Regional energy futures as decision support in the transition to net zero emissions: North of Tyne case study

Article  (Published Version)

Copeland, C, MacKerron, G and Foxon, TJ (2022) Regional energy futures as decision support in the transition to net zero emissions: North of Tyne case study. Local Environment, 27 (6). pp. 747-766. ISSN 1354-9839

This version is available from Sussex Research Online: http://sro.sussex.ac.uk/id/eprint/107238/

This document is made available in accordance with publisher policies and may differ from the published version or from the version of record. If you wish to cite this item you are advised to consult the publisher’s version. Please see the URL above for details on accessing the published version.

Copyright and reuse:
Sussex Research Online is a digital repository of the research output of the University.

Copyright and all moral rights to the version of the paper presented here belong to the individual author(s) and/or other copyright owners. To the extent reasonable and practicable, the material made available in SRO has been checked for eligibility before being made available.

Copies of full text items generally can be reproduced, displayed or performed and given to third parties in any format or medium for personal research or study, educational, or not-for-profit purposes without prior permission or charge, provided that the authors, title and full bibliographic details are credited, a hyperlink and/or URL is given for the original metadata page and the content is not changed in any way.
Regional energy futures as decision support in the transition to net zero emissions: North of Tyne case study

Claire Copeland, Gordon MacKerron & Timothy J. Foxon

To cite this article: Claire Copeland, Gordon MacKerron & Timothy J. Foxon (2022) Regional energy futures as decision support in the transition to net zero emissions: North of Tyne case study, Local Environment, 27:6, 747-766, DOI: 10.1080/13549839.2022.2075841

To link to this article: https://doi.org/10.1080/13549839.2022.2075841

© 2022 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group

View supplementary material

Published online: 30 May 2022.

Submit your article to this journal

Article views: 299

View related articles

View Crossmark data
Regional energy futures as decision support in the transition to net zero emissions: North of Tyne case study

Claire Copeland, Gordon MacKerron and Timothy J. Foxon

Science Policy Research Unit (SPRU), University of Sussex, Brighton, UK

ABSTRACT

Futures studies can fulfil a variety of purposes; for informing policy, developing investment or business strategies, and changing perceptions of what the future may hold. Futures can therefore be described as having transformative potential. This paper uses a participatory scenario approach to develop regional energy futures for a U.K. case study in the North of Tyne region. Two sets of futures are developed; pre-pandemic, and during the pandemic. This was for insights into the challenges for developing subnational scale futures, and how futures thinking may have been impacted by the pandemic. The North of Tyne energy future scenarios are based on discussions in two facilitated stakeholder workshops, pre and during the pandemic. It was found that the pandemic had resulted in shifts in practices and behaviours such as increased home working, and an appreciation of local environments and communities. However, there were commonalities too. In both settings, decarbonisation was a strong driver for change in the energy system, as was the need for fairness in the transition. There were barriers in futures thinking that had to be overcome, most notably was the presumption that meeting the net zero target was a certainty. This presented difficulties in imagining futures that didn’t achieve this target or did so more slowly. The importance of being able to imagine living in all kinds of future worlds will be critical in a system undergoing such profound change so that strategic foresight is developed to minimise risks of missing the net zero target.

1. Introduction

1.1. Importance of subnational regions

This research adopts a participatory qualitative approach in the development of future energy scenarios (FES) to support subnational decision making. In the United Kingdom (U.K.) there has been a shift to broader local energy rather than focussing on community energy projects in contributing to the low carbon energy system transition (Devine-Wright 2019). However, in a review of U.K. local or decentralised energy projects, it was found that the way that social, political and spatial factors interact is complex and are difficult to generalise (Devine-Wright and Wiersma 2013). There is nevertheless, an increasing focus on local authorities (LAs) and local enterprise partnerships (LEPs) activities, due to the potential for attracting and leveraging private business investment to
stimulate local and regional “green” economic growth, creating jobs and developing skills (Devine-Wright 2019). At the same time, there has been the creation of new regional authorities, such as the North of Tyne Combined Authority (NTCA) in the north-east of England, with enhanced powers for more strategic regional social and economic development. Through a case study with stakeholders in the North of Tyne region, this paper examines approaches and potential benefits for developing local participatory energy futures where there is an aim to deliver economic and social benefits alongside significant carbon reductions.

Devolution of central government powers increases autonomy in local policy making, and stimulating economic growth in poorly performing regions has been a key motive in agreeing devolution deals (e.g. Lowndes and Gardner 2016). The most extensive devolved powers in the U.K. are in Scotland, Wales and Northern Ireland, where there is the ability to also vary legislation and taxes. Devolved powers within England however, are much more limited in scope and relate mainly to investment funds for creating economic growth and jobs, and adult education for skills development (North of Tyne Combined Authority 2018). However, despite the importance of localism in helping to deliver national carbon reduction goals (Nadai 2019), currently, there is no statutory responsibility for conducting energy planning on a local or regional scale in the U.K. In the government advisory Committee on Climate Change 2021 report on emissions reduction progress, among their priority recommendations for 2021–2023 is the need for central government support to be provided to LAs in helping them fulfil their roles in the net zero emissions transition (Climate Change Committee 2021, 192, 212). The support they suggest includes increased resources (staffing as well as funding), guidance, statutory emissions reporting and a “duty to collaborate” among local and regional authorities and national partners (Climate Change Committee 2021, 192, 212).

LAs are at various stages in developing local plans to meet net zero emissions targets. These local plans are being developed in line with meeting net zero emissions ambitions in their Climate Emergency Declarations (CED). Seventy-four per cent of district, county and metropolitan councils in the U.K. have so far made CEDs, along with eight combined authorities and city regions (Climate Emergency UK 2022). A combination of challenges such as; rebuilding the economy as a result of the global Covid-19 pandemic and Brexit, along with delivering on net zero ambitions, has led to the recent development of approaches to support the greater understanding of local energy systems and opportunities for clean economic growth e.g. Local Area Energy Strategy (LAES) (Energy Systems Catapult 2018). The local or regional scale low carbon energy system transition is viewed as providing opportunities for LAs to deliver on further challenges including; local economic development, providing vital revenue streams, and reducing energy bills for households (Webb, Tingey, and Hawkey 2017). While combined authorities can use pooled resources in delivering low carbon projects, austerity measures and lack of formal responsibility have led to a depletion of expertise needed within many LAs to deliver the net zero transition. It has been argued that this local expertise gap can be provided by intermediary organisations (Webb, Tingey, and Hawkey 2017).

The U.K. government department Business Energy and Industrial Strategy (BEIS) has established a Local Energy Programme to provide capacity and capability support to LAs and enterprise partnerships through five regional Local Energy Hubs (Association for Public Service Excellence 2021). These Hubs provide support to local stakeholders and manage the reopened Rural Community Energy Fund (RCEF) (Department for Business, Energy and Industrial Strategy 2019). Even with such support, there are concerns about the lack of sufficient funding and resources in local and regional governments to bring about the local energy transition required (Tingey and Webb 2020).

The independent Climate Change Committee reports on national decarbonisation progress and warns of a “policy gap” between the trajectory of emissions reductions and the level that is needed to meet legislative targets (Climate Change Committee 2021, chap. 4). There are criticisms too of U.K. energy policy having “seen a series of abrupt reversals, false starts and failures” (McDowall and Britchfield 2020, 11). It is crucial therefore that there is cross-political party support, not just nationally but also locally and regionally, to ensure that energy programmes are enduring (Webb, Tingey, and Hawkey 2017).
The future goal is clear – net zero greenhouse gas emissions – both on national and subnational scales, but it is not clear how this goal is to be delivered at a local level, led by local and regional authorities with competing goals and with limited powers and resources. Thus, there is a need for further engaged research on how to develop energy futures on a subnational scale and how these could inform policy making. To underpin the development of strategies and plans, future visions and pathways are needed that explore the dynamics, risks, and opportunities over a time-frame for the future local energy system.

