(SHORT-TERM) HOUSING DELIVERY PLAN 2023-2025

Final Draft

April 2024 | Rev G

Etude

This Housing Delivery Plan (HDP) sets out the landscape for delivering lower carbon homes across the City's housing stock, in the context of the Climate Action Strategy carbon targets.

Delivering low carbon retrofit that works for the City and its residents relies on incremental, opportunistic and thorough retrofit that is delivered by multiple teams. To do this though requires immediate action and funding to avoid missing opportunities that may only arise around every 10-20 years.

Immediate actions for improving the position of housing

Within the HDP, short and medium term action have been identified, the former being most critical for the 2027 net zero targets.

Short term priority 1: Landlord services

An external consultant has proposed improvements to landlord services such as lighting, lifts, ventilation etc. This work is expected to be of minimal disruption and ready to proceed to the next phase on most estates.

Short term priority 2: Expanding pipeline projects

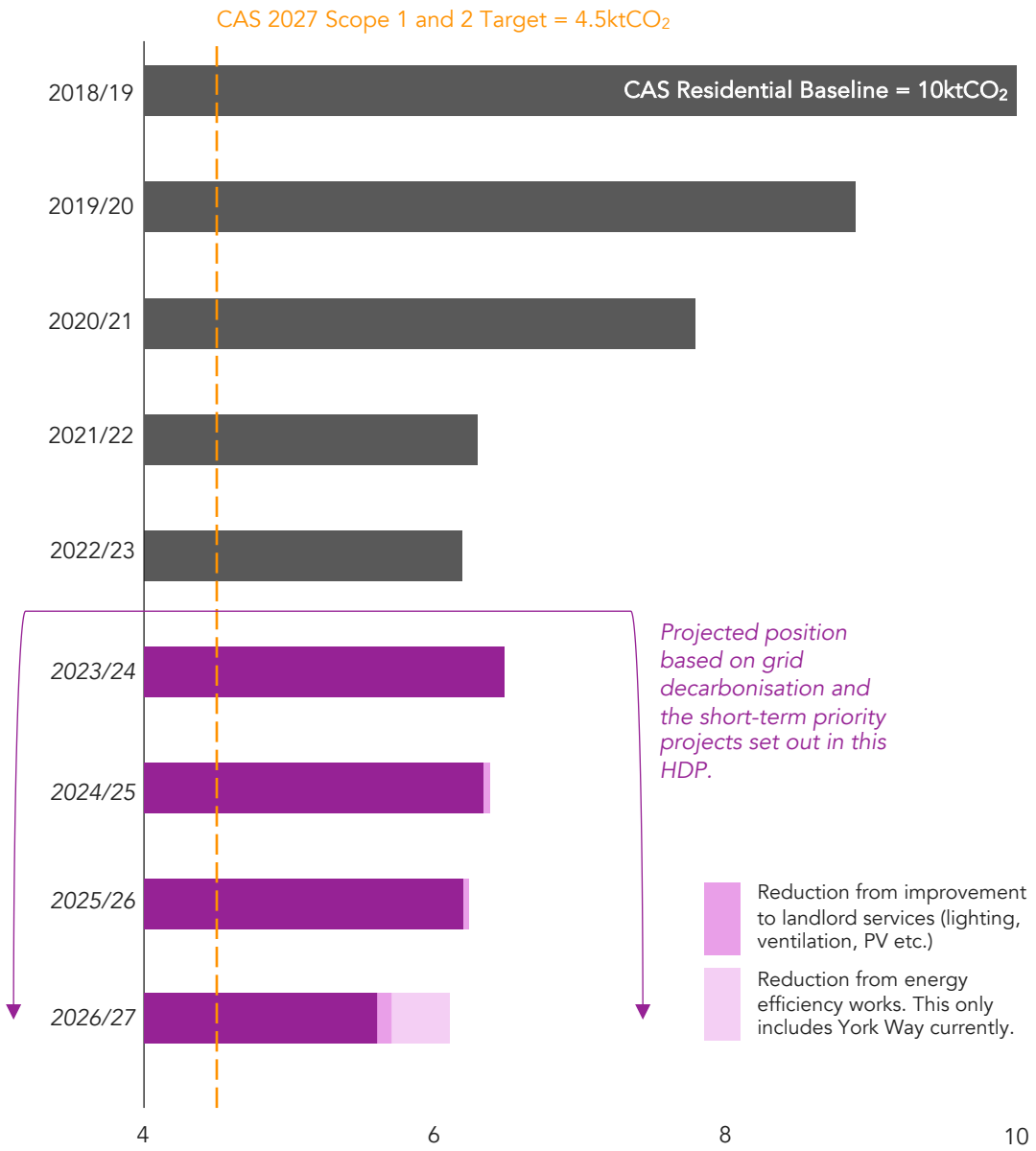
Upcoming capital projects that are in their design phase should be expanded to include low carbon retrofit measures in the scope. One of the largest of these is York Way.

Short term priority 3: Information gathering

More information is needed on the current performance of the housing stock. Relatively cheap and unintrusive surveys must be completed, as standard, to build this information.

Short term priority 4: Expanding the void programme

Voids represent an opportunity to carry out testing and complete incremental improvements towards a low carbon retrofit. Upgrading the standard void specification should be used to deliver this.



Historic measured (in black) and projected (in purple) Scope 1 & 2 emissions for housing, presented in $ktCO_2$. Based on the current projections, the housing stock is unlikely to meet its 2027 carbon target. This could change, but would require investment in identifying projects, gathering sufficient information and data to enable them, alongside commitment from all teams to deliver them.

Contents

1

Introduction | The context to delivering low carbon homes

This section sets out the context to the Housing Delivery Plan

- Targets for the City and how these are related to housing
- Analysis showing the current performance in terms of carbon targets
- Important documents on delivering change in housing

Introduction

This document is a short-term assessment of where the City should focus resources in order to move towards its net zero targets for housing.

Responsibility for retrofit falls across several teams within the City and for this reason it can be easy for good improvement opportunities to be missed. This document aims to stop these missed opportunities in the first instance and highlight the key projects requiring immediate attention and funding.

It also outlines the next steps that can be taken to be more proactive in retrofitting the housing stock.

How has this document been developed

Etude, currently on secondment with the City of London Energy and Carbon Team, have been working closely with several teams within the City to understand the current approach to major projects and create strategic and technical guidance on how retrofit could be delivered.

In 2021, Etude worked with the City to create the Net Zero Housing Action Plan, which set out a possible strategic direction for the City as well as processes that could be used for rolling out retrofit across the housing portfolio. The current secondment is a further development of this role, aiming to give more detail to the previous action plan.

This Housing Delivery Plan is a culmination of our work with the City over the past year, talking to various people and trialling ideas for rolling out retrofit. A lot of the thought and concepts expressed are explored more fully in smaller technical documents that have been issued to the City throughout the secondment.

Section 1

The document begins here, detailing the targets and their relevance to housing. This sets the context for why retrofiting homes is an important part of the City's overall net zero ambition. There is an update on the current carbon emissions and energy consumption.

The current situation is explored, looking at how the current teams across the City fit into the retrofit picture. There is an explanation of what is meant by 'low carbon retrofit' and how this was expected to be delivered in the Net Zero Housing Action Plan.

Section 2

Section 3

This is the critical section given the short-term needs for retrofit in the City. We present four priorities to focus on over the next two years, with rationale for why they are important. We want all readers to understand these clearly and think about their role in making them happen.

In section 4, ideas for the medium-term ambitions of the retrofit strategy are set out. The understanding here is that the objectives of Section 3 will only get the City so far, and there will need be longer term thinking about retrofit.

Section 4

Section 5

A brief section that outlines indicative costs for the proposed measures in the rest of the plan.

A brief section looking at potential risk associated with retrofit that the City need to consider.

Section 6

A summary of what each section in the Housing Delivery Plan sets out to achieve

Introduction | Targets that affect the housing improvements

Alongside the needs of residents and providing high quality housing, the main drive for retrofit work across the City's housing stock comes from Corporation level targets.

Carbon emissions-based targets

As part of its Climate Action Strategy (CAS) the corporation has committed to four overarching targets:

- Net zero by 2027 for the Corporation's operations (Scopes 1 & 2)
- Net zero by 2040 for the Corporation's full value chain (Scope 3)
- Net zero by 2040 in the Square Mile
- Climate resilience in its buildings, public spaces and infrastructure

The distinction between Scopes 1, 2 and 3 is important for housing. The City provides community level heating and hot water to some of its homes, this energy would fall under Scopes 1 & 2 and therefore have an earlier net zero target. Where homes are supplied by their own heat system (typically individual gas boilers), this carbon would fall under Scope 3, requiring action by 2040.

London Councils commitment to EPC B

In 2019 London Councils issued its Joint Statement on Climate Change. This was agreed by the Transport and Environment Committee and the London Environment Directors' Network.

Among the seven pledges is a stretching target to achieve an average EPC B rating across London's building stock by 2030. Parity Projects explored the options for achieving this target in their Pathways Report published 21st July 2021.

In general EPC targets do not represent the best method for delivering meaningful change. Other metrics which provide more detail on the performance of the building are better suited. The target however was presented as an interim target (as part of the London Retrofit Action Plan), until more comprehensive net zero targets could be developed.

Climate Action Strategy – Key actions

- *"Transform the energy efficiency of our operational buildings through the adoption of best available technologies"*
- *"Accelerate the move to net zero carbon and energy efficient tenanted buildings, working closely with tenants to achieve shared goals"*
- *"Increase engagement and communications about sustainability with residents, businesses, visitors and other stakeholders"*

Scope 1

Net zero carbon by 2027

Landlord controlled **gas**:

- Communal gas heating
- Gas heating of other estate premises

Scope 2

Net zero carbon by 2027

Landlord controlled **electricity**:

- Communal lighting
- Communal electric heating
- Lifts
- Other communal electricity

Introduction | Latest carbon emissions analysis

Commentary on the targets

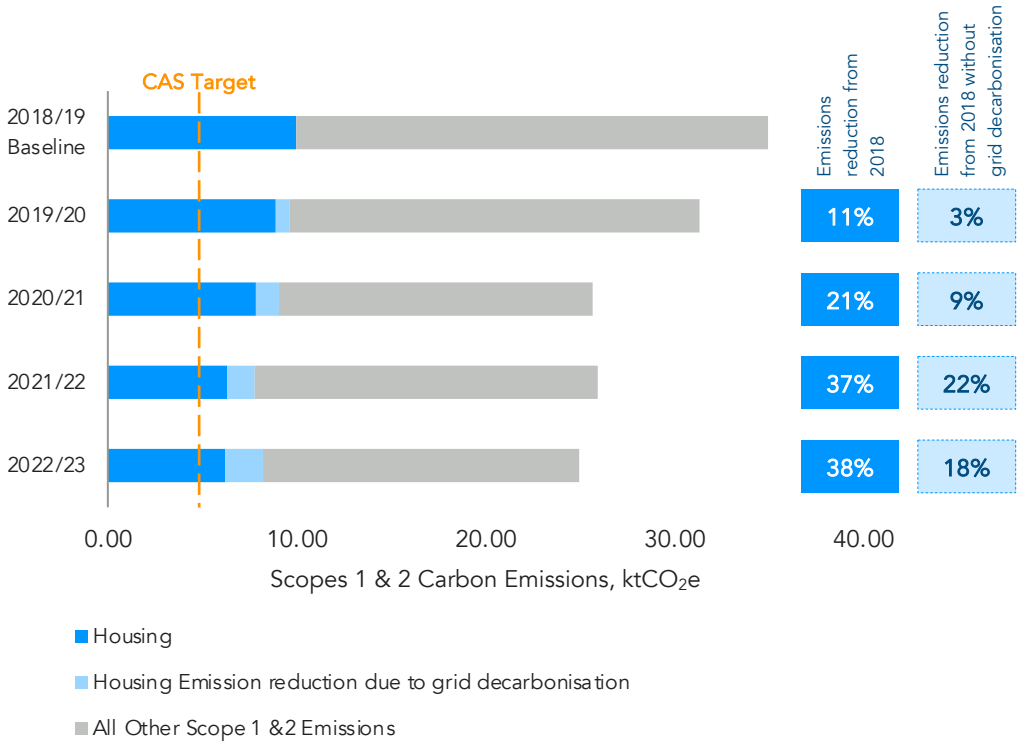
The graph across represents the scope 1 and 2 carbon emissions reported by the City across its housing, investment and operations portfolios. The data suggests there has been a significant reduction in emissions from housing between 2018/19 and 2022/23, nearly 40% However, the absolute reduction, due to reducing energy use is actually less than this, as a large proportion is attributed to the decarbonisation of the national grid. Accounting for the grid, compared with the 2018/19 baseline, there has been an 18% reduction in the housing carbon emissions.

