hist.unibe.ch/unibe/portal/fak_historisch/dga/hist/content/e11168/e52524/e69145/e186327/e188603/5_Pfister-1950-syndrome-10_ger.pdf) [25.08.2023].

[55] See Hansjörg Siegenthaler, “Zur These des “1950er Syndroms.” Die wirtschaftliche Entwicklung der Schweiz nach 1945 und die Bewegung relativer Energiepreise,” in: Pfister/Bär (eds.), *Das 1950er Syndrom*, 97–103; John A. Hassan/Alan Duncan, “The Role of Energy Supplies during Western Europe's Golden Age, 1950–1972,” in: *Journal of European Economic History* 18 (1989), 479–508.

[56] See Massard-Guilbaud, “From the History of Sources;” Carlo M. Cipolla, “Sources d’énergie et histoire de l’humanité,” in: *Annales. Économies, sociétés, civilisations* 3 (1961), 521–534, online [https://www.persee.fr/doc/ahess\\_0395-2649\\_1961\\_num\\_16\\_3\\_420740](https://www.persee.fr/doc/ahess_0395-2649_1961_num_16_3_420740) [12.02.2023]; Rolf Peter Sieferle, *Der unterirdische Wald: Energiekrise und industrielle Revolution* (München: Beck, 1982); Michael Salewski, “Energie, Macht und Politik. Realitäten und Visionen im 19. und 20. Jahrhundert,” in: id. (ed.), *Das nukleare Jahrhundert. Eine Zwischenbilanz* (Stuttgart: Steiner, 1998), 10–22.

[57] Vaclav Smil, *Energy in World History* (Boulder: Westview Press, 1994); id., *Energy and Civilization: A History* (Cumberland: MIT Press, 2017).

[58] Vaclav Smil, *Energy Transitions: History, Requirements, Prospects* (Santa Barbara, Calif.: Praeger, 2010), 1.

[59] Ibid., 17.

[60] Ibid., 2.

[61] See Vaclav Smil, *Two Prime Movers of Globalization: The History and Impact of Diesel Engines and Gas Turbines* (Cambridge, Mass: MIT Press, 2010).

[62] C. Marchetti, “Primary Energy Substitution Models. On the Interaction between Energy and Society,” in: *Technological Forecasting and Social Change* 10 (1977), 345–356, online [http://newmaeweb.ucsd.edu/courses/MAE119/WI\\_2018/ewExternalFiles/Primary%20Energy%20Substitution%20Model%20-%20Marchetti%201977.pdf](http://newmaeweb.ucsd.edu/courses/MAE119/WI_2018/ewExternalFiles/Primary%20Energy%20Substitution%20Model%20-%20Marchetti%201977.pdf) [25.08.2023].

[63] See Stephen Gross/Andrew Needham (eds.), *New Energies: A History of Energy Transitions in Europe and North America* (Pittsburgh: University of Pittsburgh Press, 2023).

[64] David E. Nye, *Narratives and Spaces: Technology and the Construction of American Culture* (New York: Columbia University Press, 1997), 77.

[65] Smil, *Energy Transitions*, 17.

[66] “If history teaches us one thing, it is that there never has been an energy transition. [...] The history of energy is not one of transitions, but rather of successive additions of new sources of primary energy.” Bonneuil/Fressoz, *The Shock of the Anthropocene*, 101; Richard York/Shannon Elizabeth Bell, “Energy Transitions or Additions?,” in: *Energy Research & Social Science* 51 (2019), 40–43.

[67] Renn, *Die Evolution des Wissens*, 769-779.

[68] Václav Smil, “Energy in the Twentieth Century. Resources, Conversions, Costs, Uses, and Consequences,” in: *Annual Review of Energy and the Environment* 25 (2000), 21–51, here 22, online <https://vaclavsmil.com/wp-content/uploads/docs/smil-article-2000-aree2000-1.pdf> [25.08.2023].

[69] Ibid.

[70] See Daniel Yergin, *The Prize: The Epic Quest for Oil, Money, and Power* (New York: Simon & Schuster, 1991).

[71] See Christopher R. W. Dietrich, *Oil Revolution: Anticolonial Elites, Sovereign Rights, and the Economic Culture of Decolonization* (Cambridge: Cambridge University Press, 2017); Graf, *Oil and Sovereignty*.

[72] See Daniel Yergin, “It's Still the One,” in: *Foreign Policy*, 22.08.2009, pp 88–95, <https://foreignpolicy.com/2009/08/22/its-still-the-one/> [25.08.2023].

[73] Our World in Data, Energy use per person, 2022, <https://ourworldindata.org/grapher/per-capita-energy-use?time=latest> [25.08.2023].

[74] Astrid Kander/Paolo Malanima/Paul Warde, *Power to the People: Energy in Europe over the last five Centuries* (Princeton: Princeton University Press, 2013), 2.

[75] Ibid., 4.

[76] Ibid., 15.

[77] World Bank, *Energy in the Developing Countries*; World Bank, *The Energy Transition in Developing Countries* (Washington, DC: World Bank, 1983), online <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/166071468764361495/the-energy-transition-in-developing-countries> [25.08.2023].

[78] See Nina Lorkowski, *Warmes Wasser – weiße Ware: Energiewende im Badezimmer 1880–1939* (Paderborn: Brill Ferdinand Schöningh, 2021).