To demonstrate the value of this approach, this work developed a set of exploratory futures, drawing on discussions in focus groups of regional stakeholders asked to explore the drivers of future pathways. The aim is to draw not only on a diversity of perspectives within the region in a participatory and democratic fashion but also to develop diverse possible futures.

1.2. Energy futures

Futures studies can be a useful aid to planning, decision and policy making when faced with an uncertain and unpredictable future, and there are a wide range of methodological tools and approaches that can be used. To a substantial degree, the choice of method is determined by the kinds of futures questions that are being addressed. Questions about the future generally take the form; what will happen, what could happen, or how to get there from here. For questions of the type what will happen, there is a tendency to adopt quantitative, probabilistic and forecasting methodological approaches (Börjeson et al. 2006). For questions such as what could happen, and how to get there from here, a wider range of futures methods are adopted broadly categorised as qualitative or quantitative methods or even a combination of methods (Börjeson et al. 2006).

In the U.K., the National Grid produces annual “Future Energy Scenarios” to determine investment priorities and identify opportunities for the national electricity network. In recent years, electricity distribution network operators (DNOs) have also produced regional variants of these FES. These futures are developed drawing on both qualitative and quantitative methods and are important in signalling the direction of travel in decarbonising the U.K.’s electricity system (e.g. Fowler, Elmhirst, and Richards 2018).

There are differences in the objectives of a LA compared with those of a (electricity) DNO however. A LA has responsibility for addressing social welfare concerns, and how to improve local regional prosperity. The LA also needs to consider wider energy needs than the DNO focus on electricity, such as energy for transport and heating. It should be noted too that a typical LA covers a much smaller geographical area than a DNO in the U.K. The LA may also have ambitions to achieve the transition on a faster timescale than that implied by these national scenarios. In their climate emergency declarations, many LAs have declared ambitions to be net zero emissions by as early as 2030, whereas the national target for England in U.K. legislation is to achieve net zero emissions by 2050.

There is therefore a need to consider and explore energy futures on a different scale. and often more local, geographical scale than the electricity DNOs’ FES, and with attention to the whole energy system rather than just electricity. This is to not only identify opportunities to satisfy the multiple objectives of a LA, combined authority, or LEP but also to identify risks in net zero emissions plans. In this research, we worked with informed stakeholders to develop energy futures for a particular region in the U.K. that has recently formed a combined authority – North of Tyne. Two sets of futures and pathways were developed – one set in 2019, prior to the Covid-19 pandemic, and one set in 2021. The purpose of the second set was to identify whether the pandemic had led to a shift in the thinking underpinning the future visions and pathways.

This research contributes to energy futures development in two ways; first by focusing on the subnational scale for the development of energy futures to support policy and decision making on this scale, and second how shocks may influence energy futures development.

A qualitative exploratory approach was selected due to the extent of future uncertainties, and being able to incorporate societal attitudes and behaviour, as well as facilitating wider consideration of the roles
of actors in the regional energy system. The repeat of the exercise during the pandemic was to determine what shifts in thinking may have occurred; either because of the pandemic itself, or more generally. This research seeks to address the following:

- How can the development of energy futures support decision making at local or regional scales?
- How have stakeholders’ views on energy futures changed because of the Covid-19 pandemic?
- What are the implications for energy futures as decision support in other subnational regions and for energy futures development more generally?

This research article first discusses the energy futures approach and method being applied to our case study in Section 2. Then in Sections 3 and 4, we describe the features of the two sets of energy futures for the North of Tyne region, developed from the stakeholder discussions in two workshops held in 2019 and 2021. Section 5 provides a discussion of the findings from the development of these energy futures, and Section 6 provides conclusions and insights for the development of useful energy futures on a subnational scale.

2. Methodological approach

2.1. North of Tyne case study

This participatory energy futures case study is based on the North of Tyne region, an administrative area within the North East region of England. North of Tyne represents the mayoral combined authority of Newcastle City Council, Northumberland County Council and North Tyneside Council. The location is in England, and geographical coverage of the NTCA is given in Figure 1.

![Figure 1](image.png)

**Figure 1.** The location of the North of Tyne in England – area in red (Rob (Inops) 2018).
The selection of this region as a case study is largely a pragmatic one, being the geographical focus of wider research activity in the U.K. Centre for Energy Systems Integration (CESI) that has funded this research. The formulation of energy futures for the region is to be used to inform CESI modelling activities.

The devolution deal for the NTCA was secured on 2 November 2018 with the purpose of greater autonomy in local decision making. For the NTCA, the devolved powers include investment funds to create growth and jobs and adult education for the development of skills.

The North East region of England was at the forefront of the industrial era in the nineteenth century. It was called the “workshop of the world” at that time, in an emerging global economy founded on coal, steel and engineering (Hudson 2005). The dramatic industrial decline in the region occurred a century later in the Great Depression, and while there have been attempts to regenerate this has failed to recreate economic activity at anything like comparable levels (Hudson 2005). The collapse of the coal industry in the 1980s has resulted in many facing long-term unemployment, and there was a reliance on LAs providing the support that was needed (Tomaney 2003). Deindustrialisation has led to high levels of social and spatial inequality in the region (Hudson 2005) that still persist today (Pike, Tomaney, and Jenkins 2019), and with worsening health inequality (Corris et al. 2020). Austerity measures following the financial collapse in 2008 have also meant that the funds available to provide support to those in need have been scaled back (Gray and Barford 2018). Nevertheless, widespread public reliance on the state, in particular the welfare system, within the region has continued (Pike, Tomaney, and Jenkins 2019, 14), and it is worth noting that this may not be so strong in other regions of the U.K.

In common with the majority of LAs in the U.K. however, each of the individual LAs within the North of Tyne region in 2019 has made a Climate Emergency Declaration (2021). The combined authority for the region has also made a Climate Emergency Declaration in reference to its own buildings and operations. North Tyneside has declared an ambition to be net zero by 2050 in line with the U.K. government, whereas Newcastle upon Tyne, Northumberland and the NTCA have all declared ambitions to reach net zero emissions by 2030.

In the net zero emissions transition, the energy sector is viewed as being a key sector for delivering economic growth in northern England (Emden and Murphy 2019) and particularly in the North of Tyne region (North of Tyne Combined Authority 2020). This is due to the region’s abundance of natural resources, particularly wind (onshore and offshore), and also the rapid growth in the digital technology sector (North of Tyne Combined Authority 2018). The North of Tyne devolution deal, in improving prosperity for its citizens, also aims to address inequality and has established a dedicated Inclusive Growth Board. There is a focus on improved education levels, skills and better quality employment (North of Tyne Combined Authority 2018).

Within the region, there has been pressure to exploit the remaining coal reserves in Northumberland and Newcastle but for both sites planning applications have been refused (Wilkinson 2020). Flooded abandoned coal mines in the region, and elsewhere in the U.K., have potential for low carbon district heating systems (Gluyas, Adams, and Wilson 2020). Off the coast of Blyth in Northumberland was the first offshore wind farm in the U.K. installed in 1992 (Still 2001), with the last turbine reaching the end of its working life in 2019 (The Crown Estate 2019). Blyth is now a demonstrator site for offshore wind floating technology (Department for Business, Energy and Industrial Strategy 2022).

There is complexity and uncertainty in planning for a future net zero emissions energy system for the North of Tyne region. Energy futures development can assist with navigating this complex and uncertain future landscape to support decision making and planning in the nearer term. The various stakeholders in that future energy system will have different outlooks as to the direction the energy system should head in and have competing sets of priorities that need to be focused on. The futures framework being applied here seeks to draw on these different perspectives while facilitating an open discussion about possible pathways.
2.2. Futures framework

The purpose of this futures study is to develop participatory local regional energy scenarios and gain insights into how the coronavirus pandemic may have led to shifts in futures thinking. The aim is for these futures to support local decision making and strategic thinking, and to inform quantitative modelling activity within the CESI research programme.