To meet the CAS targets, each department need to reduce their carbon emissions by a minimum of 55% from the 2018/19 baseline. This translates to a target of around 4.5ktCO_2e.

'Housing' is defined by the wider DCCS portfolio and as such includes Golden Lane leisure centre, the Barbican Estate Office and other estate based non-domestic buildings such as community centres and libraries. However, given these account for only 5% of the departmental housing emissions, this Housing Delivery Plan focuses only on emissions arising from the domestic properties.

How the London carbon budget relates to housing

According to the Tyndall Centre for Climate Change, the global carbon budget was 500Gt CO_2 in 2020. Since then, the global budget has fallen by more than half. London and other sub-regional budgets are expected to have followed a similar pattern. Although the net zero targets and their dates are important for the City, it is also important to remember that cumulative carbon emitted up to those dates will contribute to climate change. Staying within the carbon budgets is critical for reducing the impacts of climate change.



Scope 1 and 2 emissions for the Corporation from April 2018 to 2023 across the housing, operations and investment portfolios, for housing this encompasses all emissions associated with communal heating, lighting, lifts and any other landlord-controlled energy. The graph also quantifies the emissions reductions attributed to grid decarbonisation.

Introduction | Latest gas and electricity analysis

Carbon emissions data is taken from energy measured at the meter on buildings. This page summarises this data.

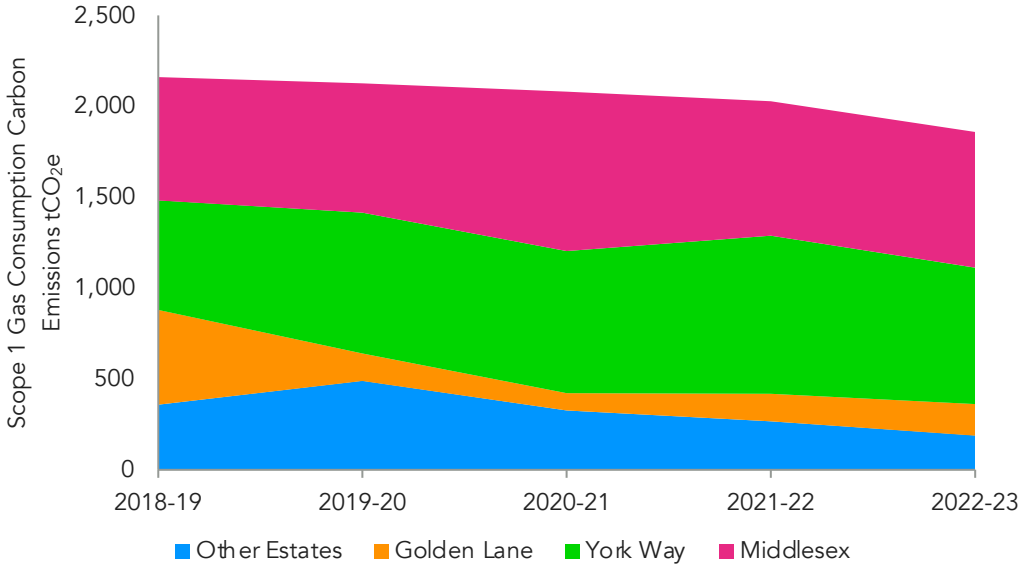
How the data is sourced

At present, the City sources its in-use metered data from invoice files and consumption reports. This performance data is stored on the data management platform, SIGMA. SIGMA captures metered energy consumption, billing and carbon emissions for the City housing (landlord and communal areas), investment and operation stock.

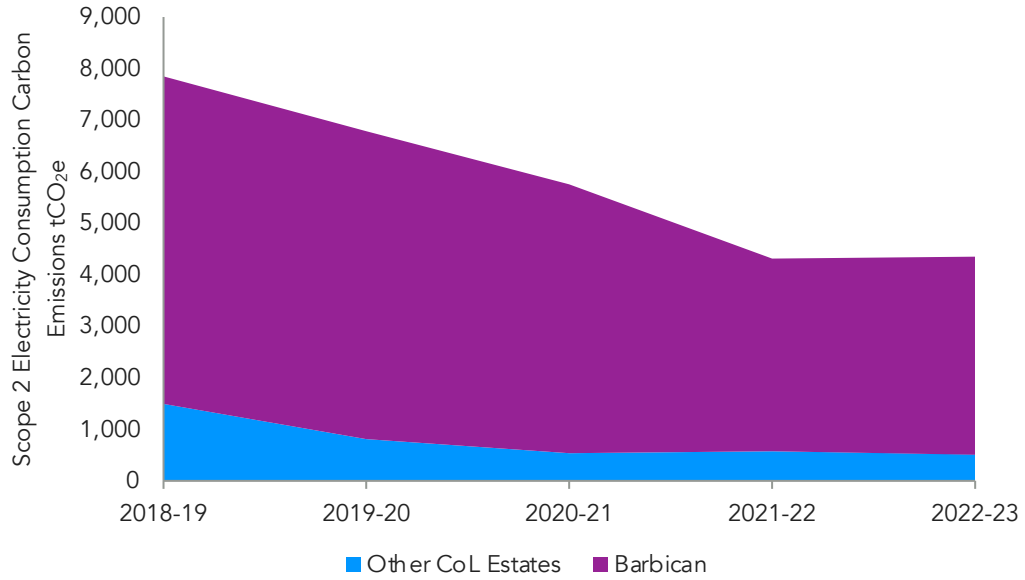
For some estates, data inputs are estimated by the Energy Team in lieu of reliable meter readings, in cases when meters are faulty or discrepancies. Stock information, including fabric, systems and energy survey data are porous for a number estates, hampering accurate retrofit measures analysis as well as funding applications.

A summary of most recent annual consumption

The graphs across highlight the largest consuming estates across the housing portfolio. They indicate a small drop in gas consumption and much more substantial drop in electricity use at the Barbican. Given that gas is a higher carbon energy source than electricity, decreasing gas consumption (both within scopes 1 and 3) should be the priority in decarbonising the housing stock.



Associated Scopes 1 carbon emissions for the gas consumption of all Estates from 2018 - 2023 (Ferndale Road has been excluded due to limited data on consumption)



Associated Scopes 2 carbon emissions for the electricity consumption of all Estates from 2018 - 2023 (Ferndale Road has been excluded due to limited data on consumption)

Introduction | Fuel poverty, an absent target

Fuel poverty is a growing concern

There are no explicit targets for improving fuel poverty, regionally or nationally. According to DESNZ published data, 13.4% of households (3.26 million) were in fuel poverty in England in 2022.

Choosing a definition

CoL should prioritise fuel poor homes for energy efficiency improvement work. Fuel poverty in England is measured using the Low Income Low Energy Efficiency (LILEE) indicator, calculated using both the EPC rating of the home and the income of the household. For CoL this definition would be difficult to apply: CoL may not have data on household incomes of their tenants.

It is possible to use a perception of need measure instead, in the form of a survey of residents' circumstances, which may be more useful to CoL, because it doesn't rely on access to privileged data.

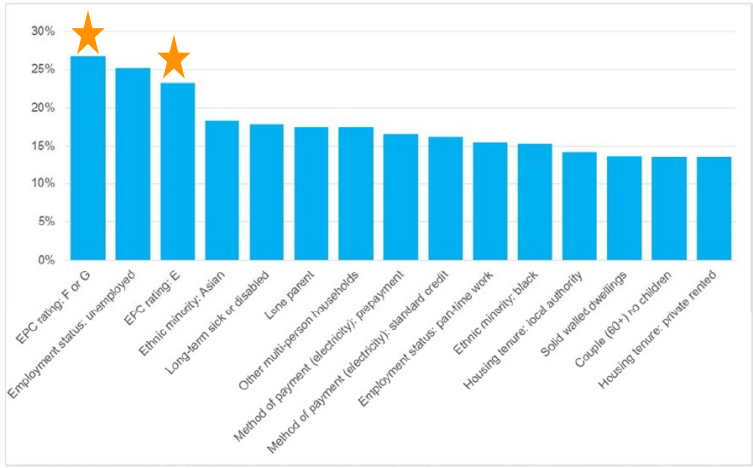
Housing and fuel poverty

The most direct action that CoL could take would be to improve the energy efficiency of their buildings, targeting the worst performing ones first. EPCs have limited value as a measure of energy efficiency so it would be useful to agree on another metric and to set a target, such as a space heat demand lower than 90kWh/m^2/year (aligned with the Social Housing Decarbonisation Fund target).

Climate adaptation and resilience

The increased frequency of extreme weather, especially heatwaves, can impact residents who are not able to make adaptations to their homes that could mitigate the consequences. Overheating is a particular risk to vulnerable people with potentially very serious health impacts. Resilience to the effects of climate change should be a consideration when identifying priorities and potential solutions. In particular, the impact of communal heating systems on overheating should be a criterion when considering which heat decarbonisation strategies to adopt.

Figure 1: Proportion of households in fuel poverty



Source: Fuel poverty in London: Research and policy report; CAG Consultants working with CSE, ACE and SE2, 2017

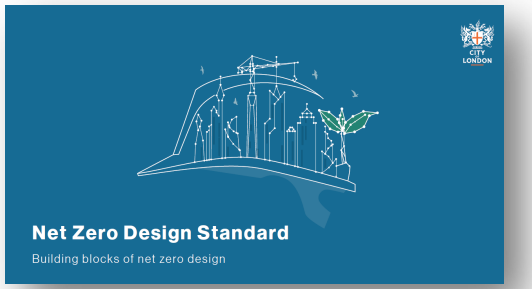
The energy performance of homes is one of the highest impact issues affecting fuel poverty. (Source: GLA Fuel poverty action plan for London)

	ALL EPCs (including those expired)							
	A	B	C	D	E	F	G	
Number of properties	-	58	1,029	744	120	17	11	
% managed properties	0%	2%	36%	26%	4%	1%	0%	69%
% managed properties with data	0%	3%	52%	38%	6%	1%	1%	100%

Proportions of EPC ratings across City of London housing stock. EPCs are available for 69% of housing stock, this includes expired EPCs.

