SciencesPo
SCHOOL OF PUBLIC AFFAIRS

PUBLIC POLICY MASTER'S THESIS

April 2022

Leaving no-one behind in the energy transition: Lessons learned from the decarbonisation policy in social housing in the United Kingdom

Alice Bergoënd

Master's thesis supervised by Sébastien Treyer
Second supervisor: Gavin Killip
Second member of the jury: Marc Ringel

Master in European Affairs
Policy Stream Social Policy and Social Innovation

Table of Contents

1. Why should I read this research?

This paper is relevant because it contributes to academic debates on policy problems and their resolution, as well as to policy debates on the social dimension of the energy transition in housing, while offering policy recommendations to decision makers.

Contribution to the academic literature

There is a lack of academic research on policy evaluation in the area of decarbonisation of social housing in the UK. Sources from the grey literature evaluate the refurbishment and transition to clean heat of private and social housing in the UK. These include reports, articles and research produced by organisations outside the traditional academic publication circuit, as well as evaluation studies carried out by governments themselves, but there is little public policy evaluation literature that addresses this issue from an academic perspective. Therefore, this paper aims to fill a gap in academic research. Moreover, it also contributes to the academic debate on policy problem definition, and in particular to the literature on wicked problems, by demonstrating that the problem of decarbonising social housing policy in the UK is a wicked problem, and that the definition of the problem and solutions to it need to be explored in a participatory way, with greater inclusion of different stakeholders.

Contribution to the policy debate on the social dimension of the energy transition

In a context where decarbonising housing has significant environmental benefits in terms of reducing carbon emissions, social benefits in terms of reducing energy bills and tackling fuel poverty, and energy security benefits in terms of reducing dependence on imported fossil fuels, it is useful to analyse which policy can best achieve this objective in a way that is fair to all. In the UK, where the housing stock is poorly insulated and national climate ambitions are high, with the target of reducing carbon emissions by 78% by 2035 and achieving net zero by 2050, it is useful to identify the design flaws in past and present social housing decarbonisation policy and the barriers to its implementation, as well as the solutions for implementing a more effective policy. This paper identifies the main barriers to decarbonising the UK's social housing stock and the solutions that could help overcome these barriers. It thus contributes to the debate on how to leave no one behind in the energy transition, providing concrete policy recommendations that could advance the design of public policies on the subject in the UK, but also elsewhere in Europe, where some countries are facing similar challenges.

2. List of abbreviations

BEIS: UK Government Department for Business, Energy and Industrial Strategy
BHBH: Better Housing, Better Health program
CPI: Consumer Price Index
DESNZ: UK Government Department for Energy Security and Net Zero
ECI: Environmental Change Institute
ECO: Energy Company Obligation
EESSH: Energy Efficiency Standard for Social Housing
EPC: Energy Performance Certificate
LAD 1A: Green Homes Grant Local Authority Delivery phase 1
LAD 1B: Green Homes Grant Local Authority Delivery phase 2
ORP: Optimised Retrofit Program
SHDF: Social Housing Decarbonisation Fund
TAF: Technical Assistance Facility
TPAS: Tenants Participation Advisory Service
UK: United Kingdom
WHQS: Welsh Housing Quality Standard

3. Introduction

In the context of soaring gas prices, the decarbonisation of the residential housing stock has gained importance on the political agenda. The building sector is a strong emitter, as it is responsible for 36% of the EU's greenhouse gas emissions. Within buildings, heating plays a considerable role in carbon emissions. While it has long been the elephant in the room in the climate debate, the decarbonisation of domestic heating is getting more attention in recent years. Indeed, IEA assessed that heating uses "about three quarters of the fossil fuels used in the world's buildings".[1] Accelerating the pace of decarbonisation of domestic heating is therefore a central issue from a global environmental point of view. The problem is particularly acute in the UK, where nine out of ten households use gas boilers.

While decarbonising the housing stock is necessary from an environmental perspective, it can also bring social benefits such as increasing comfort and reduced fuel poverty, as well as improved national energy security and independence by reducing energy demand or the demand for imported fuels. Nevertheless, housing decarbonisation's affordability remains a challenge and it can seem a long way off for low-income households. In this context, the poorest households run the double risk of being left behind in the energy transition and being locked into dependence on fossil fuels with increasingly volatile prices to heat their homes, and of being negatively affected by decarbonisation policies if they are not accompanied by strong social safeguards. It is therefore essential to analyse the barriers that prevent low-income households from seeing their housing decarbonised and to define the nature of the policy

[1] The Economist (2018), *In the rush to renewables, decarbonising heating has been overlooked*. [online] Available at : https://www.economist.com/technology-quarterly/2018/11/29/in-the-rush-to-renewables-decarbonising-heating-has-been-overlooked [Accessed date: 20/04/2023].

problem in order to develop solutions in the best possible way to remove these barriers. To target low-income households, this paper focuses on social housing. By focusing on social housing tenants, this study does not encompass low-income homeowners who are asset rich but cash poor, low-income households living in privately rented housing, and people in situations of extreme precarity that may experience poor housing or housing exclusion, and this paper argues that this population could be an interesting object of study for future research.

The choice to focus on the UK is motivated by the fact that, while the country has an ambitious climate target of reducing carbon emissions by 78% by 2035 and achieving net zero by 2050, it also has one of the poorly insulated building stocks in Europe[2]. Therefore, the renovation and decarbonisation of the housing stock constitutes a challenge and it appears interesting to analyse what, beyond political will, could be a barrier to the implementation of a just energy transition in this sector. The analysis of the solutions available in a country with poor housing quality also aims to draw useful lessons for countries with comparable situations elsewhere in Europe, i.e. in countries where the housing stock is old and fuel poverty is a challenge such as in Southern or Eastern Europe[3] [4], in a context where the EU is also aiming at achieving climate neutrality by 2050[5]. The recent literature on the just energy transition has also recognised social housing decarbonisation projects designing innovative ways to achieve affordability in London, Brighton, Oxford, Glasgow, and Dumfries and Galloway[6]. Therefore, the UK is a country where solutions are being explored by actors in the field of social housing to face the challenge of poorly insulated housing, and where it seems appropriate to undertake research for solutions and design policy recommendations. Finally, the UK's unique model of social housing with nearly public-private property development and management organisations and a central role of private finance makes it an interesting case study for analysing the impact that choices about legal status, financing and regulation can have on the decarbonisation process.

The **research question** asked in this paper is**: How does understanding the degree of complexity of the policy problem of decarbonising social housing in the UK help to design the most appropriate policy tool to address it?**

---

[2] Yanatma, S., Euronews.green (2022), *Europe's energy crisis in data: Which countries have the best and worst insulated homes?*[online]. Available at: https://www.euronews.com/green/2022/12/09/europes-energy-crisis-in-data-which-countries-have-the-best-and-worst-insulated-homes [Accessed date: 20/04/2023].

[3] FEANTSA, (2022), E*nergy prices and energy poverty in Eastern Europe, Report from the Metropolitan Research Institute, Habitat for Humanity International and Habitat for Humanity Hungary and FEANTSA´s site visit and expert meeting, in Budapest, 6-7th July 2022*. [online] Available at : https://www.feantsa.org/public/user/Activities/events/2022/Event_Report_-_Energy_prices_and_energy_poverty_in_Eastern_Europe.pdf [Accessed date: 20/04/2023].

[4] FEANTSA, (2022), *Written summary of the FEANTSA, ECODES and Cáritas Española event on Energy Poverty and Rising energy prices in Southern Europe*, [online]. Available at: https://www.feantsa.org/download/written-summary-expert-meeting-madrid-sept-16-2022907626483720345324 8.pdf [Accessed date: 20/04/2023].

[5] European Commission, *Climate Action, 2050 long-term strategy*, [online]. Available at: https://climate.ec.europa.eu/eu-action/climate-strategies-targets/2050-long-term-strategy_en [Accessed date: 20/04/2023].

[6] Sunderland, L. and Gibb, D. (2022), *Taking the burn out of heating for low-income households*, Regulatory Assistance Project. Available at: https://www.raponline.org/wp-content/uploads/2022/11/rap-sunderland-gibb-clean-heating-for-low-income-households-2022-dec-1.pdf

Secondary questions are associated with the research question: What are the main barriers to retrofitting and transitioning to clean heating in social housing in the UK? How have past policies to decarbonise social housing failed or succeeded in their design and implementation? Is decarbonisation of social housing a wicked problem? If so, while the literature suggests that solutions to wicked problems need to be designed with greater consideration to the interests of different stakeholders, what are the solutions recommended by these stakeholders? While it is likely that actors will present different definitions of the problem and possibly conflicting solutions, a complementary question for future research could be what kind of process can be designed to help them develop an alternative set of solutions through stakeholder deliberation. Finally, the paper will ask: what policy recommendations can be drawn from the solutions to best guide the decarbonisation policies of social housing in the UK?

The **first hypothesis** is that the implementation of social housing decarbonisation policy is a wicked problem, which therefore needs to be addressed with greater consideration for the position and interests of stakeholders and that the problem definition and solutions should be assessed in collaboration with them. The **second hypothesis** is that policy for social housing decarbonisation should set ambitious yet realistic targets with a focus on efficiency rather than on choosing a specific technology to be used, with support for innovation and flexibility in the means chosen, and that measures should be implemented with reduced disruption for tenants and strong social safeguards, and increased funding and assistance for social housing providers. The relevance of these two hypotheses to answer the research question is explained in the next section that reviews the existing literature.

4. Theory and interdisciplinary state of knowledge

4.1. Definitions

Before presenting the interdisciplinary state of knowledge on social housing decarbonisation policy in the UK, this section reviews and defines the relevant concepts which will be part of the analysis.

Decarbonisation. According to the Cambridge dictionary, decarbonisation is "the process of stopping or reducing carbon gases, especially carbon dioxide, being released into the atmosphere as the result of a process, for example the burning of fossil fuels".[7] Decarbonisation in housing is associated with improvements in two main areas: fabric and heating. Fabric improvements refers to better insulation through different techniques and is associated with reduced energy costs and an increasing comfort. The transition to clean heat refers to replacing fossil fuel heating systems with clean heating systems such as electric heat pumps or other forms of decarbonised heating.[8]

Energy Performance Certificate. An Energy Performance Certificate (EPCs) is an energy survey that gives a property an energy efficiency rating from A (the most efficient) to G (the least efficient) and is valid for 10 years.[9] EPCs are calculated using the Standard Assessment Procedure (SAP) and based on the amount of energy used per square metre and the level of carbon dioxide emissions.[10] EPCs are needed when a property is built, sold, or rented, and in Scotland, these must be displayed in the property.

Fuel poverty. Fuel poverty has first been defined as the situation when a household cannot have "adequate energy services for 10% of their incomes" (Brenda Boardman, 1991). In England, the indicator used to define fuel poverty is the Low-Income Low Energy Efficiency (LILEE) indicator, and fuel poor households are described as "households living in a property with an energy efficiency rating of band D or below, and, when they spend the required amount to heat their home, they are left with a residual income below the official poverty line" (BEIS, 2023)[11]. For the Scottish government, fuel poor household correspond to "any household spending more than 10% of their income on energy after housing costs have been deducted" (Scottish Government, 2023). For Sunderland (2020), the most cost-effective long-term

---

[7] Cambridge Dictionary, Decarbonization [online]. Available at: https://dictionary.cambridge.org/fr/dictionnaire/anglais/decarbonization [Accessed date: 20/04/2023].

[8] National Housing Federation (2021), *Decarbonisation of housing association homes - a briefing for external stakeholders* [online]. Available at: https://www.housing.org.uk/resources/decarbonisation-briefing/ [Accessed date: 20/04/2023].

[9] Gov.uk, *Buying or selling a home* [online]. Available at: https://www.gov.uk/buy-sell-your-home/energy-performance-certificates [Accessed date: 20/04/2023].

[10] Gov.uk, *Standard Assessment Procedure,* Last updated 28 February 2023, [online]. Available at: https://www.gov.uk/guidance/standard-assessment-procedure [Accessed date: 20/04/2023].

[11] Gov.uk (2013), *Fuel poverty statistics*, [online]. Available at: https://www.gov.uk/government/collections/fuel-poverty-statistics [Accessed date: 20/04/2023].

solution to tackle fuel poverty is the reduction of energy demand through energy efficiency (Sunderland et al., 2020)[12].

4.2. Theoretical concepts

Wicked problems. A wicked problem is a policy problem that is identified as particularly complex because it is the "symptom or result of multiple, contingent, and conflicting issues" and "defies any standard attempt to find a solution".[13] Indeed, research states that these problems are "too complex to be solved by rational systematic processes" and that wicked problems resolution rather comes from "collaborative argumentation and reflection processes".[14] Usual illustrations of wicked problems are the climate crisis or social inequalities.

4.3. Policy context

In order to understand the rationale behind the development of decarbonisation policies for social housing, this section presents statistics on social housing and explain the context of the housing crisis in the country, the impact of the decentralisation of the UK political system on energy efficiency issues, and the current regional and national policies on decarbonisation of private and social housing.

Housing crisis and statistics on social housing. The issue of decarbonising social housing is addressed in the context of the UK housing crisis. The country is facing a housing shortage which is particularly acute in densely populated cities (Centre for Cities, Breach, 2022)[15]. To face this crisis, the UK government is committed to deliver 300,000 new homes every year to match housing demand by the mid 2020s.[16] Moreover, social housing has become less affordable over time, with a stable increase of social rents by private registered providers between 2004 and 2014. It should also be noted that the cost of social housing varies considerably across the UK.[17] In 2021, According to the Office for National Statistics, 4.2 million (17.1%) of households living in England and Wales were in the social rented sector. In 2011, the number was 4.1 million households and represented 17.6%.[18] Data published by the Regulator of Social Housing on 25 October 2022 showed that social housing in England saw a

---

[12] Sunderland, L., Jahn, A., Hogan, M., Rosenow, J., Cowart, R. (2020), *Equity in the energy transition: Who pays and who benefits?,* Regulatory Assistance Project.

[13] Marshall, T. (2008), *Wicked problems*, Design Dictionary, Board of International Research in Design.

[14] Whelton, M., Ballard, G. (2002), *Wicked problems in problem definition*, International Group for Lean Construction 10th Annual Conference, Brazil.

[15] Watling, S., and Breach, A. (2023), *The housebuilding crisis: The UK's 4 million missing homes*, Centre for Cities. Available at: https://www.centreforcities.org/housing/ [Accessed date: 20/04/2023].

[16] Gov.uk, *Government announces new housing measures* [online]. Available at: https://www.gov.uk/government/news/government-announces-new-housing-measures [Accessed date: 20/04/2023].

[17] Office for National Statistics (2015), *Social housing became less affordable over the past decade*, [online]. Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/housing/articles/socialhousingbecamelessaffordableoverpastdecade/2015-08-05 [Accessed date: 20/04/2023].

[18] Office for National Statistics (2023), *Census 2021*: *Housing, England and Wales.* [online], Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/housing/bulletins/housingenglandandwales/census2021 [Accessed date: 20/04/2023].

net increase of around 31,000 social homes between 2021 and 2022[19]. Data from March 2020 from the Scottish Government shows that out of 2.6 million dwellings in Scotland, 58% of dwellings were owner-occupied, 4% were vacant or second homes, 15% were privately rented and 23% were social rented properties[20].

Power devolution and housing decarbonisation in the UK. The UK political system is devolved and this has an impact on the energy efficiency issues of the social housing stock. In Scotland, Wales and Northern Ireland, the devolved administrations are responsible for many domestic policy issues that affect the decarbonisation of social housing, such as health and the environment, but also education, culture and transport. They have the power to legislate in these areas, these are called "devolved powers". Opposed to these devolved powers, the UK parliament and UK government retain some powers called reserved powers.[21] The UK system is not federalism in that powers are devolved to the regions and can be revoked. In fact, since 1998 and the introduction of the three devolution Acts for Scotland, Northern Ireland and Wales, new powers have been devolved. The Scotland Act 2016, for example, devolves new powers to Scotland in relation to energy efficiency (the way the Energy Company Obligation and Warm Home Discount are designed and implemented in Scotland) and income tax (powers to set rates and thresholds of income tax). UK devolution power is also asymmetric, meaning that different governments have different powers. For example, Northern Ireland has considerable devolved power over energy, while England has no devolved parliament. For Jan Webb, the devolution of powers in the UK leads to uncertainty about the status of energy efficiency in relation to institutions as multiple powers are mobilised, devolved or not, and grey areas remain. Indeed, some powers over energy supply are reserved for the UK parliament such as regulation, licensing or taxation, but a high number of other powers are devolved, such as "economic development, planning and permitting, environmental and climate change legislation, building standards, property rights, stamp duty on land, local government and taxation, housing and communities, promoting energy efficiency, improving fuel poverty, winter fuel payments and cold weather payments" (Webb, 2021)[22].

UK government decarbonisation policy. In 2008, the UK government passed the Climate Change Act, updated in 2019, which sets a target of zero net greenhouse gas emissions by 2050. In August 2020, the UK Government launched the Green Homes Grant Local Authority Delivery (LAD) scheme, a £500 million fund dedicated to the financing of energy efficiency and low carbon heating projects, aiming to upgrade up to 50,000 homes, and focusing on low income households across England to tackle fuel poverty. The first phase (LAD 1A) represented

[19] Gov.uk, Regulator of social housing (2022), *Social housing sector stock and rents statistics for 2021/22 show small net increase in social homes*, [online]. Available at: https://www.gov.uk/government/news/social-housing-sector-stock-and-rents-statistics-for-202122-show-small-net-increase-in-social-homes [Accessed date: 20/04/2023].