There has been a tendency to focus on past and present “knowns” and extrapolate these into the future, particularly in western culture (Slaughter 1996). This historic evidence basis for decision making still persists and can limit thinking as to what the future may hold (Trutnevyte et al. 2016). Further, reducing the future to a single value or range of values in quantitative approaches can mean failing to learn from the futures development process. It can be argued that there are limitations in mathematical and logical intelligence in gaining deep insights (Anthony 2003). While quantitative energy models do have an important role, limiting thinking to outputs from these ignores wider interactions with politics, society and ecosystems (Jefferson 2014), and a criticism is that they can lead to “caged thinking” (Li and Pye 2018). In a review of U.K. energy scenarios produced over the period 1978–2002, almost all of a quantitative nature, it was found that in a large number of cases real-world events lay outside even the scenarios considered most extreme at the time (McDowall et al. 2014; Trutnevyte et al. 2016). The reviewed future scenario studies in that study tended to focus on a particular economic issue prevailing at the time e.g. oil prices or a particular energy technology such as nuclear power (McDowall et al. 2014).

There persists a significant gap between the outputs of models and the advice needed for policy making (Allen, Metternicht, and Wiedmann 2016). To address this it is becoming more common to conduct qualitative scenario analysis to supplement quantitative modelling in exploring potential pathways and their implications (Allen, Metternicht, and Wiedmann 2016, 200).

Whereas quantitative or more probabilistic approaches seek to reduce future uncertainty to assess future conditions in an objective fashion, plausibility thinking takes a different approach. Plausibility approaches to future scenario development acknowledge that uncertainty may not be reducible and therefore prediction is not possible. With plausibility futures uncertainty is built into a diverse range of futures with no attempt to forecast. The focus instead is on internally consistent futures that represent a logical progression from present conditions and are therefore subjective and context dependent (Ramirez and Selin 2014).

In scenario development a lack of embracing discomfort (what is known, ignored, hoped, feared) productively then this can lead to a dominance in particular perspectives and biases. Plausibility futures approaches can be used to avoid this. The power of storytelling enables issues to be addressed without the arguments in specific worldviews or perspectives behind them (Wilkinson and Kupers 2013, 124) and can help foster an understanding across different communities (Ramirez and Wilkinson 2014, 255). Having a sustained programme of scenario development can assist in leaders/decision makers being more comfortable with open future “ambiguity” and can expose assumptions that would otherwise remain hidden, can counter hubris, and develop social capital, developing futures that may happen not just those that participants want to create (Wilkinson and Kupers 2013, 127).

A common and potentially powerful approach to scenario building in exploratory approaches, and the one used here, involves constructing a $2 \times 2$ matrix. In this method, two contextual factors are used as a basis for the future scenarios structure. The most common way of identifying these two factors is through ranking factors according to uncertainty and greatest potential impact over the time horizon and selecting the top two. These two drivers form the axes of the matrix, and high and low levels of each driver make four quadrants each representing a different possible future. A key feature of this matrix approach is that there are no probabilities attributed to any of the resulting scenarios in line with plausibility thinking described above. This is known as the “deductive” approach to intuitive-logics scenarios (Godet 2001) in Bradfield et al. (2005).
The advantage of this approach is the development of a “clear, memorable and easy to communicate structure that allows the subsequent scenario storylines that are produced to be compared – even contrasted – with each other” (Ramirez and Wilkinson 2014, 255). Other authors point to an advantage of this approach as being able to help broaden views as to what are plausible futures, and as such develop different futures with different chains of causality (Wright, Bradfield, and Cairns 2013). Here the participatory and exploratory nature of the approach means that a wholly qualitative approach was adopted i.e. no quantitative modelling was undertaken.

2.3. Stakeholder workshops

A necessary activity in the development of futures using this approach is to facilitate a way for the stakeholders to engage in discussions and exchange thinking, ideas, and information. Two workshops were held with different participants (partially overlapping); one held in person on 5 July 2019 and the second using virtual meeting software on 21 January 2021. Both were facilitated by the lead author with support from colleagues from the CESI Research Centre.

Invitations to participate in the North of Tyne energy futures development exercise were made to stakeholders determined from research of the region and contacts of CESI colleagues. These included local policy makers, energy companies including both renewables and fossil fuel activities, consultancy companies, consumer interest groups and researchers. In this participatory futures method, the stakeholders were selected based on already having some prior knowledge and expertise about the local energy system. The workshops were run as focus groups with informed stakeholders, rather than “mini-publics” that are more commonly used e.g. for citizens assemblies.

Discussions during both workshops were recorded: For the 2019 in-person workshop dictaphones were used, and the 2021 online workshop made use of the online recording facility. All participants were required to complete and sign a consent form prior to each workshop that included their agreement to being recorded and discussions to be used for research purposes.

Stakeholders in the system under study can be defined as those persons that are affected by decisions and actions made, and are able to influence the effectiveness of those decisions or actions (e.g. Freeman 2010) in Reed et al. (2009). The degree of interest and influence for a particular stakeholder, or group of stakeholders, can vary for an object of study and also over time, as both the system under study changes and wider conditions influence outcomes and direction (Reed et al. 2009).

One way of classifying stakeholders is by the degree of influence and interest. In this way stakeholders are classified as either; “key players” who have high influence and interest, “context setters” who also have high influence but low interest, “subjects” (low influence, high interest), and “crowd” (low influence and interest) (Reed et al. 2009). As the method adopted a focus group approach with informed stakeholders there was no crowd representation, except for a single participant at the 2021 workshop. Representation in the other stakeholder categories for both workshops is shown in Table 1.

In the 2019 workshop participants, the vast majority were high influential stakeholders for the region being of types key players and context setters. The second workshop in 2021 again was attended by mostly high influence stakeholders, but proportionally more low influence stakeholders of the types subject and crowd. This did not always translate into dominance in the workshop.

| Category      | Influence | Interest | Examples                                      | 2019 | 2021 |
|---------------|-----------|----------|-----------------------------------------------|------|------|
| Key player    | High      | High     | Policy makers, energy companies                | 11   | 5    |
| Context setter| High      | Low      | Researchers, consultancy                       | 9    | 2    |
| Subject       | Low       | High     | Industry representation, consumer interest     | 2    | 2    |
| Crowd         | Low       | Low      | General public, activist                       | 0    | 1    |
|               |           |          | Total                                          | 22   | 10   |
discussions. For example, an industrial representative participant was able to challenge other participants' preconceptions around what decarbonisation would mean for their sector.

Ideally, the same participants would have attended both workshops, to identify shifts more clearly in futures thinking. However, while recruitment during the pandemic proved to be challenging, in fact, 5 of the 10 participants at the 2021 workshop were also at the 2019 workshop. The 2021 workshop participants had a higher representation of high interest stakeholders (key players and subjects). A possible explanation for this could be the challenge of managing workloads and home life in lockdown conditions, making it difficult for high influence stakeholders to attend.

At both workshops there was an intentional predetermined grouping of the attendees across different categories for the breakout sessions, to enable some open discussions of different perspectives. At the 2019 workshop, the lead author gave an introductory presentation to stimulate discussion, including energy futures for a previous case study (Findhorn an ecovillage in Scotland) to illustrate the approach and some information about North of Tyne. Since the Findhorn community is characteristically very different from the North of Tyne region, it was anticipated that these futures would not unduly influence the attendees.

The 2021 workshop was held using the virtual meeting software within MS Teams. At this workshop, the lead author presented an overview of the futures process and a summary of the 2019 set of futures.

The most important drivers for change in the North of Tyne energy system were determined from discussions among the participants. This was primarily in smaller groups focusing on one of the following four predetermined categories: economy, society, environment, and any/all. These were then discussed by all participants collectively and the top two most important were voted upon. The top two form the framing for a set of four different future scenarios or worldviews with either high or low levels of each driver.

Participants were then allocated one of the four scenarios in the 2 × 2 matrix and discussed the possible progression through time of the scenario – a “pathway” – using a sheet with the breakdown of different parts of the energy system and timeline as a prompt. These were then presented to all participants for comment. The pathways could only be developed to a certain degree during the workshop, and a few stakeholders were not able to attend the whole workshop. More detail was added by the authors based on the recordings following the workshop and these were shared with the participants to comment upon.

