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The methodologies, geographies, and technologies of energy justice: a systematic and comprehensive review

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E-mail: Kirsten.jenkins@ed.ac.uk**Keywords:** energy justice, energy ethics, systematic review, energy policy, research impactSupplementary material for this article is available [online](#)**Abstract**

The energy justice literature has seen a rapid surge in both academic and practical popularity. However, there has been less systematic reflection on the research conducted so far, its scope or contribution, nor what it might mean for the future of the concept. To provide insights, this paper presents the results of a systematic and comprehensive review of 155 peer-reviewed articles published across eight databases between January 2008 and December 2019. The aim is firstly to review the current state of the art in the energy justice literature and, secondly, to present findings that support novel recommendations with the potential to enhance the impact of energy justice research, including applications in the economic and planning policy sectors. Critically, our study demonstrates that the literature lacks diversity in its author basis and research design. By contrast, conceptual frameworks and the geographies and technologies of global energy injustice are proliferating. These results illustrate that energy justice has power and agency as a tool. It can act as a protagonist in energy research, provoking researchers to remain reflexively normative and active in identifying injustices and vulnerabilities, and it can act as a promising progenitor, creating new research methods and themes.

1. Introduction

Over the past decade, the energy justice literature has seen a rapid growth in application and use, with increasing numbers of volumes, books and even university courses dedicated to the issue (e.g. Bickerstaff *et al* 2013, Sovacool *et al* 2013, McCauley 2018, University of Michigan 2020). An early definition by Jenkins *et al* (2016) suggest that energy justice represents: (a) concerns for evaluating where injustices emerge (distributional justice), (b) which affected sections of society are ignored (justice as recognition), and (c) which processes exist for their remediation (procedural justice) in order to (i) reveal and (ii) reduce such injustices. But numerous other interpretations have been developed utilizing other concepts and approaches, including prohibitive and affirmative

principles (Sovacool *et al* 2013), notions of restorative justice (Heffron and McCauley 2017), spatial justice (Bouzarovski and Simcock 2017), and even calls to combine climate, environmental and energy justice under the banner of 'just transitions' (McCauley and Heffron 2018). These variations demonstrate a significant degree of conceptual growth of the term (as also discussed by Jenkins *et al* 2020).

Energy justice investigations have also appeared with more practical applications to fossil fuel labour transitions (Healy and Barry 2017), ethical consumption (Hall 2013), post-war conflict (Lappe-Osthege and Andreas 2017) and social movements and issue framing (Fuller and McCauley 2016), for instance, demonstrating growth in the topic of concern. These contributions have been encouraged, in part, by three special issues with 'energy justice' in their title; one

in *Energy Policy* (Jenkins *et al* 2017), one in *Energy Research and Social Science* (Simcock and Mullen 2016), and one in *Applied Energy* (McCauley *et al* 2019) that represent a generally growing trend in this endeavour.

However, this impressive expansion of energy justice literature has been myopic, is still fairly young, and remains scattered. Efforts are generally more multidisciplinary than interdisciplinary, and it is a potentially ‘corruptible concept’, highly vulnerable to a range of political agendas. While appropriate for a literature that transcends so many issues and is being produced from scholars from many disciplines around the world, it makes a more systematic assessment of key trends in the literature elusive. This paper has two aims. First, it seeks to systematically and comprehensively analyse 12 years of energy justice contributions to review the current state of the art. By systematically, we mean according to explicit and transparent methodologies that are replicable and updateable (Sorrell 2007). By comprehensively, we mean by considering contributions across different databases, publications and case studies, amongst other criteria. Second, this paper seeks to further explore the links between future energy justice research and its practical implementation. It does so by systematically reviewing the academic literature from January 2008 to December 2019 including 155 peer-reviewed articles spanning eight databases. We then present findings that support novel recommendations with the potential to enhance the impact of energy justice research, including an exploration of the importance of the energy justice concept to the often neglected economic and planning policy sectors.

2. Research design and limitations

To begin, our methodology for the systematic and comprehensive content analysis of energy justice research literature is presented throughout this section.

2.1. Data collection

Academic papers—including full-length articles and review papers—were sampled between 1 January 2008 and 31 December 2019. The 12 year range was chosen in order to achieve the ‘state of the art’ focus the article aims for. Data was sampled from eight major peer-reviewed academic article databases (table 1) with acknowledgement that this may exclude contributions from those without ready access to major journals and that this does not capture books published on the subject (e.g. Bickerstaff *et al* 2013, Sovacool *et al* 2013, McCauley 2018, or Bombaerts *et al* 2020). This mirrors more qualitative review approaches used by Lacey-Barnacle *et al* (2020) and Sovacool (2014) and many others before them.

To identify relevant articles, we searched for the term ‘energy justice’ within three fields, the article

Table 1. Overview of articles included by database and search term ‘Energy Justice’ (2008–2019).

Database	Search term tally
Science direct	119
Project muse	0
Hein online	7
SpringerLink	4
Taylor and Francis Online	14
Wiley online	7
Sage journals	3
Annual reviews	1
Total:	155

title, abstract, and keywords. Papers that did not use the term ‘energy justice’ exactly were excluded. This included the decision not to broaden out the search to include the related terms ‘energy ethics’ and ‘due process’, for example. This also excludes the wider body of established justice literature that covers energy issues connecting with equity or power relations, including that using the environmental justice lens as well as approaches from political economy or political ecology. Although this and the decision to search only in three article fields reduces the sample—i.e. it excludes those that use ‘energy justice’ in the main text but not in the sample fields and those which refer to energy ethics—for example, this was deemed to be the most appropriate approach as it removed subjectivity in determining the sample (mirroring the approach of Sovacool 2014) and aided our desire to track the evolution of the energy justice literature in particular, in keeping with the aims and scope of this investigation. Only full-length, peer-reviewed, English-language research submissions and review papers were taken forward. We utilized an approach in line with Sovacool (2014) because it was well suited to a fragmented discipline (the nexus of energy and climate social science) and also captured a diversity of outputs, including books, commentaries, book reviews, notes, opinion-editorials, letters, forums, viewpoints, corrigendum and similar items were excluded. The resultant sample across the eight databases is shown in table 1. The full list of coded articles is given in appendix 1 of supplementary material (available online at stacks.iop.org/ERL/16/043009/mmedia).

Duplicates of papers were removed so that those remaining were only analysed once even if they appeared multiple times across the search terms and databases.

2.2. Analytical protocol

Our approach to categorization was both inductive and deductive. That is to say that in some instances, we started with a pre-established list of categories inferred from the literature and later amended this during the process of analysis. In other instances, such as for the coding of policy recommendations, we used a more grounded approach, developing the coding criteria as we read. This activity mirrors and extends a

similar approach to that used by Sovacool (2014) and Mouter *et al* (2018).

During the content analysis, data was collected on a variety of aspects present in each article (table 2). To collate this data, the lead author read the title, abstract, and article keywords (when available), before searching the rest of the article for key terms and phrases. This data was then analysed using descriptive statistics as well as thematic analysis, allowing the creation of a series of percentages, figures, summary tables and discussions presented in section 3 of the paper.

2.2.1. Author demographics

We began the content analysis by looking at four categories relating to the most identifiable attributes of authors: author disciplinary affiliation at the time of publication, global region, gender and publishing journal. In all categories, we coded for each individual author, not just the lead author. This meant that the paper could receive numerous counts for the same category, e.g. two 'female' and one 'male'; an approach that more accurately represented the demographic variables of *all* authors. All categories were pre-determined.

For *disciplinary affiliation*, we coded the affiliation listed at the beginning of the paper for all paper authors and classified those based on the five broad categories of 'arts and humanities', 'engineering and technology', 'life sciences and medicine', 'natural sciences', and 'social sciences and management', along with the categories of 'not listed' or 'other' (table 3). This follows the approach used by the QS World University Rankings. We coded for only the first affiliation listed by an author. Where multiple authors on the paper recorded the same affiliation, it was only coded once. A paper was coded as 'interdisciplinary'—bringing together the distinctive components of two or more disciplines (Nissani 1995)—if two or more of the authors listed affiliations falling across two or more of the five categories listed above, if the affiliation itself mentioned more than one, or if it said 'interdisciplinary' or 'multidisciplinary' in its title.

For *author region*, we coded each global region listed on the paper, determining whether the authors were writing from Africa, Asia-Pacific, Europe, Latin America and the Caribbean, the Middle East or North America. Then, to achieve more granularity in our data, we also took notes of the country listed by each author. We note, of course, that although the paper may have originated from the Netherlands this does not mean the authors were Dutch. So, our analysis only demonstrates *where* energy justice is being discussed. If there were three authors from the Netherlands and one from the UK, the Netherlands would get 3 ticks and the UK 1. Where authors listed multiple country affiliations, each one was scored.

For *author gender*, authors were coded into 'male', 'female', and 'indeterminate' as some authors only used initials or had names common to both genders. Where hyperlinks were given, or where clear affiliations were listed that enabled a search of the authors, these were double-checked to increase the validity of our coding.

Finally, for *publishing journal*, we recorded the journal each article was published in, the majority of which were associated with the Science Direct platform.

2.2.2. Article methodologies and research designs

For paper *article methodologies* and *research designs*, we coded for seven categories: 'experimental', 'surveys', 'modelling', 'qualitative', 'secondary data', 'none' and 'mixed method'. Articles were only coded once based on their stated methodology. Where more than one method was present, they were determined to be 'mixed method' and further notes were taken. This follows the framing of 'mixed methods' used by Mason (2006), who considers them not only to be those that span the qualitative versus quantitative divide, but also those that use a diversity of approaches *within* those respective categories. Examples include the use of participatory action research, interviews and secondary documentary analysis in Finley-Brook *et al's* (2018) work.

2.2.3. Philosophical and conceptual approaches

We also coded for which *type of energy justice framework* was used as recognition that a range of tenet frameworks have emerged. This left us with ten categories: distribution only; distribution and procedure; distribution, procedure and recognition; universal and particular justice; six energy justice principles; eight energy justice principles; prohibitive and affirmative principles; cosmopolitan; other (then with qualitative details of what 'other' stood for); and not explicit/none.

