



A vision for a net zero neighbourhood



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1. Introduction

The West Midlands Combined Authority (WMCA) aims to reduce carbon emissions in the West Midlands to achieve an ambition that the region should be carbon neutral by 2041. It is driven by the need for a fair and just transition for residents and businesses. The Net Zero Neighbourhoods programme aims to create a holistic approach to neighbourhood-scale transition, focussing on issues such as housing retrofit, low carbon travel, green space interventions and local, low carbon electricity generation.

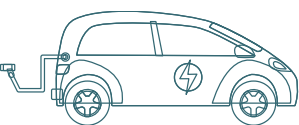
Birmingham City Council (BCC) aspires to reach net zero by 2030 ensuring a just transition without disadvantaging any of residents, workers or visitors. The Council's Corporate Plan 2025–2028 provides the following strategic drivers:

- Everyone benefits
- Reduced carbon emissions
- Cleaner air
- Greener city prepared for climate change

BCC, together with project partners SHAP (Sustainable Housing Action Partnership), Places in Common, Red Co-operative and University of Birmingham, has been developing a pathway for a Net Zero Neighbourhood in Castle Vale funded through the Local Net Zero Accelerator Programme. This brings together a series of technical data inputs alongside a communications-led and deep engagement approach to combine technical feasibility with options supported by the Castle Vale community and stakeholders.

The additional technical data was provided by external experts: Graham Oakes provided the Technoeconomic Study and Scene developed the regulatory and technical basis for the solar co-operative model.

This report sets out the approach taken (from June 2025–September 2026), what the work has demonstrated, what has been learned and the recommended next steps.



2. Castle Vale: the context

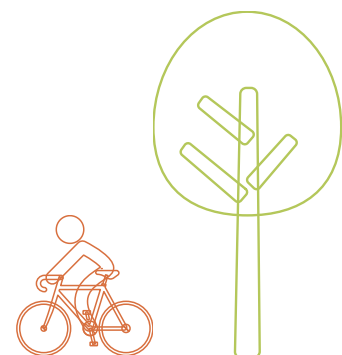
Castle Vale is located in the east of Birmingham close to the border with Solihull, and just north of the M6 between Spaghetti Junction and the M42. Geographically isolated, it was built in the 1960s, with residents typically relocated there from inner city slum clearance areas in Birmingham. It comprised 5,000 homes of which 2,000 were high rise flats, making it, at the time, the Midlands' largest tower block estate. Although initially seen as a pleasant and welcoming new place to live, the estate deteriorated. By the late 1970s it was 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 selected as the location of the first Housing Action Trust in the city.

In 1993, 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 broader regeneration approach. New community facilities and a shopping centre were provided, generating significant training and employment opportunities for local people.

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. This holistic community regeneration programme not only transformed Castle Vale's housing stock but also changed in the perception of the area with Castle Vale being seen as one of the safest and cleanest neighbourhoods in Birmingham.

However, by the 2020s, 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 such as Castle Vale more vulnerable to adverse economic impacts. Despite the improvements in Castle Vale, the area still scores poorly across a number of deprivation indicators. It is the 14th most deprived ward in Birmingham and ranks highest in the city for health deprivation and disability indicators.

Castle Vale was selected as the Net Zero Neighbourhood area in Birmingham partly due to the deprivation indicators and poor Environmental Justice score, but also due to its resilience and ability to deliver community-led improvements in the past. The project built on the approach and successes of local organisations including Pioneer Group (formerly Castle Vale Community Housing Association), Spitfire Services and YoungStars. It also built on relationships that were developed during engagement work for a feasibility study for the project in 2022 including the local ward councillor.



3. Our strategic approach

The transition to net zero is often presented as though it is predominantly an engineering problem: improve buildings, change heating systems, generate renewable energy, improve transport and find the investment required to pay for it. These all matter but they operate within a much more complicated system of homes, institutions, markets, regulations, and people's lives.

The project team aimed to develop a feasible and ambitious pathway towards net zero while recognising that technical, financial and institutional conditions will continue to change, while ensuring residents have genuine agency in shaping what that pathway looks like for Castle Vale.

The project team was acutely aware that despite not being primarily responsible for causing climate change, the least well off will be required to bear a substantial proportion of the cost of addressing it. This could lead to an increase in levels of inequality through any transition to net zero which has already made it a wedge issue that polarises opinion and public participation. Previous transitions have shown that change does not automatically distribute its benefits fairly; economic value can move elsewhere while environmental and social costs remain.

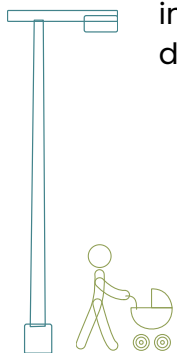
Building a clearer consensus for a just transition required an approach that started with people's day-to-day priorities rather than expecting them to prioritise longer-term ambitions that might feel disconnected from their lives.

The project team chose to work as a community of practice creating a space in which they and practitioners could share knowledge, challenge assumptions and work across organisational boundaries. Cognisant of this, the team agreed (and refined during the project) a set of principles to guide the work, ensuring the approach remained rooted in Castle Vale, responsive to local priorities and focused on creating benefits that could be shared across the community.

1. Shape change with the whole community: create meaningful opportunities for everyone to take part, drawing on lived experience and local knowledge to shape the work. Understand the realities of the place first-hand and be willing to test assumptions.

2. Make communication rooted in place: make the work look, feel and sound like it belongs to Castle Vale, reflecting what matters to local people and helping them recognise it, connect with it and get involved.

3. Bring different interests together around shared goals: bring tensions, conflicts of interest and competing priorities into the open. Find common ground and a shared direction that people and organisations can work towards together.

