8-12-2017

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Citation Details

Moezzi, M., Energy Research & Social Science (2017), http://dx.doi.org/10.1016/j.erss.2017.06.034

Energy Research & Social Science xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Energy Research & Social Science

journal homepage: www.elsevier.com/locate/erss

Original research article

Using stories, narratives, and storytelling in energy and climate change research

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ARTICLE INFO

Keywords:
Stories
Storytelling
Narratives
Imaginaries
Energy
Climate change

ABSTRACT

Energy and climate change research has been dominated by particular methods and approaches to defining and addressing problems, accomplished by gathering and analysing the corresponding forms of evidence. This special issue starts from the broad concepts of *stories, narratives, and storytelling* to go beyond these analytic conventions, approaching the intersection of nature, humanity, and technology in multiple ways, using lenses from social sciences, humanities, and practitioners' perspectives. The contributors use stories as data objects to gather, analyse, and critique; stories as an approach to research an inquiry; narrative analysis as a way of crystallising arguments and assumptions; and storytelling as a way of understanding, communicating, and influencing others. In using these forms of evidence and communication, and applying methods, analytical stances, and interpretations that these invite, something new and different results. This essay is a brief introduction to how, in our view, stories and their kin fit in energy and climate change research. We outline the diversity of data, approaches, and goals represented in the contributions to the special issue. And we reflect on some of the challenges of, and possibilities for, continuing to develop 'stories' as data sources, as modes of inquiry, and as creative paths toward social engagement.

1. Introduction

In December 2016, Oxford Dictionaries selected 'post-truth' as the word of the year, defining it as "relating to or denoting circumstances in which objective facts are less influential in shaping public opinion than appeals to emotion and personal belief."[1] This definition seems to assume that there is always an objective truth and that this truth is discoverable. While untruth is common, 'truth' is a matter of degree and perspective. As the parable of the Blind Men and the Elephant suggests, multiple interpretations readily exist in many circumstances. Even if several blind men touch one elephant, they can reach different, seemingly objective conclusions about how the whole animal relates to its parts. Humans are not omniscient, and we rarely know everything we might want to, despite the best efforts of science and the Age of Reason. Our understandings of the world are always based on emotion and personal belief, as well as (and sometimes contradicting) physical and measurable data. How do we balance the presence of multiple interpretations with the need for collective action?

References to narratives, stories, and storytelling have become more common in energy and climate change research and policy (e.g., [1–5]) following a 'narrative turn' in social sciences more generally, as well as dissatisfaction with the dominance of physical, technical, and economic representations [6,7]. Stories are used to communicate with, influence, and engage audiences; they serve as artefacts to be investigated in terms of content, actors, relationships, power, and structure; they can be used to gather information, provide insight, and reframe evidence in ways that more science-ordered formats miss. But they are not benign or neutral, nor a type of data or approach that researchers and practitioners in these fields have much experience with, and there is (understandably) no single identifiable corpus of theories, research approaches, or examples to help order their treatment. So a critical stance is needed. This special issue aims to present and cultivate structures for

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[1] https://en.oxforddictionaries.com/word-of-the-year/word-of-the-year-2016.

http://dx.doi.org/10.1016/j.erss.2017.06.034
Received 25 May 2017; Received in revised form 18 June 2017; Accepted 19 June 2017

Table 1
Varied characteristics of stories and storytelling, and of approaches to their analysis.

Aspect	Characteristics (Illustrative Examples)
Stories as Object	
Teller	Individual (including researchers), group, institution, intermediary
Protagonist, characters	Individual, group, thing, system
Energy	Time, technical change, individual change (mind and action), magical transformation
Time realm	History, present, future, out of time, alternative reality
Physical setting	Generic world, specific locality, out of the world, non-physical
Form	Oral short form, written short form, documents, books, images, geographic/space
Truth realm	Fantasy, fiction, individual experience, figurative "truth", global truth, assumptions, possibility
Using Stories and Storytelling in Research	
Data sources	Participant observation, workshops, interviews, conversations, written documents, newspapers, images, internet sources
Analytical method	Discourse analysis, text analysis, literary, anthropological, folkloristic, policy analysist, sociological, psychological, psychoanalytic, structuralist, performative, group dynamics, proxemics/dramaturgical
Purpose	Data and evidence collection, cultural analysis, policy and science critique, understanding and fostering change, engagement and learning

understanding, interpreting, and applying stories within energy and climate change research and policy by presenting a breadth of analytical approaches, and showcasing projects and research that feature stories or their performance in the energy and climate change fields. As the guest editors for this special issue, we share an interest in stories and storytelling and energy and climate change, but we do not share a common discipline.[2] Our joint lens, therefore, is intentionally more kaleidoscope than magnifying glass. We see stories and storytelling as a potentially important device in helping people from different disciplines and different domains better understand the world and each other in working on applied environmental problems, including by using the storyworld to walk outside normal constraints. In short, we hope to help foster a pragmatic playing field for taking stories and storytelling seriously in energy and climate change research, being realistic about their possibilities, strengths, and pitfalls, while incorporating a multiplicity of approaches, goals, and writers.

This review article does three things in story form. It provides a *beginning*: a brief introduction to stories and storytelling, leading to a selective discussion of the energy and climate change literature on stories. The *middle* introduces the content of the special issue itself, developing a thematic discussion of the papers published in this volume. In the *end*, we reflect on broad results in light of the current literature, practices, and problems of energy and climate change research.

2. The beginning: on stories and storytelling

In the beginning, we have to start with problems of definition. When we first developed the concept for this special issue, we envisioned bringing together a diverse set of work constituting, in ensemble, a variety of theoretical groundings on narrative, stories, and storytelling from different disciplines and perspectives, and setting up vocabulary and keywords. While the collection makes progress along these lines, the authors in this special issue use stories and related terms in widely differing ways. Stories are one of the most basic concepts in the world, so this diversity is normal. But few social sciences theorise 'stories' *per se* in clear terms. So in this review, we choose 'stories' as an umbrella term (when required) to reflect and encompass this diversity. Even in the general written literature, "story" is much more common than 'narrative.'[3]

Others have already given expositions in specific fields providing far more nuance and detail than we can here (e.g., [8–11]).Some of the contributions in this issue provide definitions as well (e.g., [12,13]). What matters, in the sense of this collection, is how the story-related concept or term helps any particular project or research question in ways more technical approaches often do not.