Introduction | Important related documents

This Housing Delivery Plan has been developed off the back of several years of work on retrofit by the City. Actions are dependent on other teams' processes and understanding of the housing stock. The three documents below have been highlighted as being particularly important.

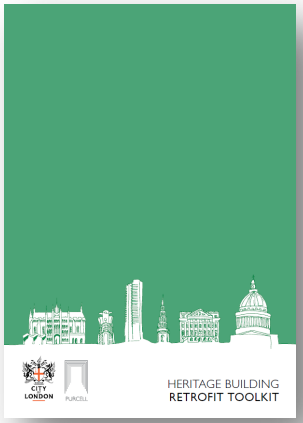


Net Zero Design Standard

For buildings that are not listed or restricted by heritage considerations, this document sets out objectives and elemental performance targets. The performance standards set both limiting and target U values for the principal elements.

Heritage Building Retrofit Toolkit

For historic and listed buildings, the retrofit toolkit sets out a process and the different factors that need to be considered. It includes summaries of areas where energy is often wasted in buildings, potential mitigation measures and improvement measures. It also advocates creating whole building retrofit plans.



Housing Net Zero Action Plan

For all housing owned by the City, the Housing Net Zero Action Plan (HAP) sets out a strategic approach to retrofit, including identification of the key archetypes. It assesses the likely improvement that could be deliverable for each archetype and projects both the costs and the carbon savings that would result from a comprehensive retrofit programme.

2

The retrofit picture | What does strategic retrofit look like for the City

Delivering retrofit across the City's housing stock is a responsibility that falls across several departments. This can present challenges in understanding who should be the first to act. Missing opportunities to make improvements to homes is however a costly error that could set back progress. In this section we explore the opportunities for retrofit and what is needed to meet the targets set out in Section 1.

Improving homes requires joined up thinking

Housing across the City's stock is mixed in age and requires constant maintenance, with capital projects and repair teams engaged in improving homes on an ongoing basis. Low carbon retrofit can involve adding something new to a building to make it operate more efficiently. In most cases, it can involve repairing or replacing particular components with something that is net zero compatible.

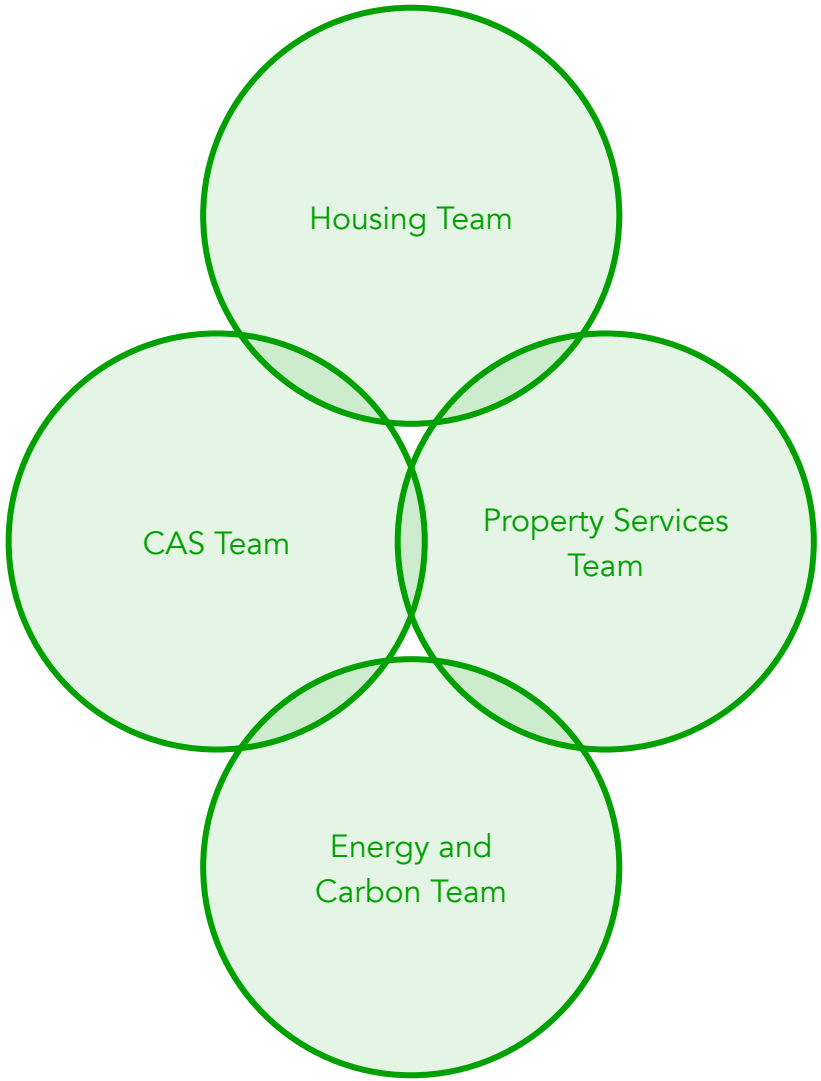
These cycles of repair and replacement are crucial to delivering meaningful change to the housing stock. Continuing in a 'business as usual' way will mean projects are being completed, residents are being disrupted, and money is being spent without moving closer to net zero objectives. Instead, low carbon retrofit must be embedded into the repair, maintenance and replacement cycles.

What is low carbon retrofit

Retrofit can seek to achieve several aims but ultimately it is about enabling homes to work with low carbon heat sources. This often means improving the building fabric and ventilation systems as well, which results in many other benefits for residents.

Low carbon retrofit can be risky though, if completed in a piecemeal way. For example, upgrading windows on their own can often lead to an increased risk of damp or mould if ventilation is not also considered at the same time. Although this ultimately leads to bigger, multi-faceted projects, there are often benefits to completing works simultaneously, such as:

- Less disruption for residents in the long run, as overall the approach results in fewer visits.
- Costs can be lower as each component of the project can share enabling works like scaffolding or temporary site accommodation.
- The design team can fully consider the impact of each measure as well as the combined impact, reducing the risk of unintended consequences.



Delivering retrofit across the City's housing stock requires cooperation between several teams. This housing delivery plan sets out priority action, but the distribution of roles and responsibilities within these teams should be decided on and undertaken as soon as possible to give it the best chance of success.

Delivering major projects across the City housing stock

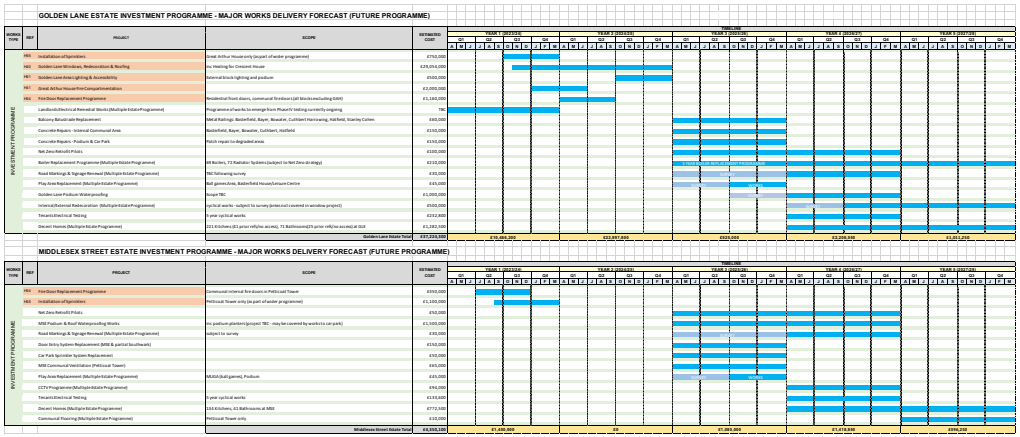
Capital project delivery is managed by the Housing Team and is funded from the Housing Revenue Account (HRA). These major projects are scheduled through a 5-year programme which are based on need, testing requirements, and cyclical replacement. The current 5-year programme is a mix of work which has been allocated funds and other projects that are yet to be funded. For this reason, the immediate focus of the Housing Team is on funded projects.

As capital projects are funded through the HRA the projects are limited in their scope. The budget provides for 'like-for-like' replacement only. This presents an obstacle for retrofit works, as often the required measures are an uplift on what is already there. Other funding streams need to be identified to provide the uplift in budget desperately needed for comprehensive retrofit work.

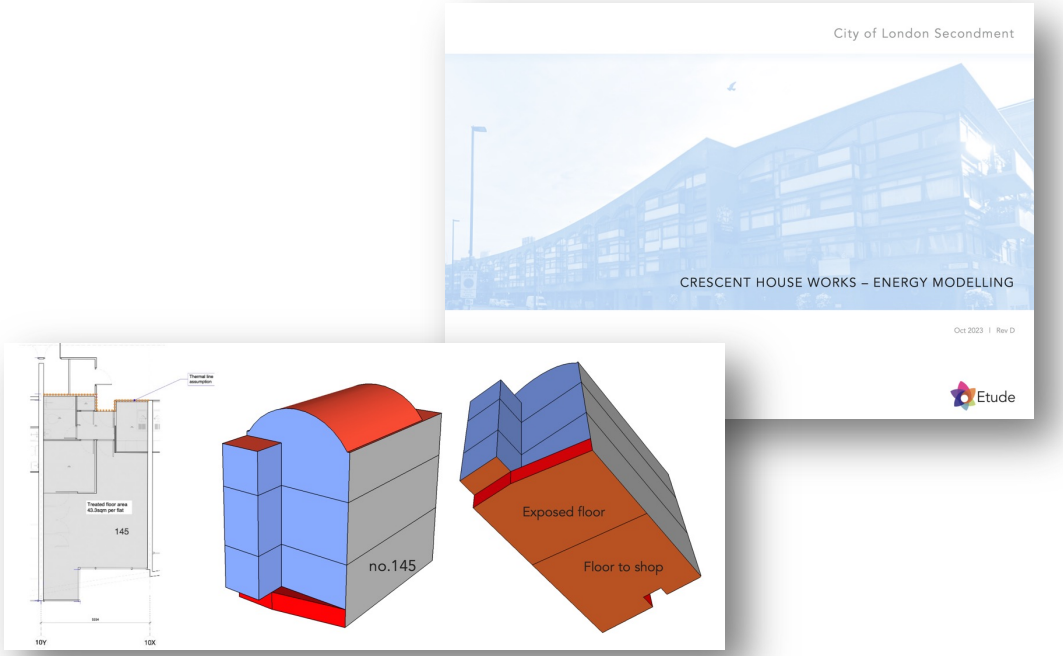
The priority projects for the Housing Team

Following discussion with the Housing Team and review of the capital projects forward programme there are a small number of clear priorities for a potential uplift in scope:

- **Golden Lane Estate** – a considerable amount of design work has been completed on one block (Crescent House) involving improvements/renewal to the building fabric and changes in some heat systems. This project will move forward into construction as the rest of the estate then begins a design phase with a similar scope.
- **William Blake Estate** – a window project at this estate has been in design stages for several years following complications in planning. Additional design work will be needed before a new planning application can be submitted.
- **Avondale Estate** – several of the blocks at Avondale are due roof renewal works. This project has not yet been fully scoped but is expected to move into a design phase in the near future.



