Birmingham City Council
West Midlands Net Zero Neighbourhood Demonstrator Plan

Re-energising Neighbourhood Retrofit in Castle Vale and the wider region

BE BOLD BE BIRMINGHAM

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Chapter 1- Introduction and setting the scene

1.1 Introduction

This plan sets the context and potential for accelerating the pace and scale of housing retrofit in the West Midlands recognising that the innovation and ability to scale, replicate and accelerate lies as much in policy innovation and the capacity to lever the distinct assets within a given place as any technological intervention. The plan includes a community learning process to enable participants from across communities of practice, interest and place to consider, with a degree of equitability, how the system can be better shaped and reconciled to drive forward a fast but fair pathway to net zero. The plan sets out the options for delivery of a net zero neighbourhood in Castle Vale, East Birmingham as the initial stage in a wider learning process and pathway to net zero across the city and region.

1.2 Framing our approach

The #WM2041 strategy and its associated Five-Year Plan shows that we need to retrofit some 300,000 homes in the region by 2026 to meet agreed targets. Currently there is not the financing models, public or private sector appetite, supply chain or indeed consumer demand to drive such a transformation. WMCA has recognised that the current focus on individual grant-based initiatives designed to encourage individual households to undertake retrofit and switch to cleaner heating technologies are not capable of driving change at the necessary scale or pace. The University of Birmingham Pathways for Local Heat Delivery Policy Commission report provides a comprehensive summary of some of the systemic challenges and inherent blockages to the consumer/market driven approach. Factors that are reflected in the WMCA Expression of Interest for the Net Zero Neighbourhood, which recognises, quite simply, that a different approach is required.

In shaping the East Birmingham NZN plan, those participating in the community of practice that forms the collaborative have recognised that a focus on a neighbourhood gives us the opportunity to identify how local assets can be harnessed and the impact of systemic dysfunctionality potentially mitigated. However, unless we place the challenge of net zero in the context of how we invest and intervene in the places that make up our cities, regions and communities, we will not secure the underpinning change required in terms of skills, employment and, critically for this region, a visibly fair transition that addresses existing patterns of inequality and deprivation.

Figure 1 shows that for Birmingham no matter how much investment and growth has been secured in the City. the spatial distribution of deprivation has remained remarkably unchanged – just that within some of the most deprived areas the experience of deprivation and poverty has intensified. The NPI's report on the State of Economic Justice in Birmingham and the Black Country commissioned by the Barrow Cadbury Trust, provides further evidence that, in tandem with driving forward a net zero pathway, if we are to avoid placing whole swathes of the region at risk then corrective action to address the social and economic impacts upon communities will be required. In this context we have sought to place the delivery on net zero as central to the shared ambition between BCC, WMCA and Government to level up the UK.

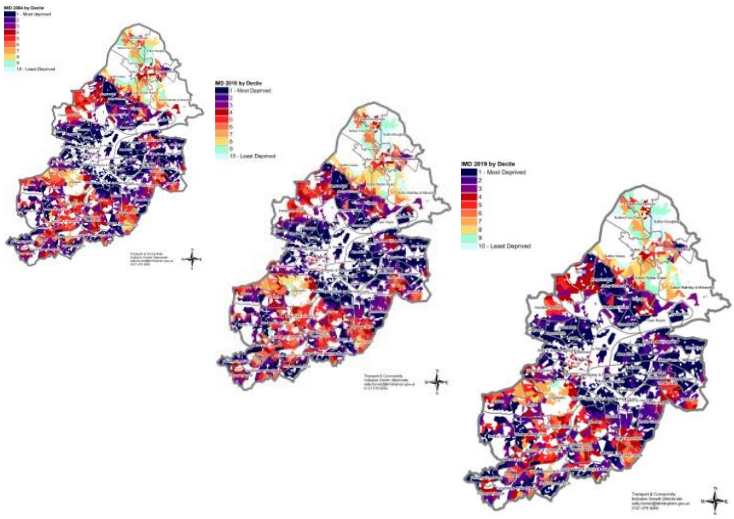

Figure 1: Index of Multiple Deprivation (IMD)for Birmingham 2004-2019.

The University of Birmingham's (UoB) Birmingham Energy Institute (BEI) working in partnership with Places in Common and the East Birmingham Community Heating Task Force has led the development of a policy approach that seeks to connect the energy innovation cluster at Tyseley Energy Park (TEP) with the city and region's wider agendas for inclusive growth and action on climate change. Two policy and research reports - *Power to the People* and *Strength in Common* - set out the energy system change required to develop a connected net zero pathway and interventions that provide a real and relevant return to the communities of East Birmingham. In developing this plan, we have sought to develop a process and set of tools that will assist in accelerating and scaling up place-based housing retrofit and changing mindsets within the city and region.

A decade of austerity, coupled with a longer-term trend of technological and organisational changes in the economy, have left large parts of the West Midlands more vulnerable to adverse economic impacts, both in real terms and in the wider public perception. Inevitably this has led to a deterioration in social cohesion. In addition, the least well off in society face a triple injustice compared to those better able to absorb the consequences of investment in a green economy. Despite not being primarily responsible for causing it, the least well off will be required to bear a substantial proportion of the cost of addressing climate change. On current trajectories, they are also likely to experience a significant increase in levels of inequality following any transition to net zero. This leaves the critical arguments for a net zero transition exposed to the threat of populism, which has with some success made it a wedge issue that polarises opinion and public participation.

The polarisation of action on climate change in the public discourse is not just targeted at marginalised communities. It also seeks to capture anger amongst those in lower skilled jobs and those with less choice and control over the transition to net zero who feel that successive governments have imposed solutions on behalf of those who already enjoy a higher degree of security and privilege. This engenders a "we're not going to take it any longer" mindset, which will be a major impediment to securing public consent for a net zero transition. Our approach, therefore, needs to be creative, and part of that creativity should be to address the imbalance between communities that has become embedded through past

transitions. Building clearer consent for a just transition requires us to design approaches that overcome the emotional responses of the public and does not ask them to place what are perceived to be long-term priorities over short-term day to day concerns.

To develop a replicable model and frame of understanding we have sought to simplify the complex issue of climate change and balance three competing and interrelated factors:

- The speed with which we need to transition to net zero carbon emissions,
- The level of impact on the economy
- The level of impact on society and equality and fairness within it.

The three competing pressures that constrain action on climate change can be thought of as three points of a triangle. The tension between each factor can be plotted on the line between them. The space in the middle of the triangle can be thought of as the parameters within which action on climate change could be taken. If there are no pressures in terms of timeliness of action, maintaining economic growth or avoiding an adverse impact on equality there would be complete freedom to act. In reality, each of these pressures places limits on action and reduces the parameters in which action can be taken.

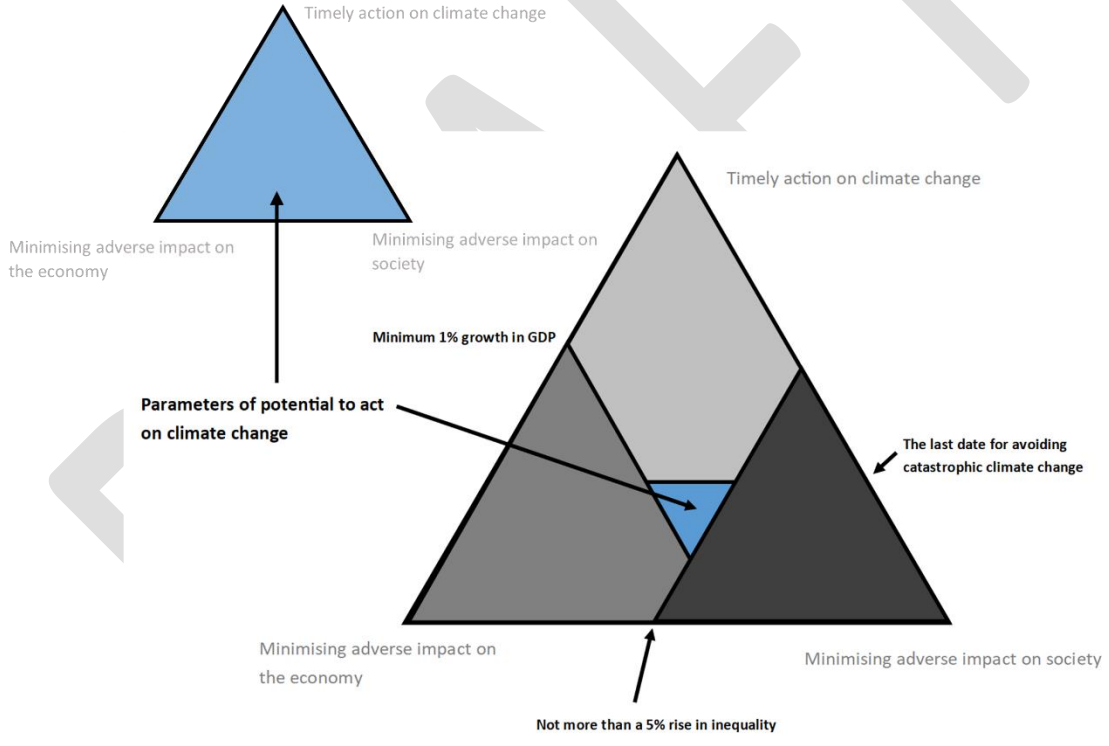

Figure 2: **Three pressure points triangle model of parameters of potential to act on climate change.**

These competing pressures are represented in Figure 2 which shows how the parameters of the potential to act on climate change are dramatically reduced when limits or red-lines are introduced in respect of the three pressures. A place must be found between the three points where action on climate change can take place. If, on the face of it, there is no room left within the triangle for action to take place it is incumbent upon society to consider which of three factors need to be the subject of compromise in order to create space to act.

In a city and region that has entrenched inequality such as Birmingham, there is actually very little room for manoeuvre to deliver upon the competing goals of climate action and economic growth. In the debate on a green transition, there has been a tendency to focus on the economy and the green jobs associated with technological advance in conjunction with varying timescales to achieve 'net zero'. Given the levels of deprivation, depth of inequality and low skills attainment within the region, if we are to level up and secure a fair and fast transition there is a need to rebalance that focus and develop a net zero pathway that starts at the point at which people and the local economy are currently situated. A package of interventions is needed that helps arrest decline, provides a pathway for community renewal, and regeneration within an overall programme that delivers for climate and community - key components of the WMCA Inclusive Growth Framework.

Whilst the causes of the current cost of living crisis are multifaceted, it has made energy, the system that underpins it, its pricing, distribution and source a live issue to both politicians and the public at large. Whilst some commentators have sought to shape the narrative and capitalise on the current crisis suggesting that 'hidden' green levies, hesitancy around new fossil fuel extraction methods such as fracking and Europe's dependency on Russia's energy are primary causes, the engagement we have undertaken has highlighted how people, for the first time since the late 70's, are really thinking and talking about their energy use. For those who can afford to pay and who own their homes this may focus on how they can move to increase their personal energy security. For those in work and with less choice and control over their income, homes and livelihoods, especially those with pre-paid meters the "heat or eat dilemma" is now a daily reality.

Whilst Government and agencies have moved to act on this by providing short term relief, there remains the need for a citizen focused approach where money advice and energy efficiency are an integral part of an engagement process. The approach should be rooted in the reality of having to act now on climate change but be real and relevant to the lived experience of most residents. This is potentially a once in a generation chance to secure the public consent and draw together a broad-based coalition to drive the required change.

Achieving net zero will involve significant planning and action at a local, as well as national, level. This requires strategic capacity and institutional architecture that has largely been stripped out of governance arrangements. Even where capacity remains, there is a need for a shift in mindset in policy assumptions and approaches across the public and private sectors. There needs to be a robust understanding of how to work across different system and service interfaces at a local level and honestly identify and address any impacts on consumers, citizens, or at-risk communities.

If we are to accelerate and broaden the take up of housing retrofit, overall co-ordination and leadership of housing retrofit in the city and region is needed, with a clear role and agency, capacity and capability. We need to collectively own the challenge and, as part of the development of the NZN demonstrator, make the case for an integrated, localised energy system with a clarity of purpose on net zero across the relevant spatial scales and spheres of governance.

1.3 A Community Learning Process

Engagement within the NZN collaboration and participation of this proposal across communities of place, practice and interest has shown that there is a shared understanding that the change starts with us all. There is a willingness to own the challenge and make the

change both in what we do and how we do it. The public purse cannot subside in full the transition, let alone meet the challenge of levelling up. Across sectors and communities there is a need to find common purpose and a collective return. The NZN's emphasis on starting with a given neighbourhood, understanding its assets and the policy levers that present within a locality as a means of bridging the economic and social gap and driving a timely net zero transition is one we have embraced.

The initial expression of interest for the NZN was developed and collated by a sub-set of partners from the East Birmingham Community Heat Taskforce (University of Birmingham, Birmingham City Council, Places in Common and the Pioneer Group). This plan builds upon that work. The NZN plan and collaboration that is seeking to take forward its delivery has been developed through a participative and iterative community learning process that has at each stage drawn upon cross-sector expertise and cross community understanding to develop a proposal and process that connects the assets and social capital held within the demonstrator neighbourhood with the wider architects and opportunities for change.

Foundational Pillars:

- Taking a whole community approach to innovation with equal participation by all whether involvement in the process and the community is professional, as a visitor for work or leisure, or as a resident.
- Bringing tensions, conflicts of interest and competing priorities into the open and constructing mutually beneficial solutions.
- Building knowledge from within the community, testing and challenging preconceived ideas and using an immersive approach that is open minded and seeks to experience first-hand the realities of the wider community.
- Developing a common language that is meaningful to the whole community, identifying a shared goal which draws upon collective capacity and capabilities.
- Identify and drawing upon the assets within a community that can support development, creating shared ownership and driving accountability.

Figure 3 sets out the workshops and activities that have enabled the initial partners to broaden out into a community of practice and has facilitated the community of place - the key stakeholders and residents within Castle Vale - to be drawn into the plan's development and influence and shape the NZN demonstrator proposition. The interests of those representing specific policy areas have been incorporated into the plan, ensuring they are directly influenced and informed by local stakeholders and the community of place, as well as those who could implement and secure wider system change.

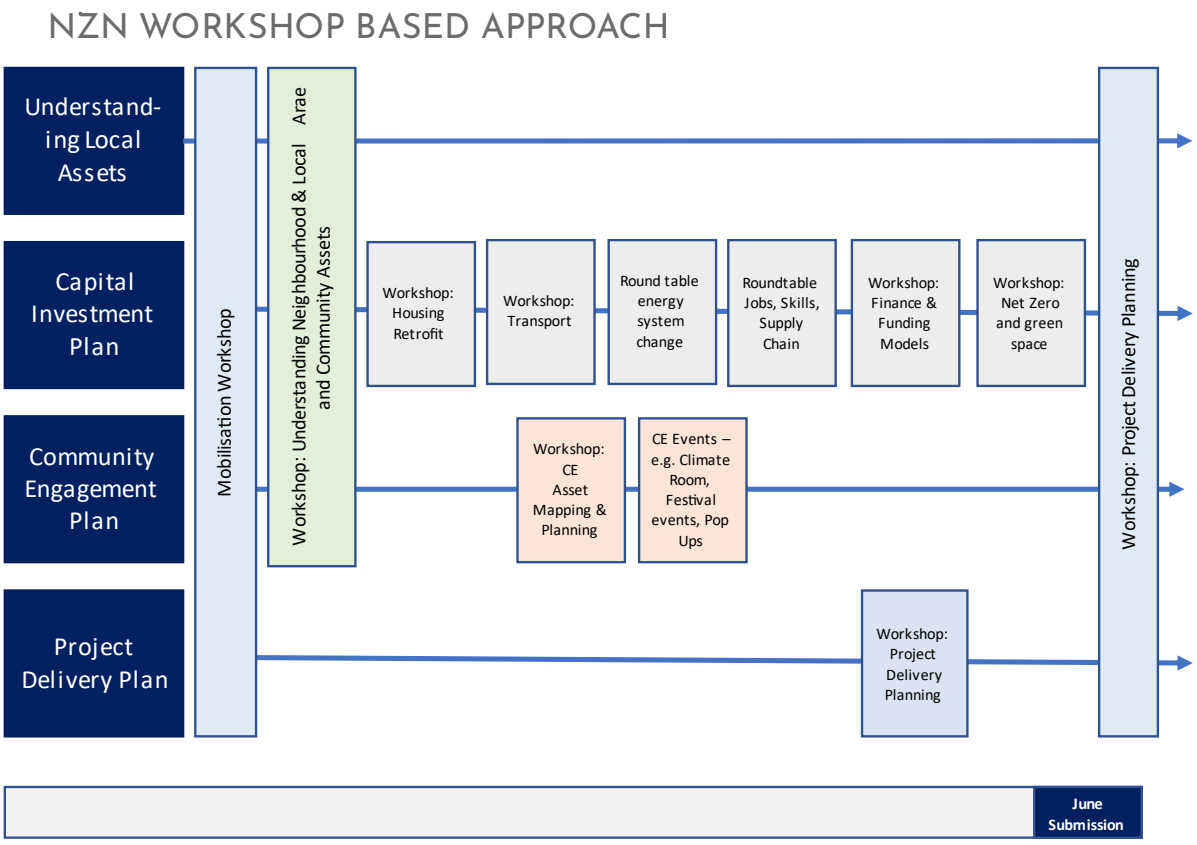

Figure 3: **Workshop approach.**

1.4 Neighbourhood Modelling Approach

Identifying Priority Intervention Areas: A study by Birmingham Energy Institute in 2020 (Moreno et al.) mapped energy deprivation in East Birmingham to identify Priority Intervention Areas for housing retrofit. The study method developed a set of urban typologies to model a theoretical level of energy demand across the building stock. The typologies were defined by a combination of factors: age of construction for different building types (e.g. detached, terrace) and total height, floor height, and floor surface area surface for different age categories of building, moderated for local climate.

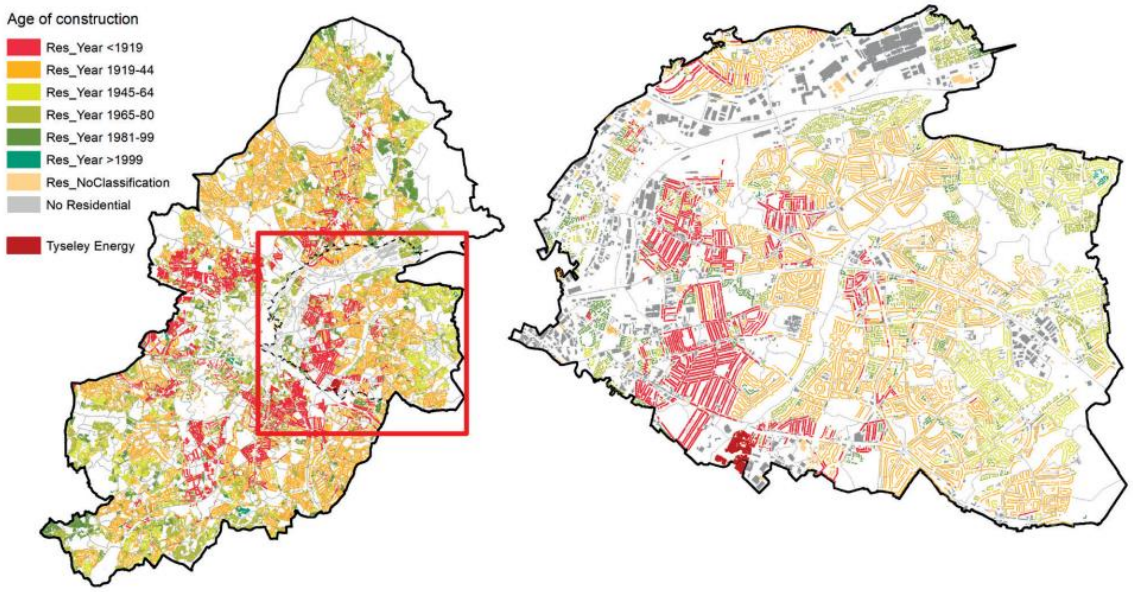

Figure 4: Profile of Birmingham and EBNS Housing Stock by Age of Construction.

The theoretical measure of energy demand was compared with actual energy consumption data at the Lower Super Output Area (LSOA) level to create an energy deprivation index for East Birmingham. The modelling assumed that in areas where actual energy demand is lower than theoretical energy demand, householders cannot afford to consume the level of energy required and hence they are energy deprived. The energy deprivation index was overlaid with the Indices of Multiple Deprivation to identify LSOAs both energy deprived and socio-economically deprived, to justify this assumption and identify Priority Intervention Areas. This method identified Castle Vale as a Priority Intervention Area.

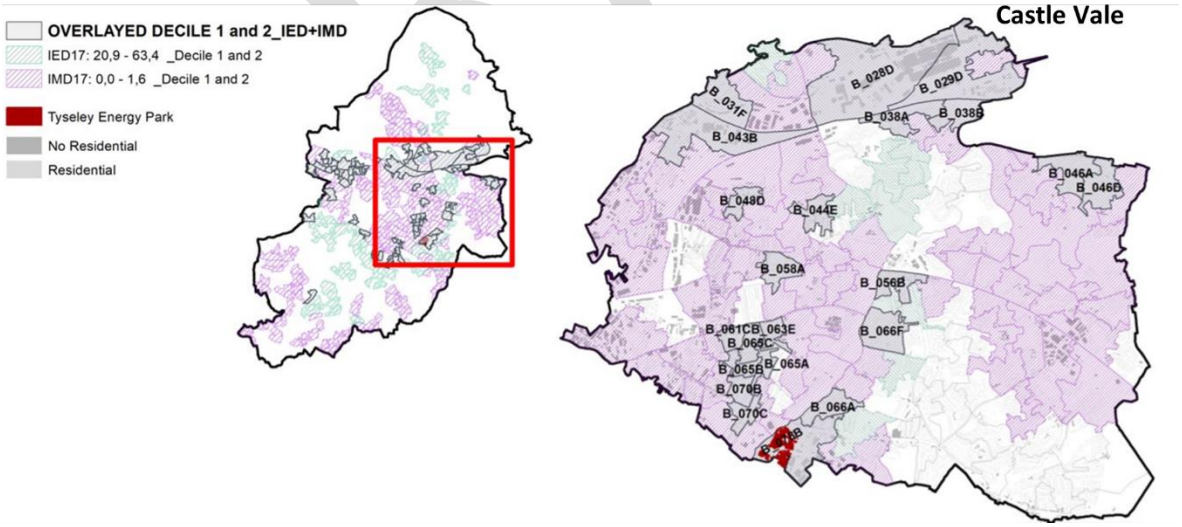

Figure 5: Priority Intervention Areas in Birmingham and East Birmingham. Source: Birmingham Energy Institute.

Community Heat Evaluation Tool: Further work by City REDI and Birmingham Energy Institute in 2021 constructed a Community Heat Evaluation Tool to inform an outline business case for investment in retrofit and heat decarbonisation in East Birmingham. Castle

Vale was selected as the case study area for this work. This was in part due to its designation as a Priority Intervention Area, with further research and engagement identifying other factors that justified its selection:

- The Castle Vale community is more organised than most others in East Birmingham because of the Pioneer Housing Group. Making it easier to engage with as a pilot area for developing an evidence based, robust costs-benefits economic model.
- Most of the Castle Vale estate is in the 10% most deprived wards in England. This means that there is a potentially a bigger impact of any socio-economic benefits of retrofitting.
- However, the average energy efficiency rating of housing in Castle Vale is higher than the East Birmingham average. This makes the area a realistic proposition for initial investment
- There is high percentage of social housing in Castle Vale managed by one social housing group, providing the opportunity to develop robust business models for a particular tenure type in a neighbourhood where householders have a higher level of control over how costs and benefits are realised.
- The location of Castle Vale close to energy and industrial assets and potential sources of waste heat provides more options for changing heating systems and opportunities for co-investment with infrastructure development.

The tool was used to carry out a high-level evaluation of the potential economic costs and benefits of different heat decarbonisation pathways - heat pumps, hydrogen and heat networks – and building retrofit. The study provided a baseline understanding of the scale of the investment needed to retrofit an estate like Castle Vale and identified that the costs outweigh the quantifiable benefits for all options except business as usual. However, there are potentially significant employment and skills benefits for first mover communities even for a small pilot programme.

East Birmingham Community Heat Test and Learn Project: Currently, University of Birmingham and Places in Common are building on this previous work to develop a neighbourhood-level modelling process for housing and heating retrofit solutions through the East Birmingham Community Heat Test and Learn Project funded by the Cadent Foundation. There are two stages to the neighbourhood modelling approach. Initial Clustering by mapping the whole of East Birmingham to identify a set of focus neighbourhoods; Deep Dive analysis focussing down on a set of neighbourhoods and incorporating quantitative and qualitative data from analysis and engagement with residents through a community learning process.

Stage 1 Initial Clustering

- Era of housing, type and tenure
- Energy use
- Socio economic profiling
- Opportunity optimisation levelling up and a fair transition
- Neighbourhood functionality and trajectory

Stage 2 Deep Dive

- Asset mapping and capital accounting
- Energy system mapping

- Cross cutting drivers
- Consumer choice and primary purpose of occupation

The methodology for Initial Clustering built on the Priority Intervention Areas study in 2020 but compares LSOAs across four domains of deprivation. The aim of this approach was to identify differently deprived neighbourhoods in East Birmingham, where there are different opportunities to optimise levelling up and a fair transition, and develop scalable and replicable retrofit solutions, and co-investment and business models.

Four domains of deprivation:

- Localised Energy Deprivation Index
- Localised Access to Healthy Assets and Hazards Index
- Localised Health Deprivation Index
- Localised Employment, Education and Income Deprivation Index (LEEIDI)

The clustering approach identified Castle Vale as particularly deprived in two domains: Health and Employment, Education and Income. The neighbourhood modelling process has provided further justification for focussing on a neighbourhood in Castle Vale as a Deep Dive area and East Birmingham NZN demonstrator.

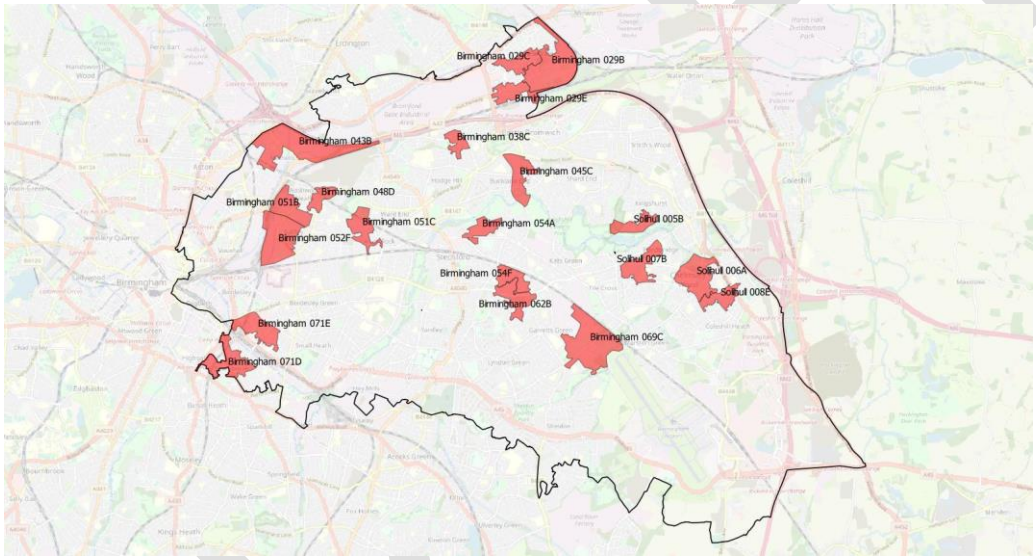

Figure 6: LSOAs with an LEEIDI of 1 (i.e. the most deprived in the education, employment and income domain).

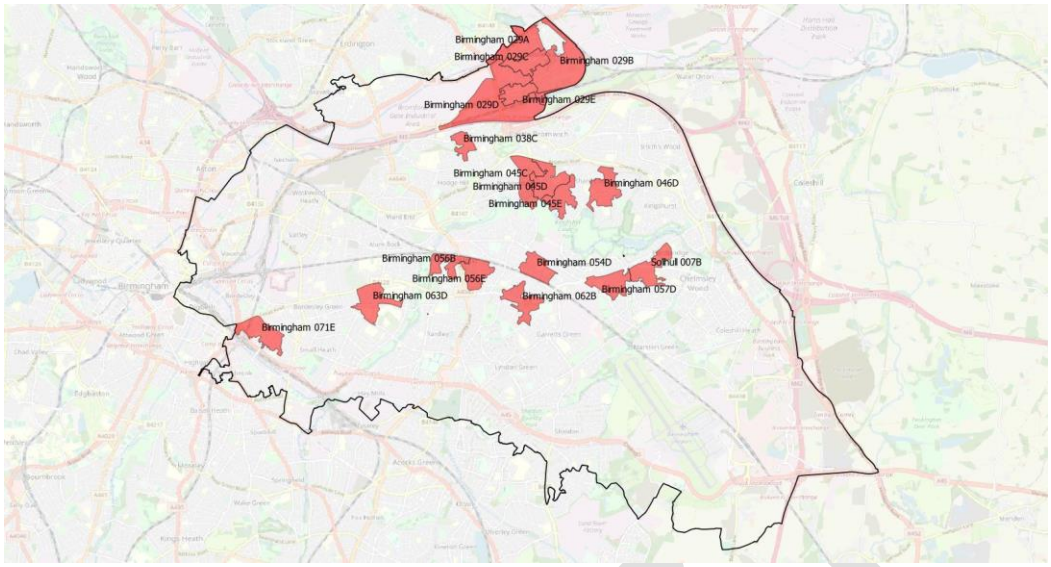

Figure 7: LSOAs with an LHDI of 1 (i.e. the most deprived in the health domain).

In summary, the research and analysis across projects justifies the selection of Castle Vale for the East Birmingham Net Zero Neighbourhood demonstrator. Castle Vale is deprived across different domains and, therefore, residents would be multiple beneficiaries of a project that led to improved health outcomes and environment, reductions in fuel poverty, and increased employment and education opportunities. In addition, the greater community cohesion in the area and presence of the Pioneer Housing Group makes this a realistic neighbourhood for a pilot project. Engagement, decision making and analysis of costs and benefits is supported by access to more data, expertise, knowledge and shared learning than other areas, and there is a higher level of control to realise benefits for residents. Finally, it's location near energy, transport and industrial infrastructure provides greater opportunity in the future for co-investment to scale up retrofit programmes

1.5 Community Capital Framework

In line with the NZN specification we have aimed to take an asset based rather than a deficit-based approach to understand how to harness all available resources to deliver on the dual mission of levelling up our city and region and delivering on net-zero. Figure 9 sets out a community capital framework for understanding the local assets and how these could be leveraged to drive forward a net zero pathway and outcomes wanted by the community.

The requirement to regenerate, repurpose and renew neighbourhoods facing multiple transitions such as post-Covid recovery, net-zero and automation has informed the investment modelling and interventions in and around the net zero neighbourhood. The NZN Plan will incorporate a shared understanding of the community capital available to Castle Vale. Using the community capital framework will help ensure the NZN development is guided or led by the community in its implementation. Given the recent history of Castle Vale and ongoing engagement and discussion in the area there is already a degree of awareness of its community capital to build on.

