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PERSPECTIVE

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Realist approaches in energy research to support faster and fairer climate action

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Rapid action is needed in the energy sector to respond to the climate emergency. Here we argue for the increased use of 'realist' approaches in sociotechnical energy studies to inform this action. Realist approaches ask not just 'what works?', but also 'for whom, in what circumstances and why?'. They place emphasis on understanding the mechanisms by which outcomes of interventions (such as policies) come about and, crucially, how this depends on contextual factors. This can inform action based on existing learning from a wide range of sectors and disciplines—action that is tailored to be effective in specific contexts, and can respond to the potential for unjust outcomes. In this way they can support justice, interdisciplinary working, and urgency in energy research. We consider limitations and drawbacks of the approach (and responses to these), and present a guide to getting started.

The energy sector is the foremost contributor to climate change. It therefore holds the most responsibility to respond to the climate emergency. Rapid and radical change is needed. However, the energy system is a complex sociotechnical system, and changes in technologies and business models will have implications for, and be shaped by, individuals and society. Therefore, change must take into account who will be impacted most and ideally deliver good outcomes for those who experience disadvantage in society. These changes are likely to occur with limited direct evidence or precedent from within the energy sector. Making confident, informed and fair decisions at the necessary pace in such circumstances is thus challenging.

Luckily, there is already a wealth of prior experience of many of the innovations, challenges and opportunities to be found in other sectors. Across health, food, water, banking and so on, similar forms of disruption and transformation have been going on for decades. Whether it is preferences for flat monthly tariffs in mobile telephony[1], the impacts of flexibility in the labour market[2] or the use of social prescribing to address chronic health conditions[3], there are many useful indirect precedents from which to learn. There is also increasing evidence about energy system transformations from a wide range of disciplinary domains that, if appropriately synthesized, could improve our understanding of how technology and society interact and how interventions could bring about transformation.

In this Perspective we argue for the wider use of 'realist' approaches to research to support this learning and inform energy system transformation. Long established in health research but as-yet little employed in energy, realist approaches ask not just 'what works?', but 'what works, for whom, in what circumstances and why?'. Based on thinking about how mechanisms lead to outcomes in different contexts, they provide a powerful way of translating, between sectors and contexts, an understanding of how activities lead to outcomes, and how these might be different for various groups. They also provide a means to synthesize evidence from across disciplinary domains. When used effectively, realist approaches can help justify decisive action without waiting years for dedicated trialling—years we can no longer afford to waste. What we seek to show here is the additional insight that realist approaches can bring, and attach it to an established way of working that researchers can use to frame enquiry of this kind.

Introducing realist approaches

Realist approaches, including realist evaluation[4–7], realist synthesis[8–10] and a more general realist orientation[11], have emerged as a powerful means of explaining change and continuity. Grounded in a critical realist logic: where society is understood to be real, but not necessarily directly observable, these approaches aim to produce theories to explain the patterns that we can see. They provide a bridge between more quantitative approaches (which typically identify patterns in society) and qualitative approaches (which typically seek to describe experiences in society), both of which are commonly used in energy research. Early iterations of these approaches position them as a social scientific response to the dominance of the randomized control trial in the production of evidence for policy and practice[12].

In realist approaches, 'theory' refers to middle-range explanations of how the world works[13]. The term 'middle range' refers to the level of abstraction of the theory[14]. Middle-range theories facilitate explanations that sit between highly abstract generalizations and those that can only be applied in very specific contexts. They should be specific enough to be of practical explanatory use, but general enough to apply across similar cases[14]. In realist research, theories are built up in response to the question 'what works, for whom, in which circumstances and why?'. Answers to this question can constitute theory in themselves; indeed, uncovering 'programme theories', the ideas and assumptions about how a particular intervention, programme or policy is intended to work that are held by those involved in the intervention, is often the first step of the evaluator in conducting realist research[13]. As new insights are gleaned through data gathering, or through literature synthesis, programme theories are further refined to offer explanations that seek to explain how context shapes the mechanisms through which an intervention works, but that also offer opportunities for wider learning. Realist theorizing is also frequently linked to existing middle-range theories, offering further explanatory power[13]. In energy research we could, for example, use practice theory, or a capability approach, as a middle-range theory, allowing us to draw on a wider range of evidence to make further generalization claims.

