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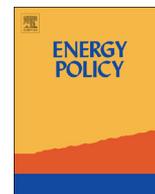
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A critical review of discursive approaches in energy transitions

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ABSTRACT

This article critically reviews the use of discursive approaches in studies of sustainable energy transitions. The review is motivated by calls to further incorporate social scientific methodologies into energy research and assess their contribution to policy. We strive to answer three questions: (1) which discursive approaches have been used to study sustainable energy transitions; (2) what thematic topics and issue areas have been covered and (3) what is the added value of discursive research designs? Our analysis is based on a review of 77 articles from the years 2004–2016. Our findings show that discursive approaches were mostly used to analyse institutional change and policy strategies at the national level and to examine energy choices through political ideology and the perceptions of publics. Nuclear power received most coverage, while renewable energy technologies were mainly studied through conflicts and opposition. We demonstrate discursive research designs to examine four distinct policy areas and discuss the added value of these approaches for energy policy and research. Discursive methodologies enable scholars to enrich policy discussions through accounting for transitions as complex and dynamic processes of change.

1. Introduction

Taking a transitions perspective to energy research attracts scholars across disciplines (Markard et al., 2012). Recently, there has been a marked increase in studies that employ social science methodologies to examine the politics and policy processes that either contribute to or hinder transitions towards low-carbon energy systems (Loorbach et al., 2017; Sovacool and Hess, 2017). This stems from an understanding that socio-technical energy transitions inherently involve high degrees of policy uncertainty and political struggles over strategies, targets and priorities (Avelino et al., 2016; Meadowcroft, 2009; Stirling, 2014).

Within the social sciences, the role of language, ideas and power is often examined with discursive methodologies (Feindt and Oels, 2005; Foucault, 1980; Hajer and Versteeg, 2005). Energy policy research is no exception: many scholars are turning to discursive approaches to analyse and make sense of changing energy systems and the related discourses through which change is given meaning. The role of discourse has also been acknowledged in this journal, most notably in the article by Scrase and Ockwell (2010), in which the authors highlight the value of discourse for energy policy research and practice, and introduce discourse analytical techniques to the multi-disciplinary audience of Energy Policy. Since then, many authors, in this journal and elsewhere, have applied discursive approaches in their studies on energy policy (among others, Chaiyapa et al., 2018; Cotton et al., 2014; Morton and

Müller, 2016; Steinhorst and Matthies, 2016). As a result of this growing trend, we argue that the multi-disciplinary energy policy community would now benefit from a more in-depth consideration of the application of these methodologies. This is because discursive approaches not only provide new knowledge on distinct phenomena, but also construct certain realities about research topics whilst excluding others (Asdal and Marres, 2014). Hence, the way discursive methodologies are applied can have substantial implications for what policy issues are made visible in the growing research on energy policy and transitions.

To augment and further inform this discussion, we present a critical literature review of the use of discursive approaches in studying sustainable energy transitions. While the term sustainable energy transitions is often used to refer to a specific research field that has emerged from evolutionary economics, sociology and science and technology studies (Markard et al., 2012), we broaden the scope of our analysis to cover any empirical articles that examine energy policy and transitions through discursive methods. We pose three questions for analysis: (1) which discursive approaches have been used to study sustainable energy transitions; (2) what thematic topics and issue areas have been covered with discursive approaches and (3) what is the added value of discursive research designs? The findings yield information on existing research practices and their policy implications to inform the multi-disciplinary energy and transitions audience. Our analysis is based on a

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data set collected from the Scopus and Web of Science data bases, which consists of 77 journal articles from the years 2004–2016.

The article unfolds as follows. We begin with a brief discussion of different discursive approaches. We then outline our methods, before presenting the data set. For readers interested in the application of discursive methodologies, we illustrate different research designs for studying energy transitions in Section 5. In turn, Section 6 summons the contribution and policy relevance of discursive approaches and points to areas of further research. Finally, we give concluding remarks.

2. The array of discursive approaches

Before delving into our review, we first introduce the range of discourse analytical approaches. For the purposes of this article, we focus on discourse, framing and narrative-related methodologies. This general categorisation allows us to introduce the main approaches developed across research fields.

Discourse analysis approaches are based on multidisciplinary theories, having roots in the sociology of science, cultural studies, linguistics and language philosophy (Carpentier, 2012). They can be viewed as the empirical investigation of discourses through a variety of disciplinary and theoretical backgrounds (Keller, 2017). Without seeking to raise a specific theoretical viewpoint above others, we offer Dryzek's (1997, p. 8) definition of discourse as a starting point: Discourse can be viewed as 'a shared way of apprehending the world. Embedded in language it enables subscribers to interpret bits of information and put them together into coherent stories or accounts. Each discourse rests on assumptions, judgements and contentions that provide the basic terms for analysis, debates, agreements and disagreements'.

In Discourse Analysis, the analytical interest inclines towards how language and ideas structure the ways we perceive reality. The power of discourse lies in legitimizing certain ways of thinking, speaking and acting at the expense of others; discourses thus both enable and restrict knowledge production and action (Feindt and Oels, 2005). One major school of thought is Critical Discourse Analysis, which studies discourse as a form of social practice (Fairclough, 1995). Drawing from social science and linguistic scholars including Halliday (1981), Habermas (1984) and Foucault (Foucault, 1980), Critical Discourse Analysis introduces the elements of social embeddedness, politics and ideology into the analysis of language. Another influential framework within discourse analysis, popular within environmental social science, is Hajer's (1995) Argumentative Discourse Analysis, which draws on a Foucauldian approach to discourse. It includes discourse, discourse storylines and discourse coalitions as analytical concepts. Moreover, other approaches within Discourse Analysis discuss discourse together with new materialism or concepts such as institutions and democracy (Asdal, 2015; Carpentier, 2012; Dryzek, 1990; Rydin, 1999).

Framing and Frame Analysis are more fragmented as a field of study, due to different disciplinary takes on the approach. Framing has been addressed, among others, in the social sciences within political science, media studies and sociology as well as in social psychology and behavioural economics (Entman, 1993; Goffman, 1974; Schön and Rein, 1994; Tversky and Kahneman, 1981). A widely used definition for frames is that they represent the 'schemata of interpretation' that guide individuals 'to locate, perceive, identify and label' issues and events (Goffman, 1974, p. 21). For the framing process, Entman's (1993, p. 52) explanation is seminal in the field: 'to frame is to select some aspects of a perceived reality and make them more salient in a communicating text, in such a way as to promote problem definition, causal interpretation, moral evaluation, and/or treatment recommendation for the item described'. Many analytical approaches build on these conceptualisations, and seek to analyse the content of talk and textual data in order to reveal the ways in which problems and their proposed solutions are presented (Schön and Rein, 1994). In addition to analysing texts to identify frames, framing can be used to create interventions for the purposes of research and policy, for example by applying nudging techniques (Thaler and

Sunstein, 2009).

