

Getting to grips with energy: fuel, materiality and daily life

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Introduction

We live in energetic times. Never before in the history of the world have humans used as much energy. Between the first Oil Crisis in 1973 and today, energy consumption by households, industry and agriculture has doubled. In Europe alone, electricity consumption per person multiplied twenty-fold between 1930 and 2000. Since the start of this millennium, 160 million people across the world have gained access to electricity. Notwithstanding advances in renewables, coal-fired power generation has also grown by 900 gigawatts (GW) in the last fifteen years; to put this in perspective, this is twice as much as the total capacity of renewable energy installed in Europe (409 GW in 2017) and eighteen times as much as the United Kingdom's peak electrical demand (53 GW) ([International Energy Agency, 2017](#); [European Environment Agency, 2017](#)). For the increase in energy generation in Europe, see [Kander et al.](#)) Climate change is the well-documented result of our carbon-hungry, energetic lifestyle.

We are dealing with more than a physical phenomenon of watts and carbon, however. Energy is becoming an increasingly central topic of cultural inquiry and political concern, too. Scholars and activists alike are debating the causes and consequences of our dependence on fossil fuels. Museums are curating new exhibitions to show how energy has transformed our lives and landscapes. As exemplified by the Deutsches Museum, Munich in their exhibition *energie.wenden* in 2017, these displays have moved a long way from the heroic story of a forward march of science and progress. Instead, visitors are invited to wrestle with the dilemmas and trade-offs involved in energy transitions. Should money and support go to renewables, gas, nuclear or to home insulation? In academia, the new field of energy humanities is flourishing with historical, literary and visual studies. In the social sciences, anthropologists, geographers and sociologists have begun to illuminate the social meanings, values and practices arising from the use of energy. Energy has a social and cultural life. As a group of

anthropologists recently put it: 'how people use energy is related to how people value it; and how people value energy is related to what it enables them to accomplish not only materially but also socially and culturally' ([Strauss et al, 2013](#)).

The excitement generated by this new curiosity about energy as a fusion of cultural artefact and physical phenomenon, however, is matched by daunting challenges. The subject is complex and disciplines fragmented. In a world divided by specialist expertise, departments and training, most researchers inevitably look at 'energy' with their own set of questions, methods and meanings. And how do you best capture and illustrate 'energy' for an interested audience?

These are burning questions for museum curators and academic researchers alike. They were the inspiration behind a workshop in London in June 2016 co-organised by the Science Museum and the Material Cultures of Energy project, funded by the Arts and Humanities Research Council (United Kingdom).^[1] The goal was to bring together museum curators and scholars from the humanities and social sciences to share some of the most innovative new work in the study of energy and discuss the challenges involved in analysing and communicating it. This special journal issue brings together several of the most interesting papers of the day, complemented by additional features on recent artistic experiments and experiences of visualising energy in museum galleries.

It would be misleading to speak of energy studies as a field in any strict sense of the word, or to treat the articles included here as an overview of such a terrain. Energy has too much entropy for that: it always disperses. That is its charm for researchers, and also its challenge. Light, heat and mechanical work cannot be as easily displayed in a glass case as a clock, a rocket or a porcelain cup. Instead of looking for a single school or paradigm, the ambition of this special issue is to offer readers a chance to enter the worlds of energy via a number of different doors and to appreciate the insights provided by different perspectives, methods and sources. Together, these articles open up the rich vein of energy as a subject of material culture. We hope it will inspire many others to mine it, too.

Figure 1



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'The Electric Spark' (*Elektrischer Funke*) represented by a couple kissing passionately, a marble statue by Reinhold Begas, Berlin, from a 1906 picture card. The original statue has been lost

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Material cultures of energy: making energy visible again

There is a fundamental tension between the so-called natural and human sciences in their treatment of energy. In Newtonian physics, the conservation of energy is a universal law. Energy does not go up or down. It merely changes form: from performing work to generating heat, for example. The laws of thermodynamics teach us that energy cannot be created or lost but also that in the process of transformation some of it always disperses in waste heat or other less useful forms – entropy is always on the rise. Human culture, of course, operates within this natural setting and not outside it. But, in culture, by contrast, energy is of interest for its relative and evolving properties. Across time and space, the role of energy in human societies has varied enormously. It has done so with regard not only to the overall quantity measured in joules or BTUs (British Thermal Units) but also the quality of energy use and its particular functions and meanings.

