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Review

Unravelling the 'collective' in sociotechnical imaginaries: A literature review

Magdalena Kuchler [a], Gubb Marit Stigson [b,*]

[a] Department of Earth Sciences, Uppsala University, Villavägen 16, 752 36 Uppsala, Sweden
[b] Department of Earth Sciences, Uppsala University, Campus Gotland, Cramérgatan 3, 621 57 Visby, Sweden

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ABSTRACT

The concept of sociotechnical imaginaries (STI) has been increasingly implemented in social science energy research to examine collectively held visions of desirable energy futures. In this paper, we attempt to make sense of the notion of a 'collective' central to the STI approach. We do so by performing a literature review of 69 peer-reviewed empirical articles that specifically delve into STIs concerning energy systems and transitions. We ask how 'collective' or 'collectively held imaginary' is defined and mobilised in these studies and what methods and empirical material scholars employ to access it analytically. Our literature review reveals a predominant emphasis on national collectives, frequently serving as the primary lens for analysis, with studies also exploring the interplay between national and local/regional STIs. Beyond the nation-state, we find instances of research delving into local/regional collectives and internationally or transnationally held STIs. Moreover, we illustrate how the choice of a specific 'collective' entry point influences methodological choices. Drawing from our literature review, we call for a more critical and comprehensive engagement with the notion of a 'collective' to elucidate how and why specific STIs gain prominence and power or lose acceptance and are marginalised within various collectives, especially in the context of low-carbon energy transitions. We further urge STI scholars to focus on diverse collectives that contribute to a sense of belonging beyond the confines of scale and place, such as class, gender, race, or ethnicity. Additionally, we emphasise the role of individuals, including those less socially prominent, in (re)shaping energy imaginaries.

1. Introduction

The concept of *sociotechnical imaginaries* (STI) has been increasingly employed as an analytical and interpretative tool in social science research scrutinising energy systems and transitions. These include, among others, bioenergy [e.g., [1–5]], nuclear power [6–9], smart grids [e.g., [10,11]], energy system design [e.g., [12]], wind power [e.g., [13–14]], solar power [e.g., [15]], coal [e.g., [16–19]], and natural gas [e.g., [20]]. In general terms, the conceptual lens of STIs operates using two key assumptions: it focuses on examining the inextricable relation between technoscientific assemblages and sociopolitical order, while also perceiving the capacity to imagine futures as a fundamental element of socio-political life [[6], p. 122]. Imaginaries, in this sense, have a performative nature: they do not only "describe" attainable futures but, more importantly, also "prescribe" feasible visions by (re)shaping and materialising them into desirable outcomes [[6], p. 120].

The concept of STIs was coined and developed by Jasanoff and Kim [6,7], who initially defined it as "collectively imagined forms of social life and social order reflected in the design and fulfilment of nation-specific scientific and/or technological projects" [[6], p. 120]. Since its inception, however, this analytical framework has gradually evolved into a more inclusive interpretative lens that encompasses processes of collective imagination beyond the boundaries of a nation-state or nationhood. Indeed, in *Dreamscapes of Modernity* [21], Jasanoff [[22], p. 4] refined and expanded the concept by recognising that STIs "are not limited to nation-states (…) but can be articulated and propagated by other organised groups, such as corporations, social movements, and professional societies". Six years later, Jasanoff and Simmet [23] reiterated that "the point is to show how an STI produces a sense of belonging to a particular kind of collective that may be as large as a nation state or as small as a breakaway utopian community" [[23], p. 3].

We observe that the gradual evolution and expansion of the concept has been reflected in the burgeoning STI literature concerned with energy visions. Over the past two decades, the analytical lens of STIs has

* Corresponding author.
E-mail addresses: magdalena.kuchler@geo.uu.se (M. Kuchler), gubb-marit.stigson@geo.uu.se (G.M. Stigson).

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been increasingly employed to examine imaginaries held by diverse collectives, ranging from nation-states, international organisations and local communities, as well as constellations of experts and activist groups (Table 1). The tendency in this literature is that the choice of a collective determines or is determined by the research focus and, thus, the selection of empirical sites and material. Although a growing number of studies concentrate on juxtaposing different sources of collective imagination (e.g., national-regional or global-local), the nation-state remains the key point of analytical entry. Recently, however, social science energy scholars have paid increasing attention to whose imaginaries matter and how to account for a rich diversity of STIs that are not only upheld by powerful actors but also performed by those that challenge or offer alternatives to dominant visions [e.g., [18,24]]. These advances in the STI literature bring forth pertinent questions regarding the ownership of collective imaginaries and who benefits from them and finds them desirable [e.g., [2,25]]. Moreover, these novel analytical ventures in STI research pave the way to important inquiries regarding the role of individual actors in constructing, shaping, contesting, or extending STIs, as well as how these individual-level dynamics interplay with collective visions.

The overall purpose of this paper is to make sense of the notion of a 'collective' in the literature concerned with STIs. We do so by examining peer-reviewed empirical articles centred on energy systems and transitions. First, we attempt to discern how 'collective' and 'collectively held imaginary' have been foregrounded in the conceptual deliberations of Sheila Jasanoff and her colleagues [6,7,21,23,26,27]. Second, we review the literature on STIs to identify and examine how researchers have, so far, addressed and engaged with the 'collective'. More specifically, we ask how 'collective' or 'collectively held imaginary' is defined (if at all) and mobilised in the studies on STIs and what methods and empirical material scholars employ to access it analytically. In reviewing this literature, we also direct our attention towards the extent to which STI scholars acknowledge and examine the role of individuals in terms of their agency to (re)shape and participate in collective visions.

We base our analysis on the literature review of 69 peer-reviewed empirical articles (Table 1) that we identified in the Web of Science Core Collection (www.webofscience.com) using the search term "sociotechnical imaginaries". We performed the first search in December 2021 and covered the titles, abstracts and keywords of scientific papers published between 2009 and 2021. The search produced 227 results that we extracted into an Excel file. We excluded non-empirical articles and work that did not focus on energy systems and transitions from our sample. We performed two additional searches in February and June 2023 to update the selection with the most recently published papers (2022/2023) and confirm the final selection. The identified articles were subject to thorough analysis with consideration of what forms of a 'collective' or 'collectively held imaginary' were studied (e.g., national, local), how the 'collective' was defined (if at all) and engaged with, and what methods and empirical material were employed in the analysis. Additionally, we paid attention to whether other forms of imaginary, such as of an individual or one that is not collectively upheld, were considered.

Our literature review reveals a predominant focus on the national collective, often serving as the primary analytical focal point or a basis for cross-national comparisons (Table 1). Additionally, we encounter studies exploring the dynamics between national and local/regional collective imaginaries, either accentuating alternative or competing STIs within national collectives or scrutinising the 'bounded' nature of local collectives. Beyond the nation-state, we find instances of research delving into local and/or regional collectives, internationally or transnationally held STIs, as well as examinations of social movements and industry as other forms of collectives. Moreover, the literature review illustrates how the choice of a specific 'collective' entry point influences methodological choices (Fig. 1). Studies on nationally held imaginaries often centre on powerful actors or institutions, analysing official documents and public debates. Local collectives are typically studied using ethnographic approaches like participatory observations and semi-structured interviews. Research on internationally or transnationally held STIs tends to capture visions through diverse actor networks, expert reports, and policies. The review also highlights a lack of attention to the role of individuals in shaping energy imaginaries. While powerful individual actors are occasionally mentioned, the criteria for identifying them are unclear, and there is a perceived deficiency in conceptual engagement on this aspect within the surveyed literature.

Drawing from our literature review, we call for a more critical and comprehensive engagement with the concept of 'collective', aiming to elucidate the mechanisms and dynamics that empower imaginaries, given their significant role in shaping the futures we envision and strive towards. This involves analysing how STIs, particularly those pertinent to low-carbon energy transitions, gain prominence and power or lose acceptance and are marginalised within various collectives. We further suggest that STI scholars could pay increased attention to the diverse collectives that contribute to and support the sense of belonging, extending their focus beyond considerations of scale and place. In this light, we assert the importance of recognising and understanding the connectedness shaped and co-produced by factors like class, gender, race, or ethnicity, emphasising the need for careful consideration of these often-overlooked collective identities, particularly when dominant STIs are intertwined with oppressive power structures. Lastly, we highlight the need for more attention to the role of individuals, especially those who are less socially prominent and seemingly ordinary, in shaping and co-producing energy imaginaries while illuminating the intricate interplay between collective formations and individual identity in the pursuit of alternative or radical energy visions.

The paper is structured as follows. In Section 2, we provide a brief outline of how Sheila Jasanoff and her colleagues understand and problematise the notions of a 'collective' and 'collectively held imaginary'. In Section 3, we attempt to review the literature on STIs by focusing on how other scholars define and engage with the notion of a 'collective' in research centred on energy systems and transitions. Here, we also pay attention to whether STI scholars recognise and examine the role of individuals in (re)shaping imaginaries. We conclude our paper with a discussion and suggest avenues for further research on STIs in Section 4.