[79] Matthew John Franchetti/Defne Apul, *Carbon Footprint Analysis: Concepts, Methods, Implementation, and Case Studies* (Boca Raton, FL: CRC Press, 2012).

[80] See Nicole Hesse, “Wind Power and Rural Modernization: Wind-Powered Water Supply Systems in Northern Germany and Southern France, 1880–1950,” in: *History and Technology* 37 (2021), no. 4, 446–467; Nicole Hesse/Christian Zumbärgel, “Wie neu ist Energiesuffizienz?: Eine Spurensuche in der Geschichte des Energiesparens,” in: *TATuP* 31 (2022), no. 2, 56–63, online <https://www.tatup.de/index.php/tatup/article/download/6972/11738?inline=1> [25.08.2023].

[81] Smil, *Energy Transitions*, 13.

[82] See Thijs van de Graaf, *The Politics and Institutions of Global Energy Governance* (Basingstoke: Palgrave Macmillan, 2013); Andreas Goldthau (ed.), *The Handbook of Global Energy Policy* (Chichester: Wiley-Blackwell, 2013); Thijs Van de Graaf et. al (ed.), *The Palgrave Handbook of the International Political Economy of Energy* (London: Palgrave Macmillan, 2016).

[83] See in this respect also the overviews: Ute Hasenöhr/Jan-Henrik Meyer, “The Energy Challenge in Historical Perspective,” in: *Technology and Culture* 61 (2020), pp. 295–306; Christian Zumbärgel, “Urban Energy Consumption, Mobility, and Environmental Legacies,” in: Sebastian Haumann/Martin Knoll/Detlev Mares (eds.), *Concepts of Urban-Environmental History* (Bielefeld: transcript, 2020), 167–190, online [https://www.researchgate.net/publication/361609862\\_Urban\\_Energy\\_Consumption\\_Mobility\\_and\\_Environmental\\_Legacies/link/62bc3c16056dae24e8ecff3a/download](https://www.researchgate.net/publication/361609862_Urban_Energy_Consumption_Mobility_and_Environmental_Legacies/link/62bc3c16056dae24e8ecff3a/download) [25.08.2023]; Patrick Kupper/Odinn Melsted/Irene Palua, “On Power. Neue Literatur zur Energiegeschichte,” in: *N.T.M.* 25 (2017), 143–158.

[84] See Jochim Varchmin/Joachim Radkau, *Kraft, Energie und Arbeit: Energietechnik und Gesellschaft im Wandel der Zeiten* (München: Deutsches Museum, 1979).

[85] See, e.g., D. V. Carter (ed.), *The History of Petroleum Engineering* (Dallas: Boyd Printing C., 1961); John Edward Brantly, *History of Oil Well Drilling* (Houston: Gulf Publishing Company, 1971); Joseph A. Pratt/Tyler Priest/Christopher J. Castaneda, *Offshore Pioneers: Brown & Root and the History of Offshore Oil and Gas* (Houston: Gulf Publishing Company, 1997).

[86] See Yergin, *The Prize*.

[87] See Christian Zumbärgel, “Viele Wenige Machen ein Viel:”*Eine Technik- und Umweltgeschichte der Kleinwasserkraft (1880–1930)* (Paderborn: Ferdinand Schöningh, 2018); David Edgerton, *The Shock of the Old: Technology and Global History since 1900* (London: Profile Books, 2006); Bonneuil/Fressoz, *The Shock of the Anthropocene*, 102.

[88] See Nora Thorade, *Das Schwarze Gold: Eine Stoffgeschichte der Steinkohle im 19. Jahrhundert*

(Paderborn: Ferdinand Schöningh, 2020); Helge Wendt, *Kohlezeit: Eine Global- und Wissensgeschichte (1500-1900)* (Frankfurt, New York: Campus, 2022); Edward W. Constant II, "Science in Society. Petroleum Engineers and the Oil Fraternity in Texas 1925–65," in: *Social Studies of Science* 19 (1989), 439–472.

[89] Gabrielle Hecht, "Political Designs. Nuclear Reactors and National Policy in Postwar France," in: *Technology and Culture* 35 (1994), 657–685; id., *The Radiance of France: Nuclear Power and National Identity after World War II* (Cambridge, Mass.: MIT Press, 1998).

[90] Hughes, *Networks of Power*, 1.

[91] See Matthias Heymann, *Die Geschichte der Windenergienutzung. 1890-1990* (Frankfurt, New York.: Campus, 1995); id., "Signs of Hubris. The Shaping of Wind Technology Styles in Germany, Denmark, and the United States, 1940-1990," in: *Technology and Culture* 39 (1989), 641–670.

[92] See, e.g., Per Högselius/Arne Kaijser/Erik van der Vleuten (eds.), *Europe's Infrastructure Transition: Economy, War, Nature* (Basingstoke: Palgrave Macmillan, 2015).

[93] Christopher F. Jones, *Routes of Power: Energy and Modern America* (Cambridge, Mass.: Harvard University Press, 2014), 228.

[94] See Dirk van Laak, *Alles im Fluss: Die Lebensadern unserer Gesellschaft: Geschichte und Zukunft der Infrastruktur* (Frankfurt a.M.: S. Fischer, 2018); Timothy Moss, *Remaking Berlin: A History of the City Through Infrastructure, 1920–2020* (Cambridge, Mass., London: The MIT Press, 2020).