2.2.4. Geographic and institutional approaches

Jenkins *et al* (2016), Mullen and Marsden (2016), and latterly Sovacool *et al* (2017) identify that some aspects of justice transcend spatial scales, requiring scholarship at both the front and back-end of energy production lifecycles and consciousness of international energy transfer and use. To test whether such a focus was present in the literature, we coded for the presence of geographical and/or institutional case studies (where the latter refers political and economic consortia, such as the European Union). This resulted in 48 different codes, given in table 2. We also coded for whether the geographic and institutional case studies were comparative i.e. whether more than one was used in each paper. If so, 1 tick was given and further notes were taken.

Table 2. Content analysis coding framework for the systematic review.

Distributive coding—author demographics	
Author discipline	Engineering and Technology; Life Science and Medicine; Social Science and Management; Arts and Humanities; Natural Science; Non-academic; Not Listed/Indeterminate; Interdisciplinary
Author region	Africa; Asia-Pacific (including Australia and New Zealand); Europe (including Russia and Turkey); Latin America and Caribbean; Middle East; North America
Author gender	Male; Female; Indeterminate
Publishing journal	Geoforum; Energy; Applied Energy; Energy Research and Social Science; Energy Policy; Environmental Science and Policy; Environmental Studies and Sciences; Journal of Environment and Resources; Science as Culture; Local Environment; Environmental Politics; Energy and Buildings; Energy, Sustainability and Society; Journal of Rural Studies; Colorado Journal of International Environmental Law and Policy; Natural Resources; Renewable and Sustainable Energy Reviews; Energy for Sustainable Development; American Association of Geographers; Post-communist Economies; Journal of Energy and Natural Resources Law; Environment and Planning C; The Geographical Journal; Asia and Pacific Policy Studies; Antipode; Transactions of the Institute of British Geographers; Energy Law Journal; Politics and Space; Environment and Planning E; The Extractive Industries and Society; Journal of Cleaner Production; Environmental Innovation and Societal Transitions; Ecological Economics; Global Environmental Change; Energy Strategy Review; Climatic Change; Risks, Hazards and Crisis in Public Policy; Energy Efficiency; Cultural Studies; Harvard Civil Rights—Civil Liberties Law Review; Harvard Environmental Law Review
Analytical coding	
Article methodologies and research designs	Experimental; Surveys; Modelling; Qualitative; Secondary Data; None; Mixed method
Philosophical and conceptual approaches	Distribution; Distribution and Procedure; Distribution, Procedure and Recognition; Universal and Particular Justice; Six Energy Justice Principles; Eight Energy Justice Principles; Prohibitive and Affirmative Principles; Cosmopolitan; Other; Not Explicit/None
Geographic and institutional approaches	The Arctic; Australia; Bangladesh; Belgium; Brazil; Bulgaria; Canada; Chile; China; Colombia; Cuba; Czech Republic; Denmark; Ecuador; England; the European Union; France; Finland; Germany; Ghana; Guatemala; Hungary; Iceland; India; Indonesia; Iran; Ireland; Italy; Japan; Kenya; Kosovo; Latvia; Malaysia; Mexico; Mozambique; Nepal; Netherlands; Nigeria; Norway; Panama; Papua New Guinea; Peru; Poland; Portugal; Russia; São Tomé and Príncipe; Sierra Leone; South Africa; Spain; Sri Lanka; Sweden; Switzerland; Turkey; United Kingdom; United States of America; Ukraine; Vietnam, and Wales.
Technologies, infrastructures and material systems	Fracking; Wind; Biomass and biogas; Nuclear: Lighting; Coal; Solar: Smart/energy meters; Hydropower; Gas; Thermal power plants; Heating/cooling; Oil; Cooking; Geothermal; Tidal; Wave; Electricity supply/grids; Smart grids; CO ₂ storage; Vehicles or vehicle components; Energy Pipelines; Energy from waste; Cryptocurrency
The marginalized peoples and victims of injustice	Unemployed (including fossil fuel workers); Biomass users; Women/gender; Ill or unhealthy; Disabled; Indigenous; Conservatives; Children, youth or young families; Elderly; Households; Racial and ethnic minorities; Land and resource owners (including farmers); Renters/tenure type (including social housing); Resisters; Poverty and economically marginalized; Limited access/disconnections; Domestic mobility; Cyber insecure; Displaced; Local populations/host communities; Procedurally disenfranchised; Politically powerless; Socially marginalized; Climate change victims/refugees; Rural; City inhabitants; Future generations Developing countries/Global South; War, conflict and corruption; Building type and age; Energy accidents; Waste streams and externalities; Ecosystems/environmentally degraded; Not clear
Policy recommendations	Present/absent Then inductive codes of what they said, including Energy-based education; Support for translational intermediaries; Supportive financial structures; Attention to local contexts; Widening recognition; Collaborative procedure and decision-making; Diversifying ownership and beneficiaries; Transparency; Allocation of regulation and responsibility; Pro-justice policy monitoring frameworks; Anticipatory, inclusive policy visions; Targeted technological investments; Application of modelling or matrices; Defining need versus choice; Fostering cross-boundary discussion; Learning from other contexts; System wide policy applications; Flexible regulatory frameworks; Supporting jobs, technological expertise trade; Soft policy instrumentation; Requirements for Environmental and Social Impact Assessments; Clarified organizational roles

2.2.5. Technologies, infrastructure and material systems

Our analysis was also interested in *what* we were researching so that we could demonstrate new fields

of research and discuss the potential methods that make them more accessible. Our purpose was to discern the general topic of research, rather than to determine the exact nuances of their writings. Thus,

Table 3. Discipline categorization framework.

Arts and humanities
American studies; archaeology; architecture/build environment; area studies; art and design; classics; drama; dance and performing arts; English language and literature; history; language and logistics; music; philosophy; theology; divinity and religious studies
Engineering and technology
Chemical engineering; civil engineering; computer science; electric and electronic engineering; general engineering; mechanical; aeronautical and manufacturing engineering; mineral and mining engineering; nanotechnology
Life sciences and medicine
Agriculture; biological sciences; clinical psychology; dentistry; food science and technology; health sciences; medicine and medical-related studies; neuroscience; nursing; pharmacy and pharmacology; psychiatry; public health; veterinary science
Natural sciences
Applied mathematics; astronomy; chemistry; earth sciences; environmental science; geography; metallurgy and materials; physics; pure mathematics
Social sciences and management
Accounting and finance; anthropology; business and management studies; communication; cultural and media studies; development studies; economics and econometrics; education; law; library and information management; politics and international studies; sociology; social policy and administration; social psychology; social work; sports-related subjects; statistics and operational research; town and country planning; innovation studies

the coding for *technologies, infrastructure and material system* took an inductive, high-level approach. Notes were initially derived from the title, keywords and abstract, where possible, before a more systematic search. From these notes, 22 codes emerged (table 2). Each paper was then allocated to all appropriate categories. Papers could be coded in multiple categories, i.e. if they referred to both ‘biogas’ and ‘nuclear’ each category would receive a tick. As above, we considered whether cases were comparative i.e. they compared two or more energy production technologies.

2.2.6. *The marginalized peoples and victims of injustice*

There is some contention in the energy justice literature around whether ‘justice as recognition’ should exist as a separate concern—or tenet—from ‘procedural justice’. In this paper, and in keeping with Jenkins *et al* (2016) and others, we consider that it *is* separate, and contend that by explicitly asking *who* is of concern, we can better represent and attend to marginalized peoples and victims of injustice. Therefore, we searched all article’s title, keywords and conclusions to initially determine the dominant focus before reading the articles in more depth. Each paper could be coded across multiple categories, including ‘indigenous’, ‘biomass users’ and ‘landowners’, for instance. The category of ‘not clear’ was used when no specific group social groups were mentioned. The emergent codes use the author’s definitions rather than our own, giving code titles such as ‘cyber insecure’ or ‘procedurally disenfranchised’.

2.2.7. *Policy recommendations*

Finally, and given that we were concerned with the practical implementation of energy justice research in the policy sector, we coded each article for its policy recommendations. This allows us both to summarize the recommendations made to date, and then to the

critically synthesizes these in order to develop our own agenda. As above, we began by coding whether they were present or absent, and following this, by inductively coding the energy justice-based recommendations where present.

2.3. Limitations

Of course, we acknowledge limitations to our study, as would be the case with any such systematic review, and we reflect on the most prominent issues. First, to keep the total number of articles read and coded manageable, we search for only academic literature, meaning we do not include insights from non-academic contributions such as reports, policy briefings and white papers. Nonetheless, we find merit in studying the academic literature and in the finding (below), that it does not often connect with issues of practical implementation. Similarly, our sample is composed only of full-length, peer-reviewed, English-language research submissions and review papers, so we did not capture other forms of contribution.

Second, we searched only for publications in English-language, which neglects contributions made in indigenous and European languages used throughout Africa and Asia, for example.

Third, a team of two authors were responsible for the coding, to improve the reliability of our inferences.

Lastly, though non-exhaustively, we appreciate that there may be texts that although they did not use the term ‘energy justice’ in the title, keywords or abstract—or indeed elsewhere in the text—may still have discussed its core approach and complementary issues. This may particularly relate to publications from non-Western contexts, where notions of ‘justice’ do not necessarily directly translate or carry the same meaning. It is also a similar challenge to that faced by the environmental justice literature, which is

dominated by literature from the United States (Reed and George 2011).

3. Results and discussion

This section of the paper presents the results of the systematic and comprehensive review and its content analysis, and discusses what some of these findings mean, following the same structure outlined above: author discipline; author region; author gender; publishing journal, article methodologies and research designs; philosophical and conceptual approaches; geographic and institutional approaches; technological, infrastructures and material systems; the marginalized peoples and victims of injustice, and policy recommendations. Where quotes are given, they have been selected as indicative representations of the discussions within the themes. To begin, table 4 presents general statistics on the collected papers.

3.1. Author demographics

Across all articles analysed in the sample, a total of 378 author affiliations were listed, covering all five of the major academic families mentioned above. In total, 76% of authors listed themselves as being associated with social sciences and management disciplines, with 10% appearing as not listed/indeterminate, 4% engineering and technology, 2% life sciences and medicine, 4% natural sciences, and 2% arts and humanities figure 1(A). The arts and humanities affiliations included contributions from a Professor of Theatre and Consecrated Layman, illustrating the full diversity of energy justice scholarship. Of these affiliations, only 3% could clearly be considered as 'non-academic'. Whilst Sovacool (2014) identified an underrepresentation of social science and humanities perspectives on energy research, the energy justice research therefore seems far more balanced in this area.