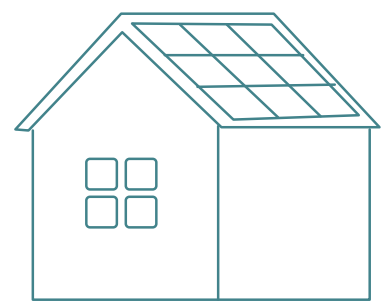
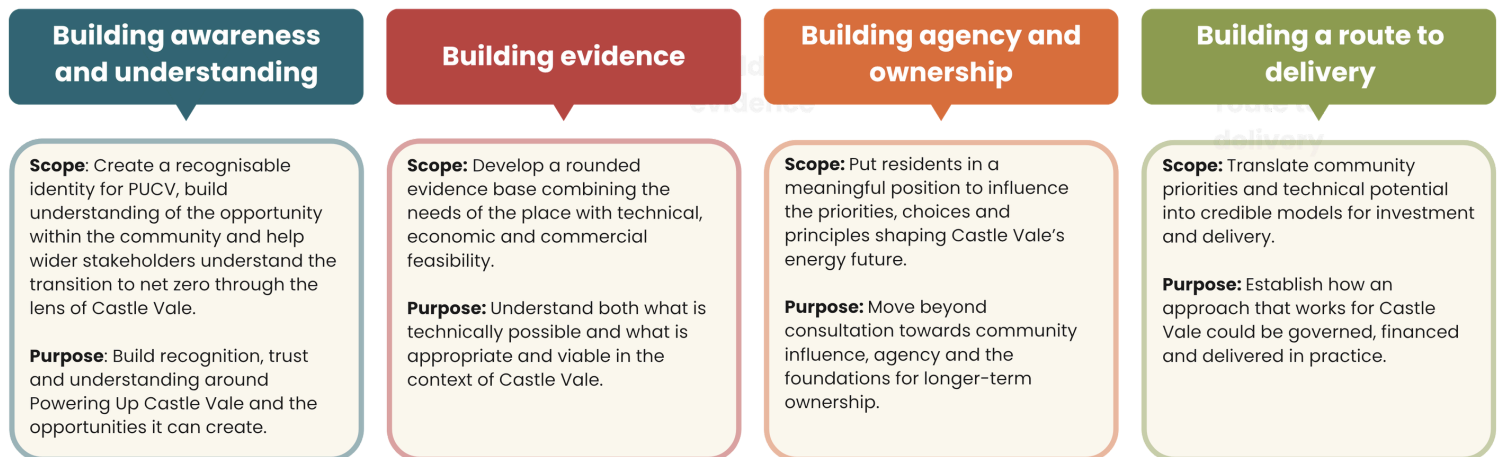


4. Build on community assets and create shared ownership: recognise and draw on the people, knowledge, skills, relationships and assets within the community. Build collective capacity, shared ownership and accountability for the way this work evolves.

5. Make sure the benefits are shared and stay local: ensure everyone can benefit, regardless of their circumstances or housing tenure, and that no one is disadvantaged through net zero. Keep value within the community wherever possible, reducing inequality and investing benefits back into the area.

6. Build in honest reflection and learning: reflect honestly on the work and approach, recognising what works, what doesn't and what remains uncertain. Share that learning openly so it can strengthen the work and inform others who may build on it.

These principles informed the strategic approach taken throughout PUCV. While activities often ran concurrently and informed one another, the approach centred on four interconnected areas:



3.1 Building awareness and understanding

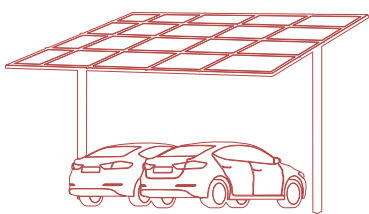
Communications played a pivotal role in PUCV, laying the foundations for community engagement and participation and helping build momentum as the work developed. Rather than simply communicating activity, the approach was built around dialogue, drawing on knowledge from within the Castle Vale community throughout the project. The approach had three objectives: to make the work visible and credible; enable participation and ownership; and build the case for a compelling, investible proposition.

This began with creating a distinct Powering Up Castle Vale identity. Rather than leading with the language of 'net zero', the name deliberately worked on two levels: reflecting the opportunity to generate more power locally, while also signalling greater community power and agency. Hyper-local imagery and accessible language helped make the work recognisable, relevant and rooted in Castle Vale. An animated explainer provided a simple, visually engaging introduction to the programme, helping translate a complex set of ambitions into a clear story about what PUCV could mean for Castle Vale.

A dedicated website – attracting more than 3,000 unique visitors during this phase – provided a consistent destination for the work, supported by targeted Facebook and Instagram activity and highly visible local communications, from bus shelters to posters in community venues and cafés.

Crucially, communications provided clear routes from awareness into participation. People were invited to attend events, join the Citizens' Jury, take part in home energy assessments and contribute to shaping what happened next. Communications and engagement reinforced one another throughout: building familiarity and interest, creating opportunities to participate, and showing how people's involvement was helping shape the work as it developed.

In terms of broader industry stakeholders, an Urban Living Lab was established which assembled organisations delivering activities in Castle Vale, such as Pioneer Group (social housing provider owning 55% of the properties in Castle Vale), WMCA officers from the Local Net Zero Accelerator team, other BCC departments such as Transport and Environment, and local community organisations. The aim was not only to keep organisations informed about PUCV, but to identify opportunities to align their work with the programme's objectives. Four ULLs were held over the project.



3.2 Building evidence

The technical assessment elements of PUCV consisted of:

- 50 property assessments (delivered by Red Co-operative) to understand the energy efficiency of a sample of different property archetypes and the potential retrofit improvements required. This also included an occupancy assessment for residents and annual energy consumption collation.
- Analysis of IMD (Index of Multiple Deprivation) data across the six Lower Super Output Areas (LSOAs) areas (delivered by UoB) to determine the demographic, health, employment, energy infrastructure, transport and green infrastructure.
- 30 indoor air quality monitor installations (delivered by UoB, BCC and SHAP) to evaluate the quality of indoor air quality.

The core team's work was supplemented by additional technical activities from beyond the core team:

- Technoeconomic Study to explore the potential to establish a community-owned solar energy offer for Castle Vale, delivered by Graham Oakes Ltd and supported by Red Co-operative.
- Legal and commercial feasibility study for the development of a community solar model for Castle Vale, delivered by Scene.
- Feasibility study to determine the potential for a heat network in Castle Vale using heat recovered from the sewage treatment works in Minworth, delivered by Possible.
- Neighbourhood Rapid Adaptation Pathway Assessment to identify climate hazards and prioritise interventions based on vulnerability, delivered by WMCA as part of the WM-Adapt programme.
- Investment Case, delivered by Living Places.

3.3 Building agency and ownership

The primary approach for creating a sense of agency and ownership within Castle Vale was to create a dialogue with embedded organisations to build a narrative and case that was recognisable to the community. This included community events to create the foundations to build trust.

The establishment of a Citizens' Jury, made up of 12 residents representing the demographic population of Castle Vale, gave residents a structured role in understanding, questioning and helping shape emerging proposals. Five Citizens' Jury events were held during the project to allow preferred choices around decisions shaping the project to emerge from a representative sample of Castle Vale residents. The Citizens' Jury tackled some complex issues, such as how solar generation works



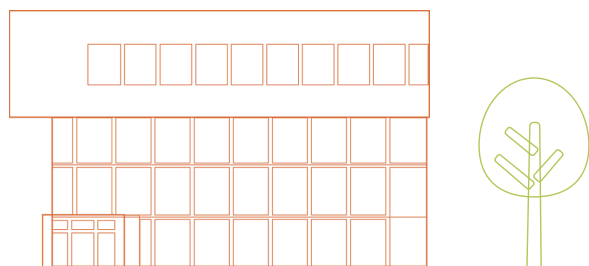
and could benefit Castle Vale, preferred models to manage a solar co-operative, communication approaches to the whole of Castle Vale and feedback on locations of ground-mounted solar panels.

