Chapter 1
Introduction

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Abstract This chapter presents the main ideas behind this edited volume and provides a background for the individual chapters encompassed therein. The chapter examines energy transition as one of the main components connected to climate change and highlights the potential contribution of the humanities and social sciences (previously largely excluded from the conversation) to the process of developing possible post-carbon economies, societies, and energy systems. It points to the energy humanities as a key means of providing insight into the various social, political, cultural, economic, and ideological aspects of energy transition, thus not only contributing to the mitigation of the consequences of climate change but also helping prevent climate change from reaching the point of no return.

Keywords Climate change · Global warming · Energy transition · Post-carbon society

1.1 Introduction

One of the main challenges humankind currently faces is connected to climate change causing irreversible transformation of our environment, which threatens the survival of both humans and other species that inhabit the Earth (Fitch-Roy and Fairbrass 2018). This change is instigated by (among other factors) the rising average global temperature, which, if not prevented, will initiate processes with devastating consequences for the environment, including rising oceans level caused by the melting of continental icebergs, severe weather conditions encompassing both frequent droughts and floods, the spread of deserts, etc. The World Bank estimates that, by 2050, climate

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changes will force more than 140 million people to move within their own countries (Rigaud et al. 2018). There are also expectations of intense international climate migration (Black et al. 2011; Laczko and Aghazarm 2009) that will have severe negative consequences for international relations and the existing international regime, causing new types of climate change-related conflicts.

To prevent such a development or at least mitigate its negative consequences, there has been an increased understanding at the global level about the need to change our attitudes towards the climate, environment, and consumption of natural resources, and adapt most (if not all) sectors of industry to the new situation. Most importantly, the 2016 Paris Agreement (which follows in the footsteps of the famous, but rather unsuccessful 1997 Kyoto Protocol) aims to limit the rise of global temperature below 2 °C above pre-industrial levels (UN 2020),[1] considered to be the threshold crossing that would mean irreversible changes to the Earth's climate. The Agreement proceeds to define an even more ambitious goal of limiting the temperature rise to 1.5 °C, which would be much better for the climate and humankind. The latest analyses show that, while keeping the global temperature rise under 1.5 °C will involve huge costs, its benefits will surely outweigh its downsides (Hoegh-Guldberg et al. 2019).

The Paris Agreement entered into force in November 2016, after being ratified by 55 countries responsible for at least 55% of the total greenhouse gas (GHG) emissions. In early 2020, 189 out of the 197 parties to the Paris Convention ratified the Agreement (UN 2020). The European Union (EU) developed a similarly ambitious plan to create an almost climate-neutral economy by 2050, proposing to cut CO_2 emissions between 80% and 95% (European Commission 2018). CO_2 and other GHG are considered to be the main cause of the temperature rise, which is why much of the efforts invested by the EU and other actors concentrate on their reduction. Several national governments, along with numerous cities and municipalities, went even further; inspired by the 'Fridays for Future' movement initiated by Swedish activist Greta Thunberg, they started declaring climate emergencies in early 2019, thus emphasising their dedication to climate and environmental issues. For example, in June 2019, the state of New York passed a plan to reduce GHG to zero by 2050 (Goldberg 2019).

However, some of these declarations could be seen more as lip service than the basis for new climate and environment policies. Most famously, the Canadian Federal Government declared a climate emergency only a few days before approving the expansion of the Trans Mountain Pipeline that will enable the country to export more of its oil produced from oil sands, a process of oil recovery which generates significant pollution (Ljunggren and Williams 2019). Similarly, in November 2019, President Donald Trump announced the U.S.'s withdrawal from the Paris Agreement (which, following the Agreement provisions, would come into effect a year later, in November 2020) thus providing severe pushback to the document as a whole (Duke 2019). The 2050 deadline for developing a carbon-neutral economy within the EU also encountered problems. Namely, in June 2019, the European Council

[1] According to NASA, the current temperature level has risen about 0.9 °C since the late 19th century (NASA 2019).

managed to reach an agreement among the member states only on the "transition to a climate-neutral EU in line with the Paris Agreement" (European Council 2019a, p. 1) without setting a deadline, due to opposition from four Central and Eastern European countries—the Czech Republic, Estonia, Hungary, and Poland. The second attempt in December 2019 was more successful as the European Council "endorse[d] the objective of achieving a climate-neutral EU by 2050", although "one member state, at [that] stage, [could not] commit to implementing" that objective (European Council 2019b, p. 1). Poland, the member state in question, was not identified in the document.