2. Sociotechnical imaginaries: foundational assumptions

Jasanoff and Kim [6] coined the term *sociotechnical imaginaries* in their comparative study of nuclear power technology in the United States (US) and South Korea. They define STIs as "collectively imagined forms of social life and social order reflected in the design and fulfilment of nation-specific scientific and/or technological projects" [[6], p. 120]. Two aspects of this definition require our attention. First and foremost, these scholars consider the 'national' collective a significant unit for analysing technoscientific visions. Jasanoff and Kim's [6] initial preoccupation with the nation-state or nationhood stems from their dual motivation: to explore "the sources of long-lasting cross-national variations" [[6], p. 120] in science and technology policies and to draw inspiration from the anthropology and political science literature concerned with 'social imaginaries'. More specifically, the authors formulate the analytical framework of STIs by drawing upon the combination of two scholarly threads: one understanding the concept of a nation as a collectively imagined community [28,29] and another interpreting the notion of an imaginary as a powerful creative source of social life and producer of meaning [30]. Hence, Jasanoff and Kim [6] associate the capacity to imagine futures with "active exercises of state power" [[6], p. 123]. National STIs, according to these scholars, are "more durable" than other collective imaginations at play because "powerful instruments of meaning-making and goal-selecting often lie within the control of nation states" [[6], p. 124]. Second, for Jasanoff and Kim [6], the design and fulfilment of nation-specific projects are guided by prescribed visions of "what is good, desirable and worth attaining for a

Table 1
Reviewed articles.

Authors, year and title	What forms of collective (s) do the researchers address and engage with?	What methods and empirical material are used in the study?	Details
[61] Adornetto, 2022. Energy Trajectories and Solar Energy Imaginaries of the Maasai	Local	Ethnographic research in the civil society context; interviews with civil society and industry.	An ethnographic study, including unstructured interviews with Maasai herders, city-dwellers of Arusha, Tanzania, and representatives from foreign solar energy firms.
[71] Alda-Vidal, Khalid, Foulds, Royston & Greene, 2023. Gender imaginaries in energy transitions: How professionals construct and envision gender equity in energy access in the Global South	Transnational	Thematic analysis; interviews with experts (in energy).	Thematic analysis based on interviews with energy professionals in Global South contexts (India, Pakistan, Nigeria, and Ghana); the focus is on "collective visions in a range of professional accounts" (p. 2), exploring two extreme archetypes of gendered STIs.
[62] Araújo, Bento & Silva, 2022. Politicizing the future: on lithium exploration in Portugal	Local	Exploratory analysis; analysis of public documents (policy) and media outlets (local, national and international).	An exploratory study focusing on local opposition to lithium production in Portugal; the analysis is based on various content published by different local media, policy papers and international media; the wide range of empirical material helps observe "how collective life at specific moments is represented and circulates through the public space" (p. 3).
[10] Ballo, 2015. Imagining energy futures: Sociotechnical imaginaries of the future smart grid in Norway	National	Interviews (in-depth, semi-structured) with politicians, civil servants, industry, or experts; analysis of public or expert documents (policy, regulatory, scientific, and public hearing documents).	Study of a national "techno-epistemic network" (p. 10) of experts holding an STI of a future smart grid in Norway, based on document analysis and in-depth, semi-structured interviews with representatives from the authorities and industry experts.
[43] Barandirán, 2019. Lithium and development imaginaries in Chile, Argentina and Bolivia	National	Comparative analysis; interviews (semi-structured) with industry (industry representatives); analysis of public documents (policy) and media outlets.	A cross-national comparison of STIs in Chile, Argentina, and Bolivia, built on semi-structured interviews with actors active in lithium policy and extraction living and working in each country, as well as analysis of policy documents and media articles.
[8] Bayer & Felt, 2019. Embracing the "Atomic Future" in Post-World War II Austria	National	No clearly defined methods or materials, but arguably archival sources, policy documents, reports, and research papers; analysis of public or expert documents.	A study encompassing the period following WWII until the mid-1970s. The imaginary is held by "specific assemblages of institutional actors, technical elements, values and futures" (p. 165); the Austrian national STI is a translation from nuclear politics in the US.
[42] Benediktsson, 2021. Conflicting imaginaries in the energy transition? Nature and renewable energy in Iceland	National	Analysis of media outlets (national printed and digital).	A study fusing the concept of STIs with "nature imaginary" understood as a "more-than-human" collective (p. 91), based on previous research by the author; examples from printed media in Iceland found via timarit.is, as well as digital publications and other sources found via general web searches.
[44] Berling, Surwillo & Slakaityte, 2022. Energy Security Innovation in the Baltic Sea Region: Competing Visions of Technopolitical Orders	National	Comparative analysis; interviews (semi-structured) with politicians, civil servants, industry or experts (stakeholders, experts, government and ministerial representatives); analysis of public documents (official planning documents and speeches).	A comparative, interpretative study of energy security STIs in countries in the Baltic Sea region, focusing on desired futures of energy sovereignty with coal and nuclear in Poland and energy independence by liquified natural gas in Lithuania (p. 1).
[45] Berling, Surwillo & Sørensen, 2022. Norwegian and Ukrainian energy futures: exploring the role of national identity in sociotechnical imaginaries of energy security	National	Comparative analysis; analysis of public documents (policy, regulatory statements); analysis of media outlets (national newspaper articles, published accounts in three languages from the last 15 years).	A comparative, interpretative study of energy security STIs in Norway and Ukraine (p. 1).
[63] Burnham, Eaton, Selfa, Hinrichs & Feldpausch-Parker, 2017. The politics of imaginaries and bioenergy sub-niches in the emerging Northeast U.S. bioenergy economy	Local/regional	Comparative analysis; interviews (semi-structured) with experts.	A comparison of competing visions or "sub-niches" of bioenergy development termed "regional production" and "community energy" (p. 66) in the Northeast US.
[74] Buzogány & Scherhaufer, 2022. Framing different energy futures? Comparing Fridays for Future and Extinction Rebellion in Germany	Social movements	Comparative analysis; analysis of public media outlets or social media (published work of the two organisations, including tweets, websites, media statements, press releases); other (leaflets, handbooks, collections of texts and other movement-produced documents).	A comparison of two social movements: Fridays for Future and Extinction Rebellion; social movement as "a network of groups and individuals striving for a common goal and implementing ongoing collective and public action through mobilization" (p. 2); emphasis on "collective action" (p. 3).

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Table 1 (*continued*)

Authors, year and title	What forms of collective (s) do the researchers address and engage with?	What methods and empirical material are used in the study?	Details
[46] Carvalho, Riquito & Ferreira, 2022. Sociotechnical imaginaries of energy transition: the case of the Portuguese Roadmap for Carbon Neutrality 2050	National	Comparative analysis; interviews (semi-structured) with civil society; interviews (semi-structured) and one informal conversation with politicians, civil servants or experts (members from three different stakeholder groups, the RNC2050 execution team, and political entities).	The study uses comparative analysis to identify four different imaginaries of energy transition in Portugal; STIs "decisively shaped by the situatedness of the stakeholder group they belong to" (p. 2421).
[47] Christiansen & Carton, 2021. What 'climate positive future'? Emerging sociotechnical imaginaries of negative emissions in Sweden	National	Analysis of public documents (the Swedish public committee report); interviews with industry or experts (NGOs representing different sectors working with NETs).	The study uses interpretive analysis and focuses on emerging imaginaries of negative emissions technologies (NETs) in Sweden; STIs "emerging among actors in the Swedish establishment" (p. 3); acknowledging that "certain voices, for example by Indigenous people and youths, tend to be marginalised" (p. 7).
[53] Chung, Kim, Park & Kim, 2021. A Site of Bounded Imaginaries: Local Narratives of Buan after Protests against a Nuclear Waste Repository	National and local	Comparative analysis; interviews with civil society (local residents); analysis of public or expert documents (articles authored by nuclear experts); analysis of public or social media (articles written by environmental activists).	A comparative textual analysis focusing on discerning dominating (national in South Korea) and excluded local imaginaries (a local example from rural town); emphasis is on "locally bounded" STIs (p. 363).
[24] Delina, 2018. Whose and what futures? Navigating the contested coproduction of Thailand's energy sociotechnical imaginaries	National	Interviews with civil society; interviews with politicians, civil servants, industry or experts; analysis of public documents (policy and regulatory); analysis of public media outlets (published accounts in two major newspapers).	The study focuses on discerning one dominant imaginary (powerful state and non-state actors) and two alternative imaginaries (among others, social movements, academic and rural communities).
[16] Delina, 2021. Committing to coal? Scripts, sociotechnical imaginaries, and the resurgence of a coal regime in the Philippines	National	Interviews with civil society; interviews with politicians, civil servants, industry or experts (government representatives, NGOs, private companies and academia); analysis of public (policy) or expert documents; analysis of media outlets (popular and news).	The study focuses on two opposing coal imaginaries, a national pro-coal imaginary and an anti-coal imaginary mobilised at the local level in the Philippines.
[1] Eaton, Gasteyer, & Busch, 2014. Bioenergy Futures: Framing Sociotechnical Imaginaries in Local Places	Local	Frame analysis; interviews with civil society (community members); analysis of public or expert documents (e.g. siting proposals); analysis of media outlets.	A frame analysis of STIs of bioenergy in four northern Michigan communities interpreting the national imaginary (US), focusing on how local actors "frame the national imaginaries woven into local bioenergy proposals" (p. 229); the authors demonstrate "the potency of collective action frames for making sense of the national imaginaries underpinning siting proposals" (p. 227).
[35] Echevarria, Rivera-Matos, Irshad, Gregory, Castro-Sitiriche, King & Miller, 2022. Unleashing Sociotechnical Imaginaries to Advance Just and Sustainable Energy Transitions: The Case of Solar Energy in Puerto Rico	National	In-depth case study; ethnographic research in the civil society context (sustained engagement with several communities); ethnographic research in the political or expert context (participant observations of energy debates); interviews with civil society (solar customers, activists); interviews with politicians, civil servants or experts (solar business owners policy leaders and journalists); analyses of public or expert documents (technical and legal); analysis of media outlets.	An in-depth case study arguing that "the public imagination" is central to meeting the dual challenge of rapid energy transition and energy equality and justice (p. 1); the authors employ a mix of methods to study solar energy imaginaries in Puerto Rico.
[11] Engels & Münch, 2015. The micro grid as a materialised imaginary within the German energy transition	Local	Qualitative case study; interviews with the industry and experts (representatives from tenants at the innovation campus).	A qualitative case study of the STI of a micro smart grid at a German innovation campus; the campus is perceived as a "living lab" where both long-term residents and newcomers are part of shaping the micro smart grid imaginary.
[15] Ergen & Umemura, 2021. Shifting patterns of expectations management and innovation policy: A comparative analysis of solar energy policy in the United States, Japan and Germany	National	Comparative analysis; analysis of public or expert documents (archival documents from government, parliament, research organisations and industry, available secondary literature); analysis of media outlets (contemporary news coverage).	The study builds on comparative historical analysis to explore STIs in three nation-states, the US, Japan and Germany, with a focus on "collective governance institutions (such as associations, state agencies and research institutions)" (p. 1).
[48] Fahimi, Upham & Münch, 2022. Afghanistan's energy sociotechnical imaginaries: Alternative visions in a conflict zone	National	Interviews with experts (professionals active in the field of energy in relation to Afghanistan); analysis of public documents.	The study uses interpretive research with a focus on policy discourse to explore the interplay of power in both past and present energy STIs in Afghanistan, with a specific focus on relations between alternative imaginaries in relation to a state imaginary and "the collective and