3.4 Building a route to delivery

The route to decarbonising Castle Vale is complex, requires some changes in national regulations and legislation, and is expensive. Section 6 sets out proposed next steps, but delivering them will fundamentally require the local community and key stakeholders to be at the heart of driving, learning and shaping future activities.

As such, the plan of activities will start by combining the learning from technical assessments with governance needs to lock in the role of the community from the beginning. This will shape engagement, agency and control, with practical steps of prioritising improvements.

Alongside the development of governance models new approaches to funding decarbonisation will be required, some of which are currently being developed by WMCA. It will be important to test and understand these funding models with the same level of communication and engagement as has characterised the first phase of PUCV.



4. What we discovered

4.1 Place-based communications and engagement can build the conditions for participation, ownership and trust

The role of communications was vital for PUCV, to ensure residents and local organisations understood and engaged in all aspects of PUCV activities. The key learning from communications activities is outlined below.

Communications and engagement are most effective when designed as one connected approach

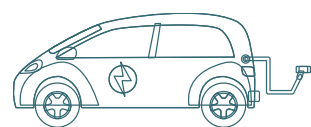
PUCV demonstrated the different but mutually reinforcing roles of each. Communications provided the breadth; building visibility, familiarity and understanding across the wider community, while creating opportunities to participate. Engagement provided the depth; surfacing lived experience and local priorities, exploring more complex issues and enabling residents to influence the work. Crucially, insights and images from engagement activities then informed ongoing communications, helping bring Powering Up Castle Vale to life for the wider community.

Communications need to be designed into a place-based programme from the outset

PUCV established its communications objectives at the outset: who the programme needed to reach, what different audiences needed to understand, why the work would matter to them and what communications needed to enable. This shaped decisions about the programme identity, narrative, communications channels and opportunities for participation. Communications became part of how the programme sought to achieve its objectives, rather than simply the means through which activity was promoted. For place-based programmes that depend on awareness, trust, participation and longer-term community support, communications should form part of programme design from the outset.

Place-based approaches need an identity that people can recognise as their own

PUCV deliberately created an identity rooted in Castle Vale rather than adopting the language and branding of a conventional net zero programme. Powering Up Castle Vale conveyed both the opportunity to generate energy locally and greater community power and agency, while hyper-local imagery created a strong visual connection with the place. This helped the programme establish recognition and familiarity in an environment where many different messages were being relayed to the community. A strong place-based identity helped shift the programme of work from something being done to a community to something recognisably about that community and its future, and engaging local, trusted organisations.



Relevance is critical

The project team agreed early on that the aim of the communications was not to increase residents' understanding of net zero, but to make the benefits associated with net zero meaningful in the context of what mattered to each target audience group. For residents and the community at large, communications focused on outcomes such as healthier and more comfortable homes, lower bills and benefits being retained locally. As engagement developed, the narrative also evolved to reflect what residents themselves identified as important, including jobs, skills and opportunities for future generations.

Build learning into the communications approach

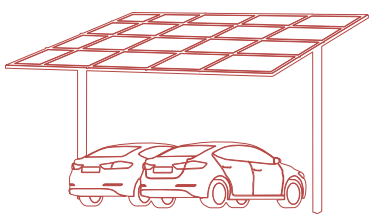
PUCV deliberately sought to understand how people were responding to communications as the work progressed. Website and social media analytics, trackable links and QR codes provided evidence of reach, interest and response, helping the team understand which activity was gaining traction and where people went next. This allowed the approach to evolve during delivery, rather than evaluating its effectiveness only at the end. For place-based programmes, building in this feedback from the outset creates an opportunity to continually test assumptions, understand what is resonating and direct effort towards the approaches that are proving most effective.

The PUCV data provides a useful picture of that response, from broad visibility through to active interest and participation. For example – over 400,000 Facebook views and 2,640 unique website visitors.

4.2 Understanding the needs and vulnerabilities of a place helps shape the right interventions

The baseline analysis of Index of Multiple Deprivation (IMD) indicators and other data sets provides a comprehensive socio-economic, environmental, housing, energy, and infrastructure profile of Castle Vale to support the development of a vision for a Net Zero Neighbourhood. It establishes a robust evidence base to inform future interventions, monitor progress, and ensure that the transition to net zero delivers social, economic, environmental, and health benefits for local residents.

Castle Vale comprises approximately 9,934 residents and 4,392 households across six LSOAs within the Castle Vale Ward. The area presents both significant challenges and substantial opportunities for place-based net zero delivery. While the neighbourhood experiences high levels of deprivation, poor health outcomes, and fuel poverty, it also benefits from strong community assets, some access to green space, established infrastructure, and a housing stock that offers considerable retrofit potential.



IMD data

Castle Vale experiences significant socio-economic deprivation, particularly in relation to health, employment, education, and income. Castle Vale is ranked:

- 14th most deprived ward in Birmingham (out of 69 wards).
- 1st for Health Deprivation and Disability.
- 3rd for Employment deprivation ranks in Birmingham.

Educational attainment and skills levels remain below city averages. Income deprivation and child poverty continue to affect many households.

Demographic data

Castle Vale has a distinctive demographic profile characterised by an older, less diverse, and more locally rooted population.

- Around 80% of residents identify as white, making the area less ethnically diverse than Birmingham overall.
- There are higher proportions of older residents, families, and single-person households.
- Household incomes and vehicle ownership are below Birmingham averages.
- Between 2011 and 2021, the area became more diverse, educated, and economically active.

Health problems and disability

Health outcomes represent one of the most significant challenges facing Castle Vale and have important implications for housing, energy, and net zero interventions.

- Poorer health outcomes than Birmingham overall.
- Higher prevalence of disability.
- Greater levels of long-term illness and health-related vulnerability.
- Increased demand for healthcare, social care, and accessible housing.
- Health inequalities are closely linked to deprivation and fuel poverty.

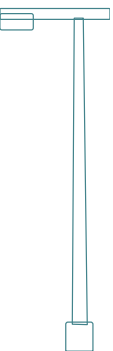
Employment

Castle Vale's labour market is characterised by lower-skilled occupations and higher levels of economic disadvantage.