The same number of joules can appear precious to one group but barely register with another. Take heat: what feels cosy and comfortable to some, can appear as too hot or too cold to others. Anthropologists have observed striking differences between cultures in their energy use and sensitivities. Norwegians, for example, heat and light the whole house as a sign of welcome and comfort, whereas the Japanese direct their energy on a particular room.^[2] While, of course, we would want to know how much energy is needed to heat a home to a certain temperature and how insulation and radiators might do so more efficiently – the job of physicists and engineers – we surely also should want to know how and why ideas of comfort were changing in ways that made people today demand more heating or more cooling than in previous generations. Similar questions arise in relation to visual cultures and aesthetics and our changing relationships to fire, light and smoke.

We must therefore be careful and not treat energy culture as the product of nature. Energy cultures have a life of their own and generate dynamics that also exert pressure on nature, for example, by making societies want to generate more power to satisfy rising norms of thermal comfort. The moment we shift our attention to the demand for energy and ask what people do in their daily lives that creates this demand, how they think and feel about the energy they use become central topics of inquiry. In short, we need to complement thermodynamics with material culture.

An important first step in getting to grips with energy today is to make it visible again. In part, this is an act of recovery. Before the triumph of large technical networks, it was a common trope to think of energy, nature and culture together. To take just one example, energy played a central role in historical materialism and in Karl Marx and Friedrich Engels' view of evolution. Engels appropriated Lewis Henry Morgan's study of ancient society (1877) to produce an evolutionary account of private property and social change. For Engels, the appropriation of energy from nature (and the technologies needed to extract it, both as food and heat) proceeded in tandem with the evolution of human consciousness and social organisation. Later anthropologists raised an obvious and damaging objection to this grand story: societies did not all follow the same line of material-cultural evolution, but showed surprising variations ([Tilley et al, 2006](#)).

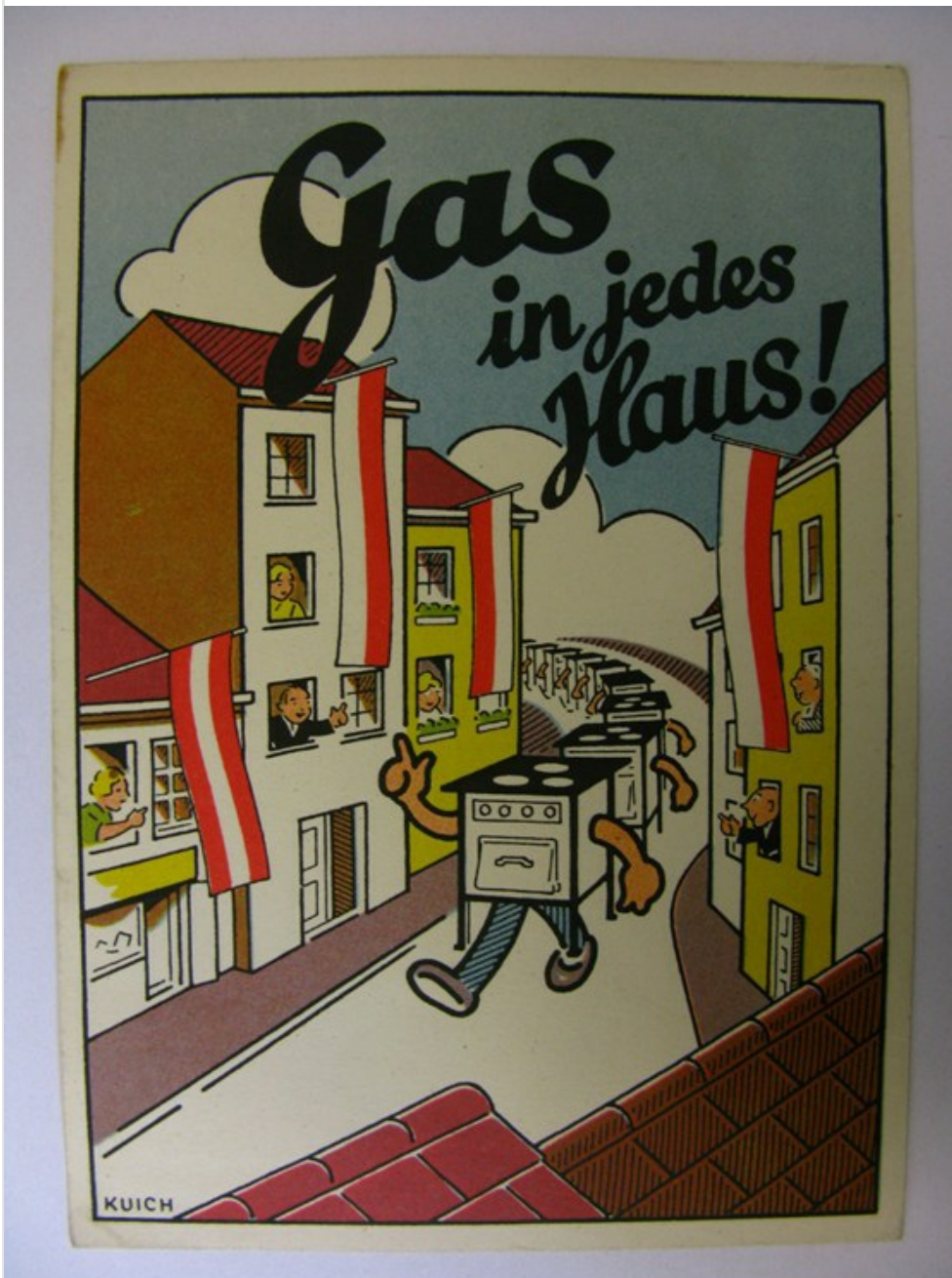
In many museums today, energy continues to perform a gradual disappearing act as the artefacts of human civilisation from pre-industrial times give way to industrial and post-industrial society. The fascinating National Museum of Iceland in Reykjavik illustrates the point. From the ninth century CE to the nineteenth century, energy occupies a central aspect in the galleries: as fuel it occupies a prime place in displays of hearth and home and the lives of the Icelandic population. Once the visitor moves to the section on consumerism since the 1960s, a radically different arrangement takes their place. Radios, fridges, record players, hair-dryers, television sets and many other consumer durables and appliances compete for attention. The energy needed to power these items, however, is now assumed. Displays of modern consumption take energy for granted in ways inconceivable in exhibits of the early modern home. In the corridor on contemporary culture, a single pylon stands lonely opposite the hall, but there is no invitation for the visitor to think about possible connections between consumer goods in an electrified home, new lifestyles and the new kinds of demand they create for the energy systems needed to feed them.