In Narrative Analysis, the main attention is given to stories, arguments, scenarios and events in texts. As opposed to Discourse and Frame Analysis, the emphasis is more on finding sequence structure or consequential elements in stories rather than examining specific wordings or phrases (Riessman, 2005). Roe's (1994) Narrative Policy Analysis is a seminal narrative approach. It views the policy process as a terrain of conflicting stories about highly uncertain policy issues. The approach thus seeks to identify asymmetries and conflicting narratives in policy situations. Hence, narrative analysis is often linked to policy analysis, more so than Discourse and Frame Analysis.

It is important to note that even if discursive approaches can be categorised methodologically as we did above, it is not always simple to position them vis-à-vis one another and the different methodologies may overlap in their application (Durnova et al., 2016). This is because discursive approaches can range from linguistic analyses of text to examining contexts, power dynamics and the ways in which knowledge is produced and reproduced in society (Asdal and Marres, 2014).

3. Methods

3.1. Data collection

To review the use of discursive approaches in the analysis of sustainable energy transitions, we have collected a data set from the Scopus and Web of Science databases, complemented with hand picking and expert consultation. The final data set selected for the review consisted of 77 journal articles. To identify relevant articles from peer-reviewed journals, we conducted a three-step search with different search strings in Scopus. The search words and search process are outlined below and illustrated in Fig. 1.

In the first step, we selected search terms that represented the fields of A) discursive methodologies B) energy and C) socio-technical transitions. This search string yielded 339 articles.

In the second step, we ran searches first with discourse and energy related terms (A + B), and then with discourse and transition related terms (A + C). However, due to the large number of results these searches returned, which included many irrelevant fields, we decided to limit the search with another parameter.

Consequently, the third step involved running the same search strings as in the second step but with journal indexing. Based on our expertise in the sustainability transitions and energy fields, we chose 15 journals known for publishing transition-relevant articles.¹

The search for discourse and energy terms produced 234 articles, while discourse and transition-related terms yielded 188 articles.

We then read the titles, abstracts and key words of all of the articles gathered through the different searches (339 + 234 + 188). Articles were added to our data set based on the following exclusion and inclusion criteria. Articles were included if they were empirically-oriented (i.e. based on case studies or analysis of historical or on-going transitions); if framing and/or discourse and/or narrative was identified as one of the methods used for analysis; and if the main topic of the article related to energy (e.g. energy technology, policy). Articles which failed to meet these criteria, for example by delivering conceptual or theoretical contributions or dealing primarily with fields other than energy (e.g. food), were excluded. To complement the data extraction

¹ A similar strategy has been used by scholars such as Sengers et al. (2016). The journals included *Environmental Innovation and Societal Transitions*, *Environment and Planning C: Government and Policy*, *Research Policy*, *Technology Analysis and Strategic Management*, *Technological Forecasting and Social Change*, *Sustainability*, *Environmental Science and Policy*, *Futures*, *Global Environmental Change*, *Journal of Cleaner Production*, *Environment and Planning*, *Environmental Policy and Governance*, *Energy Policy*, *Ecological Economics* and *Energy Research and Social Science*.

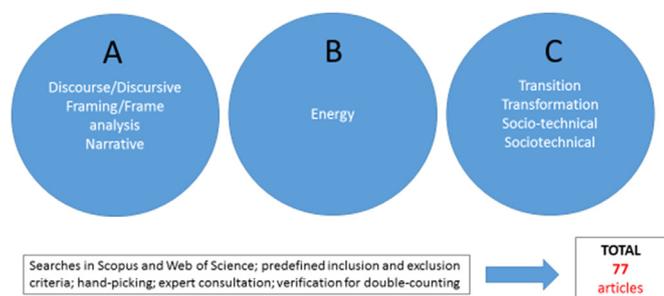


Fig. 1. Search process.

The following Boolean search query was used: **Search string 1:** TITLE-ABS-KEY ((discourse* OR discursive* OR "frame analysis" OR framing* OR narrative*) AND (energy) AND (transition OR transformation OR sociotechnical OR socio-technical)) AND PUBYEAR < 2017. **Search string 2:** TITLE-ABS-KEY ((discourse* OR "frame analysis" OR framing* OR narrative*) AND (energy) AND ISSN ((2210–4224 OR 0263774× OR 0048–7333 OR 1465–3990 OR 0040–1625 OR 2071–1050 OR 1462–9011 OR 0016–3287 OR 0959–3780 OR 0959–6526 OR 1472–3409 OR 1756–9338 OR 0301–4215 OR 0921–8009 OR 2214–6296))) **Search string 3:** TITLE-ABS-KEY ((discourse* OR "frame analysis" OR framing* OR narrative*) AND (transition OR transformation OR socio-technical OR sociotechnical)) AND ISSN ((2210–4224 OR 0263774× OR 0048–7333 OR 1465–3990 OR 0040–1625 OR 2071–1050 OR 1462–9011 OR 0016–3287 OR 0959–3780 OR 0959–6526 OR 1472–3409 OR 1756–9338 OR 0301–4215 OR 0921–8009 OR 2214–6296))).

from Scopus, we ran verifications in the Web of Science database, and used hand searching and expert consultation to reduce the possibility of some relevant articles not being identified through the search.

3.2. Data analysis

The analysis of our material was conducted by reviewing all 77 articles and subsequently completing an Excel spreadsheet, where for each article we listed descriptions of the empirical material, methods, methodology and associated theories and further questions, as well as basic information on the articles and their cases. The collected information was motivated by our three research questions. The contents of the spreadsheet, double checked by both authors, were used as an initial round of analysis to help identify the main areas of interest. After this, we iteratively consulted the original material several times during the analysis, engaging in a thorough reading of relevant sections of the articles. These results are presented in Sections 4 and 5. Unless indicated otherwise (with the use of c.f.), all articles referred to in Sections 4 and 5 are examples from our data set. To further highlight the policy relevance of our results, we discuss four different issue areas in Section 5 ‘Research designs for examining energy transitions’. These issue areas are categorisations that we developed inductively from our data set based on their popularity. For each issue area, we have selected three articles whose research design, methodological choices and policy relevance are outlined in Tables 3–6. The articles were selected to exemplify diverse research designs and highlight the policy implications of discursive methodologies.