- Higher levels of economic inactivity and labour market disadvantage.
- Strong concentration in manufacturing, logistics, retail, care, and service sectors.
- Lower representation in professional and managerial occupations.
- Greater reliance on workplace-based employment and local commuting.
- Significant opportunities exist to connect residents to green jobs and retrofit programmes that could emerge locally.

Housing and energy

Housing and energy conditions highlight both challenges and opportunities for net zero delivery.



- The housing stock is dominated by 1960s terraced homes and flats, with a renovation programme including new build housing delivered during 1990s.
- More than one in eight households are affected by fuel poverty.
- Domestic energy use remains heavily dependent on natural gas.
- Energy consumption and emissions are lower than Birmingham averages.
- Significant opportunities exist to improve energy efficiency, reduce emissions, and lower energy costs, utilising the possibilities offered by the Radburn layout of the estate.

Energy infrastructure

Castle Vale has a well-established electricity network, with 33 substations providing a strong foundation for future electrification and low-carbon technologies. However, the uptake of renewable energy technologies and EV infrastructure remains limited, creating significant opportunities for future investment.

Transport infrastructure

Residents are more likely to travel shorter distances to work, with higher levels of walking and cycling than the Birmingham average. Lower car ownership and strong bus usage suggest good potential for further promoting sustainable and active travel.

Green infrastructure

IMD data shows that Castle Vale benefits from good access to green spaces and generally favourable environmental conditions compared to many similarly deprived areas. These assets support health, wellbeing, climate resilience, and provide opportunities to enhance biodiversity and environmental quality.

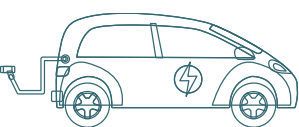
A greenspace survey showed that many residents access green space at least once a week during the summer. Most respondents were satisfied with the quality of green space but did raise concerns around safety that stopped them using more of the greenspace available. They were also concerned about the lack of shade and seating available.

Neighbourhood assets and community capital

Castle Vale has a strong network of community facilities, schools, recreational spaces, and local organisations that contribute to community cohesion. These assets provide an important foundation for resident engagement and will be critical in supporting a successful and inclusive transition to net zero.

Climate Risk and Vulnerability Assessment (CRVA)

The CRVA provides a place-based assessment of the potential impacts of climate change and the factors that influence communities' ability to prepare for, respond to, and recover from climate-related hazards. Unlike the IMD, which focuses on socio-economic disadvantage, the CRVA combines a range of environmental, physical and social indicators to assess exposure, sensitivity and adaptive capacity to climate risks. The assessment includes indicators such as socio-economic vulnerability, population density, flood risk, extreme heat, air quality, urban form and access to green infrastructure. Together, these indicators provide a comprehensive understanding of where climate hazards are most likely to occur, and which communities are most

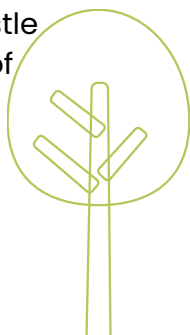


vulnerable to their impacts. The CRVA supports evidence-based decision-making by identifying neighbourhoods where targeted adaptation, resilience, and climate-mitigation interventions are likely to yield the greatest benefit.

The CRVA indicates that climate-related risks are widespread across Castle Vale, although the type and intensity of vulnerability varies between LSOAs. Four of the six LSOAs are classified as having Highest overall climate risk, while the remaining two are classified as High.

Across the assessment, fluvial flood risk, nitrogen dioxide (NO₂) and lack of tree canopy emerge as the most consistent challenges.

- Fluvial flood risk (overflowing rivers and streams) is classified as Highest in five LSOAs and High in the remaining LSOA, indicating that flood resilience is a neighbourhood-wide concern.
- NO₂ concentrations are classified as Highest in five LSOAs and High in one, highlighting the widespread influence of traffic-related air pollution.
- A lack of tree canopy is also identified as a significant issue, with five LSOAs classified as Highest and one as High, suggesting limited natural shading and reduced capacity to mitigate urban heat.
- Exposure to surface water flooding and high summer temperatures is also common across Castle Vale. Surface water flood risk is classified as Highest in three LSOAs, High in two and Medium in one, while average summer air temperatures are Highest in three LSOAs and High in the remaining three. These findings indicate that overheating and flooding are likely to become increasingly important climate risks.
- Fine particulate matter (PM_{2.5}) is rated Highest in one LSAO area (south of Castle Vale). Similarly, building form, height and density, together with the availability of green spaces vary across the LSOAs, reflecting differences in urban form and access to green infrastructure.
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Overall, the CRVA demonstrates that the dominant climate-related challenges across Castle Vale are flood risk, urban overheating, air pollution and limited urban greening. While the severity of individual indicators varies across LSOAs, these results highlight the importance of place-based adaptation measures that improve flood resilience, increase tree canopy and green infrastructure, mitigate urban heat, and enhance air quality.

Taken together, the IMD and CRVA demonstrate that effective climate adaptation requires consideration of both social vulnerability and environmental exposure. Focusing solely on deprivation risks overlooking communities with significant climate hazards, while considering climate risk alone may fail to identify populations with limited adaptive capacity. Integrating these assessments provides a more robust evidence base for place-based decision-making and supports the development of interventions that maximise environmental, health and socio-economic outcomes across Castle Vale.

4.3 Retrofit needs

Property assessments were carried out on 50 properties following an invitation to residents to receive an assessment. The properties were carefully selected to ensure that all age bands and all predominant property archetypes across the estate were represented in the study. Energy assessment software was used to generate Energy Performance Reports (EPR) on the 50 properties, allowing the assessors to model retrofit scenarios and manipulate the data in both RdSAP (Reduced Data Standard Assessment Procedure) and SAP (Standard Assessment Procedure). RdSAP is the methodology used to create Energy Performance Certificates (EPC) for existing homes while SAP is used for new-build homes and major conversions and uses more data from the construction materials.

11 of the 50 properties were owner-occupied, the rest were social housing tenants in properties owned and managed by Pioneer Group. Properties were surveyed with build dates from predominantly 1960s–2000s.

Almost all the homes achieved an EPC rating of C. One of them achieved a B and seven were D, although with scores above 62 (EPC C band starts at 69).

There was little general evidence of mould or damp found during the surveys, but there were some instances of damp on walls, eaves and around windows in the houses that were surveyed. Thermal imaging and non-invasive investigations showed this was potentially caused by missing or faulty insulation in walls, lofts and poorly installed windows, but would need further investigation to confirm this. A few homes were found to be in need of ventilation upgrades, and which gave rise to higher



moisture levels which when paired with internal cold bridges presents a risk of mould build up in those locations.