[95] See Miriam A. Bader-Gassner, *Pipelineboom: Internationale Ölkonzerne im westdeutschen Wirtschaftswunder* (Baden-Baden: Nomos, 2014); Per Högselius, *Red Gas: Russia and the Origins of European Energy Dependence* (Basingstoke: Palgrave Macmillan, 2013); Falk Flade, *Energy Infrastructures in the Eastern Bloc. Poland and the Construction of Transnational Electricity, Oil, and Gas Systems* (Wiesbaden: Harrassowitz, 2017); Douglas Little, "Pipeline Politics. America, TAPLINE, and the Arabs," in: *Business History Review* 64 (1990), pp. 255–285.

[96] Emiliano López/Francisco Vértiz, "Extractivism, Transnational Capital, and Subaltern Struggles in Latin America," in: *Latin American Perspectives* 42 (2015), no. 5, 152–168, [https://www.memoria.fahce.unlp.edu.ar/art\\_revistas/pr.11313/pr.11313.pdf](https://www.memoria.fahce.unlp.edu.ar/art_revistas/pr.11313/pr.11313.pdf) [25.08.2023]; Hans-Jürgen Burchardt/Kristina Dietz, "(Neo-)Extractivism – a new Challenge for Development Theory from Latin America," in: *Third World Quarterly* 35 (2014), 468–486.

[97] See Klaus Tenfelde (ed.), *Sozialgeschichte des Bergbaus im 19. und 20. Jahrhundert: Beiträge des Internationalen Kongresses zur Bergbaugeschichte, Bochum, Bundesrepublik Deutschland, 3.–7. September 1989* (München: Beck, 1992).

[98] See Gerald D. Feldman (ed.), *Arbeiter, Unternehmer und Staat im Bergbau: Industrielle Beziehungen im internationalen Vergleich* (München: Beck, 1989); Franz-Josef Brüggemeier, *Leben vor Ort: Ruhrbergleute und Ruhrbergbau, 1889–1919* (München: Beck, 1984); Dieter Ziegler (ed.), *Geschichte des deutschen Bergbaus* (Münster: Aschendorff, 2013); see also the research project: *Umweltpolitik, Bergbau und Rekultivierung im deutsch-deutschen Vergleich. Das Lausitzer Braunkohlenrevier, die Wismut und das Ruhrgebiet (1949–1989/2000)*, <https://www.bergbaumuseum.de/forschung/forschungsprojekte/umweltpolitik-bergbau-und-rekultivierung-im-deutsch-deutschen-vergleich-das-lausitzer-braunkohlenrevier-die-wismut-und-das-ruhrgebiet-1949-1989-2000> [25.08.2023].

[99] Timothy Mitchell, *Carbon Democracy: Political Power in the Age of Oil* (London, New York: Verso, 2011), 38; Franz-Josef Brüggemeier, *Grubengold: Das Zeitalter der Kohle von 1750 bis heute* (Sonderausgabe, Bonn: Bundeszentrale für Politische Bildung, 2018), 210–213.

[100] Clif Stratton, *Power Politics: Carbon Energy in Historical Perspective* (New York: Oxford University Press, 2020).

[101] See Ute Hasenöhl, “Just a Matter of Habituation? The Contentious Perception of (Post)Energy Landscapes in Germany, 1945–2016,” in: *Environment, Place, Space* 10 (2018), 63–88.

[102] See Benjamin Brendel, *Konvergente Konstruktionen: Eine Globalgeschichte des Staudammbaus* (Frankfurt a.M., New York: Campus, 2019); Klaus Gestwa, “Ökologischer Notstand und sozialer Protest. Ein umwelthistorischer Blick auf die Reformunfähigkeit und den Zerfall der Sowjetunion,” in: *AfS* 43 (2003), 349–383, online [https://zeithistorische-forschungen.de/sites/default/files/medien/material/2012-1/Gestwa\\_2003.pdf](https://zeithistorische-forschungen.de/sites/default/files/medien/material/2012-1/Gestwa_2003.pdf) [25.08.2023]; Klaus Gestwa, *Die Stalinschen Großbauten des Kommunismus: Sowjetische Technik- und Umweltgeschichte, 1948–1967* (München: Oldenbourg, 2010); Fabian Zimmer, *Hydroelektrische Projektionen: Eine Emotionsgeschichte der Wasserkraft im Industriefilm* (Göttingen: Wallstein, 2022); Ute Hasenöhl, “Powering Progress, Empowering People? (Hydro)Electricity and Human Rights in Post/Colonial India, 1920s–1990s,” in: Michael Homberg/Benjamin Möckel (eds.), *Human Rights and Technological Change. Conflicts and Convergences after 1945* (Göttingen: Wallstein, 2022), 37–62.

[103] See Carol Hager/Mary Alice Haddad (eds.), *NIMBY is Beautiful: Cases of Local Activism and Environmental Innovation Around the World* (New York, Oxford: Berghahn Books, 2015).