The realist question is valuable for a number of reasons. The first is because its starting point is that sociotechnical interventions will not work (in the same way) for everyone. Second, the question infers

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Box 1 | Realist approaches in action

Efficiency interventions and householder health. Researchers in Australia used realist approaches to explain the impacts of residential energy-efficient interventions on householder health[44,45]. Previous literature reviews had identified that household energy-efficiency programmes may benefit health, but not how and in which circumstances, so the existing evidence was of limited use in the precise design of effective interventions. Willand and colleagues[45] identified mechanisms that caused improvements to physical health, through improved winter warmth and lower relative humidity, to psychological health, through improved perceived autonomy and social standing and mental health, through improved satisfaction with home and reduced financial impacts. They also found that these mechanisms were shaped by contextual factors including people's expectations, culturally constructed heating practices, technical mastery, and the quality of workmanship and handover. They documented a negative effect on financial constraints for very deprived households, despite intervention measures, showing that not all households benefit from the measures. These insights add to the existing literature by illuminating how any benefits come about for those concerned, as well as showing who does not benefit from interventions. They suggest that effective intervention design should look to directly address household needs as well as being sensitive to the programme's sociocultural context[44].

Energy poverty and social relations through a realist lens. Research by Middlemiss and colleagues on energy poverty and social relations[46] follows a looser realist approach to explain how people's relationships impact on their ability to cope with energy poverty. The authors bring the capabilities approach and realist theory together here: understanding capabilities as mechanisms that shape people's access to energy services, and characterizing the ways in which these mechanisms are in turn shaped by social context. By articulating the key social relations capabilities for the energy poor—the capability to make meaningful relationships, the capability for dignity, and the capability to participate in society—they identify relational mechanisms that shape how people can cope with energy poverty. In addition, they frame these capabilities in a social context, explaining how discourses, people's access to resources, people's membership of particular social groups and their performance of social roles shape the presence of these capabilities/mechanisms. Note that this paper is less explicitly tied into realist language than some of the other contributions that we profile here. It is an example of how a realist approach and the realist logic of context, mechanisms and outcomes can be brought together with other theories to explain why change occurs.

Transferability of findings between sectors. Prosumer-centred business models such as peer-to-peer (P2P) electricity trading may play a prominent role in decarbonization. However, they are at the relatively early stages of real-world trialling and there is little evidence as to their social impacts if more widely deployed. This work by Fell[47] looked instead to extensive evidence on the much more established P2P accommodation service Airbnb to see if useful, transferable lessons could be learned. Taking a realist approach, it identified a number of relevant contexts, mechanisms and outcomes. For example, there is consistent evidence of discrimination by Airbnb hosts and guests on the basis of factors such as race and gender (for example, in choosing whether to accept accommodation requests[48]). The mechanism for this is the (new) widespread ability for users to express individual preferences over which hosts or guests to deal with, leading to some finding it harder to secure guests or accommodation, in turn affecting prices. This occurs in societal contexts where there exist explicit and implicit biases connected with race and gender. Introducing this level of choice into electricity trading might reasonably be expected to have some similar effects. As we drive it forward, therefore, we should pay special attention to monitoring and, if shown to be necessary, mitigating this potential risk.

a different model of causation to that more commonly used in positivist research, where patterns of effect are recorded, and hypotheses are built up around the relationship between these patterns and a particular intervention. Positivist research tries to answer the question 'what works?'—testing whether an intervention works or not by looking at the outcomes that it produces. However, this approach may not capture unintended consequences of that intervention, its failure (interventions are never 100% effective) or the reasons why success, failure or unintended consequences come about. Positivist research also does not capture the underlying generative mechanisms through which an intervention produces outcomes. A realist approach contends that this is not enough; monitoring what happens to the dependent variable, finding statistical relationships to independent variables, and offering explanations for these patterns does not capture the full story[4,15,16].