Although the attitude towards climate change does not follow a linear trend, and there are visible and significant ups and downs in the way our global society approaches this issue, we can observe a general trajectory of changing attitudes towards climate change, manifested especially as an understanding of the need to significantly reduce GHG emissions (Hewitt et al. 2017). This process has several dimensions, from changed personal preferences (well-illustrated by the *flygskam* concept—literally, flight shame—which stresses the need to use modes of transportation other than the carbon-intensive flying; Wolrath Söderberg and Wormbs 2019) to adaptations of industry and everything between. The 2020 Covid-19 pandemic has significantly impacted this process as, on the one hand, travel limitations and reduced industrial production have decreased GHG production, with many calling for a 'green' post-pandemic recovery; on the other hand, the industry has been requesting to be excused from existing climate and environmental commitments in order to facilitate its recovery without the need to invest heavily in climate-friendly solutions.

As the source of a significant share of GHG production and one of the main pollutants, the energy sector plays a crucial role in this process. Transition from the existing energy system based predominantly on burning fossil fuels towards a post-carbon one, based on renewable sources of energy, is therefore considered to be one of the main ways to achieve carbon-neutral economies that will produce at maximum as much CO_2 (and other GHG) as the environment will be able to naturally absorb (so-called carbon sink), without an increase in the GHG released in the atmosphere in absolute terms. Many disciplines aim to contribute to this goal as the transition towards renewable energy sources is a complex task which demands all available assistance and support. While the natural sciences are generating the data explaining the causes of climate changes and rising global temperatures, this is often not enough to stimulate "an appropriately strong and rapid societal response" (Nisbet et al. 2010, p. 329) that would translate into concrete action (see Conclusion).

The present volume builds on the notion that natural sciences are not the only ones able to contribute to solving climate change issues, including energy transition. Rather, other disciplines, particularly those within the humanities and social sciences (heretofore largely excluded from the conversation) can assist with this mammoth task by providing support and utilising their knowledge and expertise. Furthermore, the volume argues that only a combination of different points of view and types of knowledge can help us successfully deal with climate change and energy transition, complex problems with profound social, political, legal, cultural, economic, and ideological implications.

1.2 Energy Transition

The energy sector, one of the main pollutants and contributors to climate change, is being gradually transformed in order to decrease its environmental footprint, especially (but not exclusively) connected to the high levels of its GHG emissions. This transformation is better known as energy transition, a concept here defined as the shift from an over-dependency on our rapidly depleting supplies of fossil fuels, such as coal, oil, and natural gas—the burning of which produces carbon dioxide and other GHG emissions that contribute to climate change—to a carbon-free system of energy production and consumption that would not produce harmful emissions (see, for example, Stokes and Breetz 2018). The main goal of the transition is to decrease the energy sector's impact on climate change and halt the documented rise of global temperature caused by increased GHG concentration in the atmosphere.

Carbon dioxide (CO_2) has been identified as the main 'culprit' for climate change, which is why energy transition is aimed at developing and utilising carbon-free modes of energy production and consumption. While fossil fuels are finite and expected to last from the next several decades to a century or more,[2] most carbon-free energy sources are renewable (hence the name renewables, RES) or exist in supplies that are expected to last several centuries (the proposed fourth generation of nuclear power plants). Although the carbon-free nature of non-fossil fuels has dominated the current discussion, the need to replace existing energy systems also stems from the need to provide long-term energy supplies vis-à-vis the depletion of existing fields, rising costs of extracting new ones, geopolitical ramifications of the new situation brought about by these changes, technological development, etc.

While, as energy scholar Vaclav Smil notes, "[a] non-fossil world may be highly desirable, […] getting there will demand great determination, cost and patience" (2006a, [n.p.]). Namely, the transition from unsustainable and environmentally damaging fossil fuels to a world 'after oil'[3] (Petrocultures Research Group 2016), reliant on a mix of different carbon-free technologies, including renewables (biomass, water, wind, solar energy), nuclear, hydrogen, etc., is a challenging, long-term process which requires not only considerable technological advances, but also changes in the way we consume and think about energy. Smil lists five factors hindering the transition: "the scale of the shift; the lower energy density of the replacement fuels; the substantially lower power density of renewable energy extraction; intermittency of renewable flows; and uneven distribution of renewable energy resources" (2006a, [n.p.]). A good explanation for the longevity of energy transition is provided by

[2] The limits of our fossil fuel resources have given rise to a lot of discussion: while many studies highlight the bleak prognoses in their titles (e.g. David Goodstein's [2004] *Out of Gas: The End of the Age of Oil*, Richard Heinberg's [2005] *The Party's Over*, Paul Roberts' [2005] *The End of Oil: On the Edge of a Perilous New World*), others insist that fossil fuels are neither as depleted (some even going so far as to claim that oil is virtually inexhaustible; Adelman 1995, 2004) nor as dirty as is often claimed (Etam 2019; Mills 2008; Odell 2004). Furthermore, they are presented as preferable to trying (with uncertain results) to shift to expensive alternatives (Jaccard 2005).