This section first outlines some basic terms and some of the varied ways in which they are used. Second, we single out one form of research on stories (folkloristics, which is the study of folklore), and use this to help map out dimensions and characteristics that underlie diversity in stories, storytelling, and their analysis. Next, we provide a brief and partial review of stories in the natural sciences, the social sciences, and the energy and climate change literature. There should be no expectation of a unified theory on stories in energy and climate change research from this review. It is occasionally said that using stories in social science research is undertheorised or incoherent (e.g., [14,15]). This incoherence may be part of the human condition: that which allows us to be creative as well as replicative, to make art as well as science, to express things that words miss. After all, most stories are supposed to be indirect, artful, and subject to multiple interpretations. That raises, to say the least, myriad questions about how stories and their analysis fit, or complement, 'science.' Whatever these questions, we hope that they can be discussed with the positions, principals, methods, and interpretive tools that the papers in this volume refer to and advance.

2.1. Definitions and forms

One of the most common definitions of *story* is something with a beginning, a middle, and end. This sounds flippant but can be useful, particularly in defining what stories are not. Drawing from the field of folkloristics, in traditional oral stories, there is generally also a protagonist, usually a human but possibly another animate actor, an object, a practice, or an idea. Then something happens, such as a conflict between protagonist and antagonist, or a transformation, as further developed in Table 1 below. Among the papers of our special issue, 'stories' are sometimes used even more generally, e.g., as rationale or narrative explanation of circumstances.

While *narrative* is also a very general term, in the social sciences it is often used to denote non-fiction and constructed, formal, and official cases, e.g. what institutions generate and reflect in general discourse about an issue. These are often present in printed form and written or

[2] For example, together, Moezzi, Janda & Rotmann have training in statistics, folkloristics, English literature, electrical engineering, energy and resources, environmental chemistry, marine ecology and ethology, and tropical environmental studies. We live or have lived in the USA, France, the United Kingdom, Australia, Austria, Papua New Guinea, and New Zealand. We have all advised policymakers; one of us has *been* a policymaker and energy-efficiency practitioner; one is an International Energy Agency Operating Agent for a demand-side management Task, the other two are engaged in university-based energy research.

[3] Google Books Ngram Viewer (https://books.google.com/ngrams/info, English books), generated 6 June 2017. In this corpus, for the year 2000, the term 'story' was more than three times more common than frame, narrative, or discourse (which were all nearly equally common).

told by professionals, often in public, versus the less formal stories that everybody exchanges more privately orally or in personal correspondence. Because of their accessibility, these more formal narratives are easier to analyse than more local, ephemeral stories. The term narrative is also commonly used, in preference to story, to describe personal narratives such as used in psychology (see, e.g., [12] this issue).

Storyline usually refers to the plot or bare arc of a narrative, as distinct from the detailed content. In environmental policy analysis, the term is commonly used in reference to Maarten Hajer's work on discourse coalitions, where the concept of storylines serves as a device to decompose discourse into simpler framings around which actors and institutions organise themselves and create meanings [16,17]. In the conclusions, we return to this idea to outline two concepts related to storylines used by the field of folkloristics in classifying and analysing various kinds of stories: tale type and (folk-)motif [18,19].

With *storytelling*, the emphasis is on the performance, and the elicitation and construction of stories or narratives *in situ*, rather than the story as an object. Why is the story told in a particular context, and how? From this perspective, it becomes clearer that stories are crafted rather than pre-existing things, and that this crafting (including the decision to utter or write) depends on context, including audience, purpose, location, etc. The 'same' story may be told quite differently from one instance to another, even by the same teller, challenging the notion of stories as stable data points.

2.2. Research about stories: a perspective from folkloristics

To highlight how varied a set of things and processes fall within the purview of 'narratives, stories, and storytelling', and thus why approaches are so multiple, Table 1 identifies basic aspects (or dimensions) of stories, their tellings, and the research perspectives that might be applied to them. The intent is illustrative, not definitive. The table is loosely inspired by Bascom's classic folkloristics categorisation [20], distinguishing the genres of myth, folktale, and legend. Our expansion is based on the contributions to the special issue, one of the author's disciplinary training in folkloristics, and our wider review of the literature. Each of the aspects shown in the table can take on a variety of possible values, for which we supply some key illustrative examples in the Characteristics column. For example, in the first part of the table (*Stories as Objects*), the *time* dimension may be the past, the present or the near future, the imagined further future, real but indeterminate time, fantasy, etc. There also needs to be an *energy* to move the narrative from beginning to end: something, somebody, or some state changes, and this has consequences. And though we usually think of stories as made of words, physical space and images can also be read as stories, as several of the contributing papers demonstrate.

The second section of the table (*Using Stories and Storytelling in Research*) outlines some of the ways in which stories and storytelling have been approached in research. There must be a *data source*. Written forms are the most straightforward to analyse, control, and defend as scientific evidence, though by nature they are quite different than oral forms. Stories told orally can be transcribed, though this does not transcribe the performance and loses some coherence. There can also be high levels of auditing; different things are said than written. The table also points to different approaches to *analysing* stories and *purposes* for using them.