[104] See Joachim Radkau, *Aufstieg und Krise der deutschen Atomwirtschaft 1945–1975: Verdrängte Alternativen in der Kerntechnik und der Ursprung der nuklearen Kontroverse* (Reinbek bei Hamburg: Rowohlt, 1983); Frank Uekötter, *Atomare Demokratie: Eine Geschichte der Kernenergie in Deutschland* (Stuttgart: Franz Steiner, 2022); Andrew S. Tompkins, *Better Active than Radioactive! Anti-Nuclear Protest in 1970s France and West Germany* (Oxford: Oxford University Press,



2016); see also the short country reports resulting from the History of Nuclear Energy and Society<sup>41</sup> (HoNESt) project: <https://www.honest2020.eu/d36-short-country-reports> [25.08.2023].

[105] See Lars Bluma/Michael Farrenkopf/Torsten Meyer (eds.), *Boom – Crisis – Heritage: King Coal and the Energy Revolutions after 1945* (Berlin: De Gruyter Oldenbourg, 2022); Alison Fleig Frank, *Oil Empire: Visions of Prosperity in Austrian Galicia* (Cambridge Mass.: Harvard Univ. Press, 2005).

[106] See Tobias Haller, *Fossil Fuels, Oil Companies, and Indigenous Peoples: Strategies of Multinational Oil Companies, States, and Ethnic Minorities: Impact on Environment, Livelihoods, and Cultural Change* (Münster: LIT, 2007).

[107] See Melanie Arndt, *Tschernobylkinder: Die transnationale Geschichte einer nuklearen Katastrophe* (Göttingen: Vandenhoeck & Ruprecht, 2020); see also the award-winning HBO mini series “Chernobyl,” Trailer <https://www.hbo.com/chernobyl> [25.08.2023].

[108] See Michael Watts, “Economies of Violence: More Oil, More Blood,” in: *Economic and Political Weekly* 38 (2003), no. 48, 5089–5099; Cyril Obi/Siri Aas Rustad (eds.), *Oil and Insurgency in the Niger Delta: Managing the Complex Politics of Petro-Violence* (London, New York: Zed Books, 2011).

[109] See Thea N. Riofrancos, *Resource Radicals: From Petro-Nationalism to Post-Extractivism in Ecuador* (Durham: Duke University Press, 2020).

[110] See Robert Vitalis, *America's Kingdom: Mythmaking on the Saudi Oil Frontier* (Stanford, CA: Stanford University Press, 2007); John Sheail, “Torrey Canyon. The Political Dimension,” in: *Journal of Contemporary History* 42 (2007), 485–504.

[111] See for example the photographs by Edward Burtynsky, the novel by Imbolo Mbue or the graphic novel by Kate Beaton: Edward Burtynsky, *Manufactured Landscapes* (London: BFI, 2008); Imbolo Mbue, *How Beautiful We Were* (Edinburgh: Canongate, 2022); Kate Beaton, *Ducks: Two Years in the Oil Sands* (La Vergne: Drawn & Quarterly, 2022); Andreas F. Beitin/Alexander Klose/Benjamin Steininger (eds.), *Oil. Beauty and Horror in the Petrol Age* (Köln: Verlag der Buchhandlung Walther und Franz König, 2021); Amitav Ghosh, “Petrofiction. The Oil Encounter and the Novel,” in: Szeman/Boyer (eds.), *Energy Humanities*, 431–440.

[112] See Klaus Tenfelde/Toni Pierenkemper (ed.), *Motor der Industrialisierung. Deutsche Bergbaugeschichte im 19. und frühen 20. Jahrhundert* (Münster: Aschendorff, 2016); Dieter Ziegler (ed.), *Rohstoffgewinnung im Strukturwandel. Der deutsche Bergbau im 20. Jahrhundert* (Münster: Aschendorff, 2013).

[113] Henning Türk, *Treibstoff der Systeme: Kohle, Erdöl und Atomkraft im geteilten Deutschland* (Berlin: be.bra, 2021); Stephen G. Gross, *Energy and Power. Germany in the Age of Oil, Atoms, and*

*Climate Change* (Oxford: Oxford UP 2023). see also Christoph Nonn, *Die Ruhrbergbaukrise: Entindustrialisierung und Politik 1958-1969* (Göttingen: Vandenhoeck & Ruprecht, 2001); Rainer Karlsch/Raymond G. Stokes, “Faktor Öl:”*Die Mineralölwirtschaft in Deutschland 1859-1974* (München: C.H. Beck, 2003); for the GDR: Karlsch, “Energie- und Rohstoffpolitik”; André Steiner, “‘Common Sense Is Necessary.’ East German Reactions to the Oil Crises of the 1970s,” in: *Historical Social Research* 39 (2014), no. 4, 231–250, online <https://www.ssoar.info/ssoar/handle/document/40397> [25.08.2023].