Energy is likewise hidden in most academic studies of consumption and material culture. With its long-established focus on ostentatious or conspicuous consumption, luxury and affluence, most studies have ignored what sociologists have called 'ordinary consumption' and the demands it makes on power and networks. Resources and material are left to environmental studies, even though shortages and affluence have been twins of consumer society.^[3] Even an excellent compendium such as the *Handbook of Material Culture* (2006), edited by the archaeologist and anthropologist Christopher Tilley and colleagues, only offers three page references to energy – and none at all to coal, gas or electricity ([Tilley et al, 2006](#)). Yet, when read closely, forms of energy come in and out of several entries, especially in discussions of the architecture, design and organisation of the home, such as the need for cooling in different types of buildings.

The silencing and disappearance of energy can, partly, be pinned on the advance of gas, electricity and modern networks in the twentieth century and the story they told of ever greater ease, efficiency and comfort. The pioneers of electricity, in particular, promised clean, effortless energy and convenience that liberated the female grate-slave and her husband from the dirty shackles of the coal fire. The fuel itself would disappear, and with it the labour and dirt involved in operating it. Wiring would be hidden away. To access power, all that was needed now was the flick of a switch. There are some elements of truth in this story: the switch from an open fire to an electric heater banished the dirty fuel to a distant power station; wiring standards put loose cables behind plaster walls; once AC replaced DC and grids and networks took over, users no longer knew where their power came from; by the 1960s, meters moved from visible spaces inside the home to basements or external boxes.

But, ultimately, this rosy technological story is also an idealised one that obscures a much messier process. In reality, power was never completely removed from the human touch and mind. Transitions from one fuel to another were rarely linear and involved people mixing and matching fuels and technologies. Tellingly, the Frankfurt kitchen of 1926, the very icon of modern living, included a stove that combined coal and electricity.

