DECARBONISING SOCIAL HOUSING IN NORTH EAST ENGLAND

OCTOBER 2021

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CONTENTS

1. SUMMARY

This study of decarbonisation progress in social housing in North East England among social housing providers was carried out in the summer of 2021 by Northumbria University on behalf of Northern Housing Consortium and North East England Climate Coalition (NEECCo), and was funded by North East and Yorkshire Energy Hub.

Twenty four housing providers were asked to provide housing stock data, complete an online survey and take part in interviews, in order to assess the current energy performance of existing social housing stock, explore plans for achieving decarbonisation targets (EPC C by 2030, and net zero by 2050), inform supply chains of likely future procurement needs for products and services in the sector, and assess the potential impact of acceleration.

Twelve organisations provided housing stock data; the 145k properties they hold represent 11% of the 1,305,810 homes in the North-East, and 51% of homes owned by local authorities, private registered providers and other public sector organisations. Thirteen organisations completed the online survey, and sixteen took part in interviews.

The majority of housing in the study was built between the 1940s and 1980s, with just 9% having been built before 1929. 30% were terraced homes, 26% were semi-detached, 24% were flats, and 20% were bungalows. 59% of properties were in EPC bands A-C (compared to a national average of 40.4%), and 35% were in band D, while less than 0.2% of properties were in bands F or G. EPC was not known for 4% of properties.

The most common retrofit measures already installed included double glazing, cavity wall insulation and loft insulation, while external, internal and floor insulation had been completed in small numbers. Previous investment in renewables and lower carbon technologies had mainly been focused on photovoltaic panels and air source heat pumps.

Around half of housing providers were still working on their housing stock data, with common issues including missing or inaccurate data, properties without EPCs or with unreliable EPCs (e.g. EPCs that did not reflect recent works, that had been performed in inconsistent ways, or that involved estimations, guesswork or assumptions). Six providers had carried out stock condition surveys, and some were planning to carry out more EPCs. It was noted that data management is a resource-intensive process.

Organisational targets for decarbonisation broadly followed those set by the government, although some were more ambitious in terms of timescales (e.g. EPC C by 2027-28) or had set interim targets (e.g. 80% of stock at EPC C by 2025). A lack of consensus on the definition of net zero and what end goals organisations should be working towards revealed the need for more certainty about net zero definitions,

measurement and targets, with these issues ideally being determined at a national level.

Providers were generally driven to develop decarbonisation strategies by wider government targets, as well as their own commitment to climate change and long-term goals to improve the conditions of their housing stock, tackle fuel poverty, reduce their environmental impact, and provide residents with safe, warm, and high-quality houses. Almost two thirds of providers, including those with more defined milestones, had yet to develop strategies and were still in the process of creating them or adapting their long-term planning to incorporate decarbonisation.

More than half of the respondents reported adopting a fabric first approach to retrofit, which was considered a well understood and 'low regret' method of achieving the EPC band C target by 2030 or earlier. Plans beyond the 2030 target were less well formed, but there is an expectation that moving housing stock from EPC band C to net zero will be much more difficult and expensive, and will involve much greater reliance on technological solutions.

Survey findings indicate that providers were at various stages in developing their investment plans. About two fifths had already estimated their investment requirements for achieving decarbonisation targets; 38% were currently working out their investment requirements and had a adopted a methodology for identifying this, while others were still understanding the data. Some providers had worked out detailed costs for the decarbonisation of their total stock, or the cost per property, of reaching the 2030 EPC band C target and/or total decarbonisation. Housing providers' estimates of the total cost of decarbonisation of their housing stock varied widely, from £45 million to £1.25 billion, while per property costs were expected to be considerable.

Providers are mindful of their responsibilities to their tenants, and awareness of tenant needs, vulnerabilities and ensuring fairness to tenants are central considerations in decarbonisation strategies. Several providers mentioned issues around tenant refusals and wariness to adopt new technologies, and some were developing programmes to engage and educate tenants and promote positive behaviours towards retrofit.

In line with other regional and national research, respondents highlighted significant requirements for skills development in order to address the retrofit challenge. Particularly post-2030, highly skilled personnel will be required throughout the supply chain to install, repair and maintain technology-based retrofit measures. Providers were recruiting and training staff for additional and new roles such as retrofit coordinators and tenant engagement, and recognised the need for upskilling across their organisations. Several respondents commented on the scale and importance of the opportunity that this re-skilling presents for the region.

Housing providers said their wider decarbonisation strategies and plans are largely driven by the availability of funding. Providers want to make the most of funding opportunities so they can maximise the benefit to their stock and customers.

Key barriers and challenges to decarbonisation identified by respondents include government leadership and policies, funding, supply chain maturity and skills, tenant engagement and issues around availability and quality of data and evidence to support decision making and assessment of outcomes.

There was little appetite for acceleration in the rate of travel towards net zero among the organisations that took part in the study. While providers could move more quickly (for example, if government targets changed), most were cautious due to the risks of making poor investment decisions in the absence of robust evidence, their financial and tenant responsibilities and the issues identified in the supply chain and wider skills requirements.

2. INTRODUCTION

The UK government's Clean Growth Strategy set challenging targets for social housing providers over the coming years (BEIS, 2017). This research sets out to understand the current situation in North East England and explore how the social housing sector is approaching the vital contribution it will need to make if we are to *'become England's greenest region'*.

In order to understand how social housing providers in the North East are planning to address the decarbonisation of their existing stock through retrofitting work, it is important to have a clear picture of the current performance of social housing stock, so that we fully understand the challenge ahead. Also of interest is the impact that decarbonisation plans are likely to have on supply chains, for example in terms of product and technology procurement, and skills requirements. Finally, in order to address possible changes in national targets, it is useful to explore the potential, appetite and impact of accelerating the path to decarbonisation of our existing stock.

This research focuses on the social housing sector, representing 21.7% of the North East housing stock (Long, 2021). The social housing sector is not representative of the wider stock, performing better on average than owner occupied and private rented sectors. For example, 8.7% of social rented sector homes were EPC E or worse in 2019, compared to 15.4% of owner occupied and 17.1% of privately rented homes (Northern Housing Databank, 2021). However, it is anticipated that over the coming years, the social housing sector will be key in stimulating supply chains and building capacity that will benefit all housing sectors, by commissioning retrofit of existing stock at scale.

This study was carried out by Northumbria University on behalf of Northern Housing Consortium and North East England Climate Coalition (NEECCo), and was funded by North East and Yorkshire Energy Hub.

3. RESEARCH AIMS

The research aims were:

1. To assess the current energy performance of existing social housing stock in the North East.
2. To explore North East housing providers' plans and strategies for achieving i) EPC C by 2030 and ii) net zero by 2050 or sooner.
3. To inform supply chains of likely future procurement needs for products and services in the sector, through analysis of likely demand for materials and technologies associated with retrofit, and associated skills and services requirements.
4. To assess the potential impact of acceleration.

4. RESEARCH METHODS

Twenty-four housing providers were asked to take part in the study, comprising ten local authorities, two ALMOs and twelve Housing Associations. A mixed methods approach was used, including: data collection to determine the scale of decarbonisation required, and associated investment needs; an online survey; and interviews to investigate decarbonisation strategies in greater depth. Preliminary investigation involved discussions with four NE housing organisations to establish what data they held. This helped shape the design of the survey and the data capture template, ensuring that organisations would be able to provide the data requested. Piloting took place with one housing association to test and refine the research methods prior to implementation. The majority of the research took place between July and September 2021. The research methods are described below.

4.1 Data capture

Housing providers were asked to provide information on their housing stock by completing a data capture form: an Excel template designed by the researchers to collect quantitative information about the characteristics and performance of existing stock, measures already implemented to improve energy efficiency, and financial information about estimated investment requirements and planned retrofit spending.

Twelve respondents returned the data capture forms to varying degrees of completion. Of those returned, twelve provided some information about their current stock, six provided estimated investment requirements and two provided information about planned retrofit spending. There was also significant variation in the way that stock and investment data was held by organisations, which has limited the analysis in certain areas (e.g. age profiles, construction details, archetypes, etc.).

Table 1: Types of data requested using data capture forms

Category	Specific data required
Performance of existing stock	▪ Number, type/archetype and location of dwellings (urban, rural) ▪ Current EPC rating assessment for each property ▪ Fuel type, heating, lighting and hot water technologies, e.g. space heating/water heating/lighting/appliances ▪ Property construction (wall, roof and floor construction, windows etc.) ▪ Completed energy efficiency measures (e.g. how much of the stock has already been subject to internal/external/cavity wall insulation, double/triple glazing, air and ground source heat pumps, condensing boilers etc.)
Estimated investment requirements	*To achieve EPC C rating and net zero:* ▪ Estimated cost, per dwelling or by EPC rating to achieve EPC C and to achieve net zero ▪ Timescales for investment (1, 5 and 30 year estimates) ▪ Estimated investment profile by intervention (e.g. fabric efficiency, low-carbon technologies)
Planned retrofit investments	▪ Budgeted retrofit investment for up to 5 financial years (per property or by EPC rating) ▪ Planned investment profile by intervention (e.g. fabric efficiency, low-carbon technologies)

4.2 Online survey

An online survey was used to gather headline information about strategic plans, targets, approaches and barriers to decarbonisation, and the results were used to inform interviews with staff, which would enable these issues to be explored in greater depth. A short online survey was designed for completion by a representative of each housing provider, consisting of 15 open-ended questions. Respondents could write as much or as little as they wished and did not have to answer every question. Representatives of 13 housing providers completed the online survey.

4.3 Interviews

Semi-structured interviews were carried out with representatives of housing providers to investigate retrofit strategies in depth, including the rationale behind selected decarbonisation strategies and how these had been influenced by existing stock condition, legislation, supply chain infrastructure and access to funding. Where possible, analysis of the online survey responses and housing data provided by the organisation was undertaken prior to the interview, enabling more focused discussion.

Sixteen interviews took place. While twelve involved just one representative of the housing provider, in three cases, two people took part and in one instance, three people joined the discussion. Each interview lasted around one hour. Interviews were audio recorded then transcribed for analysis.

5. RESEARCH FINDINGS

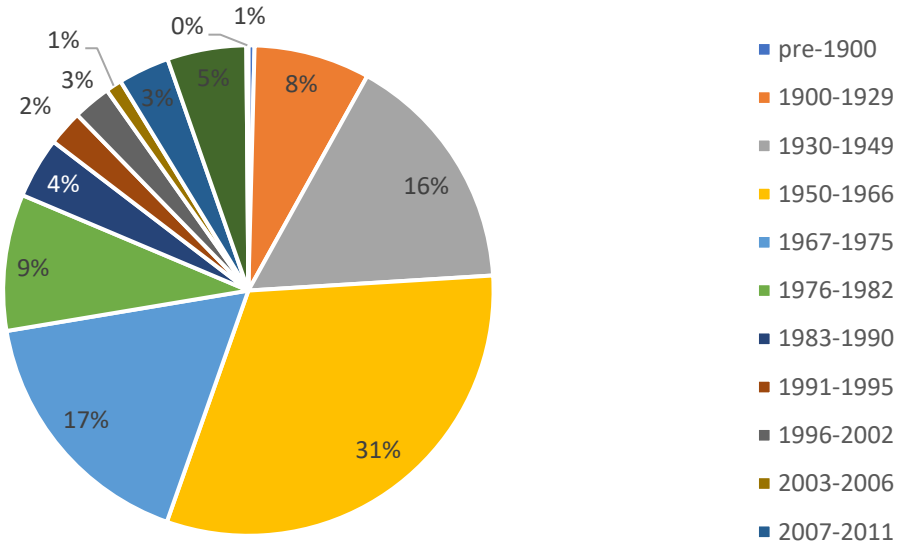
5.1 Current energy performance

5.1.1 Profile of social housing

Eleven out of the twelve organisations who returned a data capture form were able to provide detailed information regarding their housing stock's archetype and age. Based on statistics in the Northern Housing Monitor (Long, 2021), the 145k properties in the North East owned by these eleven organisations represent 11% of the 1,305,810 homes in the North East, and 51% of the 283,955 homes in the region owned by Local Authorities, private registered providers and other public sector organisations.

The age of dwellings included in this study is comparatively low, with properties built before 1929 making up just 9% of the stock in the sample, compared to 19% of all properties in the North-East dating from before 1919 (Long, 2021). The majority of housing was built between the 1940s and 1980s (as shown in figure 1), which is representative of social housing in England overall, which tends to have a younger age profile than privately owned stock (MHCLG, 2020).

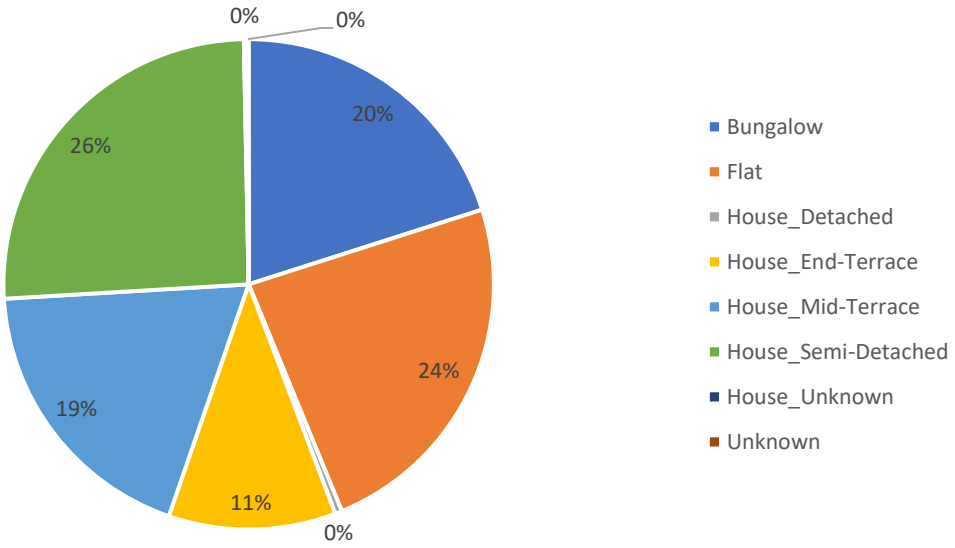
Figure 1: Properties by age



However, as shown in figure 2, the archetypes that comprised the sampled properties diverged significantly from England's social housing stock overall. While the proportion of terraced houses was broadly representative, the sample included a much lower proportion of flats (24%) compared to the wider social housing stock (44.4%), and a much higher proportion of bungalows (20%) and semi-detached properties (26%), compared to 10.5% and 17.1% nationally (MHCLG, 2020). Discussion with those

working in the sector indicate that this is in line with their knowledge of the region's archetype profile.

Figure 2: Properties by archetype

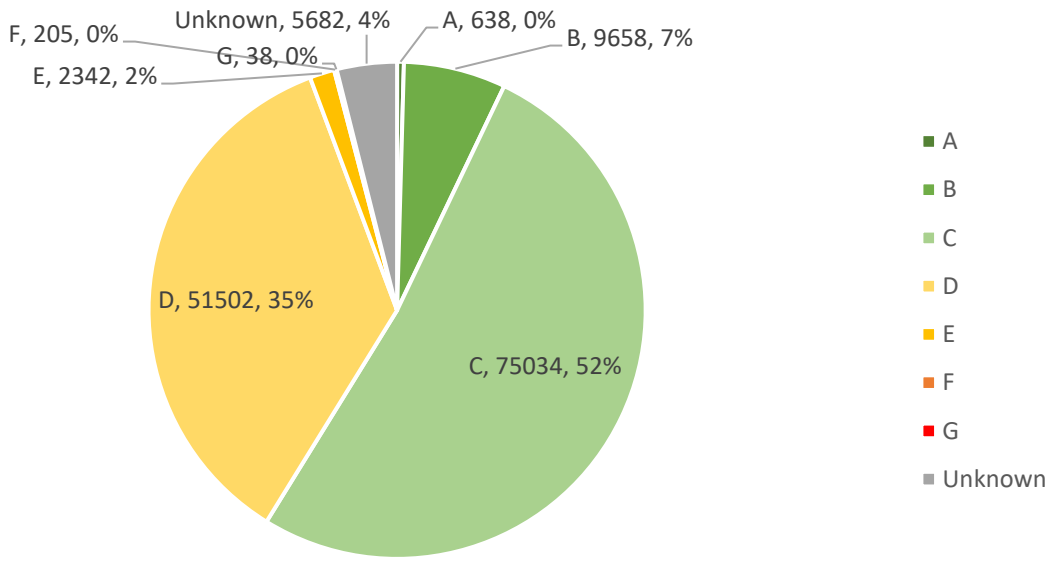


5.1.2 Current EPC rating assessment

Energy performance across all tenures of properties in the North East, measured using the Energy Performance Certificate (EPC) rating, is relatively good compared with national stock. According to the Northern Housing Monitor, in the North East, 41.9% of dwellings already achieve EPC bands A-C compared to a national average of 40.4%, while only 1.7% of properties sit within the lowest EPC bands of F and G, compared with a national average of 3.2% (Long, 2021).

This superior energy performance appears to become more pronounced when looking specifically at our sample compared to the social housing stock across England. Figure 3 shows EPC bands for 145k properties, belonging to 11 organisations who completed data capture forms regarding the EPC rating of their stock. While only 2.5% of the social housing stock across England achieved bands A or B, in our sample this group represented 7% of properties (MHCLG, 2021). However, it should be noted that the number of properties in our sample achieving EPC C was approximately 6% lower than the national average, and performance was broadly representative of national averages for Bands D, E, F and G (MHCLG, 2021). This indicates that while a larger than average proportion of the stock comprises highly efficient properties, much of the stock remains representative of social housing across England. It should be noted there remains approximately 4% of the sample where the EPC rating remains unknown.