[20] Scottish Government (2022), *Annual Housing Statistics, 2020-21*, [online]. Available at: https://www.gov.scot/news/annual-housing-statistics-2020-21/ [Accessed date: 20/04/2023].

[21] Civil Service (2016), *Devolution: Factsheet*, [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/770709/DevolutionFactsheet.pdf [Accessed date: 20/04/2023].

[22] Webb, J., van der Horst, D. (2021), *Understanding policy divergence after United Kingdom devolution: Strategic action fields in Scottish energy efficiency policy*, Energy Research & Social Science, Volume 78, 10212.

a £74 million grant allocated to 55 projects in England, and the second phase (LAD 1B) was a £126 million allocated to 81 local authorities for the delivery of energy efficiency projects[23]. However, the Green Homes Grant scheme was scrapped in March 2021, six months after its launch.[24] In October 2021, the UK government published the Net Zero Strategy, setting out policies and proposals for decarbonising the different sectors of the UK economy to meet the net zero emissions by 2050.[25] It has also announced the objective of reducing by 78% greenhouse gases by 2035 compared to 1990 levels.[26] Associated with the Net Zero Strategy, the "UK Government Heat and Buildings strategy" was also presented in October 2021, as the UK-wide plan for housing decarbonisation. It aims to drive down emissions by adopting a "whole-house" approach (an approach that aims to optimise home energy efficiency by considering the house as an energy system with interdependent parts that all affect the performance of the entire system) [27], investing in research and development, promoting "no and low-regrets actions", but also improving the communication on upcoming regulatory changes, offering flexibility and optionality for consumers, and developing policies that target support for those who need it the most. Regarding innovation, the plan announces a £338 million investment over the 2022-25 period for a broader Heat Network Transformation Programme that will scale up low-carbon heat network deployment. Another objective is to make "heat pumps smaller, easier to install and beautiful in design". The plan presents a £450m budget to replace boilers and £3.9bn to decarbonise buildings, and states that with the investments in energy efficiency and the Government support for low income households to pay for the improvements, it will help "reduce energy bills and deliver better, greener, and healthier homes". Among the measures presented, there is developing the market for heat pumps with "600,000 hydronic heat pump systems per year by 2028", reducing the cost of heat pumps by "at least 25-50% by 2025 and towards parity with boilers by 2030", "support consumers who switch early with £5,000 Boiler Upgrade Scheme grants", and an "ambition of phasing out the installation of new natural gas boilers from 2035". Critics on this strategy denounce weak social safeguards, as officials said that no equality assessment was conducted before the strategy was announced (The Guardian, 2022)[28]. For the Climate Change Committee indeed, this strategy is "a step forward for ambition", with remaining "funding and policy gaps", regarding "energy efficiency and low-carbon heat improvements in public buildings and fuel poor homes" (CCC,

[23] Gov.uk (2020), *Green Homes Grant Local Authority Delivery scheme Phase 1: successful local authorities*, Last updated 28 October 2021 [online]. Available at: https://www.gov.uk/government/publications/green-homes-grant-local-authority-delivery-successful-local-authorities [Accessed date: 20/04/2023].

[24] Harvey, F., The Economist (2021), *UK government scraps green homes grant after six months,* [online]. Available at:https://www.theguardian.com/environment/2021/mar/27/uk-government-scraps-green-homes-grant-after-six-months [Accessed date: 20/04/2023].

[25] Gov.uk, Policy Paper, *Net Zero Strategy: Build Back Greener*, Last updated 5 April 2022, [online]. Available at: https://www.gov.uk/government/publications/net-zero-strategy [Accessed date: 20/04/2023].

[26] Gov.uk (2021), *UK enshrines new target in law to slash emissions by 78% by 2035*, [online]. Available at: https://www.gov.uk/government/news/uk-enshrines-new-target-in-law-to-slash-emissions-by-78-by-2035

[27] Energy Saver, *Whole-House Systems Approach*, [online source]. Available at: https://www.energy.gov/energysaver/whole-house-systems-approach [Accessed date: 25/04/2023].

[28] Booth, R. (2022), The Guardian, *Government to consider impact of UK energy efficiency plan on poor households*, [online]. Available at: https://www.theguardian.com/society/2022/may/03/government-to-consider-impact-of-energy-efficiency-plan-on-poor-households [Accessed date: 21/04/2023].

2022)[29]. The analysis also states that while the market-based approach has benefits, it is not without risks, with the UK current supply chains being unable to deliver the objective of 600,000 heat pump installations per year by 2028. In 2019, 35,000 heat pumps were sold in the country[30]. The report states that the "strategy leaves questions unanswered" and ambitious timelines that "require consultation". Finally, it states that action needs to be taken on "enablers", such as the size of the workforce which "has shrunk since 2019", or the "access to finance, the availability of good information about homes and buildings, planning systems, and public engagement."

The UK government is commitment to upgrade as many privately rented homes as possible to Energy Performance Certificate (EPC) Band C by 2030. his objective is also transferred to the social housing sector, and the Social Housing Decarbonisation Fund (SHDF), a £3.8 billion fund aimed at improving the energy performance of social housing in England, aims to upgrade much of the social housing stock currently below EPC C to this standard. Other examples of energy efficiency policies that target low-income households and aim to tackle fuel poverty are the Energy Company Obligation (ECO), with which obligated energy suppliers install energy efficiency measures in homes of low income, fuel poor, and vulnerable households, and the Home Upgrade Scheme, which include energy efficiency measures and low carbon heating for worst-performing houses outside of the grid to tackle fuel poverty. In terms of social support for fuel poor households, targeted support exists in the UK, and is even more progressive than in other countries such as France where the tariff shield is universal, and provides less of an incentive to continue using fossil fuels as it is complemented by subsidies for switching to low carbon heating equipment. The Warm Homes Discount scheme guarantees £150 off the electricity bill for low-income households' with high electricity bill for winter 2022 to 2023, cold weather payments offer support to certain recipients of social support during periods of very cold weather (£25 each week of cold weather), an energy tariff cap puts a price cap for customers on pre-payment meters, winter fuel payments help older people meet the cost of their winter fuel bills (ranging 200 to 300£), and added support was announced in February 2022 to face the energy crisis.[31] On this topic, the policy therefore seems relatively consistent with these objectives of regression and promotion of decarbonisation.

Scottish decarbonisation policy. In Scotland, the target is net zero by 2045. The Scottish Government Heat in Buildings strategy sets out the plan to make Scotland's homes warmer, greener and more efficient, setting a target to eradicate fuel poverty through the process of decarbonisation, reduce the demand for heat, and commits to ensuring that all homes in all tenures achieve a level equivalent to at least EPC C in energy efficiency by 2035 and use zero-

[29] Climate Change Committee (2022), *Independent assessment of the UK Government's Heat and Buildings Strategy*, [online]. Available at: https://www.theccc.org.uk/wp-content/uploads/2022/03/CCC-Independent-Assessment-The-UKs-Heat-and-Buildings-Strategy.pdf [Accessed date: 20/04/2023].

[30] Hurley, P., Heat Pump association, *UK Heat Pump market set to almost double this year*, [online]. Available at: https://www.heatpumps.org.uk/uk-heat-pump-market-set-to-almost-double-this-year/ [Accessed date: 21/04/2023].

[31] This includes the Energy Bill Discount Scheme, the council tax rebate, and £144 million to local authorities to support those needing help with energy bills but not eligible for the council tax rebate.

emission heating by 2045. In March 2021, the Scottish Government released the Housing to 2040 Route Map, which outlines that the quality, location, and utilisation of both current housing and new construction must align with Scotland's goal of achieving net zero carbon emissions by 2045. The Energy Efficiency Standard for Social Housing (EESSH) is a non-statutory target set out in guidance on energy efficiency for social housing providers. The first version, EESSH1, sets a target for "social housing by house and fuel type equivalent to high D or low C EPC band depending on property" by 31 December 2020. EESSH2 (second version) sets a target for "all social housing to meet EPC Band B, or be as energy efficient as practically possible within the limits of cost, technology, and consent", by the end of December 2032.[32] A revision of the EESSH2 is expected in 2023. The Social Housing Net Zero Heat Fund, launched in August 2020, supports social housing landlords "deploy zero emissions heat, improve energy efficiency, and reduce fuel poverty". The Low Carbon Infrastructure Transition Programme, launched in 2015 and now closed, used to aim to stimulate investment and provide technical expertise and financial support to innovative, low-carbon infrastructure projects that may be replicated.[33]

Welsh decarbonisation policy. In Wales, the Optimised Retrofit Program (ORP) is a scheme to decarbonise existing homes, open to Registered Social Landlords and local authorities to put in place home decarbonisation measures in the existing social housing stock.[34] ORP 3 is for the financial years of 2022-2025. It is in the line of the Welsh Housing Quality Standard (WHQS), which is a set of mandatory standards for council and housing association homes, introduced in 2022, to ensure that dwellings are of good quality and suitable for the needs of current and future residents. A WHQS2023 is in preparation to improve the quality of Welsh social homes.

Northern Ireland's decarbonisation policy. The Northern Ireland Housing Executive (NIHE) is responsible for social housing in Northern Ireland, and has set objectives to achieve net zero by 2050, with a goal of 6% reduction in carbon emissions by 2026 and 23% reduction by 2030-31. In its Corporate Sustainable Development Strategy and Action Plan 2022-2027, the organisation identified funding gaps for energy efficiency retrofit and transition to clean heat projects, highlighting the funding opportunities available in the UK and not available in Northern Ireland such as the Social Housing Decarbonisation Fund.

4.4. Interdisciplinary state of knowledge

This section provides an understanding of the contribution of previous literature on the understanding of the policy problem of social housing decarbonisation, through the related themes of policy problem definition, wicked problems, evaluation of energy policy and housing

[32] Scottish Government (2021), Achieving net zero in social housing: Zero Emissions Social Housing Taskforce report, [online], Available at : https://www.gov.scot/publications/achieving-net-zero-social-housing-zero-emissions-social-housing-taskforce-report/pages/6/ [Accessed date: 20/04/2023].
[33] Scottish Government (2020), Social Housing Net Zero Heat Fund: overview, [online]. Available at:https://www.webarchive.org.uk/wayback/archive/20200822012034/http://www.gov.scot/publications/social-housing-net-zero-heat-fund-overview/ [Accessed date: 20/04/2023].
[34] Welsh Government (2021), Optimised RetroFit Programme, Last updated 26 October 2022, [online]. Available at: https://www.gov.wales/optimised-retrofit-programme [Accessed date: 20/04/2023].

decarbonisation policy, energy justice, and the affordability of housing decarbonisation. The aim of this section is to motivate the methodological choices presented below.

Policy problems. Literature on policy problems emphasises the influence of problem framing in the conduct of policy debates. For van Hulst and Yanow, problem framing is the way in which stakeholders attempt to persuade decision-makers of the nature and importance of a given issues (van Hulst and Yanow, 2016).[35] Problem framing has also been defined as "a way of selecting, organising, interpreting and making sense of a complex reality to provide guideposts for knowing, analysing, persuading and acting" (Schön and Rein, 1994).[36] For Hanberger as well, policy evaluation needs to evaluate the content of different policy components, and needs to scrutinise different stakeholders' perception of the policy (Hanberger, 2001).[37] Literature on policy problem framing also highlights the impact of problem framing in the design of policy solutions. For Head, the way policy problems are defined as well as the debates around their nature and causes shape the way answers to these problems are designed and implemented, and "provide the foundations for considering policy solutions and governance arrangements" (Head, 2022).[38] In the same way, agenda-setting shapes the selection of issues which are under consideration and the solutions associated with them, as well as "the pattern of winners and losers in various policy fields".[39] In this respect, Lowi (1972), cited by Hoornbeek (2017) identifies four categories of policy problems leading to four types of polices: the distributive policy, the regulative policy, the redistributive policy, and the constituent policy (Hoornbeek, 2017).[40]

Wicked problems. Some of the literature on policy problems explores particularly complex policy issues, and how these can be defined and addressed. In opposition to "tame problems", which correspond to problems with a well-defined and stable problem statement, a definite stopping point, a solution that can be objectively evaluated as being right or wrong, which looks like similar problems that can be solved similarly, and which has solutions which can be tried and abandoned, Rittel and Webber define the notion of "wicked problems" (Rittel, Webber, 1973)[41]. Wicked problems are problems that cannot be successfully treated with traditional linear and analytical approaches, "because the problem definition evolves as new possible solutions are implemented", and as "each attempt to create a solution changes the understanding of the problem". The ten characteristics of wicked problems as defined by Rittel and Webber are: no definitive formulation (1), no stopping rule (2), no true-or-false but good-or-bad

[35] Van Hulst, M., & Yanow, D. (2016). *From policy "frames" to "framing": Theorizing a more dynamic political approach*. American Review of Public Administration. Cited in Head, B. W. (2022), *Wicked Problems in Public Policy, Understanding and Responding to Complex Challenges,* Palgrave Macmillan Cham.
[36] Schön, D. A., & Rein, M. (1994). *Frame reflection: Toward the resolution of intractable policy controversies*. Basic Books, cited in Head, B. W. (2022), *Wicked Problems in Public Policy, Understanding and Responding to Complex Challenges,* Palgrave Macmillan Cham.
[37] Hanberger, A. (2001), *What is the Policy Problem?: Methodological Challenges in Policy Evaluation*, Evaluation ISSN Vol. 7, London.
[38] Head, B. W. (2022), *Wicked Problems in Public Policy, Understanding and Responding to Complex Challenges,* Palgrave Macmillan Cham.
[39] Ibid 37
[40] Hoornbeek, J. A. (2017), *Understanding policy problems: a refinement of past work*, Policy and Society.
[41] Rittel, H. W. J., Webber, M. M. (1973), *Dilemmas in a General Theory of Planning*, Policy Sciences 4.

solutions (3), no immediate nor ultimate test of a solution to a wicked problem (4), every solution is a "one-shot operation" as there is no opportunity to learn by trial-and-error and every attempt counts significantly (5), no enumerable (or exhaustively desirable) set of potential solutions and no well- described set of permissible operations that may be incorporated into the plan (6), uniqueness (7), being the symptom of another problem (8), the existence of a discrepancy representing a wicked problem can be explained in numerous ways and the choice of explanation determines the nature of the problem's resolution (9), the planner has no right to be wrong (10). For the researchers, wicked problems include "nearly all public policy issues" (Rittel, Webber, 1973)[42]. In many modern policy problems, issues are interdependent, so that changes in one aspect of the system can have unintended consequences in other areas (Head, 2022). Head defines wicked problems as problems with high levels of complexity, uncertainty and divergence (Head, 2008). For Camillus, wicked problems occur at times of constant change or unprecedented challenges, and their complexity increases with disagreements between stakeholders (Camillus, 2008)[43]. Building on this literature, Head proposes a way to define which problem can be qualified as wicked, using the degree of actors' willingness to cooperate and conflicting values and interest, and the degree of knowledge of the problem and solution (Head, 2022). This way, he defines that a problem is wicked when multiple actors have each relevant useful knowledge, and that neither the problem nor the solution are known, or when actors have conflicting values and interests and that the problem is known but the solution is not. This opposes the definition of tame problems, where both the problem and solution are known, and actors are willing to cooperate and avoid conflict. Typical examples of wicked problems include poverty, climate change, or sustainability. Literature on how to manage a wicked problem includes Ruth and Dubberly, who define the process of political argumentation through democratic and trustworthy debate as well as stakeholder engagement and dialogue as the right method (Rith and Dubberly, 2007)[44]. For Webber, wicked problems can be tackled through decentralised decision-making, with multi-stakeholder approaches and a more participatory decision making (Webber, 1983)[45]. Geertman and Stilwell argue that managing wicked problems can be done by using modern digital tools to increase stakeholders' participation (Geertman and Stilwell, 2020).[46]

Evaluation of energy policy and projects. On energy project and policy evaluation, literature states that the evaluation of all new energy efficiency policies and programs must outline their effects on wellbeing (Campbell, 2019).[47] Some literature, often commissioned by government, provides guidance for best practice on energy project evaluation. Based on the analysis of the evaluations of the £102.5 million program Prospering from the Energy Revolution and the Oxford Energy Superhub, Hampton and Fawcett (2020) introduce the concept of "over

[42] Ibid 39.
[43] Camillus, J. (2008), *Strategy as a wicked problem*, Harvard Business Review. Cited in Head, 2022.
[44] Rith, C., Dubberly, H. (2007), *Why Worst W. J. Rittel matters*, Design Issues.
[45] Webber, M. (1983), *The myth of rationality: Development planning reconsidered*, Environment and Planning B: Planning and Design.
[46] Geertman, S., Stillwell, J. (2020), *Handbook of planning support science*, Edward Elgar Publishing.
[47] Campbell, N (2019), Energy efficiency and well-being benefits. Energy Evaluation Asia Pacific Conference Bangkok, Energy Efficiency and Conservation Authority, [online]. Available at: https://energy-evaluation.org/wp-content/uploads/2019/11/eeap2019-2.1-ninacampbell-presentation.pdf

evaluation" of energy projects, as the result of "too many cooks, too many consultations, or too much data".[48] The downsides of this are the duplication of effort, wasted resources, and confusion and consultation fatigue on behalf of respondents.[49] To counter these downsides, findings suggest considering different perspectives and expertise, appealing to a wider range of audiences, and encouraging agility and high standards from evaluators (Hampton and Fawcett, 2020). Literature on decarbonisation policy in Europe includes recommendations on considering personal and social factors, as well as the importance of targeting the most vulnerable. Biresselioglu at all (2020) states that personal and social factors play a significant role in enabling energy transition and should be considered in policy-making (Biresselioglu at all., 2020).[50] Sunderland and Gibbs highlight the importance of targeting and eligibility criteria in addressing the affordability challenge in the development of housing decarbonisation policies. They argue that while social tariffs are important in bringing down the cost of electricity, particularly in enabling households experiencing fuel poverty to switch to clean heating, they cannot fully guarantee that energy bills will be manageable for tenants due to possibly imperfect targeting and eligibility criteria, or lack of access for some eligible households where these tariffs are not applied automatically (Sunderland and Gibbs, 2022).[51]