Some of the occupants claimed that their houses were cold, however most were more concerned about the cost of heating their homes rather than the house being able to reach and maintain a comfortable temperature. Some occupants had actively installed measures such as door curtains to reduce draughts and heat loss.

The software recommended the installation of solar PV in the majority of properties as it creates a significant increase in the EPC rating for suitable properties.

Generic retrofit suggestions for the properties could not be offered due to the lack of data around existing floor insulation and wall insulation, particularly behind cladded sections of property where there were various potential structures behind the cladding. Further investigation of a selection of walls and floors on the estate would be recommended before a detailed retrofit programme is designed or installed.

As most properties were EPC C, this makes them ineligible for most retrofit funding. However, at some point, properties are going to need to decarbonise their heating by changing from gas boilers to electric heating, probably heat pumps. An EPC C rated property has a space heating demand of 50–90 kWh/m²/A. Above 75 kWh/m²/A, the costs of heating the home would be more likely to be too expensive for many households. The recommendations below are intended to get the properties to a level of energy efficiency that makes running a heat pump affordable for properties – which is EPC B or high EPC C.

Loft top up insulation in all properties (with a roof)

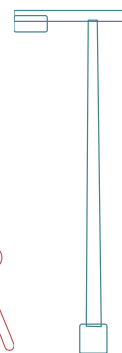
Loft top ups should ensure the insulation reaches the eaves to reduce the risk of cold patches on the ceilings below. These cold patches were evident in many of the properties surveyed and increase the risk of mould and damp from condensation on the colder surface areas.

Airtightness works

Infrared camera investigations found cold patches around window frames including some newly installed windows. Draughts were reported under external doors – replacement or adjustment of thresholds could improve this. Service penetrations can be insulated with expanding foam and sealed with proprietary purpose made grommets. Uninsulated loft hatches can be replaced with insulated ones complete with proper draught seals.

Insulate areas of uPVC weatherboarding

Based on wall depth measurements that could be taken and estimated construction beneath the weatherboarding, it looks like there may be cost effective gains in performance to be made. Further investigations should be carried out to determine the underlying construction materials.



Insulate sections of roofing over porches and bay windows

In the properties surveyed, this section of roof is not accessible from inside. Thermal imaging of some of the porches provided evidence of air infiltration and subsequent additional heat loss in these areas.

External Wall Insulation

A very small number of properties showed mould and damp patches at the lintels above the windows and doors. Infrared images suggested that the lintels bridged the cavity entirely. External wall insulation is a high-cost measure, often with very long payback periods. Unless done properly with the right materials and junction details, external wall insulation can present a liability in the future. Despite this, it is recommended where condensation risk of alternative wall insulation methods is too high.

In addition to the retrofit measures recommended, improved insulation and air tightness measures also require improved ventilation measures. To avoid ventilation increasing heating costs (as heated air is extracted from the property), the assessors also recommend that heat recovery ventilation be considered for installation. This measure reclaims the heat from the outgoing air to prewarm incoming air. It enables much greater control of indoor air quality and has a summer bypass feature when the outdoor temperature is above the internal temperature.

Installing PV to generate electricity used by the household can reduce energy bills and can also generate income through selling electricity during peak demand times. Installing retrofit measures such as insulation can generate savings in heating bills, and reducing the amount of energy needed to heat the property is vital to ensure that electrification of heating does not become more expensive for households.

Installing whole-house retrofit measures can be expensive, so further detailed work is required to understand the potential costs of retrofit measures that lead to decarbonisation of the housing stock and ensure that properties are warm, healthy and cheaper to heat. The costs of installing measures can be recovered through energy bill reduction and selling generated electricity but issues such as payback periods and surplus funds for community use will be affected by the availability of grants and low cost/patient capital funds.

4.4 Improving indoor air quality and comfort

Indoor air quality monitors were installed in 30 properties. 20 were AirGradient monitors providing a single room sensor measuring temperature, humidity, PM_{2.5}, CO₂, TVOC and NO_x. There were also ten Senze sensors installed, offered to properties where more detailed measurements could provide additional information for retrofit planning. These were multiroom sensors measuring temperature and humidity.



Both sensors had visual displays providing instant information on the air quality. Residents were given a handout on what the different measurements meant and what action they should take if measurements were higher or lower than expected.

At the time of this report, the sensors have been operational for about 60 days during a very hot period. Further monitoring and analysis will be necessary over a longer period, particularly during the winter months. Initial observations are below from the AirGradient sensors.

Temperature

The temperature averaged over 24 hours since installation varied between 23°C and 27°C for most properties. However, looking at an hourly data over some of the hotter days shows that properties did not get cooler than 22°C during the night and many peaked at 31–33°C during the day, leading to very uncomfortable living conditions. Temperature data did not show any variance according to location within Castle Vale.

PM_{2.5}

There is no safe level of particulate matter, with the World Health Organisation recommending that annual average exposure of PM_{2.5} should be no greater than 5 µg/m³. Excessive exposure to PM_{2.5} can have serious long-term health conditions and lower life expectancy. PM_{2.5} originates from wood burning, traffic and other pollution. It also originates from indoor activities such as smoking, cooking and candles.

Many properties had levels of PM_{2.5} above 5 µg/m³ since installation, some showing three to four times higher than the WHO healthy limits. There were also some very high peaks that quickly subsided in some properties (greater than 100 µg/m³) which could be due to smoking or cooking.

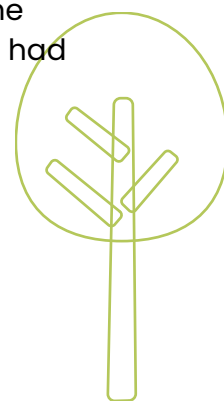
There was a cluster of higher-than-average recordings of PM_{2.5} in properties in the south of Castle Vale that is close to the M6 motorway. This could indicate that the impact of pollution from the motorway might be having a direct impact on residents' health, although this should be observed for a longer period including winter. This aligns with the CRVA assessment of PM_{2.5}.

Relative humidity

Given the connection between relative humidity levels and the potential for condensation and mould growth, this will be an important dataset to monitor over a longer period. Since installation, relative humidity has been low but this would be expected due to the hot weather and likelihood that residents will have windows open to cool their properties.

CO₂

Again, due to the likelihood that residents are ventilating their properties during the hot weather, CO₂ levels have been generally low. There were a few properties that had occasional peak readings, but this could be due to cooking or smoking.



NO_x

NO_x is the sum of nitric oxide (NO) and nitrogen dioxide (NO₂) – two pollutants having similar properties. The AirGradient sensors record NO_x as a change relative to a baseline rather than an absolute concentration, showing occasional peaks of elevated NO_x which could reflect temporary changes in local conditions.