Figure 3: Properties by EPC band



5.1.3 Fuel use

Of the eleven organisations that provided data, 96% of properties use gas as the main fuel type. Just over 3% use electricity and there are very small numbers of houses fuelled by other sources, such as oil, LPG, solid fuel and biomass.

Table 2: Fuel use by properties

Organisation	Gas	Elec.	Oil	LPG	Solid fuel	Biomass	No heating	N/a, no data	Total
1	22674	1611	40	31	180		8		24544
2	23069	784			16	88			23957
3	20388	1056							21444
4	15071	31							15102
5	9970	329	4	5	7			30	10345
6	7840	150	2		68			267	8327
7	8520	4			5				8529
8	5250	7						23	5280
10	10871	639	11	2	82	66			11671
11	18076	49	4		73			5	18207
	141729	**4660**	**61**	**38**	**431**	**154**	**8**	**325**	**147406**
	96.1%	3.2%	0.0%	0.0%	0.3%	0.1%	0.0%	0.2%	100.0%

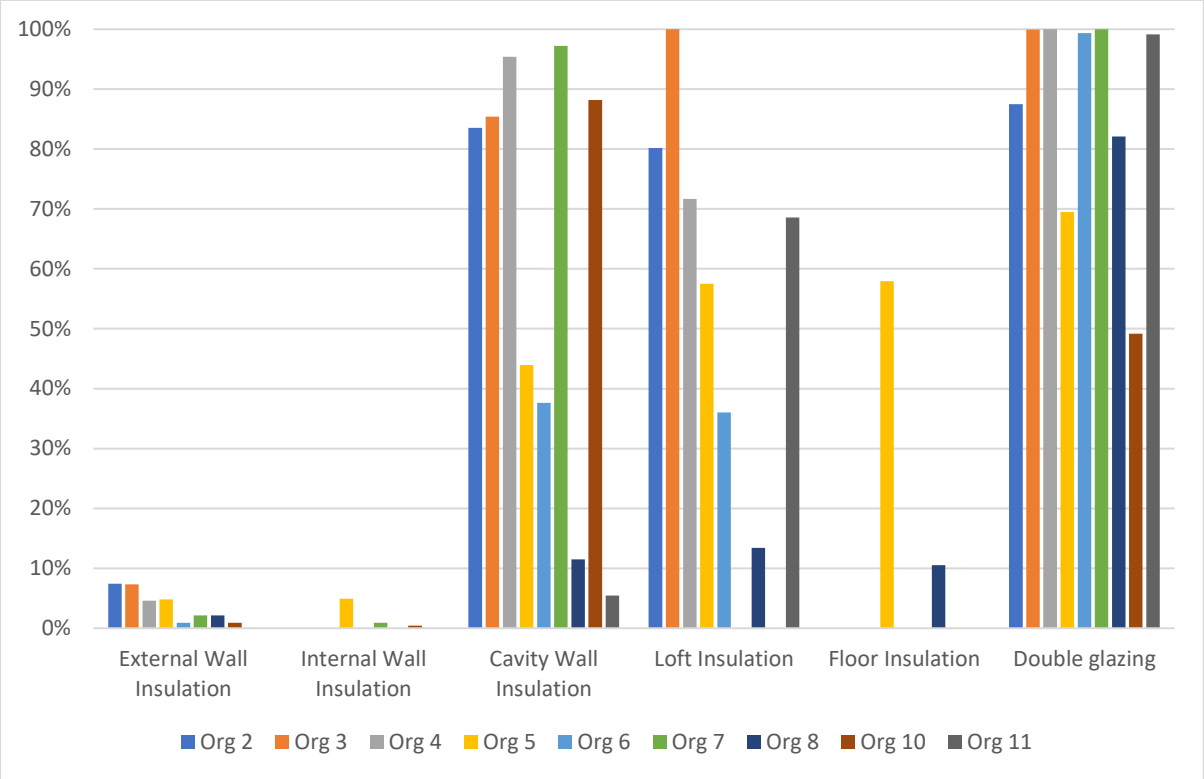
5.1.4 Previous fabric improvements

Nine organisations provided data about fabric improvements already completed to their housing stock, pertaining to 123k properties in total. These have primarily involved installing double glazing, cavity wall insulation and loft insulation, with external, internal and floor insulation improvements completed in much smaller numbers, presumably due to the relative complexity and cost of these works. Very limited information was obtained about the thermal performance of these measures, but detailed data from one or two providers suggested wide variation is likely, for instance due to differences in the thickness of loft insulation installed. Very limited data was obtained on the effect of fabric improvements on airtightness, an area that is likely to become an important consideration as insulation performance is improved.

Table 3: Fabric improvements already made to stock

Organisation	External wall insulation	Internal wall insulation	Cavity wall insulation	Loft insulation	Floor insulation	Double glazing
2	1790	0	20154	19349	0	21111
3	1576	no data	18311	21444	no data	21428
4	695	no data	14407	10820	no data	15102
5	711	724	6458	8459	8521	10221
6	76	3	3133	2998	0	8274
7	181	76	8291	no data	0	8528
8	112	no data	608	708	557	4335
10	119	56	11517	no data	no data	6424
11	12	no data	991	12483	no data	18048
	5272	**859**	**83870**	**76261**	**9078**	**113471**
	4%	**1%**	**68%**	**62%**	**7%**	**92%**

Figure 4: Completed fabric improvements as a percentage of organisation stock



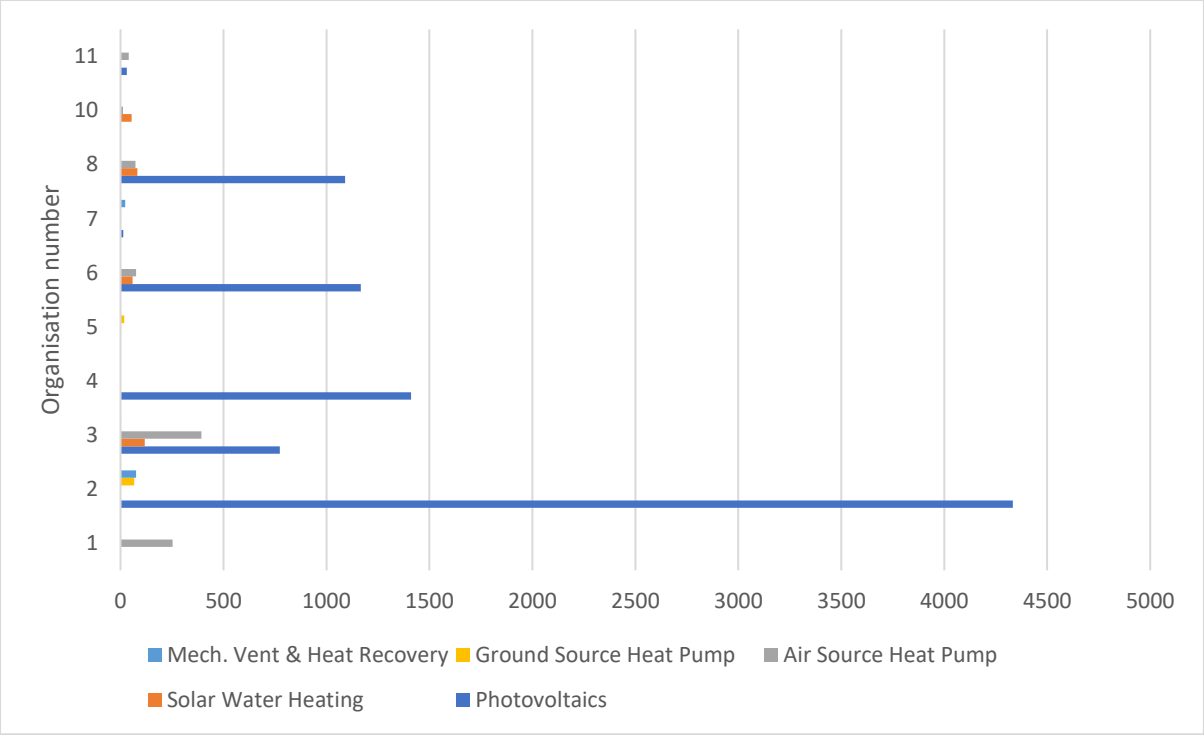
5.1.5 Previous installation of renewables and lower carbon alternatives

Ten organisations provided some data about previous installation of renewables and lower carbon technologies. While there were substantial differences between organisations, most investment has targeted installation of photovoltaic panels and air source heat pumps. Analysis of the 849 air source heat pumps already installed in the region could provide a valuable shared learning resource to inform future investment decisions. Only three organisations provided data on mechanical ventilation and heat recovery, which is likely to become an important component of fabric first approaches as airtightness of properties is improved.

Table 4: Renewable and low carbon improvements already made to stock

Organisation	Photovoltaics	Solar water heating	Air source heat pump	Ground source heat pump	Mech. vent & heat recovery
1	no data	no data	**253**	no data	no data
2	**4333**	**0**	**0**	**66**	**75**
3	**774**	**117**	**392**	**0**	**2**
4	**1411**	no data	**0**	**0**	no data
5	no data	no data	**2**	**18**	no data
6	**1167**	**59**	**76**	no data	no data
7	**13**	**0**	**2**	0	**23**
8	**1091**	**82**	**73**	no data	no data
10	no data	**53**	**12**	**0**	**0**
11	**30**	no data	**39**	no data	no data
	8819	**311**	**849**	**84**	**100**

Figure 5: Renewable and lower carbon technologies installed



5.1.6 Data issues

In order to create appropriate decarbonisation plans and strategies, as well as planning more detailed work programmes and associated costs, it is vital that housing providers have a good understanding of the **current condition and performance of their housing stock**. This is important so that works can be planned based on their likely impact on property performance and EPC/SAP ratings, meaning that EPC targets are more likely to be reached. At an operational level, it is important to know what needs to be done so you can calculate the cost and work out how it can be funded, as well as avoiding doing any unnecessary work.

Around half of providers who took part in the research said they were still working on their housing stock data. Some of the common problems they reported included missing or inaccurate data, properties without EPCs (e.g. long term lets), and properties with unreliable EPCs. This could be because the EPCs had been completed a long time ago and did not reflect recent works to the property, because of inconsistencies in the way the EPC had been carried out or recorded, or because they involved estimations, guesswork or assumptions being made about properties.

Data management issues were also a problem; maintaining accurate stock data can be very time-consuming and is not always the top priority in terms of workload, especially if there are staffing issues. In addition, changes such as mergers and takeovers between housing providers can be challenging as they mean different data sets have to be combined, and this is not always an easy task, depending on their compatibility. Six providers said that they had commissioned or carried out a **stock condition survey**, and others were planning to do so, to ensure that their stock data was accurate and up to date. Both data management and strategic planning were viewed by most providers as ongoing long-term processes.

Some providers were proactive about making sure EPCs were completed for their stock. For instance, one said they were making plans to ensure EPCs would be performed on a rolling basis, through a combination of completing EPCs internally on a reactive basis and contracting external consultants to carry out 1,000 EPCs a year.

Interviewees often felt that they already had good knowledge of the condition of their housing, particularly those who had worked for a particular provider for a long time, lived in the same area they worked in, or worked in a role which gave them a high level of familiarity with the properties. However, the task of assembling highly detailed energy performance data sometimes created surprises: *'sometimes you can meet targets just by revising your data'*, as one interviewee said (although the opposite was also true on occasion).

The issue of how best to measure energy efficiency was raised by several interviewees. While providers shared the common focus of meeting EPC and SAP rating targets, around half expressed doubts about how useful this system was, as the comment below shows.

'EPCs were meant for selling and renting homes, not for setting carbon reduction targets' (Housing provider representative, September 2021)

Another interviewee said they were *'digging deeper'* into the data, rather than simply relying on EPC/SAP data as the only way to keep and record detailed information on stock condition and decarbonisation needs. The example of failing efficiency measures was given by yet another provider, who explained that the cavity wall insulation in some of their properties was failing, but removing and replacing the insulation would do nothing to improve the EPC score, because the properties were already recorded as being insulated. However, re-insulating would be likely to have an impact on the energy efficiency of the properties involved and the thermal comfort/energy bills of the tenants. By relying only on the presence or installation of energy efficiency measures, and failing to take account of its performance, efficiency or need for renewal, EPC scores do not tell the full story. Related to this is the lack of clarity regarding what the targets are – what is actually meant by net zero carbon? – and this is discussed in section 5.2.2.

5.2 Estimated investment required

This section includes data on estimated investment required for decarbonisation of housing stock. Only a handful of organisations were able to provide their estimates of investment required to reach their decarbonisation targets, and this revealed a wide variation.

5.2.1 Targets

Providers were asked if they had specific decarbonisation targets in place and the timescales of those targets. These differ between providers, but most have prioritised achieving energy performance SAP band C by year 2030 as the closest target. This is in line with the Clean Growth Strategy which targets a reduction of 13% of UK emissions by improving the energy efficiency of all homes to EPC band C by 2030 where practical, cost effective and affordable (BEIS, 2017). Several providers were ahead of the game and established a target of reaching energy performance SAP band B by 2030, as well as employing low-carbon energy sources by 2030. While these wider targets are in place, one provider chose to use a specific energy performance measure (equivalent to SAP band C) to make it easier to assess the performance of retrofit installations. Two providers defined stepped targets as short-, medium-, and long-term milestones that are aligned to wider council actions and social housing plans. Four providers were still formulating explicit targets beyond the broader government targets, although they did have goals and ambitions to reach a zero-carbon portfolio.

Table 4: Decarbonisation targets mentioned in online survey responses

Decarbonisation targets	Responses
Energy performance SAP band C by 2030	9
WIP/targets not yet set	4
Energy performance SAP band B by 2030/2050	4
energy performance target of 70 kWh/m2/year	1
Specific targets for low carbon stock	1
Low carbon action plan to achieve carbon neutral by 2040	1

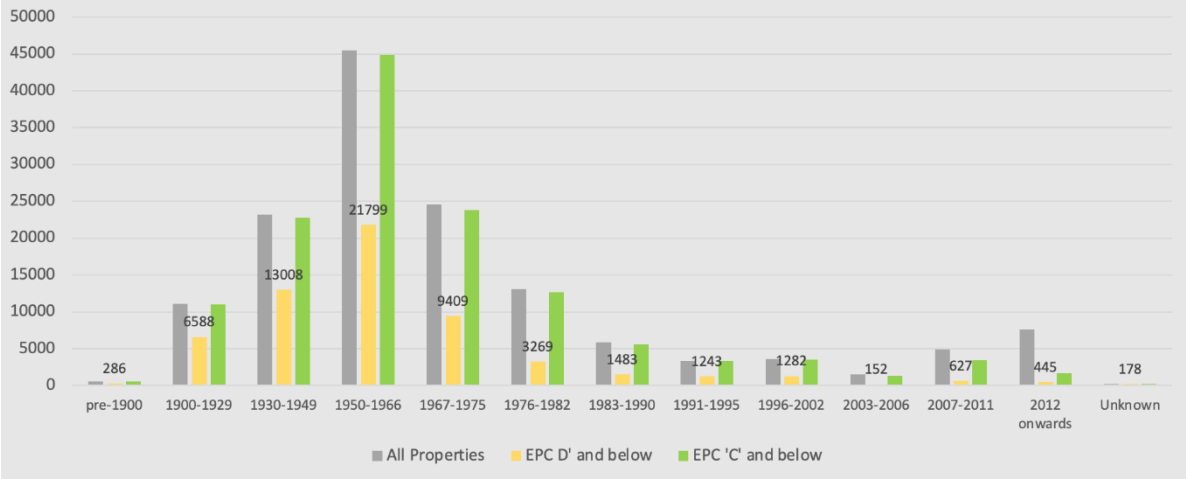
The data revealed that most providers' decarbonisation targets mirrored government targets, but the specifics of how these targets were translated into quantifiable stages varied amongst providers.

Interviews revealed that while housing providers were broadly working in line with the government's Clean Growth Strategy targets, and aiming for all their housing stock to reach EPC band C (or better) by 2030, there was some variation within this, with some providers aiming to meet this target earlier, e.g. one by 2027, one by 2028, and another *'by 2028-2030'*. One said they were aiming for 80% of their stock to be EPC band C

by 2025, and 100% by 2028. There were some differences in what was specifically meant by the EPC band C target, with one interviewee saying they were working towards a SAP rating of 75, while another said their target was SAP 69. Within these broader targets, several providers spoke about having interim targets – in some cases month-by-month ones – with one describing these interim targets as forming a *'road map'*.

Some (but not all) local authority housing providers had more ambitious targets to meet net zero: for instance, two such interviewees said their targets were aligned with the local authority's planned strategy to be carbon neutral by 2030 and 2040, respectively (meanwhile, at least two others said their plans were *'nothing more ambitious'* than following national targets). In addition, one housing association representative said their net zero target was 2040, and another said their board wanted all stock to reach EPC B by 2030. However, in most cases there was what one person called a *'strategy gap'* in terms of concrete plans for achieving net zero, and some interviewees expressed doubts as to whether these earlier targets were achievable.