Evaluation of housing decarbonisation policy in the UK. Some of the literature on housing decarbonisation policy in the UK highlights its inconsistency over time. O'Neill and Gibbs (2020) describe back-and-forth policies according to the political forces in power, summarised in three phases between 2003 and 2020. The first phase is the "policy expansion" from 2003 to 2010, with an emerging green building agenda in the context of a growing concern for climate change under the Labour government, the second phase is the "symbolic dismantling" between 2010 and 2015, with the diminution of the zero carbon homes policy and incremental changes in the context of the financial crisis under a Coalition Government, and the third phase is the "active dismantling" between 2015 and 2020 with a shift towards a much vaguer commitment to green building and the active rollback of existing environmental policies under the Conservative government (O'Neill and Gibbs 2020).[52] Rainsford (2021) highlights that the decarbonisation in social housing has received unclear policy guidance in the UK, and that there is a need for a more defined pathway and "clear standards (…) over a consistent period". An illustration of this is the zero carbon homes standard, announced in 2006 by Tony Blair's Labour government, which was supposed to come into force in 2016 and require all new housing to be carbon neutral (as defined by the Code for Sustainable Homes), and which was scrapped by the Conservative government in 2015. Researchers assess that this highlights an inconsistent approach across the UK with "few clear retrofit and new build design standards", and the housing associations being "required to interpret a variety of different policies when

[48] Hampton S., Fawcett T. (20202), *Can energy projects be over evaluated?*, Environmental Change Institute, University of Oxford, United Kingdom.
[49] Ibid 46.
[50] Biresselioglu M. E., Demir, M. H., Kaplan, M. D., Solak B. (2020) *Individuals, collectives, and energy transition: Analysing the motivators and barriers of European decarbonisation*. Energy Research & Social Science, Volume 66.
[51] Ibid 6.
[52] O'Neill, K., Gibbs, D. (2020), *Sustainability transitions and policy dismantling: Zero carbon housing in the UK*, Geoforum volume 108.

planning for investment". The paper also recommends more financial support for social housing providers (Rainsford, 2021)[53]. On the social dimension of housing decarbonisation policy in the UK, Penasco (2022), demonstrates that energy improvements have a disproportionate negative impact on the energy consumption of the poorest households. She explains that one year after implementing energy efficiency measures, the gas consumption of households outside of deprived areas reduces, but the energy savings disappear four years after the retrofit work and two years after for loft insulation, while "the most deprived households can expect statistically significant increases in the energy consumption four and five years after the energy efficacy installation", which "completely offset the initial consumption reductions during the year of installation" (Penasco, 2022).[54] On UK housing energy retrofit policy, Killip et. al (2021) show that more skilled workforce is needed, as well as more customers' understanding of the need for change, led by a supportive policy environment. For the researchers, past policy failings teach that the policy mix should include minimum standards that improve over time, better information and financial incentives for households, transform occupational standards to have a sufficiently skilled workforce to carry out the renovation work, adopt cross-sectoral systems thinking and support change among other relevant actors outside the construction sector, and give policy support to local trial programs (Killip et al., 2021).[55]

A Social Housing Decarbonisation Study from BEIS (2021) presents the views from social housing providers on the UK decarbonisation policy in social housing.[56] The survey shows limited awareness of the EPC rating of the stock among social housing providers, with 47% aware of the EPC and 26% aware of SAP rating for a very large proportion of the stock, and with smaller suppliers statistically having less knowledge of the energy performance of their stock. Moreover, the report states that providers consider energy performance as secondary in the maintenance works, due to a lack of long-term funding and expected high disruption for tenants. In terms of energy performance measures installed since 2010, 85% of providers have installed new energy efficient boilers, 72% have installed double glazing and 69% have installed loft insulation. The report highlights a general willingness to improve the energy performance of the stock, with a higher degree and higher probability to have a concrete plan for larger providers. Expected barriers to meet energy performance targets are a lack of budget and a lack of internal skills to apply for funding. Regarding tenants, social housing providers demonstrate a concern for rising energy bills. 46% of providers stated that tenants had refused improvement works in their dwelling. Reasons for refusal were shared between fear of Covid-19, dislike of the work, or noise disruption. 40% of providers with mixed tenure blocks have

---

[53] Rainsford C. (2021), *Decarbonisation in social housing: From concept to delivery*, University of Liverpool, Policy Briefing 2(06), [online]. Available at: https://www.liverpool.ac.uk/media/livacuk/humanitiesampsocialsciences/documents/PB206,combined.pdf

[54] Penasco, C., Anadon, L. D. (2022), *Assessing the Effectiveness of Energy Efficiency Measures in the Residential Sector Gas Consumption Through Dynamic Treatment Effects: Evidence from England and Wales*, SSRN.

[55] Killip, G., Fawcett, T., Jofeh, C., Owen, A., Topouzi, M., Wade F. (2021), *Building on our strengths: A market transformation approach to energy retrofit in UK homes*, CREDS.

[56] Department for Business, Energy, and Industrial Strategy, *Social Housing Decarbonisation Study Views from Social Housing Providers*, BEIS Research Paper Number 2021/056, [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1023608/social-housing-decarbonisation-study-report.pdf [Accessed date: 20/04/2023].

carried out energy performance work on their stock. Regarding the SHDF, only 29% of the providers described the government policy as clear. The report identifies a gap providers as smaller providers experienced difficulties in engaging with the policy and felt not targeted. Indeed, 30% of housing associations and 85% of local authorities were aware of the SHDF. The complexity of the application process was raised by providers and the importance of support and templates for example, particularly for small providers.

The Zero Emissions Social Housing Taskforce Report commissioned in March 2021 by the Scottish Minister for Local Government, Housing and Planning highlights main challenges and solutions in decarbonising social housing in Scotland.[57] The report highlights the high installation cost (and in some cases running and maintenance cost) of clean heating systems, and recommends increasing grant funding for social landlords to avoid that it exacerbates poverty and fuel poverty. The report calls for the promotion of a "fabric-first approach", with a focus on "further thermal upgrades and addressing airtightness and cold bridging" and "prioritising investment accordingly", as a way to reduce energy consumption and therefore the running cost of clean heating systems. To face the lack of certainty experienced by social landlords on the effective performance of heat pumps or electricity prices for example, the report highlights the need to evaluate, in collaboration with the actors, the cost increase associated with the transition, and produce a "long-term, non-competitive grant fund for social landlords which can be distributed fairly across the sector". The report highlights the opportunity of collaborating with different actors to make the most out of funding opportunities, and the importance of knowing the housing stock (with data from independent sources), as a limited number of building types are represented in most of the Scottish social housing stock, presenting an opportunity to establish standard approaches. The need to engage with tenants is seen as essential for the project's success, and the solution proposed is a fuel poverty strategy tailored to their needs. In order to ensure that the local supply chain enables social housing providers to access a qualified workforce, the report requires collective work and more investment. Finally, the report states that social housing providers should continuously monitor their contribution to tackling the climate crisis.

Energy justice. Literature on social justice and energy justice defines indicators to grasp the different dimensions of the issue. Sovacool et al. (2019) apprehend energy justice through four indicators: the costs, or how the hazards and externalities of the energy system are disseminated throughout society, the benefits, or how the ownership of and access to modern energy systems and services are distributed throughout society, the procedures, or what ensures that energy decision-making respects due process and representation, and the recognition, or the assessment of the impact of energy systems on the poor, most vulnerable and marginalised people (Sovacool et al., 2019).[58] The "what", "who", and "how" of social justice enable to consider the distribution of issues, where these are located ("what"), the recognition of who is ignored

[57] Ibid 31.
[58] Sovacool, B. K., Lipson, M. M., Chard, R. (2019), *Temporality, vulnerability, and energy justice in household low carbon innovations*, Energy Policy, Volume 128.

("who"), and the mechanisms to ensure that the injustices are addressed (Jenkins et al., 2016).[59] A share of the literature highlights the risks and opportunities associated with energy innovations such as energy service contracts, solar PV or low carbon heating from a social perspective. The opportunities of introducing these new technologies may be the reduced efforts and money needed from the households when these are controlled by local authorities, but there are other risks associated to them, such as the discrimination of poorer consumers when these are managed by for-profit energy companies (Sovacool et al., 2019). The ability to participate in these innovations requires the capability to do so (it is personal, financial and technical), as well as the opportunity (or offer to do so), and the willingness to take the risks involved in participating. Therefore, some people are at risk of not being able to access to these energy innovations, such as tenants without access to the internet or smartphone, those who might be unable to install sensors or sign up to contract, or who are designated undesirable by providers, and that might be described as the "new fuel poor", which highlights the necessity of policies to guarantee people's participation (Roberts et al*.,* 2020)[60]. In the same way, Sovacool et al. state that innovations can bring social benefits, but also social risks (Sovacool et al., 2019)[61]. As a new smart energy system comes with social opportunities, it may also create new exclusions. Another important dimension to keep in mind is the capability lens, or capacity for actors to participate in the new smart energy system (Roberts et al., 2020).[62]

Making decarbonisation of housing affordable and acceptable. Some of the literature on housing decarbonisation defines solutions to face the challenge of the projects' affordability and inclusion of the most vulnerable tenants. Sunderland and Gibbs identify that affordability in housing's transition to clean heat can be achieved in innovative projects by "combining multiple building-level technologies, combining electric heat with local or surplus renewable generation, combining heat and a service, combining heat with flexibility" (Sunderland and Gibbs, 2022)[63]. Drawing on a France-Germany comparison of citizens' projects for renewable energy production, Poize and Rüdinger show that ensuring the local acceptance and viability of the energy transition project passes by engaging with local actors. This can be done by promoting local and citizen ownership of the projects and its initiation and/or co-construction by citizens, local public and private actors. Ensuring territorial anchoring is a way to guarantee the mobilisation of savings for the benefit of the local economy as well as the awareness of the challenges of the energy transition. A favourable financial and regulatory context is necessary to enable this, as illustrate the fact that citizens' projects are less developed in France than in Germany for this reason (Poize, Rüdinger, 2014)[64].

[59] Jenkins K., McCauley D., Heffron R., Stephan H., Rehner R. (2016), *Energy justice: a conceptual review*, Energy research & Social Science.
[60] Roberts, S., Bridgeman, T., Broman, D., Hodges, N., Sage, C. (2020), *Smart and fair? Exploring social justice in the future energy system*, Phase One Report and Recommendations, Centre for sustainable energy.
[61] Ibid 56.
[62] Ibid 58.
[63] Ibid 6.
[64] Poize, N., Rüdinger, A. (2014), *Projets citoyens pour la production d'énergie renouvelable : une comparaison France-Allemagne*, Working Paper, RAEE, IDDRI, SciencesPo.

Overall, the literature on policy problems shows that the way actors define a problem shapes their view of the solution, which confirms the appropriateness of the paper's methodology for asking different actors about their view of the policy problem of decarbonising social housing in the UK, which assumes that they will put forward different views. The literature on wicked problems highlights that a set of criteria can demonstrate if a problem is wicked. This leads to the methodological choice of testing the wickedness of the policy problem using these criteria. Finally, this set of literature states that the resolution of a wicked problem lies in a greater inclusion of stakeholders' positions. This confirms that, if the problem studied in this paper is wicked, a way to find a solution is a participatory process involving all stakeholders, which justifies the relevance of the first hypothesis. The literature on the evaluation of energy policy and projects highlights the need to consider the effects on wellbeing of energy policies, which justify the choice of including notions of fuel poverty reduction in the analysis of decarbonisation projects. The literature also warns about the risks of over-evaluating these projects, which motivates the methodological choice of not interviewing representatives of the Oxford Energy Superhub, already largely analysed. The literature on housing decarbonisation policy in the UK gives preliminary findings on the barriers to its effective implementation, such as policy inconsistency, affordability of clean heating systems, social risks associated with the decarbonisation processes, lack of skilled workforce, negative impact of competitiveness in access to funding for smaller social housing providers, lack of tenants' understanding of the need for decarbonisation. This justifies the relevance of the second hypothesis. The literature on energy justice shows that new challenges accompany new technologies and that the tendency to accept these technologies is conditioned by factors such as the personal, financial and technical capacity of households, the opportunity to do so and the willingness to take the associated risks. This confirms the need to include in the analysis of decarbonisation projects a questioning of the participation of social tenants. Finally, the literature on making housing decarbonisation affordable and acceptable shows that projects of social housing decarbonisation in the UK have demonstrated that the combination of technologies could reduce the costs, and that other projects in France and Germany increased tenants' support by engaging with local actors. This confirms the value of the methodological choice of consulting the stakeholders interviewed to find innovative solutions to the problem.

5. Methodology and data

5.1. Methodology

This paper aims to define the complexity of the policy problem of decarbonising the existing social housing stock in the UK. It identifies the barriers to policy implementation on the subject and how best to design policy solutions to help overcome these barriers, and offers initial solutions and policy recommendations. This paper is therefore aimed at policy makers and more broadly aims to draw lessons from the UK experience of policy making on decarbonisation of social housing to help design a just energy transition in Europe.

The methodology is a thorough literature review and in-depth qualitative thematic analysis of semi-structured interviews with open-ended questions with researchers, social housing providers, entrepreneurs, local authorities, and policy-makers.

First, this paper analyses the degree of complexity of the problem of decarbonising social housing and assesses whether it can be defined as a wicked problem using fourteen criteria proposed in the literature. The ten first criteria are the one defined by Rittel and Webber in 1973: no definitive formulation (1), no stopping rule (2), no true-or-false but good-or-bad solutions (3), no immediate nor ultimate test of a solution to a wicked problem (4), every solution is a "one-shot operation" as there is no opportunity to learn by trial-and-error and every attempt counts significantly (5), no enumerable or exhaustively desirable set of potential solutions and no well- described set of permissible operations that may be incorporated into the plan (6), uniqueness (7), being the symptom of another problem (8), the existence of a discrepancy representing a wicked problem can be explained in numerous ways and the choice of explanation determines the nature of the problem's resolution (9), the planner has no right to be wrong (10).[65] To these ten criteria, I add four more criteria from more recent literature on wicked problems: the complexity increases with disagreements between stakeholders (11), low degree of actors' willingness to cooperate (12), actors have conflicting values and interest (13), and low degree of knowledge of the problem and solution (14). I match the data collected in the interviews to these criteria and assess this way if the policy problem of social housing decarbonisation policy can be defined as wicked.

Second, based on the results of the first section, this paper defines the best way to address the main barriers to decarbonizing public housing. If the problem is wicked or has most characteristics of a wicked problem, literature tells that the best way to tackle it is to consider the positions of different stakeholders in the definition of the solution. If the latter hypothesis is confirmed, the second part will map the solutions proposed by stakeholders to address the challenges identified. Finally, building on these solutions, the paper proposes policy recommendations.

[65] Ibid 39.

Qualitative data is chosen to represent the diversity of stakeholders' experiences and the different trade-offs that they face. The objective is to create collective intelligence between actors to define the adequate policy recommendations. This methodology is inspired from Aimee Ambrose's pioneering use of qualitative approach in studying fuel poverty.[66] The researcher assesses that research on energy related topics has traditionally been dominated by quantitative methods and misses necessary information on the diversity of experiences of stakeholders. She explains that qualitative data provides a more profound understanding of the social challenges associated with the energy transition and how it is "experienced by marginalised groups around the world".[67]

5.2. Data

Eleven interviews were conducted to collect data. Four interviews were conducted with researchers: Brenda Boardman, expert on fuel poverty from the Environmental Change Institute (ECI) in the University of Oxford, Aimee Ambrose, expert on fuel poverty and energy efficiency from Sheffield Hallam University, Simon Lannon from Cardiff University, an expert in social housing who developed a mapping of fuel poor households targeting excluded areas, and another researcher from a university in Wales with expertise in green building policies in the UK (anonymised). Four interviews were conducted with social housing providers: Ron McArthur, director of asset management for Angus Housing Association, a charity and registered social landlord, Paul Neale, Energy and Sustainability Manager at Soha Housing a non-profit registered society, Juliet Nicholas, Energy and Sustainability Manager at Oxford City Council, a local authority, and a representative from Hyde Housing, a non-profit registered society (anonymised). One interview was conducted with a former representative of a social housing provider now consultant in social housing decarbonisation at Adecoe (anonymised). One interview was conducted with Kate Eveleigh, Health Improvement Practitioner at Oxfordshire County Council, a local authority. Finally, one interview was conducted with a representative of the Department for Energy Security and Net Zero (DESNZ) in the UK Government (anonymised).