So how can this varied a concept be theorised or at least better contained? While focused on folk narratives, the field of folkloristics goes into detail about the characteristics of different narrative genres [18] and the varied nature of stories. Folkloristics [15] is a long-standing but little-known discipline that has not made very visible inroads in science-oriented research or policy. But it is a field that is experienced in collecting and interpreting stories as data, as modes of inquiry, and as forms of engagement, and some of this experience might be transferred. One of the most compelling rationales for applying folkloristics in social science inquiries is that folkloristics specialises in looking at the everyday, the commonplace, the informal, and the otherwise ignored. Folklore's focus on the informal syncs well with Czarniawaska's comment that "scholarship is customarily set apart from the everyday wisdom of ordinary people… [This] ordinary knowledge is circulated in stories." ([21], p. 29) As Czarniawaska notes, and as some of the papers in this special issue illustrate, science, scientists, policy makers, and marketers are also full of stories and metaphors, albeit with a different set of mechanisms than traditional folklore and a more restricted set of tellers. Highlighting folklore also leads to one of the challenges to using stories in science-oriented fields. Viewed in contrast to science, the term *folklore* is generally pejorative. From this perspective, stories simplify, lie, change, and resist verification. They do not lend themselves to experiments, tests, or sampling. This makes them relatively unsuitable, and in fact uncomfortable to deal with, within current scientific paradigms, as Gearty [22] also remarks.

2.3. Storied research: sciences and social sciences

Stories evolve out of the adjectives, verbs, and ordering used to describe phenomena at many levels and in different fields, even in the natural sciences. Natural phenomena and theories about the world have always been described in stories, from the weather in classical Greek and Roman texts from 1200 BCE [23] to fossils [24], medical theories [25,26], and more. In 1917, neuroscientist Santiago Ramón y Cajal described the relationship between dendrites and axons in the brain as an 'epic love story' [27]. Far from being lost in the annals of time, Ramón y Cajal's thinking has served as a frame for modern neuroscientists interested in explaining this complex process [28]. An anthropologist has shown how high-school health science textbooks describe the interaction of an egg and sperm like a romance novel, replete with gendered roles and heroic deeds [29]. This kind of anthropomorphism is often eschewed in the sciences in an attempt to preserve neutrality. The editor-in-chief of the journal *BioEssays,* for example, has called for an end to the 'anthropomorphic terminology' that evokes 'will, direction and strategy in evolutionary processes' [30]. We take it as a given (from our own work as physical and natural scientists, engineers, etc.) that physical and natural scientists implicitly use stories in thinking about, doing, and expressing their work (see, e.g., [31,32]).

In the social sciences, scholars speak of a 'narrative turn' in a number of different fields, dating variably from the mid-twentieth century to the 1980s. This narrative turn is often identified as having to do with life histories and representation, though there is a large development focusing on policy narratives and organisational narratives [30]. In addition to literature reviews provided within the contributions to this special issue, see for example, progress in a number of other fields, such as health social sciences (e.g., [33,34]), psychology [35], policy analysis [36], including the Narrative Policy Framework [37], education [22], and law [14]. And of course, certain social sciences and humanities are self-evidently storied, in particular history of technology and social studies of technology (see [28,38]).

2.4. Narratives and stories within energy and climate change research

We searched several popular energy and climate change journals for research on stories, including *Energy Research and Social Science, Building Research and Information, Energy Policy*, and *Climatic Change*. Even though this effort was exploratory rather than a full review, we found it surprising how little and how recently such an elementary form of human expression has been invoked in energy research, especially as a research object. To echo Ewick and Silbey [14] in their comment on the relative absence of narrative in the social sciences, this has (at least in part) been 'a self-conscious achievement.' Nevertheless, a number of important story- and narrative-related papers have been published in these journals.

Energy Research & Social Science has published several narrative-oriented papers. For example, Hermville [39] applies narrative analysis to

address the interplay between the individual and collective in understanding social-technical transitions, using the Fukushima Dai-ichi accident as a springboard. He differentiates narrative analysis from discourse analysis, arguing that the former focuses on the "immediate effects of the use of language in political debate" (narrative analysis) as opposed to what "language and speech… means and proposes" (discourse analysis). Bushell et al. [40] identify multiple narratives designed to promote action on climate change and propose developing a "unifying strategic narrative" to better engage audiences. Karhunmaa [41] outlines different storylines by which experts and practitioners conceptualise "co-benefits" from carbon-market household energy technology projects, and points to the material influence of the details of these storylines.

In *Energy Policy*, 18 papers since 1985 refer to 'stories.' Most of these references refer generally to success stories and sometimes failure stories. A handful of papers, all published during the last decade, unpack the idea of stories more specifically, including in UK renewable energy generation [29], German coal subsidies [42] policy responses to Fukushima nuclear catastrophe [43] nuclear power in the US [44], and energy efficiency amongst the elderly in Australia [45].

In *Building Research and Information*, Janda and Topouzi [3] use the term "hero story" (based on Joseph Campbell's classic text (1968) about the hero monomyth) to denote the propensity of energy-efficiency advocates to make continued claims about the heights of energy-saving technical potential despite lower findings in practice. This term is roughly synonymous with the "success stories" found in *Energy Policy*. Janda and Topouzi add "learning stories" (what happens in practice) and "caring stories" (what needs to happen over time) to the familiar hero story, suggesting that a "system of stories" might allow energy researchers more room to explore and address issues that are underrepresented by the monomyth. Also in *Building Research & Information*, de Carli [46] considers how resilience narratives help researchers understand the living strategies of low-income dwellers in squatted buildings in São Paulo, Brazil.

Research in climate change has used the notion of stories in different ways than has energy research, with a relative emphasis on communicating with the public. In the journal *Climatic Change*, for example, articles on stories and narratives cover climate change communications [47], scenario development [47], news coverage of extreme weather events [48], traditional weather knowledge systems among Māori [49], and ancient weather records [23].

In addition, a number of authors and groups have been working in energy and climate change-related storytelling and conversations with the public. These include *Carbon Conversations* [1] and the *Energy Biographies* project at Cardiff University [50–52]. In her research, Lertzman [41] uses narrative with a psychoanalytic approach to public apathy and engagement surrounding climate change and other ecological problems. There is also a type of "climate change storytelling" that refers to methods that institutions and organisations design to use to convince others to follow a certain course of action or adopt a certain mindset with respect to climate change, e.g., engagement through television shows. We distinguish these marketing-focused efforts from those using stories as data, and to listen and understand first, if also to engage.