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Table 1 (*continued*)

Authors, year and title	What forms of collective (s) do the researchers address and engage with?	What methods and empirical material are used in the study?	Details
			competing visions of the future Afghan energy system" (p. 2).
[64] Gross, Buchanan & Sané, 2019. Blue skies in the making: Air quality action plans and urban imaginaries in London, Hong Kong and San Francisco	Local	Comparative analysis; analysis of public documents (air quality action plans for the respective cities); analysis of media outlets (the cities' representations in the media).	A comparative study of three metropolitan cities, London, Hong Kong, and San Francisco, with emphasis on the similarity between the cities' imaginaries.
[54] Haddad, Günay, Gharib & Komendantova, 2022. Imagined inclusions into a 'green modernisation': local politics and global visions of Morocco's renewable energy transition	National and local	Ethnographic research in the civil society context (participatory observation); ethnographic research in the political and expert context (participatory observation); interviews with civil society; interviews with politicians, civil servants, and experts.	The study focuses on how a local imaginary in the province of Tata is negotiated in the national STI of Morocco.
[36] Hargreaves, Hargreaves & Chilvers, 2022. Socially smart grids? A multi-criteria mapping of diverse stakeholder perspectives on smart energy futures in the United Kingdom	National	Multi-criteria mapping (MCM); interviews with civil society (community); interviews with politicians, civil servants, industry and experts (e.g., government, energy industry, ICT industry).	The study uses multi-criteria mapping (MCM) with a broad range of actors to understand the vision of a future distributed smart grid in the UK; attention is paid to "diverse and distributed actors that will not merely respond to smart grids but also play an active part in co-shaping them" (p. 2).
[37] Hirsch, 2020. Governing technological zones, making national renewable energy futures	National	Ethnographic studies in the expert context (participatory observations at conferences, workshops and webinars); interviews with politicians, civil servants, industry and experts; analysis of public or expert documents (online and physical archives, including meeting minutes, historical political files, and policy documents).	The study explores the linkage between nationalist STIs and governance through science and innovation policy in Scotland, with emphasis on the Scottish National Party.
[55] Huang & Westman, 2021. China's imaginary of ecological civilization: A resonance between the state-led discourse and sociocultural dynamics	National and local	Not specified, but arguably analysis of public or expert documents (strategic and planning, academic articles); analysis of social media (vlogs).	The study focuses on discerning a dynamic relationship between how national and grassroots-based STIs "are co-constructed by constantly shifting collectives" (p. 2), nationally and locally in China; the authors engage with deconstructing "the idea that state visions operate in isolation from the rest of society" (p. 3).
[38] Höysniemi, 2022. Energy futures reimagined: the global energy transition and dependence on Russian energy as issues in the sociotechnical imaginaries of energy security in Finland	National	Argumentative discourse analysis; interviews (semi-structured) with experts (a wide range of energy and security experts); analysis of public documents (energy or security policy).	The study uses content and argumentative discourse analysis in focusing on storylines of protagonists (energy and security experts from public institutions, political parties, ENGOs, energy and private companies, consultants, non-fiction writers, research organisations and investors) and the conflicts of imaginaries for energy security and sustainability in Finland after cutting ties with Russia.
[6] Jasanoff & Kim, 2009. Containing the Atom: Sociotechnical Imaginaries and Nuclear Power in the United States and South Korea	National	Comparative analysis; empirical material is not specified, but the analysis is arguably based on the analysis of public documents (policy documents, public speeches), media outlets and public opinion.	The comparative study introduces the concept of STIs by defining it as "collectively imagined forms of social life and social order reflected in the design and fulfilment of nation-specific scientific and/or technological projects" (p. 120); national imaginaries (in this case the US and South Korea) are "more durable" than other collectively held imaginaries because "powerful instruments of meaning-making and goal-selecting often lie within the control of nation states" (p. 124); "nation", "national interest" or "state" is not "black-boxed or immutable" but rather it is "reimagined, or re-performed, in the projection, production, implementation, and uptake of' STIs (p. 124).
[7] Jasanoff & Kim, 2013. Sociotechnical Imaginaries and National Energy Policies	National	Comparative analysis; empirical material is not specified, but the analysis is arguably based on the analysis of public documents (policy documents, public speeches) and public media outlets (public opinion and media).	The study uses comparative analysis to explore three national STIs: the US, South Korea and Germany; the paper reiterates the conceptual premises of the concept (Jasanoff and Kim, 2009).
[23] Jasanoff & Simmet, 2021. Renewing the future: Excluded imaginaries in the global energy transition	Global and local	Methods and empirical material are not specified; arguably, the paper is based on ethnographic studies in the civil society context	The study focuses on global and local (Dakar, Senegal and Karnataka, India) STIs of the sustainable energy transition "symmetrically

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Table 1 (*continued*)

Authors, year and title	What forms of collective (s) do the researchers address and engage with?	What methods and empirical material are used in the study?	Details
		(fieldwork in selected empirical sites), as well as ethnographic studies in an expert context (workshop attendance).	interrogate who are the actors that collectively hold an imaginary and how that imaginary in turn supports that sense and claim of collectivity" (p. 3); "(…) it takes an STI that is collectively held (at whatever scale) to give meaning to a formation such as a 'nation-state' or a 'social movement'" (p. 3); "The point is to show how an STI produces a sense of belonging to a particular kind of collective that may be as large as a nation-state or as small as a breakaway utopian community" (p. 3); STIs "can in any case transcend nation states to hold global collectives together" (p. 4).
[13] Kapoor, 2019. "Who has seen the wind?": Imagining wind power for the generation of electricity in Victorian Britain	National	Historical analysis; analysis of public or expert documents (archival publications, scientific proceedings and papers); analysis of pubic media outlets (popular science representations).	The study lays out a historical emergence of energy STIs in Victorian Britain; "a group of scientists, engineers, and science writers who published, lectured, and invented in Great Britain on electrical science and technology" (p. 469).
[56] Karhunmaa, 2019. Attaining carbon neutrality in Finnish parliamentary and city council debates	National and local	Comparative analysis; ethnographic research in the political or expert context (national and municipality debates based on national and local parliamentary discussions, participant observations); analysis of public documents (energy policy).	A comparative study exploring how policymakers at the national (Finland) and municipality (Helsinki) levels; "Interpretatively flexible imaginaries (of attaining carbon neutrality) may, however, be co-produced in distinct ways across scales and places" (p. 178).
[14] Korsnes, 2016. Ambition and Ambiguity, Expectations and imaginaries developing offshore wind in China	National	Ethnographic research in the political or expert context (observations from conferences, workshops and meetings on the offshore wind); interviews with civil servants, industry or experts (individual and smaller group interviews with experts from the industry, government officials and analysts of the wind industry).	A study of STIs of offshore wind power development with emphasis on the role of the Chinese government.
[20] Kuchler, 2017. Post-conventional energy futures: Rendering Europe's shale gas resources governable	Transnational	Analysis of public and expert documents (critical in-depth reading of expertise on shale gas, such as reports, assessments and technical papers from researchers, public institutions, industry and private agencies).	The study focuses on a transnational constellation of actors; fusing the concept of STIs with the governmentality approach helps reveal that "power to imagine futures is dispersed among different state- and non-state actors assembled in loose networks and constellations of experts, practitioners, private consultancy agencies or international institutions, at different levels of governance" (p. 34).
[2] Kuchler, 2014. Sweet dreams (are made of cellulose): Sociotechnical imaginaries of second-generation bioenergy in the global debate	International	Analysis of public or expert documents (reports, analyses, assessments, and other papers published by the studied international organisations).	A study of international organisations (FAO, IEA, IPCC) as the collective that reflects aspirations of the member-states but also provides expert and science-based imaginaries (epistemic authority) of second-generation biogas.
[17] Kuchler & Bridge, 2018. Down the black hole: Sustaining national socio-technical imaginaries of coal in Poland	National	Analysis of public or expert documents (policy, reports and analyses) and media outlets.	A study focused on coal STIs encompassing the Communist period (1945–1989) and the period of post-Communism and EU accession (1990-today).
[39] Kuchler & Höök, 2021. Fractured visions: Anticipating (un)conventional natural gas in Poland	National	Analysis of public documents (issued by the Polish government institutions).	A study of anticipated development of natural gas extraction in Poland encompassing the period between 1990 and 2017.
[65] Lambert, 2022. Beneath your feet and in your place: Multi-scalar imaginaries of energy, place, and local geothermal development	Local	Place-based, qualitative case study; analysis of public documents (policy and planning), local and nonlocal news media, as well as public relations materials.	A place-based, qualitative case study focusing on the "role of collective imaginaries of place at different scales" (p. 3) or "multi-scalar imaginaries of place and energy futures" (p. 3); "place imaginaries encompass collective understandings of a distinct place" (p. 3), finding diverging STIs of geothermal energy development in New York State and the campus of Cornell University.
[66] Levenda, Richter, Miller & Fisher, 2019. Regional sociotechnical imaginaries and the governance of energy innovations	Local/regional	Comparative and discourse analysis; analysis of public or expert documents (national, state, and local policies, planning documents, and white papers from a variety of organisations, such as	A comparative study using discourse analysis of STIs in two US regions – the Pacific Northwest and the Desert Southwest – and two metropolitan areas within those regions –