Finally, we acknowledge the limitations of our research. The articles in our sample were from a wide range of disciplines, therefore caution is required regarding the generalisability of findings. Moreover, we acknowledge minor limitations in the search string used for data collection. With the keyword selection, we pre-specified our methodological coverage mainly on three popular methodologies – framing, discourse and narrative. We minimized the risk of losing relevant articles that use other categorisations by running many trials on keyword searches and adding articles to the sample based both on the authors’ expertise and on suggestions from colleagues in the field.

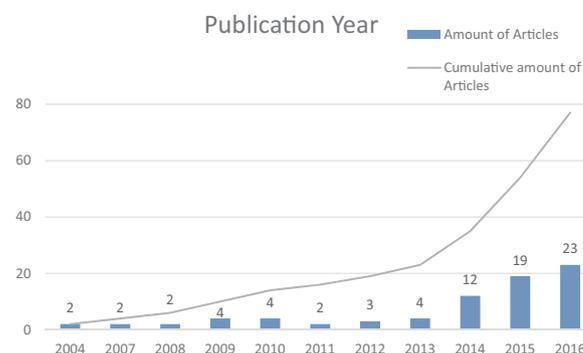


Fig. 2. Publication years of articles.

3.3. Description of data set

As explained above, the final data selected for the review consisted of 77 articles from 42 different journals, covering the years of 2004–2016 (for a full list of the data set, see Appendix A). From here on, we refer to this as ‘our data set’. In this section, we briefly describe the characteristics of the data set. All graphs and tables in the article refer to the full data set unless specified otherwise. In terms of chronology, the earliest article to include our combination of keywords (Fig. 2) was published in 2004. However, a steep increase in the use of discursive approaches occurred in 2014 and this upward trend continued for the years 2015 and 2016. Most of the articles were published in energy, sustainability and environment specific journals, the most popular being *Energy Research and Social Science* and *Energy Policy* (Table 1).

4. Results

4.1. Studied empirical topics

Energy policy as well as energy use and lifestyle were the most prominently tackled topics in our review (Fig. 3). Articles examining energy policy emphasized recent developments in different national or local contexts in the 2000s (Hendriks, 2009; Smith and Kern, 2009; Späth and Rohrer, 2010; Teschner and Paavola, 2013). Energy use was most often assessed at the level of individual practices related to energy consumption (Groves et al., 2016; Vihalemm and Keller, 2016), while only one article examined energy use and lifestyle at the organizational level (Büchs et al., 2015).

In terms of energy technologies and sources, nuclear, bioenergy and wind power attracted widespread coverage. Nuclear received most interest, with diverse research designs. The technology was approached through studying public opinion and attitudes (Wagner et al., 2016); perceptions of nuclear-related risks (Wong, 2015); and framing in

Table 1
Academic journals by number of publications, excluding single mentions.

Academic journal	Number of journal articles
<i>Energy Research & Social Science</i>	12
<i>Energy Policy</i>	11
<i>Sustainability</i>	5
<i>Journal of Environmental Policy & Planning</i>	3
<i>Environmental Policy and Governance</i>	2
<i>Environmental Science & Policy</i>	2
<i>Futures</i>	2
<i>Journal of Cleaner Production</i>	2
<i>Journal of Risk Research</i>	2
<i>Research Policy</i>	2
<i>Science, Technology & Human Values</i>	2
<i>Technological Forecasting and Social Change</i>	2
<i>Technology Analysis & Strategic Management</i>	2

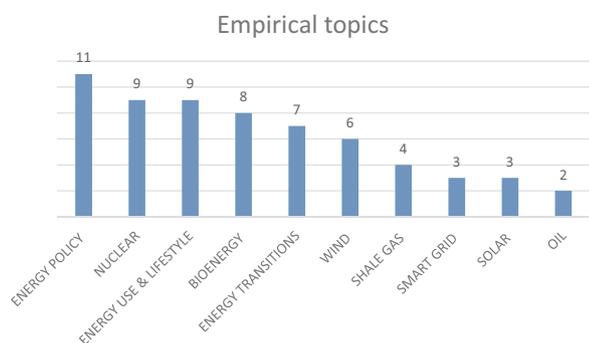


Fig. 3. Empirical topics covered in the data set.

parliamentary and governmental energy strategies (Edberg and Tarasova, 2016; Teräväinen et al., 2011) and in past public communications about nuclear-reliance in energy production (Rice and Rice, 2015; Schmid, 2004). In the case of wind and biomass, the main focus was on examining debates and conflicts over the development and implementation of these technologies (Jürges and Newig, 2015; Mittlefehldt, 2016; Peters and Schraml, 2015; Szarka, 2004). Our data set also points to a rising interest in more recent developments, such as shale gas, smart grids and solar energy. By contrast, there was limited analysis on the state and future of mature fossil fuel sources such as coal and oil.

4.2. Covered scale and geography

Discursive approaches were typically applied to examine questions at the national level (Fig. 4). This echoes an understanding of energy policy and transitions as national concerns, addressed through specific governmental policies and priorities (Bosman et al., 2014; Hermwille, 2016; Scrase and Ockwell, 2010). The UK was clearly the most studied country, both as a single case study and when included in international comparisons (Fig. 5). Comparative analysis focused on differences between governance levels whereas comparisons between countries were less frequent. Discursive approaches were applied to examine local- and state-level developments, especially related to siting concerns, local visions and assessing conflicts between scales of governance (Fischlein et al., 2010; Wilson and Stephens, 2009). This reflects three previously identified biases in sustainable energy transitions research: i) a focus on the national level at the expense of other levels, ii) insufficient attention given to comparative studies across different locations, and iii) a lack of analysis on emerging economies and developing countries (cf. Hansen and Coenen, 2015; Markard et al., 2012).

4.3. Methodological choices

The majority of studies employed a qualitative and interpretative

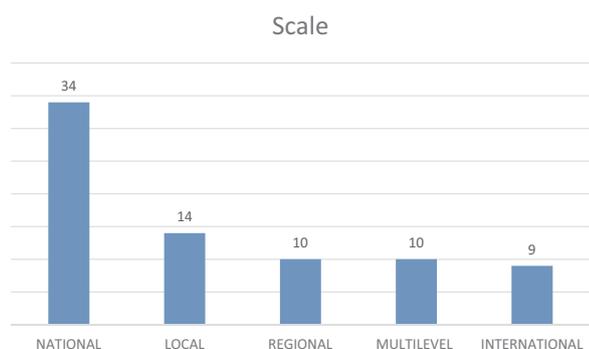


Fig. 4. Scale of analysis in the data set. Multi-level refers to local-regional, regional-national, and national-international.