In the next two sections, the energy futures developed from discussions at the 2019 and 2021 workshops are outlined.

3. North of Tyne futures 2019

3.1. Drivers for change

The first step in the approach was to determine two key drivers for change in the North of Tyne energy system. The stakeholders were allocated to one of four groups, and assigned one of four topic areas: social, economic, environment and an “any”.

What became apparent from the discussions was that the decarbonisation targets for many were considered a certainty. This resulted in an oversight initially as to decarbonisation being an important driver for change. Monetary cost was also seen as a dominant factor in achieving any change; “cost drives what is done” to quote one attendee in the Economic grouping. What was also pointed out by participants was that there is a cost associated with failing to decarbonise too. This led to discussions around the importance of communication, though generally it was acknowledged that the cheaper it is, the more (decarbonisation) can be done.

A theme that arose persistently during the workshop was fairness and equity. This theme was present in discussions around who pays and what costs relate to, and in ensuring that decarbonisation incentivisation frameworks do not just reward the wealthy. An example given was that those in
rented accommodation can be constrained in their energy use as will most likely have to accept the extent of energy efficiency measures that may or may not have been installed, and not being permitted to install devices such as batteries. Landlords may further maximise receipts from Feed-in Tariff (FiT) on solar panels installed, for example, that are not passed on to the rentee.

It was suggested that in addressing inequality and fuel poverty there should be a policy shift towards meeting minimum energy needs rather than a focus on minimum wage levels to support financial means for paying for those needs. This led to questions around who decarbonisation is for, and who benefits. It was further noted that energy needs are not uniform; they can be location specific, and due to a range of individual socioeconomic characteristics. For there to be a “just energy transition” this means not leaving anyone behind (economically and socially). It is not just about (wealth and services) distributional justice but also participatory justice (Jenkins et al. 2021). However, how can widespread participation be ensured? It was pointed out that the young are now tending to obtain their information from internet tools and social media rather than TV programmes (the main source for older generations). In meeting communication needs therefore the different ways people obtain information should be considered.

The regional identity featured in discussions in three ways: the devolution deal, the region’s landscape, and boundary issues.

With the recent devolution deal for the region, there is an opportunity to define a new identity for the North of Tyne. This region is located within the North East that also has a particular identity and character. A vision around the potential for the North of Tyne, along with a regional identity can be a strong motivator for action e.g. Tees Valley airport. This vision could be helpful in succeeding in achieving the energy transition and more swiftly.

The North of Tyne is home to a diverse landscape, with very rural and urban areas, a large national park, and areas of designated scientific interest. There has been some push back on extensive deployment of onshore wind in Northumberland, and questions arose as to what would a fair quota be, in meeting national climate targets?

And finally, there is complexity at the boundaries with people crossing these boundaries to live and work. Care is needed in attributing the level of decarbonisation to specific regions.

A list of all the drivers for change mentioned within the workshop are shown in Table 2.

In discussing the top drivers for local energy system change with all attendees, equity and fairness were almost unanimous in their high level of importance, even though strong opinions were expressed about financial cost. As mentioned above, it was noted that decarbonisation was not being put forward as a major driver. When prompting attendees as to why some responded that they had taken this driver as a given. It was further pointed out that this is a fundamental driver for change in the energy system, and the pace of change could be faster or slower depending on a whole host of factors and conditions.

Consensus finally settled on the two key drivers for change for the region being decarbonisation and equity. These formed a $2 \times 2$ matrix that was then used to frame the development of four

| Table 2. Drivers for change. |
|-------------------------------|
| **Driver** | **Description** |
| Cost and affordability | Phrases used in relation to cost: “dominates the whole thing”, “cost drives what gets done”. Support for changes needed should be directed by those that need it and not be perceived as making the wealthy wealthier |
| Equity or fairness | Reflection of people living in different locations with a variety of lifestyles, commitments, abilities and resources means that the energy needs of individuals is diverse |
| Activism | E.g. the success of the Extinction Rebellion, and how the young obtain their information |
| Resistance to change | Proposing changes as being better than currently (e.g. switch from coal to gas) can help overcome barriers. But there could be legacy issues for North of Tyne due to previous industrial change and impact that has had. Education can help encourage confidence to change |
| Preservation | North of Tyne is home to some beautiful landscape and countryside and there is a concern how this could be impacted by renewable energy deployment. There is a trade-off here between natural capital and climate change mitigation |
scenarios, each scenario representing a quadrant of the matrix. Each of the four attendee groups was assigned quadrants to discuss how this scenario may evolve over time i.e. a “pathway”, and a name for the scenario. Figure 2 shows the 2 × 2 energy futures matrix for North of Tyne.

3.2. Pathways

3.2.1. Overview

In the pathways development participants were asked to consider the different sectors of the energy system, types of demand, and sectors of the economy. In the sections that follow are descriptions of each of the four scenarios and the developed pathways are in Supplementary Material. Table 3 provides a summary of the key features of each of the scenarios: Fair Bare Minimum, Minimal Change, Just and Sustainable, and Draconian Decarbonisation.

3.2.2. Fair Bare Minimum

In this scenario, there is an improvement in economic prosperity in the region and this affords people to have higher quality lives. This is driven by the success of the digitisation sector and results in greater links with corporations globally. There is also a focus on reducing inequality and particularly fuel poverty in the region. Fuel poverty is tackled by providing fuel bill support rather than incentivising energy efficiency improvements in buildings.

For transport, there is a mixed mode in place, so people have a choice with perceived fairness. There are grants for electric vehicles (EVs), but these tend to benefit the wealthy and so progress on electrification of transport is slow. Carbon tax is gradually introduced, and a tax on flights that is also seen as fair. However, there are increased flights in and out of the region due to increased prosperity, resulting in increased emissions from this sector. There is a tax on road fuels but with conditions in place to opt out if alternative low carbon transport options are not accessible.

There is an element of rewilding as this is seen as equitable for all. Smart meters are rolled out extensively and this facilitates more time of use (TOU) tariffs that successfully shift demand, so it is less “peaky”. Carbon capture and storage (CCS) is seen as far too expensive and problematic to roll out. Decarbonisation measures generally are left to market mechanisms and therefore progress slowly. Local attractive financial regimes bring energy-intensive industries back to the region. There are tensions between land available for housing and industrial development and protecting the landscape. Some green belt land is gradually sold off for high end housing.

3.2.3. Minimal Change

In this scenario, the neoliberal agenda prevails, and the profit incentive approach drives the economy and the energy sector. Costs and benefits of any change are considered only in
monetary terms. This means that societal and environmental costs and benefits are only met if it is deemed financially advantageous to do so. Due to powerful lobbying by corporations, there is a little political appetite to put in measures to curtail emissions further nationally and regionally. Only slow progress is made in decarbonisation. Any progress made is due to the relative costs of renewable and non-renewable technologies, which are manufactured and developed overseas.

The local skill base is diminished, leading to the best employment opportunities being given temporarily to workers outside the U.K. Employment for locals is low skilled and precarious depending on the profitability of the corporations. More interconnectors with Europe are planned and this helps to decarbonise the energy system to some extent. Gas is still heavily relied on for heating. CCS is extremely slow to get off the ground, due to a lack of incentive to experiment in the U.K. since corporations want assurances that they can achieve sufficient profit levels.

A shift away from petrol and diesel cars occurs but only because global manufacturers have stopped producing them. This leads to a need to roll out EV infrastructure but only where profits can be made for investors. The result is that a significant proportion of the population in the region cannot afford EVs.

3.2.4. Just and Sustainable

The low carbon transition in this scenario also prioritises fairness. Policies are developed with all members of society in mind to improve fairness and equity.

The egalitarian economy is strongly orientated towards local development, maximising secure employment for its citizens. Devolved administrations ensure that local communities’ voices are heard in development of the region, and by appropriately balancing financial and environmental pressures. This stimulates local wealth creation and local energy generation.