[3] Although this concept highlights only one type of fossil fuel in its name, we use it to refer to all fossil fuels.

the lock-in concept (Unruh 2000), which shows how the combination of technological structures and institutions (the so-called techno-institutional complex) creates macro-level barriers to the diffusion of carbon-free technologies. Existing carbon technologies are so interwoven with the overall functioning of society and energy systems that they create path-dependency, resulting in series of decisions supporting these technologies over carbon-free ones (see Chap. 5 in this volume). In other words, technologies utilising fossil fuels play an important role and are difficult to replace, because the existing system is based on or connected to them (electricity grids, mobility, employment, technologies, etc.). Thus, a strong push is needed to create a window of opportunity for changing the existing energy systems.

While there is an overall consensus on the fact that energy transition is imperative, "[t]he difficult question of *how* such a complete transformation of social life is to be brought about remains open" (Szeman 2007, p. 816; original emphasis). What are the realities of an energy transition? What does it mean for everyday life? How exactly can the shift to a carbon-free future be realised and what kind of technological and infrastructural changes will it entail? And what should take the place of fossil fuels? The last two questions in particular have generated a lot of discussion, as well as a lot of disagreement. For example, while some believe that nuclear energy should play a key role in the energy transition, others argue against this technology, pointing to the carbon footprint of nuclear power plants created during the entire life cycle of a nuclear facility (Vaillancourt et al. 2008). Moreover, the aftermath of the 2011 Fukushima nuclear accident has dealt a significant blow to the nuclear industry, manifested in, for example, the phasing out of nuclear power plants in Germany (so-called *Atomausstieg*), negative result of the referendum on nuclear energy utilisation in Italy, and the overall decrease of interest in this technology in the Global North. However, many continue to embrace the nuclear: for instance, some of the Central and Eastern European EU members are still interested in the technology needed for developing new nuclear power stations (Mišík 2019), while many countries of the Global South see nuclear as a suitable way to accommodate the increasing energy demands of their growing economies (Andrews-Speed and Tromans 2019).

However, energy transition is not only about the ultimate goal (i.e. the substitution of 'dirty' energy sources with 'clean' ones), but also about the path leading to that end goal and the expected gradual changes it entails. According to some researchers and institutions, the prevention of climate change will not be achievable without the carbon capture and storage (CCS) technology that will ease the transition from fossil fuels to carbon-free sources by addressing the former's emission problem. CCS would enable the continued utilisation of fossil fuels such as coal, as CO_2 emissions created in the burning process would be separated and stored, thus helping develop a carbon-neutral economy. In Poland, this technology is seen as simultaneously enabling the utilisation of 'clean coal' and the fulfilment of EU climate requirements (Kuchler and Bridge 2018). However, the CCS technology is currently underdeveloped and, at the time of this writing, no large-scale CCS instalments that would demonstrate the feasibility of this solution have been built. Other proposed changes such as negative emission technologies (NETs) are similarly often dismissed as expensive, unviable

options, with only "limited realistic potential", which lack viable business models and economic initiatives needed for their implementation (EASAC 2018, p. 1).

The role of natural gas (discussed in Chaps. 4 and 5) is another important part of the discussion on energy transition, as its burning releases much less CO_2 compared to other fossil fuels, earning it the reputation of ideal bridge or transition fuel to a carbon-free future (Aguilera and Aguilera 2012). It therefore seems that natural gas could ease the process of transition, especially since it enables rapid fuel switching (for example, ships can be refurbished to use liquefied natural gas), and relies on existing infrastructure and technologies. However, it is nevertheless a CO_2-producing fossil fuel, which means it can at best be considered a mid-term solution to energy transition. A lot of discussion focuses on the role of renewables in the energy mix, especially in connection to their intermittent nature (particularly wind and solar energy), which raises questions about their compatibility with current energy systems (see, for example, Janda et al.'s [2017] analysis of the consequences of *Energiewende* on transmission networks in Central and Eastern Europe). In its attempt to remain technologically neutral and consider different types of energy and technologies on which there is little consensus, this volume does not discuss the role of the different technologies in the energy transition.

1.3 Energy Humanities

This chapter—and the edited volume as a whole—argues that the interdisciplinary combination of energy-oriented research within the humanities and social sciences—here referred to as the energy humanities—can provide insights into the different (social, cultural, political, ideological, etc.) factors hindering/supporting an energy transition, thus promoting our understanding of the transition towards a future carbon-free energy system necessary to mitigate climate change. Traditionally, research on energy—its resources and (chemical, physical, etc.) properties, conversion, exploitation, and utilisation—has been conducted within the natural sciences and engineering, and the knowledge produced within those disciplinary framework has greatly contributed to our understanding of the energy transition. Studies assuming a more technical approach have examined topics such as the different ways of increasing the efficiency of new technologies (Irandoust 2018), lower costs of technology that would make it competitive in the context of current carbon-based methods of energy generation (Shahnazari et al. 2017), or the (not always positive) effects of renewables on existing energy systems (Málek et al. 2017). However, the restriction of energy research to the previously mentioned disciplines results in a limited and fairly one-sided definition of the central issue (cf. Hulme 2011), one that typically overlooks the social, political, and cultural aspects of energy systems and energy transition. In response, much of the current research within the social sciences started focusing on the social and political dimensions of energy transition and their various implications (Sarrica et al. 2016, and many other articles, especially those published in the *Energy Research & Social Science* journal) including (among other topics) the