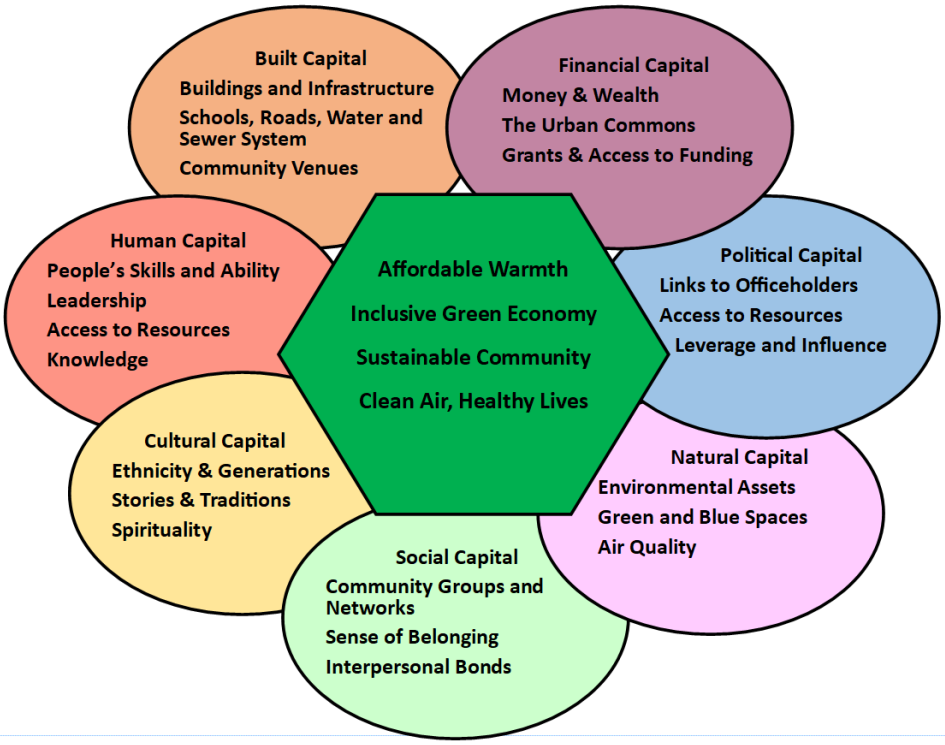

Figure 8: Community Capital Framework

Chapter 2- Understanding the Local Area

2.1 Local Assets

2.1.1 Castle Vale: place and history

Castle Vale is located in in the far east of Birmingham close to the border with Solihull Metropolitan Borough Council and just north of the M6 between Spaghetti Junction and the M42. It forms part of the East Birmingham Northern Industrial Area. Geographically isolated and encompassing some1.5 sq miles, it was built in the 1960s, with the first residents typically relocated there from inner city slum clearance areas such as Aston and Nechells. It comprised 5,000 homes of which 2,000 were high rise flats, making it, at the time, the Midlands' largest tower block estate. It had always intended to be an estate in which all services were locally available following the vision created by Clarence Stein in Radburn, New Jersey in 1929. Although initially seen as a pleasant and welcoming new place to live, the estate deteriorated and by the late 1970s it was already seen as unattractive and undesirable, with high levels of poverty contributing to the psychological as well as physical sense of isolation. The on-going challenges meant that by the 1990s the estate was identified as the location of the first Housing Action Trust in the city.

the Observer 19 November 1995 | 9

KENNETH ROY'S BRITAIN

12. The poor of Castle Vale

Poverty is not dead – it lives in the Vale

DISRAELI'S two nations, 'between whom there is no intercourse and no sympathy', are no longer the rich and the poor, according to modern Conservative thinking. Nowadays we are said to divide more subtly between the independent citizen, who owns property and earns a living, and the dependent sub-class which is either 'trapped in the safety net' or, less charitably, 'sponging off the state'.

This supposed realignment of British society is widely accepted, even by many non-Conservatives. There is a popular belief that poverty — 'real poverty' — has disappeared, any of them will come to a Jaguar or its production line.

'She says — I have Beryl Bainbridge's book open — 'that the police patrol in pairs, and the alsatian dogs run in packs.'

'Artistic licence!' Tess Randles replies bravely. Miss Randles has one of the more unenviable jobs in the Midlands. She is public relations officer for Castle Vale.

A year ago, after the people voted in a referendum to dissolve their disastrous marriage to Birmingham City Council, the estate was acquired by a Housing Action Trust — one of six in various parts of the country — which has set itself begun to question the meaning of the word dependent. It is easier to define poverty. Poverty is unemployment of 26 per cent, and 45 per cent of 16-to 20-year-olds who have never worked. Poverty is no sixth form at the local comprehensive, and 54 per cent who leave without qualifications. Poverty is 57 per cent of households on incomes of less than £99 a week, and 22 per cent whose health is so poor that their homes require physical adaptation. That is poverty. That is real. The rest is merely propaganda.

No place like home: Residents were never prepared for the physical and psychological isolation of Castle Vale estate. Photographs by Andy Hall

Figure 9: Observer article from November 1995

In 1993, following a Housing Action Trust vote with 92% of members in favour, the Castle Vale Housing Action Trust (CVHAT) was established. A 12-year programme of regeneration was initiated which entailed both the housing stock and a wider holistic approach. 2,200 homes were developed, and 1,500 new homes were built with a further 1,333 homes being improved. New community facilities and a shopping centre were provided generating significant training and employment opportunities. Castle Vale was at the forefront of a move in the 1980s towards resident led regeneration and community participation. CVHAT received some £200million from the government sponsored Housing Action Trust during 1993-2005.

The HAT had a board that comprised 12 members, four of whom were residents elected by the local population. Working and subgroups, each with six places reserved for local residents, were established to look at various aspects of the HAT's work. A range of consultation and engagement methods were adopted including public meetings, focus groups, local area groups, a 'newspaper' delivered 8 times a year and a community radio station. In addition, a Tenants and Residents Alliance was established that was an umbrella group of the residents' associations on Castle Vale.

Figure 10- Old Image of Castle Vale

From 1997 onwards Castle Vale Community Housing Association, Castle Vale Neighbourhood Regeneration Board, Castle Vale Residents and Tenants Association and an Endowment Trust Fund were set up as successor organisations to take forward and build upon the legacy of the HAT. In 2003 a ballot was held of HAT tenants to decide whether to return the management and ownership of social housing on Castle Vale to Birmingham City Council or to transfer it the Castle Vale Community Housing Association. 98% of tenants voted to transfer to the Housing Association on an 84% turnout.

This holistic community regeneration programme not only transformed Castle Vale's housing stock but was shown to contribute to life expectancy increasing by five years. There was a change in the perception of the area with Castle Vale being seen as one of the safest and cleanest neighbourhoods in Birmingham. Retail such as the "new" Sainsbury's, led to improved transport networks including a community bus service linking the estate to the airport. The continued success of the automotive sector, in particular JLR, provided the economic and employment base for the area.

2.1.2 Interface with the Net Zero Neighbourhood Demonstrator

Today the Castle Vale legacy organisations sit within the Pioneer Group - a partnership that draws upon the collective regeneration expertise held in the area to work with people,

partners and places to ensure communities can continue to flourish in the everchanging social and economic landscape. Therein lies the key challenge.

Whilst still a relatively stable neighbourhood on a number of indicators, austerity, Brexit, automation in retail and manufacturing, the drive to net zero and changing demographics have combined to place this neighbourhood significantly at risk. If the decades of investment are to be protected and sustainability, lives and livelihoods secured, then a fair but fast transition is required.

Though there is the cushion of historic investment within the community in Caste Vale - the macro and micro changes having an impact here can be found in many outer lying council estates in the city and region, including neighbouring North Solihull. The Castle Vale Net Zero Neighbourhood demonstrator presents an opportunity to create a replicable and scalable whole system approach to delivering housing retrofit that is the catalyst for the wider renewal and regeneration of the area. It will also repurpose a neighbourhood currently at risk of an unfair transition into a 15-20 minute net-zero neighbourhood fit for the 21st century.

Castle Vale is adjacent to the M6, railway and River Tame with surrounding industrial and commercial areas including the Fort Shopping Park, Fort Dunlop, and Minworth Sewage Treatment Works. Though these are all, in different ways, assets for Castle Vale providing employment opportunities, access and local facilities, they also create further challenges for the area. For example, Castle Vale's location near the M6 means it has poor air quality. The project team has explored how these assets could be harnessed to enable diversification of the energy suppply and maximisation of the resources available in the area. The team has also explored the future policies and developments that could help mitigate the detrimental impacts of Castle Vale's location on health and wellbeing.

In Castle Vale there are a variety of land uses in the area besides residential. There is a commercial high street, the offices of CVHA and Pioneer Group, a community campus and library, a trading estate with around 20 units, sporting facilities including a community swimming pool and a football stadium, areas of open green space, allotments, and heavy industry. On the periphery of the estate lie two significant growth points: the Langley Urban extension and Peddimore employment site. The new line and proposed tunnel for HS2 will form an outer boundary to the Castle Vale NZN. These assets, and how they can be harnessed to drive a net zero neighbourhood have been explored by the project team.

Figure 11: Image of Castle Vale

2.1.3 The East Birmingham Inclusive Growth Programme

The East Birmingham Inclusive Growth Strategy, 2020 (available here) sets out a clear vision for East Birmingham and its communities, within the context of major growth and planned infrastructure investment in the East Birmingham and North Solihull corridor over the next 10 years. A core principle of the East Birmingham Inclusive Growth Strategy is its focus on linking expected and planned growth with communities in order to deliver inclusive growth. The Strategy describes the challenges, characteristics, and the opportunity within the growth corridor and explicitly signals the intent to develop east Birmingham as a centre for sustainable and low carbon technologies and a major contribution to achieving a zero-carbon Birmingham.

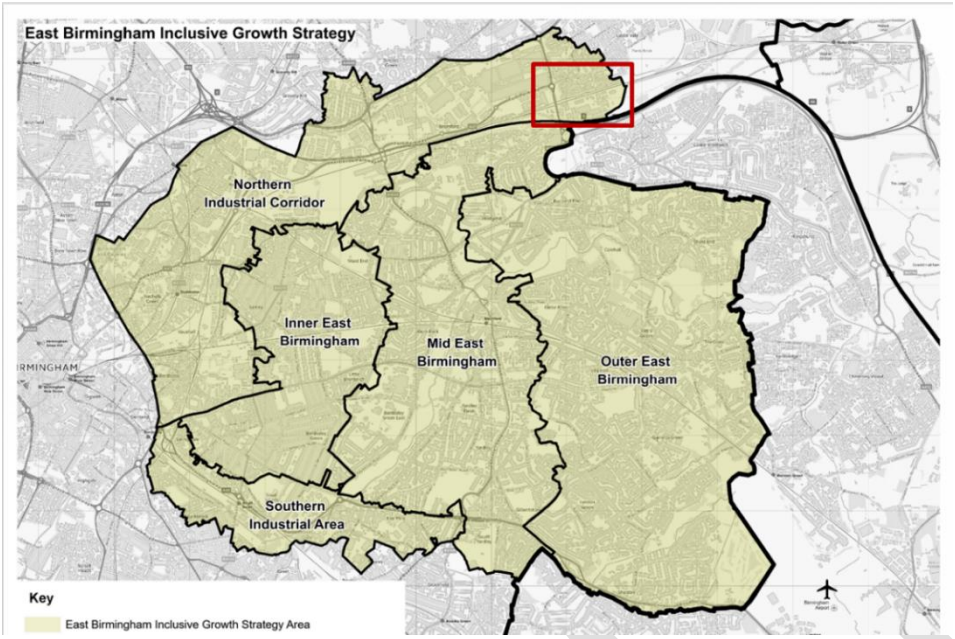

Figure 12: East Birmingham Inclusive Growth Programme area.

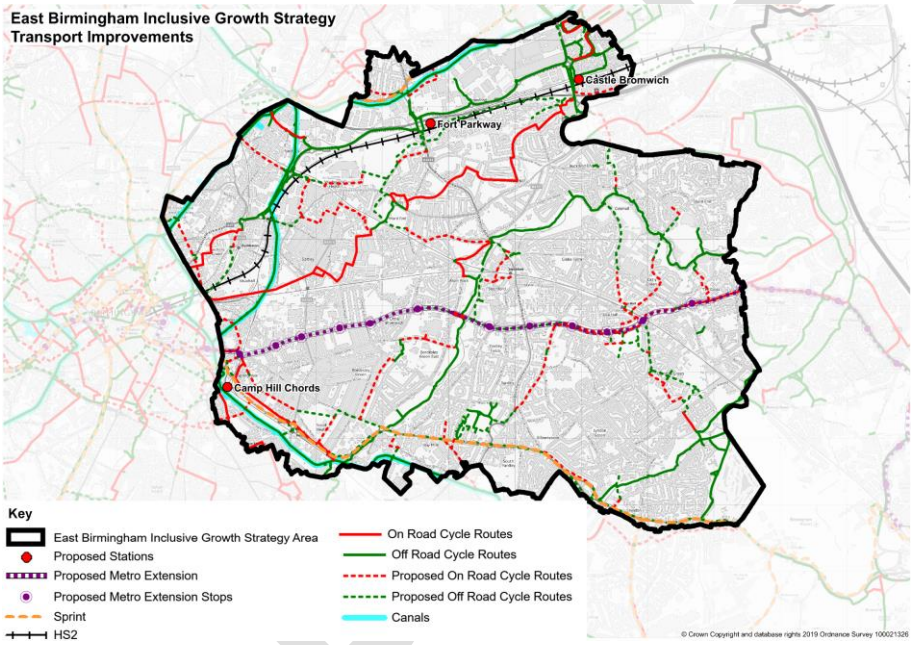

Figure 13: East Birmingham Inclusive Growth Strategy Transport Improvements.

2.1.4 The Demonstrator Net Zero Neighbourhood

The neighbourhood chosen as the initial target for the net zero neighbourhood comprises 383 multi-tenure households located within the wider boundary of the Castle Vale estate of approximately 4,500 households.

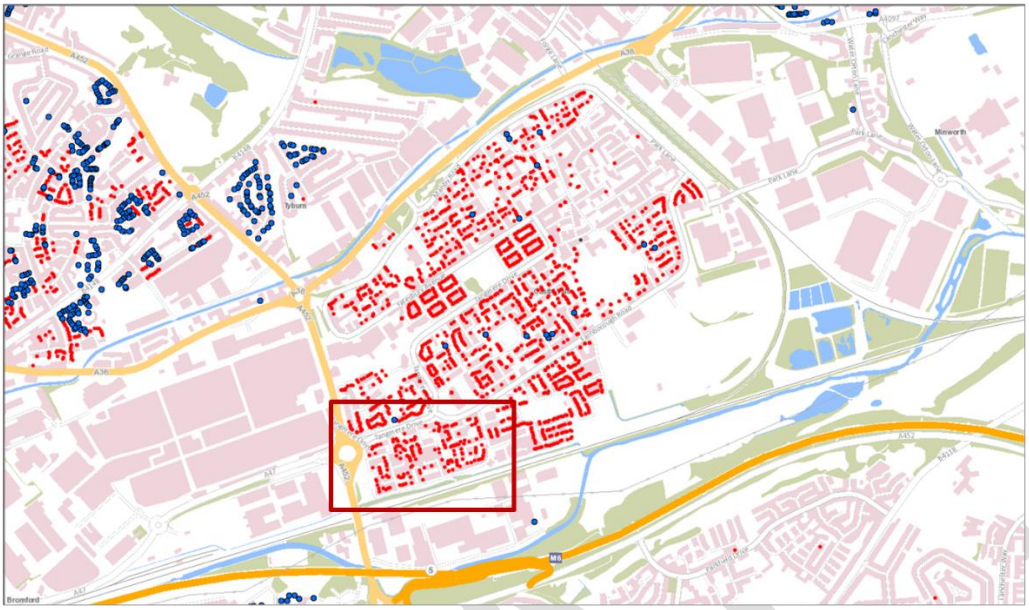

Figure 14: Map showing the NZN location within the Castle Vale Estate

Figure 15: Aerial view of the Castle Vale Estate showing the NZN location.

The NZN forms part of one of eight neighbourhood management patches (see Appendix 1). The residents of Castle Vale still identify strongly with the Vale as a whole, so the smaller area selected is therefore seen as a demonstrator NZN within Castle Vale. The NZN is situated in the southeast corner of the estate, with Tangmere Drive a key location for residents and partners. Engagement with older residents as well as the names adopted by

community services in Castle Vale, emphasises the importance that residents place upon the historical legacy of the place and how it has contributed to community development.

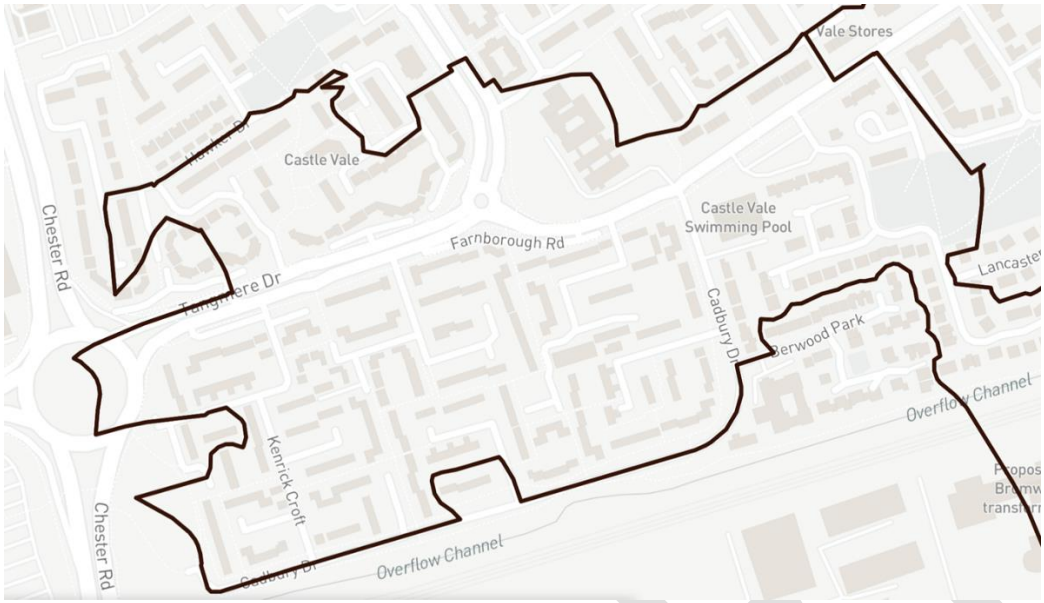

Figure 16: Street View of the Lower Super Output Area which incorporates the proposed NZN Neighbourhood.

The estate is shaped by and built around its early purpose as an aerodrome and the nearby factory at Castle Bromwich where most of Britain's wartime Spitfires were built. The main roads in Castle Vale, including Tangmere Drive notably follow the line of the old runway. Spitfire Island, the wider legacy of the place and how it has contributed to the evolution of Castle Vale is integral to its sense of identity.

Figure 17: Sentinel sculpture

The impact of the car on Birmingham's development both in terms of identity and built form can be immediately evidenced from the vantage point taken by the project team early in the plan's development. The NZN is immediately adjacent to the M6 and the construction site for the HS2 line runs parallel to its boundary at Cadbury Drive. The area sits in the shadow of the iconic Spaghetti Junction and is bounded on three sides by the M6 and two significant arterial dual carriageways (the fourth side of the estate being cut off by a railway line). The Jaguar Land Rover Factory and branding providing a backdrop to a now much neglected cycle route and recreational space at the eastern access point to the neighbourhood. Because of the way Castle Vale has been designed and the self-contained nature of the community, and as engagement has shown, the area offers a well-appointed opportunity to shape a net zero pathway in the city and region.

Figure 18: JLR Image

2.1.5 Housing stock characteristics

Mapping and modelling of the housing stock, energy consumption and tenure in the NZN has been undertaken by Dr Grant Wilson and Dr Joe Day, University of Birmingham as part of the neighbourhood modelling process for the East Birmingham Community Heat Test and Learn project. Energy Performance Certificates data is available from Department for Levelling Up, Housing & Communities database and are linked to Unique Property Reference Numbers. Building archetype data is from a data source obtained by UoB from Verisk. Expected energy consumption data is from NEED – National Energy Efficiency Data framework. The raw data and links to data sources are available in Appendix A.

Building archetypes:

Across the wider Castle Vale Estate there is a mixture of poorly insulated 1960s housing and better insulated housing built after the 1990s. There is also a proportion of new build properties (5%) which tend to be larger than the older housing. In terms of tenure, 50% of

households are social housing, managed by the Pioneer Housing Group, with most of the remaining homes owner occupied and a small number privately rented.

Properties in Castle Vale NZN have been mapped by archetype (Figure 18 below). The archetypes are defined by the following characteristics: **property type** (mid-terrace, end terrace, semi-detached, flat and bungalow), **property age** (1965-82 or post 1999) and **number of bedrooms** (2, 3 or 4). There are ten archetypes in the Castle Vale NZN area. Table 1 shows the number of houses of each archetype in the neighbourhood and that the predominant archetypes in the NZN are end and mid-terrace houses and purpose- built flats constructed between 1965 and 1982.

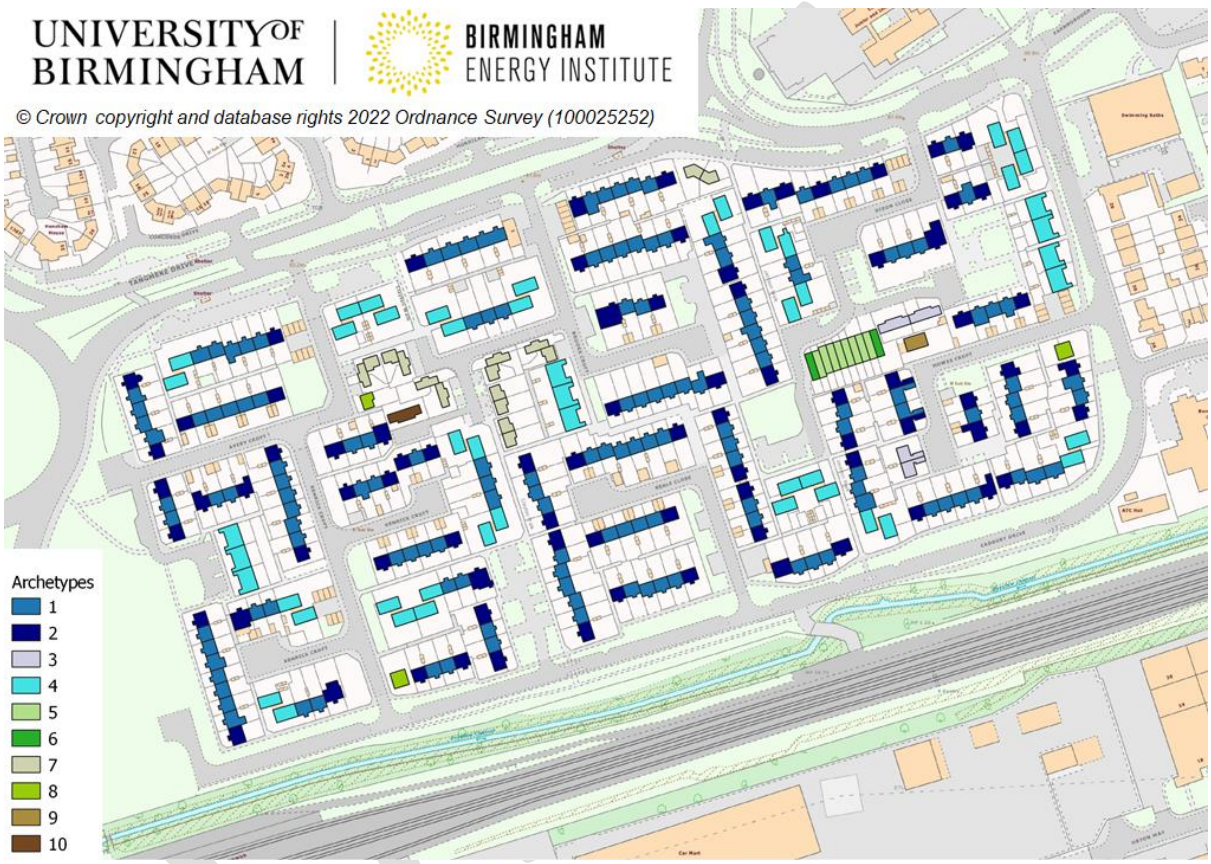

Figure 19: Properties in Castle Vale NZN shown by archetype.

Table 1: Property archetypes in Castle Vale NZN

Archetype	No.	Property type	Property age	No. of bedrooms	Gas	Electricity type	Expected annual gas consumption (kWh)	Expected annual electricity consumption (kWh)
1	151	Mid terrace	1965-82	3	Yes	Standard	10300	3000
2	83	End terrace	1965-82	3	Yes	Standard	11500	3000
3	8	Semi detached	1965-82	3	Yes	Standard	12200	2900
4	106	Purpose built flat	1965-82	2	Yes	Standard	7400	2000
5	8	Mid terrace	Post 1999	3	Yes	Standard	9500	2700
6	2	End terrace	Post 1999	3	Yes	Standard	9600	2700
7	16	Semi detached	Post 1999	3	Yes	Standard	8600	2600

8	3	Detached	Post 1999	4	Yes	Standard	14000	3500
9	1	Bungalow	Post 1999	3	Yes	Standard	12800	2900
10	1	Bungalow	Post 1999	4	Yes	Standard	18400	3800

As noted in the section on neighbourhood modelling, the condition of housing in Castle Vale is above the East Birmingham average in terms of energy efficiency. This is in part due to the high proportion of properties owned by the Pioneer Housing Group and the success of previous programmes to improve insulation in social housing. Figure 19maps the properties in the NZN by their EPC rating and shows that the majority of homes with ratings are rated C. However, there is a high number of homes in the NZN with no EPC (more than 50%). It is reasonable to assume, and our engagement in the area supports this assumption, that the houses without an EPC will on average be of lower energy efficiency rating. They have not been sold or retrofitted in recent years, which would have sparked the need for an EPC, and also suggests they are long-term, possibly older tenants or homeowners, less likely to have made energy efficiency improvements to their homes.

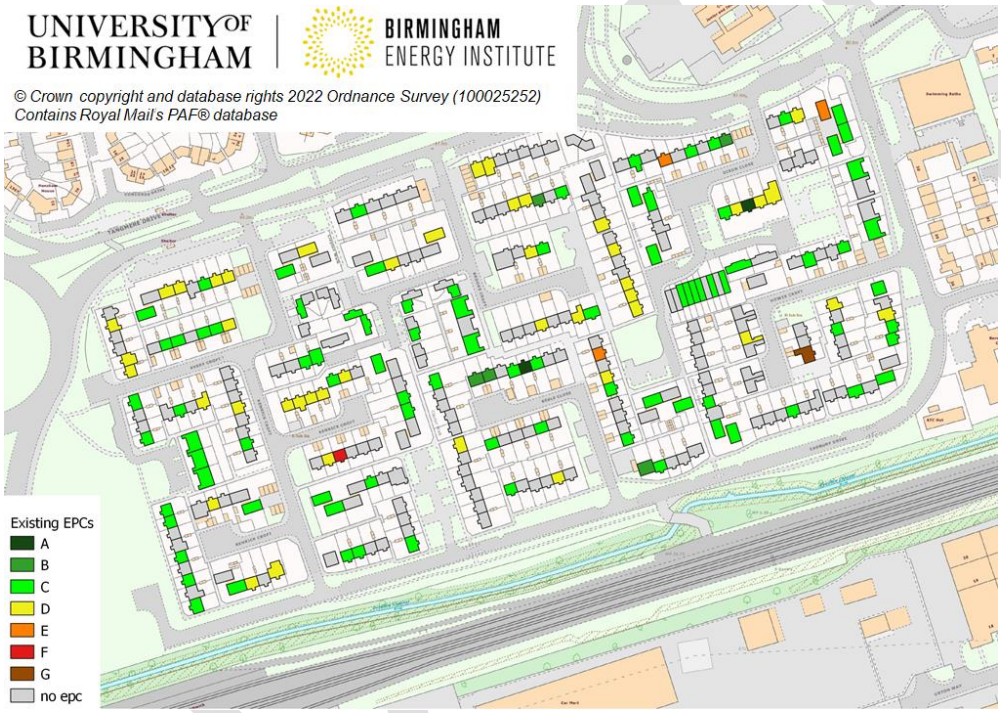

Figure 20: Castle Vale NZN property EPC ratings

Table 2: Number of houses of each EPC rating including no EPC

EPC rating	Number of properties
A	2
B	5
C	118
D	46
E	4
F	1

G	1
No EPC	202

In addition to the overall EPC ratings, figures 20 and 21 show the roof and wall efficiency for the different properties in the NZN. Despite the EPC ratings there are a large number of properties with poor and very poor wall efficiency as can be seen in Figure 20.

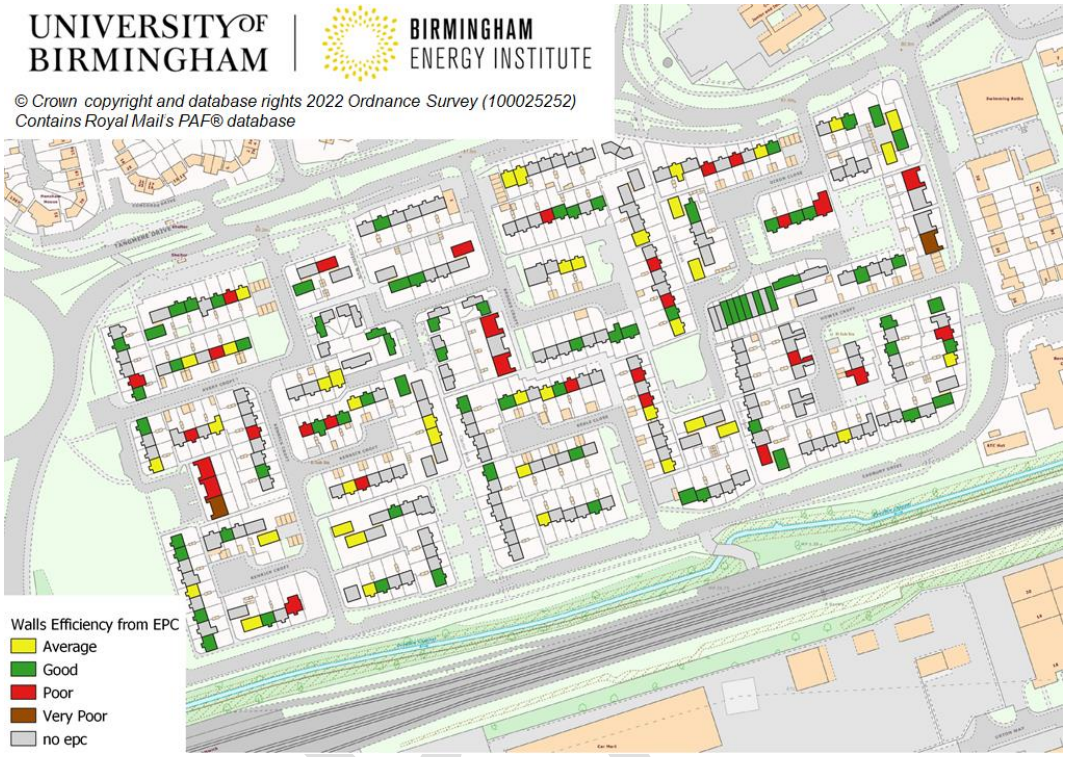

Figure 21: Castle Vale NZN property wall efficiency

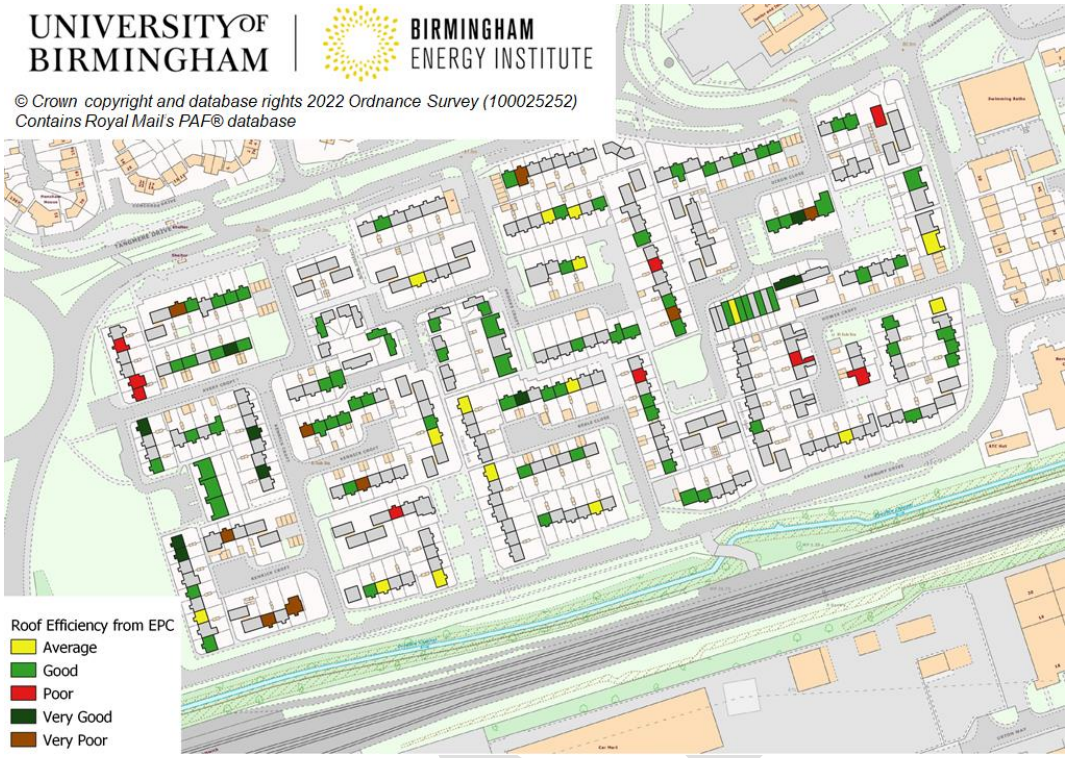

Figure 22: Castle Vale NZN property roof efficiency

2.1.6 Energy consumption profile

Metered gas and electricity consumption data is available at the postcode level from the Department for Business, Energy, and Industrial Strategy (BEIS). The average per meter annual electricity and gas consumption in kWh has been mapped for 28 postcodes in the NZN. See figures 22 and 23. There are some gaps in coverage, where the number of properties providing metered data within a postcode area was too small to include in the data set due to GDPR. For comparison, the median domestic electricity consumption in the UK was 2,902 kWh in 2020 and the median domestic gas consumption was 12,145kWh according to OfGEM. Mean electricity and gas consumption for the West Midlands was 3,780 kWh and 13,894 kWh respectively in 2020, however, the means for domestic consumption are recognised as being positively skewed due to a small number of very high users so the median is a better comparator.