There is an immediate focus and programme of action on education and skills training so that communities benefit from new employment opportunities in the decarbonised economy. There is a surge in community energy projects facilitated and incentivised by the devolved administration. Examples include collective community ownership of renewable technologies, and minimal corporate ownership except for the largest scale projects such as district heating. Regulations ensure that vulnerable members of communities are also able to partake in the benefits of such schemes. TOU tariffs are tempered by measures to protect those less able to pay.

Local banks are established to further ensure local issues are incorporated into financial decision making. There is a strong circular economy and as much recycling and repurposing as possible is undertaken locally.

Rebalancing decisions made towards consumers restore consumers’ levels of trust both in corporations and governance. This, along with the roll out of an education programme, enables the decarbonisation path to happen at a faster pace than predicted, and the North of Tyne region becoming a model example for the rest of the world to follow in mitigating dangerous climate change.
3.2.5. Draconian Decarbonisation

Under this scenario high levels of decarbonisation are achieved, but with poor levels of well-being and high inequality. The current monetary system persists with recouping costs for decarbonisation falling disproportionately on the poorer members of the community.

To achieve high levels of decarbonisation strong restrictions from central government and devolved regions on activities and energy technology deployment are in place. The energy system is predominantly a centralised system and tightly under government control.

The protection of the green belt is weakened, and this has led to a dramatic increase in onshore wind development as well as more housing being built for predominantly the affluent. Housing is under mandatory energy efficiency improvement ratings, and this has led to landlords passing on costs to those renting. Fuel poverty increases as the poor and more vulnerable members of society struggling to meet the higher housing costs.

Low carbon investments in the region are mainly from global corporations who recruit skilled employment mainly from overseas. Limited skills training is undertaken within the region leading to many in insecure employment.

6. North of Tyne futures 2021

6.1. Drivers for change

As for the 2019 workshop, the first part of the futures development involved considering what are the main drivers for change for the energy system in the North of Tyne region. Participants were divided into breakout rooms to consider different types of factors: economy, society, environment, and other/any. The suggestions for drivers were aggregated according to similarity and then these factors were then put to an online poll. Workshop participants were allocated two votes each for their top two drivers for change. The results of this poll are shown in Figure 3. As can be seen, the top two drivers were found to be decarbonisation and place-based approaches, closely followed by jobs/skills and changes in energy demand profiles.

A notable change from the previous workshop is that this time notions of equity were not such a strong driver. This does not imply that this driver was no longer an issue and could be seen as relevant across some of the other drivers e.g. reflecting characteristics of locations in place-based approaches, and in the jobs and skills agenda. Therefore, while the strongest two drivers were agreed to be decarbonisation and place-based approaches, other drivers can of course be present in each of the future views to some degree.

The 2 × 2 matrix of futures developed in this stakeholder consultation is illustrated in Figure 4. The pathways for each of these four future views for the energy system in the region are outlined in the section that follows.

![Figure 3. Poll on drivers for change in the energy system in the North of Tyne region.](image-url)
6.2. Pathways

6.2.1. Overview
In the pathways development participants were asked to consider the different sectors of the energy system, types of demand, and sectors of the economy as before. This time participants were asked to consider in addition the roles of different energy system actors in each future scenario such as: policy and governance, industry, business and institutions, and households. This is to reflect actors in the energy system with a range of different energy needs and behaviours.

In the sections that follow are the descriptions of each of the four scenarios, and the developed pathways are provided in the Appendix. Table 4 provides a summary of the key features of each of the scenarios; Local Good Life, Missed Opportunities, Greta Green and Electric Central.

6.2.2. Local Good Life
A core feature of this scenario is local governance, and in this future the region secures greater devolved powers having built trust with the government and local people. This results in the region being granted block funding by central government rather than needing to apply for competitive funding for specific projects.

There is a drive to create 15-minute communities across the region and to bring diverse communities and neighbourhoods closer together, leading to improvement in quality of life. This has the effect of increased walking and cycling and more pedestrian and green areas in towns. There are also local hubs to reduce the working commute. The region will also experience growth in SMEs

Table 4. Summary of North of Tyne 2021 scenario features.

| Local Good Life | Missed Opportunities | Greta Green | Electric Central |
|-----------------|----------------------|-------------|-----------------|
| Place-based approaches: High | Place-based approaches: Low | Place-based approaches: High | Place-based approaches: Low |
| Decarbonisation: Low | Decarbonisation: Low | Decarbonisation: High | Decarbonisation: High |
| Devolved powers | Low levels of funding | Tailored approaches to decarbonisation | Decarbonisation more nationally driven than local – high electrification |
| Regional prosperity | Wind power increases on and offshore but heating decarbonisation stalls | Businesses attracted to area – inwards investment | Levies and taxes on emissions help speed up decarbonisation |
| 15-minute community | No new technological development | Battery industry brings prosperity to region | Communities form groups to take advantage of incentives |
| Community diversity and increased green spaces | Lack of inclusivity – inequality and fuel poverty levels rise | Partnerships with clean industries develops skills within region | Prosperity is patchy within the region as the lack of tailoring benefits some and not others |
| Flourishing local businesses | Missed net zero targets for the region mainly due to misjudging hydrogen availability | Reforestation andrewilding | |
| Missed net zero targets for the region (and likely nationally too) | | |

Figure 4. North of Tyne 2021 energy futures 2 x 2 matrix.
due to increased local activities. Partnerships with industry and businesses for vocational training help ensure the right skills for employment in the region. Improved skills in the region in turn attract more industry and businesses to the area. Growth in the region reflects its strengths: tourism, agriculture, ports, offshore, automotive, and digital technology.

In rural areas, there is support for agriculture and therefore increased jobs in that sector. There are incentives to improve biodiversity and the drive to improve the quality of produce leads to a shift in practices more to organic and permaculture, and this in turn helps decarbonisation to some degree.

Due to costs involved in improving thermal efficiencies in buildings in rural areas, there is a switch from oil heating to gas connecting these to the gas grid. This is because of the expectation that hydrogen does not happen at scale by 2050, leaving these homes, along with many urban ones, dependent on gas grid. There is some deployment of heat pump technologies, but not enough to meet net zero targets.

6.2.3. Missed Opportunities
The underpinning characteristic of this future is little change from current times. Government support for decarbonisation is limited; however, pressure has built up some decarbonisation momentum through other channels – local authorities, businesses. Progress is though slower than that required for meeting net zero emissions targets.

An area where decarbonisation progress is especially slow, like the Local Good Life scenario, is meeting heating demand. Here there is very little government support and incentivisation for decarbonisation for heating. Adoption rates for heat pumps slow further in the North of Tyne, and particularly in rural areas, as costs and disruption remain a persistent barrier to adopting home energy efficiency improvements. This leads to enduring dependence on existing heating solutions. Those that can afford to do so, however, do decarbonise their homes as this is seen as a status symbol, attracting a premium on valuation. The resulting disparity in house prices results in widening inequality in the region.

Businesses and industry decarbonise to extent that may be required to remain competitive elsewhere in the U.K., and overseas. However, those in rural areas remain fossil based including diesel generators for electricity due to a lack of government incentives and lack of funding following the pandemic.

Government funding, including the Levelling Up agenda results in very little funding being directed to the region. This hampers decarbonisation progress throughout the region. The government then claims that devolution is not working and takes much of the devolved powers back to central control. By not having resources to be on the decarbonisation pathway compared to other regions, the North of Tyne misses the net zero emissions target by some margin. There is a prosperity disparity compared with other regions, and the ability to attract and retain a skilled workforce becomes ever more difficult. There is a rise in those in fuel poverty in the region, and low emissions technologies are only available to the wealthy.

Wind power persists as the cheapest form of generation, this leads to further deployment in the region both on and offshore. There are jobs for repair and maintenance and growth in a battery storage sector. Wind deployment however is deemed for the benefit of decarbonising the national grid rather than specifically the North of Tyne region and there is a net electricity export to other regions. The energy system remains largely centralised.