Figure 2



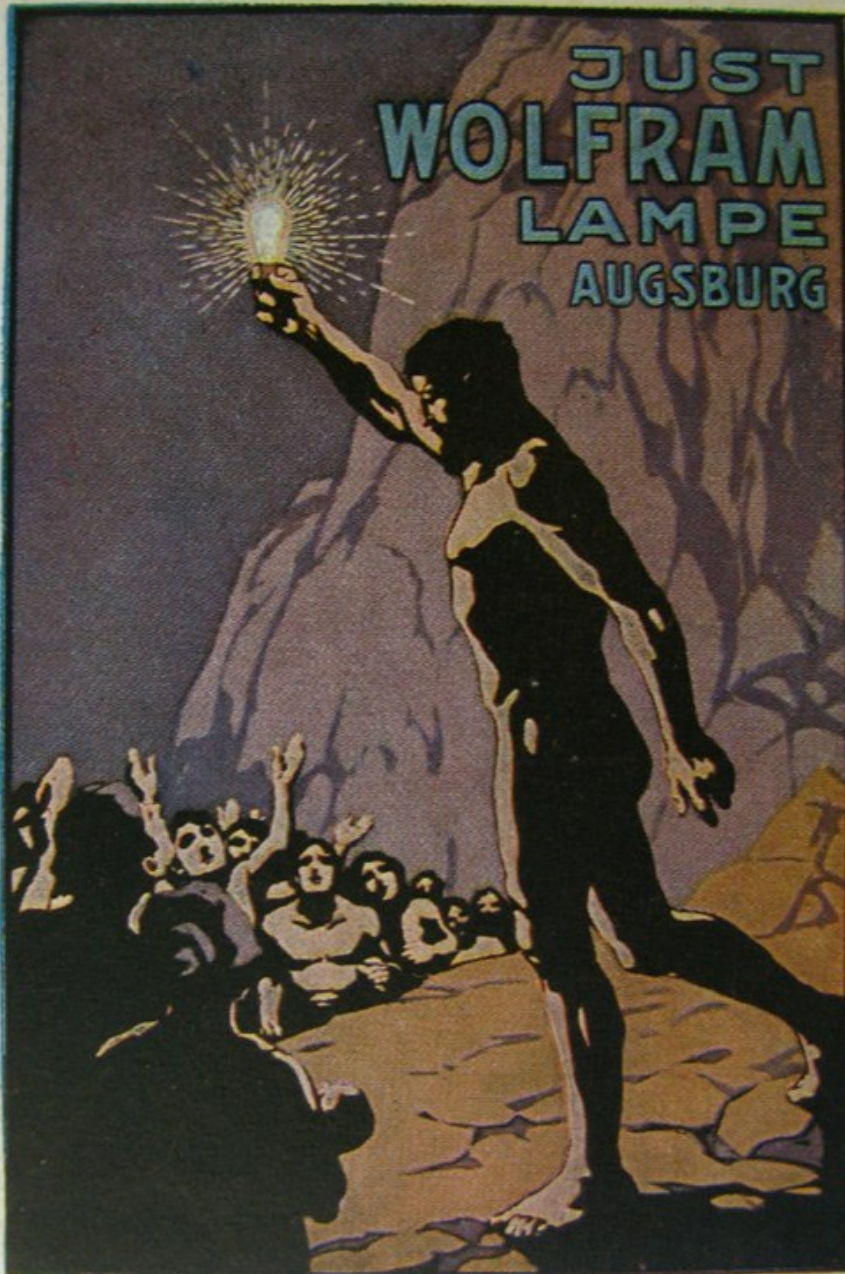
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'Gas for every Home' (*Gas in jedes Haus*), with gas cookers marching down the street, from an Austrian advertisement in April 1938; the gas cookers followed in the footsteps of German soldiers who were cheered by Austrian crowds one month earlier, when Hitler annexed Austria

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In addition to celebrating modern science, early gas and electricity adverts also borrowed from classical myths and romantic folklore. Prometheus and goblins brought light and fire.

Figure 3



Prometheus, der Feuerbringer!

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'Prometheus, the bringer of fire!' (*Prometheus, der Feuerbringer*), advertisement for a lightbulb with tungsten wire, c. 1910–14. Other manufacturers, too, tried to cash in on the ancient hero, such as Prometheus Fabrik, a factory in Frankfurt a. M. producing electric cookers and heaters

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The advance of gas and electricity was slow and uneven and, in Europe, took over three generations to reach rural communities and the urban poor. People needed convincing and new fuels had to be domesticated ([Gooday, 2008](#)). Coal was not only cheap.