Figures 23 and 24 show postcodes where energy usage is particularly high, on average in comparison to other postcodes in the NZN. For electricity consumption the 2 highest areas coincide with a postcode containing two rows of older (1962-85) terrace housing and another containing purpose-built flats (1962-85). Overall, the mapping suggests a majority of households in the NZN are using more than the national median. However, the data in the NZN could be skewed by a small number of very high users.

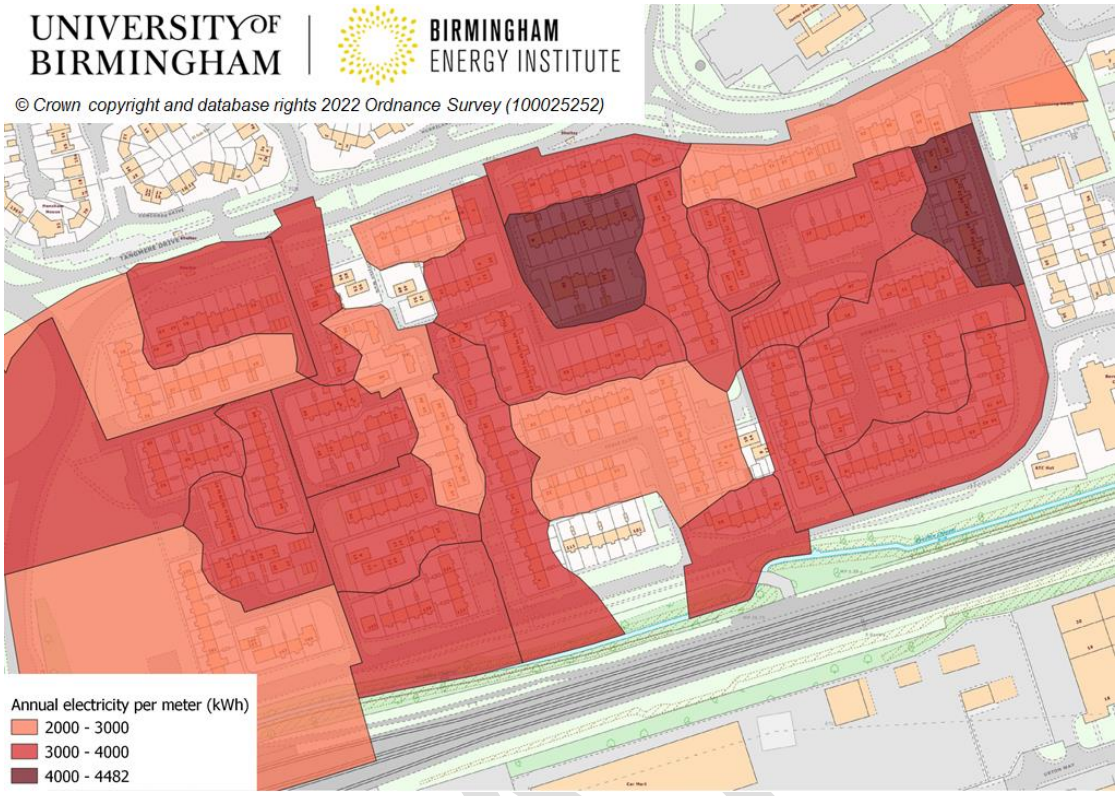

Figure 23: Annual electricity consumption per meter in the Castle Vale NZN by postcode

For gas consumption, the highest consumption area is a different postcode also containing older terrace housing (1962-85). Over the whole NZN area a majority of households appear to be consuming less than the national median for gas consumption. Further engagement with residents would be needed to understand if this is due to the energy performance of the building or because residents cannot afford to use more energy for heating.

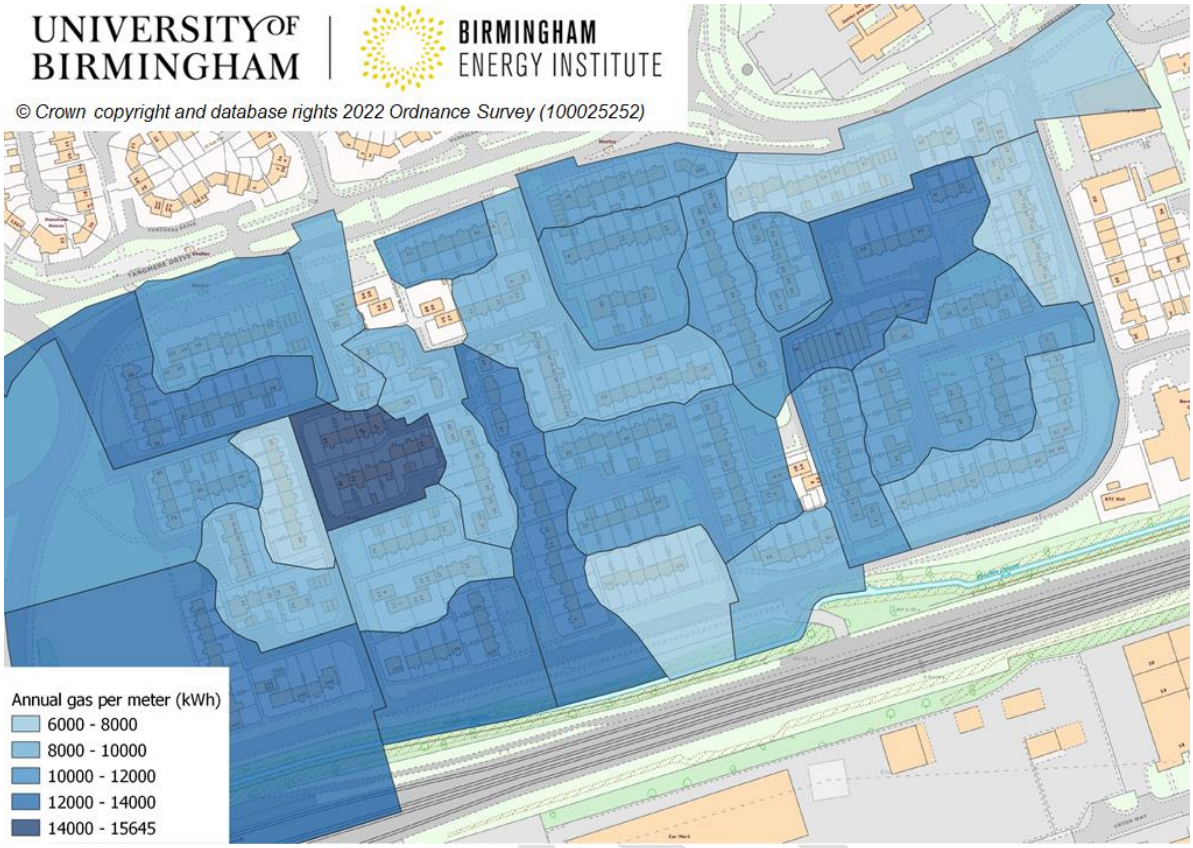

Figure 24: Annual gas consumption per meter in the Castle Vale NZN by postcode

Using other data from BEIS, it is possible to map the expected household electricity and gas consumption for different archetypes. The expected consumption data is based on modelling of energy consumption for different household types and ages. The raw data is available in Appendix?? Reflecting the work done previously by Birmingham Energy Institute, we have compared metered energy use and expected electricity use to identify postcodes where households are using more or less electricity or gas than expected. Figures 25 and 26 show the % difference between metered and expected electricity and gas consumption.

For the majority of postcodes in the NZN, metered electricity consumption in higher than expected consumption. In some postcodes, significantly so, including the areas identified as having relatively higher metered consumption in Figure 24. In comparison the majority of postcodes in the NZN are using less than, or the same amount of gas as expected. Interestingly, the postcode with the highest metered gas consumption is using considerably more gas than expected for the house archetype in that area.

Without knowing about the individual circumstances of the different properties (e.g. number of residents, age, working patterns etc) in the Castle Vale NZN, we cannot fully and accurately interpret the postcode data for electricity and gas consumption. There could be unusually high or low consumption in individual properties that is skewing the postcode mean. We could be unaware of changes in heating systems that would account for higher electricity consumption in some areas. High gas consumption for heating could be due to poorly insulated homes and fuel poverty. However, we can pick out some overall trends for the NZN to underpin our understanding of the housing stock in the area and the development of the retrofit delivery plan. We have also identified areas to explore further through the community engagement programme to better understand residents' energy

using behaviour and inform decision making about the best heating systems and retrofit approach for future stages of scale-up of the initial demonstrator.

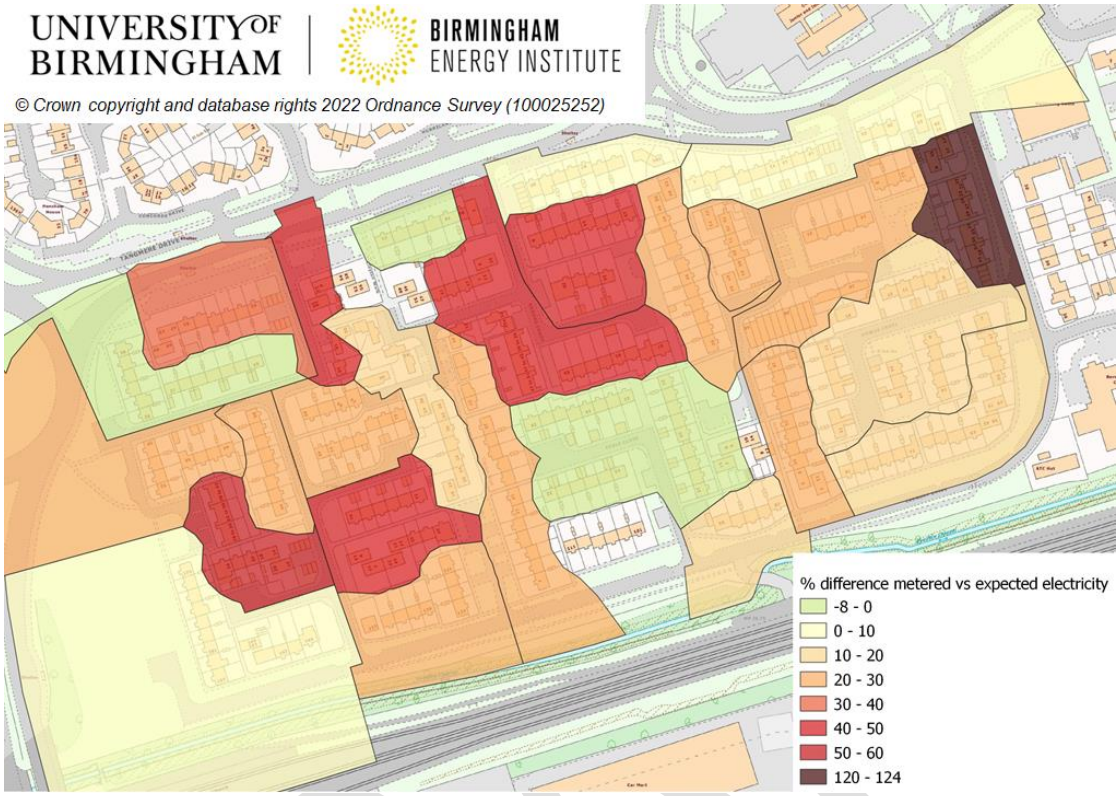

Figure 25: Percentage difference between metered and expected electricity consumption

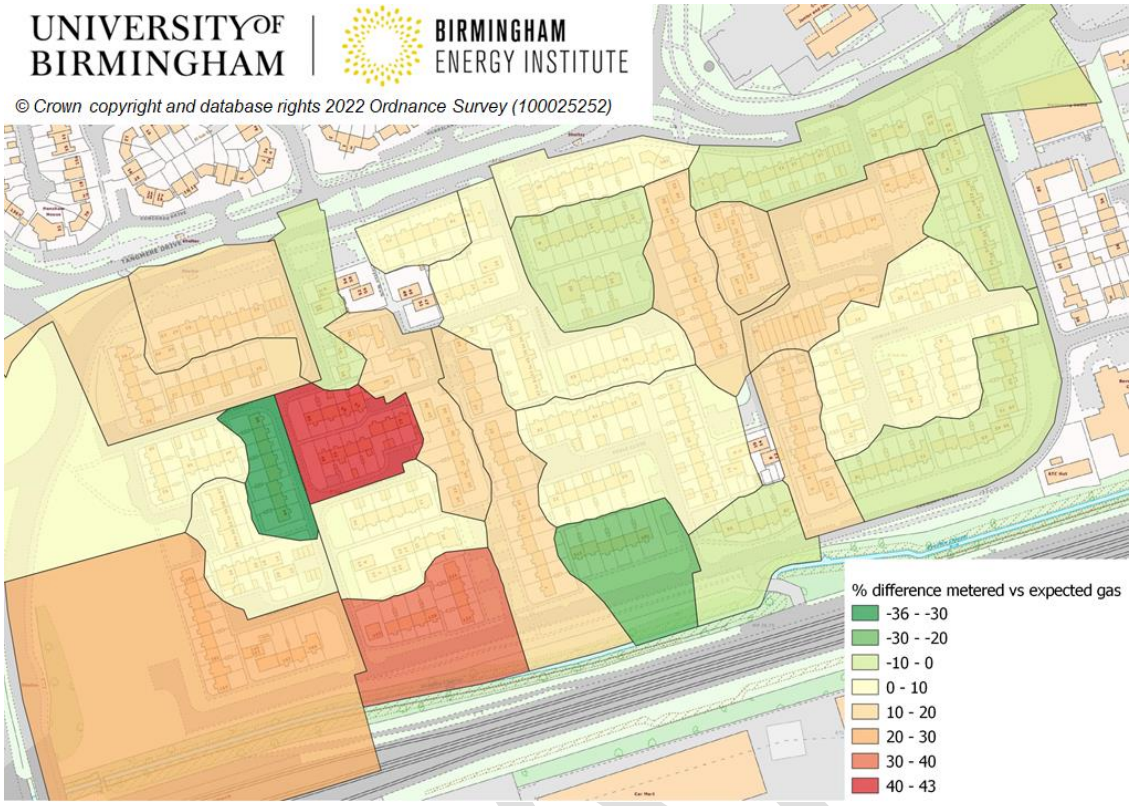

Figure 26: Percentage difference between metered and expected electricity consumption

2.1.7 Current and potential solar PV

Research by the Centre for Sustainable Energy and University of Birmingham has calculated and mapped solar PV potential in Birmingham, and at the household level for the Castle Vale NZN. Currently, only a small number of properties (7 buildings) in the neighbourhood have solar PV installed (see Figure 26). However, the analysis shows the potential for much greater solar PV installation across the NZN. Potential annual PV generation is mapped in Figure 27. The total potential generation for the NZN is 570,000 kWh per year. This is almost 50% of 2019 annual NZN electricity demand (1,180,000 kWh), so the potential is significant.

NB*: For GDPR reasons, the maps and data of solar PV potential and location of panels at the household level* ***cannot*** *be shared or published outside of the NZN submission assessment.*

The evidence of significant solar potential in the Castle Vale NZN, supports making solar PV a key part of the delivery and business plan for the initial demonstrator later scale up in the NZN and wider Castle Vale Estate. The retrofit delivery plan set out in the proposal will include solar and explore the potential financing and community benefit models. The plan also considers the role of solar PV with battery storage at the household and community level.

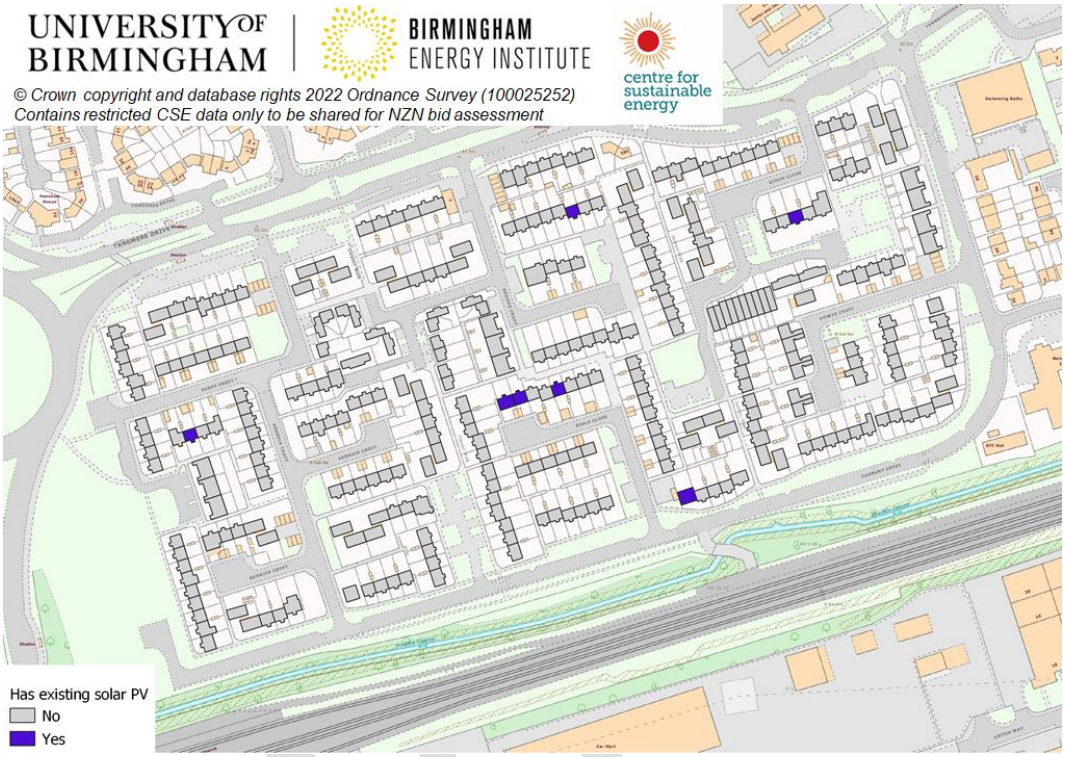

Figure 27: Properties with Solar PV panels in Castle Vale NZN

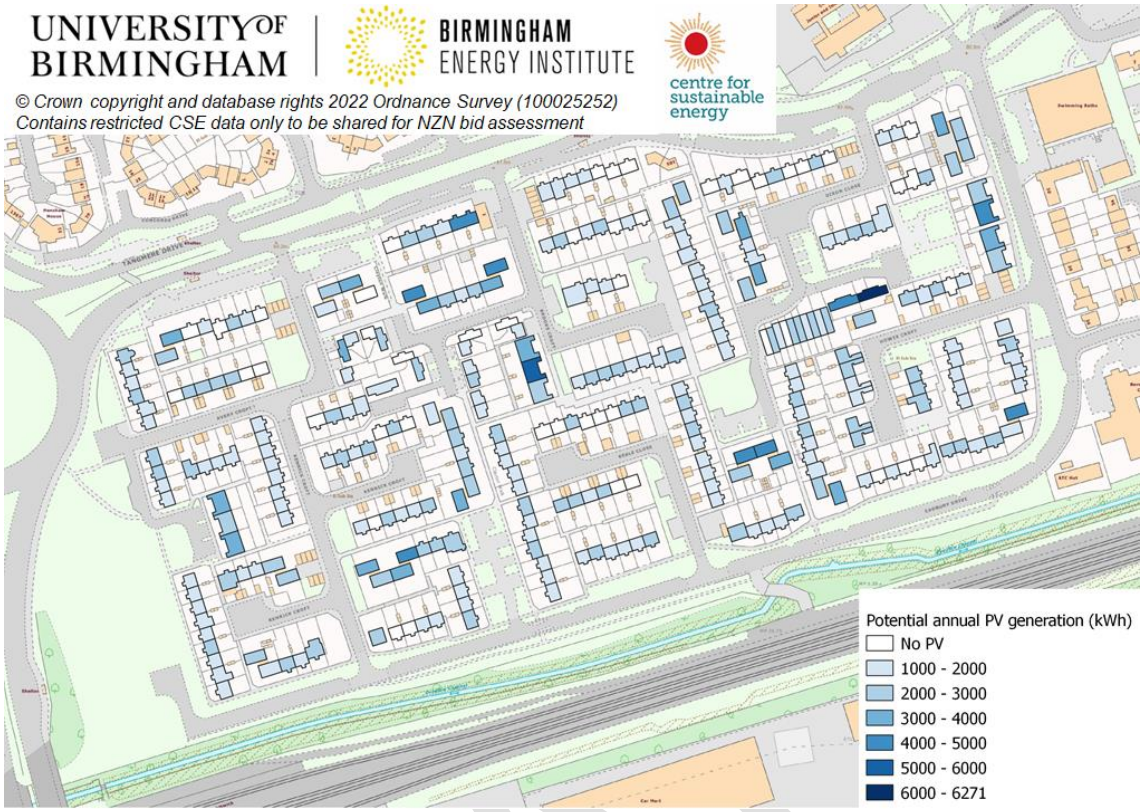

Figure 28: Potential annual PV generation in Castle Vale NZN

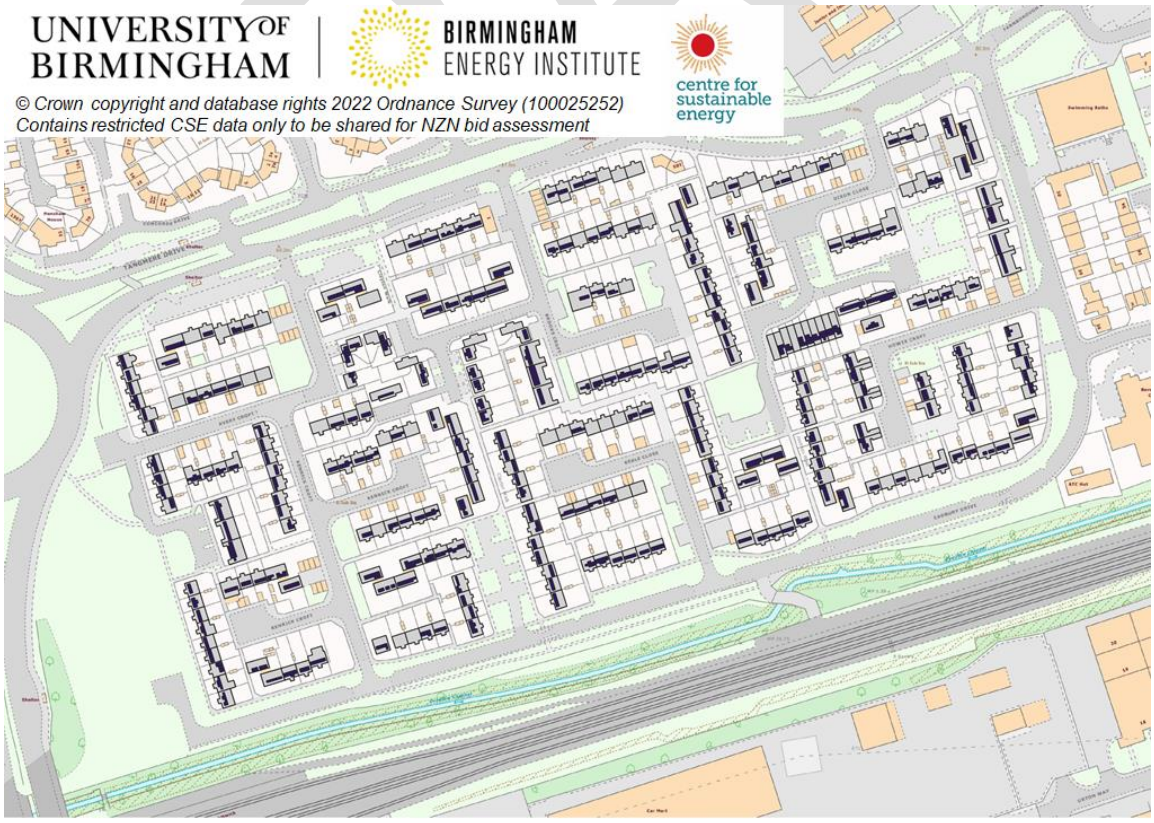

Figure 29: Potential location of solar PV panels on rooves in the NZN.

2.1.8 Housing tenure type and distribution

University of Birmingham have mapped tenure type at the household level across the NZN using data provided by Pioneer Housing Group – see Figure 29 below.

NB*: For GDPR reasons, the maps and data on tenure at the household level* ***cannot*** *be shared or published outside of the NZN submission assessment.*

As with the wider Castle Vale estate, the predominant tenure type in the NZN is Pioneer Housing group owned social housing and owner-occupied properties. However, all tenure types are represented in the Castle Vale NZN. This makes the NZN suitable for identifying different financing models for delivering retrofit to the same archetype and similarly designed properties, with different tenure types. For example. the predominant housing archetype for the NZN is end and mid terrace housing built 1962-1985 (see Figure 18) and Figure 29 shows that this is a mix of is a mix of Pioneer Housing Group and owner-occupied properties, with a small number of private rent.

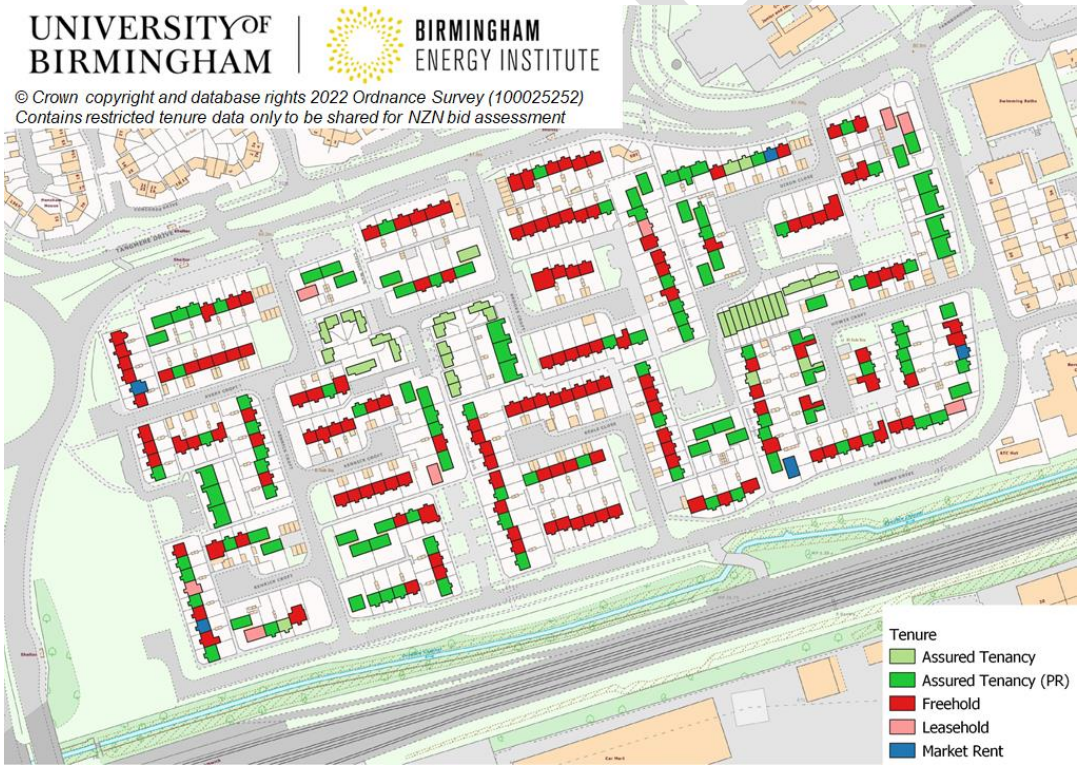

Figure 30: Properties in Castle Vale NZN shown by tenure type

2.1.9 Full retrofit demonstrator

The properties selected for the full retrofit demonstrator described later in this report are shown in Figure 30 below. Block 1 properties are purpose-built flats – Archetype 4 in Table 1- and Block 2 properties are mid and end terrace housing – Archetypes 1 and 2. Our analysis shows that for Block 1 properties there are another 76 properties of the same

building design (not just the same archetype) in the NZN and for Block 2 another 44 properties of the same building design (many more if you don't just include terrace blocks of 4). This means that over a third of properties in the NZN are represented by two property designs meaning the retrofit demonstrator project will be very scalable to the whole NZN, and indeed wider Castle Vale Estate and beyond where there are many of the same archetypes.

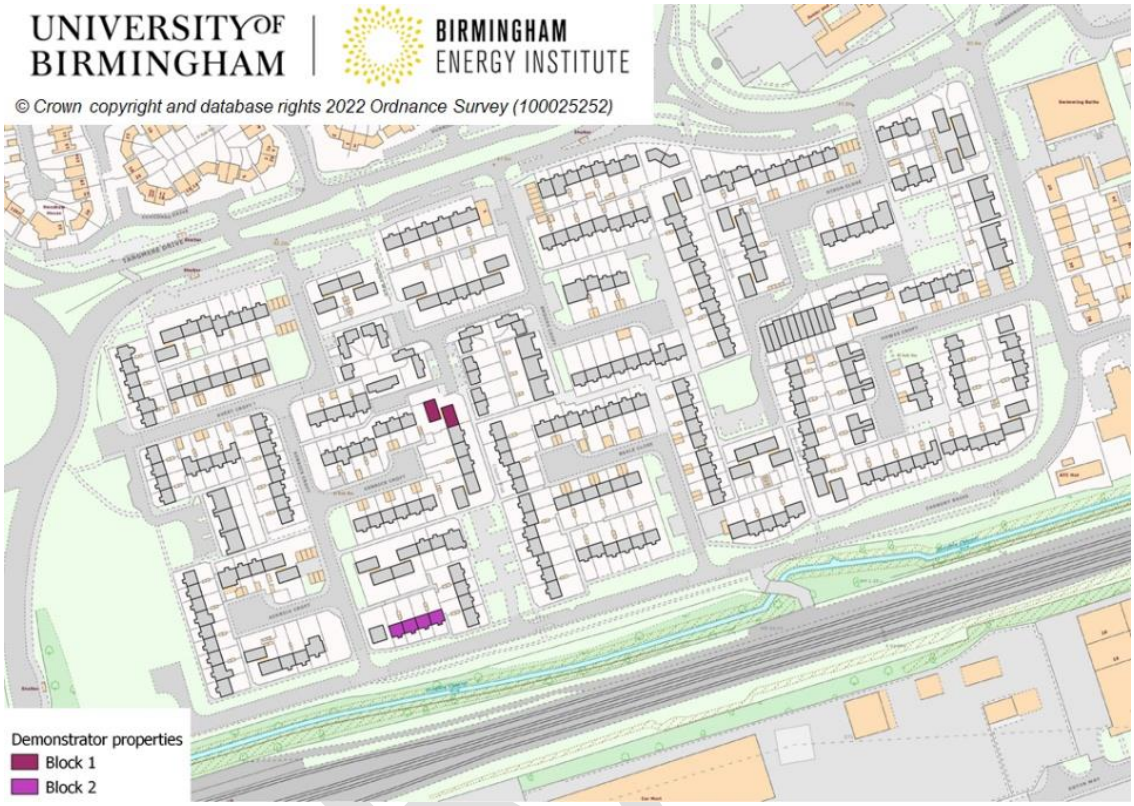

Figure 31: Demonstrator properties in Castel Vale NZN

2.2 Castle Vale – its people

Castle Vale is predominantly a white working-class community with an absence of Asian households which is in sharp contrast to other areas of the City, including adjacent areas. Our engagement in the area shows this is, in part, reflected in Castle Vale residents' perceptions of themselves and contributes to a "them and us" mindset. That mindset is reinforced by the nature of the built environment. In particular, the surrounding road network and the original inward facing Radburn layout of the estate.