Geographical coverage

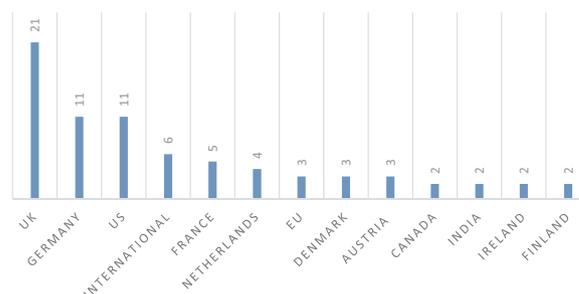


Fig. 5. Geographical coverage in the data set, excluding single mentions of a country.

social scientific approach. The articles aimed to trace and construct different discursive patterns from the empirical material. By contrast, quantitative methods were applied in only six articles. The number of articles that used discursive methods as active devices to alter research settings (such as issue framing or nudging) was very small (Clarke et al., 2015; Steinhorst and Matthies, 2016).

While a variety of data analysis methodologies were employed in our case studies, three observations can be made on the basis of their popularity. Table 2 lists the main methodologies by reference to key authors in the field that were reported by three or more articles in our sample.

First, discursive approaches developed in the realm of environmental social sciences were the most prominently employed, with the work of Hajer (2006, 1995) standing out in our sample. This included applications of Hajer's Argumentative Discourse Analysis as well as the concepts of storylines and discourse coalitions. Other authors from the environmental policy field frequently referred to in our sample included Dryzek (1990) and Rydin (1999). Socio-linguistic methodologies such as Critical Discourse Analysis were used, but less frequently than the aforementioned discourse analytical approaches.

Second, Frame Analysis and framing were almost as popular methodologies as Argumentative Discourse Analysis in our data set. However, the range of methodologies employed with reference to frame theories was varied. Both quantitative and qualitative methodologies were used, drawing on the fields of media and communication (Entman,

Table 2

Methodological choices. This table lists the main methodologies that were reported by three or more articles in our sample. It is important to note that the table is not intended to display all authors and methodologies used, but rather to provide an overview of the most popular methodological approaches with reference to key authors that were reported on in our data set. The total amounts to more than our sample size, since several articles reported using more than one methodology.

Methodology	Number
Discourse Analysis	
Argumentative Discourse Analysis (Hajer)	21
Critical Discourse Analysis (Fairclough, Wodak, Van Dijk)	7
Discourse analysis (Dryzek)	7
Discourse analysis (Rydin)	4
Discourse analysis (Fischer)	3
Discourse theory (Laclau & Mouffe)	3
Discourse analysis (Hajer & Versteeg)	2
Frame Analysis	
Frame theory (Goffman)	7
Framing (Benford and Snow)	7
Frame analysis (Rein and Schön)	4
Frame analysis (Entman)	4
Frame analysis (Gamson, Gamson & Modigliani)	4
Narrative Analysis	
Narrative analysis (Roe)	4
Narrative analysis (Polkinghorne)	3

Table 3
Examples of studying state orientation and political ideology with discursive approaches. NB. The wording of the research questions was modified by the authors when needed for coherent presentation purposes.

Article	Research question	Materials	Methodology	Relevance and policy implications
Teräväinen et al. (2011) 'Climate change, energy security, and risk-debating nuclear new build in Finland, France and the UK'	<p>1) What kinds of justifications and discursive strategies have different advocates and critics of new nuclear power employed?</p> <p>2) What similarities and differences can be identified between the recent nuclear power debates in Finland, France, and the UK?</p> <p>3) How are country-specific state orientations reflected in and constituted by arguments for and against nuclear power in national policy debates?</p>	Policy documents; newspaper articles; multi-stakeholder semi-structured interviews.	<p>Qualitative.</p> <p>Methodology: Qualitative content analysis paired with DA (Hajer, 1995; Hansen & Sørensen, 2005; Hsieh and Shannon, 2005).</p> <p>Method: Identification of structures, close reading.</p>	<p>The three countries' nuclear power debates have been conditioned by the respective state orientations. The results highlight the interconnectedness of discursive strategies and policy contexts.</p> <p>The form and content of underlying normative and ideological claims depend on country-specific, historical experiences, which have shaped the types of arguments that 'work'.</p>
Edberg & Tarasova (2016) 'Phasing out or phasing in: Framing the role of nuclear power in the Swedish energy transition'	How did members of the Swedish Parliament frame nuclear energy in the 2010 debate and how does this reveal how politicians construct and contextualize their views on the role of nuclear energy in energy transitions?	Transcript of parliamentary debates	<p>Qualitative.</p> <p>Methodology: Frame analysis (Goffman, 1974; Snow et al. 1986).</p> <p>Method: Content analysis inspired by grounded theory (Hsieh and Shannon, 2005). Identification and coding of reference points. Grouping codes into larger themes.</p> <p>Qualitative.</p>	<p>Social structures, such as political ideologies, define what are considered to be acceptable and unacceptable measures for achieving the goals of energy transition.</p> <p>How energy technologies are represented in political processes is important.</p>
Leipprand et al. (2016) 'Energy transition on the rise: discourses on energy future in the German parliament'	<p>(1) What major discourses on the energy future have been present in the German Parliament in the past three decades?</p> <p>(2) How did the discourses evolve over time?</p> <p>(3) How can the apparent convergence of discourses across political parties be interpreted?</p>	Transcript of parliamentary debates	<p>Methodology: Discourse analysis (Hajer, 1995; Hajer and Versteeg, 2005; Dryzek, 2005) and policy narrative literature (McBeth, Jones, and Shanahan, 2014; Roe, 1994; Stone, 2012)</p> <p>Method: Inductive coding to reconstruct competing discourses on energy futures combined with deductive coding based on Dryzek (2005) on existing environmental discourses.</p>	<p>Contributes to the large body of research that exists on the German energy transition's technical, economic and political implications. Sheds light on the evolution of the German energy transition and interaction between market, state and citizens.</p> <p>Changes in policy narratives can contribute to policy learning and changes in policy, however, the interaction of these processes remains understudied.</p>

Table 4
Examples of studying publics with discursive approaches. NB. The wording of research questions was modified by the authors when needed for coherent presentation purposes.