An extract from the unfunded 5-year capital works programme from the Housing Team. This document presents data on programme and cost for each of the identified projects.



Etude have been providing support on the Crescent House retrofit project, looking at the impact of the proposed measures on energy use and cost to residents

Using repair knowledge to inform the wider programme

Anecdotal evidence from the maintenance team indicates that they are busy, but focussed on immediate term fixes to common problems. Mould and damp was highlighted as a significant issue, which is often remedied with quick fixes rather than looking at fundamental building level improvements that could be a better remedy.

From our discussions it did not appear as though there is currently a good level of dialogue between the team managing day-to-day repairs and the Housing Team. It is likely that, as a result, the common issues experienced in the various buildings are not being resolved through the capital works programme.

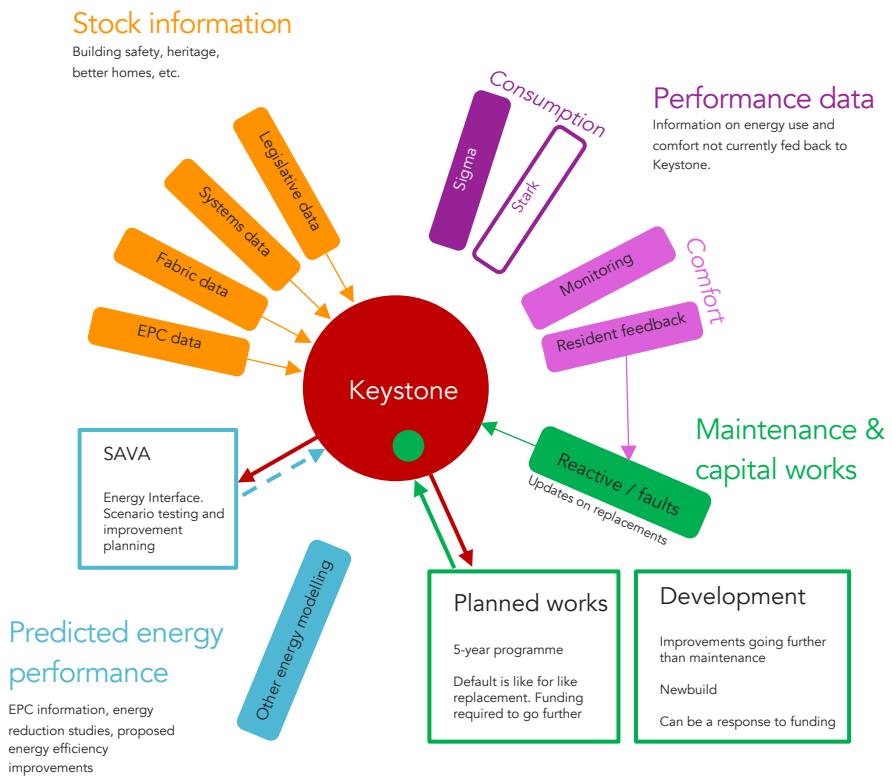
The void programme is due a refresh

Vacant homes offer one of the best opportunities for significant change and resolving problems. It is apparent that the void specification being used is several years old, generic across the variety of buildings, and not responding to the net zero objectives of the City.

Housing data management

Keystone Asset Management System is the previous central database holding the critical core data; it has been replaced by another Civica product (Cx). The data held on the system is mixed and it is unclear how much is it is being used to inform projects. Repair data may or may not be uploaded onto the platform.

Etude carried out a review of housing data systems which recommended that whichever system is used, it is used to capture detailed information about the homes in relation to their potential retrofit, and monitor problems in homes.



Etude's analysis of the current data management processes identified that the maintenance works are generally not considered within the wider planned works and development works and are usually carried out as 'like for like' replacements for expediency.

Improving the flow of data could help the City plan their work on the homes, by making sure common issues are logged and monitored and that planned works responded to this. This greater understanding of the issues with homes could help inform the retrofit strategy, and proposed retrofit plans could help inform the day-to-day building operations.

A complete retrofit strategy must consider the whole of a building, including fabric and ventilation, converting to low carbon heat, and adding renewable energy generation. This page describes individual measures and gives some example decision processes for selecting the right material or method.

Fabric

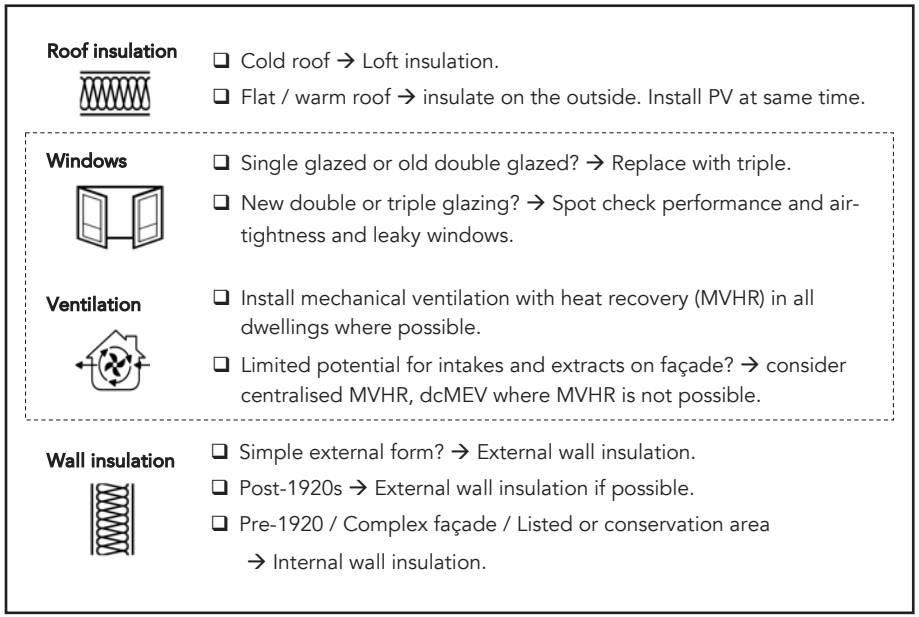
The image top right gives some high-level guidance for decisions on individual fabric and ventilation measures. Roof insulation should be a priority, with PV installed at the same time. Windows and ventilation should be upgraded at the same time, ideally triple glazed windows and MVHR with high efficiency heat recovery. Wall insulation should be installed, with external insulation being the preference if possible. It may be possible to install a low carbon heating system before many fabric measures, depending on the heating load.

Low carbon heat

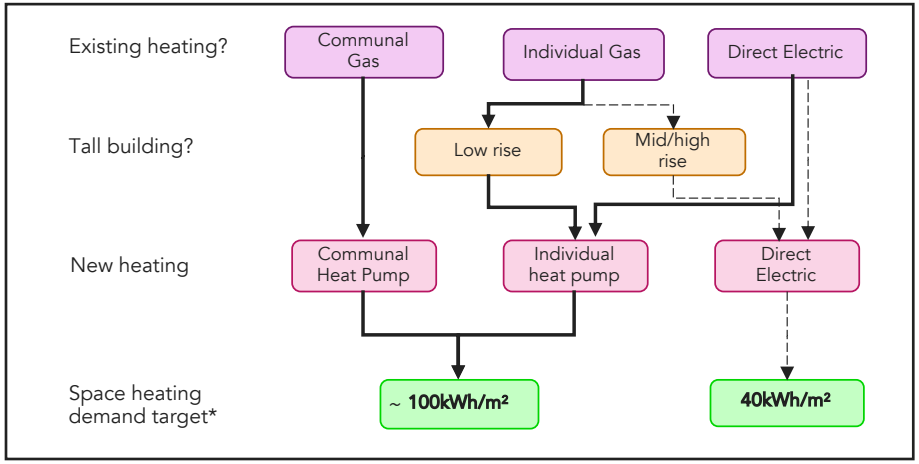
The image to the bottom right shows a strategic decision process for decarbonising different heating systems. The preference would be individual heat pumps, or a communal heat pump system with low temperature distribution. For ultra-low heating demands (e.g. less than 40kWh/m²), direct electricity is also more viable.

Solar photovoltaics

Install as many high efficiency panels as possible, as early as possible, taking advantage of opportunities to share scaffolding. Building mounted generation is a significant way to reduce the final energy and carbon balance of a building. It is a relatively 'easy win' as implementation does not necessarily need to affect the tenants and is under City of London's control.



Simple decision processes for fabric improvements – a good starting point for considering what is needed on a building-by-building basis



Decision processes for low carbon heat, bold arrows show preferred route
**note that this should be assessed on a case-by-case basis as the threshold for heat pumps is often higher*

Archetypes help to simplify the challenge

Decarbonising housing stock can be daunting, and finding ways to group the buildings is a useful way to help to identify common measures and develop a simple roadmap.

Archetypes at CoL

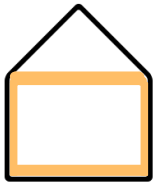
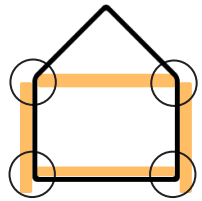
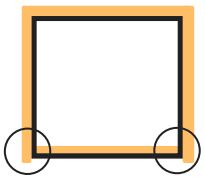
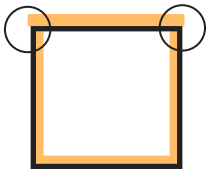
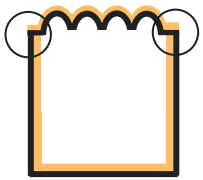
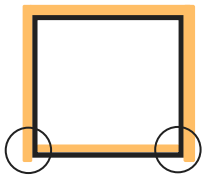
City of London's housing stock is unique in that there are many large blocks, and relatively few low-rise street properties, compared to the national average. Many of the blocks have complex facades, due to the composition and ratio of window to wall, and some are also listed or in conservation areas. Our archetyping process combined the composition of window and wall, the anticipated location of the wall insulation and the location of the roof insulation. The images to the right show examples of the six archetypes and the diagrams show the insulation locations and where complex junctions might occur.

For each archetype we developed a set of typical fabric and ventilation measures, and for each individual building an appropriate low carbon heating strategy was indicated and the potential for PV panels on the roof was assessed.

Importance of a whole building plan

The previous page described the decision processes for retrofit measures. The measures would ideally be implemented together and to the maximum possible standard. In reality, a stepped retrofit is often required, and the details influenced by numerous factors, including financial constraints, maintenance priorities and funding availability. When creating a plan, it is important to consider the desired end point and work backwards, ensuring none of the earlier steps conflict with the final goal, minimising abortive works. It is also critical to follow a PAS 2035* process to minimise unintended consequences and ensure that interdependent measures are installed together, e.g. window replacements and ventilation systems.

**For more information about PAS 2035 and unintended consequences refer to https://retrofitacademy.org/wp-content/uploads/2023/10/PAS2035_2023.pdf.*

Archetype code	Example	Location of insulation
1. Trad – IWI - loft		
2. Trad – EWI – loft		
3. Trad – EWI - flat		
4. Mix – IWI - flat		
5. Mix – IWI – barrel		
6. Mix – EWI – flat		

The six archetypes. Circles indicate where insulation is discontinuous, and attention needs to be paid to junctions.