changing modes of energy governance and their impact on EU member states (Knodt and Ringel 2019); consumer behaviour (Stephenson et al. 2010); political, regulatory, and other barriers to carbon-free technologies (Bae and Yu 2018); energy democracy (Szulecki 2018); and energy poverty (González-Eguino 2015).

However, the inclusion of the social sciences alone in discussions on energy transition does not provide a thorough enough view of the process, leaving room for further inquiries. For example, the majority of social science inquiries on the consequences of the energy transition consider the experiences of past energy transitions only to a limited degree. However, the current transition is only the latest in a long history of energy shifts (e.g. from biomass to coal, or from coal to hydrocarbons; Smil 2006b), so examining these historical cases can offer insight into the mechanisms of energy systems change, as well as lessons for the future and examples of best practices. Social (and natural) scientists have also been hesitant to address the broader implications of the energy transition and reimagine our energy future. However, it has been argued that in order to introduce change, one must first imagine it (Sovacool and Brossmann 2013), a notion inscribed in the broader concept of sociotechnical imaginaries (Jasanoff and Kim 2013; see also Chap. 9).

This is where the humanities come in. With their focus on the "problems of ethics, habits, values, institutions, belief, and power" (Boyer and Szeman 2014, [n.p.]), the humanities and humanistic social sciences are ideally positioned to expand our understanding of the energy transition—its causes, pathways, possible shapes, and outcomes—and help communicate scientific knowledge on climate change in more effective and engaging ways. For example, exploring history offers examples of past energy transitions and societies that were not growth-oriented (see Chap. 3), while literature (especially speculative fiction) provides a platform for developing new ideas and testing future scenarios (see Chap. 9). Even such an unexpected discipline as archaeology can shed new light on various energy policy issues, such as the long-term depository of nuclear waste. As nuclear technology is likely to play an important role on our way to a carbon-free future, the issue of labelling permanent depositories of nuclear waste in a way that will warn future generations about their potential risks will become an important issue[4]. With its long tradition of examining marking systems of taboo and forbidden places (David and Wilson 2002; Olsen and Pétrusdóttir 2014), archaeology can therefore contribute valuable knowledge to the discussion on energy transition.

The fact that our world is being radically altered and the traditional tools we use to make sense of it, such as storytelling, no longer adequately represent or interpret the immense scope and far-reaching consequences of the current crisis (Ghosh 2016; Heise 2008), forces us to question our knowledge about that world, and our current and future place in it. As Tobias Boes points out (2014, p. 166),

[4] Although one could argue that the fourth generation of so-called fast reactors—able to use what is currently considered waste—would solve most of the problems connected to nuclear waste, there would still be a lot of radioactive materials (e.g. different parts of decommissioned nuclear power plants) that would have to be stored in the long term.

> [a]s we hurl forward into the Anthropocene, our continued survival will hinge in part on our ability to conceive of new ways of imagining the Earth (and by extension also the human species) in both the statistical and the autopoetic fashion necessitated by modern climate science.

Likening our planet to "a book in which we write our own destiny", Boes highlights the urgent need for "a hermeneutics and a poetics (a theory of understanding and a theory of expression) that might accompany the scientific study of the changing Earth system. The challenge that our present situation poses to the humanities has never been graver" (ibid., p. 168). The emergence of the concept of the Anthropocene[5] (Crutzen and Stoermer 2000), which identifies humans as the new geological force, highlighting the unprecedented impact humankind has had on the nonhuman, has blurred the distinction between natural history and human history, which, in turn, demands a reconsideration of the very nature of human identity, activities, ethics, values, and responsibilities (Chakrabarty 2009), all of which have traditionally been studied within the auspices of the humanities.

In addition to helping us make sense of the world, the humanities also play an important role in challenging, subverting, and unsettling dominant narratives, a task which appears particularly significant at a time when carbon-free energy resources are often negatively framed as overly expensive or insufficient for meeting our energy demands (see previous section), and so-called climate change deniers continue to publicly challenge scientific evidence. By examining the roots of fossil fuel capitalism and the degree to which our dependency on oil (reflected in terms such as *petrocultures*[6]) has shaped our contemporary modes of existence, the humanities also allow us to imagine an alternative to these systems and the concrete steps that will lead to its realisation. Furthermore, they emphasise "the way in which all knowledges are rooted in cultural and historical positioning, and often grounded in the erasure of alternative understandings, in particular those of non-Western and Indigenous peoples" (O'Gorman et al. 2019, p. 450; see also Chap. 8).