Respondents were selected on the basis of the relevance and diversity of their approach to the issue, their geographical diversity across the nations of the UK and the nature of their expertise, with the aim of contrasting the diversity of situations rather than aiming for statistical representativeness. Therefore, this paper presents the views of researchers from England, Wales, and Scotland specialising in social housing policy, building decarbonisation policy, fuel poverty and targeting models in the UK. This paper also presents the views of social housing providers from England, Wales and Scotland of different sizes (small, large and medium) and types (local authority and registered not-for-profit company) to observe possible divergence of experiences. A twelfth interview was scheduled with a Northern Ireland social housing provider, but could not take place due to practical issues and time constraints.

---

[66] Sheffield Hallam University, Professor Aimee Ambrose, [online]. Available at: https://www.shu.ac.uk/about-us/our-people/staff-profiles/aimee-ambrose#firstSection [Accessed date: 20/04/2023].
[67] Ibid 49.

Initial observations show that all the social housing providers interviewed are or were engaged in decarbonisation projects. Oxford City Council applied to the Wave 1 of the SHDF and did not get it as they aimed to retrofit empty properties and were not considered to meet the criteria of helping tenants, and have now applied to the Wave 2 of the SHDF and are now waiting for the answer. Soha Housing, based in Didcot and with a stock of 7,5000 homes, has 652 homes with an EPC D or below, and has refurbished 60 homes at a cost of £800,000. In 2022, Angus Housing Association conducted their biggest project in ten years on refurbishment with Warmworks, Managing Agent of the Scottish Government's national fuel poverty scheme "Warmer Homes Scotland", to install a wider range of technologies such as air-source heat pumps, solar photovoltaics (PV) and domestic batteries to transition from the existing coal-fired heating to renewable sources and reduce bills for tenants.

The other actors interviewed have experience in social housing decarbonisation as well. The Department for Energy Security and Net Zero (DESNZ) in the UK government is focused on the energy portfolio from the former Department for Business, Energy and Industrial Strategy (BEIS). After the recommendation of the National Infrastructure Commission of a £3.8 billion fund for energy efficiency in social housing, a £3.8 billion over 10 years fund was announced through the SHDF. Adecoe works with small and large social housing providers across the UK on developing their net zero strategies. As Oxfordshire County Council has an important public health role in ensuring that homes are sufficiently safe and energy efficient, it publishes a report every two years setting out its strategy for promoting greater energy efficiency in residential buildings within its territory.

The interviews were conducted following different interview grids for social housing providers (see Appendix 1), researchers (see Appendix 2), or policy-makers. Some questions were recurring and some were tailored to the interviewee. Finally, after data collection, I gave the interviewees the option to be anonymised, an option preferred by four of the eleven interviewees, and so I anonymised their statements.

6. Findings

6.1. Defining the complexity of the policy problem of social housing decarbonisation.

At first sight, the problem of decarbonising social housing may seem simple. There are no major scientific uncertainties, the necessary technologies are known and do not cause massive disruption, and social housing providers are not as numerous and diverse as individual households. However, the actors represent a high degree of complexity in solving the problem, with a challenge of actor coordination and policy implementation. By comparing the data collected in the interviews with the fourteen criteria set out in the literature to define a wicked problem, this section seeks to demonstrate whether the decarbonisation of social housing in the UK is a wicked problem.

Criteria 1: There is no definitive formulation of the problem.

With regard to decarbonising social housing, the interviews show that different stakeholders define the problem differently. This is summarised by Paul Neale, who explains that "the government says one thing and us, the organisations who are doing it [the decarbonisation works], we are saying something else". For the expert in green building policies, "the problem is wicked because it is interpreted so differently by different stakeholders".

On the issue of funding, the UK government bases the size of the SHDF grant on its assessment of the funding required by social landlords to decarbonise their stock. As many social housing providers assess their needs differently, they feel that the amount of funding is insufficient. Juliet Nicholas assesses a gap between the actual costs of delivering the work for the decarbonisation of social housing and the budget provided by the government. She explains that Oxford City Council faced the problem of insufficient funding from the SHDF. Out of a budget of £30,000 for the decarbonisation work of a share of their stock, the SHDF had only covered £10,000, "although it is supposed to offer 50% of the costs". She points out that "this is a problem faced by many other councils who have looked at what needs to be done" and who have faced a government that "does not realise the true cost of implementation". She regrets that this difference in analysing the needs is a missed opportunity, as "there is appetite there from social housing providers [to decarbonise], but it keeps going back to finance, resources, and staff". The representative of Hyde Housing estimates that the SHDF application process and amount of data required is "disproportionate to the opportunity". "We have maximised the grant funding we can get", he explains, "the SHDF is supposed to enable the project to be 50% grant funded, but the reality of inflation makes that it will probably be more or less 40%, and for the rest, it was from our financial plan". He adds that "it is tricky to criticise social housing providers for not doing enough in terms of reducing carbon emissions, as they don't have an endless pot". He thinks that "there is a reluctance to listen to the genuine and practical applications of things". For the Adecoe representative, the difference in problem definition even worsens the problem. According him, the SHDF budget management "has put a lot of money into very specific peaks in a very tight supply chain and led to massive cost increases". He says that Adecoe used to tell its clients (social housing providers) that "net zero retrofits would cost

them £20,000 to £30,000 per property", which had been consistent for years, but that "since the introduction of the SHDF, basic insulation and window measures cost £50,000". He explains that "funding is the biggest barrier", and as Adecoe does stock analysis for housing providers, they observe that "there is still a large scary number attached to it that [social landlords] don't have the resources to carry out because they can't change the resources they have got because rents are regulated". Regarding local authorities, both the expert in green building policies from Wales and Brenda Boardman argue that it is paradoxical that local authorities are being given responsibilities for decarbonisation while "they are faced with the issue of budget cuts". Aimee Ambrose also explains that local authorities "have great potential but lack financial and human resources". For Kate Eveleigh, in a context where social housing providers have tight funding available to them, the question to ask is: "are they in a strong enough position to take up the challenge of decarbonising the housing stock they have?" According to her, "politicians have to understand that you have to put more money for some people than for others", and argues that "a BHBH phone call was estimated to cost £80, when a home visit is estimated to cost £350". The data therefore show that the government and social housing providers have a different assessment of the problem and the solution in terms of financing decarbonisation.

Criteria 2: There is no stopping rule.

The data collected shows that the policy problem of social housing decarbonisation lacks a logic that would indicate when it is fixed. Indeed, the lack of data on the energy performance of buildings and on fuel poverty complicates the assessment that the problem has been efficiently tackled.

Firstly, while the social housing providers interviewed generally have an idea of the energy performance of their stock, they often have an imprecise knowledge of EPC ratings. Indeed, like many local authorities, Oxford City Council lacks quantifiable data. Of its 7,000 social housing units, 1,500 do not have EPCs. The social housing provider interviewed that appears to have the most data is Hyde Housing, which carries out regular surveys of its properties, 20% of the stock every year, and has 80% of the EPC data from these surveys.

Second, while tackling fuel poverty is one of the objectives of the decarbonisation of social housing and of the mechanisms put in place to help actors achieve this, actors struggle to identify fuel poor households. Aimee Ambrose explains that, while social housing tenure is relatively more energy efficient than the private sector, "pockets of energy poverty still exist". Juliet Nicholas explains that "it is difficult to know who is in fuel poverty", and that Oxford City Council "doesn't have the data on it". "Given the changes in energy costs and our customers' incomes, 50-60% of our people are in fuel poverty," says the representative of Hyde Housing, before admitting that he doesn't have "the evidence for that" as Hyde "doesn't track the issue enough". However, to face gas price increase, the organisation is offering support to tenants. For decarbonisation, as their capacity to target the fuel poor is limited, Hyde prioritises the poorest performing buildings while "trying to maximise the grant funding", but "without looking at the income". This is coherent with the UK government strategy. "Our definition of fuel poverty is based on EPCs, if a property has got an EPC C, it is not in fuel poverty, so getting properties up to EPC C is helping to deliver against the target" summarises the UK

government DESNZ representative.[68] In the same way, Soha is targeting worst performing properties with EPCs E or F rather than the energy poor properly. Finding data on households' income levels might be challenging, Paul Neale says. For him, a barrier in the implementation of LAD 1B, which concerned houses with EPC D or below and households whose incomes were 30,000 pounds or less, was "the difficulty to verify in practice the income level of households". Fuel poverty experts Aimee Ambrose and Brenda Boardman believe that there is an error in the targeting of people in fuel poverty in the UK, as those targeted for fuel poverty assistance are older people, and those more vulnerable to fuel poverty are mainly single parents and single mothers. "It is important to analyse who lives in the worst performing housing, so as to avoid helping those who have chosen to live there, such as older and more expensive buildings", says Aimee Ambrose, citing researcher Lannon's model to target those in fuel poverty using the building's EPC information and tenants' income levels. Thus, if access to data is a challenge, it is difficult to solve the problem or assess its ultimate resolution.

Criteria 3: There is no true-or-false but good-or-bad solution.

While policies to decarbonise the UK's social housing stock may or may not be true in the sense that they may or may not help to improve the energy efficiency of buildings and reduce carbon emissions, the stakeholders interviewed explain that the challenge of policy implementation is more to do with power relations and how to manage the potentially negative impacts of policies on vulnerable actors, which introduces a moral notion of good or bad.

The representative of Hyde Housing highlights that while it can be environmentally pertinent to require an EPC C to sell a property, this may not be a just policy if it is not accompanied by strong enough social safeguards. He states that policy-makers "need to be careful that people can't pay a £20.0000 heat pump". Thus, a policy that would effectively reduce carbon emissions can be assessed by actors as a "bad" solution if they observe consequences that disproportionately negatively affect vulnerable actors. For Ron McArthur, a "bad" solution can also be one that maintains an "unequal balance of power between the stakeholders". The Angus Housing Association representative explains that their tenants can be made vulnerable when dealing with energy suppliers and disadvantaged by their lack of understanding of how to use their systems or new technologies for example, which has become "even more crucial with rising energy costs". Interviews show that more than being true and defining the problem accurately, the challenge for social housing decarbonisation policies is therefore to be a good policy that considers the different secondary impacts it may have on vulnerable stakeholders.

Criteria 4: There is no immediate nor ultimate test of a solution.

Interviewees demonstrate that there is no way to test the solution to a wicked problem, as it is difficult to assess the policy outcome and as the outcome observed could have occurred for reasons other than the policy itself.

Juliet Nicholas from Oxford City Council explains that it is difficult to assess the impact of the Decent Homes Standards on the quality of the social housing stock compared to private

[68] This vision can be nuanced by the fact that the definition of fuel poverty includes an income dimension (see Definitions).

housing. The impact this policy had on the social housing providers' willingness to decarbonise their stock difficult to assess. "Some would not have done anything to their properties had the policy not been implemented, some would have done loft insulation anyway as they are usually more inclined to invest in their properties and carry out works than private housing landlords", she says. Because the scheme was "poorly managed", she explains, there has been fraud in the installation of cavity wall insulation, with installers claiming that it has been installed but without actually doing it, and a lot of properties thinking they have cavity wall insulation but haven't", making it therefore difficult to assess which house has really gained in energy efficiency after the work. These two elements of difficulty in assessing the impact of policy on the behaviour of social housing providers and fraud highlight the complexity of testing a solution to the problem.

Criteria 5: Every solution is a "one-shot operation", there is no opportunity to learn by trial-and-error as every attempt counts significantly.

Respondents' analysis of past policy failures in decarbonising social housing shows that it is difficult to learn by trial and error, as each policy failure can have negative consequences on stakeholders, affect better policies in the future and delay the fight against climate change.

Brenda Boardman takes the example of the Under-Occupancy Penalty or "bedroom tax", which aimed to address the lack of space in social housing by reducing the housing benefits of tenants living in social housing with a spare room, and which led to a deterioration in relations between landlords and tenants, with the latter becoming more distrustful and refusing landlords access to their accommodation. With regard to decarbonisation, it appears that the preservation of this relationship of trust between tenants and landlords is necessary for the smooth running of the work and for the non-opposition of tenants, and that the breakdown of this trust could therefore have a negative impact on the decarbonisation work. For the expert from Wales in green building policies, the Right to Buy policy, a policy that enabled people who were living in council-owned housing to buy it at discounted rates that considered the rent they were previously paying, is another example of a policy that has had a negative impact on tenants in the long term. For her, the policy has "dramatically reduced the amount of social housing available, (…) removing a large housing stock overnight, in a context where the number of new social housing units built is low". In addition to a negative social impact, the researcher believes that this measure could have a negative impact on decarbonisation, as "being able to buy social housing at a low price does not necessarily mean that you have the resources to manage that housing". On the decarbonisation front, the Decent Homes Standard is criticised by Brenda Boardman, Aimee Ambrose and the Adecoe representative as inadequate. For Brenda Boardman, the fact that it provided a grant for a width of insulation was an error as "the efficiency of the insulation will rather depend on the fabric". The Adecoe representative explains that the Decent Homes Standard led to low standards and "broke down the approach to performance management" (focusing on the energy performance) and "became about replacing items in the property", which he describes as "elemental management" (focusing on replacing certain elements of the house). "It is being reviewed at the moment, it has the potential to send the sector backwards", he worries. For Juliet Nicholas of Oxford City Council, the Decent Homes Standard enabled to upgrade homes to better standards, but "still not to the level that these needed to be". In addition to this, fraud and false declaration of

insulation by installers occurred due to "poor control in the implementation". The scheme also caused tenants' disturbance and faced resistance from tenants. This inadequate design and poorly controlled implementation is seen as a waste of time on the way to net zero, as the work sometimes had to be redone later to achieve better energy efficiency. Another example of a scheme that respondents felt had led to delays and inefficiencies in decarbonising social housing stock was the Feed-in Tariff, a scheme implemented to incentivise people to install a renewable energy system in their home and use this energy to power their home, while being paid for the electricity they generate, which closed in April 2019.[69] Aimee Ambrose explains that the scheme was "poorly managed, abused and subsequently reduced". For Paul Neale of Soha, the mistake made was that the price was set too high at first, and while it was working well at first, it enabled people to make too many benefits, and led the UK government to cut it afterwards. "Cutting the tariffs killed the industry, there has been a massive reduction of the number of people working in the sector", he explains. For the expert in green building policies from Wales, energy transition policies seen as successful "have not benefited the most vulnerable people, such as the Feed-in Tariff". Another negative impact of imperfect past solutions is the feeling of back and forth measures and loss of newly acquired comfort, which reduces tenants' acceptability of the decarbonisation work. The representative of Hyde Housing highlights that the social housing sector has "spent the past fifteen years ripping out stored water systems and putting in combi-boilers, and all that space that we have just given to people, we are going to go back [when installing heat pumps] and change the whole system to put a storage water tank that we have just spent years ripping out". He assesses that "without all these U-turns, we would have been way ahead of where we are now." On the Decent Homes Standard, his opinion is that it was "not the cause for better insulation of the social housing stock", as "it was already out of date" and "drove wrong behaviours quickly". Beyond having a negative effect on the energy performance of buildings or the market for renewable technologies, failed trials of solutions can also simply miss an opportunity. "This was the case for the Code for Sustainable Homes 2016", says the Adecoe representative, because "everybody was ready to deliver much higher performant new homes". Juliet Nicholas of Oxford City Council affirms that "there is real momentum right now", as people want more insulation due to the energy price crisis. The UK government representative interviewed refuses to comment on the Decent Homes standard as this scheme is "part of the Department for Levelling Up, Housing and Communities". For the representative of Hyde finally, the fact that the UK "has not trained massively for 30 years", the construction sector is now behind in terms of qualified workforce and not ready to face the increase in demand in decarbonisation works with the new wave of SHDF. According to him, this will affect some of the smaller contractors who "would not have much ability to absorb bigger programs for a longer term". This shows that learning by trial and error is not an option for the policy problem of social housing decarbonisation as it can have negative consequences for the future.

Criteria 6: There is no enumerable or exhaustively desirable set of potential solutions and no well-described set of permissible operations that may be incorporated into the plan.

[69] SSE Energy services, *Feed-In Tariffs (FIT) scheme: Get paid for generating your own electricity*, [online]. Available at: https://sse.co.uk/help/energy/feed-in-tariffs [Accessed date: 20/04/2023].

The data collected show that there is no limit to the number of solutions to the problem and that the solution chosen is rather a choice between different trade-offs.

For social housing providers, the trade-offs are numerous in the decision to invest in decarbonisation projects, as they must look at building safety, building new supply, energy efficiency and decarbonisation. The representative from the UK government DESNZ explains that it is "always a bit of a balancing act as to how they fund all those different competing priorities". Brenda Boardman highlights the dilemmas between decarbonisation and safety in social housing, with the example of social housing blocks with flammable insulation boards on the outside, the removal of which would be an insulation challenge, but the maintenance of which is a safety issue. For Aimee Ambrose, the main concern for landlords is that tenants are able to pay their rent. Therefore, expensive refurbishments or the adoption of heating systems with higher input and maintenance costs are challenges. On the other hand, lower bills through better insulation or lower electricity bills could encourage landlords to decarbonise their stock. Thus, the solutions to the problem are multiple as it is a matter of balancing the different trade-offs for social housing providers. This statement can be nuanced by the fact that a model or decision-making tool could help balance these different trade-offs, without nevertheless being a one-size-fits-all choice.

Criteria 7: The problem is unique.

The problem of decarbonisation policy in social housing in the UK is unique in that it arises in the context of the climate crisis and unprecedented levels of greenhouse gases in the atmosphere. It is set in a particular political context of political instability in the UK, in a country recently affected by the Brexit and the Covid pandemic.