6.2.4. Greta Green
In this future view, the potential of the region to deliver on the net zero target is fully appraised with locations for deployment identified and actioned early. Lots of community and local business engagement and information sharing, to improve understanding of how to deploy the different technologies. Tailored approaches with activities devised in both urban and rural areas determine the action required down to individual household level. This in turn means identifying opportunities
for local businesses, and signals direction of travel for local investment and attracting inwards investment.

Within the region, there is substantial further deployment potential both for offshore and onshore wind power, mainly in Northumberland, despite previous resistance to onshore wind. Contracts for Difference (CfDs) help provide a case for onshore deployment for landowners, and the Crown Estate plays a big role in offshore wind with floating schemes to avoid degradation of seabed. There is scope for smaller scale renewable energy projects from hydro and district heating, and the potential for heating from old coal mines in the region.

Potential for economic growth opportunities from battery storage (whole supply chain) leads to the region becoming a global leader. This contrasts with wind power where much of the valuable parts of the supply chain will remain elsewhere in Europe. An upskilling local people programme is commenced in schools. There is growth in U.K. engineering and especially in the North of Tyne region.

Hydrogen availability is centred around industrial clusters which the North of Tyne region lacks – the nearest being Teeside just south of the region. Therefore, much of the investment and deployment activity is around other technologies to meet the net zero goals. Potential for CCS is limited.

With Northumberland being a destination region, many travelling within the U.K. and particularly in the summer months, there is pressure to provide the appropriate infrastructure for decarbonised transport. Charging points for EVs being installed in such as Kielder Castle and will be deployed elsewhere. Challenges in deploying enough renewable electricity and balancing with a need for growing numbers of EVs but smart infrastructure and tariffs help manage this effectively. Hydrogen vehicles become more available in later decades.

Lack of power in rural locations is an issue in the deployment of decarbonised technologies and that issue to be addressed early. Following this, broadband connectivity is deployed to all areas to ensure no one left behind in harnessing benefits of smart technologies.

### 6.2.5. Central Power

In this future view, there is very much a reversion to more centralised control and devolved powers are dissolved. The strong national drive for decarbonisation leading to government overturning any local planning and opposition, to further deployment of renewable energy technologies in locations where financial returns are most favourable. This leads to widespread onshore wind deployment in Northumberland and offshore wind along the coast of the North East. A new two-way interconnector with Europe is also developed in the North of Tyne.

There is rapid electrification of transport first, and then heating with a ban on new gas boilers from 2030. Those not connected to the electricity grid are connected in the early 2020s. District heating schemes using mine water are developed in urban areas and are in use in the 2030s, biomass combined heat and power (CHP) are also deployed in the 2030s. Towards the end of the 2030s and in the 2040s the energy system is mostly electrified with some of the gas grid used as a hydrogen store (the rest is decommissioned) when there is surplus wind.

Gas turbines producing electricity are switched over to hydrogen in the 2040s. In the 2040s there is the development of bioenergy with carbon capture and storage (BECCS) plant connecting to a national CCS grid. This net negative emissions technology is via the gasification route producing hydrogen that is used for electricity.

The rapid deployment of renewable energy technology creates jobs in the region, but the majority of the higher skilled are imported in from other regions and particularly overseas. There is a national reskilling programme, but this is not taken up widely in the region, largely due to disenchantment with the central regime, but also resentment that North of Tyne is expected to meet most of the net zero emissions target while financial benefits go elsewhere.

There is a rapid retrofit programme over the 2020s driven by minimum energy efficiency regulation. Following the pandemic and lack of available funds, however, the burden of costs falls on homeowners, housing associations and councils. There are a variety of financial mechanisms to
help, but those that least afford it go with the cheapest poorest quality installers and performance fails to match regulation requirements.

The centralised control results in worsening inequality within the region as little attention is paid to the financial impacts of the rapid decarbonisation programme on certain households. There is an increase in fuel poverty until the late 2030s/2040s when the whole system has decarbonised and there is a public enquiry into addressing fairness and more help is provided to support those more vulnerable in society. There are community action groups, and this is around campaigning for more green spaces and improved biodiversity in their local areas. This is supported by central government as seen as part of meeting the overall decarbonisation drive.

Businesses and industry are incentivised to rapidly decarbonise, and they can then maintain their competitiveness in international markets. Agriculture is incentivised to diversify revenues, by accepting wind deployment on their land and they are also incentivised to improve biodiversity and switch to organic and permaculture methods. Batteries for storage is a big growth area for the region as is digital technologies. This does encourage some training and skills development in the region and in turn does attract workers to the region reversing the ageing population trend.

7. Discussion

This discussion section applies the research findings to the questions raised in Section 1.3. These are as follows:

- How can energy futures support decision making at local or regional scales?
- What shifts in futures thinking have arisen because of the global pandemic?
- What are the implications for energy futures as decision support in other subnational regions and for energy futures development more generally?

Each of these questions is addressed in turn.

Local regional energy futures as decision support?

With the region having suffered badly from economic restructuring in the past, along with a need for a just transition to ensure no-one is left behind, there are strong elements of equity and well-being in both sets of futures. Interestingly, these were more pronounced pre-pandemic, even though there are signs that the pandemic has led to growing inequality (Stantcheva 2021). During the pandemic, the importance of the place-based approach driver could be a direct consequence of people spending more time in and around their homes due to lockdown restrictions. Local and regional identity also appears strongly to reflect a range of the regions’ characteristics, its history, and ability to deliver on climate emergency declarations. The devolution deal for the North of Tyne region provides opportunities to meet the objective of “green” economic growth and in reducing inequality. However, securing funding from central government is with the expectation of attracting substantial private sector investment. There is a need therefore to appeal to investors both within and outside the region. In the first workshop there were concerns expressed about the need for a recognisable identity for the region to provide a strong motivator for action and investment. This is a particular challenging for the North of Tyne since this region was newly formed following a breakdown in negotiations in a devolution deal for the whole North East region of England.

The futures approach adopted here facilitated the exploration of non-normative futures. In other words, futures where the net zero emissions target was not met, or at least was not met in the required timeframe. This, for some, was a cognitive hurdle to overcome during the workshop. Many energy futures studies are increasingly focusing on meeting the net zero emissions target such as National Grid’s FES which now present three out of four scenarios as meeting the net zero emissions target by 2050 (e.g. National Grid 2019, 2020). However, there is a danger that
narrowly focusing on normative futures leads to a lack of furthering understanding as to how the system might behave as it shifts in the transition. Further, it could lead to a form of cognitive dissonance where thinking is of the form real-world-is-wrong, models-are-right leading to further poor outcomes in policy and decision making (e.g. Wilson et al. 2017). A continued programme of future scenario development that exposes assumptions and incorporates different perspectives in a non-confrontational way, like the approach adopted here, can lead to developing futures that may in reality happen and not just based on wishful futures thinking (Wilkinson and Kupers 2013, 127). Futures scenario development can therefore be described as having transformational potential.

**Shocks and futures thinking**

There were similarities in the discussions at both workshops, such as the dominance of the decarbonisation driver, but there were also some differences that were not all pandemic related. In the second workshop, there was a sense of a need for more urgent action on decarbonisation, and there was more certainty and knowledge about the electrification of transport, and recognition of the challenges of decarbonising heat.

The need for quality jobs was strong in both sets of futures. In the pandemic workshop, there was much discussion of home working becoming the new working model and what the implications of this will be for energy demand in homes, offices and retail outlets supported by them, and for transport.

During the pandemic workshop, the need for access to green spaces was also recognised as an important factor for local societal well-being. This is to some extent encapsulated in the place-based approach driver and there was further discussion about local services with 15-minute communities.

Whether these factors will endure beyond the end of the pandemic remains to be seen and it is only by having a continued programme of future scenario development that shifts in drivers for change can be highlighted and explored.

**Implications for energy futures as local and regional decision support?**

The qualitative futures approach adopted in this research enabled participants to discuss and develop energy futures in an open way, and not tied to the current operation of the existing local energy system. Societal drivers and behavioural change over time could also be explored and imagined living in a diverse set of futures. It is argued that this provides an advantage over quantitative modelling methods, and a continued programme can realise the transformational potential of future scenario development.