Article	Research question	Materials	Methodology	Relevance and policy implications
Barry et al. (2008) 'Cool Rationalities and Hot Air: A Rhetorical Approach to Understanding Debates on Renewable Energy'	How is opposition and support for offshore wind energy articulated in pro- and anti-publications in the United Kingdom?	Policy documents, newspaper articles.	Qualitative Methodology: Rhetorical analysis, focussing on concepts and rhetorical devices (Rydin, 2003) Method: Identification of rhetorical devices as employed by Rydin (2003)	Public acceptance of technologies is key for energy transitions. This should be further considered in technology development and implementation. A rhetorical approach highlights the positions of anti and pro-wind protagonists in detail: there are no two homogenous and undifferentiated discourses of "pro" and "anti" facing one another; but a variety of pro- and a variety of anti- windfarm discourses that are in constant interaction.
Clarke et al. (2015) 'Public opinion on energy development: The interplay of issue framing, top-of-mind associations, and political ideology'	1) How do particular issue frames elicit different audience frames (top-of-mind associations)?	Split-ballot, telephone survey of 1000 American adults	Quantitative. Methodology: Testing of different hypothesis related to framing (Cacciatore et al., 2012; Schuldt et al., 2011) and top of mind associations with fracking vs. shale gas.	Risk communication is key to effective policy-making. Public opinion will determine the long-term viability of energy policy. Issue framing can be a problematic tool for risk communication surrounding shale gas and fracking development, as the fields contain loaded terms, linked to diverse social, economic, environmental and health impacts.
Stauffacher et al. (2015) 'Framing deep geothermal energy in mass media: The case of Switzerland'	2) How do these associations, in turn, account for framing effects on audiences' issue opinions? 1) How have newspapers presented the issue of deep geothermal energy? 2) How much media attention does the issue draw, how the issue is framed, and which actors promote which frames?	Newspaper articles	Method: A telephone survey with manipulated issue frames. Coding of results. Qualitative. Methodology: Frame analysis (Entman, 1993; Gamson and Modigliani, 1989; Scheufele, 1999). Method: Coding of newspaper articles.	Policy-makers should be clear about the impacts of fracking to better leverage issue framing as part of effective risk communication. Phrases like "shale gas development via hydraulic fracturing" may be useful additions to policy language for conveying positive and negative impacts. The media should consider the consequences of communicating information based on narrow, quantitative risk assessments. There is a risk of incomplete knowledge and of scientific advice becoming vulnerable to political pressures. Investors and elected policymakers should be mindful about the media's manner of presenting deep geothermal energy to the public. To minimize future conflicts, it is essential to monitor communication and public engagement about the issue, both in the siting processes and when launching projects. Transparency and engaging local actors in the decision-making process are also crucial.

Table 5
Examples of studying institutional and policy change with discursive approaches. NB. The wording of research questions was modified by the authors when needed for coherent presentation purposes.

Article	Research question	Materials	Methodology	Relevance and policy implications
Smith & Kern (2009) 'The transitions storyline in Dutch environmental policy'	(1) Why did the transitions storyline find favour as a basis for policy renewal?	Policy documents, interviews	Qualitative.	Shows how adopting a radical policy storyline can fail to generate change as it is co-opted by existing powerful incumbent interests operating in current market structures. Demonstrates how flexible storylines are necessary to unite actors, yet may be unable to challenge the status quo as current institutions shape the practical implementation of the storylines.
Kivimaa & Mikwitez (2011) 'Public policy as a part of transforming energy systems: framing bioenergy in Finnish energy policy'	(2) How is it manifested in policy practice? (1) How have bioenergy options been framed in Finnish policy strategies, and how has this framing changed over time? (2) How has bioenergy framing in strategies contributed to the transformation of Finnish bioenergy systems? (3) Can a deeper understanding of change and stability in policy framing improve our knowledge of the dynamics of technologies and socio-technical systems?	Policy documents	Qualitative. Methodology: Discourse Analysis (Hajer, 1995; Rydin 2003; Dryzek, 1997; Fischer, 2003), policy change (Kingdon, 1984), institutional context (Ockwell and Rydin, 2006), transitions theories (Loorbach, 2007; Geels, 2002). Method: Identification of policy storylines (Hajer and Versteeg, 2005)	The use of new framings in policy does not necessarily result in new technologies being taken up or promoted. New policy framings may result in new policy instruments, but changes in technological systems are slower. Analysis of evolution of policy framing can identify the moments when specific technological options become first protected by policy and move from niche to mainstream. Innovation policy pathways are justified by linkages to different sociotechnical imaginaries and ideas about the public good. Imaginaries are flexible resources for those wishing to gather support for particular innovation pathways: that is, support can be harnessed with reference to different imaginaries. Expectations of future public benefits are used to legitimise current policy approaches.
Levidow & Papaiannou (2013) 'Policy-driven, narrative-based evidence gathering: UK priorities for decarbonisation through biomass'	1) In its various forms, how has bioenergy been promoted as beneficial by state actors? 2) Which bioenergy innovation pathways have gained most policy commitments and funds? What future visions have been used to promote them?	Policy documents, interviews	Qualitative. Methodology: Consensus framing (Hajer and Laws, 2006; Entman, 1993; Scrase and Ockwell, 2010; Tversky and Kahneman, 1981; Druckmann, 2004) Method: Content coding (Entman, 1993)	

Table 6
Examples of studying transition dynamics with discursive approaches. NB. The wording of research questions was modified by the authors when needed for coherent presentation purposes.