This unique context shapes the dimensions of the problem of social housing decarbonisation. Climate change makes the need to reduce carbon emissions urgent, the Brexit makes it harder to find workers in the construction sector ("there have been shortages in the labour market since then", observes Paul Neale), and the Covid crisis has led to a reduction in the number of decarbonisations works and an increase in tenants' distrust of people entering their homes. On the Covid pandemic more specifically, Paul Neale explains that it "had an impact on the construction market, because things were expensive and it was difficult to get materials or contractors" as well as on tenants because they were "very reluctant during the Covid crisis, for fear of catching Covid, or for mental health reasons, and because Covid gave them an excuse to deny access to their home". Juliet Nicholas also explains that because of Covid, "tenants were cautious about people coming to their home, and even more so when they had underlying health problems". The problem also occurs in a historic cost of living crisis in the UK. Kate Eveleigh says that the cost of living crisis has increased demand for support from social tenants. In the same way, Juliet Nicholas recalls that "with the cost of living crisis, Oxford City Council has definitely had a lot more tenants coming and saying that they have been asking for insulation, saying they can't afford their bills". For Ron McArthur from Angus Housing Association, "in the cost of living crisis, social tenants still struggle to pay for their electricity and the Better Housing, Better Health (BHBH) program receives more demand from them than before". The BHBH program offers people referral to give advice on different services such as funding for new storage heaters, reading meters or supporting the bills. "We started advising people on energy efficiency through behavioural change, for example by pulling up the curtains

or putting the lid on the saucepan (…) by telephone, and then through home visits for practical issues and for vulnerable households who need more personalised assistance" explains Mr McArthur. For the UK government DESNZ representative, there is a particular issue this year that further reaffirms the uniqueness of the policy problem. While social housing providers can normally increase rents each year by CPI (Consumer Price Index) plus 1%, by the time this would have been done for the 2023/2024 financial year, inflation had reached 11%. The government was concerned about this and the government launched a consultation on capping this increase, and a policy was agreed to cap it at 7%. Thus, because these contextual elements affect the problem at a given time, it demonstrates that the problem is unique.

Criteria 8: The problem is the symptom of another problem.

Respondents recognise that barriers to decarbonising the social housing stock are a consequence of other issues such as instability in policy making and high electricity prices.

First, interviewees describe the inconsistency of funding, the lack of clear guidelines from the UK government as the cause of many problems. Paul Neale says that "clearer guidelines are needed from the government", and Brenda Boardman explains that the failure of past policies to decarbonise social housing is due to the fact that they were "too short term and inconsistent", and "depending on changes in government". Similarly, the expert in green building policies from Wales explains that "one of the biggest problems is the instability, vagueness and general lack of commitment of UK environmental policies". "It is difficult for other actors to see what direction to take", they say. More specifically, they recall that after an expansion of environmental policies in the 2000s with the Labour government, illustrated by the introduction of the Code for Sustainable Homes for example, a series of policies and programmes failed or have been dropped. "Different governments have introduced different programmes and funds that have been mismanaged or poorly implemented", they say. "Implementing a climate change programme cannot be done in the space of an election cycle", they summarise, before highlighting that in Germany, federal policies exist on sustainability in the built environment over a much longer timeframe and with stronger and more sustained political support. This instability in policy making appears to be creating barriers to the decarbonisation of social housing. Juliet Nicholas reports that Oxford City Council's decarbonisation strategy to achieve an EPC C is still "in development", as "there are a lot of questions about how to decarbonise the heating system and move away from gas". While the local authority is "looking at heat pumps or hydrogen", the interviewee complains of a "lack of clear signals and guidance from the government". "They keep talking about the no-regrets approach and the fabric-first approach, I think it's because they don't know what the solution is for heating", she confides. Hyde Housing representative says that "the biggest challenge" for the organisation "is the short-term vision" and the fact that "the government has historically given little bits here and there, and not given consistent funding", and regrets that the government is focusing on 2030 rather than 2050. The Adecoe representative explains that "not having consistency in funding is always problematic", especially because "social housing providers think 60 years in advance and do business planning over 5 years", so "anything that goes 'start-stop, start-stop' goes against their ability to plan on that basis". Moreover, they describe that one of the challenges caused by the inconsistency of policy is that social housing providers "spend money on something that, then, gets changed". They consider that "the sector

will come up with innovative solutions for funding if there is consistency". "If not, there would be no value in investing in those". The DESNZ representative recognises that greater certainty is important for the sector "both in terms of regulation, but also in giving long-term certainty on financing where we can", and necessary to see "the supply chain prepare to deliver energy efficiency and decarbonisation at scale". Nevertheless, he explains the complexity of this goal as the Department has "spending reviews which, in a normal Parliament would be 5 years spending", but "because of all the interruptions and issues that have happened over the last few years", hasn't been on a long-term basis for some time. On the choice of technology, he nuances the vision of social housing providers and describes the line of the UK government as "technologically agnostic", as he considers that "the technology used to improve the energy efficiency of a building should be tailored for that particular building".

Second, interviewees explain that high electricity prices are another cause for the difficulties experienced in decarbonising the social housing stock. Paul Neale from Soha explains that "it is hard to sell a new heating system that will cost more to tenants". Several interviewees share their personal experience of trying to buy a heat pump for their private home, but failing to do so because of the high prices. As an example, the expert in green building policies interviewed tried to switch from her oil boiler to a heat pump in their "well insulated house". "We could have spent £30,000 on a ground source heat pump, or bought an air source heat pump which is more affordable, but with electricity prices it would cost £2,000 a year, it's not feasible," they lament. A company advised them to wait, and they now feel "trapped with a boiler that is not efficient". Regarding social housing, Juliet Nicholas explains that at Oxford City Council, the "mixed feelings of tenants towards heat pumps" are worsened by the volatility of energy prices, while the landlords struggle to "explain to the tenants that they may save up money with a heat pump". To face this issue, multiple interviewees call for the reform of the energy market. The DESNZ representative explains that the government's Heat and Building strategy recognises the need to rebalance the energy market. "It needs to happen", he says, because "there is an imbalance in gas being a lot cheaper than electricity". Thus, this showed that the problem is the symptom of other problems.

Criteria 9: The existence of a discrepancy representing the problem can be explained in numerous ways and the choice of explanation determines the nature of the problem's resolution.

The data shows that the UK government defines the time needed for decarbonisation work and market capacity differently from other stakeholders, which determines the timetable it proposes for completing the work, as well as its overall ambition for decarbonisation.

First, as actors disagree on the amount of time needed to construct a bid and do the works, this leads to a solution offered by the government clashing with social landlords' capabilities. Many of the social housing providers interviewed who had applied to funding for decarbonisation through the SHDF or LAD schemes complain about the short timeframes for application and completion of the work, while the representative from the UK government DESNZ believes that the timeframe is adequate and that the problems are more likely to come from different sources, such as inconsistent policies. Indeed, Kate Eveleigh from Oxfordshire County Council says the implementation timeframe was "too short", the representative of Hyde Housing thinks that "the delivery window is still unrealistic", as "they want it done in next to

no time", and the Adecoe representative explains that the short time frame is inadequate in view of the tight budget and lack of human resources of social housing providers. Paul Neale of Soha tells that it was because of the short timescales for the application and delivery of the works that Soha did not apply for LAD 1A, which they considered unachievable. For LAD 1B, although the deadline was a little longer, Soha "got three extensions to do the work" because "the deadline was still not realistic", he recalls. According to the media Inside Housing, no organisation that applied for either LAD 1A or LAD 1B met the deadline[70]. For the second wave of the SHDF, the deadline is two years, and the clock starts when the successful bid is announced. While the social housing sector is expected to meet this deadline, Paul Neale calls for the government to "first ensure that it is organised and meets the deadlines before demanding that the social housing sector does the same", as in the first wave of the SHDF, he felt that this was not the case. For Juliet Nicholas of Oxford City Council, the fact that failure to meet the challenging deadline means no funding is a considerable challenge. Ron McArthur assesses that, although the association did not have problems of human resources compared to the other actors interviewed, the short timeframes led their team to invest a disproportionate amount of their time in guaranteeing the delivery of the project in the timeline, which prevent them from engaging with the tenants as much as they wanted to ensure their understanding and support of the works. In contrast to these views, the UK Department of Energy Security and Net Zero representative believes that, in the case of the wave 2 of the SHDF, the guidance was published well in advance, which was an improvement on the first wave, and gave "a lot more time for people to develop bids".

Secondly, the government's definition of the market capacity leads it to set targets that are considered overly ambitious by different stakeholders. For the Hyde Housing representative, "the government's ambition to deliver 600,000 heat pumps per year is not in line with the market capacity". "This corresponds to 14,000 a week in a 43-weeks working year. Where are they going to get these from?" According to him, even by investing massively in training the workforce, the objective is unrealistic. For Ron McArthur, the Scottish government also sets ambitious yet unrealistic standards such as the EPC B and passive homes standards, while for him, "all houses will not achieve the same standard" and "the government needs to check the practicality before making it mandatory". "There can be no single goal", confirms the Adecoe representative, who explains that ambition disconnected from reality leads to the government trying to deliver too many outcomes in a policy, which can undermine its effectiveness. He considers that the ECO was successful because it lasted for years and was simple with basic measures, whereas "the new rounds are too complicated" because "they try to deliver too many outcomes, introducing disproportionate and expensive refurbishment assessments for basic measures". The exclusion of social housing above EPC D has led, he says, to social housing providers no longer taking net zero ECO measures. Finally, for Brenda Boardman, some policies fail "because they try to do a bit of everything for everyone". These examples illustrate that the definition of the problem varies according to the actors and determines the formulation of the solution.

---

[70] Heat, L. (2021), *Councils struggling to meet 'unrealistic' deadlines for 'flawed' Green Homes Grant programme, Inside Housing* [online]. Available at: https://www.insidehousing.co.uk/news/councils-struggling-to-meet-unrealistic-deadlines-for-flawed-green-homes-grant-programme-70750 [Accessed date: 20/04/2023].

Criteria 10: The planner of the solution has no right to be wrong.

Interviews show that the solution planners are responsible for the potentially serious consequences of the proposed actions, which are of great importance to the people concerned.

First, as the reason for decarbonising the social housing stock is the fight against climate change, inaction or inefficient actions have the potential to lead to the worsening of global warming. This is blamed on the UK government by Paul Neale from Soha for example, who accuses the government of "not investing enough [on insulation programs] for a long time", which caused the insulation works to "drop drastically" and create a delay.

Secondly, "being wrong" and developing ineffective solutions for decarbonising social housing leads the planner to slow down the fight against fuel poverty, and can be judged responsible for a negative health impact on households. Fuel poverty affects "many" of Soha's tenants, Paul Neale says. Soha receives many "phone calls from people (…) who can't afford to turn their heating on, which causes damp and mould" in their homes. Higher levels of fuel poverty, and damp and mould are proven to "create health problems", the expert in green building policies warns. For Kate Eveleigh, "a housing stock which is poorly insulated, with leaking roofs, electrical problems and mould has a direct impact on residents' health, and leads to illnesses and an increasing number of deaths in winter, which puts pressure on hospitals and children services". The Adecoe representative denounces insufficient political will to tackle fuel poverty. "Fuel poverty is not considered enough [and] has become less of a priority because of the push for heat pumps as we know they will cost more", he says. Thus, the planner has no right to be wrong, because of the considerable environmental and social consequences this may cause.

Criteria 11: The complexity of the problem increases with disagreements between stakeholders.

With regard to decarbonisation policy for social housing in the UK, interviews show that the stakeholders disagree on many issues, which adds to the complexity of the problem. For example, stakeholders tend to disagree on the technology that should be used for the decarbonisation works in social housing, and the way to communicate about this technology with tenants.

On heat pumps, the UK government representative states that transitioning to heat pumps is "a shift in how people manage their home" and the UK government is concerned about the people's understanding of it. On the contrary, the Adecoe representative considers that having to teach tenants about the new technology is "a failure in the energy efficiency industry". According to him, "residents should not have to learn new technologies, the technologies should work for the residents" and "we should be designing systems for people, not people for systems". As he recognises the problem encountered by tenants to use their heat pumps, he states that "the solution is to create easier technologies, as nobody wants to engage with their heating system". On the other side, Juliet Nicholas thinks that it is useful to "do workshops with tenants to encourage behavioural change". She highlights the example of the energy advisors that Oxford City Council hired to give energy advice to the tenants. "If tenants have problems [with their heat pump], they come to the customer service centre and talk to servicing contractors".

On the question of hydrogen as a low-carbon heat source, actors disagree as well. The UK government considers low-carbon hydrogen as one of the credible solutions for clean heating, on the opposite of researchers or social housing providers. Indeed, in the Heat and Building Strategy, the UK government proposes to "develop hydrogen for heating buildings by thoroughly assessing the feasibility, safety, consumer experience and other costs and benefits, by the middle of the decade" and explains an objective to "potentially switch the natural gas in the grid to low-carbon hydrogen". Large-scale trials of hydrogen for heating are to be conducted, and a neighbourhood trial is planned in 2023. Nevertheless, for other stakeholders such as researchers or social housing providers, hydrogen is not the solution, and especially for social housing. First, using hydrogen for heating has been described as "less efficient and more expensive than alternatives such as heat pumps, district heating and solar thermal", and could cost twice as much as gas for home heating, which does not fit the goal of affordability in the context of social housing.[71] Another study shows that hydrogen is unsuitable for home heating[72], and Jan Rosenow demonstrates that as well in a RAP study.[73] For James Earl, director of gas at the UK's Energy Networks Association, it is rather a question of mix. "No one heating system will get us to the UK's net zero goals as a one-size-fits all approach to decarbonising heating", he states .For him, there is a need to "look at hydrogen, electrification and other technologies all as part of the mix" and that if the hydrogen fall in costs, it may "equal the cost of natural gas in 2030".[74] For the representative of Hyde Housing, "hydrogen is an absolutely no go, people are chasing that route but the infrastructure is too big.". He adds that a low carbon energy grid will raise management issues, "because there are already difficulties now to connect the grid because it can't manage the generation". Referencing Hyde's experience in Ealing, he adds "the grid can't handle new PV generation from social housing in London", and goes as far as to assess that "the government tells you to do your bit, but then they don't do their bit". Brenda Boardman agrees that "hydrogen may work in places close to industries, but it cannot work on a broad scale".

Finally, Paul Neale demonstrates that social landlord's vision of decarbonisation sometimes clashes with that of the UK government on solar PV as well. He tells that back when he was working at Oxford City Council, the local authority proposed a decarbonisation project using solar PV panels and their application to the SHDF was rejected. As Neale says he did not receive much feedback after the rejection, he assumed that the government "did not like the fact that they wanted solar PV panels as they preferred a fabric first approach". Now working for Soha, he explains that the organisation applied to a SHDF funding of £8.8 million with the aim

---

[71] Harvey, F. (2022), *Hydrogen could 'nearly double' cost of heating a home compared with gas*, The Guardian, [online]. Available at: https://www.theguardian.com/environment/2022/sep/26/hydrogen-could-nearly-double-cost-of-heating-a-home-compared-with-gas [Accessed date: 20/04/2023].

[72] Harvey, F. (2022), *Hydrogen is unsuitable for home heating, review concludes,* The Guardian, [online]. Available at: https://www.theguardian.com/environment/2022/sep/27/hydrogen-is-unsuitable-for-home-heating-review-concludes [Accessed date: 20/04/2023].

[73] Rosenow, J. (2022), *Is heating homes with hydrogen all but a pipe dream? An evidence review*, Joule. https://www.cell.com/joule/fulltext/S2542-4351(22)00416-0?_returnURL=https%3A%2F%2Flinkinghub.elsevier.com%2Fretrieve%2Fpii%2FS2542435122004160%3Fshowall%3Dtrue [Accessed date: 20/04/2023].

[74] Ibid 70.

to retrofit two hundred properties to or close to EPC C with external wall insulation, loft insulation, new windows and doors and that they did not consider solar PV because these were not funded, "even though they would like to do it". This shows how disagreements between stakeholders on technologies complicate the implementation of decarbonisation in social housing.

Criteria 12: Actors have a low willingness to cooperate.

Interviews show that a low willingness to cooperate is sometimes observed between the government, local authorities and social housing providers, tenants and landlords, as well as residents inside mixed tenure buildings.

Kate Eveleigh explains that Oxfordshire County Council aspires to be more involved with social housing providers, but that they struggle to contact them, which she explains is the result of a "lack of networking effort" from their side, and that they are "risk-averse regarding the sharing of their data". She assesses that this negatively affects the implementation of decarbonisation policies: "If they want to implement decarbonisation policy to the ground, it is necessary that they broaden their partnerships, connect with actors, and share the information to the tenants of what is available to them". Paul Neale from Soha agrees: "There could be better communication between the county council, city council, and housing associations". Ron McArthur nuances these statements by saying that social housing is "very much a network" in Scotland, and that social housing providers are "willing to share information". However, he recognises that they are "not sufficiently included in the design of policies" by the government. The representative of Hyde Housing shows how frequent changes in the composition of the government affect cooperation between actors: "Hyde's relationship with the UK government has been good so far, but people have changed and will change". The expert in green building policies also analyses a lack of cooperation on policy design: "even though the Code for Sustainable Homes has not been as transformational as it should have been, the rationale of getting rid of it completely rapidly without consultation with the housing sector was a key flaw of this policy". The representative from the UK government argues that the government is committed to consult the sector before legislating, and illustrates that it has recently consulted social housing providers as part of the social housing regulation bill that is currently going through Parliament.