This volume aims to bring these and similar issues into the discussion on energy transition, and highlight the added value of the energy humanities to our understanding of the changes that this process will bring about. If there is one basic premise this research area is built upon, it is the one voiced in Imre Szeman's contribution to this volume (Chap. 2): energy *matters*. This is especially evident in the degree to which it permeates our contemporary world, shaping virtually all aspects of both our individual, everyday lives (in the sense that we are dependent on energy to run our households, prepare food, get to work, or relax with a good movie), and our collective social, cultural, and political existence. The energy humanities highlights

[5]While the term has been widely accepted, it also has its critics (Crist 2013), who argue for the adoption of the previously used Holocene or propose alternatives, such as the Capitalocene (Moore 2017), Ecozic (Berry 1991), Plantationocene, or even Chthulucene (Haraway 2015).

[6]The term 'petrocultures' is used to highlight "the ways in which post-industrial society today is an oil society through and through", and the degree to which dependency on fossil fuels shapes not only our material and physical reality, but also our "values, practices, habits, beliefs, and feelings" (Petrocultures Research Group 2016, p. 9).

the "critical role" of energy in "determining the shape, form, and character of our daily existence" (Petrocultures Research Group 2016, p. 9), reminding us that the transition from fossil fuels to 'clean' energy (Szeman 2016, p. 1)

> necessitates a wholesale transformation in contemporary petroculture: the political structures, built environments, social dynamics, gendered realities, educational systems, discursive modes, and everyday values, practices, habits, feelings, and beliefs that have developed in relation to and as a result of the shaping force of fossil fuels.

As such, it underscores the need to reconsider energy not just as a material, economic, and technological phenomenon, but also (and, perhaps, even more so) a social and cultural one.

To be sure, explorations of the different social (e.g. social acceptance of renewables[7] or nuclear energy and development of supporting schemes aimed at improving the competitiveness of renewable—and therefore carbon-free—technologies; Arent et al. 2017; Beck et al. 2017; Osička and Černoch 2017) and historical aspects of energy systems, including energy transitions (Mitchell 2011; Smil 2017), have been conducted before Dominic Boyer and Imre Szeman coined the term 'energy humanities' to designate "a rapidly emerging field of scholarship that […] highlights the essential contribution that the insights and methods of the human sciences" can make to the study of energy (2014, [n.p.]). For example, as early as 1934, historian and philosopher of technology Lewis Mumford discussed the impact of energy transitions happening at that time (especially from coal-based steam to electric motors) on society at large. Anthropologist Leslie White examined similar developments in the 1943 paper 'Energy and the Evolution of Culture', which identifies energy as a significant factor in shaping human society and culture.[8] Similarly, the need to overcome rigid boundaries between the (natural) sciences on the one hand, and the humanities and social sciences on the other, as well as those between academic research and its practical application, which lies at the core of the energy humanities, has been repeatedly voiced by both sides of the disciplinary divide (Gottschall 2008; Hulme 2011; Nisbet et al. 2010; Snow 1960; Sovacool et al. 2015). These calls have led to lively discussions bridging traditional disciplinary divides. The humanities in particular have been engaged in multidisciplinary and cross-disciplinary collaborations—partly in response to its ongoing crisis (see Chap. 3) and criticism voiced by other disciplines (Gottschall 2008; Kernan 1997; Perloff 2005; Stover 2018)—which have resulted in the development of a number of stimulating interdisciplinary research areas, such as digital, cognitive, medical, and environmental humanities.

While the field of energy humanities has been rapidly developing in recent years to the extent that developing a single definition that would encompass all its different

[7] A prominent place within the discussion on renewables (especially wind farms) belongs to the concept of NIMBY (Not in My Back Yard), the opposition to various forms of development or implementation of renewables, based on financial, environmental, aesthetic, and similar issues they entail (see, for example, Schwenkenbecher 2017).

[8] For a more extensive overview of literature, see Szeman and Boyer (2017a, b) or the extensive, thematically organised bibliography included in the final report on the "On the Energy Humanities" project (Szeman 2016, pp. 32–73).

facets would be almost impossible (see Chap. 2), several key objectives can be identified as being central to the research area. Firstly, the energy humanities aims to trace the roots of what Stephanie LeMenager has described as our "destructive attachment" to oil and other fossil fuels (2014, p. 11) by exploring the history of energy use and energy transitions, and using the lessons learned from them to prepare an outline and possible blueprint for the future transition to a carbon-free economy (Crosby 2006; Fouquet and Pearson 2012; Herring 2005; Podobnik 2005). Secondly, it studies the degree to which energy permeates our daily lives and shapes our current culture, society, political systems, and even interpersonal relations (Huber 2013; LeMenager 2014; Luong and Weintal 2010; Noreng 2002; Ross 2012; Wilson et al. 2017). While the first objective is largely concerned with the past and the path that led us to the present moment, the second focuses on our current existence within fossil fuel—specifically oil—capitalism (Szeman 2007).