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Table 1 (*continued*)

Authors, year and title	What forms of collective (s) do the researchers address and engage with?	What methods and empirical material are used in the study?	Details
		national, state, local government offices, utilities, regulators, industry groups, non-profit organisations, citizen groups, and planning agencies); analysis of media outlets.	Portland, Oregon, and Phoenix, Arizona; finding local context affecting the uptake of national imaginaries, in turn affecting multilevel governance for energy innovation.
[4] Levidow & Papaioannou, 2013. State imaginaries of the public good: shaping UK innovation priorities for bioenergy	National	Interviews with politicians, civil servants, or experts; analysis of public or expert documents (from government departments, research councils and institutes, and parliamentary hearings).	A study of bioenergy imaginaries in the UK identifying three major STIs: localisation, agri-diversification, and oil substitution (p. 36).
[5] Levidow & Papaioannou, 2016. Policy-driven, narrative-based evidence gathering: UK priorities for decarbonisation through biomass	National	Interviews with politicians, civil servants, or experts, and representatives from NGOs; analysis of public or expert documents (policies, expert reports, and other documents issued by state agencies).	A study of evidence-based governance and the shaping of bioenergy STIs in the UK.
[49] Levidow & Raman, 2020. Sociotechnical imaginaries of low-carbon waste-energy futures: UK techno-market fixes displacing public accountability	National	Comparative analysis; analysis of expert documents (three UK research projects); interviews with civil servants or experts.	A comparative study of energy imaginaries in the UK, discerning one dominant and one alternative imaginary; the former is mainly shaped by state and large corporations, and the latter by civil society and activist groups.
[76] Lieberman & Kline, 2017. Dream of the Unfettered Electrical Future: Nikola Tesla, the Electrical Utopian Novel, and an Alternative American Sociotechnical Imaginary	National	Historical analysis; reading of work by Tesla, Edward Bellamy, Charlotte Perkins Gilman, and other "electrical utopians", interpreting their imagined utopian electrifications.	A historical study of the STIs of "electrical utopians" in the US (p. 1) focused on identifying and analysing "a nuanced alternative to the dominant sociotechnical imaginary of electrification" (p. 3).
[25] Longhurst & Chilvers, 2019. Mapping diverse visions of energy transitions: co-producing sociotechnical imaginaries	National	Comparative analysis; analysis of public or expert documents (qualitative textual analysis of published visions of UK energy futures issued by state, business and academics); analysis of texts issued by civil society.	A comparative study where the collective is understood as assembled "of different sociomaterial elements and actors" (p. 975); the focus is on discerning the diversity of visions concerned with energy transitions in the UK; the paper demonstrates "how multiple actor collectives across energy systems co-produce different visions" (p. 987) and emphasises how "the situated visions relate to wider collectively held" STIs (p. 987); the authors call for more attention "to the counter-hegemonic imaginaries that are more marginal, distributed, and decentred" (p. 989).
[18] Marquart & Delina, 2019. Reimagining energy futures: Contributions from community sustainable energy transitions in Thailand and the Philippines	Local	Comparative analysis; interviews with civil society (including farmers and fisher folks); interviews (semi-structured, qualitative) with politicians, civil servants, industry or experts (national and local actors, including government officials, researchers, donor agencies and business people).	A comparative study of a rural community in Thailand and a community-led social movement in the Philippines; the focus is on local communities as collective structures, collective protests and collective coalition building; local imaginaries challenging the dominant STIs.
[3] Mutter, 2019a. Mobilizing sociotechnical imaginaries of fossil-free futures – Electricity and biogas in public transport in Linköping, Sweden	Local	Comparative analysis; interviews with politicians, civil servants, industry or experts (politicians, civil servants, bus operators, and technicians from local and regional levels, including focus groups with researchers and a farmer); analysis of public documents (policy).	A comparative study of two locally competing imaginaries of biofuels vs EVs in public transportation in Linköping, Sweden; the former is more locally embedded, while the latter has a national and international origin.
[67] Mutter, 2019b. Obduracy and Change in Urban Transport – Understanding Competition Between Sustainable Fuels in Swedish Municipalities	Local	Comparative analysis; interviews with politicians, civil servants, industry or experts (key actors involved in public transport decision-making, including actors from both the municipal and regional level of governance, civil servants and politicians).	A comparative study of two STIs of public transportation in Swedish municipalities: Linköping (pro-biogas, resistant to electric buses) and Malmö (where the shift to electric buses has begun).
[86] Mutter, 2021. Embedding imaginaries-electric vehicles in Sweden's fossil fuel free future	National	Interviews with civil servants, industry or experts (investigators and representatives from the vehicle industry); analysis of public documents (a national investigation of fossil-free transport futures and response letters to this investigation).	A study of Swedish STIs of the future of fossil-free transportation in the form of EVs.
[60] Mutter & Rohracher, 2022. Competing Transport Futures: Tensions between Imaginaries of Electrification and Biogas Fuel in Sweden	Local	Comparative analysis; interviews with politicians, civil servants, industry and experts (from authorities and transport companies); analysis of public documents (transport policies).	A comparative study of public transport STIs in two Swedish municipalities, Linköping and Malmö; biogas imaginary is "locally bounded" (p. 85), whereas the EV imaginary is "aligned with a national and international scale" (p. 100).

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Table 1 (*continued*)

Authors, year and title	What forms of collective (s) do the researchers address and engage with?	What methods and empirical material are used in the study?	Details
[19] Rabiej-Sienicka, Rudek & Wagner, 2022. Let it flow, Our Energy or Bright Future: Sociotechnical imaginaries of energy transition in Poland	National	Comparative analysis; interviews with civil society (church and youth); interviews with politicians, civil servants, industry or experts (government, researchers and business); analysis of public or expert documents (policies of both government and NGOs/private).	A comparative study discerning one dominant and two alternative imaginaries for energy futures in Poland.
[12] Richter, Tidwell, Fisher & Miller, 2017. STIRring the grid: engaging energy systems design and planning the context of urban sociotechnical imaginaries	Local	STIR-approach; interviews with experts.	Case studies of future smart grid imaginaries in Phoenix, US, using the sociotechnical integration research (STIR) approach to create a comprehensive understanding of technological and social perspectives; interviews with experts engaging in "expert cultures" (p. 366).
[40] Ryghaug & Toftaker, 2016. Creating transitions to electric road transport in Norway: The role of user imaginaries	National	Interviews with politicians, civil servants, industry, or experts (a wide range of stakeholders involved in the implementation phase of EVs, including national and local authorities, governmental and non-governmental organisations, EV manufacturers and distributors, private enterprises, and energy suppliers).	A study exploring user imaginaries of EVs and their impact on the shift towards electrifying transportation in Norway.
[87] Santos Pereira, Carvalho & Fonseca, 2017. Imaginaries of nuclear energy in the Portuguese parliament: Between promise, risk and democracy	National	Analysis of public documents (transcripts of debates on nuclear power in the Portuguese parliament).	A study of nuclear energy imaginaries in Portugal, ranging from the dictatorship period to the post-revolution democratic period.
[9] Santos Pereira, Fonseca & Carvalho, 2018. Carnation Atoms? A History of Nuclear Energy in Portugal	National	Interviews with civil society (activists and residents from the area suggested for the site of nuclear energy); interviews with experts (scientists); analysis of public documents (historical material from the Carnation revolution).	A historical study of Portugal's nuclear energy imaginary addressed via three sociopolitical collectives: the Fascist State, post-revolutionary governments, and the public.
[57] Schelhas, Hitchner & Brosius, 2018. Envisioning and implementing wood-based bioenergy systems in the southern United States: Imaginaries in everyday talk	National and local	Comparative analysis; ethnographic research in the civil society context (multi-sited, participatory observations in three communities); ethnographic study in the political or expert context (multi-sited, participatory observations); interviews with politicians, civil servants, industry or experts (a range of stakeholders and local politicians involved in or affected by bioenergy promotion in the Southern US).	This comparative study looks at local interpretation, scepticism, and resistance to a national bioenergy imaginary in three communities in the Southern US.
[50] Shehabi & Al-Masri, 2022. Foregrounding citizen imaginaries: Exploring just energy futures through a citizens' assembly in Lebanon	National	Conducting citizens' assemblies or "mini-publics" to explore collective imaginaries.	A study using citizens' assemblies or "mini-publics" in Lebanon; discerning four different imaginaries articulated in the citizens' assembly.
[68] Simmet, 2018. "Lighting a dark continent": Imaginaries of energy transition in Senegal	International and local	Ethnographic research in the civil society context (participant observation conducted during three visits to the empirical site); ethnographic research in the political or expert context (participant observation conducted during three visits to the empirical site); interviews with civil servants, industry or experts (actors working at government ministries, and small and large-scale businesses); interviews with civil society (international and local NGOs).	The study explores international (universalist) imaginaries of the industrial world and locally embedded STIs, highlighting the "problem of collectives: what is the right scale of projects and publics?" (p. 79).
[69] Skjølsvold, Ryghaug & Throndsen, 2020. European island imaginaries: Examining the actors, innovations, and renewable energy transitions of 8 islands	International and local	Case study; analysis of public or expert documents (written material from key European networks working with energy technology innovation).	This case study focuses on both the international renewable energy STI of a European island network and the local STI of the Norwegian island Hvaler as an illustrative case.
[58] Smith & Tidwell, 2016. The everyday lives of energy transitions: Contested sociotechnical imaginaries in the American West	National and local	Ethnographic research in the civil society context; ethnographic research in the political or expert context; analysis of public documents (meetings and hearing protocols); analysis of public media outlets (local news media).	The study finds STIs nationally (US) and locally (uranium industry in Colorado and the coal industry in Wyoming); local imaginary "remains 'bounded' at a local scale rather than circulating more widely to gain national or international traction" (p. 327).
[75] Strengers, Dahlgren, Pink, Sadowski & Nicholls, 2022. Digital technology and energy	Industry	Analysis of expert documents (qualitative content analysis of digital technology and	The study builds on industry and business material to create comic strips illustrating