This realist model of causation is articulated by three key concepts: context, mechanism and outcome.

'Context' describes the circumstances, conditions and environment in which an intervention takes place. It attempts to capture the ways in which more structural social phenomena shape the outcomes of an intervention. For example, what happens to people during an intervention can be shaped by the demographic to which they belong and how it affects their access to resources, their expectations of how things should be done and what is and is not socially allowed, and how neatly the intervention fits with their existing roles and responsibilities. Realist research sometimes enumerates features that impacted on the intervention, and sometimes understands context as more relational and dynamic—describing a system rather than a list of features[16].

'Mechanism' describes the triggers of particular outcomes, typically stemming from resources offered by an intervention or how the intervention changes people's reasoning[15,17]. We use the concept of mechanisms to uncover precisely how people respond to interventions—to articulate what happened to people who experienced either positive or negative consequences of an intervention. This might be directly connected to a change in resources or reasoning as experienced by a participant or it could be an indirect consequence of these kinds of change.

'Outcomes' describes both the intended and unintended results of an intervention. They are what happens as a result of the intervention (whether positive or negative), and as such are approached relatively openly—both direct and indirect effects are considered. Mapping an intervention's intended and unintended effects helps understand how outcomes are the result of contexts, which in turn shape generative mechanisms.

The theory emerging from this can be a description of 'context-mechanism-outcome (CMO) configurations'[13], which are descriptions of patterns of causation. A CMO configuration states how contexts shape mechanisms, creating outcomes for a particular intervention. Often, realist research is most interested in the

identification of mechanisms, as this is a neglected area of theory in more positivist approaches (Box 1). One advantage of articulating mechanisms is their association with human agency: the approach helps to identify where people acted and why[18]. Realist theory might also use these concepts more loosely[19], drawing in other mid-range theories, using existing explanations to add depth and nuance, or to aid translation between sectors (Box 1).

Realist approaches have been most extensively used in health research[8,9]. Growing interest from policy circles is also apparent through the addition to the UK Treasury's Magenta Book of a supplementary guide on realist approaches[7]. So far, however, there has been relatively limited use of this approach in energy studies. For example, searches on the bibliographic database Scopus reveal just ten papers classified under 'energy' referring to realist synthesis, review or evaluation in the title, abstract or keywords. This compares to over 1,000 in the 'medicine' category. It is important to stress that energy research has been far from blind to consideration of why certain interventions work or not, and how their impact might fall differently on different groups. However, the extent to which outcomes are explicitly related through analysis to the mechanisms that are thought to cause them, and the contexts in which these operate, is often either not fully considered or remains implicit.

Key benefits for energy studies

Justice. There is a strong relationship between the energy system and human well-being[20]. Conversely, development and operation of the energy system can damage well-being and constitute an injustice[21]. Realist approaches can help to identify and avoid potential injustices arising from energy system transformation. Our understanding of 'justice' in this discussion includes the distribution of ills and benefits arising from energy system transformation, for example, displacing populations living in the path of hydropower developments[22], excluding vulnerable people from engaging in the transformation[23] and concentrating large-generation technology development in deprived areas[24]. We also consider other dimensions of justice including recognition of the diversity of participants and experiences in affected communities and participation in political and policy processes[25]. Energy system transformation must take these dimensions of justice into consideration to ensure that policies and programmes recognize the differing needs and impacts for participants, do not exacerbate existing inequalities, fairly share the benefits of transformation, and are transparent and enable participation.

The close focus of realist evaluation, synthesis and review on context—and specifically its relationship with mechanisms and outcomes—is particularly helpful in identifying and avoiding potential injustices. For example, examining how interventions change (or do not change) contexts, or how interventions generate mechanisms that change opportunities for participants, is important given that, in this way of thinking, mechanisms generate outcomes of interest for specific types of people ('for whom') in particular circumstances. By recognizing that mechanisms are active for specific types of people and in particular circumstances, this approach explicitly takes the diversity of participants and the likely diversity in outcomes into account[15]. If an intervention does not lead to positive outcomes for some participants, its benefits will not be distributed evenly. Conversely, if interventions negatively disrupt context, or activate unintended mechanisms, this could result in undesirable outcomes for some groups of people, in some circumstances. Those affected may then suffer harm, affecting the distribution of 'ills' and requiring alternative or additional policies to avoid that harm. A realist approach is much more likely to identify potential injustices than an aggregated analysis that considers impacts across a population and whether policies are effective 'on average' (and even on average within population sub-groups, regardless of context).