Figure 6: Properties in need of retrofitting by age of construction



The scale of the work that will be needed to reach these targets can be estimated from the data submitted by housing providers. Current housing stock condition data (see figure 3) revealed that 52% of properties are already in EPC band C, but 37% of properties – 54,087 homes - are currently classified as EPC band D or lower and will need to be upgraded to reach EPC C by 2030. In addition, there are a further 5676 properties for which the EPC is currently unknown. In order to meet the more ambitious targets that will apply after 2030 to move properties up to net zero, up to 89% of properties in the sample will require some form of upgrading; this includes 97% of all properties built prior to 2003.

Table 5: Specific 2030 and 2050 decarbonisation targets mentioned in interviews

2030 targets	2050 targets
80% EPC C by 2025, and 100% by 2028	
EPC C by 2030	Net zero by 2050
EPC C by 2030	Zero carbon by 2050
EPC C by 2030	Net zero by 2050
SAP 75/EPC C by 2030	SAP 86 by 2050
	Carbon neutral by 2040 (LA target)
EPC C (SAP 69) by 2030	Carbon neutral by 2050
EPC C by 2027	Zero carbon by 2040
EPC C by 2030	Zero carbon by 2050
EPC C by 2028/30	Net zero by 2050
Net zero by 2030	(Net zero by 2030)
	'Low carbon' inc. reduce carbon tonnes per property from 6 to 0.3-0.6
EPC C by 2030	

5.2.2 Definitions of net zero

Housing providers were asked about the definitions of net zero that they were working towards. The survey revealed that many providers were still trying to establish their definition of net zero, while others had a loose definition based on various standards or targets. One offered a more generic definition that captured multiple vague goals, implying that they, too, were still working things out. Others had referred to various definitions such as aiming for low carbon and then offsetting any carbon with carbon sinks or figures, using low carbon heating on all properties, measuring energy performance, and achieving SAP rating of 86.

There was no consensus on this. The interviewees agreed that they required greater clarification from the government, both on what net zero truly meant and how to get there. Providers spoke about the 2050 net zero target in terms of a general approach towards lowering carbon in their stock, based on minimising energy use in properties and making sure renewable energy sources were used.

> *'I believe we should be saying low carbon, rather than net zero, because you're never going to get a property to net zero unless you do passivhaus and demolish everything you've got and rebuild'* (Housing provider representative, August 2021)

There was also a lack of consensus in terms of end goals. Where providers were working with specific net zero targets, these usually related to EPC/SAP ratings. For instance, SAP ratings of 80, 85, 86 were mentioned by different providers, while one interviewee said the aim was simply *'raising EPCs'*. Two people proposed monitoring carbon using a performance indicator such as kilowatt hours per m2 (kWh/m2) or

tonnes of carbon per property; however, neither had defined specific targets and they were more concerned with establishing an accurate and usable method of measuring carbon (and associated carbon reduction). As one pointed out, different ways of measuring carbon were not always compatible:

> *'We are broadly working on 50 kilowatt hours per m^2 per year, and we think that will be somewhere around the EPC score of 80, but they don't seem to always match each other'* (Housing provider representative, July 2021)

This reveals a clear need for more certainty about net zero definitions, measurement and targets, with these issues ideally being determined at a national level.

Table 6: Working definitions of net zero (online survey)

Working definition of net zero	Responses
Use carbon sinks/credits to offset carbon figures	1
Use low carbon heating and (in future) meet energy performance target	1
Performance measure	2
As per Decent Homes 2 standard	1
Average SAP rating 86 to reach net zero	1
Not yet defined	6
Vague catch-all definition	1

5.2.3 Development of decarbonisation strategies

Providers were generally driven to develop decarbonisation strategies by wider government targets such as the Net Zero Newcastle 2030 Action Plan and Clean Growth Strategy, both of which specify a net zero goal by 2030 and 2050. They were also driven by their own commitment to climate change and long-term goals to improve the conditions of their housing stock, tackle fuel poverty, and reduce their environmental impact, as well as providing residents with safe, warm, and high quality housing (see table 7).

Table 7: Drivers for decarbonisation (online survey)

Drivers	Responses
Government targets	11
Commitment to climate change	7
Improve housing affordability/tackle fuel poverty	4
Understand and improve stock	2
Improve tenant experience	2

However, some variation was noted in organisations' progress regarding development of detailed decarbonisation strategies. Where housing providers were based in local authorities, they were committed to working towards wider local authority goals -

including net zero plans, climate change strategies, climate emergency action plans, and low carbon frameworks - which most (but not all) regional local authorities had already developed. Some other providers were also working in partnership with local authorities and had signed up to their strategies.

Providers were also asked whether a documented strategy existed to achieve those decarbonisation targets. Despite having decarbonisation targets in place, almost two thirds of providers, including those with more defined milestones, had yet to develop these and were still in the process of creating strategies or adapting their long-term planning to incorporate decarbonisation (as shown in table 8). A crucial part of this process for most is having the necessary underpinning data so that they understand the current condition of stock, as a basis for making relevant plans. Interviewees also spoke of the importance of integrating decarbonisation with their other long-term plans for their stock, such as asset management, Decent Homes and Fitness for Human Habitation legislation.

Other providers had their own detailed decarbonisation strategies, or else had plans that included and/or encapsulated their decarbonisation plans. Five of the thirteen providers had developed a route map, green strategy, or action plan to help them meet their targets. These were described in different ways, for instance as **sustainability or climate change strategies or action plans**. Some of these strategies have broader emphases, e.g. incorporating stable communities, social value, health, independent living (for elderly and vulnerable tenants), place making and housing quality aims.

Table 8: Decarbonisation strategies mentioned in online survey responses

Strategy	Number
Work in progress/not yet developed	8
Route map/short report	3
Green strategy based on fabric first approach	1
Low carbon framework and action plan	1
Specific mention to sustainability strategy, sustainability delivery plan, asset management strategy but no detail provided on contents/specific plans.	

In several cases, decarbonisation strategies and investment plans had been set to take providers up to 2030, with funding committed to enable the fabric first elements of retrofitting to take place, and detailed annual planning for the necessary actions to achieve this, but strategic planning beyond 2030 was less well developed. One interviewee spoke about the purpose and limits of their current strategy:

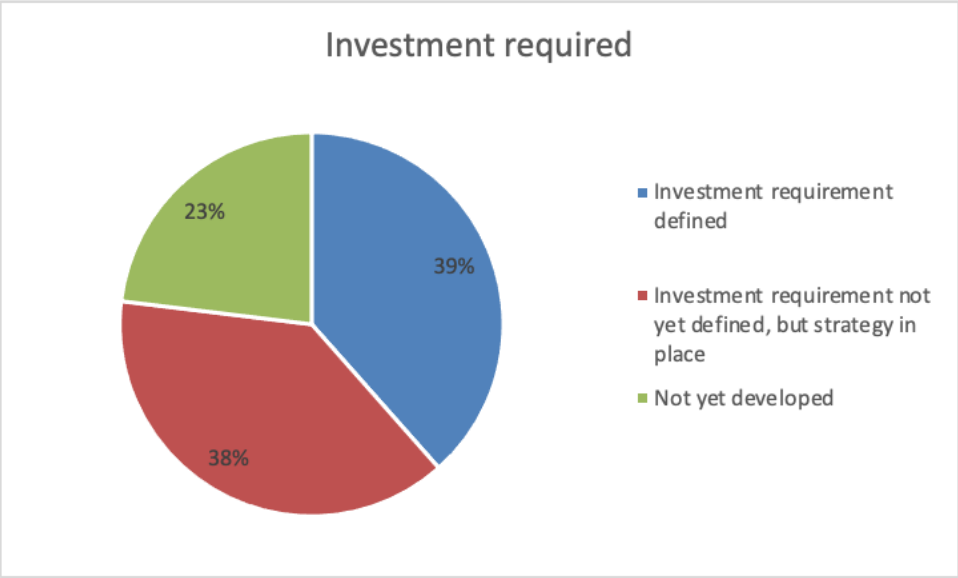
> *'We won't have the answers to net zero through the decarbonisation strategy. Essentially, it's more of a road map to help us understand broadly what the cost is going to be in total, to give us some targets to work to in the short term and get all properties to EPC C by 2027, so it will focus the mind then, and, prompt our thinking*

around, you know, how do we get to net zero?' (Housing provider representative, September 2021)

There was a recognition among interviewees that even once strategies have been developed, they remain flexible and *'always evolving',* rather than constituting a fixed set of targets and actions. Regular reviews, adjustments and responsiveness to external change, are likely to be key aspects of strategies for decarbonisation. One provider gave the example of their 30-year business plan and asset management strategy, which is reviewed and *'refreshed'* every five years.

5.2.4 Costs of decarbonisation

Figure 7: Investment required for decarbonisation (online survey)



As shown in figure 7, the survey findings indicated that providers were at various stages in developing their investment plan. About two fifths had already estimated their investment requirements for achieving decarbonisation targets based on the properties' current EPC rating. 38% were still working out their investment requirements and had adopted a methodology for identifying this, while others were still working on understanding the data.

'Per property costs to get to EPC C vary from less than £100 to over 30,000 pounds...we've got a huge amount of properties that need very little investment, and then we've got…a core of 20 odd properties that need in the 10s of thousands' (Housing provider representative, August 2021)

Some providers had worked out detailed costs for reaching EPC band C and for the total decarbonisation of their stock, or the cost per property. Estimated costs were highly variable depending on the extent of retrofitting needed by different properties (as illustrated in the comment above), as well as differences between providers concerning the amount of stock they own and factors such as property condition, size,

age, location, and archetype. This was further exacerbated in the case of targets beyond 2030 by organisations working to varying targets and definitions of net zero. Housing providers' estimates of the total cost of decarbonisation of their housing stock varied widely, from £45 million to £1.25 billion, while per property costs were expected to be considerable. One interviewee said that the cost per property of piloting retrofit works had turned out to be much higher than expected, but they were hopeful that it would come down when works were being carried out on a larger scale.

Table 9: Estimated costs of stock decarbonisation (interview responses)

Organisation	Cost	Overall cost/no. of properties
Organisation 12	£45m	£12,527
Organisation 2	£164m[1]	£6845
Organisation 11	£200-300m	£10,984 – £16,477
Organisation 10	£250m	£19,136
Organisation 4	£310m	£20,527
Organisation 13	£420m	Unknown (interview only)
Organisation 14	£1.25bn	Unknown (interview only)

'We took all our properties, we broke them down into…archetypes…and then we basically did an exercise to identify, if we could fit something we would fit it, so we looked at solar, battery storage, air source heat pumps, more cavity insulation, more loft insulation, LED lighting, and we kind of said if the property can take all of that, we'll price it, if it can only take some of it, 'cause obviously ground floor flats can't really benefit from solar, we would adjust that to suit…it identified that if we wanted to seriously invest a renewable technology into our housing stock we'll be looking at around about £310 million'

(Housing provider representative, August 2021)

While total decarbonisation cost estimates may seem extremely high, one provider suggested that sums appear more realistic and less daunting if you take into account the period of time available to complete the full works, as well as considering them in the light of annual investment spending and repairs and maintenance budgets, both of which may well run into many millions for larger housing providers.

In some cases, interviewees suggested that their financial modelling and costing exercises might not be fully accurate or may be subject to later change. One provider said they had already revisited their initial figures; they found both that they were getting better at forecasting and that the stock data they were working with had improved in accuracy. In terms of costs changing, the general expectation among interviewees was that materials and labour costs will rise over time, and the cost of retrofit technologies may come down, meaning that current cost calculations are cautious. Several providers also highlighted fluctuations in costs due to external

[1] This is considerably lower than the £378,089,520 required investment outlined in the data capture form for this organisation (see section 5.3.4), which brings the estimated costs up to £15,782 per property.

events, such as recent rises in costs linked to the effects of Brexit and the Covid-19 pandemic.

'We have done some financial modelling but the costs are very high, too high for us to afford alone, so it's important to capitalise on funding opportunities'
(Housing provider representative, August 2021)

Estimated costs are usually too high for providers to afford without help, although providers said that some of the costs can be covered through financial planning, budgetary diversion, alterations to renewal and replacement programmes, and planning works in order to benefit from economies of scale (e.g. using a 'whole house' approach). Some providers estimated that they will be able to cover most or all of their planned costs this way; but may still be planning to apply for funding where appropriate.

Figure 8: Average investment per property needed to reach EPC C identified by five organisations

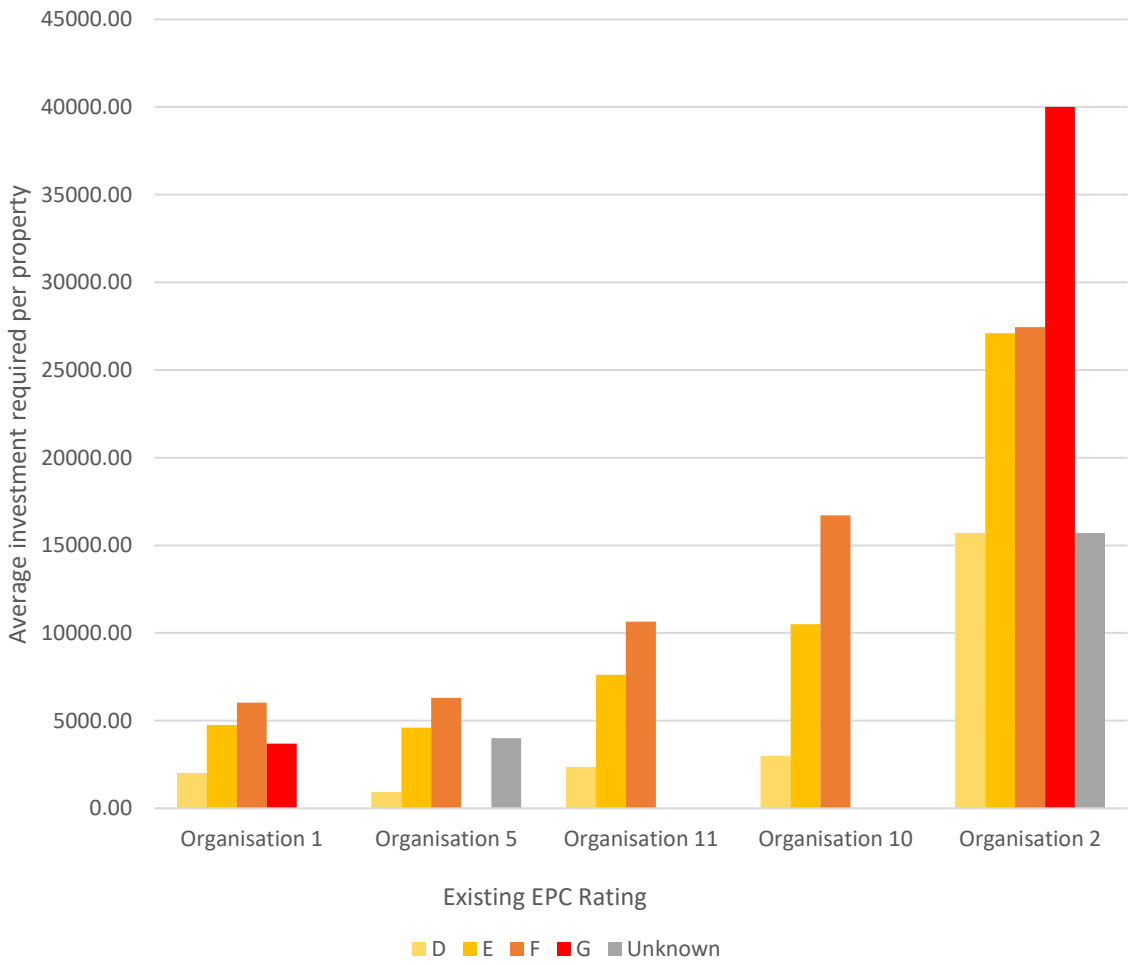
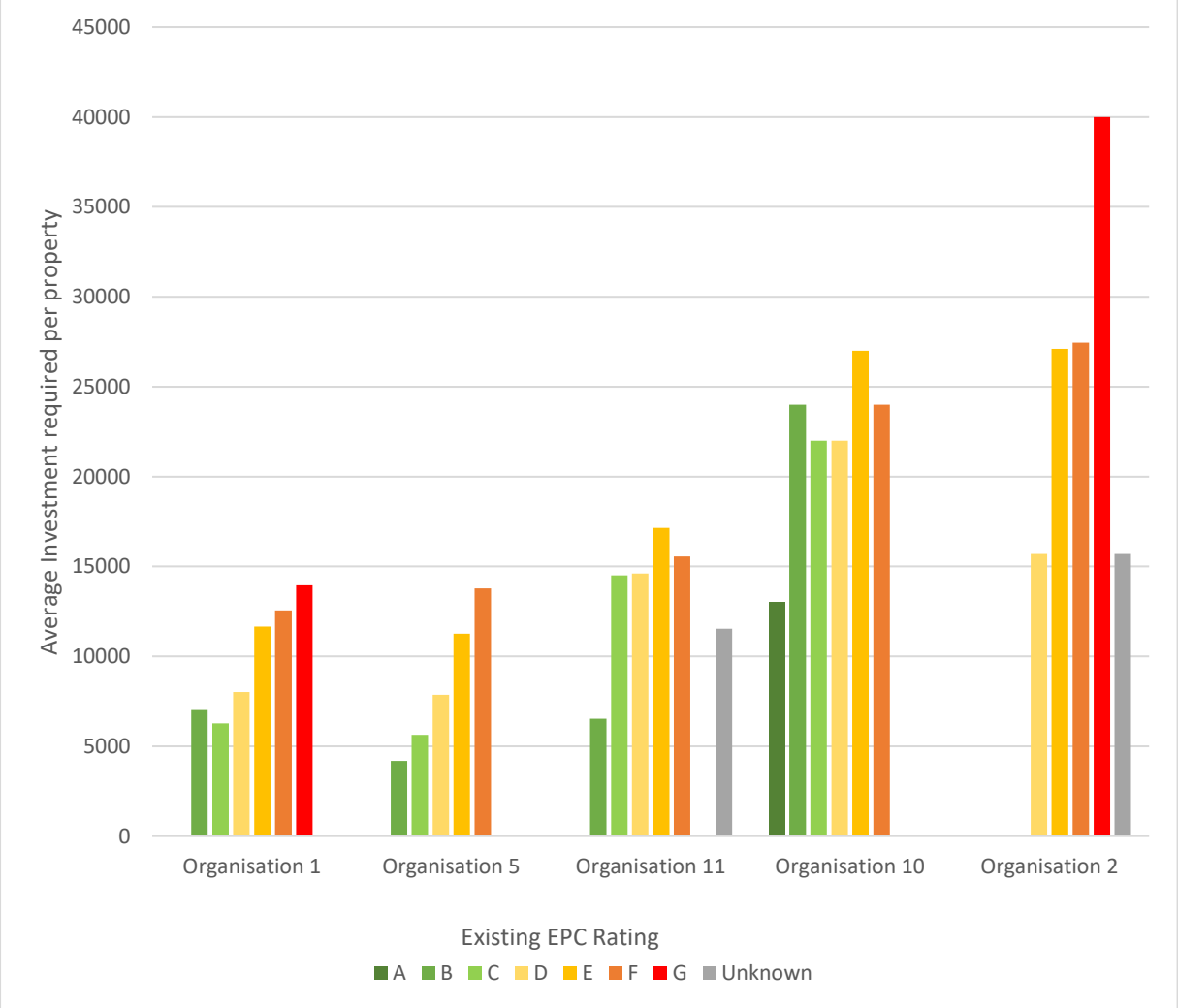