3. The middle: contributors and contributions

The articles in this special issue resulted from an open call for papers on "Narratives and Storytelling in Energy and Climate Change Research." Our call cast an intentionally wide net. Some of the authors for this special issue had a formal background or previous publications in narrative and storytelling. Many had not. And not everybody was primarily a social scientist, or even an academic. What becomes clear in this collection is that the concepts of narratives, stories, and storytelling can allow researchers and authors from many traditions and backgrounds to think about, approach, or discuss their subjects differently than normally prescribed, or at least practiced, within their disciplines, funding channels, research circles, or publication venues. Depending on the forum, researchers, consultants, and others in these fields often face very restricted dialogues, data, analytic methods, metrics, definitions, and reporting procedures [7]. We sensed that the devices of stories and storytelling, beyond their scientific values, may help inspire creativity and movement beyond what is normally encouraged or even admitted in our everyday work.

Collating this issue also brings into view the problems and promises of inter- and trans-disciplinarity, as well as the various gate-keeping mechanisms for journal publications, including peer review. In many cases, this meant writing out of the normal scope, and in almost all cases, being reviewed by people who have their own expectations, definitions and (mis)understandings. Though we were intentionally expansive, this was sometimes difficult to do in practice; disciplines are, after all, disciplines.

The 33 papers in this issue that follow this introduction *could* have been organised according to their subjects. Twelve papers focus mainly on some aspect of *energy supply*, including stories from and media representations of people who live near or make their living from fossil fuels (seven papers); non-fossil fuels and/or renewables (three papers), and the electricity grid (two papers). There are ten papers on *energy demand*, including nine papers focused on buildings (eight with a residential focus) and one on personal mobility. There are three papers that look at elements of *both energy supply and demand*, and there are five papers that focus more directly on *climate change* than energy. There are also three papers that are broadly *pro-environmental* without being directly about either energy or climate change — one on the circular economy, one on Native American perspectives relating to sustainable design, and a methodological paper about researching pro-environmental behaviours. The geography covers North America, the United Kingdom, Denmark, Sweden, Brazil, Japan, the 'Global South', and other locales, including international forums more generally.

A content-based division, however, would belie the very different approaches amongst the papers to stories and storytelling. Accordingly, we have organised the papers with a focus on the diverse, and yet, often overlapping ways in which they see, use, and interpret stories. To highlight some of these resonances, we have grouped the papers into three categories and seven themes. The first category focuses on *stories as data*, exploring their shape, nature, and meaning. This category includes three themes: (1) stories as a complement to quantitative assessments; (2) narratives about large technical systems and their transitions; (3) local, personal, and professional perspectives. The next category considers how stories can be used to develop different research modes, which we call *stories as inquiry*. Papers in this category reimagine time, interpret wordless artefacts (images and design), and make and remake individual identities. The final group discusses *stories as process,* with a focus on participation, workshops and engagement.

3.1. Stories as data

3.1.1. Stories as companion to quantitative assessments

The need for quantitative or quantified assessments is embedded in energy and climate change research as well as in policy-centred funding. Whatever the bureaucratic and scientific needs, these assessments and descriptions can also mislead, including by often failing to capture diversity, relationship, texture, or to provide sufficient information on whether and how to try to change things or even what might happen in the future. Several contributions in this issue focus on how stories or qualitative data capture policy-relevant information that traditional quantitative data and metrics overlook. These are generally local, or otherwise, micro-level insights that help show how "average" experiences or other current metrics, definitions, or storylines are often incomplete.

Working in the realm of buildings, Day & O'Brien [53] (this issue) use qualitative data collected in the course of post-occupancy

evaluation and open-ended responses from occupant satisfaction surveys. Taking these storied data seriously highlights the detailed dynamics between users and their buildings. This contradicts the characterisation of people as largely inert recipients of environmental services whose experience is adequately captured within the rubrics of satisfaction scores and simple behavioural descriptions. The shift in focus and the naming of this otherwise diffuse data as 'stories' helps by opening up the possibility of improving design and interventions by users' experiences and contexts with more detail and nuance, versus starting with the assumption that operational problems are caused by occupant 'misuse' or their unreasonable demands.

Mould & Baker [54] (this issue) take on the definition of fuel poverty in Scotland. Current fuel poverty definitions, they argue, can miss much of what is important in assessing fuel poverty and vulnerability, as demonstrated by analysing a number of case studies. The metricisation also forces a direct focus on technical circumstances, rather than the circumstances and processes that create these circumstances.

Working in another direction, Kuchler [55] (this issue) shows how the provision of scientific estimates of shale gas availability in Europe provides a legitimating platform for extensive debate about managing this resource and the insertion of shale gas into planning debates. The estimates of shale gas availability, however, are highly uncertain and conditional. While these may be the only "truths" available, the uncertainty makes its way uneasily into policy and planning, while the stakes associated with assuming widespread availability are high for industry and other players.

Taking on citizen science stories as deployed by communities on the front lines of oil refineries, Ottinger [56] (this issue) shows there is sometimes a "narrative mismatch" between lived experiences and expert data frameworks. To combat "hermeneutic injustice," Ottinger argues that laypeople and experts need to work together to reshape analytical frameworks and monitoring plans to incorporate data at scales that reflect human experience.

3.1.2. Government, media, and popular narratives on large system transitions

The largest group of contributions takes on how socio-technical and economy-scale storylines work in scientific, government, and journalistic discourse. Among them, they use a variety of different source materials and approaches.