There are two potential outcomes of these futures exercises. The first is that policy and decision makers in the region can overcome barriers in strategic thinking by exploring a broader range of futures than may do otherwise. The modelling community can also use these futures to identify model improvements so that they are more useful to decision and policy makers. The futures developed here also deliberately did not seek to create scenarios around a normative approach i.e. around the net zero emissions target goal. This is in contrast to other futures developed for local energy planning (e.g. Upham, Klapper, and Carney 2016). As already argued above the purpose of the approach adopted here was to expose and explore assumptions, and to counter overconfidence in the realisation of net zero emissions targets.

This qualitative approach is not a replacement for quantification methods which are still needed, not least for identifying progress to net zero greenhouse gas emissions, and in identifying costs and revenue streams for potential investments. The qualitative approach is helpful in framing broader plausible futures than would be possible with a (single) quantitative model, as a range of perspectives can be incorporated along with an allowance for societal and institutional behaviours.
8. Conclusions

Futures approaches can be useful for exploring how futures may evolve and to identify key early investment decisions and policies required to shape the future in the required direction. It is important to recognise that when there is considerable uncertainty, and where substantial system changes that are needed, that futures thinking will evolve over time. Dominant factors at a moment in time can be quickly overtaken by other factors, and in a relatively short period of time compared with the overall futures time horizon. Shocks to the system can and do happen as this pandemic has shown. The repercussions of such shocks, such as the global pandemic, can be difficult, if not impossible, to fully comprehend in advance of their occurrence.

If the U.K. is to meet its legislated climate mitigation targets, this requires the collective efforts of all local areas and regions. There is therefore a need to develop some thinking around local and regional energy futures within national scale futures. It has already been highlighted that some parts of the U.K. may need to decarbonise at a slower rate than others e.g. it was recommended that Wales has a target of 95% reduction by 2050, and some faster with Scotland setting a net zero target by 2045 (Priestley 2019). The electricity DNOs have recently started to develop their own Future Energy Scenarios (DFES), and these tend to relate to the National Grid’s FES. However, there need to be similar activities for local and regional government and combined authorities to address their own set of objectives and challenges.

This research explored the development of participatory qualitative energy futures on a subnational region represented by the North of Tyne Combined Authority. The energy futures were developed from discussions in two workshops held pre and during the Covid-19 pandemic. Participants with a range of perspectives at both workshops were able to discuss challenges in sectors such as agriculture, transport and heating and explore the pathways of these for each of the four discrete worlds framed by the agreed drivers for change.

In both the workshops there was a sense that the transition to a low carbon transition needed to turn around the region that has suffered from economic restructuring (resulting in inequality and fuel poverty) and respect the geographical characteristics of the region (especially the rural areas). The sense of identity was also strong and the region’s history in drawing on its world leading industrial past for the skills required for the future energy system. Though concerns were expressed that quality employment created within the region is given to those living locally and not imported from elsewhere.

This leads to complexity and tension particularly at boundaries. Employment in the region currently is not entirely served by those that live within that region, many live in regions outside North of Tyne. This creates issues in attributing levels of decarbonisation to specific regions and when competing for limited funding could potentially harm democratic relations between regions. This suggests that while activities to decarbonise may need to be focused locally, there is a need to collaborate and coordinate activities across scales not just locally or regionally but across regions and nationally.

Further research is required to understand the opportunities, the needs of local people and businesses, and the barriers in other local and regional areas in the transition to a net zero emissions energy system. It is only by doing this, that the feasibility of meeting net zero emissions targets in aggregate on a national scale can be fully appraised in detail and understood. Alongside this an investigation also as to how to monitor levels of equity and well-being on a subnational scale given the importance in discussions, and what place-based approaches could mean in practice.

Data Availability Statement

The authors confirm that the data supporting the findings of this study are available within the article and its supplementary materials.
Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

The authors are grateful for the funding of this research through the Centre for Energy Systems Integration Programme (CESI) funded by the Engineering and Physical Sciences Research Council [EP/P001173/1] and Siemens.

References

Allen, Cameron, Graciela Metternicht, and Thomas Wiedmann. 2016. “National Pathways to the Sustainable Development Goals (SDGs): A Comparative Review of Scenario Modelling Tools.” *Environmental Science & Policy* 66: 199–207. doi:10.1016/j.envsci.2016.09.008.

Anthony, Marcus. 2003. “Visions Without Depth: Michio Kaku’s Future.” *Journal of Futures Studies* 7 (4): 55–66.

Association for Public Service Excellence. 2021. We are the Local Energy Team and we sit within the Department for Business, Energy and Industrial Strategy (BEIS). https://www.apse.org.uk/apse/index.cfm/local-authority-energy-collaboration/beis-local-energy-team/.

Börjeson, Lena, Mattias Höjer, Karl-Henrik Dreborg, Tomas Ekvall, and Göran Finnveden. 2006. “Scenario Types and Techniques: Towards a User’s Guide.” *Futures* 38 (7): 723–739. doi:10.1016/j.futures.2005.12.002.

Bradfield, Ron, George Wright, George Burt, George Cairns, and Kees Van Der Heijden. 2005. “The Origins and Evolution of Scenario Techniques in Long Range Business Planning.” *Futures* 37 (8): 795–812. doi:10.1016/j.futures.2005.01.003.

Climate Change Committee. 2021. “2021 Progress Report to Parliament.” https://www.theccc.org.uk/publication/2021-progress-report-to-parliament/.

Climate Emergency Declaration. 2021. “The Climate Emergency Declaration and Mobilisation.” Climate Emergency Declaration. 2021. https://climateemergencydeclaration.org/about/.

Climate Emergency UK. 2022. “List of Councils Who Have Declared a Climate Emergency.” March 7. https://www.climateemergencyuk/blog/list-of-councils/.

Corris, Valerie, Emily Dormer, Andrea Brown, Paula Whitty, Paul Collingwood, Clare Bambara, and Julia L Newton. 2020. “Health Inequalities Are Worsening in the North East of England.” *British Medical Bulletin* 134 (1): 63–72. doi:10.1093/bmb/lda008.

The Crown Estate. 2019. “2019 – Blyth Decommissioning.” August 15. https://www.thecrownestate.co.uk/en-gb/media-and-insights/stories/2019-blyth-decommissioning/.

Department for Business, Energy and Industrial Strategy. 2019. “Guidance: Rural Community Energy Fund.” GOV.UK. https://www.gov.uk/guidance/rural-community-energy-fund.

Department for Business, Energy and Industrial Strategy. 2022. “£60 Million Boost for Floating Offshore Wind.” GOV.UK, January 25. https://www.gov.uk/government/news/60-million-boost-for-floating-offshore-wind.

Devine-Wright, Patrick. 2019. “Community Versus Local Energy in a Context of Climate Emergency.” *Nature Energy* 4 (11): 894–896. doi:10.1038/s41560-019-0459-2.

Devine-Wright, Patrick, and Bouke Wiersma. 2013. “Opening Up the ‘Local’ to Analysis: Exploring the Spatiality of UK Urban Decentralised Energy Initiatives.” *Local Environment* 18 (10): 1099–1116. doi:10.1080/13549839.2012.754742.

Emden, Joshua, and Luke Murphy. 2019. “A Just Transition: Realising the Opportunities of Decarbonisation in the North of England.” Institute for Public Policy Research North. https://www.ippr.org/research/publications/a-just-transition.

Energy Systems Catapult. 2018. “Local Area Energy Planning: Guidance for Local Authorities and Energy Providers.” Energy Systems Catapult, Blog. https://es.catapult.org.uk/brochures/local-area-energy-planning-guidance-for-local-authorities-and-energy-providers/.

Fowler, Russell, Orlando Elmhirst, and Juliette Richards. 2018. “Electrification in the United Kingdom: A Case Study Based on Future Energy Scenarios.” *(IEEE)* Power and Energy Magazine* 16* (4): 48–57. doi:10.1109/MPE.2018.2822864.