Figure 9: Average investment per property needed to reach 2050 target identified by five organisations



Only five housing providers were able to provide detailed data on the likely costs per property of retrofitting their stock. Figures 8 and 9 show estimated costs for decarbonisation based on calculations provided by the five providers, to reach EPC band C by 2030 and to reach the 2050 net zero target. This illustrates the high degree of variation in estimated costs as well the data gaps facing providers: between them, the five organisations hold just under four thousand properties for which the EPC band is not known and required investment has therefore not been calculated. The variability in terms of 2050 targets is also clear. One organisation has set it at minimum SAP 92, three have described as ‘net zero’, and one as ‘low carbon’. This illustrates a key challenge for housing providers regarding definitions of net zero, as outlined in section 5.2.2.

5.2.5 Funding

Housing providers said their wider decarbonisation strategies and plans are largely driven by the availability of funding. Providers want to make the most of funding opportunities so they can maximise the benefit to their stock and customers. Despite this, providers tend to be selective about what funding they apply for, with most saying they were not planning to bid for any funding available and will only do so if it is appropriate and timely for their housing stock. One reason for this selectiveness is the amount of time, effort and resources that are needed to prepare a funding application. Related to this, the need for longer timescales and more streamlined and efficient application processes was highlighted.

The lack of certainty arising from this funding model was emphasised: providers are unable to rely on getting any external funding, yet are often unable to afford works without it. This makes future planning harder, even when potential funding opportunities are clearly communicated.

When asked about what assumptions were made regarding government funding in their decarbonisation strategy, almost 70% reported to either still be developing these, were unsure, or had not included any assumptions in their decarbonisation strategy. Others had assumed funding will be available, particularly the Social Housing Decarbonisation Fund, but there were concerns around the potential need for partnership with a local authority to bid on funding, consideration of alternative options for the longer term, such as green financing, and the possibility of no funding being available.

Table 10: Assumptions about funding (online survey)

Assumptions about funding	Responses
Need to link up with local authority to bid on funding	1
No funding scenario	1
Alternative options for long term	1
Funding will be available	4
No assumptions yet/unsure	9

Some providers spoke about their decarbonisation strategy to date being largely led by the ability to *'grab grants'* to run pilot projects and carry out works on a piecemeal basis, rather than having a coordinated and integrated approach. More information about how much funding will be made available in future and when it will be released would facilitate strategic planning.

> *'We're not building in any assumption of grant from central sources, you know, to supplement (internally identified budgets). We hope we will get it, but we're not kind of making that an imperative part of our programme'*
>
> (Housing provider representative, August 2021)

In at least two cases, interviewees said the business was committed to meeting the cost of decarbonisation itself, even without external funding. Despite this, in most cases they still intend to bid for funding, if it is suitable and timely. Providers said funding had been released for fabric first aspects of decarbonisation through various strategies including realignment and top slicing of existing budgets, extending dates for replacement of components, and reinvestment of planned works (e.g. plans to divert gas boiler replacement funding to ASHP installation). However, most providers were less certain about how the more expensive works would be funded:

'What we haven't done at the moment is generated the additional finance for the big investments - so taking out all of the gas boilers and putting in the air source heat pumps and, you know, the big ones - we haven't tackled that yet'

'Our current priorities, our current aspirations are probably funded, but our longer-term aspirations... we're nowhere near funding them at the moment'
(Housing provider representatives, August 2021)

Applying for funding in larger groups was favoured by some providers; this approach of sharing rather than competing for resources means that procurement and engaging contractors can be easier. For instance, housing providers in the Tees Valley have jointly bid for Sustainable Warmth funding to allow a more coordinated approach and prevent competition between local providers. However, one provider said they preferred to bid alone as it is less complicated, and means you get more value as you do not have to share the funding pot. The need to partner with local authorities for funding bids – as happened with LAD funding (and currently within the Social Housing Decarbonisation Fund) - was described as difficult for providers with stock across different local authority areas. Joint bidding processes may be a way to manage this issue. Meanwhile, one local authority housing provider said they were aware this made things *'a bit easier'* for them, as other organisations wanted to partner them.

Two providers spoke of having difficulties in the past with funding opportunities where there was a need to consult with tenants as part of the application process, or where the funding conditions included household income being very low. This information is not routinely collected by housing providers past the point of establishing eligibility for the tenancy to begin, and gathering it was described as difficult and time-consuming, as well as requiring a lot of resources (despite no guarantee that funding would be awarded). Providers suggested that the funding focus should be on the property rather than the tenant, especially as there is a likelihood that tenants will move out of social rented properties at some point, especially in high turnover areas.

One housing provider suggested that a less competitive process for funding decarbonisation would be preferable to ensure that targets were met, as well as being less wasteful of the time and resources currently spent on making funding applications. As this interviewee said, everyone needs to retrofit their stock, and a competitive

process is not necessarily the best way to achieve this. Their idea was put to subsequent interviewees and met with general support.

> *'Having to compete for funding doesn't feel like a long-term sustainable solution…because it's so uncertain…[pause] until the information comes out and then actually competing for it and winning it, or not. I think something where things are a bit more directly allocated, rather than having to compete, because we're still going to have to do the work in order to reach those targets'*
> (Housing provider representative, August 2021)

The need to extend time scales for both making funding applications and delivering the resulting projects was agreed to be important. The funding application stage was described by one provider as a *'mad rush'*. Another interviewee described how a funding delivery timescale of one year often turns out to be just nine months, once the preparatory stages of getting confirmation, establishing a memorandum of understanding, and appointing contractors are completed.

As far as specific sources of funding went, a number of providers mentioned having previously bid for (and sometimes received) LAD and Green Homes funding. In the case of Green Homes funding, one provider said they had had a project pulled at the last minute, having already done some of the prep work, and this had underlined for them the need for improved certainty about funding, so that providers are confident that works can go ahead and do not end up out of pocket. At the time that the interviews and surveys were undertaken, providers were looking forward to the announcement of further information about the Social Decarbonisation Housing Fund, although there was a degree of scepticism regarding how much money would be available and how much retrofitting activity it would cover.

One housing provider had entered a long term PFI arrangement with an energy provider, linked to provision of solar PV on some of the housing stock. This had enabled a considerable number of properties to receive solar PV panels, with repairs and maintenance included as part of the arrangement.

5.3 Organisational approaches to decarbonisation

This section considers the approaches taken by different housing providers to achieve decarbonisation, and the reasons behind this.

Table 11: Approaches to decarbonisation (online survey)

Approaches to decarbonisation	Responses
Fabric first	7
Low regret approach	1
Whole house	2
Not defined yet	3

Table 11 shows the results of the online survey to the question *'What is the organisation's preferred approach to retrofit/decarbonisation?'* More than half of the respondents reported taking a fabric first approach. This was echoed in the interviews, with a consensus among providers that focusing on the fabric first approach was an effective method of achieving the EPC band C target by 2030. This incorporates various fabric improvements to properties including insulation (walls, floors, roofs) and improvement/replacement of windows, doors, and roofs to improve airtightness and reduce heat loss. These measures were described as low-cost interventions that are usually highly effective (*'quick wins'*), and that tenants are likely to be happy with. As one interviewee said, a key benefit is that they meet with a '*low level of resistance from customers'.*

One provider mentioned taking a *'low regret'* approach, which entails focusing on measures that are likely to be fit for purpose in the long run, before moving on to fabric first. This was supported by several providers in the interviews, who spoke of fabric measures as a *'low regret'* approach, in comparison to more technological interventions whose performance may be less well known, where tenants may be wary of accepting them, and where there is a danger that they may prove to be the wrong choice. Additional advantages of fabric first measures are that they help address fuel poverty and create warmer homes that are cheaper to heat, and they form essential groundwork to improve buildings' airtightness, so that when technological measures such as ASHPs do come to be fitted, they will be more effective.

Two providers preferred a whole house approach because the targeted grant funding demanded it, drawing on fabric first principles. Long-term retrofit plans and a 30-year programme are also being developed, with incremental measures being implemented as and when necessary. However, three providers had not defined a preferred approach as they argued that the approach depended on the needs of individual houses.

Table 12: Expected outcomes of decarbonisation strategy (online survey)

Expected outcomes	Responses
Lower carbon emissions	1
Improve EPC and SAP ratings	3
Reduce fuel poverty	2
Achieve net zero	1
Improve tenant experience	1
Improve housing stock	1
Carbon neutral	1
Work in progress/not available	3

Respondents were asked what the expected outcomes of this retrofit/decarbonisation were, given the variety of approaches adopted. As shown in Table 12, there were some ambitious expectations and some modest ones, while a few providers were still working this out. Half of the respondents aimed to improve the EPC and SAP ratings of their housing stock, reduce fuel poverty and lower carbon emissions. These are easier targets that could be achieved in the short term. Meanwhile, other expectations such as achieving net zero, improving tenant experience, improving the housing stock, and achieving carbon neutral were more far reaching and long-term.

Plans beyond the 2030 target were less well formed, but there is an expectation that moving housing stock from EPC band C to net zero will be much harder and more expensive and will involve much greater reliance on technological solutions. Most providers are waiting for a clearer decarbonisation pathway to emerge. The mood among providers is generally cautious, with almost all interviewees saying they had no plans to lead the sector or race ahead in terms of decarbonising their stock, but they are prepared to act quickly when the time comes, and have no plans to be left behind.

'We don't intend to be front runners, and we want to kind of see what happens and move with the crowd, and then lead out front'

'Not to be a market leader, but do the right work when the time's right'

'(We) are clear: we don't want to be a pioneer, we want to be quick to react, you know, once there's a bit of maturity in the market'
(Housing provider representatives, August and September 2021)

Providers discussed the reasons for this caution: in the absence of a clear, evidence-led route to decarbonisation which is supported by national government, the social housing sector is not in a position to take risks. Providers have responsibilities to their tenants – who are often vulnerable – as well as to their funders. As one local authority provider said, *'this is public money we're spending'.*

'We wanted to be ahead of the sector…to innovate. But of course being a housing association we can't…rush into new things and innovate'

'The thing that we always have to remember is that it's somebody's house'
(Housing provider representatives, August 2021)

Despite this, providers were aware of the challenge that will face them post-2030 and were looking at ways to address it. In general, approaches are data-driven, based on improving the data they have on their stock, then using this as a basis to plan approaches. Piloting different measures and modelling the likely effects of different interventions is another important aspect. Several providers spoke about different ways of categorising their properties to identify the type or degree of intervention that might be needed to reach net zero. One provider said their focus is on sustainability: they aim to build in decarbonisation as part of their ongoing investment and 30-year plan using a sustainable approach that involves replacing things when necessary. They were also considering measures in terms of the long-term sustainability of properties. Specific details of approaches regarding housing archetypes and prioritising properties are discussed in the following sections.

'Everything is changing so fast, it's a case of when do we dip in and what do we use? We're trying to choose things and solutions, technology that is going to stand the test of time'
(Housing provider representative, September 2021)

While housing providers were working to improve their own stock data and identify what different properties need in order to reach net zero, there is a real need for clearer guidance and support from government in terms of the pathway to net zero, as well as convincing evidence about the performance of different technologies.

5.3.1 Housing archetypes

The types of housing stock providers have is an important consideration when planning retrofitting strategies. Providers need to know what works are needed for different housing archetypes to achieve net zero. As several interviewees said, it is an easier task when the stock contains large numbers of properties with the same or similar archetypes, as this means it is well worth investing the time and effort to define an approach for that type, and the solutions found will be suitable for a large proportion of the stock. Even if different properties within an archetype have had different works done previously and are therefore not entirely comparable, this can create a useful template for planning interventions. It is harder where stock is very diverse and solutions only apply to a small number of properties, perhaps even needing to be determined on a per property basis. Some providers said their stock contained what one called a *'huge mix of property types'*, including complex and hard to treat properties, old sandstone properties, listed buildings, converted buildings, post-war

prefabs, and other non-traditional properties, and that this would make planning their approaches to retrofitting harder, and mean that progress would be slower. Providers also mentioned certain property archetypes which they identified as being hard to treat, including non-traditional properties of various types.

5.3.2 Prioritising properties

Table 13: Approaches to prioritising works (online survey)

Prioritising works	Responses
Lowest performing properties	3
Integrate into planned maintenance programme	2
Void properties	2
Piloting new technologies or small-scale net zero developments	2
Funding led	2
Fabric first approach	2
Minimal disruption to tenants	1
Realigning/mainstreaming current and planned works to improve energy performance	1
Property types	1
Small improvements to improve SAP ratings	1

Providers described their approaches to decarbonisation with reference to the properties that they wished to prioritise. The results to this were mixed with providers taking various approaches to prioritising works. Most interviewees said their priority was to target the worst performing properties (e.g. those with the lowest EPC scores) first, and this was also the approach discussed most extensively in the interviews. Some organisations stated that properties where tenants are likely to be in fuel poverty were a high priority; this might relate to a number of factors including household income, hard-to-heat homes, being off-gas (often in rural areas) or having inefficient or expensive heating systems (e.g. storage heaters). The popularity of housing is also a consideration: it was not thought to be worth spending large sums retrofitting hard-to-let properties in low demand areas. In areas like this, and especially where regeneration programmes are planned or likely to happen, providers were more reluctant to commit to retrofitting works, in case other plans emerge for the properties. For instance, properties may be demolished, or there may be regeneration funding available for retrofitting, or opportunities to build decarbonisation into renovation programmes.

The problem of what to do with hard-to-treat properties was discussed. Most interviewees said they had a very small number of very low performing properties, if any; for instance, one said they had just ten homes with an EPC of F, and another said they had one G and nine Fs. These properties were usually subject to particularly

challenging situations, such as: the property might be a converted building, off-gas, using solid fuel, impossible to insulate conventionally, listed, or in a conservation area (or a combination of these things). However, there are also some more common property types that may prove challenging to retrofit, e.g. one interviewee said they thought it would be difficult for dormer-style properties to achieve EPC C, let alone zero carbon. Providers highlighted their social responsibility and how it would be wrong for them to offload such properties so that they become someone else's problem, in the knowledge that other owners would likely be less scrupulous about retrofitting and this would ultimately make it harder for the housing sector to reach its net zero aims. Taking this responsibility a step further, one local authority provider described their recent strategy of buying poorly performing, problem stock and doing works to raise it to EPC C. Offsetting was mentioned as a possible solution to the problem of hard-to-treat homes.

'We've done so much investment over the years that most of our properties are now in EPC band C or above. We only have around about 2,500 properties that are either an EPC band D or E, and the Es are a handful' (Housing provider representative, September 2021)

Providers were confident that decarbonising the majority of their stock would pose much less of a problem, with most saying their housing was mostly EPC C or D, with the acknowledgement that any stock that was EPC D was not very far away from meeting the 2030 target.

'Our existing stock is not that bad – it's often a (EPC band) D but it doesn't take a lot to get from D to C' (Housing provider representative, September 2021)

5.3.3 Investment required to achieve 2030 & 2050 targets

Only two organisations (organisations 5 & 11) were able to provide a detailed breakdown of the scale of investment in individual interventions they estimated were required to achieve EPC C by 2030 and net zero by 2050. This data cannot be extrapolated to other organisations in the North East but illustrates the variations between organisations in terms of which measures they estimate require investment, as well as the scale and timing of the investments. While the required investments estimated by Organisation 5 appear to follow the fabric first approach described in the surveys and interviews, estimates by Organisation 11 show a much higher level of investment in renewables such as solar PV, even before 2030. The differences in these approaches may also account for the higher level of investment described as necessary by Organisation 11 both here and in figures 8 and 9.