Article	Research question	Materials	Methodology	Relevance and policy implications
Kem (2012) 'The discursive politics of governing transitions towards sustainability: The UK Carbon Trust'	How has the design and implementation of the Carbon Trust initiative in the UK been shaped by discursive politics and what can we learn from this experience about the politics of governing transitions towards more sustainable energy systems?	Semi-structured interviews, policy documents, secondary sources	Qualitative. Methodology: Analytical framework based on discourse coalition (Hajer, 1995) and discursive institutionalism (Schmidt, 2008) Method: Case study, storyline identification.	New storylines can create potential for change if they appeal to existing or emerging values. Change can be created also through uniting actors with different interests under a similar storyline. Identifies two opposing strategies for policy change: i) developing storylines in line with dominant interests to garner support or ii) developing radical storylines to dismantle dominant interests. Cautions transitions management practitioners not to neglect power of dominant discourses and institutions.
Bosman et al. (2014) 'Discursive regime dynamics in the Dutch energy transition'	What is the dominant discourse amongst incumbents in the Dutch energy regime regarding the future of the energy system, and which developments put pressure on their discourse?	Policy documents, expert interviews	Qualitative. Methodology: Argumentative discourse analysis (Hajer, 1995). Storylines in the making (Garud et al., 2010) Method: Open-ended coding, (qualitative), followed by iterative axial coding (relating coding segments to one another).	Proposes that discursive regime destabilization may be a precedent for more substantive changes in energy regime dynamics. Discursive analysis reveals the storylines in the making that challenge the status quo, and are thus signals of tensions within the dominant energy system The emergence of such storylines can lead to incumbent actors repositioning themselves within the regime. The significance of external conditions or events (such as climate change) are actively translated by different niche and regime actors to suit their own strategic purposes. Discursive approaches can examine how actors position themselves within transition processes and what types of coalitions may emerge.
Rosenbloom et al. (2016) 'Framing the sun: A discursive approach to understanding multi-dimensional interactions within socio-technical transitions through the case of solar electricity in Ontario, Canada'	1) How are actor groups depicted within the multi-level perspective struggle to frame innovations using narrative work? 2) How are these narratives formed through the ideational capacity of actors to link the content and context of an innovation?	Documents, reports and websites.	Qualitative. Methodology: Development of theoretical framework 'Multi-dimensional discursive interactions' based on qualitative discourse analysis (Hajer, 1995, 2006; Fischer, 2003; Stone, 2012) Method: Distill storylines from documents based on Hajer's (2006, 1995) steps. First, keyword search; second, reviewing documents and retaining relevant passages for further analysis; third, reading passages and distilling a set of content-related claims, contextual factors, and general storylines, identification of storylines based on this analysis; finally, mapping actors, claims, and contextual factors to storylines.	

1993), policy analysis (Schön and Rein, 1994), and sociology (Benford and Snow, 2000; Gamson and Modigliani, 1989; Goffman, 1974). Frames or Frame Analysis were also mentioned as methodologies without reference to any authors. This demonstrates the plurality of approaches and epistemological starting points behind frame analysis, theory and framing.

Third, Narrative Analysis was applied less frequently than Discourse and Frame Analysis approaches. We note references to a diverse set of authors, with Roe (1994) and Polkinghorne (1995) referred to most often. Narrative analysis or the term narrative was also often used in a seemingly ad hoc manner, with little reference to theoretical concepts or containing methodological explanation.

Overall, turning to argumentative discursive approaches within public policy was often justified with a desire to go beyond descriptions of meaning and provide explanations of how and why socio-technical transformations occur. By relying *en mass* on Hajer's Argumentative Discursive Analysis and various frame analysis approaches, energy and transition scholars favoured analysing storylines and focussed on contestation surrounding problem definitions. As the benefit of Argumentative Discourse Analysis, many authors mentioned its the ability to reveal discursive structure, different actor positions, and how these different actors, intentionally or unintentionally, used and re-group knowledge to develop storylines and form coalitions around them. In turn, the justification for frame analysis was that it presupposes complexity in policy processes and thus steers interest to examining how a certain emphasis or salience is given to policy problems. Hence, these approaches allow scholars to investigate the content, context and outcomes of what is said 'and what practices and expectations structure these utterances' (Späth and Rohrer, 2012, p. 1260).

4.4. Limitations and implications of methodological choices

Our review points to some important limitations and areas of caution in the use of discursive methods. First, a significant number of studies only attributed a short paragraph to report on their choice of methodology and application of methods. Fourteen of the 77 articles showed substantial gaps in explaining how their empirical material was examined. 55 of the 77 articles contained explicit definitions of concepts and reference to the theoretical background of the approaches. However, strikingly, only 21 articles took the step of critically contemplating their methodological choice and its suitability for the research question and design at hand. The studies that did engage in this kind of reflection either considered the implications of methodology use for research processes or criticised and discussed the limitations of their chosen methodology vis-à-vis other discursive approaches. On the whole we noticed more robust reporting on methods in the articles published later in our sample.

Second, the process of creating coding categories was not always clearly reported. While a coding technique was generally reported as the first step for conducting any discursive analysis, the ways in which codes were constructed into more specific narratives, storylines or frames was seldom described, and several articles reported on storylines or narratives 'emerging' or 'appearing'. This sidesteps the active role of the researcher in constructing storylines or narratives.

Third, several articles called for more open and transparent processes of data collection and verification in order to better engage with different actors, especially with non-academics, through consultation (Barry et al., 2008; Butler et al., 2015; Stauffacher et al., 2015). Scholars also noted the need for meticulous analysis of discursive accounts. For example, Lovell (2008) demonstrated how interviewees' retrospective reports of innovation tend to simplify complex processes into accounts favourable to the interviewees. To be more attuned to complexity when interpreting results, the studies in our review suggested employing data triangulation through the use of multiple sources, thus broadening the analysis of discursive accounts.

5. Research designs for examining energy transitions

This section further explores four distinct issue areas that were prominent in our data set by presenting a few example articles, their research questions, materials and methodology as well as their policy implications to illuminate the different research designs used. The four issue areas are 'political ideology and state orientation', 'publics', 'institutional and policy change' and 'transition dynamics'. The categorisations are our own and there is some overlap between them, most notably between 'institutional and policy change' and 'transition dynamics', with the former more explicitly linked to policy and the latter referring to broader notions of transition. The issue areas deal mostly with analysing the politics and policy of energy transitions, building on existing theoretical concepts such as institutional change, policy analysis and socio-technical imaginaries (see Tables 3–6). In addition, a small set of articles combined and operationalised discursive methodologies with theories of risk (Schmid, 2004; Wong, 2015); Actor-Network Theory (Pradhan and Ruysenaar, 2014; Wong, 2015), Practice Theory (Collins et al., 2016); as well as nudging and cognitive dissonance (Steinhorst and Matthies, 2016).

5.1. Discursive accounts unveil state orientation and political ideology

In our sample, discursive approaches enabled scholars to grasp and stress the importance of context (Späth and Rohrer, 2010), political ideology (Leipprand et al., 2016) and state orientation (Edberg and Tarasova, 2016; Teräväinen et al., 2011). All of these studies situated the politics of energy choices within the wider political and ideological debates regarding the level of state intervention in markets or the role of science, businesses and citizens in political processes. To explore how energy technologies and policies are constructed in political processes, scholars mostly applied interpretative qualitative methodologies to study political transcripts, policy documents and newspaper data, but interview materials were also used.