[114] See the original muckraking account by Ida Tarbell on Standard Oil as well as later journalistic and scholarly writings: Ida Minerva Tarbell, *The History of the Standard Oil Company: Briefer Version*, ed. by David Chalmers ([1st ed. 1904] New York: McClure Phillips & Co, 1966); Anthony Sampson, *The Seven Sisters: The Great Oil Companies and the World They Shaped* (London: Hodder and Stoughton, 1975), online <https://archive.org/details/seven-sisters-oil> [25.08.2023]; James Bamberg, *The History of the British Petroleum Company*, 3 vols. (Cambridge, 1983-2000); Stephen Howarth/Joost Jonker/Joost Dankers, *The History of Royal Dutch Shell*, 4 vols. (Oxford: Oxford Univ. Press, 2007); Steve Coll, *Private Empire: ExxonMobil and American Power* (New York: Penguin Press, 2012); Wiebke Glässer, *Marktmacht und Politik. Das internationale Kartell der Ölgesellschaften 1960-1975* (Berlin: De Gruyter Oldenbourg, 2019); Henning Türk, “Zwischen Versorgungssicherheit und Markttransparenz. Die institutionalisierte Zusammenarbeit der westlichen Industrieländer mit den multinationalen Ölfirmen nach dem Zweiten Weltkrieg,” in: Christian Henrich-Franke/Claudia Hiepel/Guido Thiemeyer et al. (eds.), *Grenzüberschreitende institutionalisierte Zusammenarbeit von der Antike bis zur Gegenwart* (Baden-Baden: Nomos, 2019), 327–352.

[115] See paradigmatically: Feldman (ed.), *Arbeiter, Unternehmer und Staat im Bergbau*; Yergin, *The Prize*; Alain Beltran (ed.), *Oil Producing Countries and Oil Companies: From the Nineteenth Century to the Twenty-First Century* (Bern: Peter Lang, 2011).

[116] See Brüggemeier, *Grubengold*, 327; Ludolf Herbst, *Option für den Westen: Vom Marschallplan bis zum deutsch-französischen Vertrag* (München: Dt. Taschenbuch-Verl., 1989), online <https://archive.org/details/optionfurdenwest0000herb> [25.08.2023].

[117] See Martin Chick, *Electricity and Energy Policy in Britain, France and the United States since 1945* (Cheltenham: Edward Elgar, 2007); Hendrik Ehrhardt, *Stromkonflikte: Selbstverständnis und strategisches Handeln der Stromwirtschaft zwischen Politik, Industrie, Umwelt und Öffentlichkeit (1970–1989)* (Stuttgart: Franz Steiner, 2017).

[118] See Vincent Lagendijk, *Electrifying Europe: The Power of Europe in the Construction of Electricity Networks* (Amsterdam: Aksant, 2008); Vincent Lagendijk/Dave Lyddon/Kurt Vandaele/Eric Venbrux, *Electrifying Europe. The Power of Europe in the Construction of Electricity Networks*

(Amsterdam: Amsterdam University Press, 2008); William J. Hausman/Peter Hertner/Mira Wilkins,<sup>43 of 48</sup> *Global Electrification: Multinational Enterprise and International Finance in the History of Light and Power, 1878–2007* (Cambridge: Cambridge Univ. Pr., 2008).

[119] See Christoph Wehner, *Die Versicherung der Atomgefahr: Risikopolitik, Sicherheitsproduktion und Expertise in der Bundesrepublik Deutschland und den USA 1945–1986* (Göttingen: Wallstein, 2017).

[120] See Elisabeth Röhrlich, *Inspectors for Peace: A History of the International Atomic Energy Agency* (Baltimore: Johns Hopkins University Press, 2022); Astrid Mignon Kirchhof (ed.), *Pathways Into and Out of Nuclear Power in Western Europe: Austria, Denmark, Federal Republic of Germany, Italy, and Sweden* (München: Deutsches Museum, 2020).

[121] See, e.g., Robert Jungk, *Der Atom-Staat: Vom Fortschritt in die Unmenschlichkeit* (München: Kindler, 1977); Uekötter, *Atomare Demokratie*; Dolores L. Augustine, *Taking on Technocracy: Nuclear Power in Germany, 1945 to the Present* (New York: Berghahn Books, 2018); Arne Kaijser et al. (eds.), *Engaging the Atom: The History of Nuclear Energy and Society in Europe from the 1950s to the Present* (Morgantown: West Virginia University Press, 2021).

[122] Hecht, *The Radiance of France*.

[123] See Cornelia Altenburg, *Kernenergie und Politikberatung: Die Vermessung einer Kontroverse* (Wiesbaden: VS Verlag für Sozialwissenschaften, 2010); Augustine, *Taking on Technocracy*; Stephen Milder, *Greening Democracy: The Anti-Nuclear Movement and Political Environmentalism in West Germany and Beyond, 1968–1983* (Cambridge: Cambridge University Press, 2019); Felix Lieb, *Arbeit und Umwelt? Die Umwelt- und Energiepolitik der SPD zwischen Ökologie und Ökonomie 1969–1998*, Diss. (Berlin: De Gruyter Oldenbourg, 2022).

[124] See, e.g., Frank Bösch, “Taming Nuclear Power. The Accident near Harrisburg and the Change in West German and International Nuclear Policy in the 1970s and early 1980s, in: “*German History* 35 (2017), 71–95; Franz-Josef Brüggemeier, *Tschernobyl, 26. April 1986: Die ökologische Herausforderung* (München: Dt. Taschenbuch-Verl., 1998); Arndt, *Tschernobylkinder*; Karena Kalmbach, *The Meanings of a Disaster: Chernobyl and its Afterlives in Britain and France* (New York: Berghahn Books, 2021); Stephen Milder, “Thinking Globally, Acting (Trans-)Locally: Petra Kelly and the Transnational Roots of West German Green Politics,” in: *Central European History* 43 (2010), 301–326.