Case study 1: Organisation 5

No. of properties: 14,706 (10,345 of which are located in the North East)

Overall estimated investment: £88,282,665

Total investment/total no. of properties: approx. £6,000/house

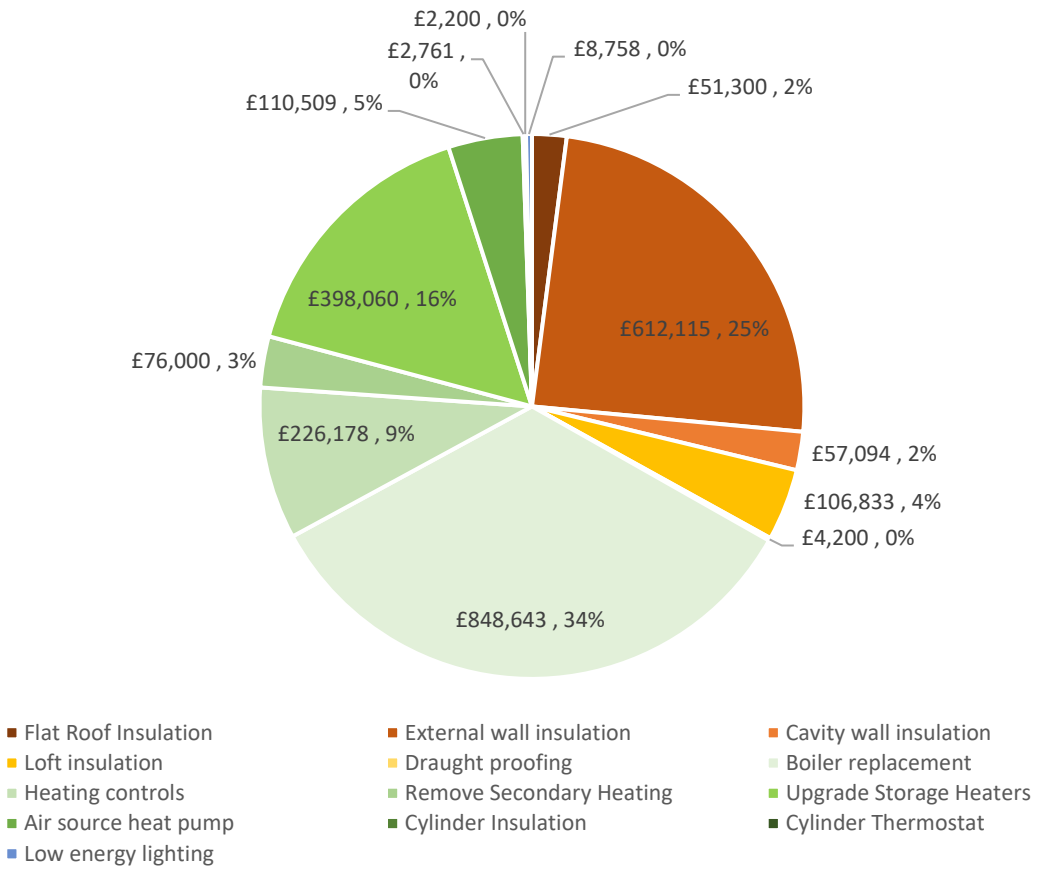
Main archetypes: bungalows, flats, terraced and semi-detached houses

Dwelling age: mainly bungalows and houses from 1950-1975, and flats from 1967-1982

Energy efficiency: almost entirely between EPC band B–D, but dominated by band C

As figure 10 shows, the required investment to enable organisation 5's stock to achieve EPC band C was distributed with roughly a third to be spent on fabric measures, with external wall insulation accounting for most of this investment. The remaining two thirds of spending were estimated to be required for works to heating systems. While an estimated £110,509 will be required for investment in new technologies such as air source heat pumps, a far greater sum of £1,553,842 is required to be spent on the improvements to, or removal of, existing heating systems. If actual spending aligns with these requirements, this would indicate that while there will be some demand for skills such as air source heat pump installation, many of the skills required to meet 2030 targets are associated with alterations and improvements to more traditional heating systems, as well as appropriate installation of insulation.

Figure 10: Organisation 5: £2,504,651 investment required to meet EPC C by intervention



However, beyond 2030 targets, the estimated required investment to achieve net zero is estimated to increase significantly, from £2,504,651 to £85,778,014. This planned investment is much more clearly dominated by more expensive renewable technologies such as solar PV, as well as the continued installation of air source heat pumps. Together these two technologies are predicted to account for 72% of the investment required to move from EPC C to net zero. If actual investment were to follow these estimates this would suggest an increase in the demand for air source heat pump installations on the part of this organisation, coupled with a significant shift away from demand for skills associated with fabric improvements, towards installation of renewables such as solar PV panels.

Figure 11: Organisation 5: £85,778,014 investment required to move from EPC C to net zero by measure

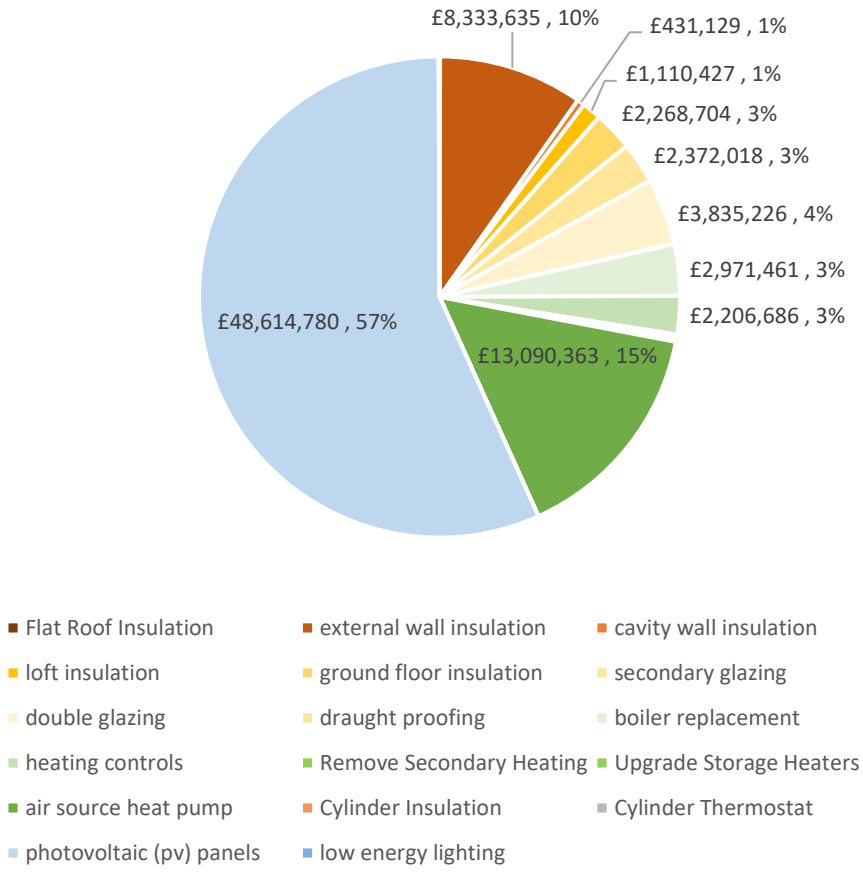
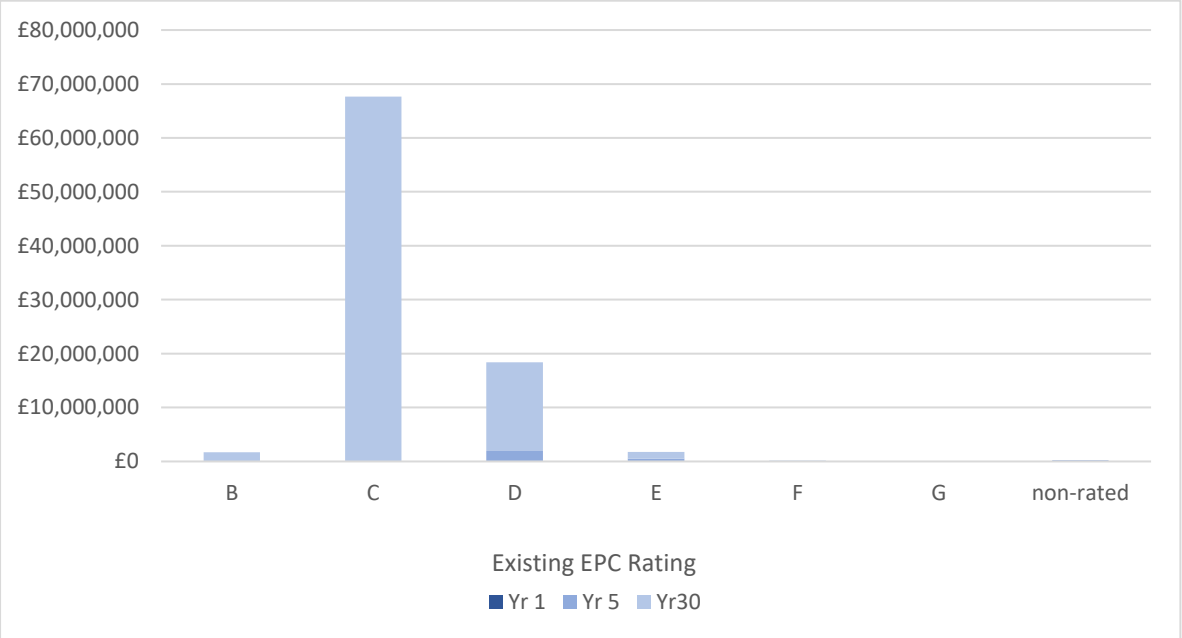


Figure 12: Organisation 5: investment required over 30 years



This is further supported by Organisation 5's estimate of the investment required over the next 30 years, which shows that the majority of the £88,282,665 investment required would occur between years 5 and 30, and would be focused primarily on further improving properties already at EPC band C.

Case study 2: Organisation 11

No. of properties: 18,207 (all located in the North East)

Overall estimated investment: £283,412,592

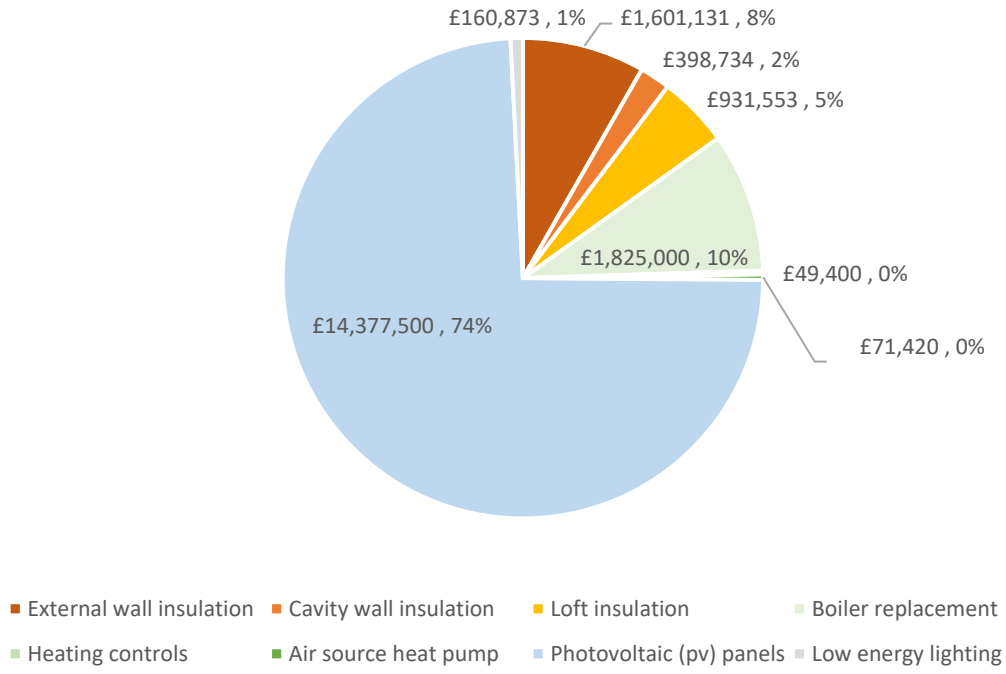
Total investment/total no. of properties: £15,566

Main archetypes: bungalows and houses (terraced and semi-detached)

Dwelling age: mainly bungalows and houses from 1930-1975

Energy efficiency: almost entirely between EPC band C and D

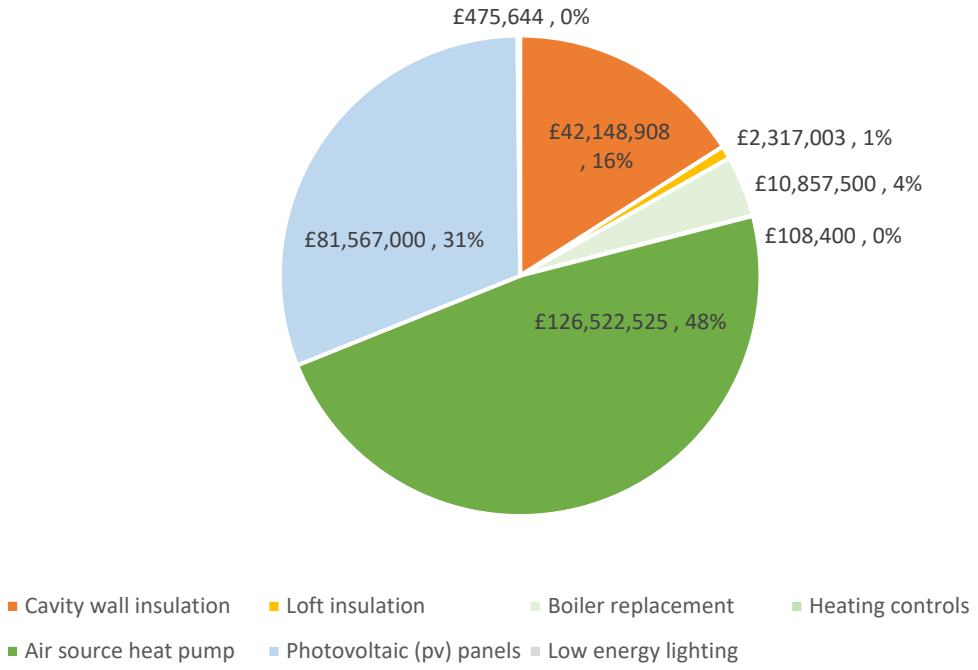
Figure 13: Organisation 11: £19,415,610 investment required to meet EPC C by intervention



In Organisation 11, required investment to achieve EPC band C is dominated by PV panels, accounting for almost 75% of the estimated investment, while insulation and boiler replacement account for only 15% and 10% respectively. If actual spending aligns with these requirements, this suggests that Organisation 11 would have a high demand for installation of PV systems prior to the 2030 target date to achieve EPC C.

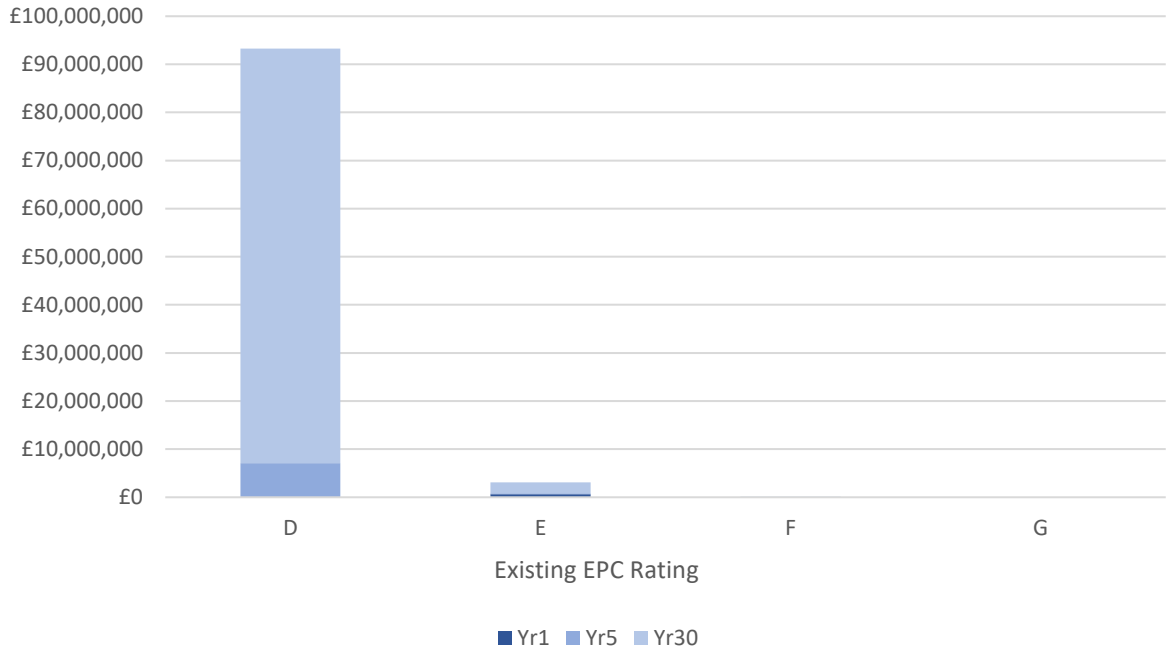
This could also account for the substantially higher levels of estimated investment required, compared with Organisation 5. Meanwhile, this outline of required investment does not convey a clear approach to the decarbonisation of heating in these properties. While the higher number of properties in EPC band D (compared with Organisation 5), or a higher number of hard-to-treat properties may account for a more renewables focused approach, a fabric first approach would likely be less costly, and the viability of this approach should be investigated further.