Yet of the papers analysed, only 16 papers were explicitly identifiable as having interdisciplinary authorship, meaning that despite an increasing shift in academic pedagogy towards interdisciplinary approaches, many authors continue to work in the confines of one of the five listed categories—arts and humanities, engineering and technology, life sciences and medicine, natural science, and social science and management—even when working across different institutions and countries.

Authors reported affiliations with all six global regions used for the analysis. This implies positive global representation, although figure 1(B) shows that there was a heavy bias towards European contributions, which amounted to 60% of the sample, whilst authors in universities from the Asia-Pacific region (including Australia and New Zealand) totalled 16%. Of those from Europe, 41% were from the UK. Particularly underrepresented global regions include universities from Africa (2%), Middle East

(1%) and Latin American and the Caribbean (1%), although we do note that our sample only selected papers written in English from major databases, which may not be readily accessible in some global regions.

For author gender, shown in figure 1(C), whilst male contributions did dominate (59%), female authors were represented at 38% of the total sample leaving 3% of the research sample as unidentifiable. Sovacool (2014) recognizes in his content analysis of social science research in the energy field, that of 9549 papers analysed, only 15.7% could be identified as female. Although our sample is smaller, our analysis shows that the energy justice literature is currently more gender progressive than the general energy studies literature.

In terms of publishing journal, and despite a wide range of publishing outlets (with 41 journals represented overall), 98 of the articles in the sample of 155 came from just three journals; *Applied Energy*, *Energy Research and Social Science* and *Energy Policy* (figure 2). This corresponds partly with journals publishing special issues on the topic but given that these contained between 14 and 20 papers a time, it also suggests these are enduring targets for this area of scholarship.

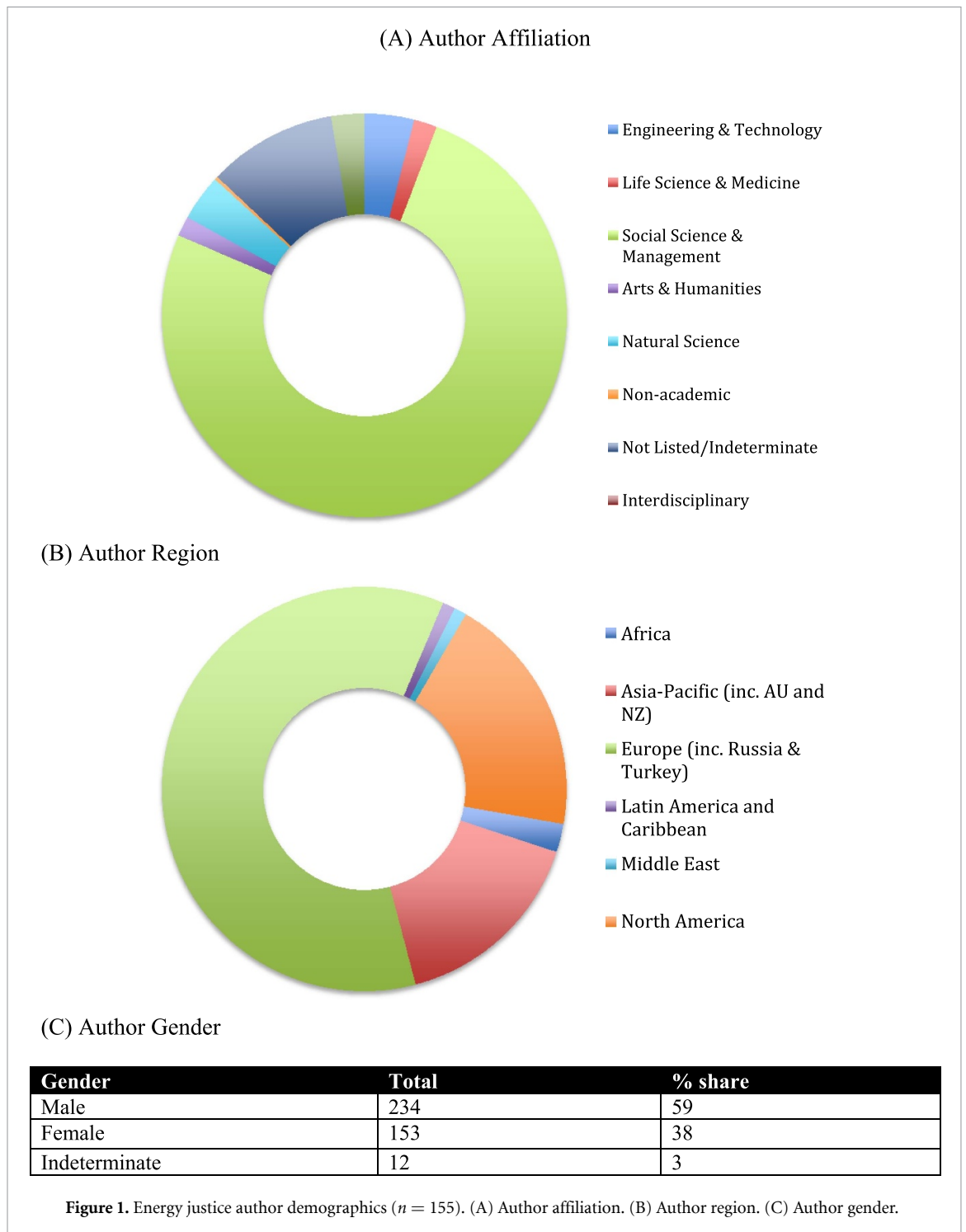
3.2. Article methodologies and research designs

Examining the methodological approach of published articles allowed an assessment of the most dominant research approaches. In total, 39% of articles contained no stated methodology, where subjectively, most of these appeared as conceptual advancements based largely on non-replicable reviews (e.g. Jenkins *et al* 2016) or in-depth case studies with no openly recorded method for data collection or analysis (figure 3; Sovacool 2016). In contrast, 45% used qualitative primary data and 35% secondary data. 48 papers also included one or more methods, such as Sareen and Haarstad (2018) who employ field observations during site visits to solar energy projects, expert interviews and documentary analysis of media reports and policy documents. Likewise, Lacey-Barnacle and Bird (2018) use participatory action research methods, focusing on interviews and focusing groups, whereas Liljenfeldt and Pettersson (2017) develop models on the basis of secondary data. As a particularly novel case, Osnes (2010) reports the findings of participatory theatre exercises used to engage women in energy development projects, such as the rollout of fuel-efficient cook stoves.

One caveat must be stated. Although the research field has a mix of conceptual and empirical studies, these findings may not suggest a lack of attention to methods from all researchers, and instead it could be that the type of papers produced may not have needed a specific methods section. Nevertheless, even in disciplines with divergent codes of practice and norms about research design, we find the dearth of detailed

Table 4. General statistics for energy justice articles, 2008–2019 ($n = 155$).

Year	Number of articles	Number of disciplinary affiliations	Number of author regions	Number of mixed method papers	Number of geographical case studies	Number of technological case studies	Number of technologically comparative case studies	Number of geographically comparative case studies
2008	0	0	0	0	0	0	0	0
2009	1	1	1	0	1	1	0	0
2010	3	3	3	0	2	2	1	0
2011	1	1	1	0	0	0	0	0
2012	1	2	2	0	0	0	0	0
2013	5	8	8	0	1	2	0	0
2014	1	2	2	0	1	1	0	0
2015	5	10	10	0	6	4	1	1
2016	17	44	43	1	16	16	1	4
2017	24	71	64	12	24	19	3	4
2018	53	151	142	21	69	52	11	9
2019	44	101	115	14	61	83	8	8
Total:	155	394	391	48	181	180	25	26



methods sections troubling on grounds of both transparency (fully accounting for techniques and assumptions in research design) and replication (giving the community the ability to try to replicate findings and methods if they so desire).

3.3. Philosophical and conceptual approaches

Within the field of energy justice, a range of tenet frameworks have emerged. Our analysis showed that the dominant framework in the sample papers was that of distributional justice, justice as recognition and procedural justice (38%), a finding

that corroborates the results of a recent review from Lacey-Barnacle *et al* (2020). In our results, this was followed by mentions of cosmopolitan justice (9%), distributional justice and procedural justice on their own (8%) and the eight principles approach (7%). A cumulative category of ‘other’ (8%) captured papers using ‘energy systems justice’, ‘spatial justice’, ‘energy sufficiency’, ‘assemblage’ and ‘energy mobility’, ‘restorative justice’ and ‘capabilities approaches’ alongside a 10 principles approach. Table 5 gives an overview of the different approaches and the frequency of their appearance.

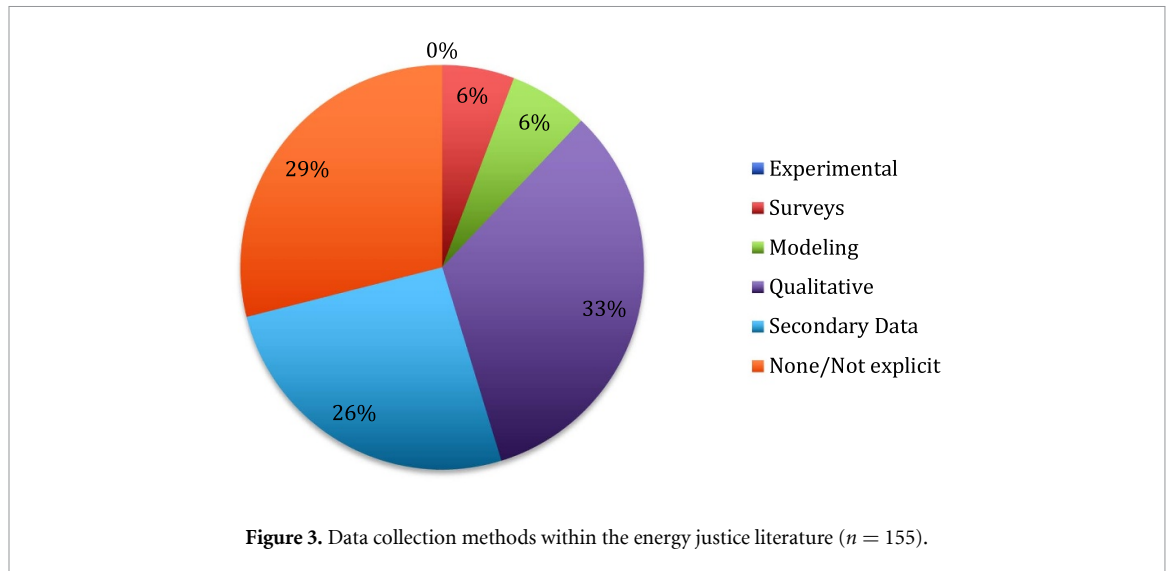


Figure 3. Data collection methods within the energy justice literature (n = 155).