The Housing Action Plan (HAP) gave the City a plan to deliver retrofit across its housing stock to meet both 2027 and 2040 targets. It is worth noting that the HAP was not formally adopted by the City following publication. For this reason, it is seen as an advisory document rather than a formal strategy one. The priorities is sets out the methodology for setting a retrofit strategy are still relevant to the work presented in this Housing Delivery Plan and the work of the various teams in the City.

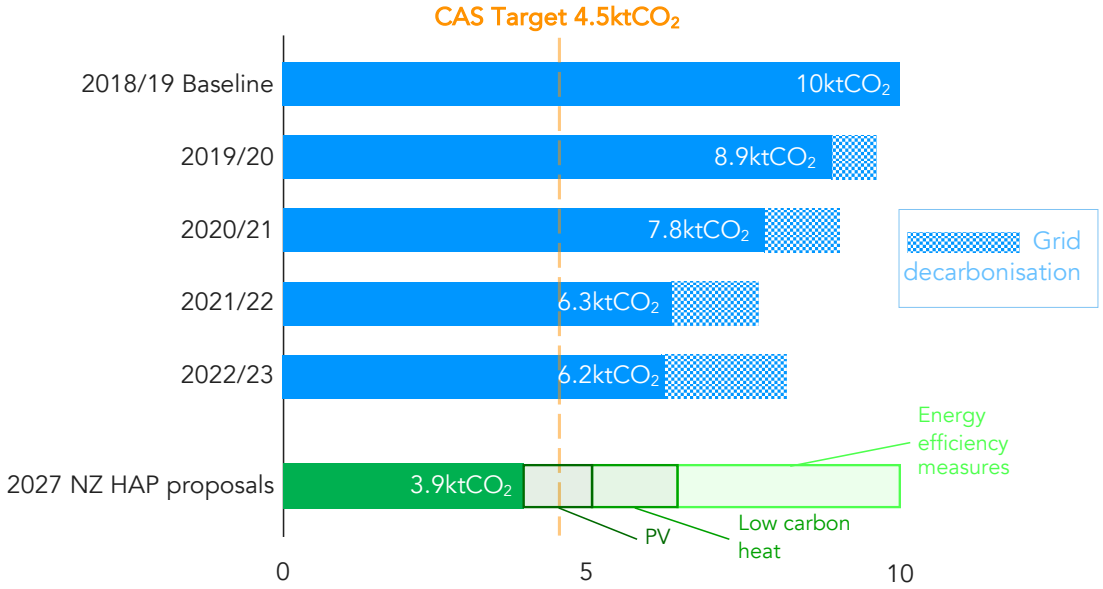
Meeting the 2027 and 2040 targets

The diagram to the right shows the predicted impact of energy efficiency measures (including fabric improvements), low carbon heat and solar PV on bringing scope 1 & 2 emissions as close to zero as possible by 2027 and scope 1, 2 & 3 emissions as close to zero as possible by 2040.

This is predicted to reduce emissions by approximately:

- 86% from the 2020 baseline by 2040 for scopes 1, 2 &3
- 49% - 61% from the 2020 baseline by 2027 for scopes 1 & 2

The reductions achievable in scope 1 & 2 emissions by 2027 is dependent on how many of the gas communal heating systems are decarbonised.



The Net Zero Housing Action Plan strategy – *The original plan demonstrated that if building fabric and ventilation was improved, as well as low carbon heat and solar PV installed, the CAS target could be achieved for Scope 1 & 2 emissions by 2027. The measured results from previous are shown in blue with the impact of grid decarbonisation separated out. The 2027 NZ HAP proposals include for the predicted grid decarbonisation figures from the time of publication.*

HAP Scope 1 & 2 priorities

- Switch gas communal heating to a low carbon alternative
- Upgrade controls and distribution of communal heating systems
- Install roof insulation early with PV systems
- Make communal lighting more efficient

HAP Scope 3 priorities (also partially required on communally heated estates)

- Replace individual gas boilers with low carbon heating alternatives.
- Improve the fabric efficiency through:
  - Upgrading to triple or vacuum double glazing
  - Installing wall, roof and possibly floor insulation
  - Improve airtightness of homes
- Improve ventilation – preferably through mechanical ventilation with heat recovery
- Install waste-water heat recovery to showers and baths.

The missed opportunities

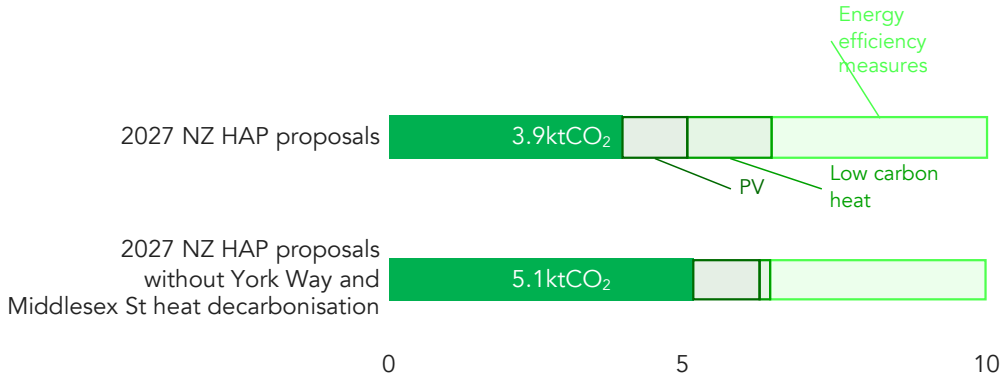
Since the HAP was published in 2021, capital projects have continued, without the 'upgraded specification' needed to meet the proposed targets. This has resulted in a series of missed opportunities that this Housing Delivery Plan is trying to help move away from.

These missed opportunities represent a mixture of fabric measures (such as window replacements) and communal heat renewals.

The replacement of gas boilers at York Way and Middlesex Street with new gas boilers has effectively 'locked in' the carbon emissions on these sites. These boilers will certainly not be replaced before 2027 and possibly not before 2040. This was known at HAP stage and 'scenario 1' in that report identified a shortfall at the 2027 target even with best case scenarios for all other buildings.

Improvements have, however, been made to the distribution pipework and controls system for the heat networks at York Way and Middlesex Street. This will likely only make a very small difference to the energy used and associated carbon emissions, but it may make the switch over to a low carbon communal heating system in the future more feasible.

Alongside this, Middlesex Estate has benefitted from the addition of roof insulation and PV, as well as improvements to landlord lighting.



Updated graph from the previous page showing the indicative impact of the missed opportunities at York Way and Middlesex Estate on the scope 1 and 2 emissions, based on the Net Zero Housing Action Plan measures. The updated green bars indicate the impact of retaining a gas fuelled communal heating system, rather than switching over to a low carbon system.

Decarbonising the gas communal heating system at York Way and Middlesex Street was assumed to deliver a 12% reduction on the baseline scope 1 and 2 emissions by 2027. Although this opportunity has been missed, there are ways to decrease energy use at these estates to partially mitigate this impact until the heating system can be replaced, as well as exploiting other upcoming opportunities across the rest of the stock.

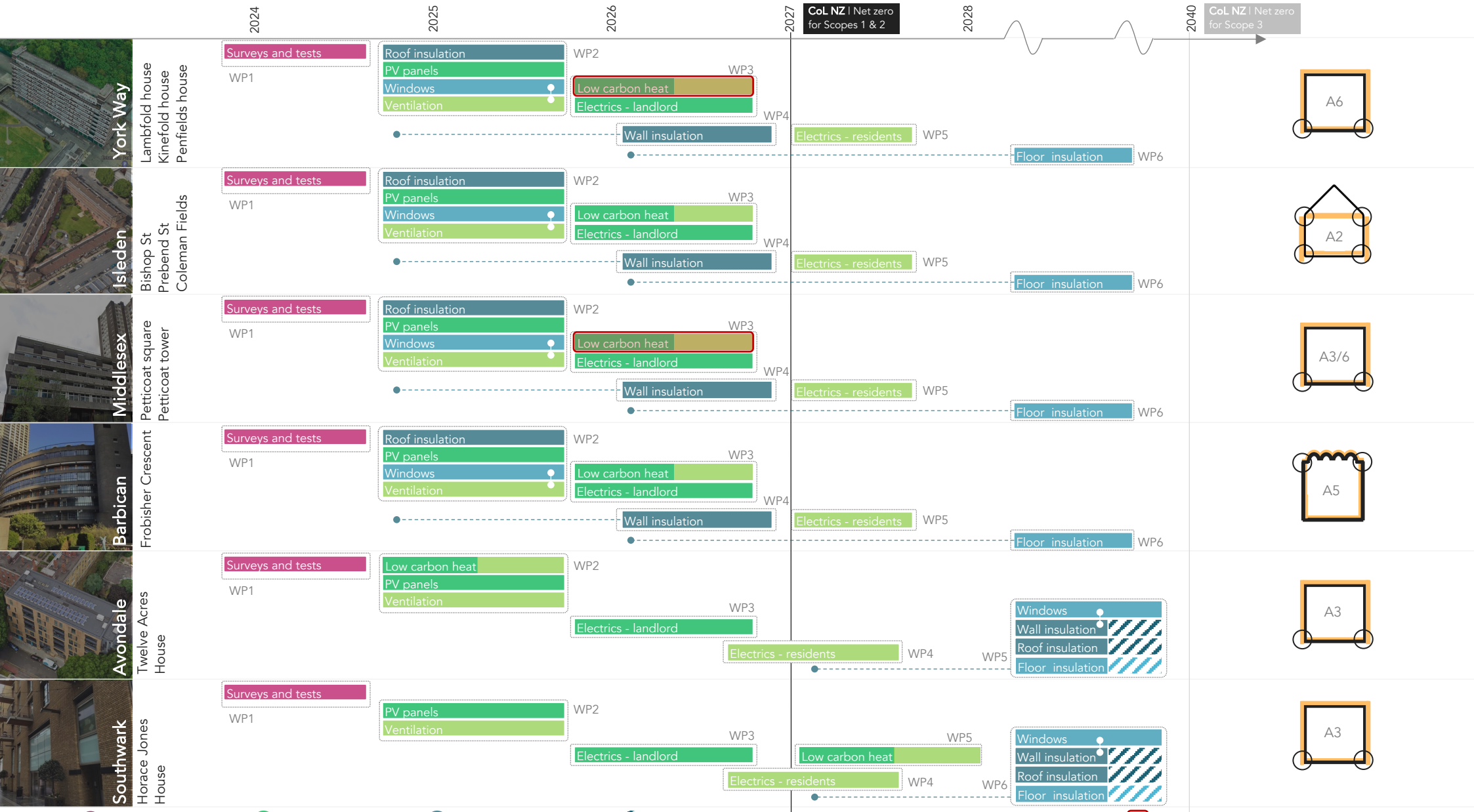
Critical estates – Isleden House

The communal gas boilers at Isleden are around 20 years old. Larger boilers like this typically have a service life of 25 to 30 years, so the boilers are likely to need replacement in the near future. The lesson learnt from York Way and Middlesex Estate is that, in order to replace gas boilers with a low carbon alternative, the City must be ready with both a plan and the necessary infrastructure to enable its delivery.