Figure 14: Organisation 11: £263,996,980 investment required to meet net zero by intervention



In contrast to the previous case study, Organisation 11 predicts an increased requirement for fabric and heating improvements following 2030. However, while the significant investment in air source heat pumps predicted by Organisation 5 is mirrored here, required investment in insulation by Organisation 11 is instead focused on cavity wall insulation.

Figure 15: Organisation 11: investment required over 30 years



Like Organisation 5, the majority of the £283,412,592 investment for Organisation 11 would be required between years 5 and 30. According to the organisation's estimates, this investment would be required for properties primarily in EPC band D, though it is not clear how properties in band C would be improved to meet net zero requirements.

5.3.4 Investment planned to achieve targets

In contrast the estimated investment required discussed in 5.3.3, this section will examine the investment that has currently been planned by Organisations 2 and 11 (the only two organisations able to provide us with this data).

Case study 2: Organisation 11 *(for details, see previous section)*

Organisation 11 was able to provide planned expenditure on decarbonisation measures for the next two years of £1,935,216 and £1,587,672 respectively. These plans reveal that despite estimated spending to 2030 being dominated by solar PV (see figure 13), the next 2 years of planned investment will focus mostly on heating systems. By 2023, Organisation 11 will have spent £1,671,916 on boiler replacements or 92% of the total estimated required investment in this measure to reach EPC Band C. This is in comparison to £165,000 (0.01%) expenditure on estimated PV required.

The planned investment also reveals a number of divergences from the estimated investment required, with £1,019,188 planned investment for installing central heating, £154,000 expenditure on MVHR, and £186,864 on double glazing that does not

appear on the estimated investment required. Furthermore, £198,000 is planned to be invested in air source heat pumps in the next 2 years, when only £71,420 worth of investment was estimated to be required to meet EPC band C. This would seem to suggest that there are other factors driving planned investment decisions beyond adhering to the decarbonisation targets adopted.

Figure 16: Organisation 11 - £1,935,216 planned investment, 2021-2022

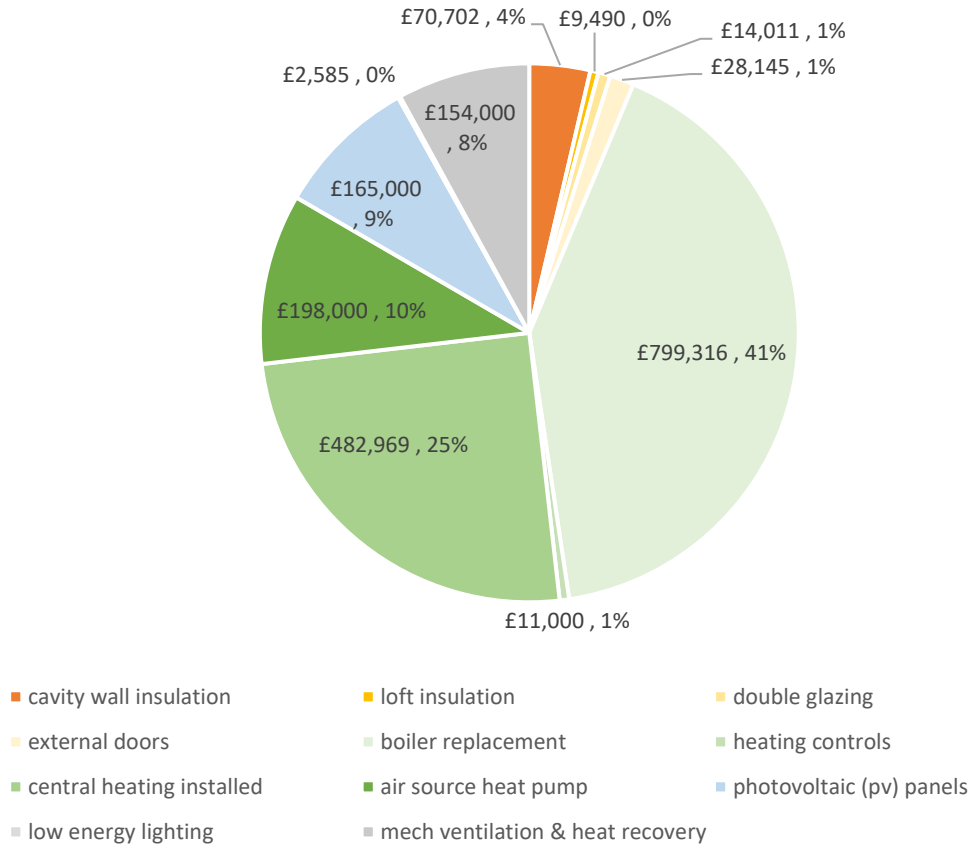
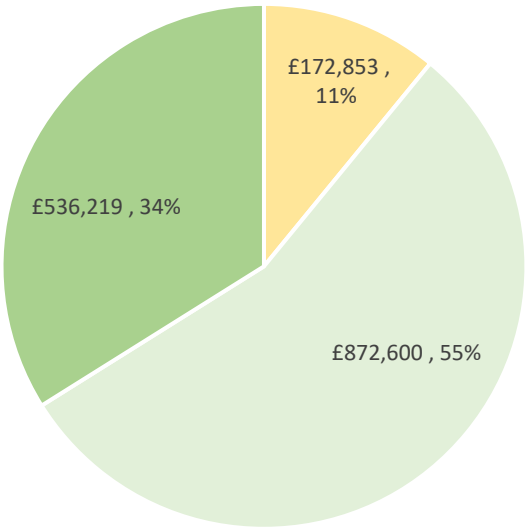


Figure 17: Organisation 11 - £1,587,672 planned investment, 2022-2023



Case study 3: Organisation 2

No. of properties: 23,957 (all located in the North East)

Overall estimated investment: £378,089,520

Total investment/total no. of properties: £15,782

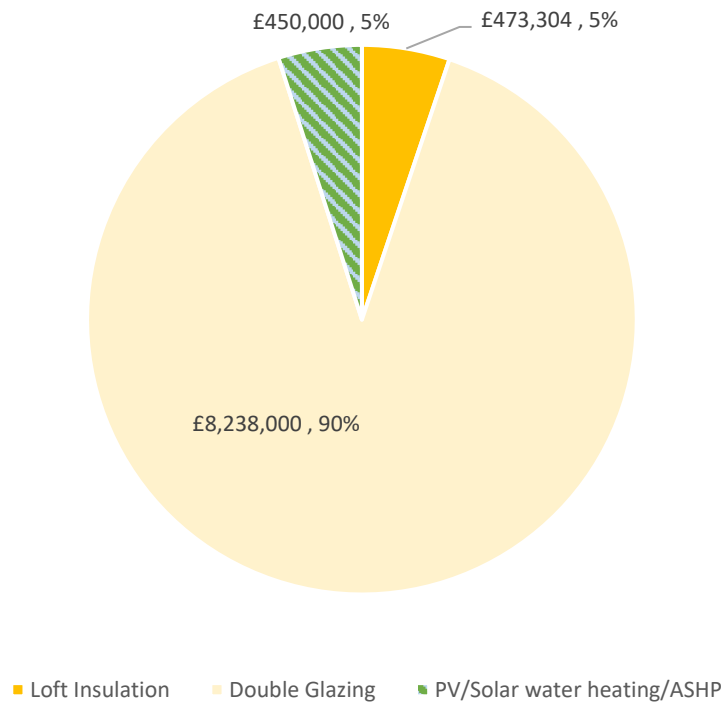
Main archetypes: bungalows, flats, and houses (terraced and semi-detached)

Dwelling age: spanning a broad range from 1930-1975

Energy efficiency: almost entirely in EPC band C & D

Despite not having estimated investment required by measure, Organisation 2 were able to provide their planned investment for the year 2021-2022. This highlights the high degree of variation in investment plans, with this organisation looking to spend over £8million on double glazing rather than the heating-based measures that dominate the investment plans of Organisation 11. However, in their estimated investment required (breakdown by measures not available), Organisation 2 estimated they needed to spend £23,668,095 in the first year, indicating that planned investment falls significantly short of the estimated investment required.

Figure 18: Organisation 2: £9,161,304 planned investment, 2021-2021


£450,000 , 5%
£473,304 , 5%
£8,238,000 , 90%
Loft Insulation
Double Glazing
PV/Solar water heating/ASHP

5.3.5 Specific decarbonisation measures

'We have 13,000 properties…we've got 21 that exceed 100 SAP points at the moment, so what I did was apply measures to the other 12,000 and whatever, up until they reached 100 SAP points'

'To achieve net zero you would need microgeneration in properties, plus offsetting. Some stock might never make it so you have to take a holistic approach and do the best you can with the stock you have'
(Housing provider representatives, July 2021)

Providers acknowledged that the measures needed for decarbonising housing *'aren't that complicated'*, and that what is required is a combination of insulation to improve thermal performance, space heating systems, and (potentially) microgeneration. However, they also pointed out that it is important to make the right choices for each property type, to ensure that there is funding available to pay for it, to follow the direction of travel in terms of 'preferred' solutions (the analogy of choosing a VHS video recorder rather than a Betamax was used more than once), and to ensure that any measures installed are sustainable over the longer term.

To avoid waste, measures must be implemented in a timely manner, such as replacing boilers and other equipment at the end of their lifetime rather than halfway through. The lifecycles of various technologies must be thoroughly understood so that maintenance/replacement budgets and timelines can be planned. Costs can vary significantly if new technology fails earlier than expected. Providers described how they are still learning about the life cycle of air source heat pumps, with more than one reporting that ASHPs they had installed were failing earlier than they had initially expected them to.

Related to this, it is important for housing providers to have access to reliable, high quality information about the measures they may implement. There is a need to monitor the impacts of measures, as more evidence is still needed to inform choices. Several interviewees said they were interested in monitoring the effects of different measures on tenants' energy use, fuel bills and behaviours, though it was not always certain how this could best be achieved. It is also important to understand which impacts matter the most: whether it is the effect on EPC/SAP, energy efficiency, energy use, energy bills, tenant behaviour, or a combination of these things.

Several providers indicated their preference for a 'whole house' approach, where retrofitting of different aspects of the property is all carried out at once. This approach was seen as having a number of benefits: it means disruption for tenants is kept to a minimum, ideally with works happening only once rather than multiple times; costs can be minimised and economies of scale can be made, for example with erecting scaffolding; and the accompanying insulation works mean that any technologies installed can be effective as possible. Interviewees noted that this approach needs careful management and flexible planning (and budgeting).

'We would like to tie in our windows and doors, re-roofing programmes and to fall in line with the EWI works…we pushed them all along so that all happens at the same time and that means probably pushing some things back and bringing some things forward'

(Housing provider representative, August 2021)

Not every property needs 'whole house' treatment to reach the required energy performance standard, depending on the standards to which the property was built and the measures that have already been retrofitted. Providers spoke about their explorations and decision making processes regarding which measures are most appropriate for different properties. Modelling software was sometimes used for this, with the combined aims of making properties as energy efficient as possible and maximising value for money.

'Every single property…has a number of measures and a cost associated with it, so every single property can be considered either as a group with other similar measures or by itself, or as a SAP band…we've got huge flexibility in how we can do those decarbonisation plans'

'What we're learning is there's different ways…you can get creative to increase your energy efficiency, so they might come back with something completely different that could actually mean that we could do more properties'

(Housing provider representatives, August 2021)

However, it is important to acknowledge that the results of modelling exercises may not be entirely reliable, and there is likely to be a performance gap for measures when they are in situ. This may arise firstly as a result of inaccurate assumptions regarding building fabric and heating patterns in the modelling process, referred to as the 'pre-bound effect' (Sunikka-Blank & Galvin, 2012). Secondly, this may occur if tenants experiencing fuel poverty recoup the value of the retrofit measures, not as reduced energy consumption, but as improved comfort, known as the 'rebound effect' (Galvin, 2014).

Providers admitted that there are some properties that will be more challenging to decarbonise, either because they have already been retrofitted extensively and there are few improvements left to make, because the cost of any additional improvements is too high (or funding is not readily available), or because they are poorly performing and hard to treat, e.g. because of their age, archetype, status or location.

'There's a lot of our properties that the only thing we could do now to improve their score is to put PV on the roofs or install an air source heat pump, and of course those two solutions require the scale financing which we haven't got in place yet'

(Housing provider representative, August 2021)

5.3.6 Retrofit measures by type

'I think one of the fears is doing the wrong thing, but I think we've invested enough over the last few years that we are sure that the approach we're doing is right, but we need to try it at scale…we have to do something and get over the fear of it being the wrong thing - try it and if it's wrong, understand why it was wrong and then do better next time'

(Housing provider representative, August 2021)

Specific retrofit measures were discussed in the interviews, with providers speaking about their experiences, learning and views relating to various different options (see table 14).

Table 14: Discussion points for specific energy efficiency measures (interview responses)

FABRIC MEASURES
Insulation (cavity walls, lofts)
▪ Fabric first approach: low cost 'quick wins' that maximise efficiency so fuel bills are lower ▪ Usually standard practice for housing providers ▪ Low tech approach means minimal user/behavioural issues ▪ Needs to be effective (e.g. it may fail over time and need to be replaced or improved) ▪ Should be in place before more technological solutions are offered, to improve their performance and avoid fuel poverty ▪ Potential need for ventilation solutions in highly insulated properties to address air quality
Underfloor insulation
▪ Two providers mentioned plans to trial Q-bot underfloor insulation, which uses a robot to spray insulation under floors with minimal disruption to tenants (one was looking for provider partners to enable this to take place) ▪ Too difficult to achieve in properties with solid concrete floors: too difficult to dig up concrete floors, and too disruptive. ▪ However, one provider said they had found solid concrete floors performed more efficiently than wooden floors anyway
External wall insulation (EWI)
▪ EWI is not suitable for all properties, but can be the best alternative where homes have solid walls or narrow cavities ▪ Most providers had some experience of EWI installation, often going back several years ▪ Some providers had already fitted EWI to all suitable properties ▪ It can be difficult to fit if the property has an unusual shape or the external features of the property (e.g. overhang on eaves, fittings etc.) need to be moved or adapted ▪ There may need to be third party involvement (e.g. relating to moving telecoms fittings and energy meters), and this can lead to delays in works

- Preferable to do EWI at the same time as new windows, doors, roofs etc., to keep costs down
- EWI is another measure that can be done before technological measures, e.g. air source heat pumps, to improve their efficiency and keep bills low
- Some providers felt EWI looked attractive and added kerb appeal; and that this encouraged tenants to agree to it (others disagreed, and thought it looked unattractive)
- Concern was expressed about its lifespan: *'It ages poorly, it's hard to repair and doesn't last as long as brickwork'*
- Repairs and maintenance were described by some as being expensive and difficult

Internal wall insulation (IWI)

- IWI was considered a less attractive option than EWI because of the degree of disruption to tenants
- It was described as tricky to install because of the need to move all of the internal fittings
- It also reduces room size which is unlikely to be popular with tenants
- Concerns was expressed that IWI may lead to condensation and damp problems for properties
- One provider said they were investigating the use of cork for IWI, as a very thin layer can provide effective insulation

Glazing and new doors

- New windows and doors were considered an important aspect of the fabric first approach to improve airtightness
- Most providers fit double glazing as standard in their properties
- Some were trialling triple glazing in a small number of homes
- Concern was expressed that the efficiency gain is marginal for triple glazing, relative to cost (compared to double glazing)

TECHNOLOGY MEASURES

Air source heat pumps (ASHPs)

- High interest was expressed in ASHPs as the current most viable solution to decarbonisation, with one interviewee calling them, *'the way forward'*
- Most providers have some experience of fitting air source heat pumps, often in off-gas properties
- Providers wanted more evidence about ASHP performance, both for their own planning and to educate tenants
- Some providers were doing their own research with tenants who had ASHPs, on running costs etc. It was thought that more time was needed for evidence to emerge
- Providers mentioned the type of heat they provide – slow heat rather than a hot blast from radiators – as something tenants needed to be informed/aware of, and also as a potential safety measure for vulnerable tenants
- As the technology is still evolving, providers expected that efficiency and quality of ASHPs may still improve, and the price may fall

- Running cost is important – it should not be more expensive for tenants than gas boiler, and should not push them into fuel poverty
- For properties with gas boilers, the move to ASHPs (run on electricity) can seem like a backwards step. Providers were reluctant to replace gas boilers with ASHPs, and said tenants were also resistant, although this had been trialled in some areas
- One interviewee reported that modelling different scenarios suggested that gas boilers give properties a higher SAP rating than ASHPs
- External space is needed to fit ASHPs; some providers expressed concern that they may be tampered with if in publicly accessible places, e.g. vandalism, theft or children throwing sweet wrappers into the fan mechanism
- As with other technologies, prior insulation work on the property is necessary to improve energy efficiency and avoid fuel poverty
- One provider identified a commissioning issue: if not fitted quite right ASHPs can run at a very high cost, highlighting the need for adjustments and aftercare for tenants
- The lifecycle of ASHPs was a concern. One provider had found that ASHPs are not lasting as long as expected – 8-9 years compared to 15 years for boilers - despite being 2-3 times more expensive. This will have impacts for budgets and replacement schedules