People's habits, visual sensations and bodily experiences of warmth were also attached to the open fire. In mid-twentieth century London, urban planners and local authorities found in their investigations that their constituents had a much lower demand for gas and electricity than the utility providers would have liked. On housing estates, some tenants were demanding more sockets and better wiring, but simultaneously many disliked new fuels and resisted the promise of 'better' technologies. In Britain, there were principled debates into the 1950s about whether it was morally right or even financially possible to deprive the working classes and the poor of their coal fire and to aspire to have the same shared norms of heating and lighting for all ([Trentmann & Carlsson-Hyslop, 2018](#)).

Nor should we overestimate the superiority of the new clean fuels. We tend to associate energy shortages with the poorer developing world. But the spectre of scarcity has haunted expanding consumer societies for centuries, from the wood crisis of the seventeenth century, across Britain's anxieties about a coal famine in the nineteenth century to the oil crises of the 1970s. In advanced industrial societies, black-outs and shortages were widespread experiences into the 1950s – and then returned with a vengeance with the first oil crisis in 1973 ([Nye, 2010](#); [Shin and Trentmann, in press](#)). Not surprisingly, fears of running out of fuel made people look sceptically at big networks and turn to other fuels and systems of provision for back-up. Ideas and habits of self-reliance and architectural visions of self-sufficiency were the natural counterparts of such shortages.

Putting material culture into the study of energy also means widening the traditional cast of characters and practices. The rise of modern networks tends to be visualised as a vast technical system of power stations, substations, transformers, peak operating schedules and grid operators. Such a point of view tends to be supply-oriented. When we instead turn our eye to what energy is used for, different actors are allowed onto the stage: housewives, children, the elderly, lighting designers and appliance salesmen and women, as well as office workers relying on energy-hungry equipment at their workplace. In the course of the twentieth century, official energy forecasts tended to legitimate a certain kind of statistical expertise and scientific expert – first scientists who estimated fuel reserves, then economists who measured GDP. However, many other types of expertise continued to circulate in home economics, energy exhibitions, film and literature peopled by experts and especially among women who knew a lot about the 'ordinary' use of fuel in everyday life ([Wright and Trentmann, in press](#)).

Thinking about the material culture of energy should not mean turning our back on technological networks. These worlds – the large scale technical-system and the quotidian culture of energy use – do not so much co-exist as they are symbiotic. They are entwined through the social practices that are powered by energy: cooking, heating, washing and moving from one place to another. Demand and supply need each other and mutually determine each other. Looking at the dynamic flow between the two opens up new ways of representing and analysing our cultures of energy. They can take a reader or museum visitor from a domestic object, such as a refrigerator, and daily practices such as the preparation and use of a stove all the way to the distribution and generation of energy.

The essays that follow explore the rich, multi-layered dimensions of the material cultures of energy. For analytical purposes, it is helpful to distinguish between the main layers of the subject: materiality; material representations; materials in use; infrastructures and practices; and material politics.

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Materiality

How people value and relate to energy has to do partly with the basic properties of different fuels and the way they are categorised and communicated. 'Energy' may be a meaningful category in science but it is not how most people use or think about the power they use in their daily lives. The US Department of Energy has suggested that if energy was purple and more visible, people would not waste it so easily. Bill LeBlanc has done an illuminating series of videos interviewing Americans about what they know and feel about energy. Hardly anybody was able to explain electricity – "it is one of those mystic forces like love or magnetism, you do not know where it comes from". The nature and cost of a kWh was equally a mystery to most; some speculated it must cost \$5 (almost fifty times the actual cost in California). Not even politicians get the price of basic goods so wrong. Most people find it easier to talk about what energy allows them to do: cooking or driving or drinking coffee. How the matter of energy is visualised by people is consequently a hugely important subject, not least in the challenge of promoting more sustainable ways of living.

As an umbrella concept, 'energy' has the inbuilt tendency of converting different fuels into the same unit; MToe (Million Tonnes of Oil Equivalent) in the case of current estimates. Imported from the Greek, the word originally had nothing to do with the heat or work we get out of burning oil or coal. Instead it referred to the power to call up mental pictures. It was only in the early nineteenth century that the modern scientific concepts of 'kinetic' energy and 'potential' energy were established. The breakthrough of the aggregate meta-category in public policy and discourse has been even more recent. It is largely a product of the years after the Second World War. In the 1960s, countries had ministries of fuel. In the United States, the Department of Energy was not formed until 1977.