The NO_x readings do not appear to show the same clear geographical pattern as the PM_{2.5} data. While there appears to be a higher PM_{2.5} pattern towards the south of the estate, the higher NO_x readings are more intermittent and occur at different locations rather than being concentrated exclusively in the south. This suggests that the spatial variation in NO_x may be less pronounced than that observed for PM_{2.5}.

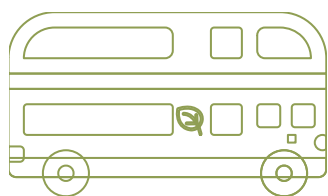
Exposure to NO_x is associated with cardiovascular diseases, asthma, diabetes, hypertension, stroke and chronic obstructive pulmonary disease (COPD). Other data collected by UoB shows that NO₂ attributable deaths are estimated to be 49% higher in Castle Vale than the Birmingham average.

The Senze monitors collect multiroom data from all habitable rooms so this can show the differences between different living spaces and bedrooms. These have also been operational during the very hot summer period and reinforce the potential for overheating in properties.

The monitors show peak temperatures of up to 36°C in some rooms during the day. These are usually the kitchen when the room is likely to be used for cooking. None of the bedrooms went below 21°C since installed and most bedrooms had a 4–5°C range between daytime and nighttime. Many bedrooms had an average nighttime temperature of around 25°C that would lead to difficulty sleeping.

4.5 Feedback from the Citizens' Jury

The Citizens' Jury was established to ensure that residents had a meaningful role in examining the emerging proposals, understanding the choices and trade-offs involved, challenging assumptions and establish the conditions under which they believed change would be fair. The Jury understood informal networks within Castle Vale, where trust exists, how households cope when money is short and how policy decisions translate into everyday life. The task was not to decide whether technical evidence or lived experience is more legitimate, but to bring them together. Regeneration activities often focus on a deficit analysis – deprivation, unemployment, poor health, but PUCV deliberately sought to complement that perspective by understanding the attributes that Castle Vale already possessed that have enabled change.



The Citizens' Jury moved the process from broad engagement into structured deliberation. Its purpose was not to make a small group of residents responsible for deciding Castle Vale's future nor provide endorsement for proposals already developed. The Jury was a mechanism for examining complexity, in particular, about the process of establishing a large-scale solar installation project on Castle Vale. This emerged from the primary recommendations from the home energy assessments and complemented by the results of the Technoeconomic Study.

Jurors were introduced to the context and subsequently worked through increasingly detailed questions surrounding the proposed solar installation. This included governance, membership, ownership, household savings, community benefit, financial risk, battery storage, employment and skills. The Jury was not expected to give unconditional support for a particular model but did create a set of conditions for broader consent. The Jury were broadly positive about the idea of community energy, but they wanted to know exactly how the benefits and risks would be distributed, with fairness being the organising principle.

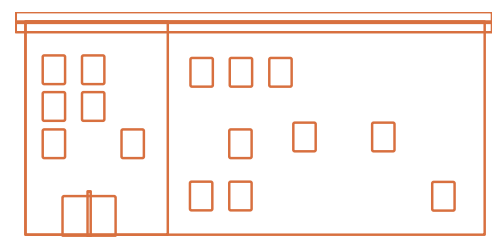
For example:

- For private tenants, the Jury was concerned that community-supported solar could increase a landlord's return without reducing the tenant's costs.
- For homeowners, they wanted certainty about panel ownership, maintenance, mortgages and what would happen when a property was sold.
- For households providing roofs to a pooled system, there was a question about whether some form of host payment or enhanced benefit would be appropriate.
- For households unable to host solar, the issue was how they would receive a fair share of the value created.

The Jury articulated a straightforward principle around household finance – benefit before contribution. Residents should not be expected to make compulsory payments into a scheme before they receive cheaper energy or other tangible benefits.

The Jury accepted that no community energy company can guarantee that it will always provide the cheapest electricity available as energy markets fluctuate. They wanted to ensure that customers could clearly understand the risks, including the worst-case position as well as the promised benefits, such as processes for changing supplier or tariff should prices change. The Jury expected that the installation of a large-scale solar installation should be accompanied with a consumer-protection framework.

The Citizens' Jury accepted that thousands of homes cannot receive interventions simultaneously, meaning the development of a large-scale solar installation may take several years. However, they felt that the sequencing of physical interventions does not have to determine the sequencing of community benefit.



The Citizens' Jury helped establish the conditions under which residents could reasonably support and participate in the transition. The development work is continuing to create proposals that show what different households might save, who would carry risk and how assets would be owned and governed. An overriding principle is that value must be retained within Castle Vale while keeping decisions open to learning and adaptation.

4.6 The delivery model matters

BCC recognised at the feasibility stage that developing a Net Zero Neighbourhood would require a range of expertise. This was reflected in a delivery model built around a central partnership of five organisations with additional consultants and close working with existing local organisations.

PUCV brought together delivery partners with complementary expertise and a shared commitment to a place-based, community-led approach. This enabled different elements of the programme – technical analysis, communications, engagement, housing and energy expertise, to be led by those best placed to deliver them, while remaining connected to a shared ambition for Castle Vale. BCC also nominated Castle Vale to be one of the wards for the WMCA's WM-Adapt project which explores local climate adaptation through Wild Weather Cafés and a Rapid Adaptation Pathway Assessment, to enable aligned activities to contribute to the PUCV vision, including as well as Council colleagues from Transport, Flood Management and Net Zero.

The Urban Living Labs supported this approach by providing the place-based space in which unresolved questions could continue to be worked through while decisions remain open. This brought community insight together with technical feasibility, regulation, investment, delivery capacity and institutional responsibility. Involving local, trusted stakeholders like Pioneer Group and Spitfire Services ensured that organisations with established relationships, influence and knowledge of Castle Vale could help shape the emerging approach.

For future place-based programmes, investing in the right mix of capabilities and creating genuine alignment between delivery partners should be considered part of programme design, rather than an operational detail. This also applies to the expectations of funders. It is important that funders understand that this type of adaptive approach does not always provide outputs at a consistent rate throughout delivery. PUCV invested significant time early in the programme in building alignment between partners and developing the shared approach. While this meant fewer visible outputs initially, it created the conditions for activities such as home energy assessments and recruitment for indoor air quality monitoring to progress quickly once promoted to residents.