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Table 1 (*continued*)

Authors, year and title	What forms of collective (s) do the researchers address and engage with?	What methods and empirical material are used in the study?	Details
imaginaries of future home life: Comic-strip scenarios as a method to disrupt energy industry futures		energy sector reports); production of comic strips illustrating the imagined scenarios.	possible future scenarios for domestic energy use as imagined by the energy and technology industries.
[88] Strengers, Pink & Nicholls, 2019. Smart energy futures and social practice imaginaries: Forecasting scenarios for pet care in Australian homes	National	Ethnographic research in the civil society context (a decade of ethnographic research with Australian households); secondary data on pet care trends.	The study focuses on household social practices in Australia, exploring "a stay-at-home pets scenario as a social practice imaginary" (p. 112).
[51] Tesfamichael, 2022. Caught between hope and reality: how citizens reconcile ambitious dominant energy imaginaries with everyday service shortfalls	National	Analysis of public or expert documents; qualitative research (questionnaire-based survey).	The study finds a dominant imaginary in Ethiopia upheld by political elites, while counter-imaginaries are articulated by citizens (urban households).
[41] Tidwell & Smith, 2015. Morals, Materials and Technoscience: The Energy Security Imaginary in the United States	National	Analysis of public or expert documents (the 1952 "Resources for Freedom" report).	The authors trace the genealogy of the energy security concept, arguing that it should be understood as an STI of a "good life" (p. 687).
[72] Tozer & Klenk, 2018. Discourses of carbon neutrality and imaginaries of urban futures	Transnational	Comparative analysis; analysis of public documents (governmental texts ranging from short action plans to long roadmaps authored by members of the Carbon Neutral Cities Alliance).	This comparative study looks at a network of local governments (Carbon Neutral Cities Alliance) and how members author long- and short-term action plans, finding five different storylines.
[73] Tozer & Klenk, 2019. Urban configurations of carbon neutrality: Insights from the Carbon Neutral Cities Alliance	Transnational	Discourse and textual network analysis; analysis of public documents (produced on behalf of the cities that are founding members of the Carbon Neutral Cities Alliance).	A study examining how carbon neutral imaginaries are being constructed in the building and energy sector as expressed in the urban governance documents of the members of the Carbon Neutral Cities Alliance (CNCA).
[59] Trencher & van der Heijden, 2019. Contradictory but also complementary: National and local imaginaries in Japan and Fukushima around transitions to hydrogen and renewables	National and local	Comparative analysis; ethnographic research in political or expert context (participation in academic, industry and government conferences); interviews with civil society (non-profit organisations); interviews (on-site, semi-structured) with politicians, civil servants, industry, or experts (informants in government, industry and academia); analysis of public or expert documents (secondary data collected from publicly available printed and Internet sources from government agencies, private companies and research institutions).	This comparative study looks at how a local energy STI in Fukushima is contradictive but also complementary to a national STI in Japan by drawing on certain features in support of the local STI.
[70] Völker, Kovacic & Strand, 2020. Indicator development as a site of collective imagination? The case of European Commission policies on the circular economy	International	Interviews with politicians and civil servants (the EU policymakers and focus groups with civil servants and EU politicians); analysis of public documents (policy and reports related to the circular economy and public statements from the EU commission).	A study of European STIs of circular economy; "indicators that are currently in development for monitoring and 'measuring' progress towards circularity" as a site of collective imagination (p. 108).
[89] Wentland, 2016. Imagining and enacting the future of the German energy transition: electric vehicles as grid infrastructure	National	Expert discourse analysis; ethnographic research in the expert context (observations of presentations at trade fairs); interviews with experts; analysis of public or expert documents (public speech transcripts, artifacts and government reports, commercial materials and visual advertisements).	A study using expert discourse analysis to find STIs of the future for EVs in a community of EV experts in Germany.
[52] Yang, Szerzynski & Wynne, 2018. The Making of Power Shortage: The Sociotechnical Imaginary of Nationalist High Modernism and Its Pragmatic Rationality in Electricity Planning in Taiwan	National	Interviews with the industry (Tai-power workers); analysis of public or expert documents (development plans, industry assessments and ministry press releases).	The study uses an interpretive approach and finds a dominant STI in Taiwan which excludes alternative energy futures.

political community" [[6], p. 123]. In this sense, the national public good – that would benefit (all) citizens of a given state – is a beacon that leads policymakers in deciding on future energy trajectories. However, Jasanoff and Kim [6] caution that although the nation-state is regarded as a crucial unit of STI analysis, it is not a black-boxed entity that can be left unquestioned. Instead, by upholding a given STI, the national collective undergoes a process of re-imagining and re-performance, as the "technoscientific and political orders are co-produced" [[6], p. 124].

This initial conceptualisation of STIs allows Jasanoff and Kim [6] to illustrate that the development path of the same energy technology can be differently imagined, depending on which reservoir of nationhood it resides in. The US decision-makers envisioned nuclear power mobilisation as a strategy of "containment", while South Korea's nuclear program embodied the imaginary of an "atom for development" [6]. In their second comparative study, the scholars reiterate their initial definition of STIs and add the case of Germany to demonstrate that the country's imaginary of nuclear energy was influenced by the national preoccupation with technological and political uncertainties [7].

In *Dreamscapes of Modernity* [21], however, Jasanoff [22] recognises the need to refine and expand the concept's definition by observing that STIs "are not limited to nation-states (…) but can be articulated and propagated by other organised groups, such as corporations, social

Methods and empirical material	Forms of collective(s)			
	National	Local/regional	Global/international or transnational	Social movements, experts, or industry
Comparative analysis	13	11	1	1
Interviews with civil society	9	7	1	
Interviews with politicians, civil servants, industry, or experts	24	12	3	
Ethnographic research in the civil society context	5	5	2	
Ethnographic research in the political or expert context	9	6	2	
Analysis of public or expert documents	33	14	6	1
Analysis of public media outlets or social media	11	8		1
Other	8	8	3	1

Fig. 1. The frequency of using specific methods depending on the 'collective' in focus.

movements, and professional societies" [[22], p. 4]. STIs are thus redefined as "collectively held, institutionally stabilised, and publicly performed visions of desirable futures, animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology" [[22], p. 4; see [31]]. As Jasanoff [22] argues, the STI perspective entails a more intricate normative coupling of space and scale that transcends the limitations of the network lens. In this regard, imaginaries reshape actors' perceptions of the potential spaces where action can occur and the ethical considerations intertwined with those actions across diverse scales, from local to global. Moreover, the co-productionist dimension of the STI concept provides a valuable entry point into "the ways in which elements of human subjectivity and agency get bound up with technoscientific advances" [[22], p. 14].

Employing the concept of STIs thus entails paying attention to the capacity of both individuals and groups to imagine different futures. Following Bourdieu [32], Jasanoff [[33], p. 329] observes that imaginaries "occupy a hybrid zone (…) between individual free will and group habitus" [[33], p. 329]. The scholar contends that the analytical framework of STIs helps disentangle "the relationship between collective formations and individual identity" [[22], p. 24]. It does so, as Jasanoff explains further [[22], p. 24], by cutting through "the binary of structure and agency: it combines some of the subjective and psychological dimensions of agency with the structured hardness of technological systems, policy styles, organisational behaviors, and political cultures". The role of an individual is therefore illuminated in the *Dreamscapes of Modernity* volume [21] to account for how STIs evolve from their origins, through embedding and resistance, and to extension. For example, as "it takes daring individuals to dream up new worlds and give personal embodiment to loosely circulating cultural aspirations" [[33], p. 324], powerful individuals (e.g., role-model scientists, privileged magnates) can function as originators of certain STIs. An individual actor can also act as a "resistor" by creating original counter-imaginaries to dominant future visions [33]. By taking into account the co-production of space and social order, a (powerful) individual can also become a "translation agent" who is "capable of moving imaginaries from one socio-political setting to another" [[33], p. 333]. Hence, the role of a 'translator' is significant for spreading specific ideas and practices from one territory or collective to another. Consequently, as Jasanoff [33] argues, the circulation of a powerful (global) imaginary leads to its "extension". The scholar provides examples of powerful political figures (e.g., with access to vast financial resources or significant military control) that contribute to the translation of dominant global imaginaries. Such translators can thus carry a given STI from one socio-political context to a new one where it is "re-embedded into local constellations of production and practice" [[33], p. 333].