A lack of cooperation is also observed between tenants and landlords, as tenants tend to resist the decarbonisation work. Paul Neale says that "it is common for Soha to see tenants refusing the work". It can be "for health reasons or simply because they do not want people in their house". "Not like in private rental where you can 'kick people out', in social housing, we can't force tenants to renovate, but with the goal of EPC C by 2030 we need to try to persuade them", he says. If tenants refuse, the organisation requires a justification. "We explain that if we don't do it now, we will have to come back and do it". Simon Lannon points out that tenant resistance is illustrated by the "acceptable fail" category of the Welsh Housing Quality Standard (WHQS). This states that a dwelling is classified as "acceptable fail" where "compliance with the WHQS for an individual element is not possible in certain situations – which may include cost or timing of the work, residents choosing not to have work done or where there are physical

constraints to the work" (Welsh Government, 2021).[75] This challenge is also identified by Juliet Nicholas who recounts how multiple LAD 1B measures were not installed because tenants refused access to their homes. "Some tenants had some work done and then, they said that they had enough and stopped the works from being carried out", she recalls. For her, the main problem is the disruption of tenants' daily lives by the entry of workers into their homes, dust and drilling. Kate Eveleigh says that tenants' life stages play a huge part in their resistance, with "some people preoccupied with debts and feeding their families, leaving little time to think about renovations and changing heating systems", highlighting that "old people don't like disturbances". Aimee Ambrose explains "the difficulties of moving tenants into hotels, sometimes for a long period of time" and forcing them to "empty houses in which they had sometimes lived for decades". The Adecoe representative recalls that "moving people out of their homes is a cost" and that it is "difficult to ask tenants to swap an inexpensive, reliable, controllable and flexible heating system, for which they can choose their supplier, for a more expensive heating system which is not always reliable and for which they have no choice of supplier". The representative of the DESNZ argues that the UK government attempts to tackle this, as the SHDF requires applicants to "set out how they've consulted their residents, how they're going to engage the residents through the works and ensure that their concerns are taken on board". "We expect applicants to work with tenants to ensure that they do understand how any new technologies work, so that they are being used to keep homes to an appropriate standard", they say. Moreover, the issue of tenants' resistance is nuanced by the representative of Hyde Housing, which states that it is important "to be mindful of the impact [of decarbonisation works] on our customers" and "understand their concerns". Hyde conducted a "customer engagement piece investigating" and realised that environmental issues were high in tenants' concerns, and that tenants were "asking for higher insulation". On the willingness of the UK government to "test" technologies, he cites Jenny Osborne, Chief Executive of TPAS (Tenants Participation Advisory Service), who testifies that the feedback from tenants on this topic is that they "don't want to be guinea pigs".

Finally, mixed tenures is also a challenge recognised by interviewees as a barrier to actors' cooperation. Paul Neale explains that in mixed tenure, in order to insulate the whole building, "private tenants will have to pay, but they don't have the money". While the SHDF tries to help social housing providers gather data from private lease holders and identify those available for decarbonisation, the Oxford City Council still "leaves the mixed tenures on the side", Juliet Nicholas says. "We don't know what to do with them", says the representative of Hyde Housing. The UK government recognises that mixed tenures are an issue and says that the SHDF grant "allows a certain percentage of non-social housing properties to be included in the projects where those properties are occupied by low-income households". Thus, various actors have a low willingness to cooperate.

Criteria 13: Actors have conflicting values and interests.

Interviews highlight conflicting values and interests between a UK Conservative government and other stakeholders, illustrated by policy choices of pursuing economic interests

[75] Welsh Government (2021), *Housing Quality Standard: Summative Evaluation* [online]. Available at: https://www.gov.wales/sites/default/files/statistics-and-research/2021-06/welsh-housing-quality-standard-summative-evaluation.pdf [Accessed date: 20/04/2023].

in the decarbonisation process the choices to deliver quality work, and the choice of a competitive and resource-intensive mechanism to allocate funding.

First, Brenda Boardman and the expert in green building policies from Wales criticise decarbonisation policy for being too focused on economic interests. The ECI researcher argues that "policies fail because they focus too much on profitability", and the second expert explains that "there is a risk that policymakers will prioritise economic growth over a long-term green agenda", which, they say, is contrary to the interests of social housing providers. This is explained to lead the actors have different interests and values on the delivery of quality work. The expert in green building policies from Wales argues that "since the financial crisis, housing in the UK has been treated as a commodity, and houses have been seen as things to be built quickly to be economically efficient". In the post-war context, "the aim was to build quickly rather than build well, "energy was cheap, modern insulation materials were not available and modern building regulations did not exist". "Even in more recently built buildings", they assess, "there are insulation problems". In the post-Covid era with the goal of "building back better", they lament the fact that "the construction industry still pays cheap labour to build quickly", which leads to seeing "problems with leaks and poor construction". While since 2020, there has been a lot of talk about changing the construction industry, they observe that there has been "no concrete delivery". Paul Neale confirms these conflicting interests in the construction industry: "It is more difficult to get equipment and skilled labour, but as contractors know that money is being thrown away, they raise their prices again", and "the government said it would encourage the training of a more skilled workforce, but it is not doing so". Hyde Housing representative highlights that the skills in the construction sector is "a big part of the problem", as there are not enough people to do the decarbonisation works in social housing: "there are 300,000 fewer people in construction this year compared to 2019", he explains.

Second, the SHDF application process is also the focus of conflicting interests, with the UK government wanting to improve the quality of bids through competition, and social housing providers of small and medium-size testifying being negatively affected by the administrative burden and resource-intensive process. Juliet Nicholas testifies that applying for the wave 1 of the SHDF was intense and competitive for the Oxford City Council, with a lot of background data needed "which many local authorities do not have". She explains that they used consultants to apply, and that she hopes that the wave 2.1 will be "less competitive since there is more money". Paul Neale also recalls Soha used consultants which were "invaluable" in helping them to apply for the SHDF. The Adecoe representative also considers the application to SHDF as "very resource-intensive". Hyde Housing representative explains that Hyde had decided to apply "collectively with four other organisations in order to increase [their] chances as medium-sized social housing providers". Although these organisations had come together and shared the amount of work for the application, he reports a bad experience for Hyde: "It was awful, we would not have done it on our own if we didn't have the support of everyone else. It was one of the worst bids I have been involved in. I've never done anything like it." and highlights the time-consuming nature of the procedure: "We spent most of last summer prepping to be able to get the bid in November. We had a project group running with two or three meetings every week, just getting the information together, starting to get the bits together, and preparing everything. It was phenomenal, and in addition to your day job and all the other things that you do". In addition to this, he explains that Hyde had worked extensively with Adecoe for their

planning, which had helped Hyde define “what needs to be done for how many properties and in what time frame”. He criticizes this functioning: “Housing providers are not natural bidders, that's what contractors are good at”. For Brenda Boardman, the competitive mechanism of the allocation of this fund is opposed to the interests of smaller sized social housing providers “who do not have the necessary staff to present a competitive application”. On the other hand, the UK government representative explains that the interest of the UK government is to “ensure that we are getting quality projects that are going to achieve our objectives”. For the government indeed, putting a minimum amount for the projects for Wave 2 was “a way to reduce the number of potential applicants to be assessed by the administration”. The UK government recognises the problem and aims to continue trying to “refine the criteria in the future to make it more accessible and try not to put too much burden on potential applicants”. “We want to target everyone”, he says. Nevertheless, he considers that improvements are being made, as it used to be mandatory to pay the grant through local authorities, and wave 2 now enables housing associations to apply directly, and highlights that the government offers a free Technical Assistance Facility (TAF), which “supports potential applicants to the SHDF to understand their social housing stock, develop their bids, ensure their bids are going to be suitable, and achieve the criteria that were set out in guidance”. On the question of competition, he states that “smaller providers can join a consortium where multiple organisations gather with a lead bidder, which can take some of the pressure off the ability of organisations to develop bids”. Nonetheless, the representative of Hyde Housing nuances this statement by saying that “even though Hyde benefited from some technical assistance from the government, the support was provided by program managers and not housing practitioners who had little understanding of the practicality of housing association governance” and could not provide all the practical information Hyde would have needed. These examples show that actors have conflicting values and interests on certain dimensions of decarbonisation policy for social housing.

Criteria 14: There is a low degree of knowledge of the problem and solution.

Finally, among the barriers to decarbonisation identified, interviewees cite the energy illiteracy of tenants and landlords.

Aimee Ambrose explains that there is a problem in implementing the policy because “social landlords sometimes don't understand the technologies and are then unable to explain them to tenants”. Juliet Nicholas tells that Oxford City Council started trials with air source heat pumps and is looking to see “how it affects tenants and whether it works effectively”, and has received very mixed feelings from tenants who have had heat pumps so far: “Tenants are used to turn on the heating and get instant heat, and they don't understand the need to leave the heat pumps on for longer and think it costs them more money, because they are on all the time. In reality, this is the only way to heat the house efficiently. They also change the settings, which has an impact on the efficiency of the system and on their prices. Tenants say their bills have gone up, but in fact this is not an impact of the heat pump as such. There is a lot of misunderstanding. Because it works at a lower temperature, they don't feel it works, and we have had to explain to them how it works differently”. She concludes that there is a lot of work to be done in terms of tenant engagement. Similarly, the Adecoe representative tells the story of refurbishments in social housing with heat pumps and PV panels, where residents were convinced that the solar PV panels were charging them rather than contributing to their energy

bills. All the social housing providers interviewed tell the same story of tenants turning their heat pumps on and off because they feel they can't afford it, when they don't leave them running all day at low temperatures. For Paul Neale, tenant's education is therefore essential, and for Kate Eveleigh, "behavioural change is needed to help residents adopt a new approach to heating". Finally, for Juliet Nicholas, the behavioural education needed is not only about the use of new technologies, but also about the issue of energy waste. "Letting the heat out" is one of the main problems she says is "still largely unrecognised", as "some tenants turn on all the radiators in a place that does not need to be heated". Thus, the lack of understanding of the need for change and the functioning of new clean heating systems by social tenants and sometimes social landlords, illustrates a low awareness of the problem and the solution.

In summary, the interviews identified the main barriers to decarbonising the UK social housing stock. Firstly, according to respondents, there is a lack of data from social housing providers on the energy performance of buildings and fuel poverty, which makes it difficult in practice to target the worst performing homes and most vulnerable tenants. Interviews show that the inconsistency of policy creates uncertainty for social housing providers in choosing which technology to invest in, and the short timeframe for applying for funding and short timeframe for completing decarbonisation work reduces their incentives to develop decarbonisation projects or respect the deadlines. Other problems were identified in the design of the policy: too many objectives to be achieved by one policy, lack of recognition of the diversity of the social housing stock and the attempt to put in place a comprehensive policy, sometimes with overly ambitious objectives. Respondents say that the procedures for applying for funding are too competitive and resource-intensive, and lead to them having to access consultancy services, which disproportionately and negatively affects smaller social housing providers. The issue of funding is central: the amount offered by the government in the form of grants to support the work is considered insufficient by social housing providers, and while local authorities appear to be optimal players in the local energy transition, their lack of resources reduces their ability to fulfil this role. Faced with these constrained resources, social landlords sometimes have to make choices between building safety and energy efficiency. The affordability of clean heating systems is also a major barrier, with heat pumps being too costly, and energy prices too high compared to gas prices. Tenants' lack of understanding of the need for change and distrust and tenants' disturbance in the decarbonisation process lead to the problem of tenants' resistance to the works, which has been worsened by the Covid crisis. The complexity of the functioning of new technologies (such as heat pumps) combined with the energy illiteracy of social landlords and social tenants leads to inappropriate behaviours in the use of technologies and energy wastage. The data collection also highlighted the problem of the shortage of skilled workforce in the labour market. With regard to interactions between actors, interviewees complained both about the lack of networking efforts on the part of social housing providers and the lack of inclusion of social housing providers in government policy-design. Competing interests are also seen as a challenge, with some actors prioritising economic interests and the need to build faster over emissions reduction and quality of work, with cases of fraud in insulation work. Finally, elemental management rather than performance management is seen as a barrier to effective decarbonisation of the stock.

Moreover, the data collected in the interviews show that the policy problem of decarbonising the social housing stock meets the fourteen criteria of a wicked problem. Thus, we can assert that policy-making on social housing decarbonisation in the UK is a wicked problem. Thus, as the literature on wicked problems shows that in order to solve a wicked problem, it is necessary to decentralise decision-making and develop solutions in dialogue and collaboration with stakeholders, and as the aim of this paper is to define policy recommendations that offer ways of solving the policy problem, the following part is an experimental attempt to define solutions by mapping stakeholder positions.

6.2 Mapping stakeholder positions on solutions to the policy problem of social housing decarbonisation.

This section groups the solutions proposed by the interviewees into different categories. The paper presents a pilot example of how one might proceed to define problems and solutions by first conducting bilateral interviews and then bringing stakeholders together to engage in a deliberative process to discuss the problems and solutions, which could not be done in the context of this paper due to resources and time constraints. The solutions presented in this section are the most consensual. Some solutions that were mentioned only once in discussions with interviewees, that seemed out of reach, unrealistic, insufficiently explained or that did not seem justified by the data, have been left out.

Solution 1: Having longer-term planning and guidance.

The main problem identified by stakeholders is the lack of long-term policy direction. Juliet Nicholas states that the solution lies in consistent and long-term funding, as well as more precise guidance on what net zero really means, whether it means switching to electricity, how to decarbonise heating and more precise guidance on heat pumps. For the Adecoe representative, the solution lies in greater overall certainty for social housing providers and greater flexibility on how they can achieve the decarbonisation target over a period of time. The DESNZ representative agrees that certainty is needed for providers to understand the regulations and what they should aim for. For the representative of Hyde Housing, short timescales for carrying out decarbonisation work in social housing lead to social housing providers moving on to the next house if their tenants refuse the work. A longer timeframe for the work to be carried out and a longer investment horizon would solve this problem. He believes it would be better to decarbonise two or three million social homes a year for forty years, rather than staying in an unstable rhythm of five million a year and one million the following year. He argues that the UK government should have three long-term visions: one for infrastructure, to ensure that the electricity grid can support demand, one for financing, and one for reforming the wholesale energy market. The representative from Adecoe argues that long-term policy planning and stable direction from the government would address the funding gap. Although he believes that the funding gap is still significant, he argues that more policy certainty would allow investment programmes to respond in a considered way, leading to lower delivery costs due to longer term commitments with the supply chain. This would allow the supply chain to be built over a reasonable period of time rather than on the basis of demand peaks, making decarbonisation more affordable and easing the process of going to tenants and

making it clear what will be done and in what timeframe. Simon Lannon shows that Wales can be a source of inspiration for long-term policies, as the country has been a forerunner in terms of sustainable development policy making, with decarbonisation policies dating back to 2000.

Solution 2: Collaborating with stakeholders.

To increase the appropriateness of the policy design and its acceptability to stakeholders, Ron McArthur recommends that it be developed in consultation with social landlords. He cites the example of the Optimised Retrofit programme, which he considers a successful example of policy design in collaboration with social landlords, with a whole-house approach and room for innovation. The representative of Hyde Housing says that surveys are a good way to understand tenants' concerns, and stresses that Hyde uses them to co-create projects with their tenants. He assesses that more co-design of projects with social housing providers is needed as well, and that it would be good to involve more of the sector, as currently the government relies on the four or five largest social housing providers and does not reach out to medium or smaller providers, like Hyde. Simon Lannon explains that the Welsh Government's policy is an example of good practice on this issue, as some of the Welsh policies on decarbonising social housing have been developed after consultation with landlords and then translated into practice, while leaving room for innovation, with the Innovative Housing Programme for example. It could be argued that, when designed in collaboration with stakeholders, policy instruments can be better designed to tackle a problem, while respecting the two main objectives of the overall policy, decarbonisation and social justice.

Solution 3: Setting the right target for decarbonisation.

"An easy policy is not a good policy", tells Brenda Boardman. Policies should strike a balance between the ambition and feasibility of the decarbonisation target, considering the diversity of buildings in the existing social housing stock. Ron McArthur explains that there is no one-size-fits-all solution and that the decarbonisation target needs to be flexible yet ambitious. He points out that there will be pockets of housing that will not be able to reduce their emissions without a considerable budget. For the Adecoe representative, a comprehensive approach to retrofit is appropriate in some cases, but in others, for social housing, as the system is based on a limited amount of income and aims to maximise the value of investments, a whole-house approach is difficult to justify and may not provide sufficient benefits to homeowners. It is therefore necessary to tailor the renovation objective to the building. For the expert in green building policies from Wales, given the great diversity of the built environment, a general policy that covers all of social housing homes is not possible. According to Brenda Boardman, a good decarbonisation policy for social housing sets specific targets to be achieved, such as everyone achieving an EPC C level, but with a flexible approach to the measures to be taken, as different solutions would be appropriate for different buildings. Stakeholders disagree on the details of the EPC target. Simon Lannon proposes retrofitting buildings to achieve EPC A by 2050. For the representative of Hyde Housing, the solution should be to aim for an EPC B by 2045 and not an EPC A as it is too expensive. However, he points out that there is a risk in removing the EPC C target by 2030 and making it longer term, as there is a risk of simply losing an already quite ambitious goal. The representative from Adecoe argues that in a context of limited resources, EPC C by 2030 is a reasonable target, as it is better to retrofit as many

properties as possible than to fully retrofit only a few hundred houses. He assesses that there has been a lack of policy and that the goal of EPC C by 2030 is not an actual regulation and has been adopted by the sector as a target, because "they are keen to do the right thing". More importantly for him, there is a need to move to housing performance management, as opposed to elemental management, with flexibility to choose the best technologies, from heat pumps to solar PV if they are most appropriate, because the housing stock is complex and all houses are different. However, this flexibility in policy and financing requires trust in the installers. Finally, Hyde Housing representative explains that setting the right target also means preventing the risk of many properties being exempted because they are considered too difficult to decarbonise, because they are conserved or because they are too rural.