[125] See Ute Hasenöhr/ Patrick Kupper, “Historicizing Renewables. Issues and Challenges,” in: *History and Technology* 37 (2021), 397–410, online <https://www.tandfonline.com/doi/full/10.1080/07341512.2022.2033384>

🌀  
[25.08.2023].

- [126] See Stephen G. Gross, “Reimagining Energy and Growth: Decoupling and the Rise of a New Energy Paradigm in West Germany, 1973–1986,” in: *Central European History* 50 (2017), 514–546; Stephen Milder, “A Struggle to Remake the Market: Feed-in Rates and Alternative Energy in 1980s West Germany,” in: *Contemporary European History* 31 (2022), 593–609, online <https://www.cambridge.org/core/services/aop-cambridge-core/content/view/FC07E236707053092D7B38864657F833/S0960777322000236a.pdf/a-struggle-to-remake-the-market-feed-in-rates-and-alternative-energy-in-1980s-west-germany.pdf> [25.08.2023].
- [127] See Terry Lynn Karl, *The Paradox of Plenty: Oil Booms and Petro-States* (Berkeley: Univ. of Calif. Press, 1997); Thad Dunning, *Crude Democracy: Natural Resource Wealth and Political Regimes* (Cambridge: Cambridge University Press, 2008).
- [128] Michael Lewin Ross, *The Oil Curse: How Petroleum Wealth Shapes the Development of Nations* (Princeton, NJ: Princeton University Press, 2012), 4.
- [129] “In Ecuador, far from undermining democracy, contention around oil extraction and the construction of a large-scale mining sector occasioned novel democratic practices.” Riofrancos, *Resource Radicals*, 24; Benjamin Kohl/Linda Farthing, “Material Constraints to Popular Imaginaries. The Extractive Economy and Resource Nationalism in Bolivia,” in: *Political Geography* 31 (2012), 225–235.
- [130] See Yergin, *The Prize*; Dietrich Eichholtz, *Krieg um Öl: Ein Erdölimperium als deutsches Kriegsziel 1938-1943* (Leipzig: Leipziger Universitätsverlag, 2006); Michael A. Barnhart, *Japan Prepares for Total War: The Search for Economic Security, 1919–1941* (Ithaca: Cornell Univ. Pr., 1987); Michael T. Klare, *Blood and Oil: The Dangers and Consequences of America's Growing Dependency on Imported Petroleum* (New York: Henry Holt and Company, 2005).
- [131] See David Edgerton, “Controlling Resources. Coal, Iron Ore and Oil in the Second World War,” in: Michael Geyer/Adam Tooze (eds.), *The Cambridge History of the Second World War. Volume 3: Total War: Economy, Society and Culture* (Cambridge: Cambridge University Press, 2015), 122–148, here 148. See also the polemic in Robert Vitalis, *Oilcraft: The Myths of Scarcity and Security that Haunt U.S. Energy Policy* (Stanford, California: Stanford University Press, 2020).
- [132] See Anand Toprani, *Oil and the Great Powers: Britain and Germany, 1914-1945* (Oxford: Oxford University Press, 2019); David S. Painter, *Oil and the American Century: The Political Economy of US Foreign Oil Policy, 1941–1954* (Baltimore: Johns Hopkins University Press, 1986); David S. Painter, “Oil and the American Century,” in: *The Journal of American History* 99 (2012), 24–39.
- [133] See David S. Painter, *The Cold War: An International History* (London: Routledge, 1999); David S. Painter, “Oil, Resources, and the Cold War, 1945–1962,” in: Melvyn P. Leffler/Odd Arne Westad (eds.),

*The Cambridge History of the Cold War*, 3 vols. (Cambridge: Cambridge University Press, 2009),<sup>45 of 48</sup> 486–507; Jeronim Perović (ed.), *Cold War Energy: A Transnational History of Soviet Oil and Gas* (Cham: Springer International Publishing; Palgrave Macmillan, 2018).

[134] See Werner D. Lippert, *The Economic Diplomacy of Ostpolitik: Origins of NATO's Energy Dilemma* (New York: Berghahn Books, 2011); Högselius, *Red Gas*; Bader-Gassner, *Pipelineboom*; Perović (ed.), *Cold War Energy*; Frank Bösch, "Energy Diplomacy. West Germany, the Soviet Union and the Oil Crises of the 1970s," in: *Historical Social Research* 39 (2014), 165–184, online [https://zzf-potsdam.de/sites/default/files/mitarbeiter/PDFs/boesch/ssoar-hsr-2014-4-bosch-energy\\_diplomacy\\_west\\_germany\\_the.pdf](https://zzf-potsdam.de/sites/default/files/mitarbeiter/PDFs/boesch/ssoar-hsr-2014-4-bosch-energy_diplomacy_west_germany_the.pdf) [25.08.2023].

[135] See Dietrich, *Oil Revolution*; Jonas Kreienbaum, *Das Öl und der Kampf um eine neue Weltwirtschaftsordnung: Die Bedeutung der Ölkrisen der 1970er Jahre für die Nord-Süd-Beziehungen* (Berlin: De Gruyter Oldenbourg, 2022); Giuliano Garavini, *After Empires: European Integration, Decolonization, and the Challenge from the Global South 1957-1986* (Oxford: Oxford University Press, 2012).