Although Jasanoff [[22], p. 4] recognises that STIs can "originate in the visions of single individuals or small collectives", such "vanguard visions" [[34], cited in [22], p. 4] can "rise to the status of an imaginary" only when they are "communally adopted" [see also [27]]. This argument is further reinforced by Jasanoff and Simmet [23] in their paper, which exemplifies how a dominant imaginary of the global energy transition is employed at the expense of excluded local collective imaginaries. These scholars emphasise that STIs can only be shaped and solidified through "social collectives, institutions, and public performances" [[23], p. 2]. Similarly, in the paper by Beck et al. [26], Jasanoff and her colleagues explicitly state that "to make novel visions of desirable futures actionable in the public sphere, as opposed to fictional expectations or incipient vanguard visions, they must become 'collectively held, institutionally stabilised, and publicly performed" [[26], p. 148].

Simultaneously, drawing upon the previous work [21,27], Jasanoff and Simmet [23] mark a decisive departure from the predominant focus on the nation-state by emphasising that "the point is to show how an STI produces a sense of belonging to a particular kind of collective that may be as large as a nation-state or as small as a breakaway utopian community" [[23], p. 3]. Significantly, the STI approach "interrogates, rather than assumes, the scale of the collective that is realised along with a shared sense of what the world is and how it should be" [[23], p. 4]. In this sense, Jasanoff and Simmet [[23], p. 4] argue, "STIs can in any case transcend nation states to hold global collectives together". The scholars [23] remind us that the 'collective' is not a fixed or black-box entity but rather a vast reservoir of norms, values and principles (e.g., forms of justice or political systems) that underpin how societies envision their collective futures. Cultural, socio-political and sociotechnical contexts greatly matter in identifying and understanding "factors at work in producing collective, future-oriented, and normative imaginations" [[23], p. 2]. By invoking the co-productionist dimension of the concept, the scholars argue that "STIs symmetrically interrogate who are the actors that collectively hold an imaginary and how that imaginary in turn supports that sense and claim of collectivity" [[23], p. 3].

However, the methodological ambiguity concerning the analytical and empirical access to diverse forms of collectively held imaginaries remains, even though Jasanoff [22] offers some reflections on suitable approaches in *Dreamscapes of Modernity* [21]. In the somewhat brief

outline, the scholar suggests, for instance, that – to transcend the structure-agency dichotomy – the methods best suited to study STIs are "the methods of interpretative research and analysis that probe the nature of structure-agency relationships through inquiries into meaning-making" [[22], p. 24]. Concurrently, a comparison is considered by Jasanoff [[22], p. 24] as arguably the most important method to study STIs, as the approach allows for identifying "the content and contours" of a collectively held imaginary while also acknowledging its situated and unique characteristics. In this sense, the comparison approach helps illuminate divergences between unique trajectories of STIs across different sociopolitical contexts and timescales. Building upon the scholarly contributions in *Dreamscapes of Modernity* and her previous research, Jasanoff [22] proposes that STIs can be captured by and accessed through analysing the language of power exemplified by official state-policy discourses and statements, as well as practices, such as those concerned with the legal system. It is thus unsurprising that she considers policy documents and judicial opinions suitable empirical material. Moreover, the author suggests that STIs can be found in popular culture and media representations, such as advertising [22]. When examining the processes by which individual visions ascend to the status of collectively held imaginaries, the analytical framework of STIs prompts us, in Jasanoff's [22] view, to recognise the significance of not only the material resources such visionary actors possess (e.g., financial means) but also their utilisation of symbolic and cultural assets.

In the following section, we review how other STI scholars address and engage with the notion of 'collective' and 'collectively held imaginary' in their empirical studies concerned with energy systems and transitions.

3. Research on sociotechnical imaginaries: across different collectives

Following the inception of STIs [6], other researchers have embarked on identifying and examining diverse 'collectively held imaginaries' of energy systems and transitions. The concept's relatively unfixed and evolving character has resulted in numerous scholarly attempts to address and engage with the notion of a 'collective' in various ways (Table 1). Generally, we observe a considerable variety in terms of how explicit the distinctions of and between collectives are made and what empirical material is collected (Table 1). While some scholars attempt to define a 'collective', others opt for more ambiguous descriptions, making it somewhat challenging to distinguish their analytical vantage point. There are also researchers who problematise the limited ability to capture one or more collectives in a single study. Others emphasise the need for research on STIs held by groups or collectives lacking formalised powers, and hence the ability to compete with or challenge dominant imaginaries. The lack of stringency in defining a 'collective' (or collectives) bears witness to the concept's indefinite and evolving character, allowing scholars to flexibly design and customise their studies, particularly in terms of methodological choices (Fig. 1).

3.1. National collective: dominant STIs and cross-national comparisons

Our literature review indicates that the national collective remains the most common vantage point used to analyse STIs (Table 1). We identify several avenues the STI scholars take to address and engage with the nationally held imaginary. In this corpus, we find studies that concentrate on interrogating one, often already embedded and/or dominant, STI [e.g., [4,5,8,14,17,35–41]]. This strain of research has proved particularly useful in tracing past trajectories of prevailing energy visions. The national collective is frequently captured via powerful or influential actors, including national policymakers, key experts and business and/or industry representatives. For instance, Ballo [10] engages with STIs of the future smart grid in Norway via a "techno-epistemic network" of actors that possess recognised expertise, competence and knowledge [[10], p. 10]. The author also points to broader implications of Norway's smart grid imaginary, namely how it frames the public in terms of consumers as either passive or obedient performers of the national STI [10]. The study by Korsnes [14] focuses on China's STI of offshore wind power, which is "understood as part of a larger process of nation-building and plan-based governance" [[14], p. 52]. This author illustrates how government-induced visions of the energy transition are received by offshore industry actors involved in developing wind technology projects at the local level. In his analysis of the future of renewable energy in Scotland, Hirsch [37] pays attention to the role of the Scottish National Party and its government's influence in shaping the national STI.

Studies focused on one national STI also provide an opportunity to problematise how a national collective imaginary is co-produced with techno-material and/or natural factors. For example, in their analysis of Austria's atomic future, Bayer and Felt [8] address the collective as "specific assemblages of institutional actors, technical elements, values and futures" [[8], p. 165]. Fusing the concept of STIs with "nature imaginary" that includes human and more-than-human collectives, Benediktsson [[42], p. 91] illustrates how Iceland's visions of pristine nature co-produce the national imaginary. On the other hand, Kuchler and Bridge [17] show how particular coal materialities have been central to the past and future development of Poland's national energy imaginary. In this corpus, researchers typically access national STIs through analyses of, among others, national policies and regulations, public hearing or committee documents, key expert and scientific reports, mainstream media representations, other forms of public debates, propaganda materials, as well as interviews with key powerful or influential actors (Table 1).

Moreover, we identify several studies that, following Jasanoff and Kim's [6,7] work, employ cross-national comparisons [15,43–45]. Such comparative analyses attempt to shed light on and untangle how different national identities are co-produced with STIs. For example, Berling et al. [45] compare STIs concerning energy security in Norway and Ukraine to discern how these nationally held imaginaries influence technological advancements and societal discourses in each country. Ergen and Umemura [15] compare solar energy STIs in the US, Japan and Germany by engaging with "collective governance institutions (such as associations, state agencies and research institutions)" [[15], p. 1]. The comparative exercise helps highlight the variations in sociotechnical trajectories across diverse sociopolitical contexts. This strain of STI research also tends to address lengthier or historical timescales.

3.2. National collective: coexisting, competing or emerging STIs

There is also an increasing number of studies that take the national collective as the vantage point to discern several coexisting or alternative, as well as competing or emerging, STIs [e.g., [9,16,19,24,25,46–52]]. This body of research concentrates on potential future trajectories of energy transitions, highlighting the dynamic, unsettled and contested nature of collective imagining within the body of nationhood. In this work, we distinguish a growing scholarly interest in focusing on groups of actors lacking formalised powers, thus having limited ability to compete with more influential stakeholders, such as national policymakers. For instance, in their study of low-carbon waste energy futures in the United Kingdom (UK), Levidow and Raman [49] discern one dominant imaginary upheld by the state and large corporations and one alternative vision supported by civil society and activist groups. Contrary to a study focused on one dominant national STI of coal in Poland [17], Rabiej-Sienicka et al. [19] show the contested character of the nationally held imaginary of Poland's energy transition, with one dominant STI coexisting alongside two alternative visions. Delina [24] illustrates a similar dynamic in his interrogation of Thailand's energy imaginaries, where the national collective is not limited to powerful state actors but serves as a collective reservoir for various competing visions, both dominant and alternative. On the other hand, Christiansen and Carton [47] attempt to examine STIs of negative emissions

technologies "emerging among actors in the Swedish establishment" [[47], p. 3] while also acknowledging potential bias towards "more marginalised voices" exemplified by indigenous people and youth movements [[47], p. 3].