Whilst this and the embedded assets in the area can be capitalised upon in terms of potentially securing a 15 minute neighbourhood by design rather than default, connecting it both physically and psychologically to the future trajectory for the city and region is very important. Looking at options for active travel and improved social cohesion will be a key consideration of the NZN demonstrator. Castle Vale is amongst the 10% most deprived wards in England on the Index of Multiple Deprivation, with 1 in 3 children experiencing poverty and with 60% of pupils taking GCES identified as disadvantaged.

Recent rises in energy prices and the cost of living crisis are seen by the local advice agency, Spitfire Services, to have intensified the experience of absolute poverty in the area. Castle Vale is the worst performing ward in the city in terms of educational attainment based upon the Attainment 8 measurement across a range of qualifications. Low skills and low educational attainment are further reflected in the adult population. The population of around 9,000 people is older than the average population in Birmingham, with a significant cohort falling into the 45-59 age bracket.

Transitioning this community and developing an educational and skills pathway that takes the community from the point it is at now, to a point where they will have the capabilities and rise in income profile to meet the challenge of a just and fair transition will be a key part of the longer term NZN programme. One in five residents are over the age of sixty and will have spent most of their working lives on Castle Vale. The need to find a pathway that supports locally arising health and social care needs will be a consideration that we will embrace in looking at the different approaches to take to create an NZN. System drivers such as these can be found on similar large scale council developments within Birmingham, the Black Country and specifically neighbouring north Solihull. This highlights that if we can get the right approach here in Castle Vale, the insight and models developed could be transferable to the wider region.

2.2.1 Demographic data

Socio demographic data for the wider Castle Vale Estate is available at Lower Super Output Area (LSOA) level and is taken from the 2011 census. (Note: the 2021 Census data is due to be released imminently and we will update our data once this is available). Table 3 below show the age and ethnicity of Castle Vale residents and demonstrates that a higher proportion of Castle Vale residents are White British and over the age of 45 than Birmingham as a whole (83% versus 53.1% and 39.6% versus 33.6% respectively).

Table 4 shows education, employment and health data for Castle Vale. A higher proportion of Castle Vale residents are limited a little or a lot by poor health. A higher proportion of residents have no qualifications compared to Birmingham as whole (32.4% versus 20.8) and fewer people are employed in professional occupations (6.8 % versus 18.3%). This is in agreement with the identification of Castle Vale as an area that is deprived in the domains of

health and education, employment and income in the neighbourhood modelling conducted by Birmingham Energy Institute.

Table 3: Basic demographic data for Castle Vale (2011 Census)

		Castle Vale	Castle Vale %	Birmingham %
Population	All Residents	9,971		
	16-64	5,964	59.8%	64.3%
	Under 18	2,621	26.3%	25.5%
	18-24	908	9.1%	12.1%
	25-44	2,496	25.0%	28.7%
	45-64	2,215	22.2%	20.7%
	65+	1,731	17.4%	12.9%
Ethnicity	British	8,280	83.0%	53.1%
	Irish	209	2.1%	2.1%
	Other White	101	1.0%	2.7%
	Mixed or Multiple Ethnicity	599	6.0%	4.4%
	Indian	46	0.5%	6.0%
	Pakistani	40	0.4%	13.5%
	Bangladeshi	40	0.4%	3.0%
	Chinese	24	0.2%	1.2%
	Other Asian	28	0.3%	2.9%
	Black African	120	1.2%	2.8%
	Black Caribbean	356	3.6%	4.4%
	Black other	103	1.0%	1.7%
	Other Ethnic Groups	54	0.5%	2.0%

Table 4: Economic activity, occupation and health limitations data for Castle Vale (2011 Census)

		Castle Vale	Castle Vale %	Birmingham %
Economic Activity	16-64 population	5,964		
	Employed	3,548	59.5%	60.0%
	Unemployed	626	10.5%	93.0%
	Economically inactive	1,790	30.0%	30.7%
	Managers, directors and senior officials	212	5.9%	8.3%
	Professional occupations	247	6.8%	18.3%
	Associate professional and technical occupations	264	7.3%	11.0%
	Administrative and secretarial occupations	422	11.7%	11.7%
	Skilled trades occupations	398	11.0%	9.8%

	Caring, leisure and other service occupations	459	12.7%	10.1%
	Sales and customer service occupations	423	11.7%	9.0%
	Process plant and machine operatives	468	12.9%	8.5%
	Elementary occupations	729	20.1%	13.2%
Qualification Levels	No Qualifications	1,934	32.4%	20.8%
	Level 1	1,161	19.5%	15.0%
	Level 2	1,199	20.1%	15.5%
	Level 3	127	2.1%	1.9%
	Level 4	683	11.5%	15.0%
	Apprenticeship	630	10.6%	25.2%
	Other Qualifications	230	3.9%	6.6%
Health Problems or disability (16-64)	Limited a lot	683	11.5%	6.8%
	Limited a little	648	10.9%	8.1%
	Not Limited	4,633	77.7%	85.1%
Employment Type (16-64)	Part-time	2,684	45.0%	32.4%
	Full-time	3,877	65.0%	67.6%
Industry (16-64)	Agriculture, forestry or fishing industries	0	0.0%	0.1%
	Mining, quarrying or construction industries	394	6.6%	6.0%
	Transport or storage industries	916	15.4%	9.3%
	Energy, water or air conditioning supply industries	85	1.4%	1.1%
	Wholesale and retail trade; repair of motor vehicles and motorcycle vehicles	1,214	20.4%	16.0%
	Transport or service industries	298	5.0%	6.0%
	Accommodation or food service activities industries	309	5.2%	6.6%
	Information and communication or professional, scientific and technical activities industries	245	4.1%	8.2%
	Financial, insurance or real estate industries`	256	4.3%	5.3%
	Administrative or support service activities industries	362	6.1%	5.5%
	Public administration or defence; compulsory or social security industries	288	4.8%	4.7%
	Education sector	394	6.6%	11.9%
	Human health and social work activities industries	905	15.2%	14.8%

2.2.2 East Birmingham and Castle Vale Mosaic Public Segment Profiles

Experian's Mosaic Public Sector citizen classifications data has been used to help us understand further the spatial demographic profile for East Birmingham, economic features and overall behaviours of Castle Vale with specific reference to the Lower Super Output Area (Birmingham 029E) that covers the NZN demonstrator area. This insight has informed the housing retrofit option and business models considered and the design of the community engagement plan.

For Castle Vale households fall principally into the "Family Basics" category defined as families with limited resources who have to budget to make ends meet and "Vintage Value" category defined as elderly people reliant on support to meet financial or practical needs. This is in marked contrast to other parts of East Birmingham where the Urban Cohesion Category predominates defined as residents of settled urban communities with a strong sense of identity.

Figures 32-33 show the clustering of three mosaic categories across East Birmingham: Family Basics, Vintage Value and Urban Cohesion and how Castle Vale is a hot spot for Family Basics and Vintage Value categories in comparison to the rest of East Birmingham.

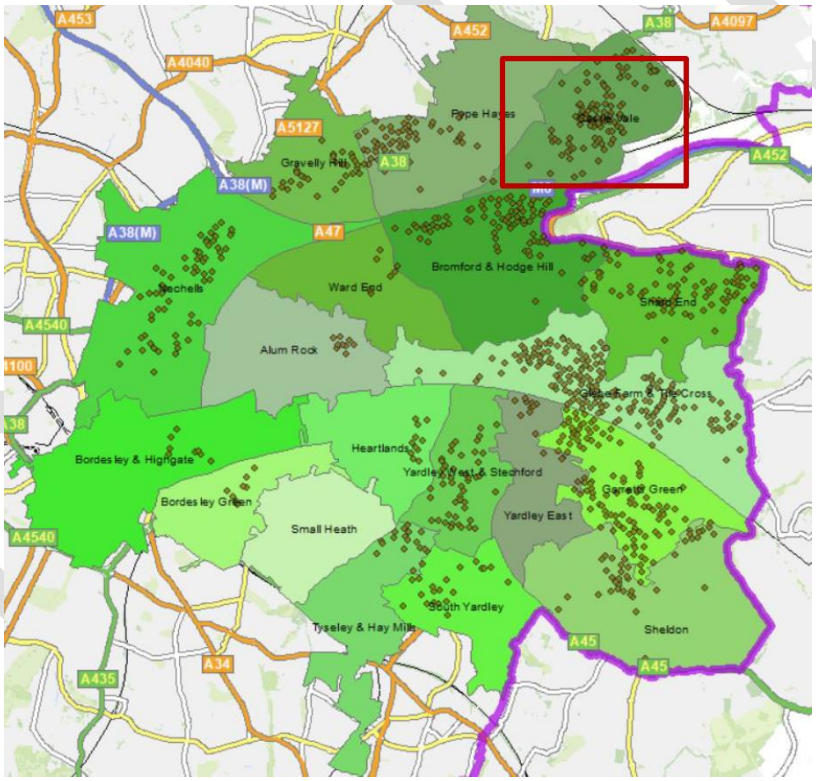

Fig 32: East Birmingham Mosaic Category "Family Basics

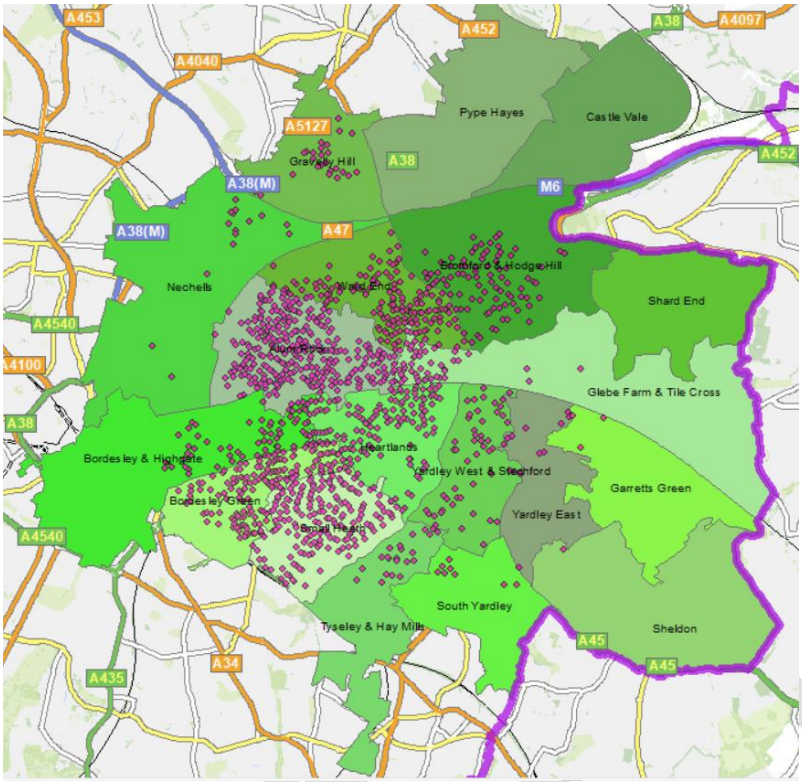

Figure 33: East Birmingham mosaic category Urban Cohesion

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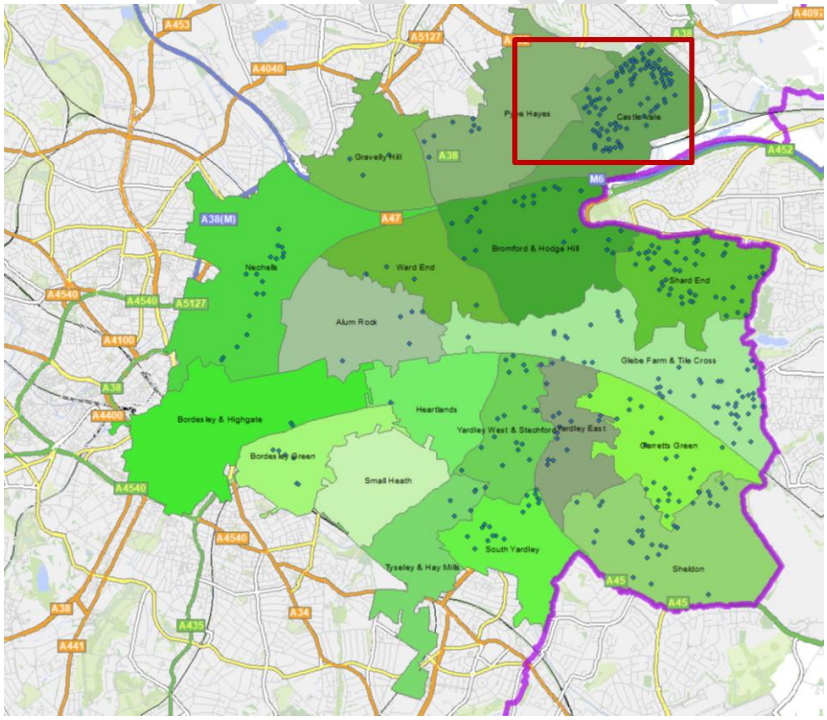


Figure 34: Castle Vale LSOAs used for Mosaic profiling.

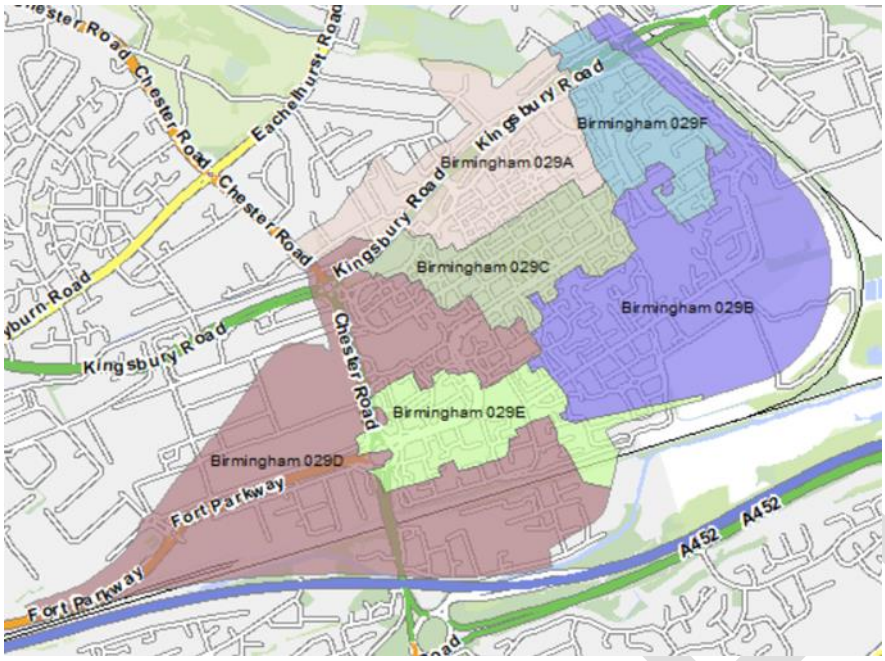


Figure 35: Five LSOAs that cover the Castle Vale estate.

Table 5 below shows the Mosaic profiling results for the different LSOAs.

Table 5: Mosaic Classifications for Castle Vale LSOAs Birmingham 029A-E

LSOA- Birmingham 029A		**LSOA- Birmingham 029B**	
N Vintage Value	44%	**M Family Basics**	60%
O Municipal Tenants	34%	**N Vintage Value**	26%
M Family Basics	12%	**O Municipal Tenants**	11%
L Transient Renters	8%	2.2% Unclassified	

LSOA- Birmingham 029C		**LSOA- Birmingham 029D**	
M Family Basics	43%	**M Family Basics**	40.85%
O Municipal Tenants	31%	**N Vintage Value**	23.94%
N Vintage Value	14%	**O Municipal Tenants**	7.04%
L Transient Renters	11%	N/A 16% & Unclassified 13%	

LSOA- Birmingham 029E		**LSOA- Birmingham 029F**	
N Vintage Value	38.10%	**N Vintage Value**	61.90%
M Family Basics	30.95%	**M Family Basics**	23.81%
O Municipal Tenants	28.57%	**K Modest Traditions**	9.52%
Unclassified 2.4%		**O Municipal Tenants**	4.76%

2.2.3 Vintage Value: Estate Veterans

LSOA 029E has been used as a proxy for the NZN demonstrator and further analysis. When looking at Vintage Value, ***Estate veterans*** were the dominant type. They can be described as elderly, long-standing social renters of council homes who are likely to have lived in council accommodation almost all their lives. Living in typical social housing rather than accommodation designed for the elderly, they have seen their neighbourhoods change over the many years they have been there.

Estate Veterans contains older people, whose average age is 75, many of whom have been council tenants all their lives and still live in the homes where they brought up their children. They have the second longest length of residency of any type and on average Estate Veterans have been at their present address for almost 25 years. These homes are two or three bedroom semi-detached or terraced properties with gardens.

They are often living alone on larger estates with some challenges. Their local communities contain people with a mix of ages and while many of their neighbours have purchased their council homes, Estate Veterans have not been able or inclined to become homeowners themselves, and instead remain long-term social renters.

These days they get by on a state pension supplemented by other statutory entitlements. They are careful with money, buying supermarket own brands and saving up for items when necessary.

Estate Veterans have largely been left behind by technology and can feel confused by computers. Apart from mobiles, ownership of technological items is low. They prefer to arrange insurance over the phone and like to be able to do one thing at a time.

Health levels amongst this type are moderate, and although naturally declining they are better than some others in the Vintage Value category. Although far fewer than average drink regularly, they are more likely to smoke. Their eating habits are fairly typical, particularly in terms of eating enough fruit and vegetables.

Crime is generally just a little above average on the estates where these older people live. They are the most likely type in this group, and more than twice as likely as the national average, to think that anti-social behaviour has increased a lot and is a major problem. In particular, they are concerned about drug use and drug dealing. Their fear of crime is greater than the crime rate might suggest, and they are more likely than average, and the most likely within Vintage Value, to worry about being a victim of crime.

Estate Veterans require higher levels of state assistance than average across a range of benefits. Their adoption of green practices and their level of understanding of green issues are both lower than amongst people in general.

Estate veterans:

- More likely than average to take their own bag shopping
- More likely to re-use items like empty bottles, jars or envelopes
- Make an effort to cut down on home energy use as well home water use
- Knowledge of climate change/global warming
- Worry online personal information not safe

2.2.4 Family Basics: Families on a Budget

When looking at Family Basics, ***families on a budget*** were the dominant type these can be described as parents with children who live in low value council homes on municipal estates on the edge of large towns and cities. High unemployment and low wages make these some of the most deprived areas in the country and result in many families needing support.

Families on a Budget are typically headed by adults aged between 26 and 45 with many households having several children, often of primary school age or under. Parents are often cohabiting and a fifth of homes are headed by lone parents.

These homes are small, socially rented terraces and semis located on large, peripheral council estates. With car ownership low, there is a reliance on buses to reach shops, colleges or workplaces.

On average people tend to have lived at their address for at least seven years, and when families do move it is often within the local community.

With education often completed at GCSE level, gaining skills and experience to compete successfully in the jobs market can be a challenge. As a result, these areas have some of the highest numbers of children living in homes with no adult in employment. Those in work often have semi-routine or routine occupations or have trained in a skilled trade. People tend to rely on mobiles for communication rather than landlines and they send many texts.

Given the high levels of unemployment and low incomes within this type, Families on a Budget require support with a range of benefits and are the most likely to experience debt issues. They are amongst the most likely of all types to depend on a number of benefits, but in particular have the highest levels of dependency on Income Support and Tax Credits.

Considering that these are fairly young families, health is poor. They are around 50 per cent more likely to be in bad or very bad health than people in general. Adults are twice as likely to smoke and are two and a half times more likely to be heavy smokers. However, they do not drink nearly as frequently as other types – most commonly less than once a month. Significantly fewer people than average follow healthy eating guidelines or do a lot to keep in shape.

Crime levels vary depending on the offence – although they are not as high as in some other areas. Incidences of criminal damage, public disorder and anti-social behaviour are all above average, while robbery is less common. These families are amongst the most likely to say that crime is a very big problem in their area. They are also most likely to feel that rubbish and littering is a major issue, and also perceive far more problems than average with drug dealing and noisy neighbours. They are 50 per cent more likely to fear being a victim of crime, but this fear is not as high as with many other types. There is a relatively low awareness of and concern for environmental issues amongst Families on a Budget.

Families on a budget:

- More likely than average to consider solar panels
- More likely to use a re-usable cup
- More likely to re-use items like empty bottles, jars or envelopes
- Leave the heating on when out for a few hours
- Keep the tap running when brushing teeth

2.2.5 Municipal tenants

The third common group are ***Municipal Tenants*** these are long-term social renters living in low-value multi-storey flats in urban locations, or small terraces on outlying estates. These are challenged neighbourhoods with limited employment options and correspondingly low household incomes.

People in Municipal Tenants are typically of working age. There are some families with children, but most are singles.

Many have been renting their flats for a number of years. These are often multi-storey or high-rise blocks built from the 1960s onwards. Those in houses on estates have been settled there for a long time.

These neighbourhoods suffer from high levels of unemployment, and incomes can be particularly low. Those in work tend to be in manual or low level service jobs. People are the most likely to be finding it difficult to cope on their incomes and they often receive benefits.

Municipal Tenants contains the highest proportion of people without a current account. They have a low take up of financial products but may use short term finance occasionally. Given their income and urban location, car ownership is very low.

Generally, ownership of technology is not high, but mobile phones are important and are the preferred means of contact. On average they spend more time watching television than they do on the internet and they prefer making purchases in local shops than buying online.

Living in areas of high levels of unemployment and with low incomes, Municipal Tenants need a high degree of financial assistance from the state. They are the most likely group to access Job Seeker's Allowance, Income Support and benefits related to disability and incapacity.

Some have health issues, and levels of poor health are only higher among the very elderly. Significantly more people than average smoke and Municipal Tenants are the most likely – over two and a half times as likely in fact – to be heavy smokers. While they drink less than average, they also have amongst the lowest levels of exercise and fewer than average follow a healthy diet.

They live in areas where the level of crime is high, although not always the very highest. Common crimes are across the board, from public disorder through to robbery and violent crime. Municipal Tenants are the most likely to think crime and anti-social behaviour has increased a lot and is a big problem in their neighbourhood. They are also the most likely to be worried about being a victim of crime. The environment and trying to be green is not really a concern for this group.

Municipal Tenants:

- More likely to keep the tap running when brushing teeth
- Make effort to cut down on home energy use and home water use

2.3 Energy Infrastructure

2.3.1 Energy infrastructure and low-carbon energy opportunities

Through the East Birmingham Community Heat Taskforce and development of the Community Heat Evaluation Tool, the project team have developed a process to understand the types of low carbon heating solution which may be deployed in different locations. Castle Vale was the first focus for this work, however, the overarching aim is to establish a deep understanding of the whole of the East Birmingham housing stock and to guide the development of low carbon heating plans. These will encompass the developments being considered for the Birmingham district heating scheme in the city centre, BDEC, through to the energy assets which are located at Tyseley and the plans to establish a Clean Energy Quarter in the Tyseley Environmental Enterprise District, as set out in the recent Master Plan created by Jacobs, commissioned by Birmingham City Council.

For the Castle Vale estate and surrounding areas there are a series of options which could deliver low carbon heating. These range from individual heat pumps to community scale heat pump solutions, facilitated by the ownership of ~50% of the housing stock by the Pioneer Group, through to exploitation of local waste heat sources, through a combination of heat pump and district heating type approaches exploiting waste heat sources nearby. As part of the Net Zero Neighbourhood programme a detailed plan for delivering a net zero heating solution would be established.

Over the last 5 years, the Pioneer Group has installed new gas boilers across its homes, which means that there is time to develop a considered investment programme which fully recognises the local assets.

Figure 36: Aerial view of the Castle Vale Estate showing location of Severn Trent Minworth

Adjacent to the Castle Vale estate lies the Severn Trent Minworth site. The Minworth plant currently treats the waste from the equivalent of 1.7 million people, which includes domestic

and industrial discharges. In addition, sewage sludge from smaller works is tankered to the site for treatment. Biogas from the sludge treatment process is used to produce electricity for their own use and for resale. Minworth can produce up to 22MWh/d of electricity from this renewable resource using 7 CHP engines. Low grade waste heat from the sewage works could also be exploited.

The heat which could be recovered from the Minworth site has been evaluated by Severn Trent, which by about a factor of three is larger in potential than any other Severn Trent sites. The treatment works produces an outflow of water which is over 5,000 litres/second with a temperature of 8 degrees centigrade even in January, and with a heat pump system could deliver, in principle, 96.5 MW thermal. If exploited, this would equate to a carbon saving of 57 KT. The Castle Vale site lies ~2 km from the Minworth plant and hence the potential heat network costs and heat losses would not be prohibitive. It is estimated that the heat which is available could be sufficient for in excess of 25,000 homes depending on their energy efficiency.

A workshop has been held with Pioneer Group, Severn Trent and the three energy companies EQUANS, Vital Energi and E.ON to explore the potential of the scheme and to begin to understand the barriers to delivery. No fundamental barriers to developing such a scheme and the aim would be to pursue the potential for the development through the Innovate UK Strategic Innovation Fund, SIF[1].

The number of homes the Minworth site could support is considerably in excess of the 5,000 homes of the Castle Vale estate but being closest would be considered if such a scheme proved to be cost competitive with more local ground source, or air source, heat pump solutions. The opportunity to link growth sites adjacent to Castle Vale such as the Langley Urban extension and Peddimore will be considered alongside the potential extension and decarbonisation of the existing BDEC network. The Net Zero Neighbourhood programme would thus catalyse the decarbonisation of not only the 300 homes identified within Castle Vale, but upwards of 25,000 homes in East Birmingham.

The focus of a SIF programme, which builds from initial funding to perform a technoeconomic evaluation to larger scale funding for delivery, would be to establish a series of options which focus on the part of East Birmingham adjacent to Minworth. The aim would be to understand

- Costs and benefits of a wastewater heat pump solution compared with community or individual heat pumps.
- Timescale for delivery of individual, community and district scale heating solutions
- Optimum scale for a district wide heating solution in North-East Birmingham.

This work would be led through a partnership of Birmingham City Council, Severn Trent, Pioneer Group, the above energy companies (plus others interested being involved), members of this consortium and the University of Birmingham.

[1] Httpnetwork –://www.ofgem.gov.uk/energy-policy-and-regulation/policy-and-regulatory-programmes/network-price-controls-2021-2028-riio-2/network-price-controls-2021-2028-riio-2-riio-2-network-innovation-funding/strategic-innovation-fund-sif#:~:text=The%20SIF%20is%20delivered%20in,scale%20in%20the%20energy%20market.

2.3.2 National Centre for Decarbonisation of Heat

The development of the NCDH programme is being led by the University of Birmingham and the Energy Systems Catapult, together with the Manufacturing Technology Centre, energy companies, boiler and heat pump manufacturers, green finance organisations, BCC and WMCA. It has the support of the CBI and also the Heat and Buildings team in BEIS. The development would be linked to the South and City College in Bordesley Green and associated apprenticeships programmes.

The aim of the NCDH is to create a space which is *the* place nationally for the sector to coalesce in order to drive the urgently required energy transition, with solutions being delivered across the city. The NCDH would be built at Tyseley Energy Park adjacent to the Birmingham Energy Innovation Centre but would have a route back to Castle Vale with the NZN Demonstrator providing a “live learnt experience”. The NCDH building will contain two mock houses and facilities which allow engineers to be trained on heat pump and district heating systems in a variety of training stations. The mock houses will reflect the housing typology that is associated with some 6-8 million homes nationally and will showcase existing housing designs together with the transition after retrofit. The two set-ups will allow communities to understand what is involved and how the new heating systems work. There will also be exhibition and community space (amongst other uses).

The NCDH will also have the capacity to build and test different housing archetypes and trial different deployment solutions before they are implemented in homes, to ensure they are optimised, lowest cost and most rapidly delivered. The NCDH is integral to the partners’ plans for the scaling up of housing retrofit in the region. In its function, this will be a unique national capability.

2.4 Transport Infrastructure

Figure 37 below shows the electricity and public transport infrastructure in the Castle Vale NZN. The neighbourhood doesn’t have a play area in the middle of it unlike neighbouring estates. Most services and facilities such as shops, health centres and schools are within

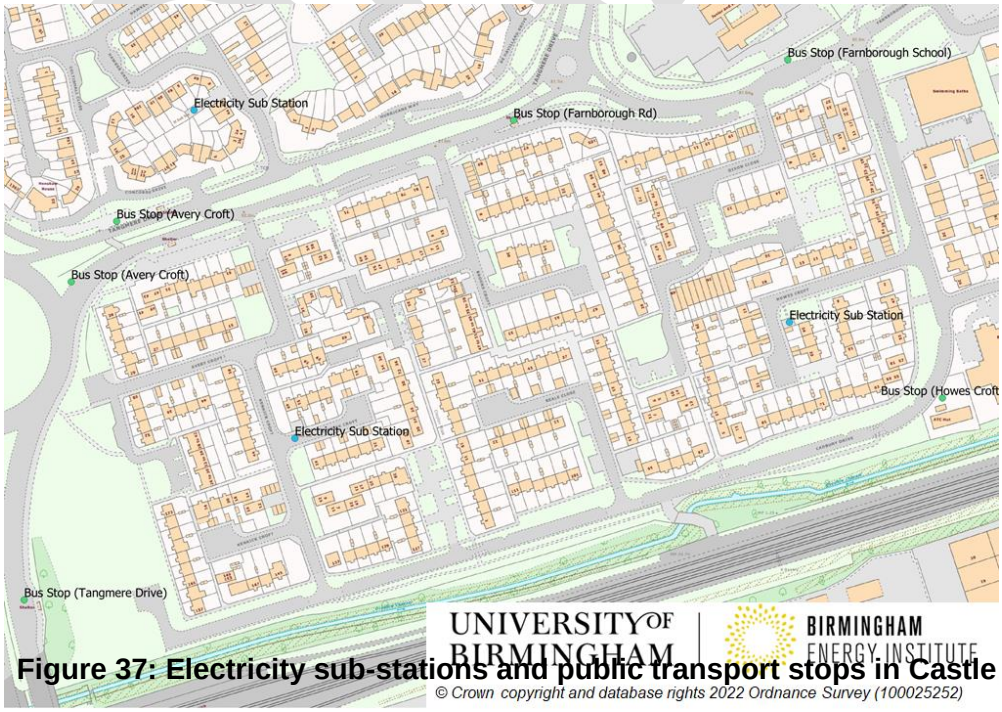


Figure 37: Electricity sub-stations and public transport stops in Castle Vale

walking distance. The neighbourhood is well served by bus stops but connections to Birmingham City Centre by public transport are slow. It takes around 20 minute by car to New Street Station versus 50 minutes by public transport.

2.4.1 Policy Background

The Birmingham Transport Plan (BTP) includes an ambitious vision for Birmingham's transport as a sustainable, green, carbon neutral, resilient transport system that will allow people to travel across the city in a safe environment. A smart, innovative, carbon neutral and low emission network will support sustainable and inclusive economic growth, help tackle the climate emergency, and promote the health and well-being of Birmingham's citizens.