Table 5. Theoretical approaches undertaken within the energy justice literature (n = 155).

Approach	Frequency (%)
Distribution	6
Distribution and procedure	8
Distribution, procedure and recognition	38
Universal and particular justice	1
Six principles	2
Eight principles	7
Prohibitive and affirmative	1
Cosmopolitanism	9
Other	8
Not explicit/none	20

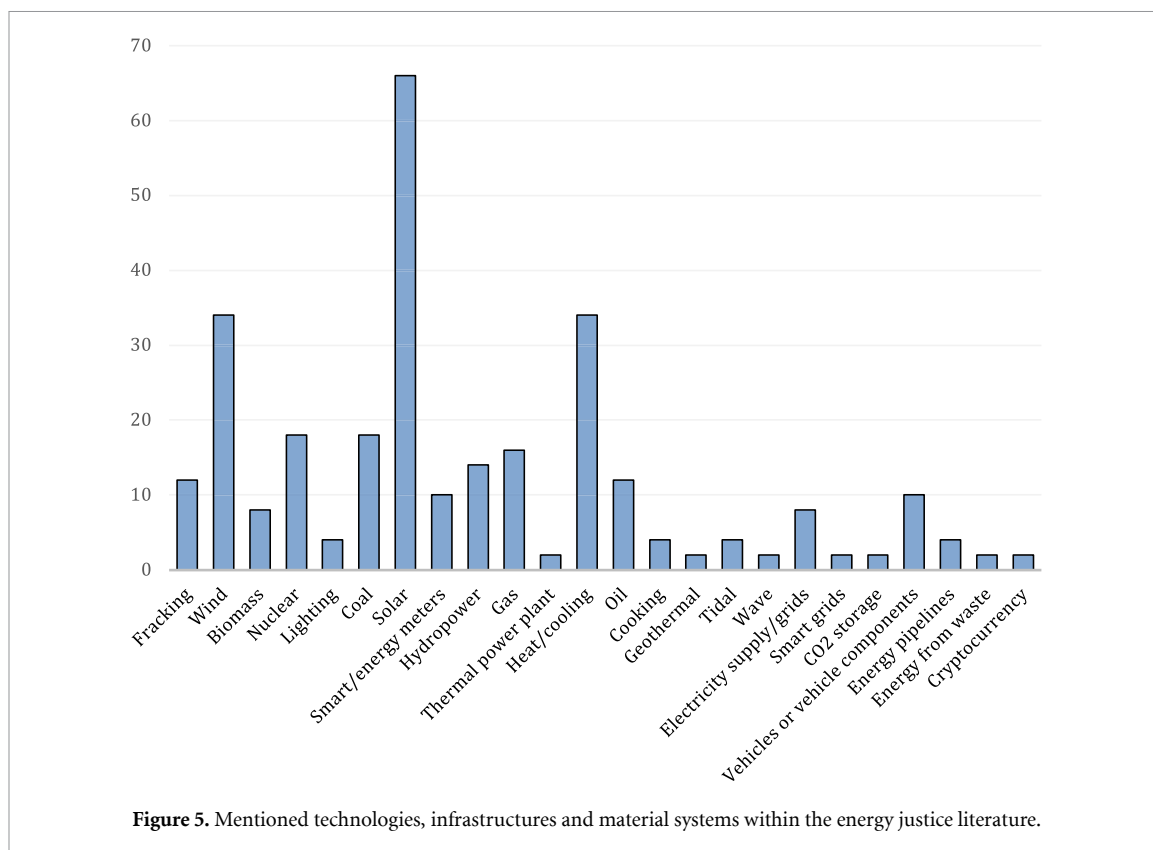
As particular observations, in seven papers, the approach of distributional justice, justice as recognition, and procedural justice was used alongside the ‘8 principles’ decision-making framework approach, which calls for attention to (a) availability, (b) affordability, (c) due process, (d) intra-generational equity, (e) sustainability, (f) transparency and accountability, (g) equity and (h) responsibility (Sovacool *et al* 2016). This may be considered a particularly profitable avenue that blends a key conceptual approach to energy justice within one intended to have more of a decision-making and practical influence. Moreover, it is worth noting too that some authors switched between approaches either through time or across different papers over the same timescale. Tentatively, this suggests that the literature may still be evolving in shape or critically, that new authors are joining and seeking to contribute their own perspectives and agendas. In this regard, there is a tension between simultaneously ‘opening up’ to new authors, disciplinary perspectives and conceptual and decision-making approaches, whilst ‘closing down’ through the continued dominance of distribution, procedure and recognition.

3.4. Geographic and institutional approaches

Out of the total sample of 155 papers, 125 drew on what we would classify as geographical case studies. Though it should be noted that this does not mean that the others contained no geographical or institutional approaches at all, only that the references were very passing without exploring them in significant depth. Comparative case studies of countries appeared in just 24 papers (15%). As an indicative example, Siciliano *et al* (2019) look at large dam construction in the global South using case studies in Cambodia, Malaysia, Ghana and Nigeria

Compared to the comparatively limited geographical scope of the universities where contributing authors are, this geographical scope of application shows real breadth in the reach of energy justice scholarship, mentioning 61 different countries across the world (figure 4)⁷. Although a subjective claim, one of the most novel case study was from the African Island nation of São Tomé and Príncipe, where Sovacool (2016) explores the notion of ‘prudence’ in fossil fuel use where energy resources out to be maximized for future use, and utilized to better the communities living near them. However, in keeping with Lacey-Barnacle *et al* (2020) we also demonstrate a neglect of case studies in particular regions of the world, including Sub-Saharan Africa, South American and Asian contexts. There is also a notable lack of research in Arctic countries, even though these countries face

⁷ The following countries were included: the Arctic; Australia; Bangladesh; Belgium; Brazil; Bulgaria; Canada; Chile; China; Colombia; Cuba; Czech Republic; Denmark; Ecuador; England; the European Union; France; Finland; Germany; Ghana; Guatemala; Hungary; Iceland; India; Indonesia; Iran; Ireland; Italy; Japan; Kenya; Kosovo; Latvia; Malaysia; Mexico; Mozambique; Nepal; Netherlands; Nigeria; Norway; Panama; Papua New Guinea; Peru; Poland; Portugal; Russia; São Tomé and Príncipe; Sierra Leone; South Africa; Spain; Sri Lanka; Sweden; Switzerland; Turkey; United Kingdom; United States of America; Ukraine; Vietnam, and Wales.



some daunting energy justice concerns (McCauley *et al* 2016).

3.5. Technologies, infrastructures and material systems

Whilst technological cases were less prevalent than those relating to different geographical and institutional approaches, they were similarly diverse, considering both production and consumption technologies such as shale gas, solar, thermal power plants, smart meters and domestic lighting. Out of the total sample of 155 papers, 102 drew on technological case studies (appendix 2). Fifty-four of the total number had no discernible technological focus, though again it should be noted that this does not mean that they contained no examples at all, only that they were either very broad (e.g. ‘fossil fuels’ and ‘renewables’) or contained only very passing reference to particular technologies without exploring them in significant depth. A total of 17% of the sample could be considered ‘technologically comparative’, meaning it compared energy justice manifestations for more than one technology. Roddis *et al* (2018) consider community acceptance for onshore wind and solar in the UK, for example, and Rudolph *et al* (2018) which considers wind, wave and tidal energy.

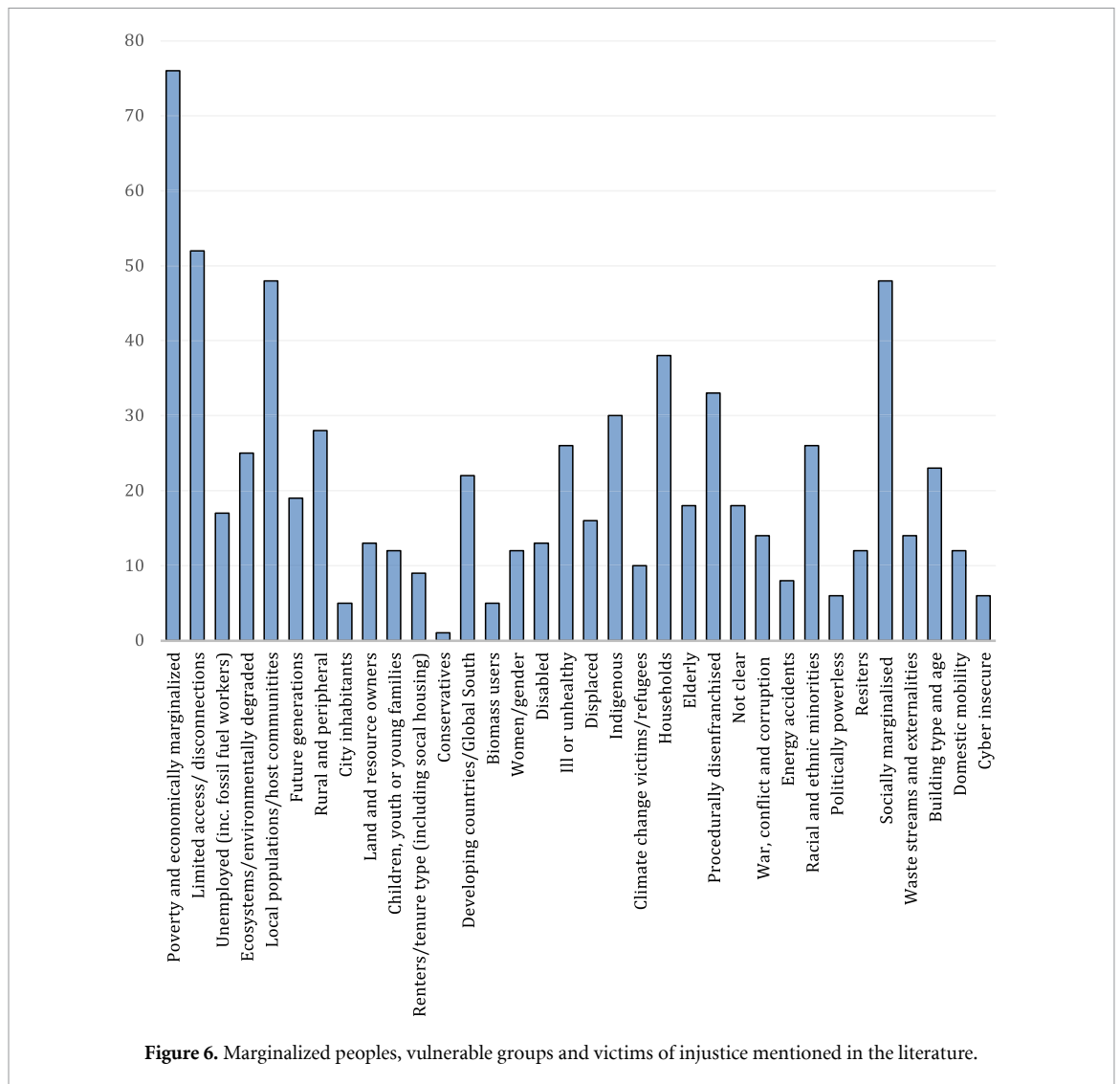
Of the technologies, infrastructures and material systems mentioned, solar (33 papers), wind (18 papers) and heating/cooling technologies (17 papers) were the most common (figure 5), a surprising finding given that fossil fuels and nuclear power are