[136] See Giuliano Garavini, *The Rise and Fall of OPEC in the Twentieth Century* (Oxford: Oxford University Press, 2019); Dag Harald Claes/Giuliano Garavini (eds.), *Handbook of OPEC and the Global Energy Order: Past, Present and Future Challenges* (London: Routledge, 2020).

[137] See Duccio Basosi/Giuliano Garavini/Massimiliano Trentin (eds.), *Counter-Shock: The Oil Counter-Revolution of the 1980s* (London: I.B. Tauris & Co., 2018); Henning Türk, *Energiesicherheit nach der Ölkrise: Die Internationale Energieagentur 1974–1985* (Göttingen: Wallstein, 2023).

[138] See Robert Lifset (ed.), *American Energy Policy in the 1970s* (Norman: University of Oklahoma Press, 2014); Jay E. Hakes, *A Declaration of Energy Independence: How Freedom from Foreign Oil Can Improve National Security, our Economy, and the Environment* (Hoboken N.J.: J. Wiley, 2008); Andy Beckett, *When the Lights Went Out: What Really Happened to Britain in the Seventies* (London: Faber, 2010).

[139] See, e.g., Graf, *Oil and Sovereignty*; Meg Jacobs, *Panic at the Pump: The Energy Crisis and the Transformation of American Politics in the 1970s* (New York: Hill and Wang, 2016); Frank Bösch/Rüdiger Graf (eds.), *The Energy Crises of the 1970s: Special Issue* (*Historical Social Research*, 39.4, 2014), online <https://www.gesis.org/en/hsr/full-text-archive/2014/394-energy-crises> [14.8.2023]; Elisabetta Bini/Giuliano Garavini/Federico Romero (eds.), *Oil Shock: The 1973 Crisis and its Economic Legacy* (London, New York: I. B. Tauris, 2016); Thomas Turnbull, "'No Solution to the Immediate Crisis: The Uncertain Political Economy of Energy Conservation in 1970s Britain,'" in: *Contemporary European History* 31 (2022), 570–592, online <https://www.cambridge.org/core/services/aop-cambridge-core/content/view/2FC960DF546E079D2ACA2C3A82816074/S0960777322000625a.pdf>

[/no-solution-to-the-immediate-crisis-the-uncertain-political-economy-of-energy-conservation-in-1970s-britain.pdf](#) [25.08.2023]; Frank Bösch, *Zeitenwende 1979: Als die Welt von heute begann* (München: C.H.Beck, 2019); Duco Hellema/Cees Wiebes/Toby Witte, *The Netherlands and the Oil Crisis: Business as Usual* (Amsterdam: Amsterdam University Press, 2004).

[140] See Nader/Beckerman, “Energy as It Relates to the Quality and Style of Life,” 2; Laura Nader (ed.), *The Energy Reader* (New York: Wiley-Blackwell, 2010); Graf, “Von der Energievergessenheit zur theoretischen Metonymie”.

[141] See Clark A. Miller, Alastair Iles, and Christopher F. Jones, “The Social Dimensions of Energy Transitions,” in: *Science as Culture* 22 (2013), 135–148, online <https://www.tandfonline.com/doi/epdf/10.1080/09505431.2013.786989?needAccess=true&role=button> [25.08.2023].

[142] David Edwin Nye, *Consuming Power: A Social History of American Energies* (Cambridge Mass.: MIT Press, 1998).

[143] David E. Nye, *Electrifying America: Social Meanings of a New Technology, 1880/1940* (Cambridge, Mass.: MIT Press, 6<sup>th</sup> ed., 2001), 381.

[144] Ibid; Beate Binder, *Elektrifizierung als Vision: Zur Symbolgeschichte einer Technik im Alltag* (Tübingen: Tübinger Vereinigung für Volkskunde, 1999); Nina Möllers, “Electrifying the World. Representations of Energy and Modern Life at World's Fairs, 1893–1982,” in: Möllers/Zachmann (eds.), *Past and Present Energy Societies*, 45–78.

[145] See, e.g., the Website “Seventeen Moments in Soviet History: Electrification Campaign,” <https://soviethistory.msu.edu/1921-2/electrification-campaign/communism-is-soviet-power-electrification-of-the-whole-country/> [25.08.2023]. On Soviet Electrification see Jonathan Coopersmith, *The Electrification of Russia, 1880–1926* (Ithaca, N.Y.: Cornell University Press, 1992).

[146] Lorkowski, *Warmes Wasser – weiße Ware*.

[147] See, e.g., Ruth Schwartz Cowan, “The Industrial Revolution in the Home,” in: *Technology and Culture* 17 (1976), 1–23, online <https://hss.sas.upenn.edu/sites/default/files/Industrial%20Revolution%20in%20the%20Home.pdf> [14.8.2023]; Sophie Gerber, *Küche, Kühlschrank, Kilowatt: Zur Geschichte des privaten Energiekonsums in Deutschland, 1945–1990* (Bielefeld: Transcript, 2015); Sophie Gerber/Nina Lorkowski/Nina Möllers, *Kabelsalat: Energiekonsum im Haushalt (Katalog zur Ausstellung im Deutschen Museum, München, 13.1.–15.4.2012)* (München: Dt. Museum, 2012).

[148] See John M. Polimeni et al. (eds.), *The Myth of Resource Efficiency: The Jevons Paradox* 47 of 48 (Florence: Taylor and Francis, 2009).