Ground source heat pumps

- Ground source heat pumps were rarely mentioned in interviews although at least one provider had experience of installing them in properties
- They were described as more difficult to install than ASHPs

Network or district heating systems

- Network heating systems may be suitable where there are apartment blocks or similar clusters of properties close together
- Three providers said they were looking at this as an option for some of their stock
- One provider had done some background work on heat network clusters several years ago, including social housing elements. The project was shelved due to costs but may be revisited
- Possibilities for energy generation from mine water (which is abundant in some areas) and deep geothermal sources were being considered by one provider

Hydrogen

- Only a small number of providers mentioned hydrogen as a serious potential future energy option that they were working towards
- Most said the lack of clarity from government about future use of hydrogen meant they were unable to make any firm plans in this area: *'it's just a constant judgment call'*
- One interviewee said, *'it's a decade away at least',* and another said, *'it's unlikely to be until 2035 before we're prevented from putting gas boilers into properties'*
- However, this means that more certainty is needed now, so that boiler replacement programmes can be adapted to anticipate change
- Two providers said they were already fitting gas boilers that are hydrogen ready: *'They could take a hydrogen mix up to 20%, so we've kept our options open there'*

Solar/PV
▪ Solar water heating and PV were considered useful ways to generate renewable energy and minimise the need to buy in energy ▪ A number of providers viewed it as likely to form part of their solution to achieving zero carbon ▪ Some had considerable experience of solar/PV and were familiar with costs, installation and energy performance ▪ The need for planning permission to install panels on certain property types, e.g. conservation properties, was mentioned as a potential barrier ▪ One provider said they planned to start making solar PV installation an integral part of their roof replacement programme, involving around 300 properties per year: *'a great time to do it because the scaffolding's already up'* ▪ The need to fit a special switch in the property during solar/PV installation was highlighted as an issue. It needs to be either fitted or approved by the tenant's energy supplier, and finding a contractor who can work with a wide range of energy suppliers can be difficult
Ventilation systems
▪ These were mentioned by a small number of providers, mainly with regard to optimising air quality in highly insulated homes ▪ Some providers were installing positive input ventilation (PIV) into some properties that were receiving comprehensive insulation works at the same time, in the hope of avoiding damp/condensation problems
Low energy lights
▪ One interviewee described this as *'low hanging fruit'*: a simple measure which they had calculated to be worth about 1 SAP point ▪ It was described as standard installation practice for all properties
Other measures
▪ A small number of other technologies were mentioned by providers, usually regarding trials they have undertaken, were thinking about doing, or would like to know more about ▪ These included ways to optimise the use of other systems and technologies, such battery cells and battery storage, voltage optimisers, radiator fans and magna cleans ▪ The potential to use technologies, e.g. smart meters and smart thermostats, to collect data about tenants' energy use and behaviours was mentioned by one provider ▪ One provider mentioned trialling the use of infrared panels ▪ All of these additional measures were mentioned by a small number of providers who seemed to be taking a more proactive approach to retrofitting ▪ One provider also mentioned the importance of ensuring that repairs and maintenance is carried out using sustainable materials
Offsets
▪ Some providers mentioned offsetting but generally in the context of needing more information and direction about it

- This was thought to be a potential solution for addressing the problem of poorly performing hard-to-treat properties

5.3.7 Pilot projects and research

Almost all of the housing providers who completed the online survey reported that they had already completed or were in the process of running a pilot project. Only two said that they had not done one, or were still gathering data to develop one. Providers reported a range of decarbonisation pilot projects that were trialled on a small sample of properties. The installation of air source heat pumps (ASHP) was the most commonly mentioned, many of which were installed in combination with other decarbonisation measures. Measures being piloted included solar panels, loft insulation, double/triple glazing, external wall insulation, ground source heat pumps, cavity wall insulation, and show homes, as shown in table 15.

Table 15: Pilot projects (online survey)

Pilot projects and research	Number
Air source heat pump installation	6
Solar panels	4
Loft insulation	3
Double/triple glazing	3
External wall insulation	3
Ground source heat pump installation	2
Cavity wall installation	2
Show homes	2
Converting ducted war air heating to ground source heating	1
Pulling together projects by focusing on available data	1
Retrofitting energy efficiency measures to owner occupied and privately rented homes	1
Regeneration	1
Waste water heat recovery	1
Net zero collective	1

'We do want to be trying new things, but we don't want to be fully committing our whole stock to these new things. It's a case of, well, we'll trial it'
(Housing provider representative, September 2021)

Most interview respondents were either planning, in the process of doing, or had previously run various pilot projects to test different approaches to decarbonisation. This enabled them to learn more about the installation process and cost of different measures, as well as their effectiveness once in place. It was also important to know the effect different measures had when used in combination in a property, as well as the effect on EPC/SAP rating. Providers had trialled a range of different measures on various scales, largely led (and limited) by funding opportunities.

A number of pilot projects involved an intensive, whole house approach targeting a small number of properties (sometimes just one) with a number of different interventions, such as insulating the walls, floors and roof, fitting new windows and doors, and installing a renewable heating system and a ventilation system. In some cases, a particular archetype was targeted to find out what works best in the context of this property type, or else a single specific measure was installed to assess its impact. Some examples of current and recent projects are included in the table below.

Table 16: Examples of pilot projects in the region, as described in interviews

Property details	Details of intervention
Non-traditional properties with low EPC	PV, air source heat pumps and EWI (LAD funding).
Properties with differing archetypes	Triple glazed windows, new doors and EWI, plus PIV (positive input ventilation) to address air quality. Self-funded by housing provider.
Off-gas properties	Air source heat pumps, plus monitoring of impact. Externally funded.
Gas properties	Air source heat pumps.
Multi-story apartment blocks	Heating systems, including ground source heat pumps and air source heat pumps.
Single property projects	1) IWI 2) Q-bot underfloor insulation 3) Smart controls for electric storage heaters 4) Whole house insulation and heating system

Some providers were doing research to help them gather evidence about the effectiveness of different retrofit measures.

> *'I'm doing my own little research project…looking at running costs of non-standard heating systems…I've gone out to all our air source heat pump tenants and asked them for running cost information, tariffs, their supplier and monthly cost, and I can use that as a comparator against the non-standard systems, like solid fuel'*
> (Housing provider representative, August 2021)

Modelling software is another source of data that providers are using, with several saying they had experimented with the software to look at the effects of different measures in different property types, or how best to decarbonise a particular archetype:

> *'A typical three-bedroom semi-detached house, of which we've got quite a number, they are one of our highest archetypes across the borough, and by sticking solar PV on, air source heat pumps, and insulation measures etc., it only took us a very short way to get to net zero for that particular household'*

(Housing provider representative, August 2021)

Evidence and learning is also being amassed through other channels, e.g. from providers' experiences of building new energy efficient homes, via feedback from their stock performance monitoring and maintenance programmes (e.g. by tracking the need for repairs), and through partnering with large national organisations involved in a wide range of projects in other areas.

5.4 Tenants

One of the most important aspects of the decarbonisation agenda for social housing providers is their **responsibility to tenants**. The online survey highlighted that improving tenant experience is a key driver for decarbonisation. One provider stated that ensuring minimum disruption to tenants was a top concern when deciding on decarbonisation works.

This was supported by several interviewees who pointed out that their tenants are often **vulnerable,** and it was important not to *'fail'* them by making changes to their homes that may turn out to be inappropriate or inconvenient, or put them at risk of **fuel poverty** if it increases their energy costs. Due to the significant potential impact on tenants, providers expressed caution in the use of testing and piloting experimental approaches to decarbonisation. *'This is their home'*, as one interviewee remarked several times.

The concept of **fairness** was also raised. Because social housing providers have many properties, often including blocks or estates of similar homes, tenants tend to be aware when improvements are being made to the stock. While providers are keen to spread the benefit of funding across their stock and ensure all properties get what they need to ensure that EPC/SAP targets are reached, tenants may be more concerned with getting their fair share of any improvements that are being carried out. This may be problematic if their property has a higher EPC and therefore does not need the same works as its neighbours. Providers must manage tenant expectations as well as ensuring that their stock is improved. One provider mentioned doing EPC surveys of properties but without telling tenants why they were doing it, *'so as not to raise their hopes about work being done, when it might not need it for the SAP rating'*.

Providers also consider **tenant needs**, and how this relates to their use of their homes. Several providers said homes with older tenants (e.g. bungalows and older people's flats) or people with health problems usually need to be warm all day, as they tend to be at home during these hours, while people going out to work have less need for this. The same groups of tenants may be more likely to feel the cold, and therefore have different needs regarding thermal comfort. Those people who are in the home during the day may be more likely to benefit from solar PV, as they can more readily use the power being generated. Tenant income was also an important consideration. Providers felt it was important to take such needs into consideration when planning the most appropriate decarbonisation solutions, and especially the need to avoid fuel poverty for tenants.

Tenant refusals were mentioned by several interviewees. Tenants are not obliged to agree when the provider offers to make changes to their home (although it is often in their interests to do so), and if they refuse then the works cannot go ahead. This sometimes means spending time persuading them to *'get on board'* with improvement programmes. While new doors and windows may be an attractive proposition, the idea of removing a gas combi boiler and replacing it with an air source heat pump may be

less so. Providers were aware that tenants were wary about changes in technologies (see for example Brown et al., 2014) and that they had to work with them on this.

Refusals are problematic in decarbonisation for various reasons: it can make the work more challenging if one home in a block is not being included (e.g. fitting EWI), and additional works may be needed to avoid it acting as a heat sink. It also creates budgetary problems, as it may be difficult to access funding for works to be done at a later date. When a tenancy ends and new tenants move in, they may request to have the work done (e.g. if neighbouring properties all have it), and it may not be possible, or be more difficult and expensive to do as a one-off. Finally, it is more difficult for the housing provider to meet decarbonisation targets if not all of the planned improvements can be made.

To avoid refusals, **educating tenants** about the proposed changes is important, and some providers talked about doing extensive work with tenants to encourage them to agree to changes being made. Being able to give tenants accurate information about the likely benefits was agreed to be vital for encouraging tenant buy-in. This was a key reason why some interviewees felt that more research was needed into emerging technological solutions (e.g. air source heat pumps), so that evidence can be provided on issues such as likely cost and energy savings. Where there are unlikely to be any cost savings (e.g. where solutions offer carbon reduction alone), some interviewees felt there was a need for broader education into the benefits of decarbonisation, to encourage tenants to feel that they are *'doing their bit for the planet'*.

Tenant behaviour was identified as a crucial aspect of housing performance and meeting net zero, as previously identified by Elsharkawy & Rutherford (2018). As one interviewee said, *'technology will only take you so far'*. Knowledge about how low carbon technologies and interventions will operate with tenants in situ is still emerging, and providers thought it was important to know more, both for their own targets and to enable them to educate and inform tenants of optimal behaviours and usage of technologies. It was generally thought that government leadership was needed to engender this sort of change.

> *'Cultural and behavioural change - that's one of the several asks that we would be looking to government to actually support, because that's not something we can do on our own as an authority'* (Housing provider representative, August 2021)

Doing works on properties can be **disruptive** to tenants, depending on the nature of the work. This is off-putting to tenants and sometimes leads to refusals, particularly for older and more vulnerable tenants. Most providers said they preferred to avoid the difficulties and expense relating to decanting tenants into other properties while works are done. Providers said it was often preferable to do works between tenancies, while properties are empty. This also has the benefit of minimising issues relating to behaviour change; however, it is not possible to work in this way with all properties,

due to long term tenancies. A ‘whole house’ approach in which all works are done at once was advocated by some providers in order to minimise disruption to tenants.

Tenant engagement is sometimes a condition of funding, with bids requiring providers to show evidence that they have consulted their tenants. It is also an important way of ensuring that tenants agree to have works done, understand what is being done and how it will benefit them, and learn how to use any new equipment or adapt their behaviour to get the best out of it (Jansson-Boyd et al., 2017; Walker et al., 2014). Housing providers spoke of a range of tenant engagement activities they were using or planning to use, as shown in table 17.

Table 17: Tenant engagement activities

Category	Activity
Dedicated staff	Creating specific roles to work with tenants, e.g. Resident Liaison Officer, Customer Engagement Team
Expertise	*'We've got a customer engagement team that will sort of professionally advise on what's the best way to do it, what the framework should be, how we should ask the questions'*
Partnering	Partnering with large national contractors means that they can add their expertise to tenant engagement, based on experience and training in this area
Consultation	*'Our tenants want to contribute to the climate change emergency and they want to do their part so…our engagement piece certainly needs to build on that and get a real movement from our tenants to work with us to do it'*
Approach	Community development approaches and working one-to-one with tenants. *'We've actually brought in somebody to do specific engagement with the 57 properties and it is he's been doing a lot of intense one-on-one conversations, and so far we've got 51 out of the 57 signed up'*
Peer education	Asking other tenants whose homes have new technologies, e.g. air source heat pumps, to share their experiences and show their energy bills *'It was a similar resident age group because they were elderly, so they were able to talk to other people in their boat and say, like, 'how are you finding it?', and they had good experiences'*
Demonstration	Getting manufacturers of new technologies and equipment to demonstrate it *'ASHP manufacturers have normally got a van with the system in it so that the tenants can come down and look at it, touch it, feel it'*
Pre-works	*'There is a tenant engagement piece planned for every scheme that we do'*
During works	Having someone that can be contacted for reassurance and to handle any arising issues is important throughout the works programme
Aftercare	*'We get the technical manufacturers in, then afterwards they will be given a one-to-one demonstration on how to use it, and a user guide and contacts for if they don't understand'* Explaining servicing and maintenance plans, ensuring tenants know who to call Making sure tenants understand that they should get in touch if there are any problems or things do not seem right

5.5 Supply chains

While there was a degree of confidence that the 2030 EPC band C target can be quite comfortably met, primarily through fabric first interventions, there was a feeling among housing providers that the supply chain will become a much more pressing issue beyond 2030, because of the nature and extent of the work that will be needed to reach net zero. Market capacity may be a particular issue if, as is likely, all housing providers are trying to get the same works done at the same time.

There was a sense that the market is still in its early phase, and that it needs to expand in order to meet future demand. As clients, housing providers will benefit from having a range of contractors to choose from to perform works, enabling them to select the most suitable. If demand outweighs supply, contractors may be able to *'pick and choose'* what work they do – which may make it especially hard to appoint contractors for smaller projects - and charge artificially high prices. Being able to choose between a range of contractors, including *'large businesses offering everything',* and, *'small contractors who can do bits of it, and being able to sort of specialise in things',* was highlighted as an important aspect of supply chain strength.

The sustainability of the market must also be managed, with steady growth in supply chains, supported by skills development (see next section). Some interviewees pointed to previous lessons learned when funding for EWI was at a peak several years ago, pointing out the potential for new companies, lacking skills and experience, to be quickly set up and do the works (often to a poor standard), then subsequently disappear, making aftercare a problem. This needs to be avoided through careful management of the supply chain, so it is ready to cope when project funding is released on a large scale and demand for works suddenly goes up.

Related to this, one interviewee spoke about the influencing role government funding can have on supply chains:

> *'The capacity issue is driven by the way the government has released all this funding in the last 12 to 18 months, insulation companies have been slowly getting less work because of less funding out there, so we're getting a smaller workforce, and then some millions of pounds being invested in it and they wanted delivery, so there's a real capacity issue and increasing costs, everybody struggling to secure the resources and it's going to be like that until the capacity gets built back up within these industries'*
>
> (Housing provider representative, September 2021)

Careful management of large funding streams could help to avoid supply chains being overwhelmed in this way.

Most providers thought that increased supply chain capacity is needed in terms of more products, product improvements, and diversification in product ranges. As one said, it is likely that 'preferred' solutions such as air source heat pumps will be subject

to high demand: *'I'm not sure there's enough to go around'*. Such developments are quite likely to happen over the next few years as the market develops and continues to be driven by technological improvements.

Some providers said they were less concerned about supply chain difficulties because of the way they work in partnership with preferred suppliers or main contractors, by negotiating responsive contracts for repairs and maintenance, or employing in-house staff teams. Working with other providers in larger networks is also helpful in terms of creating additional buyer power and minimising competition for resources. Another benefit of this sort of joint working is that it facilitates sharing of experience and learning among providers.

It was suggested that more agile procurement is needed to avoid lengthy procurement processes:

> *'Having a framework and being able to procure services quickly, and not having to go through really lengthy processes, is important. We've used the government framework for digital services, where you can procure things in a more agile way, and you know, you can follow a reliable process and have assurance that you've followed that process, but it's a lot quicker and I think the government should be looking at something similar (for this)'* (Housing provider representative, August 2021)

It is also important to consider how carbon use in supply chains can be minimised, whether through the types of materials being used, for instance when carrying out repairs, or for other issues such as transport and local procurement. Finally, some providers said their experience of running pilot retrofit projects had highlighted additional supply chain needs. One interviewee described how a project to install solar/PV panels several years ago kept running out of the clips needed to fix the panels in place. Such issues can cause delays to projects, with potential implications for budgets.