For example, the policy area of fuel or energy poverty—the inability to access adequate energy services—is widely considered a systemic and complex problem[26–29]. The current definition in England of fuel poverty, as a problem of inefficient housing stock inhabited by low-income households[30], takes a narrower view. The resulting policies in England focus on bringing low-income homes up to energy-efficiency band C and above. Such policies are likely to have positive effects for many households, but are unlikely to address all of the facets of this complex problem as outlined above.

Seeing this through a realist lens, we can recognize that a variety of contexts shape energy/fuel poverty in richer nations, including low incomes, poor housing stock, the precise workings of energy markets, health status, social isolation and tenancy relations. Interventions are also likely to trigger a variety of mechanisms, for example, increasing energy literacy, supporting people through change to help them face fears associated with financial risk, or offering new resources to ameliorate housing stock. Each of these mechanisms is known to be more or less successful in particular contexts. For example, increasing energy literacy is unlikely to result in positive outcomes if people are already carefully rationing consumption (as is often the case in fuel-poor UK households)[31]. Households have been known to reject housing improvements due to suspicion of resources offered for free[32]. Realist approaches allow us to see the broader experience of fuel poverty (the context of interventions), to unpack how this will play out in everyday lives (mechanisms) to produce outcomes that either further entrench or alleviate fuel poverty. Understandings built using a realist approach therefore elicit more systemic and contextually grounded policy recommendations.

Understanding what works for whom and how is also critical from a procedural justice perspective: in a transition to net zero, many of the necessary actions require substantial shifts in lifestyle from diverse populations. Participation is thus required in both the process of developing interventions and in their implementation. It is important to understand who is likely to engage, why, and how they might do so. A focus on how diverse populations might respond to interventions will also help to tailor those interventions to their target populations.

Interdisciplinarity. The energy system is a complex system—its transformation requires the deployment of a multitude of technologies, measures and business models, by a range of actors with differing objectives, interacting through physical and social networks, governed by institutional and political systems[33]. This complexity renders single disciplinary enquiry ineffective and demands an interdisciplinary approach. This increases the volume of evidence available, but bringing together this disparate knowledge to inform coherent action is challenging. Realist approaches can help address this in two key ways: through an alternative approach to evidence synthesis, and in the way they can support discussion, evidence sharing and theory development in interdisciplinary teams.

The increasing volume of evidence relating to energy system transformation has prompted a trend for evidence synthesis using well-established methods such as systematic and rapid evidence reviews[34–36]. Literature review methods developed for synthesizing data from experimental medical research bring many advantages. However, these methods can sometimes limit what can be learned, for example, by specifically excluding large portions of literature due to narrow framing, prioritization of quantitative research, and through difficulties in addressing complex problems and the additive approach to synthesis[37]. These limitations present particular problems when trying to promote an interdisciplinary approach.

Many studies using literature review methods do collect data from different disciplines and include evidence on context and transferability (for example, ref. [38]). In some cases, reviews consider data relating to 'for whom' interventions work. However, this is rarely explicitly referenced, suggesting that it is not a central focus of analysis. The focus on realist approaches is to uncover 'how' interventions

work and identify causal mechanisms, which requires an alternative approach to simply assimilating evidence relating input and outcomes. Evidence is used to develop and refine a programme theory, which inherently engages with the assumptions and complexity that can make it hard to assimilate evidence from different disciplinary traditions[10]. It is this that makes the results of realist review relevant to more complex, embedded challenges, typical of energy system transformation, that require interdisciplinary enquiry.