Thirdly, the energy humanities seeks to identify the social, cultural, and political changes necessary to facilitate a full-scale energy transition, anticipate their consequences, and imagine possible scenarios for a future 'after oil' (cf. Sovacool and Brossmann 2013). Intertwined with this goal are creative responses to past and current energy-related issues, such as photographs, art installations, performances, films, plays, and poems (for a selection of these, see Szeman 2016, pp. 65–72; Szeman and Boyer 2017a), and explorations of the role and representation of energy in different art forms and media (Anca Farca 2015; Bellamy 2016; Ghosh 1992; Macdonald 2012, 2016; Szeman 2011; Wenzel 2006; Wilson et al. 2017; Yaeger 2011). Energy humanities thus examine the past, present, and future of energy systems, and therefore have much to offer to a discussion on the energy transition.

1.4 The Present Volume

The edited volume consists of twelve contributions, some of which originated at the 'Energy Humanities: What We Know and Where We Are Going' workshop (see Preface to this volume), while others were written specifically for this book project, in order to expand its thematic, disciplinary, and methodological scope. The selection of diverse energy-oriented research included in the volume provides a variety of topics, angles, critical approaches and practices, methods, interpretations, and voices, which, when taken together, illustrate the diversity and complexity of the energy humanities, as well as the heightened attention to energy issues and the proliferation of energy-oriented scholarship within the humanities and social sciences.

Penned by both seasoned researchers and early-career scholars, the individual contributions in the volume critically investigate the current state of the energy humanities and provide outlines for its future development. Furthermore, they offer novel insights on issues that have dominated scholarly discussions (climate protection, energy policy) and open up new avenues of thought (energy history of the humanities, critical theory of energy) connected to energy transition. In this way, the volume aims to avoid some of the pitfalls of existing research within the energy

humanities, primarily its 'petromyopia' or excessive focus on oil, which, according to Christopher F. Jones, "can distort our understanding of energy systems and distract scholars from giving proper weight to other energy sources", be they non-renewables or alternative resources (2016, p. 1). While boasting a variety of voices and approaches, the volume also acknowledges its inherent limitations, as some topics, approaches, and disciplines have inevitably been omitted (see Conclusion).

The role of the energy humanities has so far largely been exhausted in bringing together the different strands of energy research within the humanities and social sciences, prompting a conversation and collaboration between them; however, the present volume argues that, in order to reach its full potential, the research area must also challenge and transform those disciplines. In other words, as the following chapters demonstrate, energy is more than just a new topic of research for the humanities and social sciences; rather, it profoundly affects those disciplines, prompting them to develop new theories, methods, and vocabularies better suited to energy-oriented research (see Chap. 2). Furthermore, it prompts us to reconsider the relationship of those very disciplines with energy, for they—like everything else—also depend on energy for their very existence (see Chap. 3). Finally, it invites us to reconsider the way we produce, consume, and think about art (also a product of energy; see the chapters in Part III).

Energy Humanities. Current State and Future Directions aims to contribute to the pertinent ongoing discussion on the various energy challenges humanity is currently facing, with a primary focus on energy transition. As indicated in its title, it proposes to provide an overview of some of the key issues the energy humanities is currently preoccupied with and outline possible directions for its future development. Finally, it underscores the need for developing an interdisciplinary critical theory of energy and reconsider not only the social, political, and cultural aspects of energy, but also the tools used to study them.

1.5 Structure of the Edited Volume

The edited volume consists of ten original contributions—framed by this Introduction and the Conclusion—divided into three thematic sections. Entitled 'Energy and the Humanities', the first section is theoretical and programmatic in nature. It encompasses two contributions which contemplate the nature and history of the energy humanities, its theoretical foundations and future directions, as well as the different ways in which the humanities approach energy issues and how they, in turn, are challenged and transformed via this new field of inquiry. The section opens with a contribution by Imre Szeman (Chap. 2), one of the pioneers and leading experts in the field, who proposes that energy humanities may be understood as an attempt to develop a critical theory of energy. Crucial for Szeman's argument (and the present volume) is the notion that energy should not be seen merely as a new topic for the different disciplines within the humanities, one which can be described using existing vocabulary and studied with existing theoretical and methodological apparatuses.

Rather, the newly emerged focus on energy demands a transformation of the disciplines, which require wholly refashioned, energy-oriented vocabularies and theories to investigate this burgeoning and highly relevant area. Furthermore, the notion of critical theory demands interdisciplinary research and collaboration, thus challenging traditional disciplinary divisions. The chapter also provides a brief overview of the energy humanities, highlighting some of the most significant contributions made across the disciplines, while also drawing attention to under-researched areas and topics, such as the role of energy in the different operations of politics, governance, power, and freedom.