The Energy and Carbon Team have submitted an application to the Heat Network Efficiency Scheme (HNES) for a match-funded grant to improve the existing heat network infrastructure at Isleden. The proposed scope of work includes monitoring of the current system, as well as measures to reduce heat loss in the distribution pipework and increase the overall efficiency. This will provide a small decrease in gas consumption in the short term but will also facilitate the future switch of heating systems to a low carbon option, when the boilers have reached the end of the operable life. This should be combined with work to reduce the heat loss of the homes.

The retrofit picture | High level strategy | Detailed roadmap for communally heated estates

To deliver the 2027 net zero target retrofit work will be needed across all the housing estates served by a communal heating system. This page sets out the packages of work needed to deliver this and the potential order for delivery. Low carbon heat should be delivered earlier if possible. More detail on each package is provided later in the HDP.



KEY:

- Communal areas surveys
- Home surveys
- Communal services
- Home services
- Communal fabric measures
- Home fabric measures
- Measures to renew if surveys suggest necessary
- Measure to be installed renewed earlier if necessary, e.g., for low carbon heat strategy
- Missed opportunity because works have recently been completed

3

Short-term priorities | Focusing efforts and funding before 2027

Given the picture presented in Section 2 there are some short-term priorities the City must work to achieve. These mostly seek to avoid any further ‘missed opportunities’ and put the City in a good position to continue delivering well informed retrofit projects. Funding these priorities is a crucial step and will require immediate work across several teams in the City.

Short term priorities | Overview and rationale

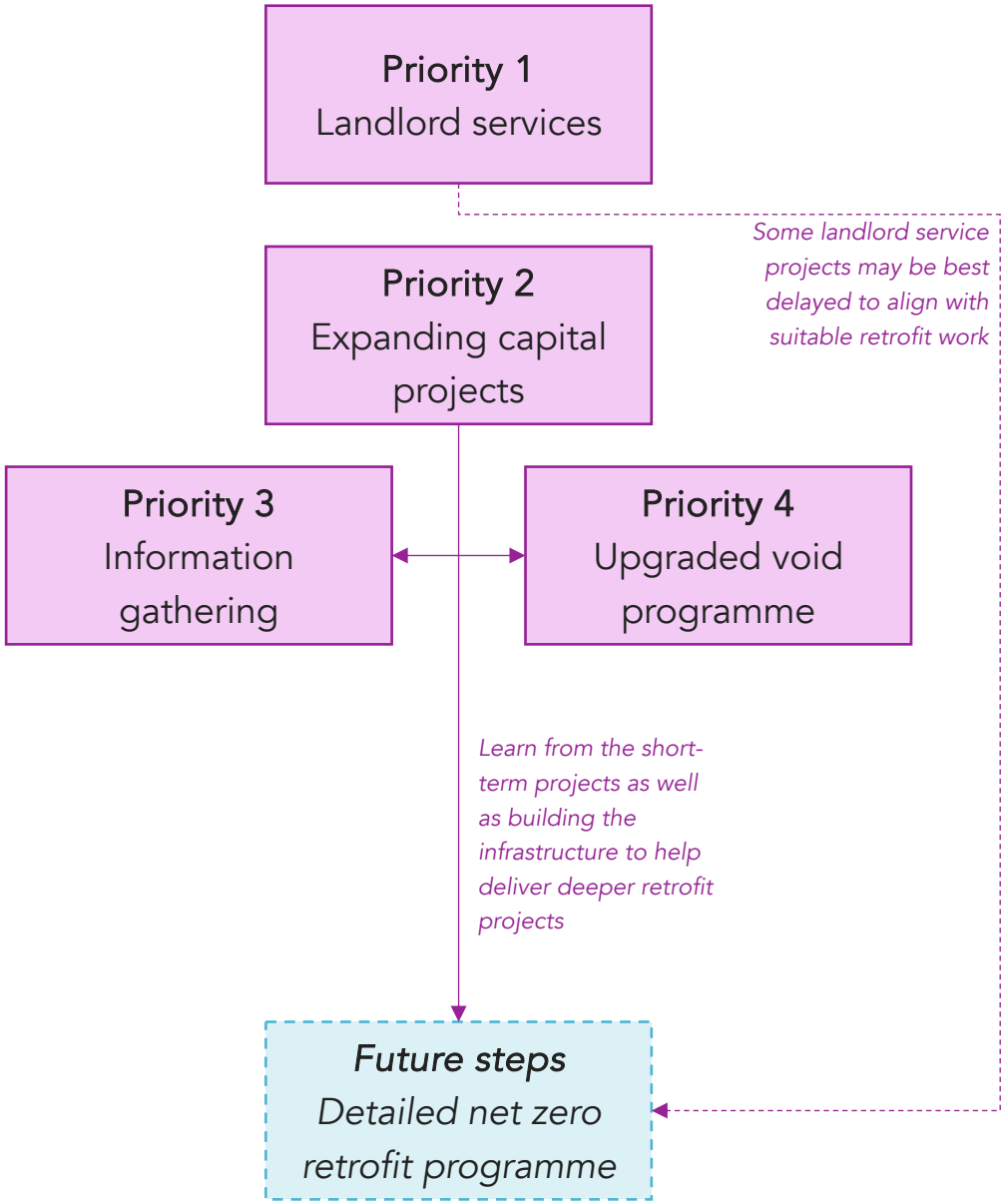
Net zero retrofit must be embedded into standard practice

The previous sections have highlighted that there has been a small change in the carbon emissions from housing since 2018. Capital projects and repair work completed within that period has continued in a business-as-usual manner. For this reason, it is unlikely that the retrofit roadmap set out on page 18 is achievable, given the quantity of work needing delivery by 2027.

With the 2027 target approaching it is crucial that the City looks towards the short-term priorities, setting out clear responsibilities for each of the involved teams and identifying the funding sources suitable for providing the uplift over business-as-usual.

From the review of the team structure, the work completed by external consultants, and the understanding of upcoming capital projects, 4 short term priorities have been identified and could be considered the main purpose of this Housing Delivery Plan. These priorities are summarised here with more detail on subsequent pages.

- Priority 1 – Landlord managed services (such as lighting, lifts, ventilation etc.) have been surveyed by an external consultant. They have developed options for their upgrade, where appropriate. This work can be completed in a relatively independent way of other retrofit work and disruption to residents kept to a minimum.
- Priority 2 – Upcoming capital projects that are in their design phase should be expanded to include low carbon retrofit measures in the scope.
- Priority 3 – De-risking retrofit projects will be key to their success and speed. More information is needed on the current performance of the housing stock. Relatively cheap and unintrusive surveys must be completed, as standard, to build this information.
- Priority 4 – Voids represent an opportunity to carry out testing and complete incremental improvements towards a low carbon retrofit. The void specification and programme should be upgraded to take advantage of this.



Short term priority 1: Landlord services | CAS funded survey work

Communal heat decarbonisation plans

Beveridge Associates were appointed in 2022 to produce a decarbonisation plan for each communally heated block. These plans set out options for changes in heat generation and distribution.

The decarbonisation of heat in communally heated blocks is a complex topic with many factors that can influence the right path for a particular building. The outcome of this work is more an initial appraisal of the potential options. Further work will be needed to take this work forward and develop more detailed options.

For this reason, they are not considered a 'quick win' and do not form part of the short-term priority in terms of immediate delivery work. Their further development should however be a priority for the City as many of the systems are approaching the end of their service life and a low carbon option should be identified prior to this.

Landlord services energy conservation measures

Elevate Everywhere were appointed in 2022 to carry out site energy usage surveys of all housing estates to analyse potential energy conservation measures (ECMs) in landlord or communal areas. The review looked at:

- Landlord managed services, such as lighting, lifts, pumps and ventilation systems.
- The electrical metering and distribution systems.
- Options for installing solar photovoltaics (PV) on the roof.

A distinction was made between systems that were economical to replace and those that were considered modern enough to not require replacement.

Given the potential to start these projects quickly and for them to be completed in relative isolation to other retrofit activities, these are considered quick wins for moving closer to the 2027 net zero target.

The landlord services survey highlighting potential energy conservation measures has been completed for all of the City housing estates. Alongside this is a heat decarbonisation plan for each of the communally heated estates/blocks.

Short term priority 1: Landlord services | Delivering it

A plan is in place for delivery

The landlord services projects have started to be scheduled by the City's Energy and Carbon and Housing Teams. A certain proportion of the projects have been considered economical to go ahead. This comprises a proportion of the lighting and PV projects, which have begun the Gateway 2 process.

Although timing will be dependent on funding, contractor and availability and access to the estates, a rough timetable up to 2027 has been developed:

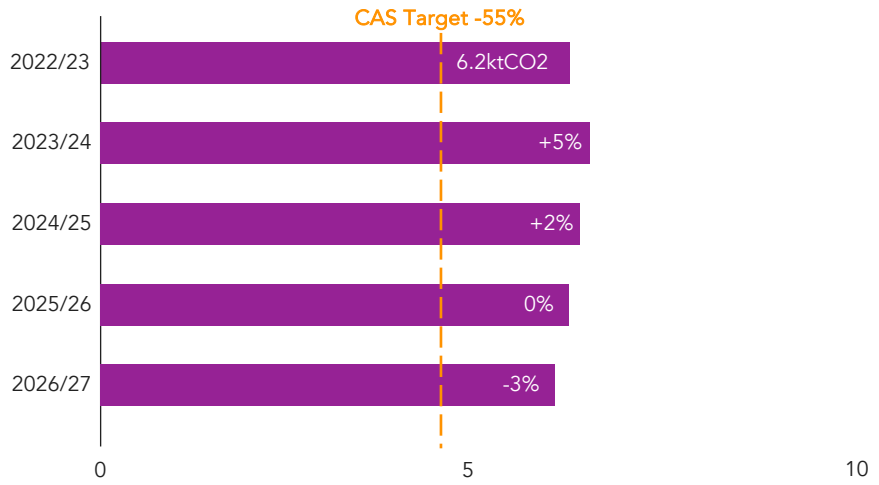
- **2024/25** – All HRA housing estates, apart from Golden Lane to undertake the proposed landlord lighting upgrades. Approximately a quarter of the overall proposed PV panels will be installed across several estates.
- **2025/26** – Golden Lane Estate upgrade to landlord lighting and installation of 50% of the remaining PV systems.
- **2026/27** – Barbican upgrade to landlord lighting and installation of remaining PV systems.

Uncertainties in these estimates

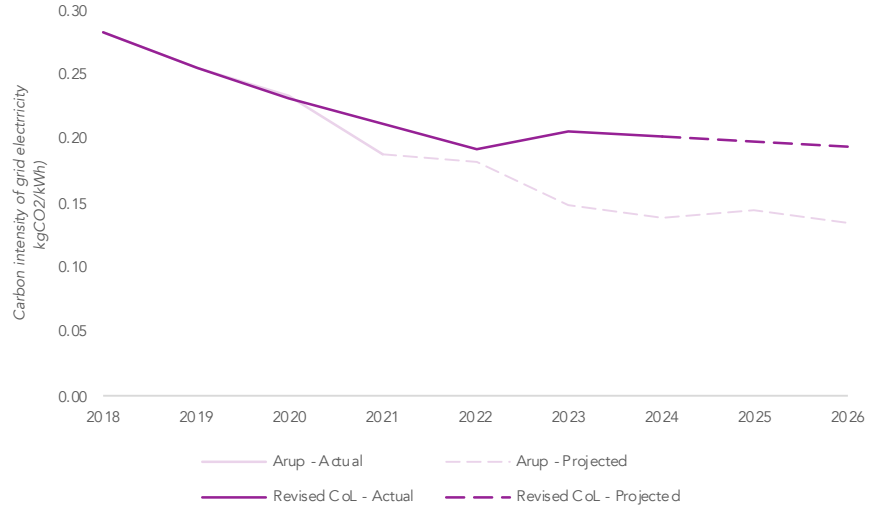
The savings associated with lighting energy are based on high level estimates for the current consumption by Elevate Everywhere. The energy generated from PV is based on desktop studies of the potential PV and further design work will be needed to improve on these estimates. In a similar way costs associated with the proposed measures are high level.