Table 3 provides three examples of research designs for examining state orientation and political ideology. Our analysis of the studies conducted by Edberg and Tarasova (2016) and Leipprand et al. (2016) illuminates the different rationalities and policy implications of methodological choices. Both studies examined parliamentary discourse using political transcripts as data. However, Edberg and Tarasova applied Frame Analysis while Leipprand et al. drew on Hajer's Discourse Analysis and Roe's Narrative Policy Analysis. These differing methodological choices were reflected in the research design. Leipprand et al. analysed the evolution of political parties' discourse over time whereas Edberg and Tarasova examined how parliamentary actors' views on a particular policy choice align with ideological positions about the role of state intervention in markets. An analysis of state orientation and political ideology through discursive approaches sheds light on the policy salience and legitimacy of arguments in different political contexts and over time.

5.2. Publics mobilise, shape and (de)legitimise energy policy

A second important issue area in our review was studying 'publics', i.e. the ways in which citizens, users, stakeholders, communities etc. influence the development of energy infrastructure and policy. Frame Analysis through media materials was the predominant approach for studying publics. The media was valued as an outlet and source of material due to its role in both constructing and reflecting public discourse. Whilst qualitative methodologies were popular, we also found studies developing a quantitative approach to the study of publics, for example in the analysis of the effect of different issue frames by Clarke et al. (2015) (Table 4).

Discursive approaches using interviews and media analysis often sought to situate and understand public opinion and reaction to policy-issues. As such, they examine collective opinions that shape energy

policy-making. In particular, discursive approaches were frequently used to study political conflicts involving publics. For example, Barry et al. (2008) analysed the public acceptability of wind power among various societal groups to reveal rival pro and anti-wind arguments. Stauffacher et al. (2015), in turn, assessed the conflicting frames different actor groups have mobilised regarding deep geothermal energy in Switzerland.

Very few studies contemplated or problematized the notion of publics itself. The studies largely referred to publics as recipients of policy and those affected by new energy developments. Scholars often inferred ‘a public’ around a specific issue from newspaper articles or large-scale surveys. While few accounts opened up the notion of publics, Schmidt (2004) was an exception, distinguishing between ‘(1) the public as it enters the media as activists/ authors (a “visible public”) and (2) the public as it is—explicitly or implicitly—addressed and envisioned in the texts analysed (an “imagined public”)’. In general we noted a distinct lack of conceptualisations of the public and limited discussion of ongoing debates on the role of publics in fields such as science and technology studies (cf. Marres, 2007; Rommetveit and Wynne, 2017). Developing a more nuanced understanding of publics would contribute to understanding technological uptake and development in different contexts and potential policy pitfalls.

5.3. Changes in institutions and policies involve discursive strategies

Third, institutional dynamics and policy change were a popular issue area analysed with discursive methodologies. Discursive approaches, such as discursive institutionalism (c.f. Schmidt, 2008), were described as enabling the analysis of non-static institutions. Due to the current pressure on existing energy regimes to change, discursive methodologies were considered more apt for studying their institutional dynamics as compared to other dominant approaches in the policy and institutional literatures (cf. North, 1991; Scott, 2008), which according to articles in our sample tend to favour explanations of stability and path-dependence (Genus, 2014; Kern, 2012). Through discursive methodologies, the scholars in our review identified and examined, for example, the rise of alternative storylines in an energy system and their ability to shape the dominant discourses and contribute to the destabilisation of the existing regimes (Smith and Kern, 2009; Teschner and Paavola, 2013).

In addition, discursive approaches allowed policy change to be traced. Kivimaa and Mickwitz (2011), for example, identified specific moments of discursive change when policy options move from the innovation-level to the mainstream. Discursive approaches can thus shed light on moments where a “policy window” (cf. Kingdon, 1994) may open for substantial policy change to occur. Likewise, discursive approaches may be able to trace the development of specific policy pathways.

5.4. Discursive methodologies' link to transition frameworks

Finally, discursive approaches were also applied to elaborate on processes of change specifically within energy transitions. We find that these conceptual synergies were mainly established between Discourse and Narrative Analysis and the multi-level perspective (Hermwille, 2016; Leipprand et al., 2016; Lovell et al., 2009; Rosenbloom et al., 2016; Späth, 2012). The multi-level perspective is one of the seminal frameworks in the transitions literature, describing energy system dynamics through the levels of niche (radical, experimental innovations), regime (established practices, institutions and infrastructure) and landscape (exogenous environment) (for a more detailed explanation, see Geels and Schot, 2007). Especially Hajer's approaches were frequently used together with the multi-level perspective to help explain policy change across scales (Hermwille, 2016; Lovell et al., 2009; Rosenbloom et al., 2016; Späth and Rohrer, 2012). For instance, discursive accounts were used to reveal how niche-level innovations

have been (de)legitimised or how system framings in the landscape level may favour regime structure. As such, discursive approaches enrich transitions frameworks analysis of policy change and political processes.

While studies in our sample most often built on existing conceptual models, two studies took a further methodological step to critically reflect upon the contribution of discursive methodologies to transitions research. In their respective articles, Kern (2012) and Rosenbloom et al. (2016) identified the added value of discursive approaches vis-à-vis existing transition frameworks, especially in the analysis of agency and political struggles. Kern developed a novel discourse-transition framework to examine institutional context and change, while Rosenbloom et al. propose a new framework to conceptualize multi-dimensional discursive interactions in transition dynamics.

6. The contribution of discursive approaches to energy policy and research

Our results show that examining socio-technical discourse enriches analysis of energy policy. The results confirm earlier arguments put forward by Scrase and Ockwell (2010) that discursive methodologies facilitate our understanding of how different framings of energy policy problems and solutions influence existing and future policy pathways. In addition, our results highlight the benefits of viewing energy policy from a multi-disciplinary angle (Kern and Rogge, 2017). Here, we further these arguments with three tangible points and an illustrative example.

First, discursive approaches contribute to understanding the interaction between social norms, regulation and politics related to technologies and their lifecycles. A discursive lens allows viewing technologies as more than instrumental objects (Sovacool and Hess, 2017) and yields policy relevant information from the different phases of a technological lifecycle. For example, discursive analyses of public support, risk perceptions or local contestations surrounding technologies give valuable information about the drivers and barriers related to technology adoption and diffusion. As Sovacool and Hess (2017) have aptly pointed out: ‘narratives of technology and diffusion are replete with contradictions and are continually (re)produced and negotiated as people experience them’. This makes discursive approaches an integral part of analysing energy technologies.