5. Conclusion – learning summary

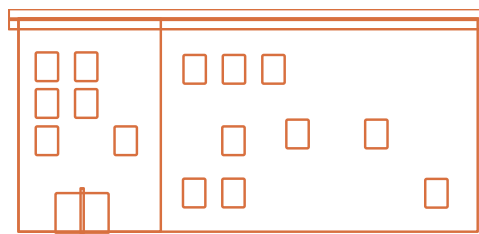
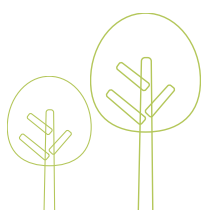
Castle Vale demonstrates many of the characteristics commonly associated with communities facing both socio-economic disadvantage and high decarbonisation needs. Poor health outcomes, fuel poverty, lower incomes, and lower qualification levels create additional challenges that must be addressed if net zero ambitions are to be achieved equitably. The area is also highly vulnerable to the impacts of climate change.

This context shaped the communications approach. Rather than leading with the language of net zero, communications connected the programme to the priorities of people and place and focused on what the work could enable – healthier and more comfortable homes, lower bills, skills and employment opportunities, and benefits being retained locally. This helped make the work relevant to Castle Vale and build awareness, interest and participation in PUCV.

Feedback from the Urban Living Labs showed that many local organisations supported the objectives of PUCV as it complemented their core activities. This included support for residents and social tenants, green space improvements, climate adaptation, and training and job opportunities for residents. Focusing on the benefits the transition could bring, rather than on net zero itself, helped create a common understanding between organisations with different priorities as well as supporting greater information sharing and collaboration.

Despite the poor level of IMD indicators, there have been improvements over the past ten years – particularly in education outcomes and economic activity. The area also possesses significant strengths, including strong community assets, good access to green infrastructure, established energy infrastructure, and substantial opportunities for housing retrofit and low-carbon investment. This was stressed many times to the project team from residents and local organisations during community events, Citizens' Jury and Urban Living Lab – Castle Vale is an area where people work together to bring improvements. Residents and organisations were clearly very proud of this.

Residents and organisations demonstrated that with suitable support, they could play a meaningful role in driving and shaping the transition in Castle Vale and help ensure benefits are retained in the area. While the role of the Citizens' Jury and other communications did not use the term net zero, it did discuss some complicated, technical issues that would effectively enable Castle Vale to become net zero. This included presentations about how solar generation works, the benefits of battery storage, energy trading and potential business models. This was a two-way dialogue, and Jury members spoke about the suitability of locations for ground-mounted solar panels and how the arrangement of panels around car parking sites could be designed to ensure security of vehicles.



Based on the findings of the Technoeconomic Study on the potential of solar PV in Castle Vale and feedback from the Citizens' Jury, the development of a solar co-operative to oversee the installation of a large-scale solar PV generation and energy storage scheme emerged as a clear priority from the project. This should create an investable model to give residents lower energy bills and funds to invest in other local needs. More feasibility work is currently being undertaken on this by Scene.

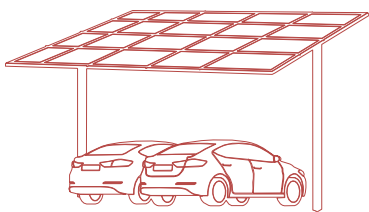
There are other issues that emerged during engagement around transport and mobility that need to be addressed, such as better bus services, a cycle route into the city centre or the possibility of reopening the Castle Bromwich train station on the edge of Castle Vale. These are essential elements of improvements for Castle Vale and require engagement from stakeholders not yet involved in PUCV.

However, the broader decarbonisation challenge is significant. Castle Vale cannot meaningfully decarbonise without changing the heating from gas heating and cooking. Moving to heat pumps requires some retrofit improvements to ensure the properties do not become more expensive to heat – feedback from residents has shown that current properties are sometimes underheated due to energy costs. This leads to the largest challenge that progressing PUCV faces – there is not an existing grant programme that could support the housing and heating improvements. As most properties are EPC C, they are not eligible for Warm Homes funding for retrofit works to get them to an energy efficiency level where heating is affordable. 55% of properties are owned by Pioneer Group, who as a social housing provider will not be eligible for the Boiler Upgrade Scheme. Clearly, a new approach to funding is required to progress the needs and potential in Castle Vale.

Decarbonising Castle Vale potentially requires a 10–15 year programme if changing heating and installing an estate-wide solar PV project can bring benefits to everyone living in Castle Vale. At the same time, there are some more pressing needs, such as unhealthy PM_{2.5} levels and that recent overheating demonstrates. The next stage needs to consider the whole system of Castle Vale and to understand how improvements can meet several objectives. For example, mechanical ventilation with heat recovery could help reduce levels of pollutants inside properties while not losing heat energy and improving ventilation to reduce condensation risks. When this is coupled with a drive to train and employ local people, then the health, environmental and economic benefits genuinely start to be realised in Castle Vale.

Delivering these improvements while maintaining the core disciplines of fairness, shared power, transparency, lived experience and iterative learning requires the approaches and learning from PUCV to be key principles of future improvements:

Everyone starts from the same place: ensuring that every household should have a genuine opportunity to participate in and benefit from the transition. Recognising differences of property or ability to contribute should not become reasons for exclusion.



Choice, agency and control: residents should have meaningful choices about changes affecting their homes, finances and neighbourhood. People need sufficient information to understand their choices and enough influence to shape decisions before the most important technical, financial and governance arrangements are fixed.

Keep value local: the transition should be designed to retain as much economic and social value as possible within Castle Vale, to create local employment, apprenticeships and skills, support community assets and strengthen the capacity of residents and organisations.

Shared community benefit: energy, local assets and investment should create benefits that extend beyond individual households combining meaningful household savings with pooled community benefit.

Lived experience as evidence: the experience of residents should continue to be treated as a legitimate form of evidence alongside technical, economic and institutional knowledge.

Open, transparent and protective: residents should be able to understand how decisions are made, where money comes from, where it goes, what risks are involved, who carries those risks and what benefits they can reasonably expect.

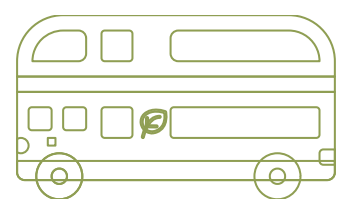
Join things up: the programme should continue to treat Castle Vale as a connected place and single system rather than separating energy, housing, transport, health and other priorities into individual workstreams.

Decisions at the right level: future programme should distinguish between what local partners and residents can control, what they can influence, and what they must advocate for at city, regional or national level.

Learn and adapt together: uncertainty should be treated as a reason to learn rather than as a reason to delay indefinitely or to claim false certainty. Decisions should be revisited where evidence changes and interventions should be adjusted where outcomes differ from expectations.