The material properties of different fuels make quite different demands on users. Coal and wood, for example, are bulky and heavy and require storage; this was something that seriously disadvantaged the urban poor who had little space and were especially vulnerable to temporary shortages. By contrast, it is difficult to store electrical energy, although we are currently witnessing significant advances in battery technologies. Not all coal is alike, moreover. Lignite (brown coal) has a very high water content which means in winter it easily freezes to the ground or freezes in transport. Countries that were heavily reliant on lignite, such as the GDR and its Eastern European neighbours consequently faced different problems from, say, France which relies heavily on nuclear power. Similarly, town gas and natural gas have different burning points and caloric properties, which meant appliances needed to be modified or replaced entirely when a society shifted from one type to the other. Transitions to a new fuel and technology consequently involve major adaptations on the demand side, in appliances, use and skills, as well as on the supply side.

None of this means that the material properties determine human action or meaning. They don't. But, equally, it would be foolish not to take them seriously in understanding what people do or think about the fuels they use. One conceptual platform to explore this relationship is 'affordance theory' created by the psychologist J J Gibson, which stresses the possibilities of action contained in things and the natural world. Merleau-Ponty's emphasis on the body as a site of knowing, Actor-Network-Theory and studies of everyday objects for thinking and doing provide further possibilities ([Gibson, 1979](#); [Latour, 2005](#); [Brown, 2003](#); [Dant, 2005](#); [Trentmann, 2009](#); [Turkle, 2007](#); [Norman, 1988](#)).

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Material representations

The representation of material objects is the classic terrain of museum curators. In the case of energy, the dominant inherited genre and narrative has been modernist and progressive, from early scientific experiments and the collection of lightning in a Leyden jar in the mid-eighteenth century across to turbines and models of nuclear power stations. International trade fairs and exhibitions, innovative advertising and showrooms all tried to surround gas and electricity with an aura of science and modernity. Today, this Whiggish story of advancing rationality and efficiency has run out of fuel. This is for two reasons. First, climate change and discourses of the Anthropocene have put a much darker shadow over this period. But, secondly and just as importantly for scholars and curators, the old narrative has been found wanting as a far too smooth and one-sided representation of energy in modern times. Electricity was not only communicated as cold scientific fact but through the body and emotions, and literally so. Public displays showed how currents were crawling down people's bodies. One of the hyped early uses for electrical appliances was a vibrator for the treatment of hysteria, numbness and neuralgia. Electricity had shock value ([Morus, 2011](#)).^[5] Electricity, in particular, has been the embodiment of the narrative of scientific modernity, but it never stood alone and needs to be viewed in relation to the kinds of visual representation expressed through other fuels, such as the wood or coal fire and the cultural genres attached to these. Finally, we need to step back and appreciate that not only the forms of visual representation have changed but the substance, too, as lighting itself has changed. Light bulbs have different 'colour temperature' (measured in Kelvins) and also render colour more or less sharply (the Colour Rendering Index). Light artists, such as Dan Flavin, and contemporary lighting manufacturers give a sense of the broadening spectrum of light and colour through which we are seeing the world. Artists and scholars alike are thus exploring new narratives and new forms of representation that step beyond the modernist, progressive genre.

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Materials in use

A lot of the material culture of energy concerns how power is used and what for. In contrast to material objects in the strict sense, which are mostly tangible but inert, this means treating energy as a service and something on the move. People do not consume coal, gas or electricity for their own sake but for what they manage to perform, be it heating a room, rotating a wheel, or sending a text message. It is at this point that analytical danger lurks. Viewing energy purely as a means to an end can encourage a single-minded focus on the ends. A focus on the material culture of energy tries to avoid this. Instead of treating fuel and energy only as an input for something else, we are interested in the connections between fuel, domestic technology and skills. Wood and a fireplace are of not much use unless you know how to lay a fire and keep it alive. To see how these units fuse into a joint action, we can turn to practice theory: things, practitioners and competence come together to accomplish a practice. [6] The point to stress here is that material culture is relational. Energy enters into a relationship with the user via other material intermediaries (such as appliances, heaters, cookers, etc.). For curators and researchers alike, the focus of attention should therefore be as much as possible in making visible these points of contacts – and to show how they change across time.