known to have more severe externalities and social and economic costs than low-carbon or renewable energy systems (Roth and Ambs 2004, Sundqvist 2004, Healy *et al* 2019, Kalkuhl *et al* 2019)⁸. For heating/cooling technologies in particular, the instances were almost entirely in the context of fuel poverty concerns. We also note the comparative neglect of emerging technologies such as hydrogen (although they have been noted in more recent publications, e.g. Scott and Powells 2020), which although it was discussed in passing in nine papers was not explored in any real depth. Despite from the fact that that ‘the energy justice concept can expose exclusionary and/or inclusionary technological and social niches before they develop, leading to potentially new and socially just innovation’ (Jenkins *et al* 2018, p 67) this demonstrates that energy justice scholars may not yet be *proactively* exploring upcoming justice issues of concern (with the exception, perhaps, of studies on smart metering and smart grids (e.g. Hielscher and Sovacool 2018, Milchram *et al* 2018 and Xu and Chen 2019).

3.6. The marginalized peoples and victims of injustice

Out of the total sample of 155 papers, 136 contained reference to at least one social group of concern or

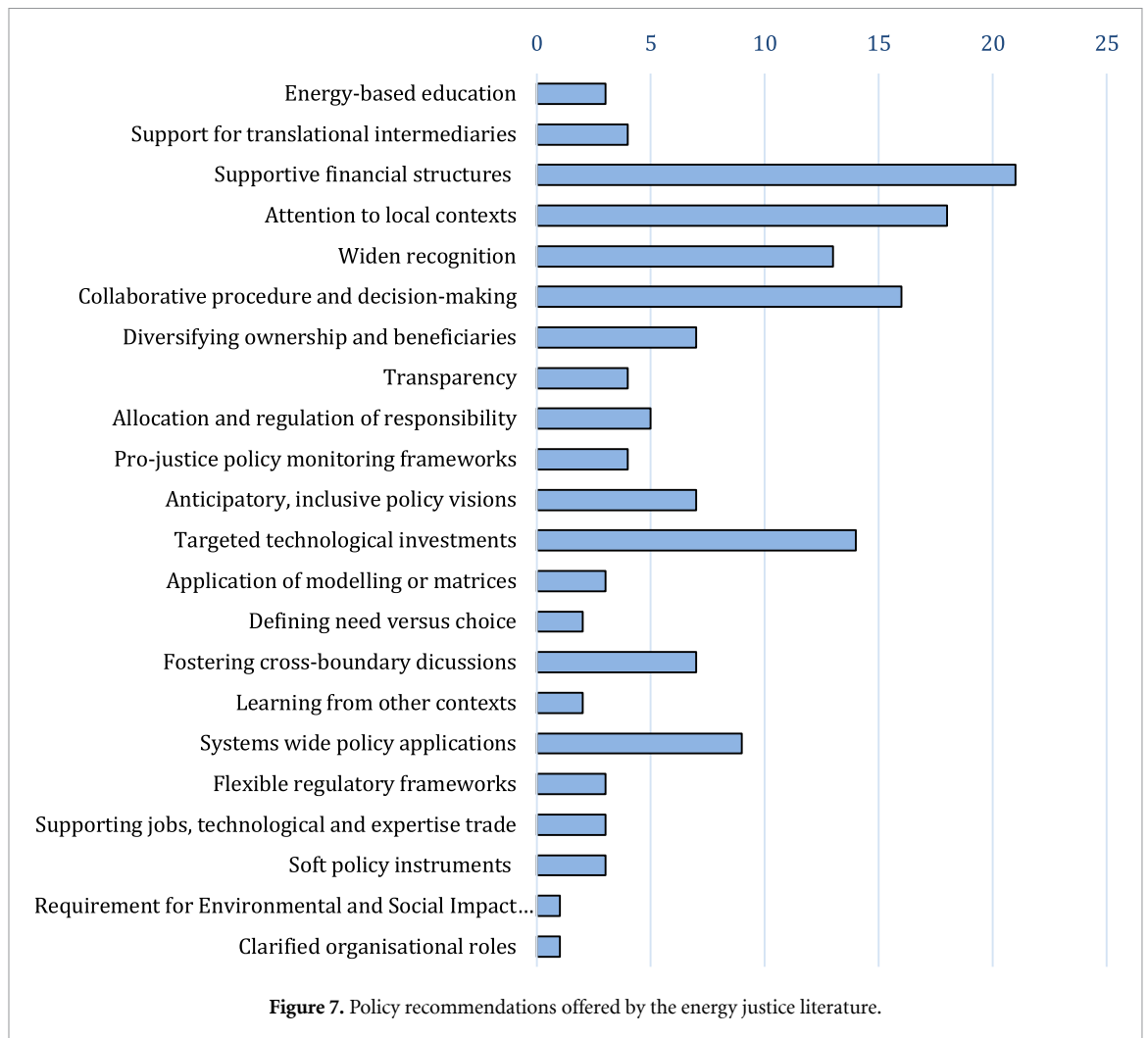
⁸ Though we do note that there is significant, closely related work on these topics in the wider environmental justice literature (e.g. Shiva 2008, Evans and Phelan 2016).



enhanced vulnerability to energy injustice; a reference to the marginalized peoples and victims of injustice. In total, 34 different coding categories emerged (table 2). These categories included demographic characteristics, such as individual's health, disability status, age and care responsibilities around children, as well as a wider set of material conditions (e.g. inhabitants of particular building types), social performances (e.g. whether groups were procedurally disenfranchised or 'resisters' to a form of socio-technical change) and wider contextual changes (e.g. victims of war, conflict and corruption or the unemployed in the context fossil fuel production closures). In some cases, the categories shown in figure 6 and appendix 3 represent a grouping of concerns; 'poor and economically marginalized' includes those suffering from financial poverty, energy poverty and fuel poverty for example, and 'socially marginalized' captures a range of stakeholders facing restrictions in their social mobility through class, caste status, illiteracy or the use of English as a second language, for instance. On the whole, almost all papers carried statements of who we should be concerned about in

achieving energy justice outcomes, illustrating to a complex web of different social, material and socio-structural vulnerabilities.

Although at times the identification of some social groups was only briefly stated—e.g. in a list or as a series of short sentences—a number of papers engaged with their articulation in more depth. By example, Finley-Brook *et al* (2018, p 182) include overview tables of the 'victims of injustice', showcasing concern for 'climate change hard to future generations', 'harm to wetlands and biodiversity', those affected by the 'forced buy-out of homes', and 'harassment of threats to protestors and opponents'. Likewise, Bartiaux *et al* (2018) illustrate the complexity of households affected by affordable warmth, including whether inhabitants were urban or rural, tenants or owners, single or multiple occupants or even their educational status. Taking a notably different approach, Chatterton *et al* (2016, p 85) focus on the highest consuming members of society, arguing that, 'Energy justice work in the context of energy consumption has tended to focus on ensuring that certain sectors of society identified as fuel poor



receive support in order to allow them to meet their fundamental energy needs at a cost that is affordable by them. However, here we argue that in terms of both the just targeting of climate policies to reduce energy consumption, and strategies to create a more equitable use of national energy systems, there is a need to broaden the justice lens to consider not just the lower end of the consumption spectrum, but also the higher end too. This perspective raises ongoing questions about notions of ‘justice by whom’, in addition to ‘justice for whom’ concerns.

It is worth noting that considerations of ‘poverty and the economically marginalized’, ‘racial and ethnic minorities’ and ‘climate change victims/refugees’ shows some overlap with groups that would typically be recognized with the environmental and climate justice literatures, albeit in an energy-systems context.

3.7. Policy recommendations

In total, 43% of the sample of papers contained policy recommendations, spanning a total of 21 categories derived from inductive coding. For the 57% of studies that did not include policy recommendations, this is a fairly common trend in the literature. Marsden

and Reardon (2017) examined the field of transportation governance and found that many studies were one-step removed from policymaking and that research did not contribute to understanding options and opportunities to intervene and improve policy processes.

Where recommendations were present, they were largely in publications from the journal *Energy Policy* (figure 2), a trend largely explained by the journal’s author guidelines that require it to integrate a ‘Conclusions and Policy Implications’ section in every manuscript. Across all papers in our sample, the recommendations ranged from context-specific suggestions for particular organizations or countries to broader, systematic statements spanning technological development and improvements for policy practice and monitoring. The most frequently mentioned categories were (a) attention to local contexts, (b) supportive financial structured, (c) widening recognition, (d) collaborative procedure and decision-making, and (e) targeted technological investments (figure 7). This speaks to the scalar applicability of the energy justice concept, with intended applications in local, national and international settings.

In keeping with Lacey-Barnacle *et al* (2020), our findings showcase a policy emphasis on increasing participation, with less explicit discussion on how to reduce the power of elites (except, perhaps, through the work of Chatterton *et al* 2016). It should be noted too, that some recommendations were provided for social groups beyond traditional policy ‘elites’, including recommendations for utilities, activists and developers. By way of illustration, Rudolph *et al* (2018, p 106) suggest that ‘developers should therefore be urged to consider, reveal, discuss, and justify openly what is achievable and expectable in terms of community benefits when engaging local communities’ and Liévanos and Horne (2017, p 209) recommend ‘that utilities be particularly clear in their information-sharing efforts with disadvantaged communities’. For the policy recommendations in particular, indicative quotes for each coding category are given in table 6.