Other projects should be delivered as well

The savings shown on this page assume that no other improvements are made to the building stock and show the landlord services in isolation. As can be seen on the next pages, there are plenty of other opportunities that can be delivered alongside this.



The estimated reduction in scope 1 & 2 carbon emissions from implementing the plan for landlord services. This estimate takes the 2022/23 electricity and gas consumption as a baseline and reduces the electricity consumption based on the proposed measures installed year-on-year. Reductions/increases are also as the result of changes in the carbon intensity of grid electricity, based factors in the graph below.



Updated analysis of the carbon intensity of grid electricity. The original Climate Action Strategy was based on the projection completed by Arup and shown here. More recent analysis undertaken by the Energy and Carbon Team has shown that decarbonisation is happening slower than initially expected. Grid carbon intensity is still decreasing, and the grid has a robust decarbonisation plan.

Short term priority 1: Landlord services | Decarbonising communal heat

Studies for the communally heated estates

Beveridge Associates were commissioned to carry out decarbonisation feasibility reports for the communally heated estates. Their recommendations include a forecast of potential carbon savings arising from the various options considered. These possible reductions have not been included in the forecast 2027 carbon reduction figures for a number of reasons:

- Where the recommendation is to **connect to Citigen:**
  - There is no defined decarbonisation plan for this network with dates and currently heat is primarily supplied through fossil fuel-based systems.
  - Significant infrastructure upgrades would be needed within the buildings, as well as to the network, to connect the nominated estates to Citigen. Both of which will take time to plan and deliver. This is not expected to be delivered before 2027.
- None of the estates with the recommendation to install **new communal air source heat pumps** are scheduled for a heating system replacement prior to 2027. If systems could be replaced earlier than their standard lifetime, some significant carbon reductions could be achieved.
- Where the recommendation is to **use a local source of waste heat**, the timescale for delivery of the source is uncertain and outside the City's control. The interim system proposed is to continue to use existing boilers, so no carbon reductions are expected to be delivered by 2027.

Isleden HNES funded measures

At Isleden, funding has been secured to carry out some monitoring and investigative works to the existing heating system. It's understood that these are enabling works but will not, in themselves, achieve direct carbon reductions. However, the hope is that they will lead to efficiency improvements and the enabling of low carbon heat in the medium term.

7.5 System Options Matrix

DECISION MATRIX - WEIGHTED												
CRITERIA DESCRIPTION	Criteria 1 Operational carbon emissions	(Tonnes of CO2 over 20 years)	Criteria 2 Embodied Carbon	Criteria 3 Capital Costs	(£)	Criteria 4 Ongoing cost impact to residents	(£)	Criteria 5 Level of disruption to residents	Criteria 6 System functionality - resident control/comfort	Criteria 7 Planning permission / external space	Criteria 8 Impact on air quality	
WEIGHT (%)	20		5	20		20		20	5	5	5	100
OPTIONS	Scores		Scores	Scores		Scores		Scores	Scores	Scores	Scores	
Option A – Like for Like Replacement, including HIUs	0	4,514	1	3	£1,216,390	2	£2,591,723	3	1	3	1	1.90
Option A + PVT – Like for Like Replacement, including HIUs + PVT	1	3,239	2	3	£1,537,328	3	£1,739,464	2	1	2	1	2.10
Option B1 – Central ASHP Plant & Local HIUs	3	1,000	1	2	£2,719,642	3	£2,051,258	1	2	1	3	2.15
Option B1 + PVT – Central ASHP Plant & Local HIUs + PVT	3	657	2	1	£3,117,142	3	£1,348,076	1	2	1	3	2.00
Option B2 – Central ASHP Plant with Elec Boiler Assistance (Bivalent) to HIUs	2	1,852	1	2	£2,132,242	1	£3,799,581	3	2	3	3	2.05
Option B2 + PVT – Central ASHP Plant with Elec Boiler Assistance (Bivalent) to HIUs + PVT	2	1,609	2	2	£2,589,742	1	£3,301,276	2	2	3	3	1.90
Option B3 – Cascade Central Heat Pump Plant & Local HIUs	2	1,844	1	2	£2,518,185	1	£3,783,381	3	2	3	3	2.05
Option B3 + PVT – Cascade Central Heat Pump Plant & Local HIUs + PVT	2	1,502	2	1	£2,836,185	2	£3,080,200	2	2	3	3	1.90
Option B4 – Ambient Loop Heating	2	1,571	1	2	£2,634,108	1	£3,579,630	2	2	2	3	1.80
Option B4 + PVT – Ambient Loop Heating + PVT	2	1,317	2	1	£2,952,108	2	£3,003,603	2	2	2	3	1.85

Table 7 – System matrix used to score feasibility of decarbonisation strategies.

Beveridge Associates produced decarbonisation feasibility reports for each communally heated estate. Each report compares various options for that estate and evaluates potential carbon savings (example options matrix from Isleden House).

Short term priority 2: Expanding capital projects | Introduction

Existing projects are a clearer route to delivering retrofit

The forward programme sets out the capital projects over the coming 5 years. From this and an understanding of which ones are currently funded, it is possible to derive a list of projects that are likely to start on site before 2027.

Given that these projects will involve some level of fabric renewal there is a golden opportunity for retrofit, both uplifting the proposed specification for the identified building element, as well reviewing other retrofit works that could be completed alongside it.

Only some of these works are funded, the rest remain as a future need that can only progress once a budget is made available. Here they are identified as *medium-term* priorities.

* Multiple estates - Individual boiler replacement

Within the capital works programme there are multiple boiler replacement projects needed across almost all the housing estates. These mostly refer to individual gas boilers. Although these contribute to scope 3 rather than scope 1 or 2 emissions, continuing to replace individual gas boilers with new ones threatens the 2040 net zero target.

Boilers typically last over 15 years, meaning that replacing them beyond 2025 may result in them being removed earlier than their full lifecycle potential. This may make the option of continuing to install new gas boilers not actually cost effective when considered over the lifetime of the appliance.

As part of this priority, a strategy should be developed for replacing individual gas boilers with with heat pumps to begin the incremental decarbonisation of the entire housing stock. This would require a strategy for each building and would need agreement from several teams as well as a funding source.

Missed opportunities

Projects that are complete or almost completed and therefore opportunity for improvement has been missed

- **Southwark Estate** - window replacement
- **Holloway Estate** – window replacement
- **York Way** – replacement boilers to communal system
- **Sydenham Hill** – window replacement
- **Middlesex Estate** – replacement boilers to communal system

Urgent priority projects

Projects about to start their design work or have started design and are funded. These are priority projects for improvement.

- **William Blake Estate** – All buildings – window replacement and external redecoration
- **Golden Lane Estate** – All buildings – window replacement and roof structural check
- **Avondale Estate** – Avondale House – Flat roof renewal

Medium-term priority projects

Projects that are short-term priorities for cyclical renewal but have not received funding.

- **York Way** – All buildings – window replacement and external redecoration
- **Isleden House** – All buildings – communal heating improvements
- **Middlesex Estate** – communal ventilation system replacement/upgrade
- **Multiple Estates** – boiler replacements expected* see note across

Note: Estates highlighted in purple are 2027 NZ Target Priority estates

Short term priority 2: Expanding capital projects | 2027 NZ Target priorities

Opportunity for retrofit works at York Way

The Housing Team Capital Works programme currently includes a major refurbishment project at York Way. This comprises window replacements, external redecoration, and improved communal ventilation. These improvements come with a forecasted investment of £4.14 million based on a 'business as usual' approach.

The type of work and scale in the proposed project represents a significant opportunity to improve the energy efficiency of an estate connected to communal heating. It is doubly important given the fact that recently the mains gas heating systems was renewed, keeping York Way on carbon intensive fossil fuels for the immediate future.

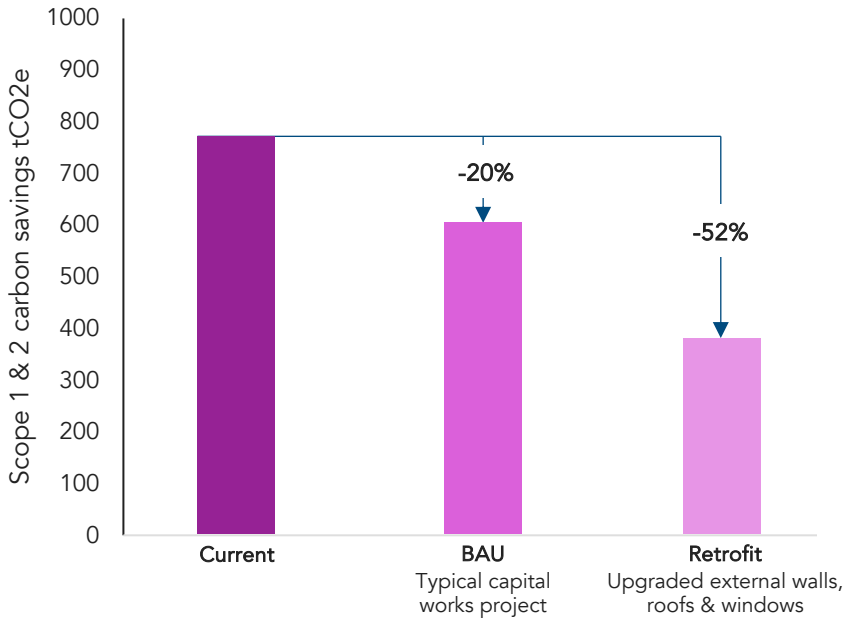
To quantify the potential, energy models have been created for:

- The **current** situation
- A **business-as-usual (BAU)** capital project – assumed to be compliant with building regulations minimum standards (including insulating walls and double-glazed windows), and
- A low carbon **retrofit** option – including best practice wall (EWI), ground floor, and roof insulation, the installation of triple-glazed windows, MVHR, best practice communal ventilation, and PVs. PV panels have been discussed as part of 'Short term priority 1' and are therefore not included in this analysis. PV should be installed at the same time as these measures, rather than before, however.

Shepherd House has been excluded from the analysis because it is not a priority block for 2027. Given the scale of the works required in both the BAU and Retrofit cases, the work may extend beyond 2027.

Other estates

There are two other medium-term priority projects: Isleden House communal heating system renewal/improvements and Middlesex Street communal ventilation. Both these projects should seek to deliver an expanded scope as a contribution to the 2027 net zero target. The Housing Team has begun looking at options for Isleden House through HNES, as discussed on previous pages.



The estimated reduction in Scope 1 & 2 carbon emissions for the current estate, a business-as-usual capital works replacement programme, and an upgraded capital works programme including wall insulation, triple glazing and roof insulation. The potential further impact from adding PV is also presented.