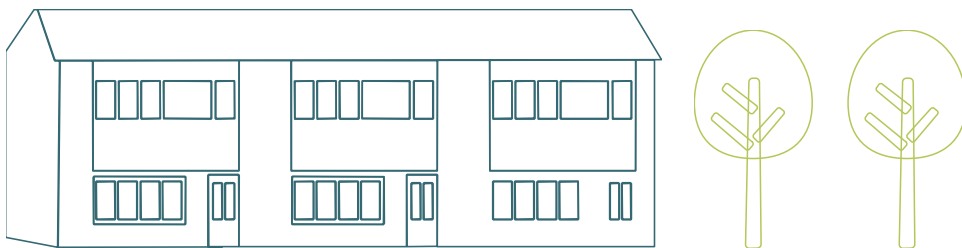
Think about replication from the beginning: from the outset, the programme should capture the context, system changes and investment arrangements that affect whether an intervention succeeds to understand why it worked and what might have to change for it to work somewhere else.

Turn ideas into action: connect learning to decisions, investment and implementation making sure residents can see tangible change.



PUCV's key conclusions are:

- A place-based approach to net zero needs to connect with the wider priorities for a place and its people.
- PUCV has shown that communities can engage meaningfully with complex work when that work is made relevant to their lived experiences and they have genuine influence.
- PUCV has created credible opportunities for delivery but there are structural barriers that now need resolving.
- Replicating the approach in other places means thinking about the capabilities needed to deliver it.



6. Proposed next steps

PUCV's work indicates that creating a Net Zero Neighbourhood and moving away from fossil fuels is significant and complex. It can only be achieved by placing the community at the heart of the transition, with residents actively involved in shaping decisions, testing options and determining what is in their best interests.

A decarbonisation pathway can be delivered through four overlapping phases. They are not a rigid sequence – learning in later phases may require earlier assumptions to be revisited. Some aspects of the pathway will be able to be delivered before other improvements.

Phase one: confirm the proposition and evidence base

The first phase should ensure that partners and residents have a clear shared understanding of what the programme is seeking to achieve and the evidence on which future decisions will be based. This should include confirming programme scope, geography, partners and governance and identifying evidence gaps that must be resolved before significant commitments are made.

Phase two: develop and test options

The second phase should move from broad propositions into options that residents and partners can genuinely assess by utilising existing connections within the Urban Living Lab, Citizens' Jury and wider community engagement. This phase should develop technical, financial, legal and governance options to address the evidence base. It includes developing procurement, workforce and local-benefit proposals, and exploring investment readiness and financing alongside social and environmental outcomes.

Phase three: prepare for delivery

The third phase should convert preferred options into an investible and deliverable programme. This should include publishing a staged implementation plan and selecting preferred interventions and delivery partners through transparent criteria. It will confirm investment and funding arrangements while establishing how community benefit will be created, shared and retained locally. It will set baselines, targets and monitoring responsibilities, and establish decision gates at which activities can be continued, adapted, paused or stopped.

Phase four: implement, learn and scale

Implementation should retain the learning infrastructure established during co-design alongside the testing fairness, affordability, community benefit and resident control. Learning should inform delivery as it happens, as opposed to serving as retrospective evaluation. This phase should also address the potential of replication elsewhere in Birmingham, the West Midlands and beyond.

The pathway needs to start with some straightforward activities (such as the development of the solar co-operative) but also progress the more complex and difficult activities, such as electrification of heating, cooking and travelling over the next 15 years.



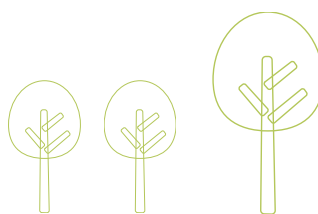
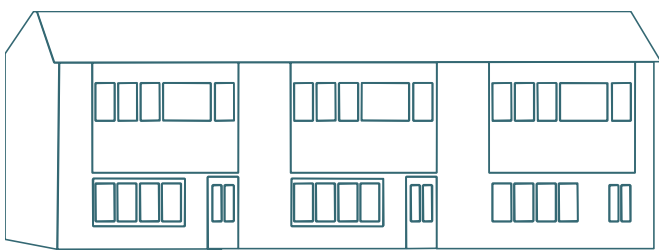
The following activities are recommended to progress the development of a decarbonisation pathway for PUCV.

Short-term activities (from end of first phase for 12 months):

- Completion of Scene feasibility work to establish a detailed model for solar co-operative.
- On-going monitoring and analysis of indoor air quality monitors to develop a detailed dataset for 12 months.
- Scoping of grants for potential early solar PV installations.
- Development of solar co-operative structure to establish community roles and information to prepare for installation of PV generation and battery storage.
- Launch and recruitment for solar co-operative.
- Completion of heat network feasibility work by Possible.
- Financial evaluation of heat network costs compared to individual heat pump installation costs.
- Scoping work for potential space for ground-mounted solar PV installation, including consultation with relevant stakeholders and residents.
- Outline scoping work to produce masterplan and potential timing for estate-wide installation of solar PV.
- Phased delivery plan of detailed retrofit installations.
- Engagement with NGED and utilities for solar installation.
- Ongoing communication to residents and relevant stakeholders.

Long-term activities (year 2 – year 10):

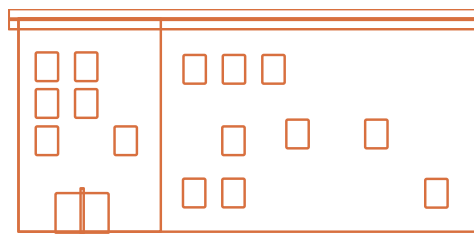
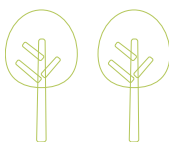
- Planning application for solar installation across Castle Vale.
- Finance model established to develop large-scale solar installations.
- Heat decarbonisation plan developed.
- Revised transport and mobility plan developed for Castle Vale.
- Revised greenspace plan developed for Castle Vale.



7. Supporting information

The following reports provided evidence and information to support the development of PUCV.

Report	Organisation
BCC Corporate Plan 2025-2028	BCC
Property Assessments	Red Co-operative
Data Analysis – Executive Summary	UoB
Baseline Profile Data – Methodology Note	UoB
Data Mapping and Baseline Assessment	UoB
Climate Risk and Multiple Deprivation Assessment	UoB
Active Travel, Green Space, Health, Climate and Finance Survey Mapping	UoB
Occupancy Energy Survey Mapping	UoB
Substation Area Energy Mapping	UoB
Communications Approach	SHAP
Citizens' Jury Report	Places in Common
Technoeconomic Study – Executive Summary	Graham Oakes Ltd
PV Feasibility Study	Scene
RAPA Report	WMCA





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