Chapter 3 by Dan Tamïr looks at what is commonly described as a crisis within the humanities, focusing especially on its energy aspects. The latter are often overlooked as the humanities have traditionally been viewed as almost immaterial and dissociated from their physical environment, especially when compared to the natural sciences which rely on complex infrastructures. Despite their reputation, the humanities, like any other human pursuit, are energy dependent and therefore do have an energetic history of their own. The chapter discusses this history in terms of two regimes: the old, sun radiation-dependent regime, and the new regime, which also includes fossil fuels. The chapter also considers concrete steps that might be taken to deal with climate change (also explored in Chap. 6) and the energy crisis, highlighting the crucial role of the humanities in this process.

The three chapters that constitute the second section, entitled 'Social and Political Implications of Energy', examine individual countries and international organisations to better understand the role of public discourse in shaping the perception of different energy resources, explore the role of energy within international relations, and identify examples of best practices regarding climate change policy. The section opens with a contribution by Justin Tomczyk (Chap. 4), which focuses on the Eurasian Economic Union (EAEU). The chapter examines the role of natural gas in the process of Eurasian integration and highlights the importance of including energy integration and common energy markets among the EAEU's founding principles. Special focus is on the highly energy-dependent Armenia. The existence of a common gas market allows EAEU members to keep Russia in line by preventing it from shutting off gas delivery to individual countries or raising prices. This enables smaller states like Armenia to exert pressure on Russia, forcing it to abide by a rules-based order. However, despite these provisions, Armenia's position continues to be precarious because it imports energy via Georgia, a country at odds with Russia. Through its examination of the EAEU, the chapter highlights the various political dimensions of energy, especially its use as a means of exerting pressure on energy-importing countries (often described using the concept of energy weapon, explored in more detail in Chap. 9) and its role in regional integration processes.

Written by John Szabo, Chap. 5 also focuses on natural gas, specifically, the political public discourse shaped by various key actors (EU-level institutions, private corporations, policy makers, etc.), which promotes it as the cleanest fossil fuel. By using a critical discourse analysis of policy documents and statements of key stakeholders in the EU's natural gas scene, the chapter traces the development of the

discourse on natural gas as a bridge fuel, which overemphasises its positive, climate-friendly qualities, as well as its impact on the role of this resource in the EU. In this way, it examines the ideological inscription of energy and its permeation of social and political relations, i.e. the connection between energy, its material practices and production (the structure), and its political and ideological inscription (the superstructure) which supports wider power relations. Ultimately, the research shows that support for natural gas stems less from its status as a climate-friendly energy source, and more from the economic and other interests of key actors inscribing it with ideas which contribute to the preservation and perpetuation of existing power relations, relations of production, and structures of fossil capitalism. As Szabo points out, this insistence on maintaining and perpetuating fossil capitalism is at odds with the process of energy transition, substituting the goal of sustainability with carbon neutrality and prolonging our dependency on fossil fuels.

The final chapter in the second section, written by Mishka Lysack (Chap. 6), starts from the notion that the abundance of scientific evidence pointing to the devastating and accelerating consequences of climate change does not prompt sufficient and/or sufficiently efficient action on the national and international levels. The author sees this as a direct result of a lack of effective climate policy implementation, accountability, and transparency. While many countries are struggling to meet their international climate commitments, some are making considerable progress and should therefore be studied as examples of good practices. The chapter does precisely that by analysing the UK and its Committee on Climate Change, which are compared to less successful cases (specifically, Canada). It examines the key building blocks and operating principles of the Committee, with special emphasis on its foundational legislation, the 2008 Climate Change Act, and considers its limitations and shortcomings, as well as opportunities for its modification. As Lysack demonstrates, analysing such examples of best practices and asking what makes them so successful offers valuable lessons which countries struggling to meet their climate commitments can implement in order to enhance their climate policies.

The volume's third section—'Representations of Energy'—encompasses five chapters, which study the depiction of select energy sources (oil and nuclear energy) in different media, from film and television series, through literature and photography, to art installations. All the chapters consider these representations within wider social, cultural, ideological, and political frameworks, asking how they shape our perception of the past and our visions of the future. Using the concepts of eco-guilt and eco-shame, reinforced with the concept of toxicity, the contribution by Tatiana Prorokova-Konrad (Chap. 7) examines how two examples from recent Norwegian visual media—the thriller *Pionér* (2013) and the TV series *Okkupert* (2015–)—depict the country's dependence on fossil fuels. Spanning nearly half a century, the analysed examples illustrate the transformations of Norwegian society, enabled by its access to oil. Furthermore, they reflect on the devastating human impact on the environment by staging the conflict between humans and nature through various acts of violence (criminal activity, war), which are ultimately linked to climate change. *Pionér* in particular reflects on the dangerous (toxic) aspects of our current oil dependency by depicting the various criminal deeds it drives the characters to. Viewing the

film and series as examples of eco-narratives, the chapter highlights the importance of visual media in raising public awareness of the pressing issue of climate change.