The BTP focuses on four Big Moves including prioritising Active Travel in Local Neighbourhoods, which is directly relevant to this bid. The principles focus on making walking, cycling and active travel the first choice for most people making short journeys in their local neighbourhoods and providing a fully integrated, high quality public transport system that will be the go-to choice for longer trips. This policy directly contributes to helping to deliver carbon network zero by creating the right conditions to influence travel behaviour and travel choice.

The BTP directly supports the policies contained within the Birmingham Development Plan 2031 (BDP) which include:

- TP1: 'Reducing the City's Carbon footprint', by promoting sustainable transport systems including cycling and walking.
- TP38: 'A sustainable transport network', - the development of a sustainable, high quality, integrated transport system, where the most sustainable mode choices also offer the most convenient means of travel, will be supported.
- TP39: 'Walking' – the provision of safe and pleasant walking environments throughout Birmingham will be promoted.
- TP40: 'Cycling', - cycling will be encouraged through a comprehensive city-wide programme of cycling infrastructure improvements (both routes and trip end facilities) supported by a programme of cycling promotion, accessible cycling opportunities, training and travel behavioural change initiatives.

Moreover, the BTP and BDP align to the West Midlands Local Transport Plan Green Paper: Reimaging transport in the West Midlands. This Green Paper, produced by the WMCA/TfWM in partnership with the West Midlands Local Authorities, recognises that in order to respond to the challenges posed by climate change, the next refresh of the West Midlands Local Transport Plan (LTP) will need to have a much stronger focus on achieving transformational change within the next 10 years.

The Birmingham Walking and Cycling Strategy and Local Cycling and Walking Infrastructure Plan (LCWIP) further enhances the aspiration of encouraging active travel by outlining an approach for delivery over the short and medium term. This sets the context for future investments in measures to enable, develop and inspire walking and cycling (and other active travel modes) in the city. It influences the shape of the future cycling network and identifies focus areas for walking interventions, as well as the design of infrastructure for the city up to 2031.

The key objectives of the Birmingham Walking & Cycling Strategy are as follows:

- Enable walking and cycling
- Develop a great city for walking and cycling
- Inspire walking and cycling

A key component and focus of the LCWIP is route improvements for cycling and walking in the city which in combination with public transport, offers a real opportunity to move Birmingham forward and deliver transport that is efficient, equitable, sustainable, healthy and attractive. Proposed route improvements for cycling and walking are therefore designed to connect with new and upgraded public transport facilities and services. Overall, a focus on this will contribute towards making walking and cycling the everyday choice for local journeys and leisure activities as part of a safe and integrated transport network

2.*4*.2 Local Policy Context

Moreover, the BTP and East Birmingham Inclusive Growth Strategy include a number of wider aspirations to transform the area to support residents to enjoy more sustainable, low and no carbon lifestyles. Part of this includes ensuring residents can sustainably access employment, educational and leisure opportunities within the local area.

For Castle Vale, this is reflected in the major new development sites to the north at Peddimore as a new employment area and the Langley Sustainable Urban Extension. In addition, there are key existing employment areas along the A38 Kingsbury Road and A38 Tyburn Road corridor where there is a need to ensure residents in Castle Vale can fully and sustainably access all of the employment, Leisure and educational opportunities within the locality.

2.*4*.3 Supporting initiatives

The ***A38 Kingsbury Road Corridor Study*** highlights the need to improve sustainable connectivity choices between residential areas along the A38 Kingsbury Road Corridor and employment, education and leisure opportunities for people living in areas of higher deprivation such as Castle Vale. As part of this initial corridor study, enhancing public transport provision and improving the active travel network were identified as the priorities for further developments for the medium and long-term as well as other interventions such as roll out of more free bikes, mobility hubs and enhanced pedestrian improvements.

As a result, funding for further development work has been secured. This includes an options appraisal study to explore the feasibility of providing continuous active travel routes linking residential areas such as Castle Vale to employment opportunities along the corridor. The options appraisal study forms part of the Transforming Cities Fund package. The options appraisal on the A38 Kingsbury Road Active Travel Route(s) isn't anticipated to complete until early 2023. However, the wider A38 Kingsbury Road Corridor study provided an indicative budget estimate of delivering such a scheme, which was in the region of £10,000m. It should be noted that no budget for delivery has been identified yet for such a scheme nor if this is even the correct scheme estimate.

The specific longer-term active travel proposals could include:

- A new cycle ‘super highway’ along A38 from Salford Circus (M6 Junction 6) to Minworth. This will provide a link between Castle Vale, Minworth, Peddimore to the north and the City Centre to West.
- A new segregated shared footway between Castle Vale and Castle Bromwich with bridges over the railway, river tame and under the M6,
- A new cycle/footway connecting Castle Vale with Midpoint Park and Prolgis Park
- Wider shared footways linking Castle Vale to Pype Hayes/Chester Road Cycle Lanes/Maybrook and the Ward End Cycle Route in the south

In addition, the City Council and partners, including TfWM, are working collaboratively to develop a network of cycle routes to align to HS2 Ltd’s commitment to develop active travel routes alongside the trace of the new railway. Although this is a medium-term project for delivery, linked directly to the delivery of the railway, it is likely to benefit Castle Vale as some key new routes would open up accessibility to areas such as the Tame River corridor and areas south of Castle Vale within the wider East Birmingham area. This would make a truly integrated sustainable transport network.

Regarding the improvements to public transport, £59.000m has been allocated within the City Region Sustainable Transport Settlement (CRSTS) programme (2022-2027) towards the six packages of interventions to improve cross-city bus routes. Cross City Bus Package 4 scheme seeks to improve bus reliability in the area and proposes a new entrance at the north-east corner of the Castle Vale estate for buses and cyclists onto the A38 Kingsbury Road corridor. The scheme proposes a new 2-way bus gate linking Manby Road with the A38. This scheme will enable residents from the Castle Vale area to access a much greater range of employment, education and training, health and leisure opportunities across the whole city. While the six bus priority packages have yet only been developed to concept design, detail design of Package 4 will be developed and delivered within the next 5 years.

In addition, there are longer term aspirations to deliver a new rail station to serve Castle Vale. The delivery of the station at Castle Vale would provide a key rail link to Birmingham and also the East Midlands. The delivery of the station is however dependent on available funding and delivery of the Midlands Rail Hub (MRH). The MRH is a package of rail schemes which include new rail chords within Birmingham City Centre. The package of measures within the MRH together seek to bring a consolidated viability to rail investment in the area and across the West Midlands region. (NB: The required rail chords are relatively small lengths of linking track (but substantial in construction) to create new access rail track paths into Moor Street Station from the Water Orton line).

As part of this, the West Midlands Rail Executive is commencing a study into potential new stations in the TfWM area which includes development options for the Castle Vale station. This study is due to report during Summer 2022 and will identify key delivery and operational dependencies as well as funding requirements for the station development and will include a possible delivery timeline.

Where private car use is required, the Electric Vehicle Charge Point Strategy (EVCP) will enable the transition to electric vehicles by improving accessibility to public charge points within the Castle Vale area as the market begins to create demand. The EVCP supports the development of low carbon and net zero neighbourhoods and aligns fully with the Birmingham Transport Plan in this regard. The **Electric Vehicle Charge Point Strategy**, like

other BCC policy and strategies support the development of low Carbon/net zero neighbourhoods.

The wider Governance & policy framework, where the EVCP (as approved on 9th Nov 2021) is an integrated element in support of net zero neighbourhood development. As such, it specifically aligns to the Birmingham Transport Plan in regard to the low carbon and net zero infrastructure development such as Sprint, metro, road space re-allocation, low traffic neighbourhoods, supporting the significant level of modal shift required (at least 40%) through public transport, walking and cycling infrastructure required to meet the net zero target. Behaviour change is a major requirement for achieving this level of modal shift.

The EV charge point strategy sets out the wider city approach for public accessibility to EV charge points. The EV Charge Point Network operates using 100% renewable energy. The initial focus of the strategy is the roll out of 394 fast (22kw) and rapid (50kw) charge point hubs at strategic public locations on the highway and public land, within the city centre and within local community areas, including the ***Castle Vale*** area. This aims to enable the widest public accessibility and meet early EV market demand. Further to this, from 2023-2032, there will be the ongoing deployment of charge points to meet market demand alongside private sector deployment on private land.

There is the recognition that 30% of residences within Birmingham do not have or have limited off-street parking. Where proximity to accessing the strategic fast and rapid charge point network is challenging, coupled with low grid capacity, innovative lower power level charge point technology, will be roll out as part of the EVCP strategy and programme, within local community areas. However, where private car use is required, the EVCP strategy will enable the transition to EVs via public accessible charge points on the Highway and public land infrastructure.

2.5 Green infrastructure

Environmental justice is integral to a fair and sustainable transition to net zero, and I, therefore, should be a key part of any NZN plan. Birmingham City Council has looked in detail at the issue of unequal access to green space in the City; and is the first UK local authority to develop a measurement tool for Environmental Justice. An environmental justice score has been developed for each ward based upon:

- Access to a green space, 2 hectares or larger, within 1,000m.
- Flood Risk.
- Urban Heat Island effect.
- Health inequalities (measured through Excess Years of Life Lost).
- Indices of Multiple Deprivation.

Figure 38 shows where in the city all these compound issues are being experienced most acutely. The red wards show those areas of the city where there is the least environmental justice for citizens. Where access to green space is lowest, urban heat island effects and risk of flooding are greatest, there are high levels of deprivation and people have worse health and wellbeing than other wards. As can be seen from the Ward scoring in Figure 39, Castle Vale is along with Balsall Heath are the most at risk of environmental injustice.

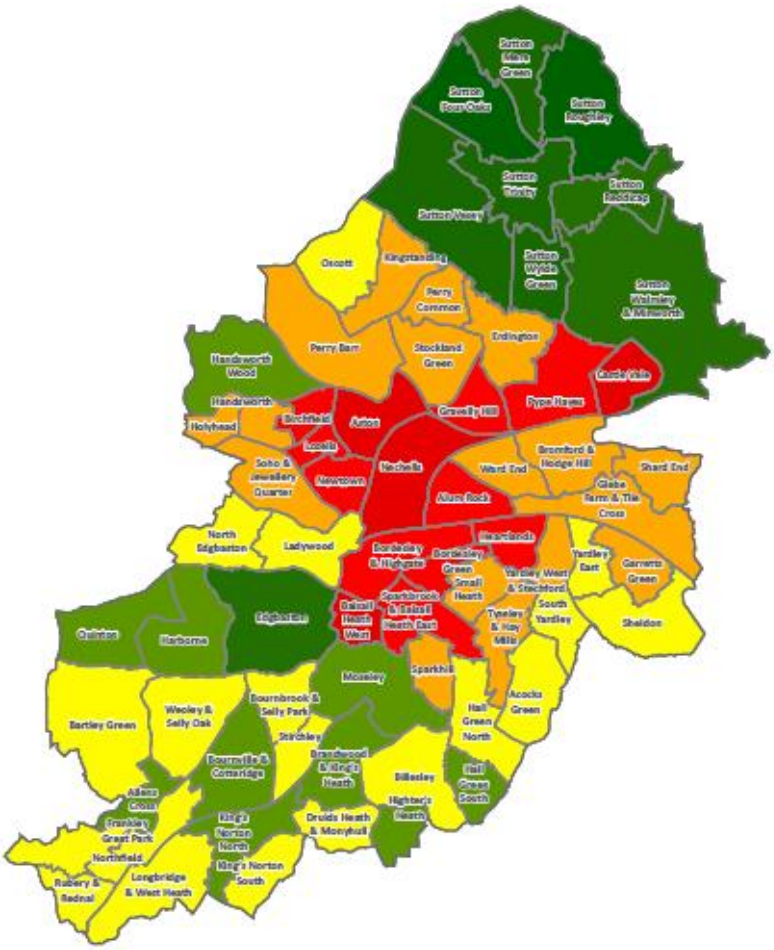


Figure 38: Environmental Justice - Parks and Green Spaces (map from geospatial team BCC)

0.12- Sutton Roughley	0.28 - Brandwood & King's Heath	0.32 - Frankley Great Park	0.37 - Garretts Green
0.12 - Sutton Four Oaks	0.28 - King's Norton North	0.32 - Acocks Green	0.38 - Shard End
0.15 - Sutton Vesey	0.29 - Northfield	0.32 - North Edgbaston	0.38 - Handsworth
0.16 - Sutton Wylde Green	0.30 - Rubery & Rednal	0.33 - Ladywood	0.38 - Ward End
0.16 - Sutton Mere Green	0.30 - Bournbrook & Selly Park	0.34- Erdington	0.39 - Sparkbrook & Balsall Heath East
0.18 - Sutton Trinity	0.30 - Hall Green North	0.34 - Holyhead	0.39 - Alum Rock
0.21 - Edgbaston	0.30 - King's Norton South	0.34 - Yardley West & Stechford	0.39 - Birchfield
0.22 - Sutton Walmley & Minworth	0.30 - Yardley East	0.34 - Small Heath	0.39 - Heartlands
0.22 - Sutton Reddicap	0.30 - Weoley & Selly Oak	0.35- Tyseley & Hay Mills	0.39 - Bordesley Green
0.24 - Hall Green South	0.30 Longbridge & West Heath	0.35- Sparkhill	0.39 - Pype Hayes
0.26 - Harborne	0.30 - Oscott	0.36 - Perry Barr	0.39 - Bordesley & Highgate
0.26 - Bournville & Cotteridge	0.31 - Bartley Green	0.36 - Soho & Jewellery Quarter	0.40 - Lozells
0.26- Moseley	0.31 - Sheldon	0.36 - Perry Common	0.41 - Gravelly Hill
0.26 - Handsworth Wood	0.31 - Billesley	0.36- Bromford & Hodge Hill	0.41 - Newtown
0.27 - Quinton	0.31 - Stirchley	0.37 - Stockland Green	0.42 - Aston
0.28 - Highter's Heath	0.32 - South Yardley	0.37 - Kingstanding	0.42 - Nechells
0.28 - Allens Cross	0.32 - Druids Heath & Monyhull	0.37 - Glebe Farm & Tile Cross	0.43 - Castle Vale
			0.43 - Balsall Heath West

Figure 39: Environmental justice scores for Birmingham Wards

In developing this NZN demonstrator plan Castle Vale's parks and open space have been audited and assessed under 5 themes that form part of the Birmingham Fair Park Standard – set out in the Birmingham City of Nature Plan:

- **Fair.** Is it welcoming, accessible, clean and safe?
- **Green.** Are there different trees and plants? Are there habitats for wildlife? Is it managed sustainably?
- **Healthy**. Are there walking routes, quiet areas, and activities? Is the park used for social prescriptions and play value?
- **Involved.** Can you find out what's happening in your park, can you influence what is happening?
- **Valued**. Do we know the worth of what the park provides, is that shared, are there ways to raise extra funds?

These themes and their metrics also align with the 5 capitals used through the Donut Economics model and help to capture the full value and place that parks play in people's lives, their well-being and community cohesion. The UN Sustainable Development Goals (SDGs) are also integrated in the Fair Parks Standard, with each action of the standard matched to a UN Goal and a specific indicator. This integration of metrics is important moving forward to ensure Birmingham attracts and maintain a flow of resources into their long-term sustainable management of parks and green spaces.

As part of this work, a successful funding application was made to the Community Infrastructure Levy fund for a programme of work to develop parks in line with the Birmingham Fair Park standard. Within the NZN there are 3 sites directly affected by this ongoing city programme; Blenheim Way, Farnborough Fields and Spitfire Play Area; with over £35,000.00 committed towards their upgrade. This work will commence in 2023. The draft plans are included at Appendix G. Figure 40 shows the location of development areas.

Figure 40: Map of the location areas

A key part of this park's improvement programme is the widescale involvement of local people and essential community capacity building, to develop an effective community voice and long-term community engagement and ownership. The drive to deliver the Fair Standard for the parks encompassing the NZN will form part of the community engagement plan.

2.6 Air Quality

As identified, the Castle Vale area has relatively high levels of poor health compared to the rest of Birmingham. The Experian Mosaic modelling has identified that the "Municipal Tenant" category of resident in particular, have very poor health. Interventions introduced as part of the NZN demonstrator should take a whole place approach that makes the NZN a sustainable and resilient place to live.

Due to its location in close proximity to major road networks and industry, air quality is expected to be below average in the Castle Vale NZN. Poor air quality results in short- and long-term health effects and is responsible for ~ 28 - 36,000 premature deaths each year across the UK. The key pollutants of concern in the West Midlands today are nitrogen dioxide gas (NO2) and fine particles in air (PM2.5) (WHO Air Quality Guidelines and Implications for the West Midlands).

Air quality in the Castle Vale NZN area has been modelled by UoB and is found to be poor – particularly for NO_x emission. Interventions to improve air quality have been considered as part of this proposal and built environment design guides are included in Appendix B. As part of the Castle Vale NZN demonstrator programme of works UoB would monitor air pollution in the NZN and explore implementation of innovative urban design and policy interventions with BCC.

2.6.1 Modelling methodology

WM-Air - Clean Air Science for the West Midlands, https://wm-air.org.uk/ - is a NERC funded initiative, led by the University of Birmingham, working in collaboration with over 20 cross sector partners, to apply environmental science expertise to support the improvement of air quality, and associated health, environmental and economic benefits, across the West Midlands.

The WM-Air standalone ADMS-Urban baseline model configuration (Zhong et al., 2021- see Appendix B) for the West Midlands for the year of 2016 has been developed in collaboration with Cambridge Environmental Research Consultants (CERC). Model predictions for NO_x, NO_2, O_3, PM_{10} and $PM_{2.5}$ have been evaluated using the measurement data of 32 monitoring sites from local authorities within West Midlands and Defra's Automatic Urban and Rural Network (AURN).

The 2016 WM-Air baseline model has been updated to 2021 business-as-usual (BAU) case, by implementing the projected 2021 traffic fleet, while other model inputs were kept same as 2016 baseline model to represent the conditions for a representative year. The WM-Air air quality model has also been used to model 2030 BAU case, where reductions in emissions, in line with the actions proposed in the 2019 Air Quality Strategy are assumed, which includes ongoing modernisation of the vehicle fleet, agricultural actions etc.

The WM-Air team has conducted a piece of research to use the newly-developed, high resolution ADMS air quality model to explore the air quality within West Midlands, which included air quality predictions for Castle Vale.

This work was broken down as follows:

1) Update the 2016 WM-Air baseline model to 2021 business-as-usual (BAU) case and 2030 BAU case.

2) Explore air quality for Castle Vale against WHO guidelines.

2.6.2 Air quality maps for Castle Vale

Figure 41 shows model predictions of $PM_{2.5}$ and NO_2 for Castle Vale for the 2021 BAU and 2030 BAU cases. Selected receptors within Castle Vale were also indicated in the map. Table 6 further reports detailed air quality for these receptors within the Castle Vale estate against WHO guidelines.

Both $PM_{2.5}$ and NO_2 are above WHO guidelines for both 2021 BAU and 2030 BAU cases, although there are reductions from 2021 to 2030. The percentiles for Castle Vale ward against West Midlands wards are about 58th for $PM_{2.5}$ and 91st for NO_2.

Selected receptors within Castle Vale were also indicated in the maps. Drawn from NAEI emission data & WM-Air modelling (Zhong et al., 2021).

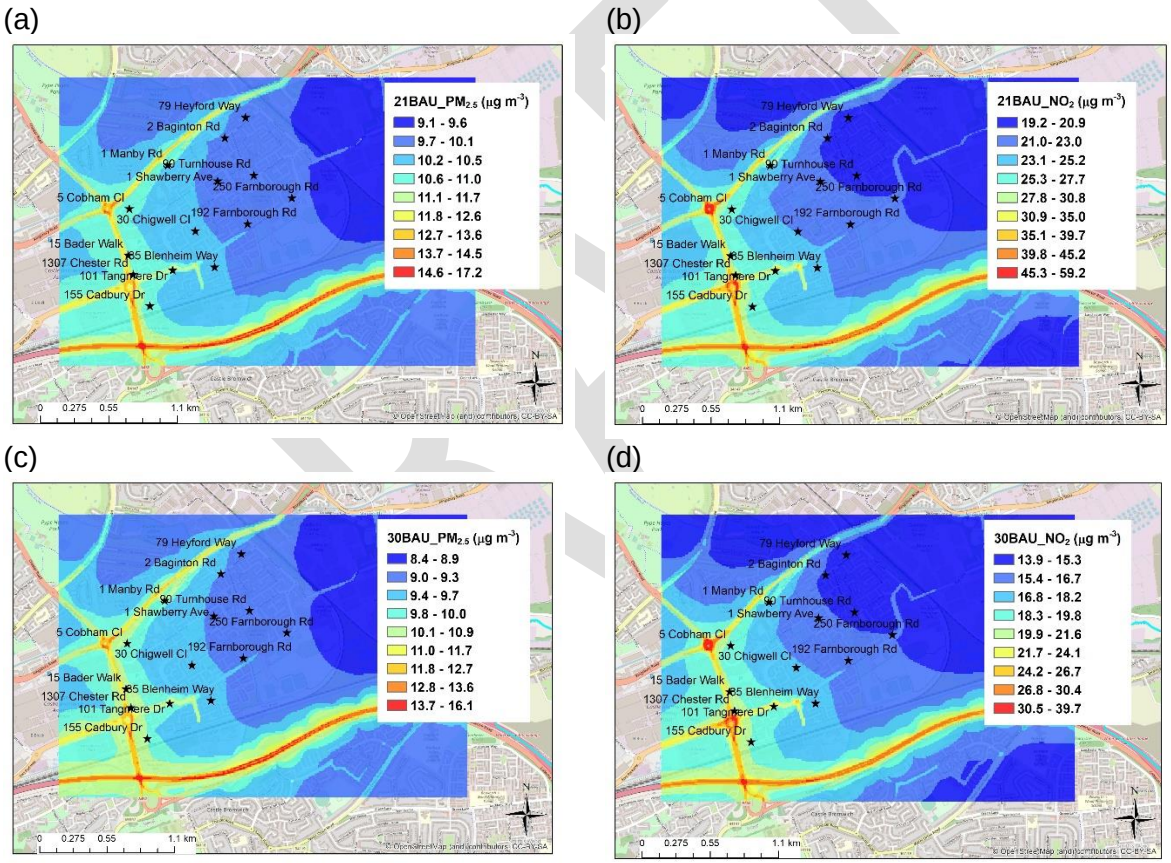


Figure 41: Predicted annual air quality maps for Castle Vale for the 2021 BAU cases for $PM_{2.5}$ (a) and NO_x (b) and for the 2030 BAU cases for $PM_{2.5}$ (c) and NO_x (d).

Table 6: Air quality for selected receptors within for Castle Vale for the 2021 BAU and 2030 BAU cases against WHO guidelines and percentile against WM wards.

Name	PM2.5_21BAU µg/m^3	NO2_21BAU µg/m^3	PM2.5_30BAU µg/m^3	NO2_30BAU µg/m^3
WHO limit	5	10	5	10
15 Bader Walk	11.00	27.20	10.20	20.00

5 Cobham Cl	10.73	26.30	9.96	19.21
155 Cadbury Dr	10.77	26.71	10.00	19.59
101 Tangmere Dr	11.17	30.26	10.38	21.60
30 Chigwell Cl	10.13	22.93	9.42	16.96
1 Shawberry Ave	9.98	21.27	9.31	15.61
1 Manby Rd	11.46	31.04	10.70	21.57
2 Baginton Rd	10.00	20.87	9.35	15.16
79 Heyford Way	9.89	20.47	9.24	14.83
90 Turnhouse Rd	9.81	20.62	9.15	15.07
192 Farnborough Rd	9.93	21.87	9.24	16.03
35 Blenheim Way	10.14	23.36	9.43	17.21
250 Farnborough Rd	9.81	21.60	9.13	15.65
1307 Chester Rd	11.04	28.20	10.23	20.68
Castle Vale (Ward average)	10.20	23.29	9.50	16.96
Percentile against WM wards	**58th (111/192)**	**91st (175/192)**	**58th (110/192)**	**90th (173/192)**

The full methodology and references are provided in Appendix B

2.7 Community and commercial assets

Castle Vale is broadly a combination of a housing estate bound by heavy industry and the M6 road network. A large Sainsbury's that serves wider North Birmingham is the main destination of a retail park in the western corner of the estate. A "commercial" High Street" developed as part of the HAT regeneration programme, includes the offices of CVHA and the Pioneer Group, a community campus and a library that is home to Spitfire Services, the principal advice and support agency on the estate. Spitfire services also run a re-use shop, community café and a swimming pool which is adjacent to the NZN demonstrator area.

A community run football stadium, nature reserve and allotments run by the Community Environmental Trust, and an open green space at Farnborough fields all offer sports and leisure opportunity. For employment and skills, there is a purpose-built community centre that is home to Compass Support, the community regeneration vehicle formed as part of the succession structures in Castle Vale and part of the Pioneer Group. A newly built school, Greenwood Academy and purpose-built medical centre for the Eden Practice, with a social prescribing service run by The Active Wellbeing Society, contribute to a broad-based community and public service offer which has in many ways anchored the investment taken forward through the HAT.

By any standard definition Castle Vale is already what could be seen to constitute a 15-minute neighbourhood, and indeed there is a strong sense of identity that prevails both physically on the estate and within the mindset of older residents, however this has to be balanced by a narrative shared by younger residents and families working at the margins of a sense of isolation and disconnection from opportunities around them. Notably established resident and tenant engagement structures are dominated by HAT veterans with all agencies reporting reducing levels of engagement and participation by the resident body.

Austerity, Brexit, automation, and changing employment patterns have contributed to a narrowing of the social and economic opportunities available to residents, leaving older estate veterans feeling lonely and uncared for, with younger and newer residents moving into the area without the employment anchors that once drew people to the estate. Recent upsurges in ASB and drugs related concerns seem to have fuelled residents' perception that the estate is again at a tipping point. There is a need to intervene again and break the lifecycle of place so that the investment to date is sustained and the estate can be equipped to a new and future context.

A Neighbourhood Plan developed pre-Covid but still relevant offers a forward direction and as part of the initial business planning phase a full audit and evaluation of the potential to harness these community and commercial assets to work together towards a net zero future will be undertaken. The underpinning ambition for lead stakeholders will be that in securing a net zero future the established assets should combine to enable Castle Vale to be judged a 15-minute neighbourhood by design not default. The need to connect to surrounding economic opportunities and build upon the cycling infrastructure in and around the neighbourhood has informed the immediate transport considerations, whilst the opportunities for low carbon manufacturing and development within the Langley Urban extension will be drawn into the business planning process.

Chapter 3: Capital Investment Plan

3.1 Capital Plan Summary

The capital plan as set out will deliver whole house retrofitting to the initial 25 properties and thereafter the rest of the neighbourhood in a way that leaves no resident out of pocket. In most cases residents will be better off both in terms of income and day to day living costs as well as, for owner occupiers, an enhanced value in their property. Where residents are in fuel poverty the approach we have developed will be able to make a substantial contribution to lifting them out of that situation. We are confident that the plan as envisioned will be fair which is critical if we are to secure engagement and participation from the community.

There will be a need for some powers and authorisations to be secured from Government and regulators. It is believed that these could form part of the Trailblazer Devolution Deal. As well as the opportunity to move those households who have benefitted from whole house retrofitting from social to affordable rents it would be hoped that steps could be taken to secure additional or accelerated prudential borrowing or a loan fund that would help to roll out the programme beyond the initial neighbourhood.

As has been set out elsewhere, the initial investment area comprises 380 dwellings in total. Of those, 218 are owned by Pioneer Housing Association as socially rented housing. With the initial funding from the WMCA it is intended to undertake full house retrofitting of 25 demonstrator properties. Eight of the properties have already been identified and a further 17 will be selected in consultation with the residents at the outset of the programme. It is anticipated that there will be an 80/20 split initially between socially rented housing and owner-occupied properties (i.e. 20 social housing and 5 owner occupied).

As part of the preparation of this plan, one house has been survey by Charlie Baker of the Red Co-Operative Ltd and a retrofit action plan has been drafted with detailed specifications, costings and energy measurements. That has been supplemented by financial modelling which includes a reiteration of the costings, repayment of borrowing, energy demand reduction calculations and future energy costs. Those documents are attached in the appendices to this document. The financial modelling is based as a proposal to an owner occupier but most of the calculations are able to be read across to modelling which has been undertaken for the socially rented housing properties.

3.2 Housing retrofit approach

3.2.1The first twenty-five properties

For the initial 25 properties it is intended to follow a similar retrofit pattern which has been set out in the action plan prepared by Red Co-Operative Ltd as set out in Appendix D. This will include:

- External wall insulation.
- Enhanced loft insulation.
- Triple glazed windows.
- Replacement doors.
- Draught-proofing.
- A heat pump.
- Photovoltaic (PV) panels.
- Battery storage.

- Ancillary energy saving measures.

Precise details of the specification for the individual measures and a costing breakdown is included in the action plan. Although each property will be separately assessed and appropriate measures scheduled it is anticipated that given the similarity of properties within the area of the NZN that these measures can generally be applied on a property by property basis. Where low rise flats are involved there will be some cost savings in terms of materials and whilst there may be more limited potential for a PV and battery system, the lower specification for the system will be offset by relatively lower energy demand in the first instance.

A smart display energy monitor will be provided to all households who benefit from the retrofitting to allow them to monitor energy usage and to encourage behaviour change. In addition to the monitor, information and support will be provided to households to enable them to derive maximum benefit. Further support will be provided in relation to operation of the ventilation systems. This support will be through the appointment of neighbourhood energy counsellors who will be employed by a trusted local third sector organisation. As well as providing support to households the energy support team will provide useful feedback to the work that is undertaken in the research and development work streams through a test and learn process.

Initial work has been undertaken in relation to the roll out of whole house retrofitting to the remaining 355 properties in the initial NZN which could be expanded across the rest of the Castle Vale estate. Detailed consideration has been given to possible funding mechanisms including contribution towards costs from households. These are detailed below but in relation to the initial tranche of 25 properties, it is proposed that for both owner occupiers and socially rented housing tenants the cost contribution through rent increases or a warmth charge would not commence unless and until the further roll out of the scheme took place incorporating such an approach. It is also proposed not to seek a capital contribution from the initial owner-occupied households in order to secure engagement with the scheme.

3.2.2 The Next 355 Properties – The Net Zero Neighbourhood

The cost of undertaking whole house retrofitting to all 380 properties in the NZN area, even if costs were limited to the cost of works and a 10% uplift representing the cost of assessing the property, scheduling the work and supervising the same, would amount to £21,109,000. Of that sum £12,109,900 relates to the socially rented housing and the remainder is privately owned. It is anticipated that some funding will be available from the LADS3 programme or any successor programme as well as schemes such as the Social Housing Decarbonisation Fund (SHDF).

Given the operation of the Housing Action Trust on Castle Vale, the housing association owned properties are generally above a level which would attract SHDF funds but there will be some properties that do fall into that scheme (as can be seen in Figure x and Table 2 – EPC ratings for NZN properties). Given the fact that we anticipate the NZN programme is unlikely to commence in time to benefit from current schemes such as LADS3 and SHDF we have not at this time incorporated specific funding from those sources in our modelling. That is not to say that funding from those sources will not be forthcoming. Based upon the current policy framework it is anticipated that all properties will benefit from the heat pump grant that has been introduced.

Although there are broad similarities between the approach that will be taken in relation to finance for socially rented properties and for privately owned properties there are some differences. In relation to owner occupiers at present it is intended to consult the community upon a number of options and it is anticipated that ultimately there will be a mixed set of options available.

An owner occupier could, by way of a general approach, be provided with funding to carry out the retrofitting work with a charge being attached to the property. Even where there is insufficient equity in the property it would still be appropriate to attach a charge to protect the future position. Repayment of the borrowing could be met by the sale of excess electricity, which is generated together with regular payments (akin to a warmth charge) and would be funded from the savings achieved in energy costs. Those payments would serve, over time, to pay off the borrowing that funded the retrofitting.