Asayama and Ishii [57] (this issue) take on a discursive analysis of the promises of carbon capture and storage (CCS) as reported in four of the most-widely circulated newspapers in Japan. These accounts, the author finds, are optimistic and strongly in favour of CCS, as aligned with the continued use and exploration of fossil fuels. Critical narratives that point out risks and uncertainties are nearly absent, despite the immaturity and halting progress of innovation in the technology. As in the case of shale gas estimates for Europe ([55] this issue, described above) there are tremendous stakes that support techno-optimism.

Focusing on an economic model rather than a technical system, Lazarevic and Valve [58] (this issue) use text analysis of policy documents to analyse visions of the circular economy condoned as a desirable future for Europe by the European Commission. These visions, in some cases radical, are nevertheless an appealing and uncontroversial solution the surface, and embody a number of normative assumptions which have so far been taken for granted. By dissecting published narratives, the authors articulate details of what seems to be expected in this transitioned economy, call out the need for some critical discussions about these visions, what they set in motion, and what they miss, and point to the mechanics and dangers of "everybody wins" visions.

As one condition of success, government narratives of energy supply technology transitions should synchronise with established narratives of national character, Malone et al. [59] (this issue) argue. The authors take on three different cases: nuclear energy in the United States, biomass in Sweden, and ethanol in Brazil. Benites-Lazaro et al. [60] (this issue) look at industry storytelling about sugarcane-based ethanol in Brazil through the analysis of video and multi-media records. Technologies are routinely contested, and support varies over time. Using the historical example of American rail, Roberts [61] (this issue) explores the role of negative or counter-narratives in destabilising socio-technical regimes, and interprets the case with respect to the possibility of destabilising the dominance of fossil fuels in the United States.

Grubert and Algee-Hewitt [62] (this issue) use corpus analysis of US fiction and nonfiction texts, including sentiment analysis, to interrogate the portrayal of fossil fuels. Their analysis shows oil personified as "hypothetical and exciting" while coal is "real and disappointing." These depictions, they argue, help surface public attitudes about these fossil fuels socially (including with respect to gender), locally, and environmentally.

Muto [63] (this issue) uses US government documents and narrative analysis to tell a strange tale about how the National Institute of Standards and Technology tried (and failed) to govern a standards-setting process for the evolving smart grid, a realm where industry-led innovation is the norm.

3.1.3. From local to personal and professional stories

Psychologist Jerome Bruner wrote that "we organise our experience and our memory of human happenings mainly in the form of narrative — stories, excuses, myths, reasons for doing and not doing, and so on" [35]. Bruner further comments that narratives are "a version of reality whose acceptability is governed by convention and 'narrative necessity' rather than by empirical verification and logical requiredness" (). This line of reasoning evokes, especially, personal narrative — people talking about their own history and experience, by nature local and centred on the teller.

Darby [64] (this issue) contributes a historical perspective on energy transitions where demand and supply meet. Drawing on interviews in a historically coal-mining area in England, she shows how the grand narrative of low carbon and sustainable growth holds different meaning in fuel-producing communities. She suggests that energy advisors serve as important "middle actors" in assisting the transition from local solid fuels to distant supplies of gas and electricity.

Drummond and Grubert [65] (this issue) also deal with the local character and interpretation of the fossil fuel industry, in their interview-based analysis of narratives related to the seismic activity associated with wastewater injection used for oil and gas production in Oklahoma. They outline the varied narratives that individuals use to negotiate local seismicity — greatly increased in the past decade — and the economic value of oil and gas to state industry and individual livelihoods.

Goodchild et al. [66] (this issue) provide a 'proof of concept' of oral history in energy research, demonstrating its feasibility, validity and usefulness to illuminate home heating experiences in the UK. The paper demonstrates that memories in oral history appear as moments of stability, are timeless and absolute, whilst history is about relative differences. Much depends here on timescales and the character of change to contrast the past and present.

Goodhew et al. [67] (this issue) also consider home heating in the UK, using interviews to understand the mental models of thermostats, rates of heating, heat dissipation, insulation, and heat flows, for example, finding that people imagine heat as material substance. The authors argue that these mental models affect how building users operate their heating systems and reveal assumptions that can inform future communications.

Turning from fuels and their consumers to energy researchers, Staddon [68] (this issue) puts the energy researcher front and centre, showing how they negotiate between their own personal stories and reflections of energy use and the professional and scientific stories about energy that emanate in and from the workplace. Everybody has personal experience with using energy in buildings. The personal stories, taken reflectively and seriously, can destabilise formulaic

models of energy use and 'decisions.' As Staddon notes, it is also problematic, scientifically, to let personal experience rule, in so doing pointing to a long-standing tension between 'scientific fact' and belief.

3.2. Stories as inquiry

3.2.1. Reimagining past and future

In thinking about and planning for the future, policy visions often focus on increased penetration of particular technologies as the desired centrepiece of the future, then following through by back-casting a technological trajectory. This style of visioning has difficulties realistically seeing the technology as a part of larger social and technical systems, of the types invited by social practices or systems analysis perspectives. By drawing on traditions that imagine whole worlds, rather than isolated elements as affixed to pre-determined policy desires, the energy and climate change research, policy, advocacy, and industrial communities can come to better understandings about how things change and how to promote, discourage, manage, or at least estimate consequences of socio-technical transitions. Instead of focusing narrowly on political targets, these broader and more intricate visions may lead to stronger, more integrated modes of planning a workable future.

There are tools from fiction that can help. Raven [69] (this issue) discusses how and why science fiction about the future can help build more realistic visions. This can also provoke thoughts about the past and its connection to the present. Pargman et al. [70] (this issue) turn to the past, through thought experiments that begin by positing alternative worlds with different historical conditions — in this case, Coalworld, which starts its allohistory with the assumption that there is only half as much oil as there has been.

Harris [71] (this issue) places climate change in the scale of the geological past, using the concept of geological imagination as a mode of breaking out of the current 'Climate Inc.' routinised responses to climate change. Here, the stories are not centred on humans; Harris points out that non-human actors are common in indigenous storytelling, echoed by similar comment in the case of Native Americans by Saiyed and Irwin [72] in this issue (discussed below), and highlights spiritual development as linked to preserving the earth, as well as the applicability of traditional ecological knowledge.