Solution 4: Understanding the costs and increasing funding.

Juliet Nicholas says that the priority is for the government to understand the costs and reflect them in the grant amounts. According to Paul Neale, more funding would allow the PAS 2035 approach to be followed and grants could cover important elements such as ventilation, solar PV, enabling works or surveys. With more funding, social housing providers could decarbonise their stock to an EPC A, and as many properties cannot achieve an A, they could aim to achieve the highest EPC possible. "Then, the house would be finished and there would be no need to go back to it" says Neale. For the properties that cannot be upgraded, he considers that they should be destroyed and started again. "Retrofit is not cheap nor easy, but it has to be done", he states. Aimee Ambrose also argues that, since technology are known, the UK should learn from the historic transition from coal to gas heating, which took place over a decade, and implement a National Insulation Programme with ambitious funding. Interviewees also see innovative funding methods as a way to increase funding. The representative from Adecoe says that social housing providers could "start selling carbon credits, renewable energy, or use ESCO models", which will be transformative as it could bring known consistent funding. He argues that the social housing sector is "the place where one could get quantified, verified and monitored carbon credits, because social housing providers don't compensate by planting trees on the other side of the world", but do measures on properties that are assessed before and afterwards and delivered by high standards from contractors. For Hyde Housing representative, there is a need for an incentive to transform social housing providers' willingness to decarbonise into concrete actions. He explains that Hyde still has "a long way to go on [their] sustainability approach": "I don't think sustainability is part of our core decision making (…) and we don't have it built into all our supply chains". He thinks that there is a need for "someone telling 'you're responsible for this, you need to do something better'". By increasing funding, the government's expectations of the decarbonisation performance of social housing providers could also be raised.

Solution 5: Increasing the engagement of social tenants.

To tackle the challenge of tenants' resistance to the works, Simon Lannon tells the importance of a simple messaging that improves communication, as well as demonstrating the benefits such as reduced bills. Aimee Ambrose explains in the same way that it is important that the benefits of the transition are understood by people, and that tenants are able to see that the work will improve their quality of life. It shows that insulation is often well perceived by

tenants, in contrast to a difficult technology that can bring new problems. The decarbonisation work carried out by Angus Housing Association is good practice in this respect, as Ron McArthur explains that although the work was disruptive to tenants, "tenants understood what the landlords were doing and almost immediately saw the benefits of having a warm and comfortable home at an affordable price". Reducing disruption during the works is another way of increasing tenant engagement. Kate Eveleigh proposes the solution of doing the work when families move out, and Paul Neale when tenants are on holiday. Interviewees argue that there are opportunities in social housing, as social landlords engage easily with tenants and tenants trust them, as Brenda Boardman explains, and tenants are keen to see their homes improved, made more beautiful and comfortable. In terms of innovative participation processes, Juliet Nicholas reports Oxford City Council's good results success with engagement workshops. They are trying to get "champions"-other tenants who have carried out renovation work and who testify that, although the work has been disruptive, the benefits they see are worth it as they could sometimes not afford to heat their homes before-, to have tenants communicate directly with other tenants rather than to a council representative. Aimee Ambrose adds that increasing tenants' engagement is also determined by the consideration of the life stages of people, and Kate Eveleigh confirms that it is central to understand the complexity of tenants. The BHBH is an example of a scheme which could help people who switch to heat pumps to have behavioural support. "After a first visit, tenants could have a follow-up visit to make sure that everything works well", she says. Regarding reducing tenant disturbance, Paul Neale highlights the bad practice (from a project with LAD1B) of internal wall insulation work being carried out with the tenants staying inside the property, which was not cost effective. He said the solution is to negotiate with tenants and make it clear what is going to happen, and to target empty homes between contracts or when people die, and with the challenge of getting the government to accept this uncertainty. Finally, to tackle energy illiteracy, Aimee Ambrose states that policy should help raise the skills of tenants regarding new technologies, and Adecoe representative states that the government should rather incentivise companies to make the technologies easier to use.

Solution 6: Tackling fuel poverty and reducing electricity prices.

For Adecoe representative, to tackle fuel poverty, the perspective of the policy-maker on fuel poverty needs to change, as he analyses that "if there was a trade-off between reducing carbon emissions and tackling fuel poverty, carbon would win at the moment". To tackle fuel poverty, Aimee Ambrose explained that fuel poor households need to be mapped and targeted in advance of decarbonisation work so that they can be prioritised for the work. According to Kate Eveleigh, particular attention must be paid when conducting work on families, personal health and inequalities. Aimee Ambrose shows that Scotland has examples of good practice policies and could be a source of inspiration for policy design, with energy advisors in remote hard-to-reach areas, and recognition of different levels of fuel poverty. Another example of good practice is presented by Ron McArthur, who assess that as Angus Housing Association has around 40% of their tenants who have difficulties to pay their bills and thus can be identified as experiencing fuel poverty, the financial inclusion team helps fuel poor tenants to get the right benefits, and the organisation has applied for funding for "an energy advice worker who would help tenants to go through the base of various energy providers and try to get the best deal".

For Brenda Boardman, this reduction in fuel poverty cannot be achieved without a reform of the energy market to bring down electricity prices. She proposes a new model to produces cheaper renewable electricity. In the same way, the representative of Hyde Housing argues that a low-cost electricity supply is needed, as the cost of electricity is too high compared to the price of gas.

Solution 7: Simplifying the application process to funding.

For Ron McArthur, applying for funding should be less resource intensive, with longer delays and external support. He shows that there is an opportunity to be taken as housing associations are already "self-motivated to deliver quality housing", and "have been doing it for years". "[Social housing providers] are keen to do the right thing", explains the Adecoe representative as well. For Simon Lannon, "social landlords in Wales are willing to engage in decarbonisation". Nevertheless, "they are more likely to think about the components of the house (the roof, the walls, the tenants), rather than in terms of whole-house retrofit", which can be a limitation to energy efficiency gains. The way in which subsidies are granted could steer the actors in the right direction, provided that the application is feasible and does not disadvantage the smaller social housing providers. The Hyde Housing representative explains that bidding needs to be easier and more proportionate to the opportunity. Finally, in terms of good practice, Kate Eveleigh cites the Warm Front Scheme as an example of a successful easy access policy for social housing providers.

Solution 8: Providing quality work tailored to the building.

Interviewees stress the importance of ensuring that the work carried out is of high quality, and several mention the importance of monitoring to prevent installation fraud. In terms of good practice, Paul Neale describes the mechanism put in place by Soha to hold contractors accountable for their work. A retrofit assessor evaluates the heating system, insulation, windows, ventilation and advises on how best to improve the building in their social housing stock, and a retrofit coordinator oversees the decarbonisation works from assessment to completion and files all measurements on the Trust Mark. Within five years of the work being done, if there is a problem, it is possible to look in the database and see which contractor did the work and ask them to fix it. Soha choose to use one company as bid writer and contractor, and a third party as the coordinator for the retrofit. While Paul Neale says this is a good way to ensure quality work, he also complains about this method becoming increasingly expensive and sometimes running into technical problems when the data collection is not done properly. The UK government representative explains that the government insists on decarbonisation projects complying with PAS 2035, which is designed to ensure that social housing providers don't have unintended consequences of doing the works and that the retrofit plan is appropriate for the particular property that it is being used for.

Solution 9: Stimulating innovation to define the appropriate technologies.

Respondents believe that the government should provide incentives for innovation and that social housing providers are willing to engage in innovative decarbonisation trials. Aimee Ambrose argues that good policy leaves room for innovation in the implementation of decarbonisation at the local level. For Simon Lannon, in addition to a long-term commitment

with strong targets, decarbonisation policies must be flexible to allow for innovation in the implementation. Ron McArthur explains that pilot projects provide a clearer picture of what investments need to be made, while reducing risk through lower investment. To this end, Angus Housing Association has carried out a trial passive house project, and Paul Neale explains that Soha has piloted new technologies such as a ventilation system that responds to humidity and does not require electricity, and heat pumps. He regrets that these pilot projects are limited by the expectation of new funding which never materialised. Juliet Nicholas explains that it is a question of trade-offs and decisions based on the priorities of social housing providers, because while solar PV may be part of the solution to decarbonising social housing, in the fight against energy waste, energy production on buildings will not encourage waste reduction. She also believes that heat networks should be bigger and, although Oxford City Council has not invested in them, she is interested in the Bunhill Heaton power network in London, which aims to recover heat from the tube, and cites a project in Cambridge which is looking at it as an opportunity to reduce emissions. For the UK government representative, the solution lies in a mix of technologies and, with regard to the challenges posed by heat pumps, he believes that more heat pumps will help develop the market, highlighting the importance of trials and small-scale projects.

Solution 10: Building market capacity, developing skills and facilitating the access to data.

In addition to long-term support signals to investors through stable policies, all stakeholders interviewed agree that massive investment in training for construction workers is needed to ensure that the workforce is sufficiently skilled to explain and install new technologies correctly. The representative of Hyde Housing says that because there are not enough installers at present, investment is needed in this sector to increase the number of installers who can understand, explain and correctly implement technologies such as heat pumps in social homes. Paul Neale from Soha, for example, believes that the solution lies in mass training which should address the current labour market shortages in the construction sector. Furthermore, the Adecoe representative explains that facilitated access to data and the way we measure housing performance is essential to deliver quality work, as it will transform the way social housing providers invest in their properties and change the ability of residents to control their own environment and choose between warmth and cost, for example. The consultant believes that although this is beginning, "we are not there yet".

7. Policy recommendations

Based on the mapping of stakeholder positions and the most recurrent solutions collected, this paper provides five policy recommendations for improving the design and implementation of decarbonisation policies for social housing in the UK.

Policy recommendation 1: Increasing the use of participatory methods in the policy design. The first recommendation is to design policies in a decentralised and participatory way with stakeholders both at the stages of problem definition and solution design. This can materialise in a consultation with a representative panel of small, medium and large social housing providers, representatives of companies in the construction sector, local authorities and social housing tenants, to ask stakeholders to express their views on the barriers to the decarbonisation of the social housing stock and the necessary solutions to tackle these barriers, and engage in a discussion to compare these visions and find points of consensus on the conflicting solutions. Similarly, to tackle the issue of tenants' resistance to the decarbonisation works, a fact sheet could be designed for social housing providers to encourage and guide them to use participatory practices to gather tenants' concerns and questions before a decarbonisation project, have the opportunity to convince them of the need for and benefits of decarbonisation works with the use of "champions" (former tenants who have benefited from this transition to insulated home and clean heating), provide details on the progress of the work and how new technologies such as heat pumps work and should be used.

Policy recommendation 2: Providing a long-term vision and simplifying the application process for funding. The second recommendation is to provide greater stability in terms of policy and funding, by launching an ambitious plan to decarbonise the social housing stock while ensuring that existing schemes are not abandoned along the way. Grant amounts and deadlines for grant applications and completion of decarbonisation work should be set after consultation with a representative panel of large, medium and small social housing providers to ensure that they reflect the reality they experience. In addition, more investment could be made in the technical assistance facility and the communication around it in order to effectively support social housing providers in the development of their bids, ensuring that assistance is provided by professionals who have direct experience of social housing management and who can provide personalised and practical advice. Finally, an annual meeting of social housing providers on decarbonisation could be planned by local authorities, and financially supported by the government, to share good practice, including the use of innovative financing methods such as carbon credits.

Policy recommendation 3: Setting the right target and tackling fuel poverty. The third recommendation is to set an ambitious but flexible target that respects the diversity of the social housing stock, i.e. the renovation of the social housing stock to maximum capacity from EPC C (either EPC A, B or C). Where dwellings cannot exceed an EPC D and are not protected, one could encourage the demolition and reconstruction of more energy efficient dwellings. Tackling fuel poverty could be an explicit priority for the decarbonisation work in social housing, and the government could incentivise social housing providers to target the least energy efficient

dwellings where the lowest income tenants live using existing models that use EPC data and households' income data, giving them priority in the selection of decarbonisation projects. This requires facilitating access to data for social housing providers.

Policy recommendation 4: Facilitating the practical implementation of decarbonisation works through innovation and workforce training. The fourth recommendation is to clearly define the technologies that should be supported for decarbonisation, based on the input of an expert group. This would enable the government to send a clear signal to social housing providers on what technologies they can include in their projects (such as heat pumps, solar PV or hydrogen). The government should also ensure that it is flexible on technologies and encourage social housing providers to launch trial projects to find the right technologies to decarbonise their stock. A massive training programme in the construction sector should be funded on decarbonisation and the installation of new green heating technologies and the government should stimulate employment in the sector to address the shortage of skilled labour. Finally, the government should encourage quality work through monitoring, and rules should be more flexible in the allocation of funding to facilitate decarbonisation works in empty dwellings between tenancies to reduce tenant opposition.

Policy recommendation 5: Reducing electricity prices. The fifth recommendation is to make the transition to a clean heating system effectively affordable. To this end, the electricity market needs to be reformed to reduce electricity prices. Here, an inspiration could be drawn from the reform project of the European electricity market, that aims to achieve greater market resilience, make electricity bills less dependent on fossil fuel prices, guarantee a greater protection for households against electricity price volatility, give incentives for households to generate and share electricity, while ensuring a secure energy supply, particularly from renewable sources.[76]

[76] Widuto, A., European Parliament briefing (2023), *Reforming the EU electricity market*, European Parliamentary Research Service [online]. Available at: https://www.europarl.europa.eu/RegData/etudes/BRIE/2023/739374/EPRS_BRI(2023)739374_EN.pdf [Accessed date: 20/04/2023].

8. Limitations and conclusion

8.1. Limitations

Although I have tried to limit the bias, my research has limitations in terms of method and content. First, in terms of method, by choosing to focus on social housing, this study does not include low-income landlords who are asset-rich but cash-poor, low-income households living in private rented accommodation, and people in extremely precarious situations who live in inadequate housing or who are experiencing housing exclusion. An expected impact of this bias on my conclusion can be that it is easier to define solutions for social housing as social landlords can be easily targeted and contacted, while the policy recommendations will not help address asset-rich but cash-poor homeowners, who still might be left behind in the transition, as well as low or middle-income tenants in the private rented sector, who might face evictions following decarbonisation works and increased rents (or "renovictions"). My advice for future researchers on the topic would be to focus on these categories of households and define policy recommendations targeting these groups, with the priority being, in my opinion, low or middle-income tenants in the private rented sector as examples of "renovictions" have already been observed in other countries such as Canada and Sweden.[77]

In selecting the interviewees, the methodological choice was not to aim for statistical representativeness but to contrast the diversity of situations. Practicality and time constraints led me to rely on the network of researchers at the Environmental Change Institute in the University of Oxford, where I was based during the research, and on the recommendations and contacts of the people I interviewed, which saved me time and ensured the quality of the discussions. However, there is a risk of confirmation bias. As I was still able to show that the actors do not agree on the definition of the problem, the risks can be considered low, even if more contrast between the actors' positions would have even improved the diagnosis. What could have been done differently, and what is another piece of advice from this paper for future research, is to select social housing providers of even more varied origins and types (including from Norther Ireland) and to contact a wider range of actors, such as representatives of the construction sector and social housing tenants who have experienced and/or opposed decarbonisation works in their homes. The use of quantitative data through surveys could be a way to obtain representative data on tenants' experiences of decarbonisation works.

Second, a limitation of the section on solutions is that the literature indicates that solutions to wicked problems have to be designed considering the positions of the actors, but also in dialogue with the actors. Due to time constraints, I was only able to collect the different opinions of stakeholders without confronting them with each other. Therefore, both the definition of the problem and definition of the solution would need a proper participatory and deliberative multi-stakeholders process. On how to best design this participatory process, this paper recommends to refer to the literature and more precisely Rith and Dubberly work, who analyse Rittel's

[77] FEANTSA (2022), *Renovictions in Europe*, Briefing [online]. Available at: https://www.feantsa.org/public/user/Resources/reports/2022/2_Briefing_-_Renovictions_in_Europe.pdf [Accessed date: 25/04/2023].

conception of wicked problem resolutions as “a radically new conception of design and planning processes and of methods”, with a design process being “inherently argumentative, in which the designer continually raises questions and argues with himself and others over the advantages and disadvantages of alternative responses”. They explain that Rittel calls for “methods that support argumentation and facilitate the identification of questions, responses, and arguments”, which can help design the participatory process.

Finally, one of the limitations of the policy recommendations is that the UK is a non-interventionist, market-oriented state. Therefore, some of the policy recommendations that may seem appropriate for decarbonising stocks could be considered too interventionist for the political culture. With more time to conduct the research, one solution might have been to present the policy recommendations to UK government officials and UK policy researchers to assess their feasibility and ensure that they fit the current political balance in the country.