Now, when considering the prevalence of policy recommendations in the energy justice literature, one important caveat merits mentioning. Our review paints a useful picture as to the frequency by which policy recommendations appear in the literature, but it does not speak to the quality by which those recommendations are crafted, grounded in data, or presented in actionable ways to policymakers. It could be that few of the policy recommendations in table 6 are sufficiently contextually specific to be useful, or feasible enough to be meaningful. However, it does still tell us the intent of the authors to take policy implications into serious consideration. Moreover, past trends may not be predictive of future ones: overall, the energy justice scholarship may now be at a phase where policy outcomes are perhaps more likely.

As a final observation, it is also worth considering the potential role of currently under-explored or under-emphasized policy mechanisms, including the role of cost–benefit analyses (CBAs) as a particular facet of supportive financial structures and impact assessments, for example, which were infrequently mentioned across our sample but widely used in non-academic circles. Other options include impact benefit agreements, truth commissions, and the use of prohibitive or punitive environmental bonds as ways to enforce energy justice principles (Sovacool and Dworkin 2014). This is necessary both so that we can deploy a broader array of policy tools, as well as better understand their potential and to develop impact beyond silos, given that these mechanisms are frequently applied beyond the ivory tower. To that end, and as indicative examples of areas in which more research is required, we further reflect on the potential role of CBAs and some forms of impact assessments in sections 4.2.1 and 4.2.2.

4. Reflections: recommendations for practice and policy

Our analysis has given a 12 year systematic assessment of energy justice scholarship, including both a descriptive consideration of who is writing, from where and through which outlets, and an analytical consideration of which methods we are using, which conceptual frames are being applied, in relation to which case studies and topics and to what end. Various, and in considering why these findings matter on a broader scale, our analysis therefore points towards potential areas of growth and refinement in the energy justice literature in its next wave of development, including the possibility of increasing interdisciplinarity and the geographical breadth of contributors, exploring currently underutilized methods as part of interdisciplinary outlooks and impact beyond silos, exploring new case studies and geographical peculiarities and even questioning not only which groups are marginalized, but which groups receive disproportionate benefit and therefore might reallocate these. We highlight these areas not with a view to suggesting that continued growth is always inherently positive but as a process of ongoing systematic reflection. Indeed, researcher reflexivity is certainly necessary to refine and direct the concept of energy justice beyond the analysis here of what the literature is doing and where the gaps may be for future scholarship (Jenkins *et al* 2020, Sovacool *et al* 2020a). This first proposition therefore suggests that energy justice researchers should further focus on what frameworks, approaches and methods *are* being used in the context of both energy storage, demand and supply, before assessments of what *can* or *should* be used.

Nonetheless, we do see merit in capturing new perspectives, ensure representation and as ever, move towards practical impact. In this regard, our analysis lends itself to both introverted and extroverted reflection. It allows us as an authoring team to take stock on what has been achieved through our collective experience as energy justice researchers as well as the results given above, and to collectively look forward, considering which further research gaps have been highlighted and which practical recommendations have been made for a range of energy systems stakeholders including NGOs, educators and policymakers. In this Reflections section that follows, we therefore seek to synthesize and extend a select few of these potential avenues into a series of recommendations for both academia and ‘practice’ (which we loosely define as being the implementation of energy justice principles outside of academia), all of which are oriented towards securing a more impactful energy justice agenda. In so doing, we highlight potential directions for the next wave of energy justice

Table 6. Indicative examples of policy recommendations in the energy justice literature.

Category	Authors	Quote
Energy-based education	Heffron and McCauley (2017)	'Policy-makers and educators need to ensure energy justice is part of the energy curricula.'
Support for translational intermediaries	Labelle (2017)	'Policy makers need to act as mediators between global business and regulatory structures while also asserting local norms with acceptable business models and profit levels.'
Supportive financial structures	Capaccioli <i>et al</i> (2017)	'For instance, these initiatives could be allowed to use the incentive schemes that already exist for renewables to feed the creation of the energy bonus in connection to improvements of energy consumption.'
Attention to local contexts	Munro <i>et al</i> (2017)	'This includes the understanding of actual, rather than presumed, political economic forces that shape energy access, as well as the kinds of energy futures that particular communities desire ...; a form of 'recognition justice' that helps to articulate voices and knowledges from people experiencing energy poverty.'
Widening recognition	Bouzarovski and Herrero (2017)	'...also of importance is the nature of policy recognition afforded to groups who are susceptible to the condition but remain outside the focus of present policy measures, due to the state's failure to detect the specific age, gender and locational profiles of energy-poor households'
Collaborative procedure and decision-making	Baker (2016)	'Substantively, the consultation process must offer opportunities for meaningful exchanges among community members, and also among community members, government officials, and developers.'
Diversifying ownership and beneficiaries	Forman (2017)	'As recent policy approaches in the United Kingdom under Electricity Market Reform have tended to prioritize affordability over ownership as a means to enhance equity, the analysis suggests that there is much scope to capitalize on a wider equity dividend through a more diverse approach to ownership in UK energy policy.'
Transparency	Jenkins <i>et al</i> (2017)	'As this is the study, we highlight the necessity of using policy tools oriented towards the regular reassessments of who is responsible, and of how successfully transparency is being achieved.'
Allocation and regulation of responsibility	Jenkins <i>et al</i> (2017)	'Policy frameworks that allocate and uphold responsibility are required.'
Pro-justice policy monitoring frameworks	Bouzarovski and Simcock (2017)	'... correcting end-use energy injustice requires improved energy poverty detection and monitoring frameworks.'
Anticipatory, inclusive policy visions	Poruschi <i>et al</i> (2018)	'If policymakers are to avoid unintended outcomes, moving forward, federal and state governments need to also define a vision of how the future grid will operate and steer technological development in that direction, before technological advances can dictate the evolution of grid system with unintended, unjust consequences for its users.'
Targeted technological investments	Islar <i>et al</i> (2017)	'Thus, Nepalese policy-makers may choose to strengthen the local technological capacity, by supporting local grid-extension movements in NACEUN, but they may also cultivate geopolitical relations to China and India by agreeing to technological transfers through development aid or trade.'
Application of modelling or matrices	Bednar <i>et al</i> (2017)	'Modelling both heating consumption and efficiency provides a useful tool that may assist policymakers, energy conservation and efficiency program administrators and retrofit installers develop more effective targeting strategies.'
Defining need versus choice	Chatterton <i>et al</i> (2016)	'In moving forward to establishing a just set of policies for achieving ambitious climate change and energy targets it will be necessary to much better identify the boundaries between choice and need, particularly in the context of high energy consumption where action is needed the most.'
Fostering cross-boundary discussions	Pesch <i>et al</i> (2017)	'...have to reflect on the way in which decisionmakers can involve the different territorial levels that are affected by an energy project in a productive way.'
Learning from other contexts	Gillard <i>et al</i> (2017)	'Similarly, with regards to energy efficiency policy, there is certainly scope for collecting best-practice examples from multiple country case studies, as well as from complementary areas of social policy, and on-the ground perspectives from vulnerable households.'

Table 6. (Continued.)

Category	Authors	Quote
Systems wide policy applications	Urban <i>et al</i> (2018)	'It would be useful for the government of Vietnam to develop more coordinated, integrated approaches, policies, and plans that span across the three areas that address green transformations: green growth, sustainable development, and climate change.'
Flexible regulatory frameworks	Hiteva and Sovacool (2017)	'This means that policymakers (at national and even supranational levels) should introduce sufficient flexibility within existing regulatory frameworks to make use of such local conditions and to turn them into local deals.'
Supporting jobs, technological and expertise trade	Islar <i>et al</i> (2017)	'Thus, Nepalese policy-makers may choose to strengthen the local technological capacity, by supporting local grid-extension movements in NACEUN, but they may also cultivate geopolitical relations to China and India by agreeing to technological transfers through development aid or trade.'
Soft policy instrumentation	David (2018)	'The comparative case study approach pursued in this article shows that soft policy instruments, like the means of contention used by the two organizations analyzed here, help the move toward intra- and intergenerational energy justice by aiming for the exnovation of carbon intensive infrastructures.'
Requirements for environmental and social impact assessments	Calzadilla and Mauger (2018)	'... public, private or community-led renewable energy projects should be submitted to a compulsory environmental and social impact assessment (ESIA), but this does not always happen.'
Clarified organizational roles	Fleming (2019)	'This leads to the third and final policy recommendation of this article. It is crucial for the EU to clarify the role and function it has vis-à-vis EU Member States in gas supply security.'

scholarship. But we also want to avoid our recommendations as being seen as dogmatic or hegemonic; we believe the field as a whole should avoid privileging a particular type of energy justice scholarship over other types and to more carefully consider the importance of diversity and pluralism as guiding principles. We thus present our reflections with the idea of germinating and opening up future discussion, not closing it down.

4.1. Looking in: recommendations for academic practice

Here, we explore three key areas which, in light of our experience and the findings discussed above, highlight critical areas of refinement for academic practice. As noted above, almost about two-fifths of articles (40%) had no research design or no methods section at all. This lack of attention to methods and empirical reinforcement may limit the insight gained from and the applicability of energy justice research, particularly as energy justice remains, to some degree, conceptual and not applied. It also would preclude any sort of replication study or a study seeking to confirm initial results. Therefore, it seems important to push professional researchers, and even the next generation of students, to strengthen their ability to offer more methodologically transparent and at times rigorous assessments. Universities may also recommend continuous training for energy justice researchers, similar to what the legal profession does with its continuing legal education (CLE) requirements (Overland and Sovacool

2020). CLE requirements ensure that all practicing lawyers remain professionally certified on a continuing basis well after they pass the bar or become a law professor. Implementing a similar approach for energy justice or even broader social science work could be fairly easily done via a multitude of options and permutations. At the institutional level, university departments, faculty congresses or senates, or university colleges could all make this training as a requirement for employment. At the level of research councils, it could be made a condition of funding (one must show they have been certified) by particular initiatives, or across entire programs. It could lastly supported or implemented by various professional bodies and associations, even those with a disciplinary focus, i.e. the International Studies Association for international relations, or the Royal Geographical Society for geographers in the United Kingdom, or the Society for the History of Technology or Society for the Social Studies of Science for those in technology studies.