In the event that the property was sold before the borrowing had been repaid, in most cases the remaining borrowing would be discharged from the sale costs. It is worth bearing in mind that whole house retrofitting with significantly reduced demand and income generating PV and battery systems will enhance the value of the property so that would not necessarily amount to ‘a loss’ to the home owner. Once an owner occupier had discharged the borrowing which covered the retrofit costs it is intended that they could continue to participate in the community energy collective (outlined below) and a structure for an equitable shared reward will be established.

Further consideration to the way in which cost contributions can be made by owner occupiers is in a paper attached as Appendix C. Owner occupiers will of course benefit from significant demand reduction and revenue generation from the PV and battery systems installed. If they are to achieve greater levels of return, they will need to participate in the energy collective. It is intended to access low cost loans for owner occupiers which would ultimately aim to be at a prudential borrowing rate of 2.8%. Higher interest rates could be managed if necessary.

Though it is intended to consult upon a variety of options, financial modelling of the overall cost to owner occupiers of different options is not felt to offer much by way of insight. The single property cost model that has been prepared by the Red Co-Operative Ltd demonstrates the potential benefit to owner occupiers of the approach we are proposing, which can be tailored to each householder’s circumstances. Some households who are heavy users of electricity will not generate the levels of surplus energy for sale as other households, which will affect the timescale for repayment of borrowing. Whilst variations can be smoothed out across social housing households, with owner occupiers there will need to be a more careful accounting to ensure actual sums generated are recognised.

It is possible that some owner occupiers may fail to repay the borrowing and the equity to cover the cost of any outstanding sum that exists. Some assessment of the likely levels of default will need to be considered but it is thought that it will be modest. Flexible support can be built in for owner occupiers so that where circumstances require it, they could have periods of time (if not the entire period) where only the interest payments on the borrowing are covered and it could in certain circumstances be the case that no payments are made and interest is accumulated with the sum charged to the property. Whilst these would not be preferred options they could offer support to households who are in fuel poverty or other financial difficulty.

In relation to the social housing sector more detailed modelling has been undertaken and is attached in Appendix E. At present the modelling is limited to the 218 social housing properties in the initial NZN. There are some assumptions made in relation to the model:

Pioneer will contribute a £5,000 allocation from their window maintenance programme.

We have adopted a 40 year public sector business case model as advised by the University of Birmingham but have then assumed that tranches of borrowing will be over a 30 year period. We would aim to achieve a 2.5% prudential borrowing rate in relation to this financing. For the purpose of the modelling, in discussions with Pioneer we have applied a 2.8% borrowing rate. It is obviously possible that lower rates could be achieved through prudential borrowing or bond issues to support the programme. Interest rates are rising but there is affordable debt available still.

We have assumed a small amount for 2 houses from SHDF Wave 2 for the demonstrator as the houses need to have an EPC of D or below to be eligible. We anticipate that there may be other houses in the area that will be eligible for further SHDF waves but we have not included this in the modelling.

We have assumed that Pioneer are able to transfer from social to affordable rent properties which are retrofitted which uplifts rental income by £26.93 per week (rising by a cautious 2% per annum). We feel the social/affordable rent approach would be a key discussion with the WMCA and Government possibly on an Innovation Zone basis. There is also income accruing to Pioneer from the sale of surplus electricity generated which is based upon information provided by the Red Co-operative Ltd on the single property analysis and multiplied accordingly.

It is likely that the levels of remuneration that can be recovered from excess electricity will increase as market flexibility develops but we have adopted a cautious approach for the time being and not factored that into the calculations. Were we to do so the modelling would obviously be positively impacted.

We have added in some maintenance costs which are again drawn from information provided by the Red Co-operative Ltd on the single property analysis. Pioneer do already have maintenance costs factored into future budgeting including, boiler maintenance and replacement. It is also the case that Pioneer will be able to achieve economies of scale. It has not been possible to factor in the future maintenance costs which will be offset in Pioneer's budgeting so there will be some positive movement when those savings are added.

We have not assumed for the purpose of producing this modelling that there will be any additional public funding or revenue available but part of the business case development if this plan is successful would be to identify additional opportunities to attract funding or revenue streams such as further energy generation opportunities outside PV and battery systems on residential accommodation.

As the modelling stands, the revenue raised from sale of surplus energy and the additional rent revenue will produce a surplus income from about year 6 (having generated a very modest surplus in years 1 and 2 whilst the project is developing). In later years the difference between debt financing and income is predicted to vary significantly as income outstrips the sums needed for debt repayment. It is intended that 'profit' from the sale of surplus energy generation will accrue to a community benefit vehicle, likely to be along the lines of a

community development trust and/or a community energy scheme. One consideration is to what extent in the early years' effort is made to enhance income to some degree to a community vehicle to foster engagement and allow future plans to develop.

A key feature of the plans we have developed in relation to the social housing tenants is to enable the transfer of houses that have been subject to whole house retrofitting (and therefore seen their EPC rating change from typically a C or a D to above the current A rating) to transfer from social rent to affordable rent. This is dependent on government or regulator support although we feel a strongly compelling case can be made, particularly on a piloting approach. In the event this transfer is not achieved it would be possible to proceed on the basis of a warmth charge which is not our preferred options for the reasons set out in the appendix looking at cost recovery but would still enable to the scheme to proceed.

3.3 Community Energy Collective

As part of the Net Zero Neighbourhood it is proposed to create a community energy collective in Castle Vale that brings residents together in a way that allows them to benefit from the energy generation opportunities within the community, in particular in the first instance the installation of PV and battery systems as part of the NZN programme. This will also allow the organisations carrying out the NZN programme (whether as a social landlord or a public body supporting owner occupiers and the private rented sector) to recover part of the capital outlay and also incentivise residents to embrace the scheme.

As detailed elsewhere, it is intended to carry out a programme of whole house retrofit initially in one neighbourhood of Castle Vale and thereafter across the estate. PV and battery systems will be installed that will both meet the electricity needs of householders and also generate a surplus that will be captured by the battery storage. The surplus energy will be available to be sold back to the grid and whilst individual households could arrange a contract with a Smart Export Guarantee (SEG) company there is greater benefit to be gained by an aggregated approach.

At present the amounts payable for surplus energy via the SEG are fairly limited and even if this changes in due course it is always likely to be the case that greater revenue can be raised via an aggregated collective selling its surplus energy in bulk. Beyond simply selling surplus energy there is also the potential for a smart system to be created that would allow storage systems to be charged and discharged in a way that is optimized to gain maximum benefit from real time pricing of energy and varying system demands. In particular if a 1MW tradable capacity can be created there are more options for selling through someone such as Flexitricity as part of the balancing mechanism.

Although collective energy schemes have been in existence for some years they are still uncommon and a developing phenomenon. The benefit of a NZN programme is that a large number of households are likely to be fitted with similar technology that could form part of a collective approach such as the Moixa Grid Share scheme.

With smart technology households who form part of the collective energy scheme would allow the scheme to control their electricity storage systems depending on the wholesale market price of electricity at a particular point in time and the overall need. At times when there is high demand on the market that would entail switching households to battery supply rather than grid supply and/or sale of electricity to the grid. At times when market demand is low (for example overnight) then energy would be drawn from the grid either to provide the electricity which households required for everyday operations or to recharge the battery

storage. It is intended to use software as part of a system of algorithmic learning of household's usage patterns.

Energy support workers or counsellors will be employed to help households understand better how to approach energy usage and interacted with the smart systems. Wider behaviour change will also be encouraged.

For rented homes the landlord would be a participant in the energy collective. This will reflect the fact that they retain ownership of the renewable energy systems as owners of the properties. It will also reflect the investment they have made into the properties. It is possible that in the case of an organisation such as Pioneer there will be opportunities for PV systems as part of their own infrastructure that might supplement existing PV installations and which could form part of the collective.

In the next steps of the development of the NZN the structure of the community energy collective would be created and consulted upon with local residents and organisations. That work would consider how far there would need to be a return to organisations such as Pioneer that were supporting the retrofitting of properties and develop community support for that approach. Accountability will be a vital part of the community energy collective giving residents a meaningful sense of ownership.

Additional framework and rules would allow participants to move between different tenure types (exercising the right to buy) and for changes in householders (through sale, re-letting, inheritance or other life events). By creating a mutual, federated, structure it would be possible for communities in different locations and with different circumstances to benefit from a similar model to the one developed on Castle Vale.

As the flexibility market evolves and new opportunities arise a community energy collective such as the one envisioned for Castle Vale will be ideally placed to take advantage of greater revenue and cost saving potential. With a growing group of residents within the community who have a broad communality of interest it will be possible to quickly embrace the further opportunities from developments such as "P415" increases in flexible energy markets.

3.4 Transport

The bid includes a transport element aligned with the wider vision, aim and objectives of the BTP set out in the local assets section of the proposal. This would focus on promotion of active travel and public transport as lower carbon alternative to private car use.

The immediate Castle Vale NZN area is already reasonably well served by a good network of walking and cycling infrastructure to access local amenities. There are a number of bus services with good frequencies with a range of destinations, so in order to understand and try to encourage sustainable travel behaviour with residents within the area, it is anticipated the Net Zero Neighbourhood project will include a personalised journey planning programme. This will include individual household travel surveys to understand the existing travel patterns in the area. This element of the plan would seek to understand what the barriers are to sustainable travel for the residents in the NZN, promote the opportunities for sustainable travel and where possible, seek to address any local barriers. This approach would deliver and promote an environment which is more conducive to active travel, influence travel behaviour and help to create more sustainable lifestyles for local residents, thereby contributing towards the target of carbon net zero.

The Personalised Journey Planner programme costs for one year are detailed in Table 7:

Table 7: Personalised Journey Planning Programme

Intervention	Funding
***Personalised Journey Planning work**	£20,000
***Minor revenue/capital fund to support personalised journey planning programme**	£20,000
Total	**£40,000**

*Programme likely to be run separately to existing City Council's Travel Demand Management Team resource, but expectation any additional resource secured through NZN bid to be embedded with City Council's Travel Demand Management Team).

Table 8: Possible transport interventions for Castle Vale NZN

Possible interventions to remove identified barriers	Other existing programmes/partners with potential to support delivery
Provision of secure cycle parking	Cycle parking programme with City Council Transport and Highways Capital Programme
Converting existing paths for shared use	Potential use of the Local Improvement Budget
Local works to upgrade existing on-road cycle routes	Potential use of the Local Improvement Budget
Minor pedestrian improvements and other highway maintenance issues	Working with Birmingham's Highways Maintenance PFI contractor to address any defects in footways, cycleways etc.
Bike Loans/Giveaways	Clean Air Zone funded extension of Big Birmingham Bikes project
Other improvements identified by the journey planning programme including establishing a mobility hub	Liaison with TfWM and Mobility Hub pilot.
Encouraging Car-Share operator(s) to set up in the area	Liaison with private operator to encourage establishment of new car club site in Castle Vale. Requirement to provide highway space and TRO for parking bay.
Promotional events	Working with Travel Demand Teams at the City Council, Transport for West Midlands and other delivery partners i.e. bus operators, Sustrans, local bike groups etc.

Cycle Training	Bikeability Training Courses (@£40 per person)
E-scooter availability	Potential opportunity to further extend e-scooter trail to Castle Vale as part of existing pilot.

Upon identifying any barriers to active travel within the personalised journey planning outputs, particularly by active travel modes (including walking and cycling), a minor capital/revenue package is included as to undertake minor infrastructure improvements to improve the attractiveness, utility and accessibility of these active modes of transport for all. These supporting measures could include, but are not limited to, interventions set out in Table 7.

3.5 Monetising indirect benefits and co-benefits

The work carried out by University of Birmingham (CityREDI and Birmingham Energy Institute) to create a Community Heat Evaluation Tool set out a method for evaluating and monetising benefits arising from housing retrofit and heating system decarbonisation. The range of benefits considered arise from improving the energy efficiency of homes, shifting to cleaner energy sources, and investing in improvements to the existing stock of residential properties.

Benefits appraised in the initial model included:

- Energy savings resulting in lower household bills
- Employment created directly and from investment into housing retrofit
- Health and wellbeing improvements through improved living conditions and reduced air pollution
- Training opportunities for local residents
- Private sector money leveraged in through public sector investment
- Overall impact to the regional economy (GVA) taking account of economic multipliers, displacement and leakage effects, and optimism bias

Currently a revised version of the model monetises the following benefits:

Table 9: Monetised benefit and description

Monetised benefit	Description
Energy savings achieved through retrofitting homes (net of the cost of retrofit delivery and changes to whole life costs);	• The reduction in energy usage due to thermal efficiency improvements is calculated and monetised. • The impact of the transition from predominantly gas heating to other forms, especially heat pumps, is calculated. Given that gas is currently less costly than electricity the monetised savings may show as negative. • Monetised energy savings are also calculated net of the cost to deliver retrofits (equipment + installation) but also taking into account natural replacement cycles, therefore avoiding

	some additional cost, and savings on servicing.
Carbon emissions (and equivalents) reduction;	• The impact on greenhouse gas emissions due to reduced energy usage and the transition to cleaner sources is quantified and monetised using guidance from BEIS.
Health savings from reducing the risk of excess cold	• The impact of reducing the risk of excess cold in homes by improving thermal efficiency. • Monetised using research and modelling produced by the Buildings Research Establishment (BRE) on the cost to the NHS of treating health conditions caused by excess cold in homes.
Savings relating to air quality improvements	• Air quality improvements due to change to cleaner energy sources. Monetised using guidance from BEIS. • Mainly relates to health impacts.

In addition, the model calculates the number of jobs (job years) created or safeguarded for retrofit delivery. Safeguarded jobs include those currently installing gas boilers that will need to retrain ahead of their phase out. A valuation can be assigned to these jobs, however, there they also represent an economic cost to deliver the retrofits and are not just an employment benefit (reskilling/upskilling/job creation).

Chapter 4: Community Engagement Plan

4.1 Framing the Community Engagement and Learning Process

4.1.1 Common Purpose

The NZN demonstrator is taking a whole place neighbourhood-based approach. The range of assets in a neighbourhood and the energy system interface within these are invariably not in the control of a given agency or commercial entity. Given this, there is limited certainty over the combined outcomes and far greater integration both vertically and horizontally across the domains is required. Critically, common purpose is also needed- between asset owners, system enablers and key stakeholders.

The need for common purpose and shared interest in the delivery of a given outcome is particularly acute in the case of housing retrofit given that the asset that the key funder, local or national government or lead energy supplier seeks to assert influence over or invest in is an individual person's home, and how they occupy that home can be a key determinant in the success of any measures fitted. For us, the broader community engagement piece and learning process we want to undertake has to be about shaping the common purpose and shifting the mindset of the individual agency.

Whether that be actor or investor, or homeowner or financiers, there is a needed shift to a wider perspective that identifies the co-benefits in taking a more collaborative place based approach to the delivery of the net zero pathway. Finding common purpose is therefore intrinsic to the process of engagement.

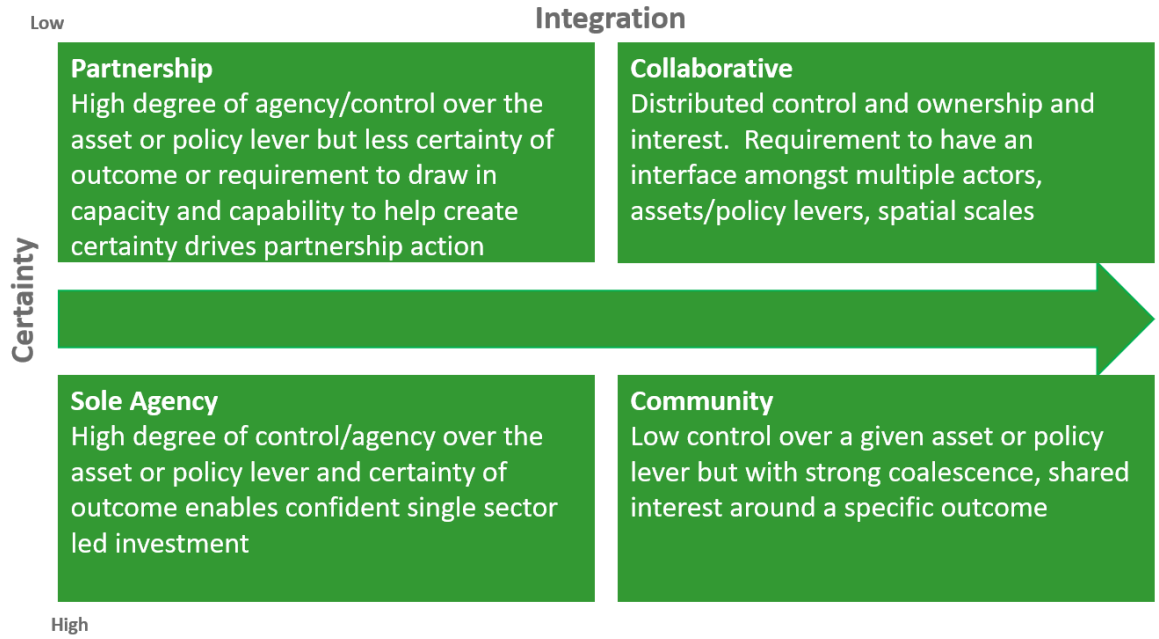


Figure 42: Differential customer journey explored through workshops

Historically, it is also the case that individualistic approaches to housing retrofit and decarbonisation have not facilitated the scale or pace of change required in terms of driving forward investable and deliverable propositions for housing retrofits. Partnership and entity

driven approaches can help move individual organisations or commercial entities towards achieving net zero for themselves or the assets they hold. However, the inherent complexities and uncertainties within place shaping and the securing of net zero pathways require approaches that are capable of flexing to the changing context and/ or reconciling systemic constraints in a way that is both timely and fair.

In developing our project governance, engagement and delivery structures we have sought to shift the debate and approach to one that enables the assets and policy levers to be harnessed in the most effective way and will seek in our engagement and learning process to evidence how these will provide a clear return for asset owner and occupier.

Access to energy is a foundational pillar in a civilised society. We have a common dependency either as direct purchasers of energy or our reliance upon the social and physical infrastructure that frames our engagement and participation in society. However, as householders our participation and the power, and the benefits we may potentially be able to gain from energy system change are defined by the degree of choice and control we have over our homes and livelihoods.

The private tenant with a pre-payment on a zero hours' contract struggling to heat their homes because of high leakage and the immediacy of recent price hikes has less options than the secure social tenant with similar circumstances. Although the impact upon their health and wellbeing and experience of, for example, damp and mould growth is likely to be shared, the risk of eviction on demanding improvements from a landlord is far higher for those who increasingly find themselves in the private rental market.

In contrast, a comfortably off homeowner can better harness technology to drive down their energy costs, and ultimately sweat their equity to take forward home improvements, However, the fact that in exercising choice many currently choose to prioritise investment in areas that add directly to the value of their asset e.g. new kitchens or protect their assets repairs and maintenance rather than investing in deep retrofit and net zero heating options is significant. This differential customer journey was explored in some of the early work undertaken in WMCA led retrofit working groups and is set out in Figure 41. This has now been tested as part of our engagement with residents and local stakeholders, in developing this plan.

Throughout this engagement we have been very conscious of the context within which we are operating. In particular, the cost-of-living crisis and how during development of this plan the "heat or eat" dilemma has extended its reach to many more families in areas such as Castle Vale.

The Neighbourhood Plan highlighted key "pull down factors" such as inflation, low growth, deflated projected earnings and welfare reform pushing those at the margins further into poverty. With the known repercussions of Brexit, Covid and now the energy crisis playing out on the lives and livelihoods of residents, the heat or eat dilemma is now all too often a daily challenge for many residents on the estate and within the NZN.

The majority of social housing tenants within the targeted area are on prepayment meters. Tenants spoke to us about their fears and how the recent rises were already impacting. One Mum talked constantly of watching her SMART meter and the daily cost of heating one room rising from £5 a day to £11 day. Another spoke of how she could not bear to look at her pre-payment meter because she knew she would not be able to add money to her meter that week.

Equally marginal owner occupiers, whilst relieved to have some shorter-term protection with fixed tariff schemes, spoke of costs rising whilst wages were falling with less shifts on offer and inflation impacting.

In developing our approach to investment and engagement we have sought to consider how we can best mitigate and sustain an approach that delivers for climate and community in terms of the energy crisis and pressures upon public finances. With the affordable warmth rent proposition we have sought to evidence that this provides value for both the householder and exchequer. In taking forward our engagement with residents we have sought to respond to the immediacy of the heat or eat dilemma by providing opportunities to source and prepare meals as part of our engagement on net zero and housing retrofit opportunities.

The second issue of concern shared by both residents and key stakeholders is again around the changing economic context but, in particular, how low skills and poor educational performance contribute to an inter-generational cycle of dependency upon low skilled and low paid employment. Even where opportunities had been grasped in local manufacturing, there was an awareness and fear that “things are afoot” and that electrification and automation will negatively impact. The closure of the GKN factory on the Chester Road during the development of this plan contributed, for some residents, to a very real sense of “us and them” and no matter the “fine talk” of a green industrial revolution and new green jobs they would become off worse.

When scenarios provided by national bodies around the potential for jobs to be created in housing retrofit were shared, we were met with basic questions such as “so what does that mean for me?” What jobs, where and how much? Questions that neither lead agencies in the public sector or education and skills providers could meaningfully answer.

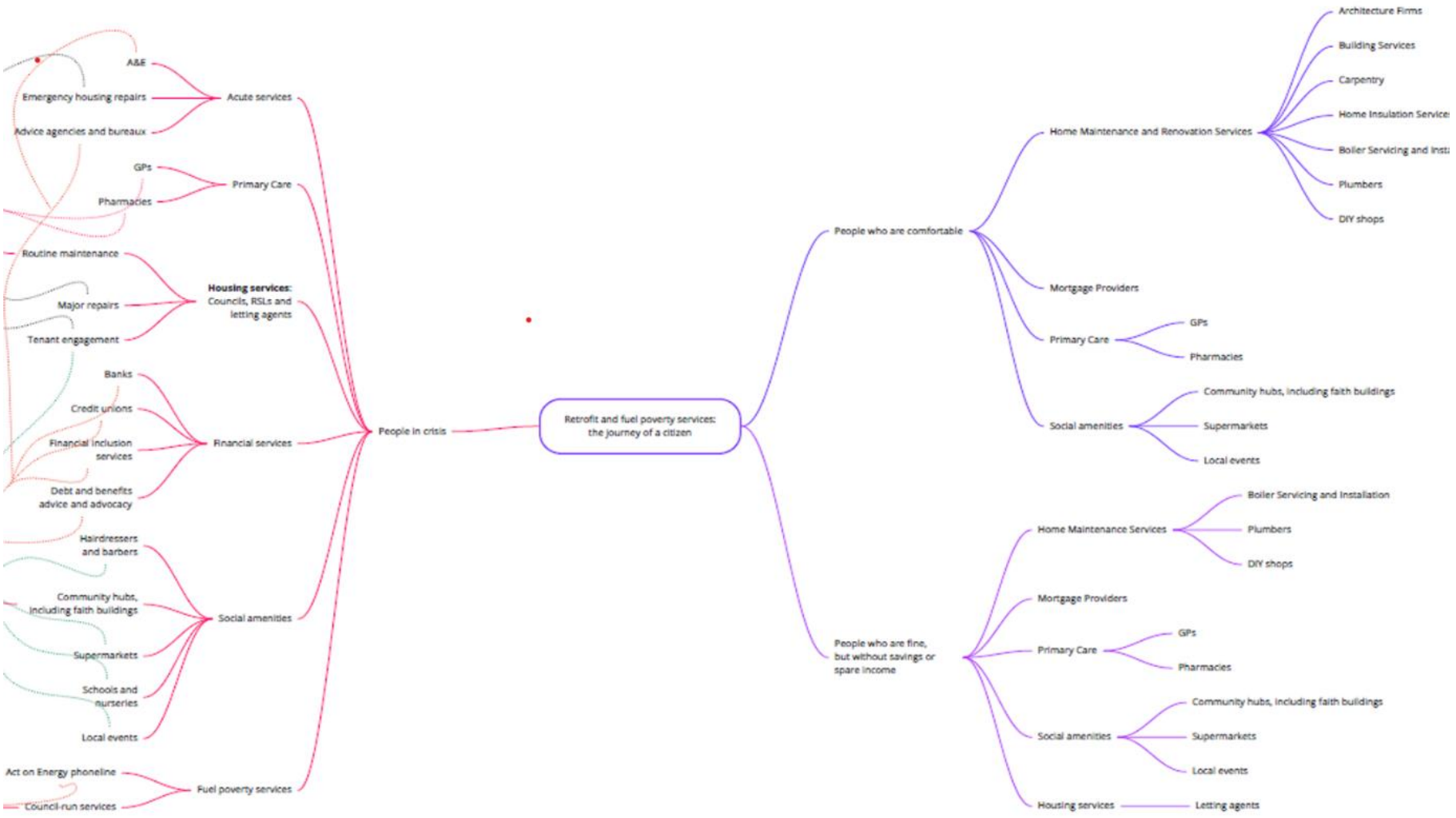


Figure 43: Figure showing various scenarios

4.1.2 The way forward – jobs and skills pathways, and later life care

If public consent is to be secured for the pathway to net zero, the approaches and policies adopted have to be meaningful and real to the lived experience of residents we are trying to take with us. There are limited opportunities for aspiration for the future of a child if parents are defeated by systems that they feel work against them. The articulation of a jobs and skills development process as part of the NZN was therefore seen to be a key part of the pathway to housing retrofit both on Castle Vale and critically is scaling and replication is to be secured on neighbourhoods with a similar profile.

The need to support this process has been picked up by UoB in the levelling up fund bid for a National Centre for the Decarbonisation of Heat (NCDH). How such a centre will relate to the NZN is articulated within the Local Assets section of this plan.

Engagement with members of the Skills Team within WMCA, Compass Support and the Red Coop is informing the development of a place-based housing retrofit and support services skills programme initially focused upon Castle Vale NZN. Given the archetypes and occupancy patterns can be replicated across the region this will enable skills embedded within a neighbourhood to be scaled and mirrored in similar type neighbourhoods.

Our engagement to date suggests economies of scale can be achieved and a pathway to better paid jobs secured through breaking the retrofit process into a set of specifications and skills requirements. These can meet a resident at the point they are at from either entry level or unskilled or can break the tasks into specific work segments - identifying the training required to secure transferability and transition from current employment into a Housing Retrofit occupation.

Our approach will ensure that local employers and trades people will be engaged in the further development of this process – with the retrofit training and skills packages co-designed within the NZN by the Retrofit Co-ordinator and lead training provider SBCC. This programme and how directional negotiation of a changing employment structure can support a fair transition to net zero will be picked up in the early phase of project delivery when a bid to the Shared Prosperity Fund will also be made.

A further dimension to engagement in Castle Vale, and one that can be found in estates across the region and similar urban areas, is the high concentration of older owner occupiers who have either exercised the right to buy or who are lifelong social housing tenants. Their horizons are often very much constrained to Castle Vale or the neighbourhood they have lived most of their adult lives. For these residents. there is an immediate or approaching concern regarding their care and support and the desire to be able stay within their home and immediate neighbourhood. For the neighbourhood and housing provider there is the issue of the occupancy or tenancy once the property is re-let or sold on.

In developing our NZN pathway there is a need to be cognisant of individual need and requirement and understand how localised approaches around care and support could be sustained along with a future for the asset that enables investment to be protected and enhanced within a future occupancy. In developing further the investment model and engagement plan shared equity and buy back options will be considered with RPs and local authority landlords.

4.2 Three-tiered approach to community engagement

We will take a three-tiered approach to community engagement:

1. A citizen driven approach - In the initial phases the heat or eat dilemma can be addressed through a series of food related interventions with advice and support channelled through Spitfire services outlets with the back-up energy expertise and know how provided by Act on Energy. Training, advice and net zero awareness support will be given to a range of other agencies that interface with the neighbourhood including the CVHA Neighbourhood managers, the Social Prescribers working out of the Eden Practice and staff and pupils at Greenwood Academy.

The **Neighbourhood Energy Counsellor** will deliver the direct input and engagement with the initial cohort of 25 households and will further support outreach and activities with the CET and with parents and pupils in primary school settings. **The Active Wellbeing Society** will hold 12 batch cooking and communal eating sessions to enable residents to draw on surplus food and cooked meals that can be cheaply reheated at home and shared with neighbours.

This work stream will receive initial funding from the NZN and additional funding bids to the lottery programme and others will be made to extend out the food provision and outreach support to the provision of highly efficient community freezers, washing machines and other appliances. The participation of the residents and prioritisation of surplus funds distributed via the **Community Energy Collective** would ultimately enable the citizen focused activity to be developed into a self-financing social and community enterprise offer.

2. A cross community collective approach will be established where shared purpose and common interest will be brokered via a community learning process (CLP) that will include system controllers and enablers, the owners and occupiers of the assets in question, the communities of place, practice and those potentially interested with a stake in the future viability and sustainability of Castle Vale NZN and a wider net zero pathway. The key principles within the CLP and the Community Capital Framework are set out in the Framing our Approach section of this report.

Virtual and immersive events, round tables, and tools such as deliberative dialogue, deep democracy and appreciative inquiry will be utilised, with the core project team and first phase residents coming together as communities of place, practice and interest to form the **Castle Vale CLP**. The participants in the **Minworth Waste Heat SIF** bid will also feed through into this process enabling connectivity to wider system change.

As part of the Cadent commissioned work **the Climate Room** has been set up. This is a digital space and community learning platform which will be utilised with a Castle Vale NZN door to provide safe space where challenges can be explored, and an open and transparent process facilitated in terms of programme delivery and project development. The neighbourhood modelling that has been undertaken will have a practice and place frontage here where residents and local stakeholders can interrogate the data and test out the impact of a range of different priorities for investment.

Residents from the NZN first cohort will be recruited and trained alongside the community-based organisations to provide embedded learning and support throughout the Net Zero pathway. Members of the Castle Vale **Community Energy Company CEC** will be trained and empowered to provide pathway support.

3. A consumer driven approach - The respective drivers of owners - both those who can afford to pay and those at the margins - will be further explored. Given our engagement has highlighted the absence of owners with capacity to directly self-fund in Castle Vale it would

be our intent to co-join our learning to the “Can Pay” model recently launched in Greater Manchester. This will enable us to ensure the model is replicable and scalable in the region but especially to the adjacent borough of Solihull where the archetypes and profile of Castle Vale can be identified. There is also an opportunity to roll out informed “Can Pay” models in Solihull drawing upon a workforce trained and developed as part of the NZN pathway.

Further reading: The ‘Strength In Common Report' Strength in Common – A Just Transition and Recovery in A Post COVID World’ highlights residents perceptions of East Birmingham, including where they have come from, and what they could be.

Chapter 5- Project Delivery Plan

5.1 Project Partners and Governance

NZN Demonstrator Lead Agency and Accountable Body:

Birmingham City Council

Housing provider and principal asset owner:

The Pioneer Housing Group: Castle Vale Housing Association, Compass Support

Innovation, research development and community learning

University of Birmingham led *Castle Vale Net Zero Neighbourhood Consortia*: including from UoB - Birmingham Energy Institute (BEI), CityREDI and WM-AIR; and Places in Common, Red COOP, Spitfire Services, South and City College Birmingham (SCCB), BCC and Compass Support.

Other key stakeholders (local, regional and national)

SHAP
Green Square Accord
Matrix Housing Partnership
Cadent Foundation
TAWS/Eden Practice Social Prescribing
BEIS/MNZH
OFGEM
LUHLC
Homes England
Social Housing Regulator

The lead organisation for this submission is Birmingham City Council who have been developing their approach to net zero and in particular neighbourhood-based community retrofit, renewal and regeneration in partnership with the University of Birmingham and Places in Common. This forms part of ongoing work with the UoB and the business led Tyseley Energy Park (TEP) co-creation group in seeking to accelerate a net zero future in Birmingham.

To take forward the focus on community heating, housing retrofit and homes, **the East Birmingham Community Heat Task Force**, working with **Places in Common** and the **University of Birmingham** has been developing the neighbourhood modelling and community learning process funded through the Cadent Foundation. This foundational work has underpinned the partners' overall approach to the NZN plan.