Bergman [73] (this issue) reports on an exploration of personal mobility futures by industry stakeholders in the UK transport sector. Drawing on the use of frames and narratives, he theorises and explores how these documents, peppered by pre-conceived notions, frame the future toward more of the same (e.g., continued automobility) rather than toward more egalitarian socio-technical change (e.g., car sharing).

Though each of these efforts are different, they largely adopt the view that in order to make climate change more manageable to individuals and groups, it needs to be rendered salient and reduced from its status as hyperobject [71]; stories are one way to do this.

3.2.2. Stories without words

Stories usually imply something verbal, but images [74], things [75], and spaces [76] can also be interpreted as stories or story-making. In this issue, Broms et al. [77] focus on design as a social agent, foregrounding the role and possibilities of artefacts in the story-making space we move through and physically interact with in everyday life. The authors note that current versions of even 'green' built environments can reproduce archaic, less-sustainable, and other hidden values, while featuring superficially green elements. Through artistic renderings and small models, they construct pieces of a re-imagined future to provoke new thoughts about a university campus redevelopment project.

Herrmann [78] (this issue) focuses on visual storytelling in the case of 'America's first climate change refugees', combining analysis of visual depictions along with the accompanying texts, as rendered in a variety of newspaper and other media accounts. These stories distance, victimise, and disempower, the author argues, but can be, and are being, renegotiated and countered by representations from the indigenous communities themselves.

3.2.3. Identities, makings, and re-makings

People express, develop, and model their identity, and even their future actions, through narration. How they do so is not simple or direct. Sayings certainly do not necessarily match beliefs (which are hardly stable anyway) or doings, but they do sometimes provide a model for them, as well as a means of thinking through, and thinking, learning, and negotiating in the company of others.

In his review article in this issue, Brown [12] presents a basis for considering the application of narratives in pro-environmental psychology research. He identifies relevant literature in history, philosophy, sociology, anthropology, education, social work, psychology, and literary theory. Within this literature, Brown finds authors who consider narratives and stories to be synonyms, as well as writers who argue they are different. Given complexities that are abundant in everyday life, Brown suggests a movement away from the concept of an "integrated/monological self" to "a process of understanding people that is inherently dialogical." In other words, even the stories that we tell ourselves may not be internally coherent or transferrable, even when moving between home and work.

Drawing on interviews of climate change activists in Washington DC, and taking a Bourdieusian approach, Boucher [79] (this issue) examines logics and tastes of frugality (and non-frugality), identifying fourteen different logics of frugality amongst his interviewees. The analysis complicates simple interpretations of frugality or thrift, and calls out the taboo nature of talk about frugality, lending doubt to future hopes for its diffusion in society unless this taboo is eased.

Drawing from feminist theory and applying text analysis, Munro [80] (this issue) takes a critical approach to how environmental concern testimonials contributed to environmental advocacy websites. These narratives stress the 'special powers' of mothers in caring for the environment, and in so doing reproduce existing power relationships and narrow, idealised gender roles. In outlining the hegemonic nature of these narratives, the contribution makes it clear that even personal narratives are not simply 'nice.' Stories reflect and create cultural values; they are expressions but also forms of power that shape and coerce, as Gramsci himself argued about folklore [81].

Hagbert and Bradley [82] (this issue) use in-depth in-home interviews of households involved in a sustainability transitions group in a Swedish town to uncover a counter-discourse to mainstream conceptions of sustainability, including storylines on negotiating past the ways that people are locked into the mainstream. Voluntary scaling back of consumption, new practices, collaborating to build local resilience are all aspects of how people use stories to negotiate their own identity and to help create community transitions.

Written work on stories often focuses on stories as static and coherent objects, while in comparison, oral storytelling in Native American communities is often chaotic and non-linear. Saiyed and Irwin [72] (this issue) argue the strength of this non-linearity in their Perspectives piece on Native American storytelling related to architectural sustainability. Here, the process of storytelling is self-evidently also a matter of personal and community development. This line of reasoning contrasts with the idea of stories as 'things' that simply convince of, convert to, or reflect, e.g., a scientific or policy-correct viewpoint or ethical stance. Opening up the possibility of a different way of thinking, of creating and developing a different cosmology (e.g., where nature takes a different position) creates the potential for lifting out of currently restrictive frames where human dominance is always privileged.

Taking on the topic of progressive planning interventions for energy efficiency, Jensen and Quitzau [83] (this issue) comment on the distance between research on the one hand and planning practice on the other: 'Our mission with this article is to explicate and discuss the

seemingly missing links between planning practices and research practices.' Writing the core of their argument in storied form, they approach planning as bricolage, connecting it to the bricolage of storytelling itself, outlining actors, plot, setting, a main act, and transformation, and pointing to the fact that actors (as in fairy tales) can do 'extraordinary things.'

Cloke et al. [84] (this issue) start with the framing of rural community energy projects in the Global South, relating these framings to sociotechnical imaginaries that prescribe 'universalised energy futures' for these communities, achievable by scalable delivery models and resulting, theoretically, in improved livelihoods. The large and top-down scales of these visions, models, and mechanisms miss in-depth local sociocultural understanding and local communities' own participation in, and visions for, their own futures. Thus, they may often fail to deliver what they promise or what they could achieve. The authors propose a Social Energy Systems approach in order to reframe these renewable energy technology projects to better admit alternative, and more local, imaginations, knowledges, and aspirations.

3.3. Stories as process

3.3.1. Participation, workshops, and engagements

Four contributions cover experience in conducting participatory storytelling workshops and interviews. Some are designed to engage, or learn how to engage, citizens in climate change, climate change policies, and energy transitions. How exactly might stories be elicited and used in these contexts? This group of authors focuses on narrative inquiry and even participatory narrative inquiry [85], which invites workshop participants to develop and work with their own stories.