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Infrastructures and practices

The focus on energy-in-use enables us to zoom in on the quotidian interplay between domestic appliances, fuel and social practices. It also, though, allows us to zoom out and reconsider the relationship between private life and public infrastructures. The road between infrastructures and practices is not a one-way street. Heating, driving or, most recently, texting and social networking do not simply emerge in response to infrastructures. They also feed them. Broadband, to take a recent example, arrives in cafes and trains because digital communication has been spreading and creating a demand for it. How practices and infrastructures fit together depends on context and is a subject that deserves future study. It is a major question, not least because it asks revealing and controversial questions about the links between our current energy-intensive lifestyle and mostly polluting infrastructures. But doing so also holds out the hope of steering practices in a more sustainable direction that reduces the need for large-scale power stations and infrastructure investments by lowering our demand for them ([Shove and Trentmann, 2018](#)).

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Material politics

Together, these layers expand our view of the material politics of energy in many fresh and exciting directions. Material politics encompasses the ramifications of infrastructures and objects on political action, structures and expectations – from the empowering and disciplining capacity of states and other organisations to the potential for resistance and association among the users of power. Traditionally, the politics that attracted most attention here was that of utilities and networks – their legal establishment, regulation, nationalisation and privatisation – and of fiscal and other policies affecting generating capacities and supply. To these the layers of material culture add a host of subjects and problems: the politics of changing and setting new norms; the relationship between energy users and infrastructure providers; the political landscapes of energy which brought power to some communities but not others and promoted some energy-hungry practices but not others; the cultural politics of fuels and their meaning for national and group identities; and the space assigned to energy use and energy users in policies, forecasts and planning.

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The contribution of this special issue on the Material Culture of Energy

As customary in this journal, the articles in this special issue are organised by genre into research pieces, discussion pieces (in this case including a group of articles on museum practice) and object biographies. Each article can be read as a discrete work but we also invite readers to read across them and travel between the various layers of the material cultures of energy. In her contribution, Lynda Nead unpacks the meanings and associations of the coal fire in Britain after the Second World War.

'Modern' gas and electricity had made considerable advances in the inter-war years, but, as she shows, it is quite misleading to think of the open coal fire as 'traditional' or in retreat. Rather, the coal fire experienced a cultural resurgence, flickering with highly modern ideas about post-war reconstruction and national identity. The article also demonstrates how to view energy in a fresh light by combining different genres of sources, from smoke abatement reports to radio, literature and architectural reviews. Hal Wilhite adds an anthropological perspective on the shifting body politics of energy use in India. His ethnographic in-depth case study of the advance of the refrigerator in households in Kerala reveals how new cooling technology has been changing ideas of bodily health, freshness and convenience. The final piece in the research article section takes a long-term comparative view of the course of electrification in twentieth century Canada and Japan. Combining the methods of geography and history, Heather Chappells and Hiroki Shin remind us of the different paths taken by electricity between and within countries. Instead of showing a convergence towards a shared ideal of electrical modernity, Canada and Japan reveal multiple co-existing arrangements. Connections, the authors argue, involved cultural as well as material arrangements. Where these did not match up, the result was frustrated and protesting consumers.

Joanna Entwistle and Don Slater illuminate a subject that is at the same time one of the most pervasive yet neglected aspects of the material cultures of energy: lighting. Taking us from the conceptual plane into the streets of Cartagena, Colombia, they reveal the interplay between intended and unintended sources of light, social spaces and practices. Genuinely interdisciplinary, combining sociology, architecture and urban planning, their project is an example of how creative academic research can make a difference by engaging technical experts with local communities, in this case over lighting design.

Stuart Butler reports on the multi-country project History of Nuclear Energy and Society (HoNESt), which started in September 2015 and has been funded by Euratom (the European Atomic Energy Community) and the European Commission in its Horizon 2020 programme. There are methodological reflections here on the challenges of tracing attitudes to nuclear power in twenty countries with different political systems, literatures and sources. Brought into conversation with each other, these investigations revealed the insights from detailed comparative analysis. Views about nuclear and social protests, Butler shows, remained entangled in specific national and regional political cultures and concerns.

A discrete and tangible object is at the centre of Alice Cliff and Jenny Rinkinen's investigation: a three-dimensional chart of a load curve from Manchester in the early 1950s. Their article shows the value of combining curatorial and academic expertise on material culture and sociology. Taking us on quest through the biography of this rare specimen and its material layers, they situate it in the wider history of visualisation techniques, unpack its daily use by the experts at the Central Electricity Generating Board, and situate it within the temporal patterns of work and housework characteristic of the period.