Birmingham Energy Institute has led on taking forward energy system change thinking. In addition to the National Centre for Decarbonisation of Heat (NCDH) development, this includes bringing Severn Trent and the four energy companies engaged in the NCDH - **EQUANS, E.ON, Vital Energi and Pinnacle Power** - into consideration of how the waste heat from the Minworth Sewage Treatment Plant adjacent to Castle Vale could be a driver for the decarbonisation of the existing Heat Networks and the development of new ones.

During this plan development the **University of Birmingham** has convened a Policy Commission Chaired by Sir John Armitt looking at Pathways for Local Heat Delivery and Net

Zero. East Birmingham NZN partners direct participation in the policy commission has enabled the thinking and recommendation of the report to be shaped and also informed by and local and leaders in the field

Places in Common (PiC) has provided a bridging and brokerage function connecting key stakeholders' interests and assets within east Birmingham with the ambition to drive forward a Net Zero Neighbourhood in Castle Vale. In parallel with this work, PiC, together with **Birmingham Energy Institute** via funding from the **Cadent Foundation** has facilitated a **Community Learning Process (CLP)** that enables communities of place, practice and interest to identify and co-own the challenges and opportunities within a fair and fast transition to Net Zero.

In practical terms, this process has meant lead officers in **Birmingham City Council**, **community activists, academics and businesses** have had a shared space to develop common understanding and co-create the options set out in this plan.

The NZN plan is building upon the **CLP**. It has been developed through a participative partnership process facilitated by **PiC** to ensure that the range of evidence, expertise and available resource is aligned to deliver on the shared mission of a fast but fair transition to Net Zero for east Birmingham. This links to the wider strategic objective for east Birmingham to create economic opportunity and connect communities to the Net Zero pathway through Green and Blue Infrastructure.

PiC is also part of a wider ERDF collaboration with **UoB, the Environment Agency, TAWS, Canal and River Trust, BCC and TEP** to secure social and economic purpose on the back of investment in the green infrastructure.

The **Pioneer Housing Group** agreed to participate in initial modelling of housing retrofit that underpinned the EOI, with **Green Square Accord** and more widely the **Matrix Housing Group**. The group provided the Registered Provider context and framed thinking around off-site construction for new build and retrofit, drawing upon the expertise and experience of developing the LoCal Homes factory and driving forward a local supply and skills chain.

The NZN consortium has subsequently worked with **RED Coop** and members of the **SHAP** to draw down on their extensive experience and expertise in Housing Retrofit. This has also provided a link to the Greater Manchester "Can Pay" housing retrofit scheme, which creates a pathway for cross-regional learning. In particular, in relation to consumer led workstream and product development.

Our well-established **partnership** values the expertise of each partner and residents and local communities have been at the core of shaping our proposal. Chapter 5 sets out the community engagement process and plan and highlights the importance of segmenting the customer journey.

As well as the need for an embedded citizen focus that is able to respond to the immediate need to heat and eat. The NZN partners will be working with a range of local community groups but it is intended that **Spitfire Services** plays a key role in offering. money advice. The **Compass Support** programme, **Places4Work** will be developed out into a Castle Vale Neighbourhood Work programme that can be replicated in other neighbourhoods in the city and regions.

These partners also bring key local assets including the **Library, Swimming Centre, Upcycling Shop and the Sanctuary** -a dedicated neighbourhood resource centre.

Harnessing and drawing these assets into the Net Zero pathway will be a key part of the business planning process.

The project will continue to draw in and upon the collaborative leadership that is represented on the **Birmingham City Council** led **East Birmingham Board** and the cross-party **East Birmingham Members Forum**. The community engagement and learning workstream forms an integral part of the East Birmingham Inclusive Growth Strategy delivery plan and will inform wider place-based system change.

The **East Birmingham Community Heat Taskforce** will have oversight of the work of the University of Birmingham led Castle Vale Net Zero Neighbourhood consortia which includes the members of the initial project team and local delivery agencies supporting wider project development and energy system change.

In taking forward this Plan the partnership would aim to have **Energy Capital** and the **UK Central Energy Hub** at the core of the next stage of delivery. This is so the NZN and the key component parts of a net zero transition set out in this plan, and those submitted by other cities can come together to drive a whole system and whole place change process.

Birmingham City Council would aim in its grant agreement with the WMCA to identify the key inputs of the **UK Central Hub**, **University of Birmingham** led **CVNZN consortia** with monies passported directly through to the lead partner.

Table 10: Delivery model and contract management plan- Castle Vale NZN Work Packages

Work package	Lead	Project development & delivery partners	Key Outputs
1. Business planning, financing, and cost recovery	Joint BCC (Tonia Clark) /WMCA (UK Central Hub)	• Trailblazer Devolution Deal Team • Pioneer Finance Director • WM Housing Partnership • UoB/CVNZN Consortia	• Detailed development of longer-term business plan • Identification and arrangement of financing • Detailed working up of cost recovery programme
2. Community engagement – recruitment of tenant and owners, 8+17, introduction to project phase and initial recruitment	UoB/CVNZN Consortia	**Development:** • Pioneer, Director of Asset Management • CVCH Neighbourhood Managers, Tenant Participation Officer **Delivery:** • Spitfire Services • Act on Energy • TAWS	• Recruitment of tenant and owners for early stages of retrofitting programme • Development of wider community communication and engagement • Building community led net zero programme and wider interventions • Recruitment of residents for oversight

			and programme section bodies • Citizen and Community wellbeing - Batch cooking, money advice and neighbourhood energy counselling
3. Community Research, Development and Learning	UoB/CVNZN Consortia	**Development:** • WMCA Skills/Place Based programme team/WMCA SMART Hub • National Centre Decarbonisation Heat consortia **Delivery:** • PiC • RED COOP • BEI • SBCC	• Retrofit Coordination, evaluation, and analysis • Development of a place based retrofit skills programme (inc. shared prosperity fund application) • Training and reskilling for retrofit • Dissemination of project learning • Brokerage and undertaking of community engagement and learning process to capture and validate community led approach • Analysis of replicability and scalability
4. Community energy collective	UoB/CVNZN Consortia	**Development** • BCC (Tonia Clark) • SHAP expert advisor • COOP UK **Delivery** • PiC • Expert advisors to be procured via SHAP Framework	• Legal framework • Infrastructure development • Operational planning
5. Wider Neighbourhood	BCC (Mark Gamble)	**Delivery:** • BCC (Active Travel Team) • BCC (City of Nature Team)	• Transport – personalised journey planning • Future Parks Standard implementation Blenheim Way

6. Retrofit Delivery	Pioneer - Director of Asset Management lead/BCC	**Development:** • CVNZN Consortia • Act on Energy, • RED COOP • Retrofit Coordination **Delivery:** • To be procured - PAS 2035 compliant assessment, design and installation provider from SHAP Framework **Site Management:** • Pioneer Asset Management	• Assessment, design, installation of PAS2035 compliant deep retrofit • Site management • Contract and asset management
7. Project Management	BCC East Birmingham Programme Board (Mark Gamble)		• Project initiation • Procurement and contract management • Oversight • Reporting

5.2 Phasing of delivery and budget

The budget below is phased over 18 months, with spend in the first six months focussing on business planning and community engagement. Experts will be commissioned to support with the development of the community energy collective and the community research and learning. During this phase the procurement plans will be co-ordinated with Birmingham City Council leading on procuring the retrofit co-ordinator and issuing grant funding for community organisations, University of Birmingham will lead on procuring researchers and consultants and Pioneer will commission the retrofit suppliers. In this period there will also be the opportunity to understand the role of the WMCA in supporting on the ground activities, for example with the UK Central Hub at Jaguar Land Rover.

The funding for the private home owners from LADs3 will need to be spent by March 2023 and this is factored into the budget and work planning.

The budget draws in funding from other sources which are currently being applied for and there are alternatives to these should these applications be unsuccessful.

The costs are based on quotes and we are aware that prices in the retrofit sector are rising, so we have included a small contingency for this. We also anticipate that bulk purchase and the tender process will keep prices affordable.

The City Council is also providing match funding from the Route to Net Zero staff team to the value of £40,000.

Table 11: Expenditure Table

		Total	Oct 22 to Mar 23	Apr 23 to Mar 24
Income		£	£	£
WMCA Grant		1,650,000	1,650,000	
Pioneer Windows Programme (20 x £5,000)		100,000		100,000
Heat pump grant (25 x £4,000)		100,000		100,000
Social Housing Decarbonisation Fund (2 x £10,000)		20,000		20,000
LADS3 (3 x £10,000)		30,000	30,000	
Future Parks Standard		35,000		35,000
Total Income		**1,935,000**	**1,680,000**	**255,000**
Expenditure		£	£	£
Retrofit cost for 25 properties @ £50,500	Work Package 6	1,262,500	30,000	1,232,500
On costs for retrofit design, detailed site supervision, (PAS2030/5)	Work Package 6	126,250	3,000	123,250
Retrofit coordination, revision of approaches, data gathering and evaluation	Work packages 3 and 6	100,000	30,000	70,000
Pioneer officer time (50% FTE)	Work Package 6	26,250		26,250
Project management (BCC) – part time Grade 6	Work Package 7	85,000	56,000	29,000
Personalised Journey Planning, small scale investment, FPS,	Work Package 5	75,000		75,000
Community interventions, neighbourhood Energy counsellor (via Spitfire and ActOn Energy),	Work Package 2	60,000	20,000	40,000
Redecoration grants (£1,000 per house)	Work Package 6	25,000		25,000
Expert input	Work Packages 1 and 4	25,000	25,000	
Community learning, prototyping, energy collective development, neighbourhood facilitation,	Work Packages 3 and 4	75,000	50,000	25,000
Contingency		75,000		75,000

Total Expenditure		**1,935,000**	**214,000**	**1,721,000**

Our delivery plan is detailed and includes all elements from transport and procurement of retrofit through to evaluation. We anticipate working on houses in groups of 8 and will be guided by the experts on how this is implemented on the ground. All of the proposed actions are included in the Gantt Chart in Appendix F.

There is room for slippage in the delivery plan, but tight, on the ground programme management from the East Birmingham Programme Board will minimise the amount and duration of this.

5.3 Project assurance, including quality assurance, PAS 2035 compliance and escalation processes

Birmingham City Council will have overall responsibility for project assurance as Lead Partner and the Accountable Body for the Project. They will be responsible for Risk Management of the project.

For the retrofit delivery, procurement will be carried out via the SHAP framework, as detailed in the delivery plan, to assure compliance with PAS 2035, and to ensure recruitment of a qualified Retrofit Coordinator.

The Pioneer Housing Group Director of Asset Management in liaison with BCC will be responsible for overseeing the Retrofit Coordinator, Retrofit Evaluator and quality assurance of the retrofit delivery.

Escalation processes for work packages will be agreed between work package leads and the project and project management lead – BCC.

Figure 44 below sets out the role of the Retrofit Coordinator in overseeing the assessment, identification, specification and evaluation of energy efficiency measures.

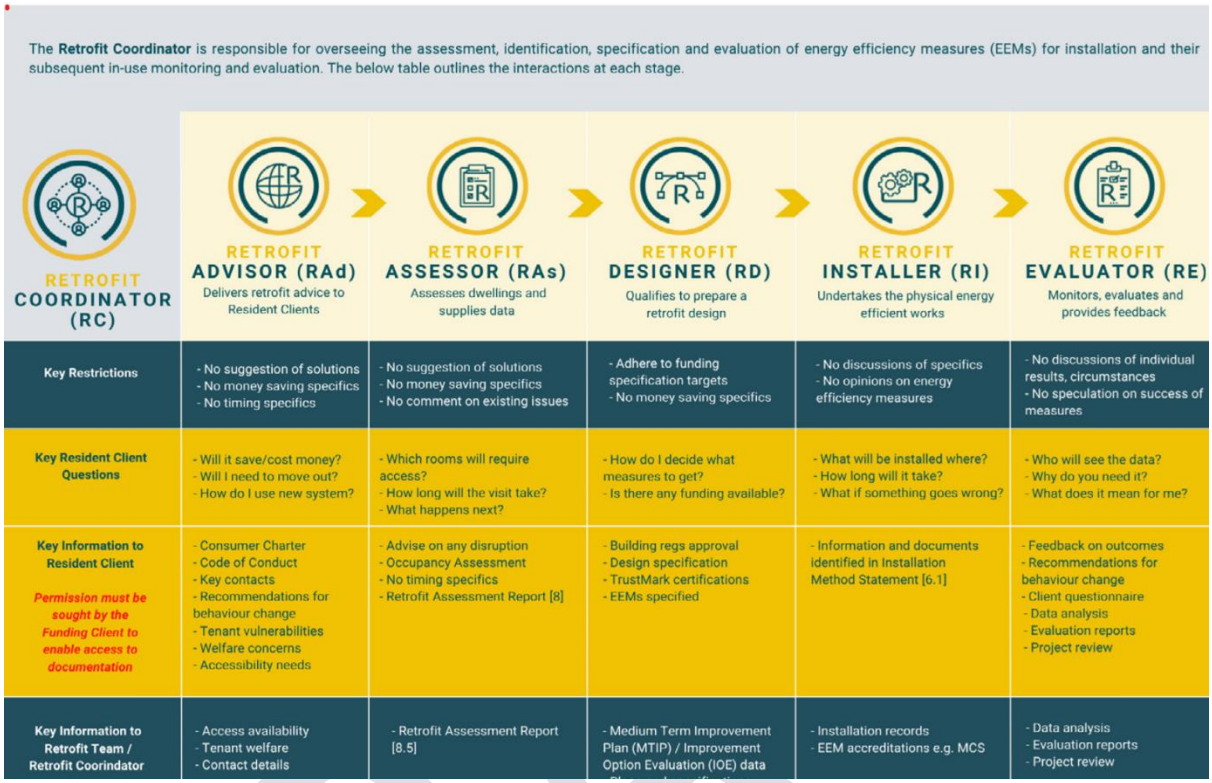


Figure 44: Retrofit coordinator role and framework

5.4 Risks and risk management

Table 11 below sets out the Risk Management process of Lead Partners Birmingham City Council.

Table 12: Risk Register and Mitigation

Risks	Mitigation
Finance – unable to secure loan finance at an affordable rate	Approach a range of funders including Public Works Loan Board, Abundance Investment for an investment bond
Finance – match funding and partner funding is not realised	Scale back on activities Apply to a range of funders
Finance - Government unwilling to support a transfer from social rent to affordable rent.	Adopt a 'warmth charge' approach with appropriate measures to address the additional challenges that might create.
Procurement – process does not award a contractor for the installation works	Repeat the process with reviewed criteria/timescales/costs
Procurement – length of process impacts on ability to complete the works at an appropriate time and before the deadline	Ensure the process is followed properly to prevent appeals Ensure the tender documents are complete and ready on time

Procurement – lack of appropriately qualified/experienced contractors	Identify Trustmark registered contractors as part of the procurement process and ensure that the opportunity is widely advertised
Capital works – supply chain problems and stock unavailability	Work closely with the supply chain early in the procurement process to ensure there are sufficient supplies available locally. Support local businesses with apprentices and, where possible, with support from the Chamber of Commerce
Capital works – 'as built' issues - plans of houses and services vary from the drawings leading to increases in spend/time.	Undertake detailed surveys of each house and services prior to work commencing on retrofit and make good any issues before hand. This may lead to the number of houses in the programme being reduced
Capital works – timing issues cause some works to be done in winter	A phased approach may need to be taken to ensure that homes are not without power for long periods in the winter. Families could be re-homed temporarily if this was an issue
Capital works – sub contractors delivering poor work	The retrofit co-ordinator will monitor the work along with the retrofit evaluator and Pioneer Housing Association who will be the commissioner for this element of the programme. Sub-contractors will be expected to make good on any defective work
Programme Management – communication problems due to complexity and number of partners	The East Birmingham Programme Board will programme manage and hold frequent management meetings with partner leads to ensure that deadlines and budgets are met. Information will be centrally available (eg through MS Teams) to ensure that everyone can access the non-confidential programme information
Programme Management – problems due to lack of capacity	The East Birmingham Programme Board have identified a role to take on the programme management
Partnerships – partners unable to secure funding or allocate resources	Work with partners throughout the programme and support with funding applications where appropriate. Communicate with partner leads to ensure resources are allocated
Public engagement – unhappiness with disruption causes loss of trust in programme	Clear communication with residents during the planning stages about the amount of disruption and the length of disruption so that expectations are managed. Community engagement workers available for day-to-day problem solving
Public engagement – failure to engage with the 15 minute neighbourhood and transport mode shift	Clear communications at the planning stage and incentives to promote cycling and walking eg free bicycles, free cycle lessons (all ages), a cycle club

	Consider promotions for walking and liaise with public transport providers to improve the service
Public engagement – managing house moves during the programme	Community engagement workers will conduct informal interviews with residents as part of the selection process to minimise any house moves during the programme duration
Public engagement - Unable to recruit owner occupiers to the programme.	Clear communication with residents about the benefits and protections which will exist. Provide additional support and advocacy for owner occupiers and consider widening the scope of potential participants in a demonstrator programme.

Birmingham City Council and the East Birmingham Programme Board (EBPB) will be the risk managers and at the outset of the programme they will develop a risk matrix which will identify the known risks (see above), the risk owner, mitigations and a RAG rating. The Programme Manager from EBPB will monitor these risks using information from stakeholders. New risks will be added and managed as they arise. Risk reports will be discussed at the programme meetings with partners.

5.5 Evidence and Evaluation Approach

In alignment with the net-zero neighbourhood specification, for Castle Vale we will measure progress against a set of indicators that are metrics for the following criteria:

- Energy needs are reduced through demand reduction measures
- Remaining energy needs for transport, heat and power are met through decarbonised energy sources
- And wider measures are taken to create a sustainable **resilient** place to live

5.5.1 Setting our baseline

The baseline for the Castle Vale NZN establishes the following place-based indicators against which progress on the journey to net zero can be measured:

INDICATOR TYPE	INDICATOR	MEASUREMENT
1. Total, per household and per capita end use (non-renewable) energy consumption and related emissions	• For heat and power in residential building • For heat and power in other buildings • For private car/van/motorbike journeys	Postcode energy consumption modelling Energy meter readings for public and private sector buildings WMAir modelling
2. Renewable generation/technology installation and capacity	• Solar panels • Battery storage • Heat pumps • Other	Neighbourhood audit Neighbourhood audit Neighbourhood audit Neighbourhood audit
3. EPCs ratings and fuel poverty levels	• EPC ratings for all properties	EPC data and synthetic EPCs

	• Number of households in fuel poverty	EPC data and synthetic EPCs
4. Active travel and low-carbon vehicles	• Number of journeys made by bike • Number of journeys made on foot • Number of journeys made e-scooter • EV ownership	BCC monitoring BCC monitoring BCC monitoring Neighbourhood audit
5. Wider sustainability	• Amount of green space • Air quality (indoors) • • Air quality (outdoors) • • Noise pollution • • Recycling rates	Neighbourhood audit WMAir modelling & sensor monitoring WMAir modelling & sensor monitoring WMAir modelling & sensor monitoring BCC data

Appendices

Appendix A: Raw data and data sources for NZN maps

See Excel Spreadsheet.

Data sources:

- Postcode energy consumption data for electricity and gas is from BEIS:

https://www.gov.uk/government/publications/postcode-level-domestic-gas-and-electricity-consumption-about-the-data/postcode-level-domestic-gas-and-electricity-consumption-notes

- Archetypes are from UK Buildings (dataset UoB bought from Verisk) for the building attributes and NEED data from BEIS (multiple attribute tables) for the expected energy consumption.

https://www.gov.uk/government/statistics/national-energy-efficiency-data-framework-need-consumption-data-tables-2021

- Tenure is from a specific dataset provided from Pioneer, a spreadsheet called Total Properties: Note – this is not open data and should not be shared outside the NZN bid submission and review process.
- EPC data is from the Department for Levelling Up, Housing & Communities database:

https://epc.opendatacommunities.org/

Appendix B: WMAir Air Quality Modelling Methodology

Emissions

Emission sources in the model included explicit point sources, explicit road sources and 1 km × 1 km horizontal resolution grid sources for the baseline year of 2016 (shown as Figure A1). The EMIT Atmospheric Emissions Inventory Toolkit (developed by CERC) was used to pre-process the emission data before import into the ADMS-Urban model.

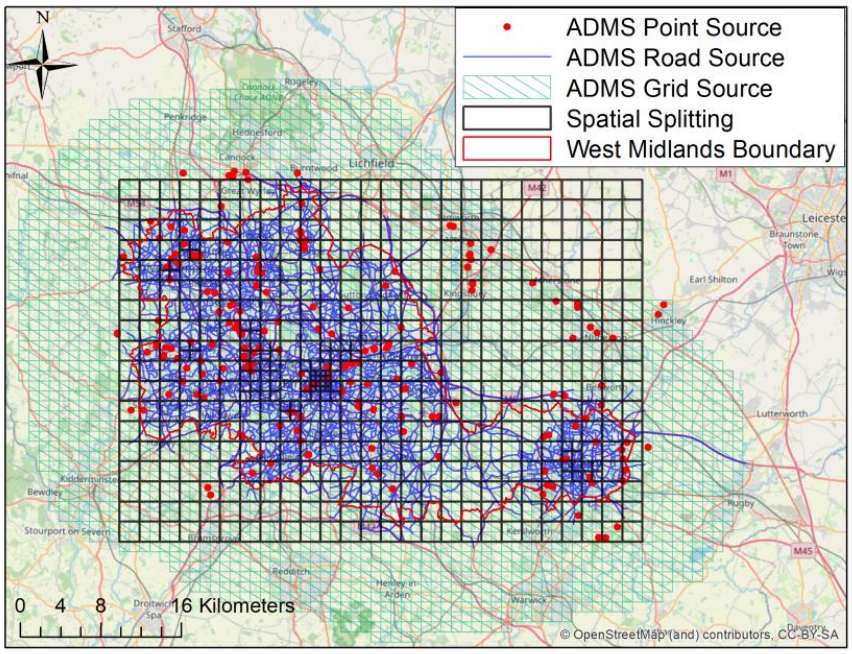


Figure B1: Emission sources and spatial splitting for the modelling domain over West Midlands.

1) Point sources (explicit)

Point source emission rates were taken from the UK National Atmospheric Emissions Inventory (NAEI) (NAEI, 2016), which collected detailed emission data from large individual sources. Other smaller emission sources in the industrial and commercial sector were included as grid sources (Section Grid Sources). Large industrial point sources were considered explicitly as elevated point sources in the dispersion model. The emission inventory for these point sources combined the NAEI 2016 data (for emission rates) and Birmingham City Council (BCC) Airviro (Airviro, 2018) model data (for stack parameters, e.g., stack height and diameter, efflux temperature and exit velocity). Representative typical stack characteristics by sector were used for the point sources where the stack characteristics are not known.

2) Road sources (explicit)

Road sources in the current baseline model combined the traffic maps from Transport for West Midlands (TfWM) PRISM model (PRISM, 2019) and BCC's SATURN model (BCC_report, 2018). The SATURN model has more road links within the forthcoming Clean Air Zone of Birmingham (BCC, 2021). The traffic map covers major roads, e.g., motorways and "A" roads. Minor roads not represented by the current traffic map are modelled as grid

sources. The traffic data for AM peak, PM peak and inter-peak time periods have been combined and converted into Annual Average Daily Traffic (AADT). The traffic flows were categorised into heavy and light vehicles. These traffic model output data were evaluated against the TfWM's traffic count data. The light vehicle from the traffic model agrees well with traffic counts, while the heavy vehicle is consistently underestimated compared to traffic counts and an adjustment was made. Bus timetable data from Remix (Remix, 2019) were also processed and included in the model input. Representative fleet composition data (Euro classification for each sub-type of heavy and light vehicles) were taken from ANPR data in a recent Birmingham Clean Air Zone (CAZ) document (BCC_report, 2018) and has been incorporated into the EMIT calculations. The UK NAEI 2014 road traffic emission factors, with real-world adjustments following the approach described in Hood et al. 2018 (Hood et al., 2018), were used for the calculation of emission rates.

3) Grid sources

Grid sources for 2016 were defined at 1 km × 1 km resolution with a typical depth of 10 m. The base gridded emissions were downloaded from the NAEI website (NAEI, 2016) in the OSGB coordinate system, and have been converted to the LCC modelling coordinates. NAEI emissions are available for all SNAP (Selected Nomenclature for Air Pollution) sectors, i.e.:

SNAP01—Combustion in Energy Production and Transformation (energyprod);

SNAP02—Combustion in Commercial, Industrial, Residential and Agriculture (domcom);

SNAP03—Combustion in Industry (indcom);

SNAP04—Production Processes (indproc);

SNAP05—Extraction and Distribution of Fossil Fuels (offshore);

SNAP06—Solvent Use (solvents);

SNAP07—Road Transport (roadtrans);

SNAP08—Other Transport and Mobile Machinery (othertrans);

SNAP09—Waste Treatment and Disposal (waste);

SNAP10—Agriculture, Forestry and Landuse Change (agric);

SNAP11—Nature (nature).

The pollutants of interest are NO_x as NO_2, NMVOC, PM_{10}, $PM_{2.5}$ and SO_2. SNAP07 has been reduced by subtracting the emission contribution from the explicit major road sources. EMIT also aggregates the explicit major road emissions into the same 1 km × 1 km grid. The residual emission for this SNAP07 sector can be then derived and modelled as SNAP07_minor road.

Assumptions

A2 Time varying factors

Time-varying factors from the EMEP model (Simpson et al., 2012, EMEP, 2021) were available for each hour of the day by SNAP sector and pollutant. An emissions inventory covering the area of interest was available, with total emission for each sector. These

emission rates were used to calculate a combined set of weighted average monthly emission factors for each pollutant, which were applied to the total gridded emission rates. Separate time varying factors were applied to particulate and gaseous gridded emissions, reflecting different balances between sectors and source types for these pollutants. In additional to the gridded emission rates, time varying factors have been also applied to explicit road sources. The monthly factors used for explicit road source emissions were taken from Community Modelling and Analysis System (CAMS) regional emissions v3.1 (ECCAD, 2021). Diurnal profiles for road traffic have been calculated using 24-hour flow and speed data from automatic traffic count sites (data downloaded from TfWM), typically available for 1 week per site. The roads of interest were isolated, and the light and heavy vehicle hourly flows and speeds were processed through an Emissions Factor Toolkit (EFT, version 9.0) (EFT, 2019) spreadsheet to calculate hourly emission rates of the pollutant of interest. The emission rates were then normalised by the average emission rate on the road, to give a time varying profile for the road. The roads were classified into medium or high flow and average time-varying profiles were calculated for each type. The diurnal profile for medium roads was also applied to the grid source, representing both the significant contribution of minor roads to the residual gridded emissions and the representation of emissions from roads outside the current sub-region and buffer zones in the gridded emissions.

A3 Background data

Background concentration files were created using historic observation data from a variety of rural background sites surrounding the West Midlands modelling area, available from the Department for Environment, Food and Rural Affairs (Defra) UK-Air website (Defra, 2019b). Data were limited in the West Midlands area, so a suitable background file was created using the following sites for different pollutants: (1) NO_x, NO_2, O_3: Ladybower (Lat, Lon: 53.403370, −.752006), Market Harbough (52.554444, −0.772222), Chilbolton (51.149617, −1.438228), Leominster (52.221740, −2.736665), (2) SO_2: Ladybower, Narberth (51.781784, −4.691462), Chilbolton and (3) PM_{10} and $PM_{2.5}$: Chilbolton (with large periods of missing data filled using data from Sheffield Devonshire Green). The direction of each monitoring site from the centre of the modelling region, and wind direction sectors which were appropriate for each site, were calculated. The monitored wind direction for each hour was used to identify upwind monitoring data for that hour. The use of Chilbolton for particulate background concentrations was due to the fact that appropriate background monitoring sites for PM were scarce around the West Midlands area. The monitored Chilbolton concentration was multiplied by the ratio of the annual average concentration at a rural area bordering the West Midlands to that at Chilbolton based on Defra's background concentration maps (Defra, 2019a).

A4 Meteorological data

For the West Midlands, an appropriate synoptic meteorological measurement site is located at Birmingham Elmdon, within Birmingham Airport, with data obtained from Met Office MIDAS in CEDA Archive (CEDA, 2019). "UK Hourly weather data", "UK Mean Wind" and "UK Hourly rainfall data" have been combined to create the met data format required by the model. The generated met file included hourly data for wind direction, wind speed (converted from knots to m/s), total cloud fraction, air temperature, relative humidity and precipitation.

A5 Advanced Canyon and Urban Canopy files

The data required to carry out the advanced canyon (Hood et al., 2021) and urban canopy (Hood et al., 2014) calculations are (1) a road network shapefile and (2) a buildings shapefile, including a height field. The building data have been obtained from Digimap database (Digimap, 2019) via the University. The ADMS-Urban software package included ArcGIS tools (Jackson et al., 2016) which have been used to calculate an Advanced Canyon file. The building height and canyon width along each road link were derived. The gridded urban canopy parameters have also been calculated for use in representing urban wind flow variations. These will enable the ADMS-Urban model to account for the street canyon effect for road emissions and spatially varying urban canopy flow for all source types.

A6 Model Evaluation

For the purpose of model evaluation, the model was first run in a "Receptor" Mode (a run with output for a limited number of specified receptors) for 32 air quality measurement sites within the WM over the whole year of 2016, with measured concentration data obtained from local authorities and Defra's AURN (Defra, 2019b) (shown as Figure A2, mostly with available hourly air quality measurements). These sites included three types, i.e., 1 airport site, 19 roadside sites and 12 urban background sites. In order to reduce the model computational time, the source exclusion option (CERC) was used to not explicitly model road sources far away from specified receptors, and therefore unlikely to contribute significantly to modelled concentrations at receptors, with a specified exclusion distance of 750 m. The Receptor run was conducted in a Windows PC and it took about 12 hours' computation time to get the hourly output of five air pollutants (NO_x, NO_2, O_3, PM_{10} and $PM_{2.5}$) across a whole year for all 32 receptors. The Model Evaluation Toolkit (Stidworthy et al., 2018) was used to conduct the evaluation of the model by comparing to the measured air quality data using statistical and graphical methods.

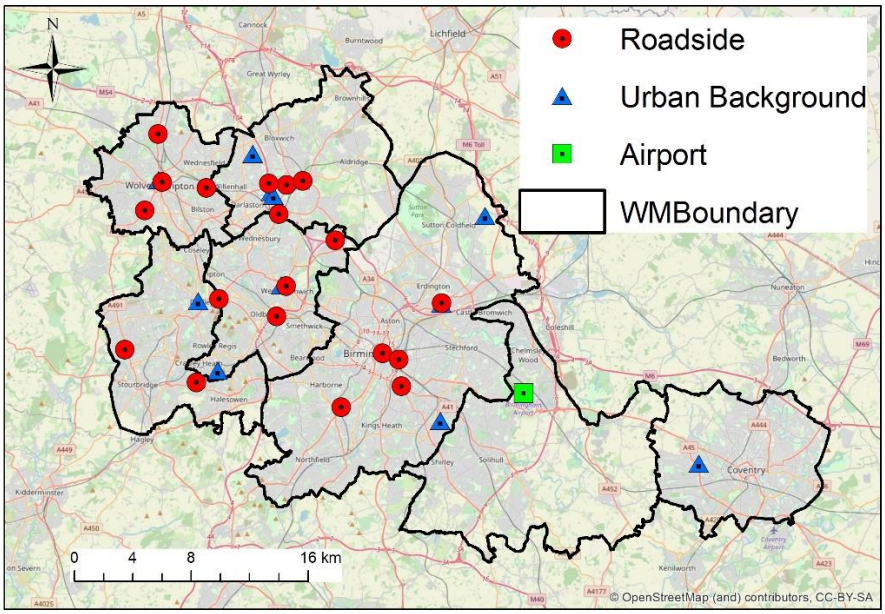


Figure B2: Monitoring sites within West Midland used for the model evaluation.

1) NO_x and chemistry

Figure A3 shows the evaluation of modelled annual NO_x, NO_2 and O_3 against observations using scatter plots divided by site type. Overall, the model performed well in terms of NO_x

and NO_2 for all site types. The good fits for O_3 further suggested good performance of the model chemistry.