A realist review uses preliminary searches to track programme theories, focusing on identifying the main ideas (for example, administrative thinking, policy history, legislative background and key points of contention) that underpin a particular class of interventions. This stage of the review identifies initial CMO configurations to refine in later stages of the review. This process is distinct from a traditional, systematic search process, which undertakes a scoping/background search with the intention of identifying terms that structure the search for primary studies[39]. A realist, programme theory search is more likely to use manual and iterative search approaches to ensure that fuzzy or contested concepts are included. This will also ensure that relevant studies from other sectors and outside academia are included, which can include the best source of original ideas[40].

Realist reviews then conduct a search for empirical evidence on the class of interventions under analysis (qualitative, quantitative, comparative and so on). This can employ traditional systematic searches, although some iteration is always likely[39]. Reviewers gradually develop and refine the initial CMO configurations identified during the search to better understand how interventions lead to outcomes. The focus on causal mechanisms, rather than on simply 'what works', can help identify measures to manipulate the context or activate a particular mechanism to cause the desirable outcome for a diverse range of groups[9]. Intervention design is thus more likely to reflect the complex sociocultural system in which change happens, increasing the chances of an intervention having intended outcomes for a broad range of participants. Importantly, different mechanisms may best be understood through a range of disciplinary perspectives, rewarding an interdisciplinary team or mindset.

The principles of realist approaches are also able to support interdisciplinary working beyond the field of evidence synthesis. Developing a programme theory can be a helpful way of getting interdisciplinary team members in many forms of research project to share their expectations and assumptions about how and when different outcomes will come about. This has aspects in common with 'Theory of Change' (ToC) approaches[41], and can bring some similar benefits. These include helping to promote discussion and consensus, making hidden assumptions explicit, encouraging the pre-statement of ideas or hypotheses that can be subject to confirmatory analysis, and creating representations of how interventions worked that can be useful in communicating findings. In comparing realist and ToC approaches, ToC tends to be more broadly inclusive of all stakeholders during project or intervention planning, and provides high-level insights at the macro programme level[42]. Realist approaches, meanwhile, can zoom in and add detail on particularly important areas of the ToC, helping show why, exactly, they work in certain settings[42]. This combinatorial approach may be best applied when the primary aim is formative learning, rather than simply assessing the outcomes (success or failure) of a programme[43].

Urgency. Greenhouse gas (GHG) emission cuts made sooner will have a much bigger role in limiting climate change, but there are concerns about stepping into the unknown. Like new pharmaceuticals, we expect innovative services and policies (and so on) in energy to sometimes fail to deliver their objectives, or come with unintended consequences, as discussed above. This can translate into political, commercial and other risks. The result can be paralysis and inaction.

Realist approaches have a part to play in mitigating the risks of bold action on energy system transformation. They invite the researcher (or research user) to look beyond traditional horizons that may determine which evidence on 'what works' is deemed admissible. By focusing on mechanisms and contexts, the transferability of existing evidence from other countries, times, sectors, and so on can more easily be considered and demonstrated (Box 1, 'Transferability of findings between sectors'). As well as guiding our own understanding, realist approaches can also help in structuring clear communication with research users such as policymakers. Indeed, they are complementary to a pragmatic, experiential way of thinking about policy that many policymakers are likely to relate to[10]: 'we are faced with implementing this new scheme A but it's rather like the B one we tried at C, and you may recall that it hit problems in terms of D and E, so we need to watch out for that again' (ref. [10], p. 39). Rather than being held back by a perceived lack of evidence on which to base decisive policy, realist approaches can provide a systematically evidence-informed basis for action and highlight the potential pitfalls.

Drawbacks, limitations and responses

Realist approaches can be subject to a range of limitations. In this section we briefly set out the main ones and consider how their impacts can be minimized (for a more thoroughgoing discussion see refs. [39] and [6]).