Furthermore, several STI scholars emphasise that actors' sense of belonging to diverse groups within a given collective influences how they (can) envision energy futures. For instance, Carvalho et al. [46] identify four different imaginaries of energy transition in Portugal and observe that STIs are "shaped by the situatedness of the stakeholder group they belong to" [[46], p. 2421]. Similarly, in their insightful attempt to map diverse STIs of energy transitions in the UK, Longhurst and Chilvers [[25], p. 987] demonstrate that "multiple actor collectives across energy systems co-produce different visions" and emphasise how "the situated visions relate to wider collectively held" STIs.

Methodologically, these papers employ approaches and collect empirical material that helps capture the dynamic, mutable and contested character of collective imagining (Table 1). The material is often broader in scope compared to studies focused on one dominant STI and typically includes a more comprehensive document search combined with wider stakeholder outreach (e.g., different groups of state and non-state actors). Some researchers employ more novel approaches to illuminate the contested and unfixed nature of national collective imagining (Table 1). For instance, Shehabi and Al-Masri [50] conducted citizens' assemblies or "mini-publics" to discern four different STIs of Lebanon's energy future.

3.3. National collective: interactions with locally held STIs

Apart from the studies that attempt to discern competing STIs within a given national collective, we identify several papers that, instead, examine STIs by juxtaposing national and local/regional collectives [1,53–59]. In this body of work, we find that researchers tend to discern different dynamics between nationally and locally or regionally held imaginaries in various ways (Table 1). While some authors indicate the synergetic effects of the national-regional co-production of STIs, others highlight the "bounded" character of locally held imaginaries. For example, a study conducted by Trencher and van der Heijden [59] identifies synergies between Japan's national hydrogen STI and Fukushima Prefecture's regional imaginary of achieving 100 % renewable energy, as both visions have the potential to facilitate economic recovery and restore the local reputation after the nuclear disaster in 2011. The authors thus illustrate how a "hybrid imaginary" emerges [[59], p. 217].

On the other hand, Smith and Tidwell [58] explore contested STIs of energy transitions in the North American West by addressing the nationally held STI in the US and engaging with two local collectives situated around the uranium industry in Colorado and the coal industry in Wyoming. By doing so, these scholars pay attention to how the national imaginary is translated into and modified in "the lived experience and future hopes" of local people [[58], p. 328]. But rather than examining only the top-down direction, Smith and Tidwell [58] simultaneously interrogate the bottom-up circulation of energy visions, focusing on the role of local mining industries in shaping STIs of a good society and sense of belonging to a particular community. The authors demonstrate that due to already established material infrastructures (e.g., extraction sites) and "the lack of political power to modify them", locally held energy imaginaries that are alternative to dominant national visions remain "bounded" to a specific location and are thus unable to "circulate at broader levels where they could be realised through policy action" [[58], p. 328]. The "bounded" character of energy imaginaries held by local collectives is also highlighted in two other studies by Chung et al. [53] and Mutter and Rohracher [60].

Conversely, in their analysis of STIs concerned with wood biomass energy in four communities in northern Michigan in the US, Eaton et al. [[1], p. 228] demonstrate that while the nation-state materialises future visions, "local actors define and contest the ways bioenergy may or may not contribute to a better future". The authors argue that local communities can interpret, contest, and act upon the national STIs "woven into local bioenergy proposals" depending on "competing collective memories of place", e.g., experiences, histories, and technical narratives [[1], p. 227].

In the body of work juxtaposing nationally and locally held STIs, we find more frequent use of ethnographic field studies, interviews with local actors, analysis of local political processes (e.g., observations made at a local assembly and other local events) and public debates (e.g., scrutiny of local media outlets), as well as engagement with local communities in addition to the focus on materials produced by experts and authorities (Table 1).

3.4. Beyond the national collective: local and transnational STIs

Moreover, our literature review indicates research on STIs situated beyond the confines of the nation-state or nationhood. Within this corpus, we distinguish two scholarly strains. First, we identify several studies that attempt to analyse STIs held by local and/or regional collectives [3,11,12,18,60–67]. In this body of work, we find various engagements with locally or regionally held imaginaries, but we also observe a tendency among researchers to emphasise the sense of belonging to a specific local (or regional) collective. This inclination towards highlighting the connection and attachment to a particular community or place reflects the significance of sociocultural contexts and how they shape perceptions and aspirations within their immediate surroundings. Some researchers attempt to illuminate how opposition or resistance to a prevailing national energy vision or project underpins or reinforces the sense of belonging to a particular local collective.

For instance, Marquart and Delina [18] combine STIs with the concept of "prefigurative activism" to analyse imaginaries of collective mobilisation in a rural community in Thailand and a community-led social movement in the Philippines. The authors illustrate how this localised collective coalition building and protest effectively resists dominant visions of energy transition [[18], p. 99]. Engels and Münch [11], on the other hand, explore the role of an innovation campus in conceiving and developing the STI of a microgrid in the Berlin-Schöneberg area. This "living lab" [[11], p., 35-36] exemplifies how energy technology can become materialised by being closely interlinked with a specific location. The authors demonstrate that, with a locally designated place, the microgrid project provides a "shared imagined space and concrete space for opportunity" for a range of involved actors [[11], p. 36]. Likewise, Lambert [65] explores "place-based" STIs exemplified by the campus Enhanced Geothermal Systems project at Cornell University, New York State. This scholar shows how energy imaginaries and place-based identities or "people's relationships with place" co-produce each other at various scales. By doing so, Lambert [65] explores how these multi-scalar energy imaginaries, which encompass different desirable visions of living in a specific place, can impact public reactions to new energy infrastructure.

Second, within the body of work concerned with locally held imaginaries, we also observe a growing interest among scholars to understand how local STIs are influenced or affected by prevailing global or international visions [e.g., [23,68,69]]. Such is the study by Simmet [68] in which the author shows how the industrial world's universalist imaginaries of "lighting a dark continent" of Africa collide with local visions of energy transition in Senegal. Similarly, Jasanoff and Simmet [23] illuminate how locally held imaginaries of sustainability in two communities located in Senegal and South India are excluded or erased in the process of translating the global vision of sustainable energy transition into the local context.

Based on our literature review, studies exploring locally held STIs typically use methods and materials that help capture local contexts and dynamics. These include ethnographic approaches (e.g., empirical site visits, participant observations), focus groups, semi-structured or unstructured interviews with key local actors and community members, as

well as analyses of local media articles, local proposals, decisions and action plans and other planning documents (Table 1).

On the other hand, some studies focus on discerning internationally [e.g., [2,70]] or transnationally [e.g., [20,71–73]] held STIs. For example, in her analysis of second-generation biofuel imaginaries, Kuchler [[2], p. 432] concentrates on international organisations as a particular collective that reflects "the desires, goals, and priorities of their state-members" and exercises "influence and power in the form of epistemic authority". Two studies by Tozer and Klenk [72,73] examine STIs of urban futures held and produced by the Carbon Neutral Cities Alliance, a transnational network of local governments. In their account of gender imaginaries in the Global South, Alda-Vidal et al. [71] discern "collective visions in a range of professional accounts" across India, Pakistan, Nigeria and Ghana [[71], p. 2]. Fusing STIs with governmentality, Kuchler [20] demonstrates how "the power to imagine" future shale gas availability is "dispersed among different state- and non-state actors assembled in loose networks and constellations of experts, practitioners, private consultancy agencies or international institutions, at different levels of governance" [[20], p. 34]. In this corpus, researchers rely on approaches and empirical material that capture the work of such diverse assemblages of actors. These include analyses of expert reports, assessments, policies and other documents, as well as interviews with professionals involved in a loose network or more formalised international agency.

Among the research addressing and engaging with STIs beyond the confines of the nation-state, we also find two studies that focus on forms of collectives other than local, regional, global or transnational. Buzogány and Scherhaufer [74] compare energy imaginaries held by two social movements in Germany, namely Fridays for Future and Extinction Rebellion. These scholars define a social movement as "a network of groups and individuals striving for a common goal and implementing ongoing collective and public action through mobilisation" [[74], p. 2] and analyse the frames each organisation employs in published material and communication with the world. The study by Strengers et al. [75] discerns digital and energy imaginaries of energy and technology industries. The authors employ a "comic-strips" method to illustrate and disrupt the imagined scenarios.

3.5. *The role of individuals in (re)shaping STIs*

Finally, our literature review indicates that STI research concerned with energy systems and transitions does not directly address or engage with the role of individuals in terms of their agency to (re)shape and participate in collective imaginaries. Interestingly, none of the reviewed papers attempts to explicitly identify individuals who originate, resist, or translate a given STI in accordance with Jasanoff's insights in *Dreamscape of Modernity* [33]. Instead, we come across a few intriguing and implicit recognitions of individual agency, either briefly mentioned without further conceptual considerations or perceived as part of a collective. For instance, Marquardt and Delina [18] illustrate how the mobilisation of a local collective's resistant STI takes place and expands through the actions of the individuals. The authors exemplify this process of resistance building by referring to one specific local development worker who played a significant role in initiating a movement network alongside his neighbours in Thailand's farm community [18]. The same local worker is also distinguished in the study by Delina [24]. But although a "daring individual" [[33], p. 324] may play a significant role in (re)shaping a given collective imaginary, the criteria for identifying such individuals, particularly ordinary citizens lacking social status and authority, remain unclear and undefined. Hence, other scarce examples that we found in the STI literature refer to actors who possess considerable power and influence due to their position or function in society.