[149] Perović, *Rohstoffmacht Russland*, 39; Sina Fabian, *Boom in der Krise: Konsum, Tourismus, Autofahren in Westdeutschland und Großbritannien 1970-1990* (Göttingen: Wallstein, 2016).

[150] Nye, *Consuming Power*, 196; Victoria de Grazia, *Irresistible Empire: America's Advance Through Twentieth-Century Europe* (Cambridge, Mass.: Belknap Press of Harvard Univ. Press, 2005).

[151] Bonneuil/Fressoz, *The Shock of the Anthropocene*, 113.

[152] Brüggemeier, *Grubengold*, 9.

[153] Yergin, *The Prize*, 14.

[154] Bob Johnson, *Carbon Nation: Fossil Fuels in the Making of American Culture* (Kansas: University Press of Kansas, 2014), xix.

[155] Stephanie LeMenager, *Living Oil: Petroleum Culture in the American Century* (Oxford University Press, 2014), 6; Beitin/Klose/Steininger (eds.), *Oil. Beauty and Horror in the Petrol Age*; Barry Lord, *Art & Energy: How Culture Changes* (Washington, D.C: American Alliance of Museums, 2014).

[156] Sheena Wilson/Imre Szeman/Adam Carlson, "On Petrocultures. Why We Need to Understand Oil to Understand Everything Else," in: Sheena Wilson/Adam Carlson/Imre Szeman (eds.), *Petrocultures. Oil, Politics, Culture* (Montreal: McGill-Queen's University Press, 2017), 3–20, here 4.

[157] Cara New Daggett, *Petromaskulinität: Fossile Energieträger und autoritäres Begehren* (Berlin: Matthes & Seitz, 2022).

[158] See Andrew Nikiforuk, *The Energy of Slaves: Oil and the new Servitude* (Vancouver, BC, Berkeley, Ca.: Greystone Books; David Suzuki Foundation; Distributed in the U.S. by Publishers Group West, 2012).

[159] Melissa Büttner/Matthias Schmelzer (eds.), *Fossile Mentalitäten: Zur Geschichte der fossilen Durchdringung moderner Vorstellungswelten* (flumen, Working Paper 3, Jena, 2021), online [https://www.flumen.uni-jena.de/wp-content/uploads/2021/06/Working-Paper-Nr-3\\_Schmelzer-und-Buettner\\_Fossile-Mentalitaeten-Zur-Geschichte-der-fossilen-Durchdringung-moderner-Vorstellungswelten-1.pdf](https://www.flumen.uni-jena.de/wp-content/uploads/2021/06/Working-Paper-Nr-3_Schmelzer-und-Buettner_Fossile-Mentalitaeten-Zur-Geschichte-der-fossilen-Durchdringung-moderner-Vorstellungswelten-1.pdf) [25.08.2023]; Andreas Malm, *Fossil Capital: The Rise of Steam power and the Roots of Global Warming* (London, New York: Verso, 2016).

[160] Chakrabarty, "The Climate of History. Four Thesis," 208; Fredrik Albritton Jonsson, "Anthropocene Blues. Abundance, Energy, Limits," in: Frederike Felcht/Katie Ritson (eds.), *The*

*Imagination of Limits. Exploring Scarcity and Abundance* (Rachel Carson Center for Environment and Society, Munich, Germany, 2015), 55–64, online [https://www.environmentandsociety.org/sites/default/files/2015\\_i2\\_web\\_1.pdf](https://www.environmentandsociety.org/sites/default/files/2015_i2_web_1.pdf) [25.08.2023]

## Empfohlene Literatur zum Thema

Kander, Astrid/Malanima, Paolo/Warde, Paul, *Power to the People: Energy in Europe over the last five Centuries*, Princeton 2013: Princeton University Press

Massard-Guilbaud, Geneviève, From the History of Sources and Sectors to the History of Systems and Transitions. How the History of Energy Has Been Written in France and Beyond, in: *Journal of Energy History* 1 (2018), 2, online [https://www.energyhistory.eu/sites/default/files/pdf/06\\_%20From%20the%20history%20of%20sources\\_0.pdf](https://www.energyhistory.eu/sites/default/files/pdf/06_%20From%20the%20history%20of%20sources_0.pdf) [25.08.2023]

Mitchell, Timothy, *Carbon Democracy: Political Power in the Age of Oil*, London, New York 2011: Verso

Nye, David Edwin, *Consuming Power: A Social History of American Energies*, Cambridge, Mass. 1998: MIT Press

Smil, Vaclav, *Energy and Civilization: A History*, Cumberland 2017: MIT Press

Szemann, Imre/Boyer, Dominic (eds.), *Energy Humanities. An Anthology*, Baltimore 2017: Johns Hopkins University Press

## Nutzungsbedingungen für diesen Artikel

Copyright © 2023 - Lizenz:

**Clio-online e.V.** und Autor, alle Rechte vorbehalten. Dieses Werk entstand im Rahmen des Clio-online Projekts „**Docupedia-Zeitgeschichte**“ und darf vervielfältigt und veröffentlicht werden, sofern die Einwilligung der Rechteinhaber vorliegt. Bitte kontaktieren Sie: [redaktion@docupedia.de](mailto:redaktion@docupedia.de)