Four articles describe approaches to energy exhibitions in museums in the UK and Europe. That energy can spark emotions is the context for Sarah Kellberg and Christina Newinger's contribution on the *energie.wenden* exhibition at the Deutsches Museum. In the exhibition, viewers were literally asked to 'turn energy around' when thinking about 'energy transition', a hugely controversial (and expensive) political as well as social and environmental undertaking, especially in Germany where the phasing out of nuclear power by 2022 and the shift to renewables has been a major policy and civic platform. Instead of taking a linear approach, from the problem of our growing reliance on energy to a technical solution, the exhibition gave viewers a chance to observe the different approaches taken across the world. And the de-centring of solutions also made use of the emotional and social reactions of museum visitors. Viewers also had a chance to donate 'useless objects' and reflect on the energy embedded in their possessions. The article reflects on the intellectual and logistical itinerary taken in the design and communication of a special exhibition on the controversial topic of energy traditions.

Sabine Oetzel reports on an innovative outreach programme for disadvantaged children at the Museum für Strom und Leben (Museum of Electricity and Life) in Recklinghausen, Germany. The challenge was how to bring this group into the museum and get them to engage with a world of 'dead' objects and forgotten practices. Rather than being treated as passive visitors, 8–12 year olds were given a chance to handle objects and, through storyboards and plays, make their own journey through the history of energy.

In their conversation piece, Jan Hicks from the Museum of Science and Industry (MSI), Manchester, and the film artist Bill Morrison talk about their collaboration on the exhibition *Electricity: the spark of life*, a joint project by the Wellcome Institute, London, MOSI and Teylers Museum in Haarlem in the Netherlands. In a creative departure from the traditional format, this

exhibition included three new artworks specially commissioned for the occasion: John Gerrard's 'Frogs in Space', which reflected on early experiments on bioelectricity; Camille Henrot with a piece on our energy-hungry lifestyles, and Bill Morrison, who looked at networks and connectivities. Morrison pieced together animated sequences from historical films to show the movement of current, its generation and distribution and creation of a network. More generally, Hicks and Morrisons' conversation can be read as an invitation to reflect on the potential synergies between the aesthetics and archives of energy.

Aesthetic considerations are complemented by the power of stories in the contribution by Elsa Cox and colleagues from the National Museums Scotland. They report on the new *Energise* gallery and their use of stories to accompany objects such as solar kits, both by the companies producing them and by people using them in Bangladesh. Objects here become pathways into the world of social practices and the stories people tell.

The issue is rounded off with a bibliographic essay in which Hiroki Shin takes us from Lewis Mumford in the 1930s and ideas about energy as a foundation of cultural advancement to recent interest in the role of private energy users and changes in domestic technologies and lifestyles. These pages and references give readers an overview of the changing ways in which energy and culture have been related to each other in the last century. As this article and this special issue makes clear: humanising energy is an on-going endeavour that has never been more urgent.

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Tags

- [Material culture](#)
- [Science and society](#)
- [Public engagement](#)
- [Science museums](#)
- [Energy](#)

Footnotes

1. Special thanks go to Tim Boon and colleagues at the Science Museum, to all participants, and to Kate Steiner and Richard Nicholls at this journal for their thoughtful and careful support in editing and producing this special issue.
2. See the seminal study by Wilhite, Harold, Hidetoshi Nakagami, Takashi Masuda, Yukiko Yamaga, and Hiroshi Haneda, 1996, 'A Cross-Cultural Analysis of Household Energy Use Behaviour in Japan and Norway', *Energy Policy* 24, no. 9: 795–803.
3. See Trentmann, Frank, 2017, 'Material Histories of the World: Scales and Dynamics', in *History after Hobsbawm: Writing the Past for the Twenty-First Century*, edited by M Hilton and J Rueger (Oxford: J Arnold), pp 200–21.
4. 'Power Walking Series', 2011 (2:05 to 3:05 min) and 2014 (00:20 to 00:47 min), at <https://www.esource.com/videos>
5. See also: Rebecca Wright, 2016, 'Moral Energies in American Thought, 1908–47' (PhD Thesis, Birkbeck College, University of London).
6. See Shove, Elizabeth, Mika Pantzar, and Matthew Watson, 2012, *The Dynamics of Social Practice: Everyday life and how it changes* (London: Sage).

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