Second, opening up the black box of policy processes with discursive analyses enhances our knowledge about energy policy-making, and this information can be harnessed to design policies in a way that increases their likelihood of being adopted and sustained (Kern and Rogge, 2017). Discursive approaches shed light on the critical processes surrounding policy formulation, change and convergence. These include, for example, how ideas are institutionalised in a political environment or how political resistance and contestation surrounding a policy plays out. Discursive approaches are particularly insightful in studying situations where policy-makers are faced with ‘Knightian uncertainty’, or situations with limited or no quantifiable knowledge about outcomes (Kern and Rogge, 2017, p.8). Discursive approaches thus add nuance and complexity to analysis of policy processes.

Third, discursive approaches enrich existing analytical frameworks on socio-technical change. The use of discursive approaches in our review was often justified by stating the limitations of the popular and widely-used multi-level perspective: it does not adequately account for politics, power relations or agency. Discursive approaches can do exactly this as they focus on the politics of transition processes, the positioning of actor networks within these processes, and how different actors interpret sustainability and the goals of potential transitions differently. Therefore, discursive considerations can help explain how energy systems have ‘diverse evolutionary pathways, including non-change’ (Sovacool and Hess, 2017, p. 9).

Fourth, to further illustrate the contribution of a discursive take on energy policy change, we want to reflect upon the use of these

methodologies against a specific empirical example. For this purpose, we take a look at one policy area that was under examined during the years covered in our review, yet has received more and more discourse analytical interest in the past year: incumbent technology decline, in particular, coal phase-out. Three recent studies have used discursive approaches on the policy developments surrounding the decline of coal use in electricity generation in three different contexts: the UK, Germany and in Ontario, Canada. The role of discourse and language has been critical in these three cases, yet, manifested in different ways.

In the UK, an application of argumentative discourse analysis revealed how normative contestations over coal's legitimacy could be traced well prior to the UK government's decision to phase-out coal. The method allowed to examine coal decline as a battle over technology delegitimation in a changing energy policy environment. The findings show that coal decline in the UK happened much faster and resistance by incumbents was significantly weaker than anticipated in the transitions literature (Isoaho and Markard (submitted)). In the case of the Canadian province Ontario, coal phase-out was part of a government-led strategy. In this case, discourse analysis enabled the examination of the underlying discursive struggles over managing and defining a policy pathway for coal phase-out, which included ongoing political contestations with evolving actor positions and priorities (Rosenbloom, 2017). In Germany, a frame analysis was conducted on policy discourse in a context where coal decline was neither taking place in the energy mix nor an official policy objective. Here, the focus was instead on the debates surrounding the future of coal. The frame analysis revealed how policies supporting the decline of coal were seen as highly conflictual, regardless of the type of suggested policy (regulation, bans, carbon pricing). It also illustrated that policies banning coal would be likely to meet strong resistance as the negative costs will most likely be born by a few powerful actors (Leipprand and Flachsland, 2018). In sum, these examples show how discursive methodologies can give insights into different phases of policy change. This is important because any policy change involves strategies to create new meanings and is likely to face resistance by actors who hold on to the established policy discourse.

Finally, we point to a few directions for further research. An important next step would be to advance theoretical and conceptual developments in discourse-transition crossovers. With the exception of public policy and science and technology studies, we found little novel conceptual development or interdisciplinary combinations. This has enabled scholars to examine processes of politics and policy to a large degree, yet, the potential of further theoretical-conceptual developments remains underexplored. Areas where we see the potential for cross-overs include energy use and practices, political ecology and technology legitimacy. As sustainable energy transitions matures as a research field, it should strive to overcome the highlighted deficits in methodological practices. While we advocate developing new conceptual synergies, the incorporation of approaches from different fields requires caution and prudence regarding their methodological possibilities and different starting points, especially in the case of mainstream cognitive behavioural approaches.

7. Conclusion and policy implications

Social scientific methods are increasingly applied in the field of energy research. This has enlarged methodological diversity in a field that has been dominated by the natural sciences and economics. Our review sought to further inform multi-disciplinary energy and transitions scholars on the use of discursive methodologies. We posed the following questions for analysis: First, which discursive approaches have been used to study sustainable energy transitions? Second, what thematic topics and issue areas have been covered with discursive approaches? And, third, what is the added value of discursive research designs?

Analysis of the first question revealed that despite the diversity of

discursive approaches, energy and transition scholars have largely relied upon Discourse and Frame Analysis methods developed within the field of public policy and environmental social science. They have mainly been used to study problem framing (e.g. agenda setting stages in policy-making) and contestation of specific problem frames (e.g. to explain controversy surrounding the diffusion and deployment of specific technologies). A starting point for the use of these methodologies includes viewing knowledge as contingent and constructed, taking an interest in different actor positions, and presupposing complexity in policy processes and the associated socio-technical changes. This contributes to enriching understandings of the policy process. However, we at the same time note a limited amount of critical methodological reflection in our sample, which is a shortcoming with repercussions for research. If reporting on the research process is overlooked, there is a risk of it leading to limited discussions regarding *why* a specific methodology is deemed appropriate for a given research question and *how* it is applied in that context.

Concerning the second question, our study finds that nuclear power has received most in-depth discourse analytical coverage with diverse research settings. Renewable technologies have mainly been studied through analysing opposing actor positions and concerns related to siting matters. Meanwhile, a small but methodologically advanced set of articles also argued for the ability of discursive methodologies to study technological innovation, for example, the processes by which actors (de)legitimise specific technologies, such as solar PV, in a particular setting. While our data set contained only a limited amount of articles on fossil fuel technologies, these topics have since 2016 increased in popularity.

In conclusion and in response to our third question, our review demonstrates how discursive approaches are especially apt for the study of socio-technical change in contexts where change is understood as involving power struggles between different actors and coalitions. Discursive methodologies can be used to scrutinise incumbent and alternative policy strategies, political ideology, institutional change as well as perceptions of publics on technological choices. Importantly, the study of agency was identified as an area in which discursive approaches could fill in gaps and help overcome the inability of existing sustainability transition frameworks to analyse politics and policy in transitions. While these points arise from the review of 77 articles from our data set, they also have wider implications for research and practice. Discursive accounts influence shared visions and expectations about sustainable energy transitions. Scholars applying discursive approaches therefore play an active role in determining which policy issues or technologies are given attention and from what kind of a research angle. Considering the uncertain, non-static and complex characteristics of energy transitions, energy and transition scholars would benefit from incorporating discursive insights into their future work.

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Appendix A. Supporting information

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