The main challenges associated with realist approaches stem from the greater interpretation of data that they demand compared to other approaches. It is insufficient for the researcher(s) to mechanistically identify a range of specified activities and outcomes. Instead, they must develop and confirm, refute or refine ideas about what constitute the important mechanisms and contexts at work (that is, what is 'really going on') in creating these outcomes. This requires a more intimate understanding of the subject at stake and relevant theory, stakeholders and so on. This has a number of implications.

For one, the deliberate building-in of flexibility to respond to what is uncovered during the course of enquiry can limit direct reproducibility. A protocol cannot simply be produced at the start of a study and followed to the letter. Instead, productive avenues are identified and explored as studies proceed. The ability to recreate a study such as a systematic review from the original protocol is part of what enhances its reliability. The best that realist approaches can do is report important details and decisions, potentially employing reporting guidelines such as RAMESES[5,9]. This still has substantial value, as it allows other researchers to check the basis of any claims, which enhances their validity. It is also particularly valuable in the context of the urgency of our current situation, to have the means to collect and synthesize evidence as best as possible to support faster decision-making.

A related limitation is that realist enquiry cannot generally make the same claims to 'comprehensiveness' as other systematic review and evaluation approaches (in the sense of attempting to identify all prior research on a tightly specified topic). It intentionally foregoes efforts to identify all available evidence on the subject of interest, opting instead to focus on uncovering the most useful evidence. Because this could potentially be drawn from a wide variety of topics, it would be both inefficient and impractical to attempt comprehensive coverage. A more purposive, targeted approach is therefore adopted. Although this limitation cannot be avoided, it can be clearly acknowledged (along with its rationale) so that the reader is clear about the intentions of the work.

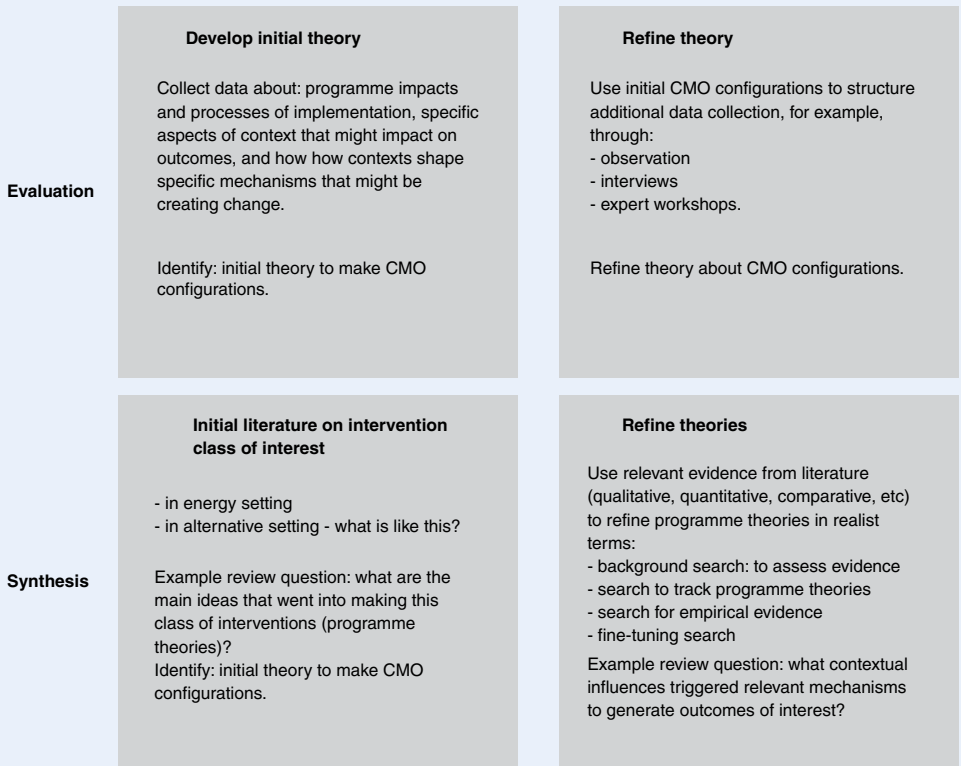
A further implication is that the conduct of realist enquiry can be less easily 'farmed out' to general researchers, potentially raising capacity challenges for research teams. This also prompts the more fundamental critique that it is just too subjective. Generally, the idea that a range of objective observers could come to the same