Furthermore, we call on researchers to consider more intersectional forms of energy justice analysis that go beyond many of the simple binaries implicit within current research, e.g. gender (male and female), income (rich and poor), or race (black and white), categories which frequently appeared across our sample, but often not in intersection. Groundbreaking work in this regard from the energy justice community includes that of Mulvaney (2013) (examining justice and solar commodity chains), Adams *et al* (2012) (examining justice and whole

systems analysis of microgeneration technologies), and Healy *et al* (2019) (embodied energy injustices). Groundbreaking work from the energy studies community includes Lennon (2017) (intersections of race, ethnicity, and gender), Ryder (2018) (intersections of feminism, class, and power), Johnson *et al* (2020) (gender and class/equity), Lieu *et al* (2020) (intersections of indigenosity and gender), and Newell (2021) (race and class).

In reality, many people suffer energy injustices due to a confluence of these factors; they live the experiences of injustice due to their gender, income and race but also their age, religion, and even location. Sovacool *et al* (2020, p 14) documented this extensively in their assessment of the injustices facing cobalt miners in the Congo, who often dig up cobalt to provide materials for low-carbon energy systems such as solar panels or electric vehicle batteries. As their research indicated, 'there are ethnic dimensions to vulnerability, also, as the system is predicated on displaced persons working for artisanal mining bosses trying to stay rich and keep others, less experienced miners or different ethnic groups, poor as a result. So socioeconomic class mixes with ethnicity for vulnerability' and 'inequalities in terms of work conditions map onto and reinforce existing inequalities of ethnicity, race, class, and social status'. These intersectional injustices demand more robust conceptual frameworks that account for the complexity of lived experiences across space and time.

Finally, many of the cosmopolitan concerns identified in the literature remind us that justice impacts are multi-scalar and do not occur only in a single country (see figure 8) and yet our sample shows that geographically and technologically comparative studies were not common. This may include nuclear reactor designs being exported, cheap electricity trade, uranium mining, and nuclear waste for nuclear energy; low-wage manufacturing in China and material inputs for solar energy; copper and cobalt (DRC), e-waste (Ghana) for smart meters; and extractive industries (cobalt, lithium) for EVs, e-waste, cheaper/dirtier cars flooding other markets (Sovacool *et al* 2019a). Cleaner and lower carbon energy may be a human right, but securing it currently forces trade-offs with other human rights, leading to 'green on green' and even 'poor on poor' conflict. We must avoid conceptual approaches or research designs that obscure or mask this emerging spatial divide to energy justice.

4.2. Looking out: minimizing injustices

Looking outward, we offer suggestions about better incorporation energy justice into assessments of costs and benefits, as well as how it can improve energy planning and policymaking. Here, we recognize the work on increasing participation and information sharing captured above, but point towards

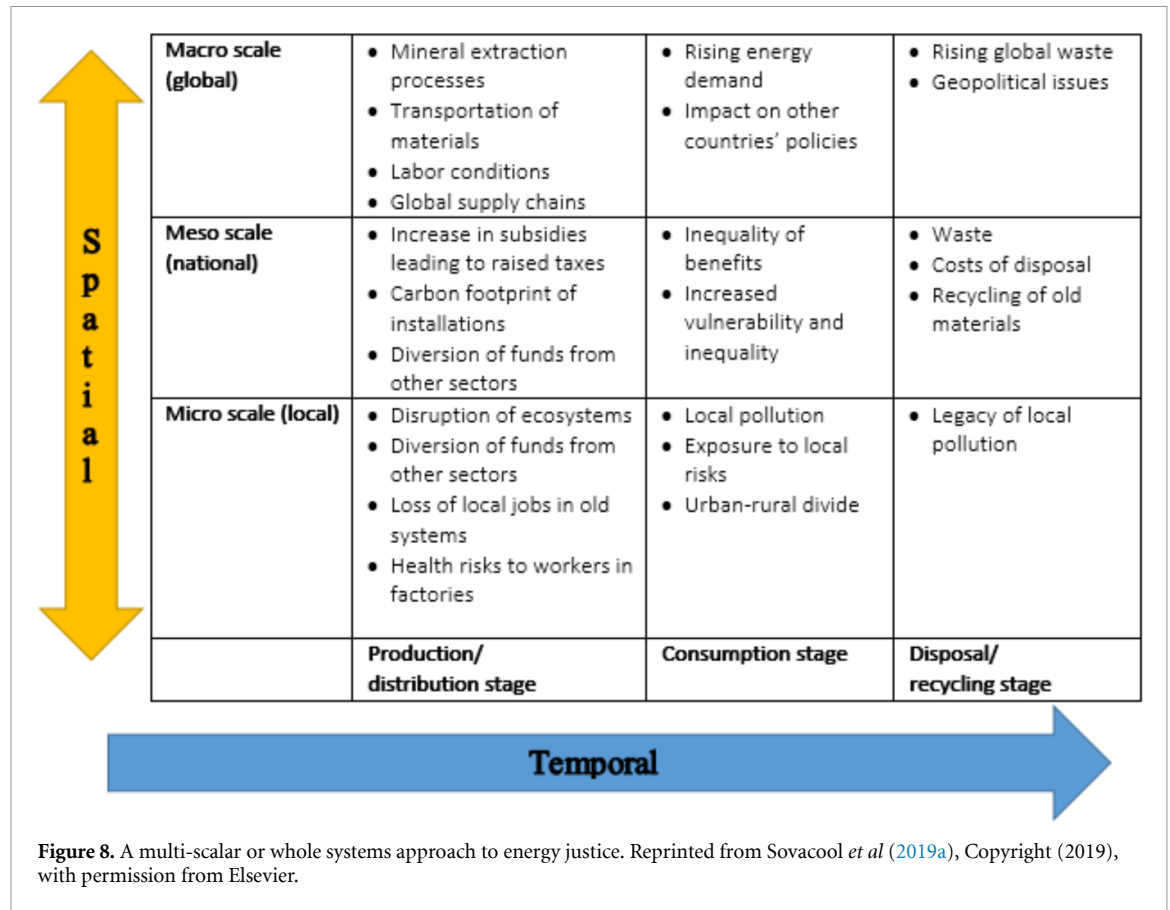
less common but potentially very beneficial and complementary mechanisms.

4.2.1. Improving real-world (economic) policy assessment through energy justice

Energy justice needs to be more formally incorporated into mechanisms of assessing costs and benefits. One of the main criticisms is that CBAs have difficulty incorporating ethical considerations (van Wee 2012), such as procedural and distributive aspects, which are important for the social acceptance of sustainable energy policies (Sovacool and Dworkin 2015, Sovacool *et al* 2016). This is problematic, in part, because lack of local social acceptance increases the risks of failures and delays of sustainable energy policies (Enevoldsen and Sovacool 2016). Acknowledging this line of argumentation, as well as the generalized need for strengthening of policy contributions within the energy justice literature, we position Participatory Value Evaluation (PVE) as a promising avenue for future operationalization.

PVE is a novel web-based evaluation approach that holds the promise to integrate the three tenets of energy justice into economic assessment methodology. PVE has been used in the context of the assessment of a transport investment plan (Mouter *et al* 2021a) and a flood protection scheme (Dekker *et al* 2019, Mouter *et al* 2019) and the energy transition of the city of Utrecht, the Netherlands (Mouter *et al* 2021b). The most important difference with conventional CBA is that individuals are conceptualized in a PVE as co-owners of the government instead of consumers of public goods. In a PVE, citizens are basically put in the shoes of a policymaker. They are confronted with the choice situation of the policymaker. Citizens receive information about the personal and collective impacts of each of the options they can choose from and the limitations that exist (e.g. limited budget or a sustainability target). They are then asked to provide a recommendation to the policymaker. Finally, citizens explain their choices, which provides a clear picture of their preferences and considerations. For instance, in the case of the energy transition PVE in Utrecht over 600 citizens were asked which neighbourhoods need to get rid of natural gas before 2030 to achieve sustainability targets (Mouter *et al* 2021b). Citizens could make their own selection, but they also had the opportunity to select predefined strategies such as 'cheapest option which starts in the poor neighbourhoods', 'freedom of choice for citizens', 'maximum reduction CO₂', and 'start in the wealthy neighbourhoods'.

The use of PVE might contribute to citizens' acceptance of government decisions by recognizing three justice dimensions that play an important role in acceptance of government policies: distributive, procedural justice and justice as recognition (McCauley *et al* 2013, Sovacool and Dworkin 2015,



Jenkins *et al* 2016, Sovacool *et al* 2016). As a more precise example, the use of PVE might secure or enhance distributional justice as citizens are explicitly asked to consider the distribution of burdens and benefits of government projects. The procedural justice benefits are clear as, when incorporated in the policy process, a large group of citizens is directly involved in decision-making about these government projects. Moreover, justice as recognition is fostered through the inclusion of the option in a PVE to provide qualitative motivations as this might be a vehicle for citizens to express their (local) concerns and values. Table 7 shows how the three tenets of energy justice are neglected in a conventional CBA and recognized in a PVE.

Although PVE holds promise as a practical energy justice tool, it is worth mentioning that participatory evaluation processes will in fact represent an advance in energy justice of policies and programs provided that participation becomes a part of the political and governmental decision-making processes. However, explicitly asking citizens about the distribution of costs and benefits is no guarantee that the final decision will incorporate greater doses of energy justice. To this end, regulatory frameworks must contemplate the mechanics of distribution alongside procedure, and consider for example issues of community participation or ownership, the reallocation of profits via bonds, restrictions placed on

environmental degradation, and more explicit disbursement of funds or support to socially marginalized groups (to name a few).

4.2.2. Improving energy planning policy assessment through energy justice

The forward planning of energy infrastructure—or ‘energy planning’—involves developing long-range policies to help ‘guide the future of a local, national, regional or even the global energy system’ (Kaya and Kahraman 2011, p 6577). Energy planning is typically a top-down bureaucratic activity involving centralized policy decision-making at the national level. To determine the likely impact of a technology in a certain place and for a certain time means weighing up conflicting quantitative and qualitative evaluation criteria covering technical, economic, environmental and social attributes. In this respect, energy planning practice initially involves going beyond techniques such as CBA. Instead, energy planning currently includes a range of multi-criteria decision-making (MCDM) tools to help with analysis of the likely impacts of new energy infrastructure (see the far left-hand column of table 8) (Kaya and Kahraman 2011, Glasson and Therivel 2013).