Freeman, R. Edward. 2010. Strategic Management: A Stakeholder Approach. Cambridge: Cambridge University Press. https://doi.org/10.1017/CBO9781139192675.

Gluyas, J. G., C. A. Adams, and I. A. G. Wilson. 2020. “The Theoretical Potential for Large-Scale Underground Thermal Energy Storage (UTES) within the UK.” *Energy Reports* 6: 229–237. doi:10.1016/j.ejgr.2020.12.006.

Godet, M. 2001. *Creating Futures: Scenario Planning as a Strategic Management Tool*. London: Economica.

Gray, Mia, and Anna Barford. 2018. “The Depths of the Cuts: The Uneven Geography of Local Government Austerity.” *Cambridge Journal of Regions, Economy and Society* 11 (3): 541–563. doi:10.1093/cjres/rss019.

Hudson, Ray. 2005. “Rethinking Change in Old Industrial Regions: Reflecting on the Experiences of North East England.” *Environment and Planning A: Economy and Space* 37 (4): 581–596. doi:10.1068/a36274.

Jefferson, Michael. 2014. “Closing the Gap Between Energy Research and Modelling, the Social Sciences, and Modern Realities.” *Energy Research & Social Science* 4 (Supplement C): 42–52. doi:10.1016/j.erss.2014.08.006.
Jenkins, Kirsten E. H., Benjamin K. Sovacool, Niek Mouter, Nick Hacking, Mary-Kate Burns, and Darren McCauley. 2021. “The Methodologies, Geographies, and Technologies of Energy Justice: A Systematic and Comprehensive Review.” Environmental Research Letters 16 (4): 043009. doi:10.1088/1748-9326/abd78c.

Li, Francis G. N., and Steve Pye. 2018. “Uncertainty, Politics, and Technology: Expert Perceptions on Energy Transitions in the United Kingdom.” Energy Research & Social Science 37: 122–132. doi:10.1016/j.erss.2017.10.003.

Lowndes, Vivien, and Alison Gardner. 2016. “Local Governance Under the Conservatives: Super-Austerity, Devolution and the ‘Smarter State’.” Local Government Studies 42 (3): 357–375. doi:10.1080/03003930.2016.1150837.

McDowall, Will, and Colm Britchfield. 2020. “Evidence in Energy Policy Making: What the UK Can Learn from Overseas.” Institute for Government. https://www.instituteforgovernment.org.uk/sites/default/files/publications/evidence-energy-policy-making.pdf.

McDowall, Will, Evelina Trutnevyte, Julia Tomei, and Ilkka Keppo. 2014. “UKERC Energy Systems Theme: Reflecting on Scenarios.” Report UKERC/WP/ESY/2014/002. UKERC. http://www.ukerc.ac.uk/publications/ukerc-energy-systems-theme-reflecting-on-scenarios.html.

Nadal, Alain. 2019. “Unlocking Energies, Unpacking the Entanglements and Temporalities of Local Initiatives.” Local Environment 24 (11): 971–979. doi:10.1080/13549839.2019.1681950.

National Grid. 2019. “Future Energy Scenarios 2019.” https://www.nationalgrideso.com/future-energy/future-energy-scenarios/fes-2019-documents.

National Grid. 2020. “Future Energy Scenarios 2020.” https://www.nationalgrideso.com/future-energy/future-energy-scenarios/fes-2020-documents.

North of Tyne Combined Authority. 2018. “North of Tyne Combined Authority: Devolution Deal.” https://www.northoftyne-ca.gov.uk/who-we-are/about/.

North of Tyne Combined Authority. 2020. “£3.5 m North of Tyne Programme Seeks Offshore Innovators.” NTCA, Blog, October 20. https://www.nationalgrideso.com/news/3-5m-north-of-tyne-offshore-innovation/.

Pike, A., J. Tomaney, and M. Jenkins. 2019. “The North of Tyne Metro Mayor.” https://www.ncl.ac.uk/media/wwwnclacuk/curds/files/North%20of%20Tyne%20Metro-Mayor%20-%20An%20Office%20Without%20Power.pdf.

Priestley, Sara. 2019. “Net Zero in the UK.” CBP8590. House of Commons Library.

Ramirez, Rafael, and Cynthia Selin. 2014. “Plausibility and Probability in Scenario Planning.” Foresight (Los Angeles, Calif) 16 (1): 54–74. doi:10.1108/FS-08-2012-0061.

Ramirez, Rafael, and Angela Wilkinson. 2014. “Rethinking the 2 × 2 Scenario Method: Grid or Frames?” Technological Forecasting and Social Change 86 (Supplement C): 254–264. doi:10.1016/j.techfore.2013.10.020.

Reed, Mark S., Anil Graves, Norman Dandy, Helena Posthumus, Klaus Hubacek, Joe Morris, Christina Prell, Claire H. Quinn, and Lindsay C. Stringer. 2009. “Who’s in and Why? A Typology of Stakeholder Analysis Methods for Natural Resource Management.” Journal of Environmental Management 90 (5): 1933–1949. doi:10.1016/j.jenvman.2009.01.001.

Rob (Inops). 2018. “Location of the North of Tyne Combined Authority Within England.” This file was derived from: North East Combined Authority locator map.svg Ordinance Survey OpenData: Boundaries and England, Wales and Scotland coastline National Geospatial-Intelligence Agency Ireland, France and Isle of Man coastlines, Lough Neagh and UK–Republic of Ireland border. https://commons.wikimedia.org/wiki/File:North_of_Tyne_Combined_Authority_locator_map.svg.

Slaughter, Richard A. 1996. “Futures Studies: From Individual to Social Capacity.” Futures 28 (8): 751–762.

Stantcheva, S., 2021. “Inequalities in the Times of a Pandemic.” Economic Policy. doi:10.1093/epic/eiac006.

Still, David. 2001. “Offshore Wind at Blyth.” Renewable Energy 24 (3): 545–551. doi:10.1016/S0960-1481(01)00040-4.

Tingey, M., and J. Webb. 2020. “Net Zero Localities: Ambition & Value in UK Local Authority Investment.” EnergyRev. https://www.energyrev.org.uk/outputs/net-zero-localities-ambition-value-in-uk-local-authority-investment/.

Tomaney, J. 2003. “Politics, Institutions and the Decline of Coal Mining in North East England.” Mining Technology 112 (1): 40–46. doi:10.1179/037178493x393551.

Trutnevyte, Evelina, Will McDowall, Julia Tomei, and Ilkka Keppo. 2016. “Energy Scenario Choices: Insights from a Retrospective Review of UK Energy Futures.” Renewable and Sustainable Energy Reviews 55: 326–337. doi:10.1016/j.rser.2015.10.067.

Upham, Paul, Rita Klapper, and Sebastian Carney. 2016. “Participatory Energy Scenario Development as Dramatic Scripting: A Structural Narrative Analysis.” Technological Forecasting and Social Change 103: 47–56. doi:10.1016/j.techfore.2015.10.003.

Webb, J., M. Tingey, and D. Hawkey. 2017. “What We Know About Local Authority Engagement in UK Energy Systems.” UKERC. https://ukerc.ac.uk/publications/what-we-know-about-local-authority-engagement-in-uk-energy-systems/.

Wilkinson, Tom. 2020. “End Opencast Mining.” December 22. https://theecologist.org/2020/dec/22/end-opencast-mining.

Wilkinson, Angela, and Roland Kupers. 2013. “Living in the Futures: How Scenario Planning Changed Corporate Strategy.” Harvard Business Review May: 119–127.

Wilson, A., C. Copeland, E. Tehrani, and C. Dent. 2017. “Modelling in Public Policy.” HubNet. https://www.research.ed.ac.uk/en/publications/modelling-in-public-policy.

Wright, George, Ron Bradfield, and George Cairns. 2013. “Does the Intuitive Logics Method – And Its Recent Enhancements – Produce ‘Effective’ Scenarios?” Technological Forecasting and Social Change 80 (4): 631–642. doi:10.1016/j.techfore.2012.09.003.