Shaw and Corner [86] (this issue) focus on the methodology used in workshops designed to engage UK citizens with climate change and its policies. Their Narrative Workshop methodology was designed primarily as a research methodology, so that an otherwise largely disinterested and uninformed public can engage in meaningful deliberation about this complex subject. Rather than keying in on this public as being in 'information deficit', they argue that the public engages more positively in climate change discussions when the conversations are situated within narratives that validate their values and identity.

Reporting on elements of the Stories of Change project, Smith et al. [87] (this issue) use stories and storytelling in engaging individuals and groups in energy transitions. These authors focus on the concept of 'energy utopias' as a means of creating a shared intellectual space, contra the unwieldy space offered by climate change per se. Their project experiments with approaches to engagement that might, delivered at scale, return some momentum by looking in a fresh way at stories of the past, present and future of humanity's often fast-changing relationships with energy.

Drawing from interviews with individuals in the UK academic, policy, and practitioner communities rather than lay-people, Howarth [13] (this issue) considers the use of stories to constructively engage the public in creating lower-carbon futures, and in particular, the positive aspects of such a future. She emphasises the value of moving beyond high reliance on a linear flow of information, accentuating instead the importance of overlaps in perceptions, values and motivations to create dialogue about and opportunities for social shifts.

Rotmann [88] (this issue) reports on using a fairy tale-based 'story spine' in behaviour-change practitioner workshops to elicit stories from diverse stakeholder groups. She argues that these group storytelling experiences promote empathy and engagement, foster multi-stakeholder collaborations, and help develop better interventions to change citizen energy-use behaviour. The focus here is on the *process* of using the fairy tale story spine, rather than the *product* (the stories).

In all cases, the question remains as to how to evaluate, beyond anecdotes, how well these efforts 'worked' and their impact on reducing energy consumption, fostering adaptation, or other difficult-to-track changes. These are not interventions in the normal sense. But it is possible that certain stories, whether created, told or heard, can and do stick in ways that more boring, depersonalised, or instructional information and scientific facts do not.

4. The end: conclusions

In the era of 'post-truth' and 'alternative facts', science seems more visibly destabilised. The problems in the energy and climate change research realms are at least ostensibly practical and real-world rather than isolated or theoretical. There is an increasing need to see relationships and dynamic systems integrating people and things [89], where there is plenty of quantitative data (e.g., smart meters) and social communication networks are increasingly prolific. Our analytical tools may not yet be up to the task of providing understanding or meaning of these abundant data. Facing this combination of circumstances, we think that taking stories seriously can help. In particular, we sense a 'stuck-ness' posed by more conventional forms and rules of evidence, while the execution of these conventions frequently misstep [4]. Given the uncertainties and difficulties already faced in trying to make sense in the challenges outlined above, it is as logical to sometimes loosen the grip, as well as tighten it. We outline below three related ways in which stories (and narratives and storytelling) can help loosen this grip: they let researchers speak and inquire differently, they provide a different set of data and voices, and they let go of some rigid notions of truth.

To use stories more systematically than has been the case, changes are required. First, the field needs practice using and communicating to each other about stories, accompanied by suitable tools, approaches, words and organisation, and wariness against falling into overly-formulaic applications or anything-goes. It is the researcher's care and engagement that matter. Second, we would need better ways to admit this activity into funding and policy channels, to make it legitimate, rather than discounting it for falling outside the frame or failing to achieve more traditional evidentiary standards that it is not designed to meet. This is difficult, as there is a great deal of expectation, training, regulations, tools, and other organisations that hold existing scientific institutions and practices into place. Third, we may need different ways to use much of what stories and narratives bring to the table in energy and climate change research. These contributions can complicate the guidance implied by simpler, quantitative or otherwise compartmentalised information. At the same time, it is clear that current policies, programmes, and knowledge are hardly the result of pure science and logic [30,90].

Considering the contributions in this issue in ensemble, the following three traits, all speaking for the usefulness of stories relative to our normal traditions of evidence and analysis, stand out.

4.1. Stories provide a different type of evidence

Stories provide different material than other traditional forms of data used in energy and climate change research. They are obviously different than more quantitative, quantifiable, and generalisable forms of data, and (less obviously and more entangled with definitional questions) provide a different emphasis, a different lens, than interviews, participant-observation, and other social scientific forms of data collection normally do. They are immediately oriented to relationships, in particular between people and things, the present and the past, actions and consequences, etc. And they often have emotional, psychological, symbolic, and cultural content absent or sublimated in more purified 'objective' data. So, stories invite a different intellectual and emotional framework, beyond the (fictional) logical brain. Where the questions involve humans, this sort of content has special importance since (as argued by Staddon [68] in this issue) researcher reflexivity is often not enough. These stories are not always about how to do something or what can be done. They also reveal constraints, prejudices, misunderstandings, and untruths (e.g., [80] in this issue) and, include the 'known, but under-acknowledged' that regularly escape

more formal data collection (see discussion of the 'informal' as used in folkoristics in the introduction).

One direction that may be of use is to find a way to better name and categorise the stories, motifs, actors, and settings that circulate in the stories and narratives used in energy and climate change work. Such categorisations could serve several purposes: specificity, reference, and the positioning of stories as data. There are two tools from folkloristics that may help. Broadly similar to the concept of storyline above, the folkloristic concept of *tale type*, originally developed by the Finnish folklorist Antti Aarne and updated by others, renders the multiple and varied story versions following particular plot-lines into tangible units of analysis [91,92]. For example, Little Red Riding Hood — in its myriad varied tellings — is Aarne-Thompson Tale Type number 333 (AT 333). It is included as one of a large group of 'Tales of Magic'. Rotmann's ([88], this issue) work on using a folklore-based story-telling spine to elicit visions and communications across diverse stakeholders would also fall into this category.