5.6. Skills

'Anyone can fit insulation, but it's going to be different as the tech comes on board more'

'We're going to have to train people or employ trained engineers in-house eventually'
(Housing provider representatives, August-September 2021)

Previous studies (e.g. Gupta et al., 2014) indicate that, in contrast to the above statement, there are often consistency and quality issues surrounding the retrofitting of insulation, highlighting the importance of appropriate skills and training for fabric interventions. However, as we move beyond 2030, highly skilled staff will be increasingly in demand to install, repair and maintain technology-based retrofit measures. Peaks of demand will likely coincide with the release of funding streams, with many providers trying to have similar works completed at the same time. This was viewed by some providers as a significant positive opportunity for the North East region to re-skill its workforce and reboot industry by providing training and employment opportunities in the sector. One interviewee said:

'Re-skilling in the region, I think that's a real opportunity as part of the whole levelling-up agenda, and to do that, you know, some great qualifications, frameworks and get young people through them really quickly and get industry alive and kicking, producing the green technologies that we need'
(Housing provider representative, September 2021)

Rising demand for skilled EPC and energy assessors may be an even more pressing issue, with many providers currently in the process of scrutinising and improving their housing stock data. Several housing providers said they had commissioned stock condition surveys, and some were planning to increase the number of EPCs they carried out as a matter of routine, either by using contractors or increasing their in-house capacity.

Some providers already have (or plan to appoint) dedicated staff in post for decarbonisation, for instance in retrofit coordinator and tenant engagement roles. However, upskilling is also needed across the board for current staff so that they are better able to engage with the decarbonisation agenda. For instance, asset management staff will need to improve their knowledge of installation and maintenance works for quality assurance purposes, so they can determine whether retrofit work is done correctly. While tenant engagement staff have a particular role communicating the importance of decarbonisation and providing advice, information and reassurance, all tenant-facing staff will need to be familiar with this area of work so they can deal with enquiries and other aspects.

Upskilling may be managed through a combination of internal and external training, as well as new appointments. A number of providers said that they were providing relevant in-house training for their staff. Other training opportunities are also available,

e.g. PAS 2035 accredited retrofit co-ordinator and retrofit assessor courses, and providers said they were accessing them. Some training providers, such as the Retrofit Academy, have offered free training places to housing providers. However, several short-staffed providers said that they had not been able to take advantage of these training opportunities due to pressure of other work. This highlights the problems faced by some housing providers with regard to staffing issues and high volume of work, which has meant that the relatively long-term goal of decarbonisation is sometimes given lower priority than other, more pressing tasks. One interviewee said that despite having commissioned and received a stock condition survey report for their housing stock, they had not yet had time to read it due to the pressure of other work. Another, who was working in a local authority context, said they had lost staff to housing associations because while the work and pay was the same, the workload was smaller.

Re-training people like gas fitters, whose current skills may be less in demand in future, was seen as a positive step, although one interviewee pointed out that it may be difficult to persuade people of the need to re-train when they are still finding plenty of work fitting and servicing gas boilers.

As well as ensuring that their workforce is well trained and ready to deal with the challenges of retrofitting, providers acknowledged the importance of ensuring that some staff have PAS 2035 accredited training for funding requirements. As with other supply chain issues, some providers recognised the benefits of working in partnership with large contractors who are better placed to meet upskilling needs by providing or accessing training programmes. Potential shortage of PAS 2035 trained staff, and related to this, PAS 2035 trainers and courses, was highlighted by some interviewees. One also said they were *'a little bit sceptical'* about how well audited some training courses and accreditation routes were, especially in a time of sudden high demand.

One housing provider said that one of their aims as an organisation is to provide training and employment opportunities through an in-house employability service, but said that finding accredited college courses to support this work had proved difficult:

> *'They're trying to work with their delivery partners and to develop green skills. But there's a real lack, of course, available so some of the colleges were not, you know, they said, 'oh well, maybe going to do something in the future, but we're not doing something yet', so you know, it's a bit challenging if you add that on to all the providers in the North East who will be needing to do the same'*
> (Housing provider representative, September 2021)

This is something that needs to be addressed in order to ensure that people can access the relevant training, develop their skills, and facilitate the decarbonisation of the region's housing. The North East LEP are currently undertaking a study to establish the domestic retrofit skills gaps in the region which is due for completion in Dec 2021.

5.7 Key barriers, challenges and needs

Several barriers and challenges, along with associated needs for achieving decarbonisation of the housing stock were identified in the survey, as shown in figures 19 and 20. The top three barriers identified in the online survey were funding, supply chain and tenant engagement (figure 19). This was paralleled in the critical need for skills development and funding as key resources to meet zero carbon targets (Figure 20). These were explored in greater detail in the interviews and are discussed in the following section.

Figure 19: Barriers and challenges to meeting zero carbon targets (online survey)

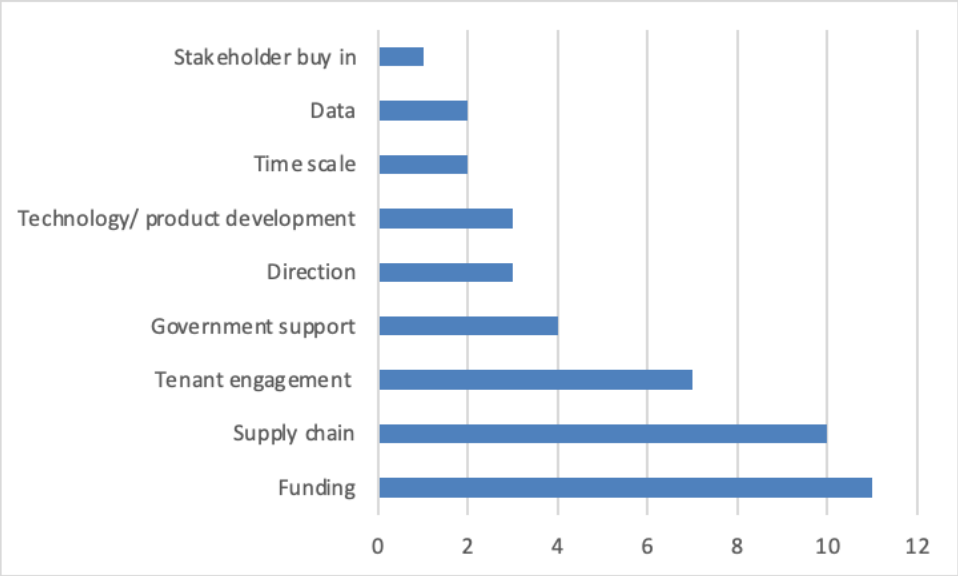


Figure 20: Resources needed to meet zero carbon targets (online survey)

5.7.1 Government/BEIS support

'Government policies are almost always high level, no-detail, 'this is what we're going to do'…and then that's it. They don't tell you...'we'll leave you to work out the details''
(Housing provider representative, August 2021)

Barriers: A lack of leadership or guidance from the Government to underpin its commitment to decarbonisation and provide a strategy and direction was frequently cited as a barrier in both the online survey and interviews. This made it difficult for providers to navigate decarbonisation solutions. Stakeholder buy-in was also problematic at times, which may be attributed to a lack of education, promotion of energy efficiency information, and behaviour change driven by the government.

Challenge: Without effective national leadership on decarbonising the social housing sector, individual housing providers are left to confront challenges alone and without support. If all providers are attempting to do the same thing in various ways, this may result in duplication of effort and waste of resources.

Needs: A regulatory framework would aid in providing guidance on recommended strategies and technology for reaching net zero. Clarity is needed on net zero carbon definitions and related targets. Providers believed that stronger government leadership was required to enhance public knowledge and drive behaviour change in order to increase stakeholder buy-in. In addition, more joint and partnership working within the sector may also be beneficial.

5.7.2 Funding

Barriers: Lack of available funding was the most cited barrier in the online survey, and this was echoed in the interviews. Some providers questioned whether the competitive nature of funding calls was appropriate in a context which requires all homes to be retrofitted.

Challenges: Making the most of the funding available and spreading the benefit of limited funds fairly across the stock was a challenge for most providers. This was exacerbated by the time- and resource-heavy bidding processes involved. There was often a need to work across multiple local authorities (where bidding is through local authorities, as with LAD funding), which necessitated more time to handle partnerships with other agencies.

Needs: Much of the pressure of funding applications could be removed by extending timescales. Several providers agreed with the idea of removing the competitive applications process altogether, in favour of a system where government funding is allocated rather than won.

5.7.3 Timescales

Challenges: In addition to the challenges with funding time scales outlined above, the difficulty of staying on track while working with partners or involving third parties is a potential problem. This includes the need to deal with local authorities over planning issues, as well as other stakeholders in the properties, and appointing contractors to carry out works, especially in situations where supply chains are over-stretched. Any delays, no matter how little, can have an impact on the overall project timeline and expenses. As work programmes grow and more parties are engaged, this becomes more difficult to control, and the consequences of delays become more severe.

Needs: More relaxed timescales for completion of works with increased leeway for delays, as well as enhanced collaboration among partners, were required.

5.7.4 Supply chains and skills

Barriers: The lack of supply chain capacity and skilled workforce needed to cope with extensive decarbonisation programmes were recognised as major barriers to decarbonisation initiatives.

Needs: There is a need to strengthen the supply chain's capacity to meet rising demand while also ensuring relevant upskilling across the board. This includes developing technical skills, tenant engagement skills, and reskilling existing human resource. The requirement for skills development is also emphasised in the Northern Power Homes report, which anticipates that this will result in the creation of around 15,000 jobs in the North East to do the work of decarbonising the housing stock (IPPR, 2020).

(Sections 5.5. and 5.6 contain a fuller discussion of supply chain and skills issues identified by interviewees.)

5.7.5 Operational issues

Challenges: The geographical spread, condition, needs, and archetypes of each provider's housing portfolio vary substantially. This may make determining what measures work best in different homes and the costs associated with them extremely challenging, including both hard-to-treat properties in areas of housing market failure, as well as upgrading energy efficient homes into net zero homes, including newer properties.

Needs: To overcome these challenges, there is a need for government leadership, improved evidence of approaches to achieve zero carbon, technological breakthroughs, and sector-wide collaboration/partnership/information exchange.

5.7.6 Tenants

Barriers: Tenant engagement emerged as a recurring theme in the survey and interviews. Tenants' resistance to having decarbonisation work done on their homes was commonly quoted as a barrier by providers. The process of decarbonising homes

can only be successful with the support of tenants and combined effort between tenants and providers.

Challenges: Challenges facing providers include the need to provide education and information, minimise disruption, manage expectations, and promote behaviour change while ensuring tenants' quality of life in their homes is not compromised. In response to this challenge, providers have supported the Social Housing Tenants' Climate Jury project, which investigates how tenants and providers can work together and has highlighted similar concerns about disruptions and communicating expectations (NHC, 2021).

Needs: Tenant engagement, including pre-works and aftercare, requires the commitment of time and resources. Government leadership or assistance may be needed on education, awareness, and behaviour change aspects.

(A fuller discussion of issues relating to tenants can be found in section 5.4.)

5.7.7 Measuring outcomes

Challenges: Interview discussions revealed issues around measuring outcomes. There are several ways in which decarbonisation outcomes (and therefore success) can be measured, including EPC band, SAP rating, kilowatt hours per m2, tonnes of carbon per property, U values, energy use, fuel bills, heat loss, energy efficiency etc. Some providers had noticed anomalies in SAP calculations, such as gas combi boilers outperforming ASHPs. Not all measurement methods are easily comparable, and it is unclear whether one is more useful or 'preferred.'

Barriers: The ability of providers to control or change tenant behaviour is limited, as is access to household bills and energy use data. One provider had experience of using remote energy data monitoring in a pilot project and discovered that it did not work. This makes it difficult for providers to obtain the necessary information to make informed decisions.

Needs: There was a need for government leadership on how best to measure outcomes, including better standardisation of measures. One interviewee mentioned upcoming changes in the way SAP will be calculated in its newest iteration (SAP 11) as a potential opportunity to improve the way SAP measurement reflects energy efficiency of retrofitted homes.

5.7.8 Evidence

'(We are) very open to trying things, we have an asset base where we can implement small-scale trials of things, so we never say never, but we need to be just a little bit convinced of the outcomes to us as an authority, and data is one of those things, so if you could influence the market or government to make robust data available that would be great for everybody concerned'
(Housing provider representative, August 2021)

Challenges: There is some doubt regarding whether retrofit initiatives will produce the expected results. Providers wanted to know how different decarbonisation methods performed, especially once in place. Better evidence may boost provider confidence and assist their decision making about which approaches to utilise, while also contributing to strategic and financial planning.

Needs: Robust evidence is needed to help providers identify installation issues, costs, energy efficiency impacts, behavioural effects, life cycles, and performance gaps. To avoid unnecessary duplication of efforts, much of this can be addressed through research and development including funding to carry out pilot studies, as well as sharing of lessons and evidence from research and pilot projects within the sector.

5.7.9 Uncertain future

'There's no clear guidance coming, so everyone's falling back to see which ones lead. Or you might back the wrong horse and then everyone else goes the other way and then you'll be stuck with a lot of properties that you will have to replace the boilers back again'

(Housing provider representative, August 2021)

Challenges: All housing providers expressed uncertainty about the future direction of travel and what the best and 'preferred' solutions to decarbonisation might be, and how this created unnecessary risk in terms of choosing what strategies they should adopt. As well as general uncertainty about which technological solutions were the best, concerns included potential alternatives for gas, e.g., whether hydrogen would form part of the solution; whether or when the grid would become *'100% green'* so that electricity could be viewed as a *'clean energy source'*; and if the electricity supply could cope with the potential increased demand of ASHPs.

Needs: Again, most of these issues might be resolved with earlier, firmer, more responsive, and detailed guidance from the government and BEIS. The government's Heat and Buildings Strategy was published in October 2021, setting out how the UK will decarbonise its housing stock. However, this fieldwork was undertaken before this report was available.

5.7.10 Risk management

Challenges: The public funding associated with social housing meant providers had an increased awareness of their responsibility to invest funds wisely and with due regard for any potential risks. This is of particular importance given new legislation in the financial sector looking at how lending on assets that could have risk when it comes to climate change are managed. Social Housing providers do not need to comply with this legislation directly, but as customers of the people who do have to comply, will be indirectly affected.

Needs: Greater clarity is required on what this will entail for the financial planning of social housing providers in the future.

5.8 Acceleration

'We're not building houses as fast as we need to, so why will we retrofit any quicker?'
(Housing provider representative, August 2021)

There was little appetite for acceleration in the rate of travel towards net zero among the organisations that took part in the study. While it would be possible for providers to move more quickly, most were cautious about this. Providers were aware of the risks involved, such as investing in decarbonisation measures which turn out not to be the most effective or 'preferred' actions. They were also mindful of their responsibilities to their tenants and funders. In the case of tenants, the responsibility is to improve their homes and ideally reduce their energy bills, or at the very least not make things worse. With funders, the responsibility is financial, and where public money is involved, this feeling may be even more acute.

Funding is a major issue preventing faster progress towards decarbonisation, but there was a general feeling that, even if more funding was made available, additional time is needed to address the other challenges identified, enable the market to mature, and ensure that approaches are tested to provide robust evidence on their effectiveness. All of these things combined are considered necessary to give the best possible chance of success.

There was a clear sense that the government needs to move faster and provide better leadership to the sector and greater clarity about the road ahead, including information about legislation and enforcement and a clear definition of net zero.

Although the consensus was that providers did not see a need for acceleration, it was pointed out on several occasions that faster decarbonisation could be achieved, if necessary, for instance if government targets were revised. Project and investment planning has built-in flexibility, strategies could be altered or rewritten, and capacity could be increased. As one provider said, this would have the advantage of delivering decarbonisation benefits – such as lower bills and better insulated homes - to tenants more quickly. However, the limits described in this report regarding how quickly effective decarbonisation could be achieved do still apply.

'We could accelerate the 2030 plan, and then also the 2050 one after that…it would require all current plans to be rewritten. Procurement, installation, equipment would be a challenge if we accelerated' (Housing provider representative, August 2021)

6. ACTIONS FOR THE REGION

Analysis of the research findings revealed a series of potentially beneficial actions that the social housing sector in the North East can collectively work towards. The emphasis here is on partnership working, joint funding bids and retrofit works, knowledge sharing and lobbying for change. Generally speaking, these are things that are already happening in the region, but there is an increasing feeling that this is a timely issue that must be addressed now, and that much could be achieved through existing groups and initiatives such as NHC, NEECCo and the North East Carbon Group, in partnership with local authorities and in other local networks.

With the private sector representing 78.3% of housing in the North East (Long, 2021), addressing these problems within the social housing sector is a significant first step for decarbonising housing in the region. The private sector potentially represents a bigger challenge, with lower initial EPC ratings (*ibid*) and a more atomised structure of ownership. Ongoing monitoring and research in the region should examine how the lessons learned and infrastructure developed through decarbonisation of the social housing sector can be applied to the wider decarbonisation of all housing in the region.

6.1 Potential actions

1. Partnership and cooperative working within the social housing sector in the region, including joint retrofit programmes.
2. Sharing knowledge on approaches to decarbonisation, research findings, pilot project results, lessons learned and best practice.
3. Lobbying for stronger government leadership on key aspects of decarbonisation.
4. Campaigning for changes in the way decarbonisation funding is released and allocated, so that it is based on longer timescales and a less competitive approach, and that funding is released in such a way to support rather than overwhelm the supply chain.

7. CONCLUSION

In summary, the picture is complicated: the landscape is still emerging, and we have a long way still to go.

Organisations are willing to act when the time is right, but for now the general mood is cautious, and this is largely because of the responsibility that the social housing sector has to its funders and its tenants. A small number of housing providers are being more proactive and are willing to lead, but most are waiting for things to become clearer.

Current plans to achieve 2030 targets of EPC C, through the fabric first approach that most organisations are taking, will lay the groundwork for the next stage. However, even before that can be done, there is a need to ensure there is reliable data about current stock condition so the right measures can be taken.

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