Box 2 | Getting started with realist approaches

There is an extensive literature on how to deploy realist approaches (such as realist evaluation or realist synthesis), and the RAMESES Projects are a good starting point for resources[49]. In this box we summarize some of the starting principles useful for research projects with an interest in context-sensitive causation for outcomes within a complex intervention or phenomenon, whether or not they are being approached in a predominantly realist way. The first step is constructing a tentative 'programme theory'. This is best done in collaboration with team members if possible:

1. Thinking about the research you are conducting, what interventions did (or will) it involve? And what are the demonstrated (or expected) outcomes?
2. Now, how were/are the interventions expected to lead to these outcomes? Describe the mechanism, if possible, in some detail. So far, you might have something along the lines of, 'Sharing regular updates on social media [intervention] was expected to result in participation in the project [outcome]. This was because people who had previously heard of but knew little about the project would become more aware of the benefits, and choose to participate in order to capture those benefits themselves [mechanism]'. There are likely to be multiple mechanisms to consider.
3. Now think about context. What might affect whether or not each mechanism works as expected? In the above example, this could range from technical aspects such as access to social media, to connection to the relevant social groups, to people's ability to access the benefits offered by the project and their relative appeal. By considering context, we can now see why the intervention might lead to different outcomes for some groups compared to others.

The combination of contexts, mechanisms and outcomes represents the causal claims made within a programme theory. This can now be used to design the collection of data or evidence to establish whether or not the theory holds up, and how it might need to be adapted to reflect the real situation. It can also be used to think through comparable processes in other settings or sectors where the same mechanisms may be in operation that might help yield useful insight. All of this can help improve outcomes for similar programmes in the future. The basic processes involved in realist evaluation and synthesis are summarized in the figure.



conclusions based on a body of evidence strengthens our confidence in the validity of those conclusions. Does realist enquiry therefore place too much reliance on the judgement and interpretation of a single team or individual? Again, the response to this critique must come down to transparency and clarity in justifying research decisions and conclusions. By making clear the basis on which mechanisms are, in certain contexts, related to outcomes, and the logic from transferring these between areas of interest, the researcher or team opens their work to exploration and challenge by others. That the work may stand up to, or fall in the face of, such challenge permits a strong case to be made for validity.

A final cause for concern relating to realist approaches lies not in their underlying philosophy, but in their relatively limited application so far in fields outside of health and social policy. We suspect that the current lack of use of this approach in energy research is due in large part to lack of familiarity, meaning it is not considered when projects are being planned. Although energy is a highly multidisciplinary subject area, education and prior experience in the

main represented disciplines are unlikely to provide much exposure to realist approaches. This extends to research commissioners (for example, government departments), who are similarly unlikely to have much precedent for the approach. Only if it becomes more widely used will examples of good practice and useful outputs become better known, providing confidence for future uptake.

Conclusions

With this Perspective we call for greater application of realist enquiry in energy research. This consists of approaches that place emphasis on understanding how and why interventions work (their mechanisms) to cause outcomes in different contexts. Such an approach is well suited to helping energy researchers address the climate emergency, because it permits the exploration and mitigation of justice challenges, can support interdisciplinary working, and allows rapid but structured learning from related work in other sectors and contexts.

There are a number of steps that researchers persuaded of the potential of realist approaches can take. Some may choose to adopt these approaches wholesale, designing their projects around them. For most researchers, however, simply bringing the principles to their thinking could be helpful. In our experience, having the prompt to systematically think about and express what mechanism really caused a given outcome, and what it was about the context that enabled this, has substantial value. A basic guide to getting started with realist approaches is provided in Box 2. What is beyond doubt, we believe, is that in a time of climate emergency we need to draw on all the diverse learning that that has already been done on what works, for whom, in what circumstances, to rapidly deliver fair climate solutions. Realist approaches provide a framework to do just that.

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Competing interests

The authors declare no competing interests.

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