Chapter 8 by Samantha Spady and Siobhan Angus further explores the violence that underscores our dependency on fossil fuels by addressing the important issue of colonialism and its legacy, and exploring how it has shaped our contemporary society, including our understanding of climate change and energy transition. Using photographs of the Athabasca Tar Sands in Western Canada as their case study, Spady and Angus explore how settler colonialism and extractionism led to the expropriation of Indigenous lands and their appropriation for oil extraction. The authors argue that various means of cultural production—specifically photography—reflect the extractive view and the colonial gaze, and therefore played an important role in these processes by promoting the image of the Tar Sands as wild territory which belongs to no one (*terra nullius*). Such dispossessed land could easily be appropriated for the various 'civilising' projects which used the land for resource extraction, agriculture, etc., paving the way for its capitalist-colonial appropriation. The chapter vividly illustrates the importance of understanding energy transition not merely as a substitution of one energy source with another, but as a complex process with deep social, cultural, ideological, and political consequences and implications.

The contribution by Matúš Mišík and Nada Kujundžić (Chap. 9) explores the possibilities of the energy humanities by demonstrating how an interdisciplinary approach wherein a literary text is analysed with the tools of the social sciences can lead to a better understanding of both the text and the tools, while also yielding new concepts with extra-literary application. Specifically, it analyses Isaac Asimov's science fiction novel *Foundation* by relying on the energy weapon, a concept used within international relations to describe situations in which energy-exporting countries use energy to promote their own agenda and modify the behaviour of energy-importing countries. The chapter first examines whether the use of nuclear energy in the novel meets the criteria for energy weapon and then identifies three types of energy weapon use: deterrence, ideology, and trade. To demonstrate that the usefulness of this classification goes beyond the literary text, it applies it to the case of the Russian Federation. Building on existing research on energy in science fiction, the chapter highlights the potential of the future-oriented genre (and fiction in general) as a fictional laboratory of sorts, which can be used to test different scenarios for an energy transition and life 'after oil', and develop strategies that will allow us to realise the most suitable ones.

In Chap. 10, Inna Sukhenko examines three U.S. examples of Chernobyl fiction—fictional narratives depicting the accident at Chernobyl Nuclear Power Plant (1986), its causes, and aftermath. Situated within the proliferating research niche of nuclear criticism, the chapter uses Jacques Derrida's notion of the 'fabulously textual' to analyse the literary dimensions of the Chernobyl accident and its impact on nuclear narrative, which initially largely subscribed to Derrida's rhetoric of the nuclear as 'an imagined event'. Chernobyl marked a significant movement away from the fictional to the factual, as narratives sought to provide authentic accounts of events, often based on eyewitness accounts and memoirs. To illustrate this insistence on the factual, the analyses of the three novels (Frederik Pohl's *Chernobyl*, Andrea White's *Radiant*

Girl, and James Reich's *Bombshell*) focus on their spatio-temporal settings, created through references to real locations, historical dates and persons, and elements of popular culture of the time.

The section closes with Chap. 11, in which Laura Pannekoek considers the aesthetics of and discourse on nuclear risk management. Her contribution analyses Trevor Paglen's and Taryn Simon's radioactive cubes, *Into Eternity*—Michael Madsen's documentary about the Finnish deep geological nuclear waste repository Onkalo, and the GEOSAF project of the International Energy Agency. Through their sheer materiality, the two artworks make the threat of radiation, often described as intangible and even unthinkable due to its extreme temporal displacement, concrete, material, and tangible. In this way, they contribute to developing a new vocabulary, temporality, and epistemology, necessary to address the unique, unthinkable, and unknowable nature of nuclear demands. The cubes can also be seen as a means of communicating with the future, since they will not be available to the public until their (or the sites') radioactivity levels drops, which will not happen for at least 1,000 years. The issue of communicating with the future is also raised in Madsen's documentary, which discusses the problem of labelling nuclear waste sites, asking how future generations will interpret the signs and symbols used to mark them. Building on Frances Ferguson's notion of the nuclear sublime, the chapter develops the concept of the nuclear mundane, which seeks to give the nuclear shape in order to stabilise its energy future (rather than highlight its instability and unpredictability).

The Conclusion summarises the main findings of the assembled chapters and their contribution to the energy humanities, reflects on some of the volume's limitations, and proposes guidelines for future research. It highlights the role of the humanities and social sciences in enabling a more efficient communication of scientific knowledge related to climate change to relevant actors (e.g. decision makers) and the general public.

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