In Bayer and Felt's [8] analysis of Austria's atomic future, we find examples of Austrian and American political leaders, along with prominent scientists. Haddad et al. [54] touch upon the role of the Moroccan king in advancing the national energy vision, whereas Delina [16] alludes to the president of the Philippines and his instrumental role in aggressively promoting the national coal imaginary. Kapoor [13] sheds light on "a group of scientists, engineers, and science writers who published, lectured, and invented in Great Britain on electrical science and technology" [[13], p. 469]. Among those mentioned are engineering pioneers and inventors, such as James Blyth, C. W. Siemens and Sylvanus Thompson, who championed wind power as a means of generating electricity during the Victorian era. Likewise, Lieberman and Kline [76] explore "electrical utopias" of visionary figures, such as Nikola Tesla, Edward Bellamy and Charlotte Perkins Gilman. These prominent individuals presented an alternative imaginary that resisted the dominant vision of electrification in industrial North America. Nonetheless, we observe that these revealing instances of the role of an individual lack conceptual problematisation addressing when individual imagination turns into a collective imaginary.

4. Concluding discussion

In recent years, the concept of STIs has gained significant traction as an analytical and interpretative lens in social science research investigating energy systems and transitions. The approach has proven to be useful in identifying and studying historical trajectories of embedded or dominant energy visions and, increasingly, in discerning and scrutinising the coexistence of diverse alternative, often competing, imaginaries concerned with future energy paths and transitions. Since its inception [6,7], Sheila Jasanoff and her colleagues have shifted the framework's initial preoccupation with the nation-state as a significant unit of STI analysis towards expanding the interpretative scope by encompassing other forms of collectively held imaginaries [[21–23,33]; also, [26,27]]. The gradual evolution and relatively unfixed character of the concept's lens have been reflected in the burgeoning literature exploring STIs of energy systems and transitions. This scholarly work has seen a rise in the application of the approach to identify and study a variety of imaginaries held by different collectives (Table 1).

In this paper, we have attempted to unravel how STI researchers address and engage with the notion of a 'collective' or 'collectively held imaginary'. Our literature review indicates that this scholarly work continues to concentrate predominantly on the national collective, either as the primary analytical point of entry or as a vantage point for exploring cross-national comparisons and scrutinising the dynamics between national and local/regional collective imaginaries. Apart from insightful analyses that interrogate dominant national energy visions or compare different nationally held imaginaries, we observe a rise in perceptive studies that address and engage with the national collective as a reservoir of several co-existing, alternative or competing STIs. The reviewed literature also offers insights into various dynamics between nationally and locally or regionally held imaginaries. In this body of work, we observe more emphasis on the 'bounded' character of local collectives. Additionally, our literature survey identifies research on STIs situated beyond the confines of the nation-state or nationhood. These comprise analyses of imaginaries held by local and/or regional collectives, including work on how local STIs are influenced or affected by prevailing global visions, as well as studies focused on discerning internationally or transnationally held imaginaries. Finally, we distinguish a few instances of research that examine other forms of collectives, such as social movements and the industry.

In this literature review, we have also attempted to illuminate how opting for a specific 'collective' point of entry in the analysis of STIs influences the selection of methods and empirical material (Fig. 1). Studies addressing nationally held imaginaries tend to focus on powerful or influential actors and typically analyse public official documents, such as policies and expertise, and/or study national political debates via, e.g., newspaper publications, public hearings or citizens assemblies. Unsurprisingly, imaginaries residing in more local collectives are typically discerned with the help of ethnographic approaches, such as participatory observations, site visits, and semi-structured interviews

with local actors. These methods are complemented with analyses of locally significant documents, such as local proposals, planning decisions, and local media representations. Studies examining internationally or transnationally held STIs are inclined to capture such visions via diverse assemblages of actors or institutions, analyses of expert reports, assessments, policies and other documents, and interviews with professionals.

Additionally, we have paid attention to whether STI scholars recognise and examine the role of individuals in (re)shaping energy imaginaries. Apart from scarce instances where individuals are mentioned in passing or implicitly recognised, an 'individual' is largely overlooked in the reviewed literature. Although certain powerful individuals are distinguished, the criteria for identifying them are unclear, and there is a lack of conceptual engagement in this regard.

Nevertheless, the notion of a 'collective' remains central to the analytical framework of STIs, irrespective of its boundary, shape or size. Imaginaries may originate from the visions of single individuals or small collectives, but they become imaginary only when collectively held. This is because imaginaries gain social power when shared and performed by a group of individuals united around common ideas, dreams and aspirations. Hence, the "power to imagine futures" [17] can only be attained and manifested in the public realm through a collective effort. The greater the size of a given collective (e.g., national) and its proximity to influential instruments of meaning-making (e.g., expertise) and goal-setting (e.g., authority), the higher the likelihood that a particular imaginary prevails or becomes widely accepted and performed. In this regard, as Jasanoff [[22], p. 28] argues, scales matter as the "power to imagine moves from single 'inspired' individuals or small collectives to communities and their leaders to nation-states and supranational global agencies". Therefore, it is pertinent to critically and substantially engage with a notion of the 'collective' to elucidate how and why specific STIs gain prominence and power or lose acceptance and are marginalised within various collectives, especially in the context of envisioning low-carbon energy transitions.

Yet, as our literature review indicates, addressing and engaging with larger collectives, such as a nation-state or global community, is a challenging conceptual and empirical task, as we are reminded that any collective is a reservoir of co-existing and often competing norms, values, desires, and thus imaginaries. The unfixed and contested nature of the collective is particularly evident in papers dealing with future energy paths and transitions. In these studies, attempts to distinguish collectives holding dominant STIs and alternative or competing energy visions are not always conceptually and empirically clear-cut. In some instances, it is not entirely evident whether authors deal with one national collective containing several co-existing or competing imaginaries or rather with several collectives, including some locally bounded, within a larger domain of nationhood. Sometimes, it is unclear how authors analytically and empirically access their understanding of much larger STIs, such as a global vision. Hence, we suggest that a more substantial and critical engagement with the notion of a 'collective' can not only help explain "why and how particular STIs become collectively held" [[77], p. 221] but also attain a better analytical grasp on the "situated and partial" [[25], p. 985] nature of various imaginaries, particularly those concerned with future energy trajectories, such as low-carbon energy transitions. Here, we bring attention back to the point made by Jasanoff and Simmet [[23], p. 4] that the STI approach "interrogates, rather than assumes, the scale of the collective that is realised along with a shared sense of what the world is and how it should be".

In this regard, we concur with Longhurst and Chilvers [[25], p. 988] that "it is fundamentally important to open up to the diverse settings and collective practices through which futures are co-produced". Indeed, as Felt [[78], p. 104] argues, "different actor constellations matter when making choices about which societal futures are to be attained". To attain this wide aperture, we suggest that STI scholars could be more attentive to other forms of collectives underpinning and co-producing the sense of belonging beyond the confines of scale and place. If, according to Jasanoff and Simmet [[23], p. 3], "the point is to show how an STI produces a sense of belonging to a particular kind of collective that may be as large as a nation-state or as small as a breakaway utopian community", it is pertinent to capture the sense of belonging based and co-produced by other factors, such as class, gender, sexual orientation, race or ethnicity. Across a range of social science energy research, we find hints of how such social identities could be employed as critical points of entry into studying collectively held imaginaries.

For example, by conducting studies on the gendered division of household practices and energy efficiency in rural Denmark, Danish scholars [79,80] found that energy savings campaigns have different implications depending on whether they target men or women in heterosexual households. Similarly, in their study on solar energy communities in Sweden, Lazorska et al. [81] found that gender played a role in the level of engagement with collective solar ownership. Despite women's high interest and investment, they were underrepresented on the boards of energy communities. Other scholars provide illuminating insights into how indigenous communities may be affected by large-scale developments of renewable energy [e.g., [82–84]]. In another instance, von Platten [85] shows how a variety of factors such as health, age, employment, gender and income affect the ability to use demand flexibility to remedy the impact of rapidly rising energy prices in Sweden. These and other illustrative cases suggest that the sense of belonging to a given collective or several collectives simultaneously is negotiated by individuals through a myriad of socio-political relations and processes, such as contestation, bonding, inclusion, and exclusion. Hence, we suggest that it is crucial to carefully consider these factors and other overlooked collective identities, especially if dominant STIs are co-produced with various built-in oppressive power structures.

Finally, to avoid reducing "human agents to mere cogs in machines" [[22], p. 23], we call for more attention to the role of individuals in (re) shaping energy imaginaries. This could be achieved, as some rare instances in the literature attempted to illustrate, by taking an analytical look at individuals possessing power and influence by virtue of their position or role in a particular collective. Indeed, Jasanoff [33] offers conceptual insights on the "originator", "resistor", and "translator agent" that can be proved useful in discerning and examining the ways in which such actors actively contribute to (re)shaping specific STIs. However, we argue that for the concept of STIs to help cut "through the binary of structure and agency" [[22], p. 24], equally important is attention to the role of daring individuals lacking social status and authority, as exemplified in studies conducted by Delina [24] and Marquardt and Delina [18]. To untangle "the relationship between collective formations and individual identity" [[22], p. 23] while simultaneously detecting impulses for alternative or radical energy visions, STI researchers need to engage in the exploration of seemingly mundane individuals.

CRediT authorship contribution statement

Magdalena Kuchler: Formal analysis, Supervision, Writing – original draft, Writing – review & editing. **Gubb Marit Stigson:** Conceptualization, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

This literature review is built on an analysis of 69 peer-reviewed articles (Table 1).

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