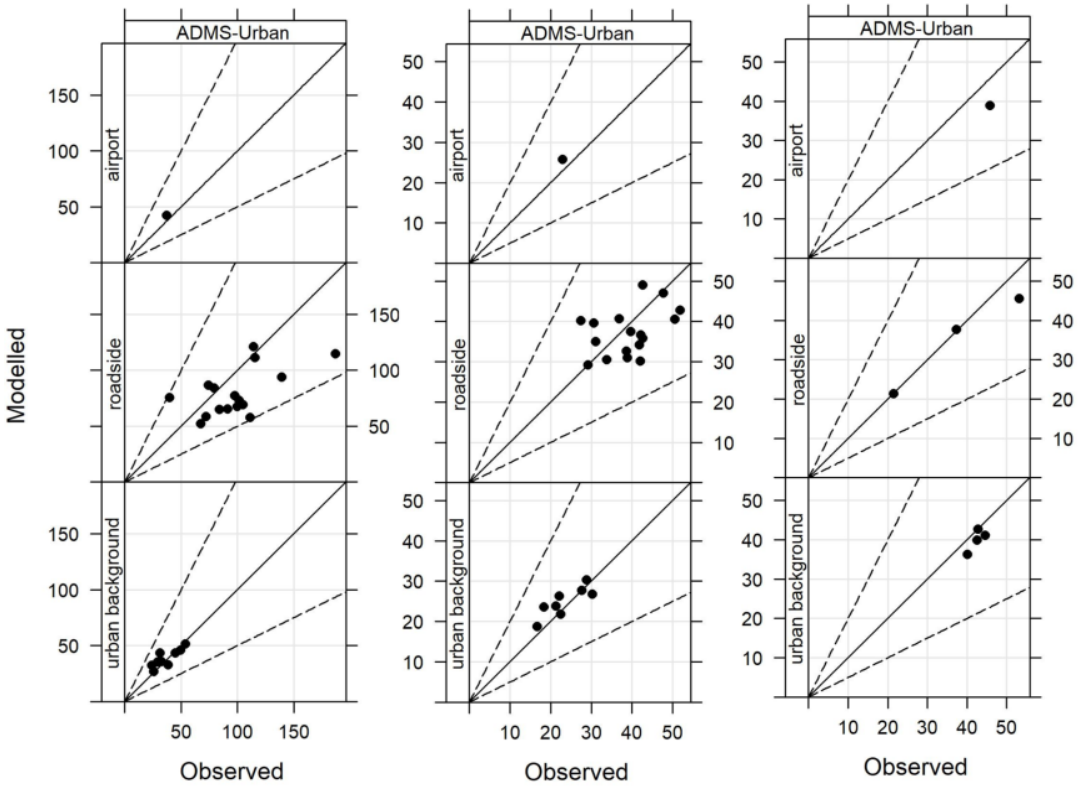
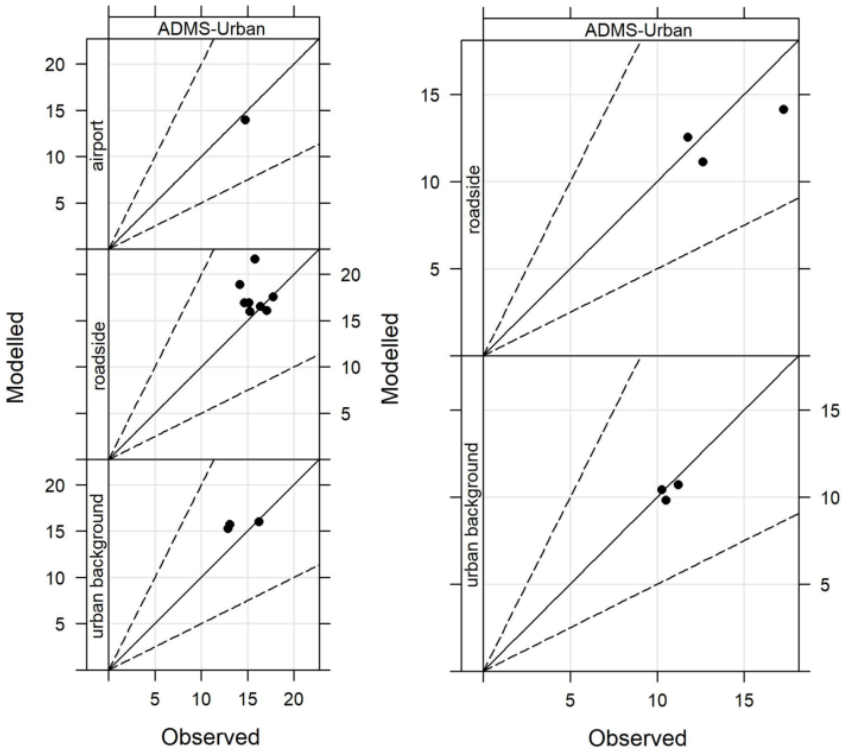


Figure B3: Annual averages for (a) NO_x (in µg m^{-3}), (b) NO_2 (in µg m^{-3}) and (c) O_3 (in µg m^{-3}).

2) PM_{10} and $PM_{2.5}$

Figure A4 shows the evaluation of modelled annual average PM_{10} and $PM_{2.5}$ against observations using scatter plots divided by site types; note that there were no $PM_{2.5}$ measurements at the single airport site. PM_{10} had a very good fit for the airport and urban background sites. PM_{10} tended to slightly over-predict at roadside sites, possibly related to uncertainties in traffic non-exhaust emissions and background data. The model had good predictions for the small number of sites with available $PM_{2.5}$ measurement data.



(**a**) (**b**)

Figure B4: Annual averages for (a) PM_{10} (in µg m^{-3}) and (b) $PM_{2.5}$ (in µg m^{-3}).

A7 Modelling output

For the generation of air quality maps, the model was then run in a "Contour" Mode (with the splitting option activated) to include output points covering the whole WM (and extending up to 1 km outside the WM boundary). An array job with 540 cores, each for a single sub-domain as shown in Figure 2, was submitted to the HPC at the University of Birmingham using the Linux version of the ADMS-Urban model. The overall elapsed time for the run (determined by the slowest core of 540 cores) for the typical whole year 2016 baseline case is about 35 h.

The output for each subdomain was in netcdf file format, which has been combined and interpolated using the CombineCOF and AddInterpIGP utilities developed by CERC. The re-combination and interpolation time was about 1 hour. The recombined and inter-polated outputs for the hourly output of the whole year over WM region contained ~0.61 million and ~1.26 million output locations and had file sizes of about 120 GB and 247 GB, respectively. The hourly output in netcdf format can then be used to derive the annual averages and other statistics, ready for the generation of maps using ArcGIS. The outputted pollutants are NO_x, NO_2, O_3, PM_{10} and $PM_{2.5}$. The air quality maps can be in 10m x 10 m resolution. An example of annual NO_2 concentrations over WM is shown in Figure A5.

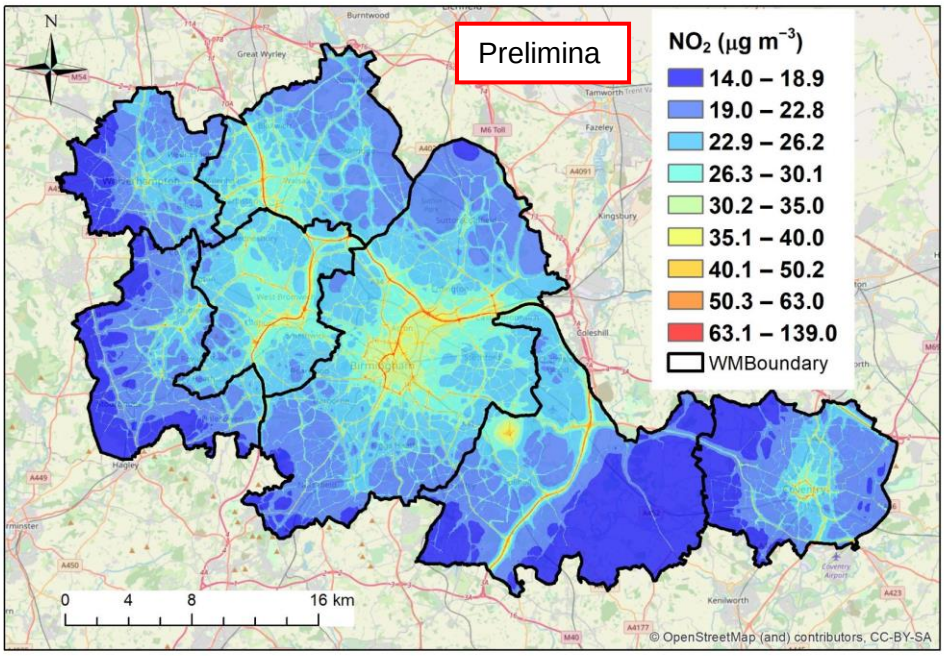


Figure B5: Annual NO_2 (in µg m^{-3}) maps for 2016 over WM.

Appendix C: Background Note; Modelling Financial Contributions of Households Towards the Cost of Whole House Retrofitting.

In order to make the financial model work for an extended net zero programme it is likely that some form of contribution from householders will be needed. This should be able to be offset against significantly reduced energy demand as a result of retrofitting works. At present the means by which such a cost recovery might be achieved is not straightforward and as part of the work around this bid consideration has been given to the issues.

Energy supply is evolving and there are some new approaches which apply across all tenures which is worth setting out as a starting point by way of background. Traditionally energy (whether electricity or gas) has been supplied by an energy supply company and is paid for based upon a combination of metered usage and a standing charge. Sometimes there is a third party between the energy supply company and the end user such as a landlord of a shared property or a landlord who maintains common parts of a building. Heat networks have introduced a further such relationship with a supplier drawing upon and supplying heat from already converted energy.

For the vast majority of household's energy supplies will sit alongside other utilities together with direct housing costs, either rent or mortgage payments, and property based taxes as their main property related expenses. An extensive housing retrofitting programme may introduce a further aspect to property related costs which would arise out of the expenses of a significant energy demand reduction being created. Payment to reflect those works may need to sit amongst the other property related expenses in one way or another.

There are two particular tenure wide approaches to energy supply and consumption that should be noted.

Heat Metering

Although heat networks remain a relatively small part of the UKs heating provision they are growing and are also seen as part of the future. Since 2014 the Government have regulated the provision and charging as part of those and all consumers should have been provided with individual meters and separate consumption bills by 31 December 2016. Apart from the fact that the service supplied is heat rather than fuel that may be converted to heat, the operation of heat metering is essentially similar to energy supply contracts. The regulations surrounding heat metering are very much geared towards measurement of and payment for a service that changes the space temperature (up or down) or heats water. It would not cover a 'warmth' payment.

Power Purchase Agreements

PPAs allow the purchase of energy from a provider outside of the typical domestic supply relationship. PPAs are more common in commercial settings with large generators entering into an agreement with a large energy user to supply an amount of electricity. This may entail the installation, maintenance and ownership of solar panels on the roof of the end user and I expect that there is a power purchase agreement behind the relationship between Pioneer Group and Birmingham Community Energy.

In a domestic setting the (troubled) Stoke on Trent Community Energy Scheme appears to have had a power purchase type agreement with the tenants upon whose homes solar

panels have been installed. Whether this was covered by PPA rules or some other regulatory framework is not known although efforts are continuing to obtain further detail of the scheme. What has been shown is that there is a difficulty (similar to the one below) where solar panels are installed on a council property which is either already vacant or becomes vacant. In Stoke, a prospective tenant would have to agree to enter into a contract with CES or be ineligible for the property. They would not lose any 'housing points' or other housing entitlement as a result but in a housing system where there is a very limited supply of good quality public sector accommodation, the pressure to enter into an agreement would be substantial.

Beyond the tenure wide approaches there are specific issues in relation to each type of tenure.

Social Housing Tenants

Social housing tenancies are more homogenous than owner occupiers and tenants in the private rented sector. That is not to say that there is not a broad diversity within the socially rented sector but due to the fact that entry to the sector is limited, or even rationed, unlike the other two sectors social housing tenancies share a number of characteristics which make it easier to consider approaches that may be taken to address the retrofitting cost challenge.

There are a number of aspects to social housing tenants finances and these are considered below as to how they may affect the ability to address issues within the context of retrofitting.

Service Charges

On a basic level service charges are simply one element of a contract between two parties which they are free to agree in any way they choose. Whether something is called 'rent', 'service charge' or some other description is nobody's business save the contracting parties. In reality the law of property is heavily regulated and 'rent' and 'service charge' have taken on a significant meaning. Even if that is the case it is important to appreciate that, on one level, a landlord and a tenant can agree whatever contractual arrangement they wish.

Service charges do perform a specific role with the laws and regulation around property. In particular where there is a mix of exclusive possession and communal areas it allows a charge to be made to a group of tenants that shares the cost of shared services being provided. Given the potential for service charges to be a significant source of disagreement or even to be exploited as a way of extracting additional funds out of tenants, a number of rules have been enacted which for the most part give an unhappy tenant the right to seek redress.

A service charge, to be upheld at law therefore has to be:

- Authorised by the contract.
- A variable (not fixed) charge.
- Applicable to a dwelling.
- Connected to services, the cost of which is reasonably incurred and which are carried out to a reasonable standard.

It should be noted that there are many examples of 'fixed' service charges but for the purposes of the rules around service charges these are not strictly service charges in the legal sense. Tenants who are unhappy about the level of a service charge can challenge the

same at the Residential Property Tribunal. This is not a straightforward procedure and is not a well trodden path. We would assume that most, if not all, social landlord tenancies incorporate a right to recover service charges. If any work was to be undertaken that might prompt a significant increase in service charge payments there would be an obligation on the landlord to consult tenants first. Although that would not amount to a right to veto the suggested work the landlord would have to take into account the consultation and act in a reasonable way as per the usual requirements of a public body.

From the point of view of whether the cost of retrofitting could be covered as part of a service charge by the landlord (or lessor) the greatest barrier would be whether the cost could be said to be reasonably incurred. Although it is widely held that action needs to be taken on climate change it would be difficult to argue that whole house retrofitting properties at the expense of tenants is a reasonable step when this is far from commonplace at the present time. The burden of proof for establishing 'reasonableness' lies with the landlord.

Housing Benefit

Housing benefit regulations include most service charge payments made by a landlord but exclude payment for 'fuel' unless it relates to communal areas, for example electricity to light stairs and landings. Housing benefit covers any payment which is a condition of occupying a property unless it is an 'excluded' service charge. Charges that relate to a person's 'daily living expenses' are specifically excluded in addition to a specific exclusion of fuel costs. It is therefore likely that 'heat' or 'warmth' charges are likely to fall within this exclusion. What would fall within the ambit of the regulations is any increase in the value of the property and therefore an increase in its rental value arising out of retrofitting works. Issues around rent increases are considered below.

Heat Charge (The so called Energiesprong Model)

The Energiesprong model effectively replaces a payment for energy consumption for a payment reflecting the reduced energy cost through retrofitted insulation. There does not appear to be any formal regulation or requirement in relation to such a charge and we would anticipate that it is a simple contract between the tenant and landlord which is either incorporated into a new tenancy agreement or as a separate agreement.

There are a number of challenges that arise around this type of model. Firstly, in the event of non-payment would the warmth charge be included as part of the 'rent' payable giving rise to a right on the part of the landlord to seek possession. From a tenant's point of view given the current backdrop of the cost of living crisis, this would be of concern. Equally from a landlord's point of view, the absence of such an entitlement to seek possession could make the recovery of the payments problematic.

It is likely that the warmth charge would not be able to be formally incorporated into social housing rents given the limits placed on such rents and the links to the wider market rates. Therefore it is likely that a warmth charge would have to sit outside the rent payment and recovery would be a problem. A further problem would be that each new tenant would need to agree the separate or parallel contact for the warmth charge and this could conflict with the registered providers duties in relation to homelessness (see below).

A further complication would be for those tenants who have had the benefit of retrofitting and are paying a warmth charge who then exercise the right to buy. Whilst a separate contract relating to the warmth charge could continue without any difficult following a right to buy sale,

if the property was then sold again it would either be necessary for the new homeowner to accept an assignment of the warmth charge contract or the former tenant would continue to be liable. This could give rise to a complicated legal situation and could include, say, the landlord having a right to refuse to transfer the agreement to a potential purchaser whom they did not deem to be creditworthy.

New Tenants – can you impose an additional charge or contract?

Housing associations have a duty to cooperate with a local authority in the discharge of its duty towards homeless people. It is a mandatory duty "to the extent that it is reasonable in the circumstance". In a situation whereby there is a side agreement between a housing association and a tenant in relation to a property that has benefitted from retrofitting which subsequently becomes available to a homeless nomination there is a potential problem as to whether the housing association can either insist upon the tenant entering into a 'warmth charge' agreement or withhold the property.

Whether doing so would be reasonable in the circumstance would need to take into account the need for the housing association to operate a scheme which could bring down the carbon footprint of its housing stock against the needs of the homeless person or family. There is the wider societal backdrop of there being a housing crisis with very little suitable accommodation for homeless people. In a situation whereby it might be one, or a handful of properties, it is possible although by no means inevitable, that a housing association could argue it was reasonable to restrict the property to someone who would be willing to enter into a warmth charge agreement. If a point was reached where there were many such properties within its stock (and even perhaps where there was an approach taken whereby any vacant property was retrofitted in a similar approach to the Stoke Community Energy Scheme) then it would be hard to persuade a Court that it was reasonable to restrict access only to those who were prepared to pay a warmth charge. Ultimately it could lead to social housing providers to be said to be providing a two tier housing offer.

The only way that this probably could be avoided is if a warmth charge was something that was supported by legislation, regulation or some other form of formalisation. It is notable, for example, that the Dutch Government has enacted an ability to increase rent following an appropriate level of retrofitting which is considered further in the next section.

Rent

At present there are limitations on how far social landlords might be able to increase rents where retrofitting work has been carried out. Most properties will be covered by 'social rent' restrictions which is a formula that combines national rental levels, local property values, local income levels and the number of bedrooms. Each year there is the potential to increase the rent by an agreed amount (currently 1% above CPI). Some properties which have been built recently will be covered by 'affordable rent' restrictions which are more flexible and allow a charge of 80% of market rents. It is possible to convert properties from social rent to affordable rent with agreement of Homes England, the Greater London Authority or the Secretary of State. Conversion from social to affordable rent may offer some scope for reflecting the dramatic reduction in energy costs brought about by retrofitting.

In the West Midlands the current difference between social rents and affordable rents is approximately £30 per week in local authority housing and £26.93 per week in housing association properties. If, as a result of a whole house retrofitting, it was possible to convert a property from a social to an affordable rent this could generate significant additional

income to landlords who bear the cost of retrofitting works. It is estimated that a whole house retrofit could reduce the cost of energy from £1,800 to £386, a saving of £27.19 per week. This suggests that it is possible to justify some or all of that saving being applied to the rent charged to the property. One possible difficulty with this approach is that it would increase the housing benefit bill as the increased rent would be covered by the Housing Benefit Regulations.

It is possible at the moment to apply to the Social Housing Regulator for exemption from the Rent Standard which governs social rental payments. At present this is limited to circumstances where, not to apply an exemption and allow higher rental charges, would place the housing association at risk of financial non-viability. It could be that as a policy decision Government might extend the circumstances where exemptions might apply.

It is therefore the case that what appears to be the favoured solution at the moment of many retrofitting models of a 'warmth charge' is a possible solution but on a large scale will need consideration to be given to its operation. A more straightforward solution is to seek the co-operation of the relevant authorities to reflect the significant enhancement of properties that are subject to whole house retrofitting by moving them from social rent status to affordable rent status.

Owner Occupiers

Few home owners would be ready and able to fund a whole house retrofit solution which costs in the region of £50,000. This is even more the case where those home-owners are living in properties that were formerly rented social housing both due to the relative value of the properties in question and the likely financial resources available to the individuals in question. It is reasonable to assume that virtually none of this cohort of householders will be able to fund such work from their own savings or income. It is therefore the case that the options are either that grant funding is made available, arrangements are made for homeowners to borrow funds to undertake the work or a mix of both approaches.

On the basis that grant funding will largely be determined by government of whatever level, the alternative option of self-funding supported by borrowing will be considered here. Borrowing can be secured or unsecured – either backed by a legal charge on a property or not. Secured borrowing tends to be cheaper because the potential of default by the borrower is much less but it is dependent on the latter having an asset to which a legal charge can be applied. Where a person is already borrowing more than the value of their home – in negative equity – applying a legal charge is largely meaningless. There is much less negative equity than had occurred during the 1990s but it remains an issue and there will be many householders who do not have a full £50,000 of equity available on their property.

Assuming that there is equity available in a property there are a number of possible approaches:

1. Traditional (second) mortgage. It is possible to simply borrow the full sum required to fund the retrofitting and for the householder to pay the mortgage in the traditional way of gradually repaying the sum borrowed plus interest. A £50,000 mortgage over a period of 25 years at an interest rate of 3.9% (a typical current rate) would be repayable at £261 per month or £60 per week. That compares to the assessed savings on energy payments of approximately £27 per week and is unlikely to be attractive to a home-owner.

2. There is relatively little data that sets out the increase in the value of a property of a whole house retrofit approach. It is inevitable that a quality retrofitting that dramatically reduces the energy requirements of a property is likely to see an uplift in the value of a property. Given the pressure on living costs at the moment and for at least the immediately foreseeable future, it is unlikely that we would be able to persuade large numbers of owner occupiers that an increase in payments of £33 per week in their household expenses is worth the potential of realising the increased value of their home at some point in the future.

3. An alternative approach could be to take an 'equity release' approach. This is a commonly used approach by people who are looking to increase their available cash later in life when they may have wholly or largely cleared a mortgage on their home. A charge would be placed upon the property to cover the cost of the retrofitting but for the duration of the occupier's ownership of the property no principal lending would be repaid.

4. There is a consideration as to whether there would be payments, akin to the 'warmth charge' that would be added to the rent (or paid separately) of social housing tenants or whether there would be no ongoing payment. The difference in the two situations is that in social housing, tenants in receipt of housing benefit would not be affected by the increase in rent payments. There is a further issue, which in part would be related to whether a 'warmth charge' was paid as to whether the sum secured by a charge on the property would accrue interest. Not to do so would entail a cost to the operator of the retrofitting scheme as they would have to bear the cost of the borrowing. To have a situation whereby interest did accrue on the principal sum borrowed without any payment of interest it could be that at the point the sum is redeemed on the sale or disposal of the property the amount would be substantial. Over a 20 year period, £50,000 would grow by £24,500 at 2% APR and due to the nature of compound interest by £61,000 at 4% APR.

5. The intention would be that at the point at which the property is sold, the sum charged to the property would be redeemed. This would allow the gradual recovery, which is likely to be predictable, of the amount spent over a period of years. There are a number of considerations to this. Firstly, it may have the effect of recuing the mobility of home owners who will have seen a significant reduction in the equity in the property which might otherwise allow them to move up the housing ladder, relocate for reasons of employment, family growth or to manage caring responsibilities of, say, elderly relatives. Family growth could be partly addressed if a roof cassette solution allowed a property's roof space to be converted.

6. Many property disposals are not by way of sale. Inheritance of a property involves an assignment of property and this can also be the solution in cases of relationship breakdown. Where a property is transferred in this situation and the new (or residual) owner decides to dispose of the property to realise the value, no particular problem arises. They will hopefully benefit from the elevated value of the property by virtue of the retrofitting works and the charged sum can be repaid. If there is an intention to live in the property then either there would be a requirement for the new owner to raise the capital sum repayable or there would be a need to continue or renew the agreement with the former owner.

7. It would not be particularly onerous to have an approach that allowed home owners to chose and even switch between options in terms of making some payments akin to a warmth charge, allow interest to accrue on the sum charged to the property or a mix of the two. A particular problem for homeowners is the role of a mortgagor – the bank, building society or financial institution that provides a mortgage for the purchase of the property. Mortgagors have the right to refuse a second charge which is what, typically, a retrofitting charge would represent. There should be less challenges in this regard, particularly if a careful and considered approach is taken with prior engagement with mortgage lenders. The work should enhance the value of the property (and the mortgagor will need to consent to the work in any event), improving the insulation of the property will have a positive impact on the home owner reducing the prospect of defaulting on repayments and as a prior charge, the mortgagor will not have to share any sale proceeds with the second lender. None of this would apply to properties on which there is no current mortgage.

8. There is an option for the installation of solar panels and a battery system to home owners' properties with the energy generated being retained by the retrofitting scheme administration or other third party as a means of funding in whole or part the cost of retrofitting. This would amount to a 'rent a roof' scheme that has been seen as a less than perfect solution to renewal energy approaches. A particular problem is the hesitancy of mortgagors to agree to the side contract with the PV provider which may complicate the potential to sell the property and affect its value. Although the schemes persist, they have become less attractive to home owners with the closure of the feed in tariff scheme.

9. The idea is that by creating some form of energy co-operative, the potential energy generation derived from the home owner's roof space could be aggregated with others and sold into the wider energy market. The amount of energy generated and the potential revenue raised as a result will depend upon a number of factors on a property by property basis. The space available to accommodate solar panels, the orientation of that roof space and the degree of shading will affect the amount of energy to be generated.

10. The amount of revenue which might be raised is dependent upon the grid export price which is particularly hard to predict at the moment. One calculation could be that a 5kW array might generate, say, 3,994 kWh annually. At 35p per kWh a gross annual revenue of £1,397.90 would be raised. At 15p per kWh only £599.10 would be recovered. Therefore the grid export price will be critical to the effectiveness of this type of model.

11. One way of addressing the hesitancy of the lending community could be to require the 'debt' which the retrofitting has created to be repaid upon the sale or disposal of the property with the ownership of the PV and battery system being passed to the homeowner as part of the transfer. Similar issues will arise as above in relation to what is done in a situation of a non-sale transfer of the property (inheritance or relationship breakdown) which will need to be addressed. Although the same approaches can be taken as suggested above, there will be an added complication of needing to satisfy a lender that the proposal is appropriate.

12. As before, it is possible that a ‘rent a roof’ approach could form part of a mix of solutions to home owners meeting the cost of retrofitting and enable a scheme to be operated that also is practical from a public policy point of view.

The Private Rented Sector

The private rented sector (PRS) provides harder challenges in terms of retrofitting than either social rented housing or owner occupiers. There is a particular issue in that reducing demand and generating electricity via PV and battery systems benefits tenants but would need to be funded, at least in the first instance, by landlords. The PRS matters however as it is now the second largest sector accommodating 4.4 million or 19% of households in 2020-21 making it larger than the social housing sector. Unlike the latter sector, the PRS is very diverse with everything from high end rental properties to HMOs and shared accommodation. In some, limited, PRS properties whole house retrofitting will be attractive. For the most part, there is little immediate incentive for landlords to pursue retrofitting.

The Energy Efficiency (Private Rented Property (England and Wales) Regulations 2015 introduced a prohibition on the new (i.e. first time or change of tenant) rental of properties with an EPC rating of less than E and from 2023 it will apply to all PRS tenancies. Whilst this does not reflect a particularly high standard, it has been a first step in driving improvement in the PRS. The Government have indicated an intention to raise the standard to a minimum of EPC B by 2030. How an EPC rating of B might be achieved will vary from property to property but it is quite possible to reach such a rating without an extensive, whole house, retrofitting. Therefore whilst the Government have recognised that the PRS is an area where there needs to be regulation and intervention it has also been clear to date that the nature of the compulsion applied to the sector will not for the foreseeable future require a net zero approach.

One possible legislative change that could affect the situation to some degree is the proposal by the Government to end ‘no fault’ eviction which allowed landlords to require tenants to leave a property without any cause after an initial fixed period of as little as six months. Giving tenants security of tenure may increase their leverage in terms of the quality of rented properties but it remains unlikely that this will go as far as prompting whole house retrofitting.

There is an option for landlords to participate in rent a roof type approaches that are referenced in relation to owner occupiers. Ultimately it is already open for landlords to utilise their roof space for PV to generate revenue. At present the low levels of return from the smart export guarantee scheme do not make this attractive but if a landlord was able to participate in an energy collective that may change. Ultimate the aim of a retrofitting project would be to encourage landlords to convert PRS properties to a ‘net zero’ standard and not simply to install PV and battery systems whether for their benefit or those of tenants. Consideration would need to be given therefore whether some form of link could be created between installation of PV and batteries and wider retrofitting measures in a way that was compelling to private landlords.

Provided that there is not reliance of housing benefit to pay rent for tenants, there is not the same restriction on rent levels as might exist in relation to social housing. Essentially the free market operates in the PRS but local authorities will only pay a percentage of local market rents in housing benefit. Changes in approach that would allow higher percentages to be

paid for retrofitted properties would certainly add a layer of incentive but would face a challenge of being seen to be using public money to enrich private individuals.

The PRS which is not largely reliant on housing benefit payments could use the potential to increase rents as a means of funding retrofitting. The difficulty is that the repayment period for any investment in retrofitting is considerable and few landlords would want to wait for a period of 20, 30 or 40 years to see a positive return on investment. It might be possible to take a similar approach to owner occupiers where, in exchange for extensive retrofitting of a property, a charge is taken to reflect the investment made and a 'warmth charge' is added to the rent of the tenant but payable to the retrofitting scheme, reflecting the dramatic savings in energy costs. This could be combined with a PV and battery system which forms part of an energy collective. As with owner occupiers consideration will need to be given as to whether the charge on the property would accrue interest or not. Given that landlords may see property as a relatively long term investment, interest being accrued without being covered by payments would see significant value being lost by the landlord.

Retrofitting the private rented sector, in the absence of regulatory intervention, has its challenges but is not impossible. The next step may be to look at possible models of return on investment and cost to tenant, landlord and retrofitting schemes together with testing the appetite for this type of approach amongst the PRS.

Appendix D: Retrofit Action Plan

Retrofit Action Plan – Financial Modelling and Short Report (two attached)

Appendix D Retrofit Action Plan - Short Re

Appendix D Retrofit Activities - Financial M

These documents have been prepared by RED Co-operative Ltd to give an estimated price for a house deep retrofit.

Appendix E: Short Term Retrofit Programme for Social Housing

Short Term Retrofit Programme for Social Housing (attached)

Appendix E Short Term Retrofit Progran

This spreadsheet models how a community energy collective with affordable rents could pay back an initial capital investment on the social housing homes owned by Pioneer when they scale up the demonstrator to cover more homes in the area.

The model makes certain assumptions about borrowing rates and affordable rents which will need further testing as part of the business planning process in the first 6 months.

It does indicate that the model is feasible and give confidence to Pioneer that a larger roll out is achievable financially.

Appendix F: Gantt Chart

Castle Vale NZN Gantt Chart (attached)

Appendix F Castle Vale NZN Gantt Chart

This chart shows the delivery plan for the NZN for the first 18 months of the project. After this point it is expected that Pioneer and the East Birmingham Programme Board will be able to roll out the project to the other houses in the area and maintain the transport and green infrastructure projects by mainstreaming them or identifying other sources of funding for them.

Appendix G:

CV Parks Proposals - Fair Standard - Castle

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Urban Design for Air Quality

Urban Design for Air Quality: Urban design influences where air pollution is produced, how it disperses through streets and neighbourhoods, and where, when, and how much people are exposed. Good urban design improves air quality. This design charter from WM-AIR and BIFOR (UoB) sets out the principals for designing for improved air quality:

http://epapers.bham.ac.uk/3493/1/WM-Air_Design_Charter.pdf

Ferranti, EJS., Acton, WJF., Lindop, A., Wolstencroft, M., Han, U.P., Levine, J.G., MacKenzie, AR., Grayson, N. 2021. Urban Design for Air Quality. A Design Charter produced by the WM-Air Project, University of Birmingham. Funding provided by NERC Innovation grant NE/S003487/1. https://doi.org/10.25500/epapers.bham.00003493

First Steps in Urban Air Quality for Built Environment Practitioners: Air pollution is the biggest environmental risk to health. Globally, nine out of ten people live in a city that does not comply with WHO air quality standards. Within the UK, poor outdoor air quality is linked to 50,000 deaths each year. The most vulnerable are children, the elderly, or those with pre-existing medical conditions. The design of our urban infrastructure – including Green Infrastructure (GI) such as trees, parks, and green walls – determines where air pollution is produced, and how it disperses. Urban GI can also create environments that are conducive to a greater uptake of walking and cycling, thereby helping to reducing the amount of road transport pollution. Built environment professionals should consider air quality at all stages of urban design and development.

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