8.2. Conclusion

In conclusion, this paper demonstrates that social housing decarbonisation policy and its implementation is a wicked policy problem and that, in line with the recommendations of the existing literature on wicked problems, it should be addressed through a participatory and decentralised process that involves different stakeholders, both at the problem definition and solution design stages. The main barriers identified to retrofitting and transitioning to clean heat in social housing in the UK are inconsistent policies, lack of funding and resources for social housing providers and local authorities and their lack of data on building energy performance and tenants' experience of fuel poverty, overly competitive and resource intensive application procedures to funding and short timescales for completing works, lack of recognition of the diversity of the social housing stock in decarbonisation targets, lack of accessibility of clean heating, high energy prices, lack of understanding by tenants of the need for change, inappropriate behaviour towards new technologies, disruption of the decarbonisation process and resistance to the work, shortage of skilled labour, lack of networking efforts by social housing providers, lack of inclusion of social housing providers in the design of government policies, fraud in installation, and preference of basic management over performance management. This paper argues that these problems could be addressed by making greater use of participatory methods in policy design, providing a long-term vision and simplifying the application for funding, setting an ambitious but flexible decarbonisation target, explicitly aiming to tackle fuel poverty, facilitating the practical implementation of decarbonisation work and reducing electricity prices. Finally, a recommendation for future research would be to conduct a similar study focusing on low-income households living in private rented homes as well as low-income homeowners, as they may be more difficult to target and risk being left behind in the energy transition if strong social safeguards are not put in place.

9. Bibliography

Books

Geertman, S., Stillwell, J. (2020), *Handbook of planning support science*, Edward Elgar Publishing.

Marshall, T. (2008), *Wicked problems*, Design Dictionary, Board of International Research in Design.

Head, B. W. (2022), *Wicked Problems in Public Policy, Understanding and Responding to Complex Challenges,* Palgrave Macmillan Cham.

Articles

Biresselioglu M. E., Demir, M. H., Kaplan, M. D., Solak B. (2020) *Individuals, collectives, and energy transition: Analysing the motivators and barriers of European decarbonisation*. Energy Research & Social Science, Volume 66.

Camillus, J. (2008), *Strategy as a wicked problem*, Harvard Business Review.

Campbell, N. (2019), *Energy efficiency and well-being benefits*. Energy Evaluation Asia Pacific Conference Bangkok, Energy Efficiency and Conservation Authority.

Hampton S., Fawcett T. (20202), *Can energy projects be over evaluated?*, Environmental Change Institute, University of Oxford, United Kingdom.

Hanberger, A. (2001), *What is the Policy Problem?: Methodological Challenges in Policy Evaluation*, Evaluation ISSN Vol. 7, London.

Hoornbeek, J. A. (2017), *Understanding policy problems: a refinement of past work*, Policy and Society.

Jenkins K., McCauley D., Heffron R., Stephan H., Rehner R. (2016), *Energy justice: a conceptual review*, Energy research & Social Science.

Killip, G., Fawcett, T., Jofeh, C., Owen, A., Topouzi, M., Wade F. (2021), *Building on our strengths: A market transformation approach to energy retrofit in UK homes*, CREDS.

O'Neill, K., Gibbs, D. (2020), *Sustainability transitions and policy dismantling: Zero carbon housing in the UK*, Geoforum volume 108.

Penasco, C., Anadon, L. D. (2022), *Assessing the Effectiveness of Energy Efficiency Measures in the Residential Sector Gas Consumption Through Dynamic Treatment Effects: Evidence from England and Wales*, SSRN.

Poize, N., Rüdinger, A. (2014), *Projets citoyens pour la production d'énergie renouvelable: une comparaison France-Allemagne*, Working Paper, RAEE, IDDRI, SciencesPo.

Rainsford C. (2021), *Decarbonisation in social housing: From concept to delivery*, University of Liverpool, Policy Briefing 2(06).

Rittel, H. W. J., Webber, M. M. (1973), Dilemmas in a General Theory of Planning, 155–169, Policy Sciences 4.

Rith, C., Dubberly, H. (2007), *Why Worst W. J. Rittel matters*, Design Issues.

Roberts, S., Bridgeman, T., Broman, D., Hodges, N., Sage, C. (2020), *Smart and fair? Exploring social justice in the future energy system*, Phase One Report and Recommendations, Centre for sustainable energy.

Rosenow, J. (2022), *Is heating homes with hydrogen all but a pipe dream? An evidence review*, Joule.

Sovacool, B. K., Lipson, M. M., Chard, R. (2019), *Temporality, vulnerability, and energy justice in household low carbon innovations*, Energy Policy, CREDS.

Sunderland, L., Jahn, A., Hogan, M., Rosenow, J., Cowart, R. (2020), *Equity in the energy transition: Who pays and who benefits?,* Regulatory Assistance Project.

Sunderland, L. and Gibb, D. (2022), *Taking the burn out of heating for low-income households*, Regulatory Assistance Project.

Webb, J., van der Horst, D. (2021), *Understanding policy divergence after United Kingdom devolution: Strategic action fields in Scottish energy efficiency policy*, Energy Research & Social Science, Volume 78, 10212.

Webber, M. (1983), *The myth of rationality: Development planning reconsidered*, Environment and Planning B: Planning and Design.

Whelton, M., Ballard, G. (2002), *Wicked problems in problem definition*, International Group for Lean Construction 10th Annual Conference, Brazil.

Online sources

Booth, R. (2022), The Guardian, *Government to consider impact of UK energy efficiency plan on poor households*, [online]. Available at: https://www.theguardian.com/society/2022/may/03/government-to-consider-impact-of-energy-efficiency-plan-on-poor-households [Accessed date: 21/04/2023].

Cambridge Dictionary, Decarbonization [online]. Available at: https://dictionary.cambridge.org/fr/dictionnaire/anglais/decarbonization [Accessed date: 20/04/2023].

Civil Service (2016), *Devolution: Factshee*t, [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/770709/DevolutionFactsheet.pdf [Accessed date: 20/04/2023].

Climate Change Committee (2022), *Independent assessment of the UK Government's Heat and Buildings Strategy*, [online]. Available at: https://www.theccc.org.uk/wp-content/uploads/2022/03/CCC-Independent-Assessment-The-UKs-Heat-and-Buildings-Strategy.pdf [Accessed date: 20/04/2023].

Department for Business, Energy, and Industrial Strategy, *Social Housing Decarbonisation Study Views from Social Housing Providers*, BEIS Research Paper Number 2021/056, [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1023608/social-housing-decarbonisation-study-report.pdf [Accessed date: 20/04/2023].

Energy Saver, *Whole-House Systems Approach*, [online source]. Available at: https://www.energy.gov/energysaver/whole-house-systems-approach [Accessed date: 25/04/2023].

European Commission, *Climate Action, 2050 long-term strategy*, [online]. Available at: https://climate.ec.europa.eu/eu-action/climate-strategies-targets/2050-long-term-strategy_en [Accessed date: 20/04/2023].

FEANTSA, (2022), E*nergy prices and energy poverty in Eastern Europe, Report from the Metropolitan Research Institute, Habitat for Humanity International and Habitat for Humanity Hungary and FEANTSA´s site visit and expert meeting, in Budapest, 6-7th July 2022*. [online] Available at: https://www.feantsa.org/public/user/Activities/events/2022/Event_Report_-_Energy_prices_and_energy_poverty_in_Eastern_Europe.pdf [Accessed date: 20/04/2023].

FEANTSA (2022), *Renovictions in Europe*, Briefing [online]. Available at: https://www.feantsa.org/public/user/Resources/reports/2022/2_Briefing_-_Renovictions_in_Europe.pdf [Accessed date: 25/04/2023].

FEANTSA, (2022), *Written summary of the FEANTSA, ECODES and Cáritas Española event on Energy Poverty and Rising energy prices in Southern Europe*, [online]. Available at: https://www.feantsa.org/download/written-summary-expert-meeting-madrid-sept-16-20229076264837203453248.pdf [Accessed date: 20/04/2023].

Gov.uk, *Buying or selling a home* [online]. Available at: https://www.gov.uk/buy-sell-your-home/energy-performance-certificates [Accessed date: 20/04/2023].

Gov.uk (2013), *Fuel poverty statistics*, [online]. Available at: https://www.gov.uk/government/collections/fuel-poverty-statistics [Accessed date: 20/04/2023].

Gov.uk (2020), *Green Homes Grant Local Authority Delivery scheme Phase 1: successful local authorities*, Last updated 28 October 2021 [online]. Available at: https://www.gov.uk/government/publications/green-homes-grant-local-authority-delivery-successful-local-authorities [Accessed date: 20/04/2023].

Gov.uk, *Government announces new housing measures* [online]. Available at: https://www.gov.uk/government/news/government-announces-new-housing-measures [Accessed date: 20/04/2023].

Gov.uk, *Net Zero Strategy: Build Back Greener*, Policy Paper, Last updated 5 April 2022, [online]. Available at: https://www.gov.uk/government/publications/net-zero-strategy [Accessed date: 20/04/2023].

Gov.uk, Regulator of social housing (2022), *Social housing sector stock and rents statistics for 2021/22 show small net increase in social homes*, [online]. Available at: https://www.gov.uk/government/news/social-housing-sector-stock-and-rents-statistics-for-202122-show-small-net-increase-in-social-homes [Accessed date: 20/04/2023].

Gov.uk, *Standard Assessment Procedure,* Last updated 28 February 2023, [online]. Available at: https://www.gov.uk/guidance/standard-assessment-procedure [Accessed date: 20/04/2023].

Gov.uk (2021), *UK enshrines new target in law to slash emissions by 78% by 2035*, [online]. Available at: https://www.gov.uk/government/news/uk-enshrines-new-target-in-law-to-slash-emissions-by-78-by-2035

Harvey, F. (2022), *Hydrogen could 'nearly double' cost of heating a home compared with gas*, The Guardian, [online]. Available at: https://www.theguardian.com/environment/2022/sep/26/hydrogen-could-nearly-double-cost-of-heating-a-home-compared-with-gas [Accessed date: 20/04/2023].

Harvey, F. (2022), *Hydrogen is unsuitable for home heating, review concludes,* The Guardian, [online]. Available at: https://www.theguardian.com/environment/2022/sep/27/hydrogen-is-unsuitable-for-home-heating-review-concludes [Accessed date: 20/04/2023].

Harvey, F., The Economist (2021), *UK government scraps green homes grant after six months,* [online]. Available at:https://www.theguardian.com/environment/2021/mar/27/uk-government-scraps-green-homes-grant-after-six-months [Accessed date: 20/04/2023].

Heat, L. (2021), *Councils struggling to meet 'unrealistic' deadlines for 'flawed' Green Homes Grant programme,* Inside Housing [online]. Available at: https://www.insidehousing.co.uk/news/councils-struggling-to-meet-unrealistic-deadlines-for-flawed-green-homes-grant-programme-70750 [Accessed date: 20/04/2023].

Hurley, P., Heat Pump association, *UK Heat Pump market set to almost double this year*, [online]. Available at: https://www.heatpumps.org.uk/uk-heat-pump-market-set-to-almost-double-this-year/ [Accessed date: 21/04/2023].

National Housing Federation (2021), *Decarbonisation of housing association homes - a briefing for external stakeholders* [online]. Available at: https://www.housing.org.uk/resources/decarbonisation-briefing/ [Accessed date: 20/04/2023].

Office for National Statistics (2023), *Census 2021*: *Housing, England and Wales.* [online], Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/housing/bulletins/housingenglandandwales/census2021 [Accessed date: 20/04/2023].

Office for National Statistics (2015), *Social housing became less affordable over the past decade*, [online]. Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/housing/articles/socialhousingbecamelessaffordableoverpastdecade/2015-08-05 [Accessed date: 20/04/2023].

Scottish Government (2021), Achieving net zero in social housing: The Zero Emissions Social Housing Taskforce Report, [online], Available at : https://www.gov.scot/publications/achieving-net-zero-social-housing-zero-emissions-social-housing-taskforce-report/pages/6/ [Accessed date: 20/04/2023].

Scottish Government (2022), *Annual Housing Statistics, 2020-21*, [online]. Available at: https://www.gov.scot/news/annual-housing-statistics-2020-21/ [Accessed date: 20/04/2023].

Scottish Government (2020), Social Housing Net Zero Heat Fund: overview, [online]. Available at:https://www.webarchive.org.uk/wayback/archive/20200822012034/http://www.gov.scot/publications/social-housing-net-zero-heat-fund-overview/ [Accessed date: 20/04/2023].

Sheffield Hallam University, Professor Aimee Ambrose, [online]. Available at: https://www.shu.ac.uk/about-us/our-people/staff-profiles/aimee-ambrose#firstSection [Accessed date: 20/04/2023].

SSE Energy services, *Feed-In Tariffs (FIT) scheme: Get paid for generating your own electricity*, [online]. Available at: https://sse.co.uk/help/energy/feed-in-tariffs [Accessed date: 20/04/2023].

The Economist (2018), *In the rush to renewables, decarbonising heating has been overlooked*. [online] Available at: https://www.economist.com/technology-quarterly/2018/11/29/in-the-rush-to-renewables-decarbonising-heating-has-been-overlooked [Accessed date: 20/04/2023].

Watling, S., and Breach, A. (2023), *The housebuilding crisis: The UK's 4 million missing homes*, Centre for Cities. Available at: https://www.centreforcities.org/housing/ [Accessed date: 20/04/2023].

Welsh Government (2021), Optimised RetroFit Programme, Last updated 26 October 2022, [online]. Available at: https://www.gov.wales/optimised-retrofit-programme [Accessed date: 20/04/2023].

Welsh Government (2021), *Housing Quality Standard: Summative Evaluation* [online]. Available at: https://www.gov.wales/sites/default/files/statistics-and-research/2021-06/welsh-housing-quality-standard-summative-evaluation.pdf [Accessed date: 20/04/2023].

Widuto, A., European Parliament briefing (2023), *Reforming the EU electricity market*, European Parliamentary Research Service [online]. Available at: https://www.europarl.europa.eu/RegData/etudes/BRIE/2023/739374/EPRS_BRI(2023)739374_EN.pdf [Accessed date: 20/04/2023].

Yanatma, S., Euronews.green (2022), *Europe's energy crisis in data: Which countries have the best and worst insulated homes?* [online]. Available at: https://www.euronews.com/green/2022/12/09/europes-energy-crisis-in-data-which-countries-have-the-best-and-worst-insulated-homes [Accessed date: 20/04/2023].

10. Appendix

10. 1. Standard interview form for social housing providers

Q1: Is your organisation committed to achieving net zero and can you tell me what decarbonisation work you have done or are planning to do on your existing social housing stock?

……
……
……

Q2: Have you encountered any obstacles in carrying out this project, and more generally, what do you see as the main obstacles to decarbonising the existing social housing stock in the UK today?

……
……
……

Q3: Do you know how many of your tenants are in fuel poverty and is reducing fuel poverty a target you are setting as part of your decarbonisation works?

……
……
……

Q4: What are your views on the evolution of decarbonisation policies in the social housing stock in the UK, do you have in mind examples of policy failures and policy successes and why do you think they have succeeded or failed?

……
……
……

Q5: What are your views on the current Social Housing Decarbonisation Fund and its application process?

……
……
……

Q6: What are, according to you, the solutions to the barriers identified and main policy recommendations you would make for a better design and implementation of decarbonisation policies in social housing?

……
……
……

Q8: What can be the role of small-scale projects in decarbonising social housing and tackling fuel poverty?

……
……
……

Q9: Are there any people you recommend I contact or projects you recommend I look into on this topic?

……
……
……

10. 2. Standard interview form for researchers

Q1: What are the criteria to assess a good decarbonisation policy for social housing?

……
……
……

Q2: How widespread is fuel poverty in social housing in the UK and what are its main characteristics?

……
……
……

Q3: What are your views on the evolution of decarbonisation policies in the social housing stock in the UK, do you have in mind examples of policy failures and policy successes and why do you think they have succeeded or failed?

……
……
……

Q4: How do you assess the current Social Housing Decarbonisation Fund in general and in relation to the fight against fuel poverty?

……
……
……

Q5: What are your policy recommendations for more effective decarbonisation of social housing stock targeting households most vulnerable to fuel poverty in the UK?

……
……
……

Q6: What can be the role of small-scale projects and structures in decarbonising the social housing stock and tackling fuel poverty in the UK?

……
……
……

Q7: Are there any people you recommend I contact or projects you recommend I look into?

……
……
……

Public Policy Master's Thesis Series

This series presents the Master's theses in Public Policy and in European Affairs of the Sciences Po School of Public Affairs. It aims to promote high-standard research master's theses, relying on interdisciplinary analyses and leading to evidence-based policy recommendations.

Leaving no-one behind in the energy transition: Lessons learned from the decarbonisation policy in social housing in the United Kingdom

Alice Bergoënd

Abstract

In the face of the climate crisis and energy transition, and in a context where decarbonisation of housing has become an environmental and social necessity, this paper assesses the complexity of the policy issue of decarbonising the UK's social housing stock. Through qualitative interviews with researchers, social housing providers, consultants, and representatives of local authorities and the UK government, it assesses the existing barriers to retrofitting and transitioning to clean heating in social housing, and finds that decarbonisation of social housing in the UK is a wicked problem, which should therefore be addressed through a decentralised process and better consideration of stakeholder positions.

Key words: Decarbonisation, social housing, wicked problem, retrofit, fuel poverty.