New infrastructure and monitoring are delivered via local governmental actors and a range of associated stakeholders. As plans and projects are evaluated via national and regional planning systems, other

Table 7. The three tenets of energy justice versus conventional cost–benefit analysis and participatory value evaluation.

	Conventional CBA	Participatory value evaluation
Procedural justice (Fairness/quality decision-making process)	Procedural justice is not deliberately fostered in a CBA as citizens are not involved in compiling the study.	Procedural justice is deliberately fostered as it empowers citizens to participate in decision-making in a serious way. Moreover, PVE might increase transparency in public spending.
Justice of recognition (Recognizing the specific characteristics/needs of a community)	Justice as recognition is not fostered as a CBA uses standardized models and generic price tags to determine policy impacts and transform impacts into monetary terms.	Justice as recognition is fostered as local knowledge is mobilized and local preferences are respected.
Distributional justice (Fair distribution of burdens and benefits)	The fairness or desirability of the distribution of burdens and benefits is not studied.	Citizens are explicitly consulted in the distribution of burdens and benefits.

assessment tools further to the right in table 8 help to estimate the likely impacts of a particular energy technology at a range of scales. Environmental impact assessment (EIA) is the most widely known assessment tool for energy infrastructure. Developed in the 1960s, EIA is a statutory requirement for projects above a certain scale (Cornero 2010). However, EIA is narrowly focused in terms of social indicators and lacks appraisal of cumulative impacts. These shortcomings led to the development of social impact assessment (SIA) in the 1970s, strategic environmental assessment (SEA) in the 1980s (which are statutory in the UK for Local Development Plans and spatial development strategies), and health impact assessment (HIA) in the 1990s.

Table 8 shows that, when these assessment tools—MCDM, EIA, SEA, HIA and SIA—are compared alongside Sovacool *et al's* (2017) criteria for energy justice, only SIA has the potential to satisfy all the criteria. This is, in part, because SIA is designed for this purpose, with, according to Vanclay (2003), the role of SIA going far beyond the ex-ante prediction of adverse impacts and the determination of who wins and who loses. This extends to claims that SIA practitioners believe that there should be an emphasis on enhancing the lives of vulnerable and disadvantaged people, and in particular, that there should be a specific focus on improving the lives of the worst-off

members of society (Esteves *et al* 2012). This suggests two energy planning policy improvements: (a) to further support the development of MCDM analytical tools in line with the SIA approach (where the human and natural realms are more equally weighted), and (b) to further support *and enforce* the pragmatic screening of projects, plans and policies for a range of assessments (whether SIA, SEA, HIA or other impact assessment types). Where SIA is undertaken, it appears likely that practitioners and policy-makers working within national planning systems at least have the potential to begin to help achieve many of the normative outcomes sought by energy justice advocates.

5. Conclusions

Energy justice has emerged at a critical moment in academic and contemporary history, guided by many researchers and practitioners who want to make a difference in tackling many of the inequalities, unfair practices, unaccountable institutions, and mounting negative costs of the current energy system, including the consequences of climate change alongside many other ills. It reminds us that energy systems and material infrastructures, even clean or low-carbon ones such as wind energy and solar power, can be reframed not only as matters of national security, economic competitiveness, or environmental degradation, but as matters of social injustice. Many ethicists would question the underlying morality of forcing people to abandon their homes for energy projects, imposing the burden of pollution on the young and vulnerable, violating basic civil liberties and human rights, misappropriating energy funds, and creating an energy system with unequal access. This demands that contemporary analysts and professional researchers in the academy begin to reconsider their energy decisions not only as technical and economic or even environmental concerns, but as moral ones. It also suggests that energy justice become a lever for *action* and community mobilization, so that new transformations to global energy systems can be intently debated, evaluated according to justice principles, and enacted.

Our study, documenting 12 years of energy justice scholarship, offers insight into the rich variety of methodologies, case studies, technological focus, and findings from a state of the art sample of the literature. This literature has some problems—chiefly in terms of diversity—it is still dominated by men and by a focus on Western or Northern countries, and in terms of research design, many studies are still weak on rigour and have no comparative research designs. Nevertheless, we see a diversification of conceptual frameworks that cut across the usual tenants of social justice research, moving beyond only distribution or procedure. We have shown that methods and knowledge from a range of disciplines are being used to

Table 8. Matrix of energy justice criteria versus decision-making and impact assessment tools^a.

Selection	Technology		Project				Plans, policies and programmes	
	Multi-criteria decision-making (MCDM)	Non-statutory	Environmental impact assessment (EIA)	Strategic environmental assessment (SEA)	Health impact assessment (HIA)	Social impact assessment (SIA)	Health impact assessment (HIA)	Social impact assessment (SIA)
Tools Energy Justice Criteria ^b	Non-statutory	Statutory	Non-statutory	Non-statutory	Non-statutory	Non-statutory	Non-statutory	Non-statutory
Sufficient Energy Resources for Daily Needs	Can be covered under 'Technical', 'Economic' and 'Social Aspects'.	A mitigation measure for 'Socio-economic Environment'.	Can be a mitigation measure for 'human health'.	Can be a socio-economic mitigation measure.	Can be a mitigation measure regarding 'poverty'.	Can be a mitigation measure regarding 'poverty'.	Can be a mitigation measure regarding 'poverty'.	Can be a mitigation measure regarding 'poverty'.
Avoiding Energy Poverty	Can be covered under 'Technical', 'Economic' and 'Social Aspects'.	A mitigation measure for 'Socio-economic Environment'.	Can be a mitigation measure for 'human health'.	Can be a socio-economic mitigation measure.	Can be a mitigation measure regarding 'poverty'.	Can be a mitigation measure regarding 'poverty'.	Can be a mitigation measure regarding 'poverty'.	Can be a mitigation measure regarding 'poverty'.
Due Process and Human Rights	None. Rights' efforts are better supported where the UN <i>Guiding Principles on Business and Human Rights</i> (UNGP) (Ruggie 2011) are upheld.	Produced a non-technical summary. Include a description of how the assessment was done.	Fully applicable.	Fully applicable.	Fully applicable.	Fully applicable.	Fully applicable.	Fully applicable.
Open and Accountable Energy Decision-making	Democratic efforts are better supported where the <i>Aarhus Convention</i> (UNECE 1998) is upheld.	A mitigation measure for 'Socio-economic Environment'.	Can be a mitigation measure for 'material assets'.	Can be a socio-economic mitigation measure.	Can be a mitigation measure regarding 'poverty'.	Can be a mitigation measure regarding 'poverty'.	Can be a mitigation measure regarding 'poverty'.	Can be a mitigation measure regarding 'poverty'.
Energy Resource Savings	Can be covered under 'Economic Aspects'.	A mitigation measure for 'Socio-economic Environment'.	Can be a mitigation measure for 'material assets'.	Can be a socio-economic mitigation measure.	Can be a mitigation measure regarding 'poverty'.	Can be a mitigation measure regarding 'poverty'.	Can be a mitigation measure regarding 'poverty'.	Can be a mitigation measure regarding 'poverty'.
Community Development	Can be covered under 'Economic' and 'Social Aspects'.	A mitigation measure for 'Socio-economic Environment'.	A mitigation measure for 'population' or 'protected community status'.	Can be a socio-economic mitigation measure.	Can be a mitigation measure regarding 'poverty'.	Can be a mitigation measure regarding 'poverty'.	Can be a mitigation measure regarding 'poverty'.	Can be a mitigation measure regarding 'poverty'.
The Precautionary Principle	Can be incorporated for environmental weighting.	Can be invoked where mitigation measures are perceived to fail.	Can be a mitigation measure for 'population'.	Can be a socio-economic mitigation measure.	Can be a mitigation measure regarding 'poverty'.	Can be a mitigation measure regarding 'poverty'.	Can be a mitigation measure regarding 'poverty'.	Can be a mitigation measure regarding 'poverty'.
Fair Access to Energy Services	Covered by 'Economic' and 'Social Aspects'.	A 'Socio-economic Environment' mitigation measure.	Can be a mitigation measure for 'population'.	Can be a socio-economic mitigation measure.	Can be a mitigation measure regarding 'poverty'.	Can be a mitigation measure regarding 'poverty'.	Can be a mitigation measure regarding 'poverty'.	Can be a mitigation measure regarding 'poverty'.
Protect Natural Environment	Can be covered under 'Environmental Aspects'.	Covered by a wide range of mitigation measures.	Some encouragement for 'Public Participation'.	Some encouragement for 'Public Participation'.	Some encouragement for 'Public Participation'.	Some encouragement for 'Public Participation'.	Some encouragement for 'Public Participation'.	Some encouragement for 'Public Participation'.
Resist Unjust Energy Projects	Little or no provision for 'Public Participation'.	Some encouragement for 'Public Participation'.	Some encouragement for 'Public Participation'.	Some encouragement for 'Public Participation'.	Some encouragement for 'Public Participation'.	Some encouragement for 'Public Participation'.	Some encouragement for 'Public Participation'.	Some encouragement for 'Public Participation'.

^a Based on Kaya and Kahraman (2011), Glasson et al (2008), Kemm et al (2004), and Vanclay (2006).

^b From Sovacool et al (2017).

answer similar research questions. The questions that many academic researchers feel are most important in the field of energy justice are focused on equity, policy and planning, and the risks of new energy systems, but this picture is continually being contested as contributions from these different disciplines to this emerging knowledge space open up new territory. We see 85 specific case studies documenting various forms of injustice, with almost every continent on the planet represented by at least one study, and more than 70 distinct analyses of energy technologies and systems, revealing the emerging geography and technology of global energy injustice. We lastly exhibit an inventory of 34 distinct groups of people, including indigenous communities, the poor, and women, who are continually at risk to energy injustices.

Alongside reflections on where some of the research effort for energy justice may focus next, including recommendations for academic practice, the role of PVE, EIA and SEA mechanisms, for example, these findings remind us that energy justice has the potential agency to serve as the unceasing protagonist in energy research and beyond, provoking researchers and practitioners to remain reflexively normative and active in identifying injustices and vulnerabilities. But it can also serve as a promising progenitor, creating new research methods and themes about the unfolding and often accelerating risks that emerge alongside conventional and low-carbon energy systems, and the intersectional, multi-scalar and even unintended repercussions those may have on the most vulnerable.

Data availability statement

The data that support the findings of this study are available upon reasonable request from the authors.

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