The second basic folkloristic concept relevant to categorisation is *motif*. In folkloristics, motif is usually defined as the smallest narrative element that persists in tradition (as ambiguous as this may be [38]). These motifs may focus on actors, items, or incidents. For a few examples: 'triumph of the weak,' 'the power of habit,' and even some that fit well with behavioural economic theorems (e.g., 'present values preferred to the past' and 'choices: little gain, big loss') These tale types and motifs have not been adapted to the less traditionally-folkloric, if still tradition-laden (e.g., 'policy legends and lists' [93], vocabularies and the theories they invoke [7], academics' stories about artefacts [28]) realms that are usually more relevant to energy and climate change research, but perhaps they could profitably be. Relationships between people, technologies, and fate have always been a subject in folklore (e.g., magic objects in folk tales). Some of these old stories and motifs are like the new ones, such as the transformative powers of technologies [38] and the economics motifs just mentioned.

Observation and data collection represent major costs in applied social sciences. While there are billions of potential subjects, they are often difficult to select (for a given question) and difficult to access. In US energy and climate change research, surveys have been one of the major routes to collecting data about people, if this data is formally collected at all (see, e.g., [94]). But surveys (and the data analyses that render them into models, tendencies, and other knowledge) are limited in their ability to represent and learn about the complexity of how people relate to technology, the environment, and the rest of the world. Collecting stories as primary data is not particularly easy. Many stories are already available (e.g., as open-ended responses in surveys, in social media, in fiction etc., as demonstrated by issue contributors). There are major questions about what these existing stories, or any sample of stories mean, what they represent, and what they miss. But, we argue, they are a basic form relating human experience, observation, and expectations, and (we assert, if tautologically) exist as some sort of synthesis, because there is something to express.

4.2. Stories provide a different perspective

As Janda et al. [95] suggest with respect to energy demand, the framing of the problem affects the types of solutions that researchers and policymakers propose. We suggest that a more storied framing of the 'problem' of energy and climate change research could contribute to a wider set of 'solutions'. The contributors in this issue use stories to 'zoom out' and see the bigger picture (e.g., [58–60,69,70,73]), 'zoom in' to better understand micro-dynamics, local scale, and refine models of how things work (e.g., [54,82,83,96]), 'zoom through' by looking what's behind the surface (e.g., [55,56]), and 'zoom and hook' by capturing adherents or re-steering listeners and tellers (e.g., [13,72,78,80,87,88]); often they may zoom in multiple ways. These creative forms can provide inspiration and motion for researchers and audiences.

By *zooming out*, one can better see that which is taken for granted, or possibilities and assumptions that are forgotten, for example, as highlighted in science fiction-style (and other) imaginaries (see, e.g., [69–73,97], this issue). *Zooming in* helps support the 'why' and 'what' that are hidden in averages and quantitative summaries (e.g., [53–55] in this issue; [98]). By *zooming through*, and in particular critically analysing stories as to cultural assumptions, power dynamics, symbols, and framings, stories become clues as to where to look (see [99,100]), how we think and thus sometimes, a way to question these assumptions and perhaps lead to a better way of doing. And, most practically, *zoom and hook* stories can capture thought processes, even adherents, that lead people down alternative courses in what they do and how they think, a common tactic in marketing and communications as well as other storytelling forums where convincing people of something, e.g., sympathy for the defendant in court trials [101], is the desired outcome.

4.3. Stories and storytelling provide a different set of tools

Moving from stories as research objects and modes of inquiry to stories as active processes, the act of storytelling and story-listening can connect diverse stakeholders and foster imaginative forms of collaboration and collective action. These techniques thus provide a form of engagement and a forum for mutual learning, as outlined above. This works, we think, in connecting scholars from diverse backgrounds together too, by gently challenging the normal disciplinary and institutional stories we work within, and providing some natural grounds upon which we might advance. Official stories can often over-simplify or routinise in a way that creates political movement ([90]) but also deadens thinking [7,102]. But used well, they might also help us say what or how we think, in a fresher way than our disciplinary or sectoral jargon and boundaries often allow.

In addition, dealing in stories can change who speaks, who gets heard, and even who hears, relative to more standard procedures of data collection, what ideas and topics are considered in scope, authorship, and peer review. For example, as to authors, everybody can talk about what they think a story means or does. If the person is not a social scientist, they will not sound like a social scientist or do the things social scientists would do. But the insights can be every bit as useful. This also applies to the huge group of professionals who work in climate change or with energy use, energy supply, or related systems, but don't necessarily write about it (e.g., building operators). At the risk of sounding romantic, it could also apply to the many other people, most people, who do not get to say much, at least not in their own terms, in our normal data collection on people (see, e.g., [53,54,56,65,84,86,87,96] this issue).

4.4. What's next

There are, we acknowledge, many outstanding questions about how stories and storytelling can be appropriately used and accepted in research, how they can be used in combination with more traditional models, methods, and data sources, and how to develop and retain the right kind of scientific vigilance and a critical stance, at least when the claims are scientific. The fact that stories are a different kind of data than our current methods (statistics, observation, sampling, experiments, modelling) are designed for, and that a huge apparatus of assessing scientific validity expects, is definitely a challenge. But it seems clear that using stories as data, inquiry, and process in energy and climate change research can do things that other approaches do not, given that the forms, speakers, analytical possibilities, and reception are also different. They might, at the least, offer a way to surface insights, misconceptions, beliefs, experiences, or perspectives that commonly exist but are not systematically brought to light. We hope that this special issue delights, engages, raises questions, and provides insights and inspiration for other energy and climate change researchers.

Acknowledgements

We are deeply grateful to the contributors to this special issue, the reviewers for these contributions whose efforts played an essential role in developing the content, the three anonymous reviewers of our introduction, Dr. Benjamin Sovacool for his continual support and encouragement, and Elsevier. Portions of this work were supported by the RCUK Centre for Energy Epidemiology (EP/K011839/1) at University College London and by IEA DSM Task 24.

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