North-west view of Kinefold, Lambfold and Penfield in York Way Estate.

Short term priority 2: Expanding capital projects | 2040 NZ Target priorities

In addition to the priority projects with communal heating (i.e. the priorities for the 2027 target) there are significant planned capital projects that are currently in, or approaching, design phase. The estates are:

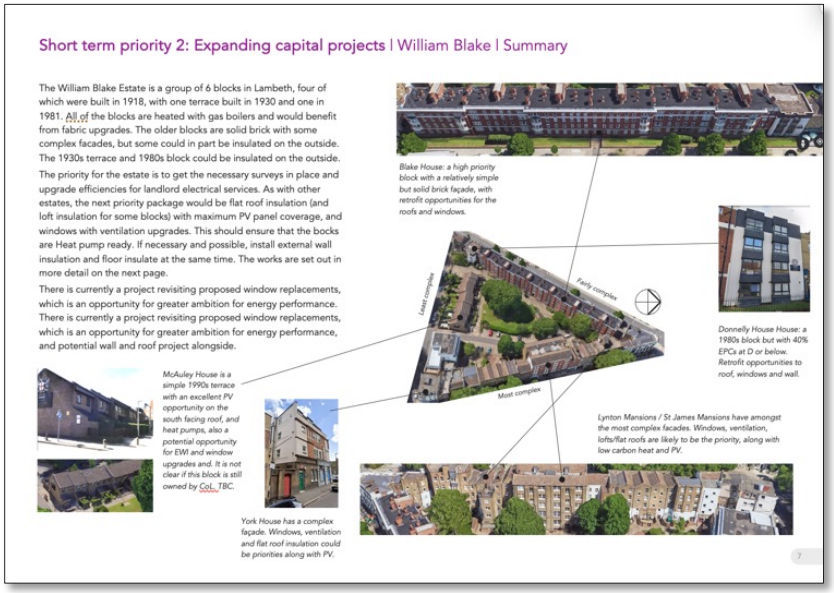
- William Blake
- Golden Lane
- Avondale Square

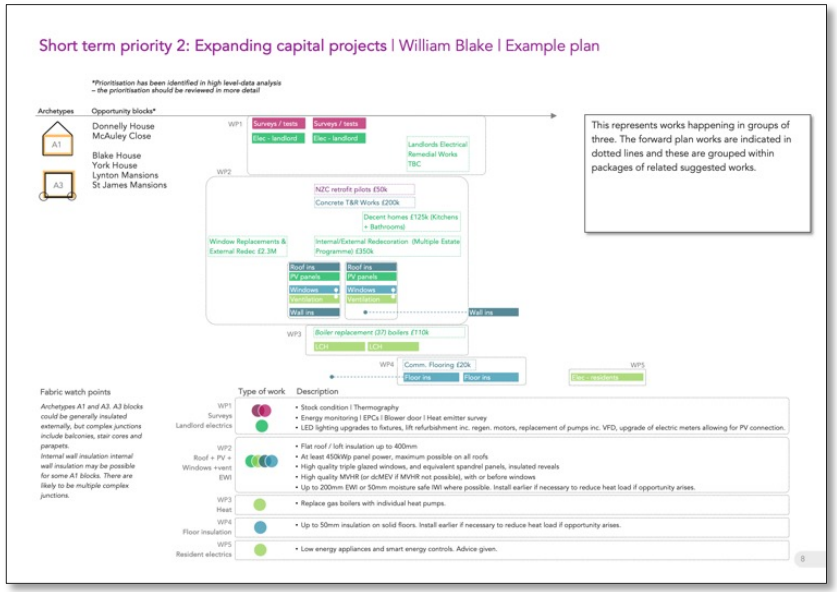
The following pages show a high-level strategy for selected blocks within these estates. These include an introduction to the estate and a Gantt chart of potential energy efficiency works, in the context of planned capital works.

The order might change but the ambition should remain

These plans are based on our understanding of technical priorities, other strategic priorities will need to be incorporated. The order for the estates and blocks is indicative, but they give an overview of the **quantity of works** that need to be completed.

This should therefore be adapted to suit other priorities, but the ambition for the amount of work, and potential carbon emission savings should not be sacrificed if specific works get delayed.





Example estate overview and potential works for William Blake Estate

Short term priority 2: Expanding capital projects | William Blake | Summary

The William Blake Estate is a group of 6 blocks in Lambeth, four of which were built in 1918, with one terrace built in 1930 and one in 1981. All of the blocks are heated with gas boilers and would benefit from fabric upgrades. The older blocks are solid brick with some complex facades, but other façades could in part be insulated on the outside. The 1930s terrace and 1980s block could potentially be insulated on the outside.

The priority for the estate is to get the necessary surveys in place and upgrade efficiencies for landlord electrical services. As with other estates, the next priority package would be flat roof insulation (and loft insulation for some blocks) with maximum PV panel coverage, and windows with ventilation upgrades. This should ensure that the bocks are Heat pump ready. If heating loads allow, heat pumps could be installed earlier. If necessary and possible, install external wall insulation and floor insulate at the same time. The works are set out in more detail on the next page.

There is currently a project revisiting proposed window replacements, which is an opportunity for greater ambition for energy performance. Potential wall and roof projects are being considered alongside.

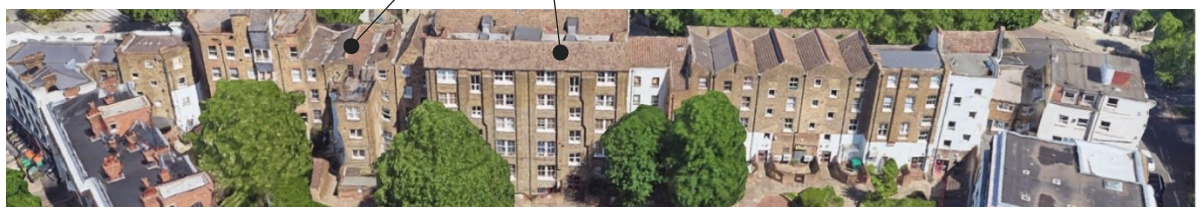
Blake House: a high priority block with a relatively simple but solid brick façade, with retrofit opportunities for the roofs and windows.

Donnelly House House: a 1980s block but with 40% EPCs at D or below. These are potentially heat pump ready with retrofit opportunities to roof, windows and wall.

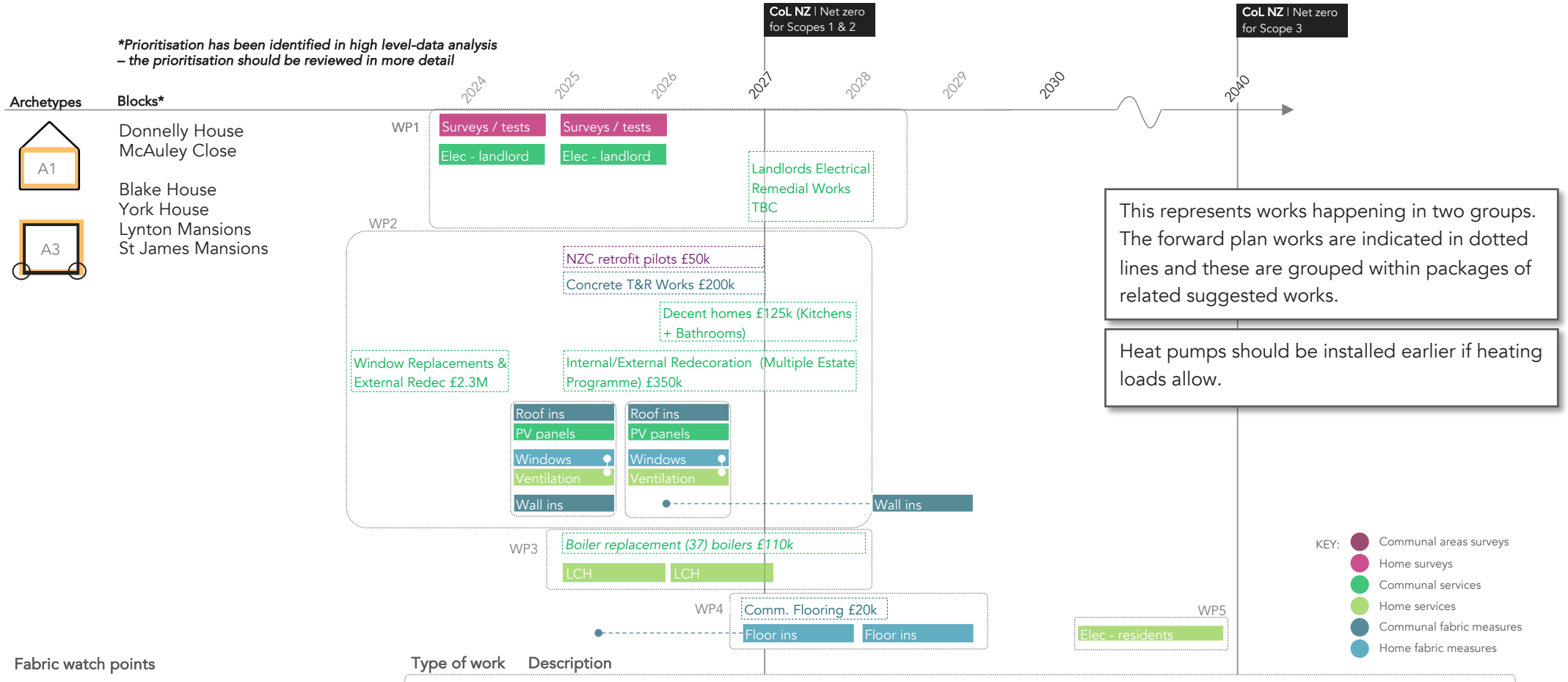
McAuley House is a simple 1990s terrace with an excellent PV opportunity on the south facing roof, and heat pumps, also a potential opportunity for EWI and window upgrades and. It is not clear if this block is still owned by CoL. TBC.

York House has a complex façade. Windows, ventilation and flat roof insulation could be priorities along with PV.

Lynton Mansions / St James Mansions have amongst the most complex facades. Windows, ventilation, lofts/flat roofs are likely to be the priority, along with low carbon heat and PV.



Short term priority 2: Expanding capital projects | William Blake | Example plan



Fabric watch points

Archetypes A1 and A3. A3 blocks could be generally insulated externally, but complex junctions include balconies, stair cores and parapets.
Internal wall insulation internal wall insulation may be possible for some A1 blocks. There are likely to be multiple complex junctions.

	Type of work	Description
WP1 Surveys Landlord electrics		• Stock condition | Thermography • Energy monitoring | EPCs | Blower door | Heat emitter survey • LED lighting upgrades to fixtures, lift refurbishment inc. regen. motors, replacement of pumps inc. VFD, upgrade of electric meters allowing for PV connection.
WP2 Roof + PV + Windows +vent EWI		• Flat roof / loft insulation up to 400mm • At least 450kWp panel power, maximum possible on all roofs • High quality triple glazed windows, and equivalent spandrel panels, insulated reveals • High quality MVHR (or dcMEV if MVHR not possible), with or before windows • Up to 200mm EWI or 50mm moisture safe IWI where possible. Install earlier if necessary to reduce heat load if opportunity arises.
WP3 Heat		• Replace gas boilers with individual heat pumps as early as possible.
WP4 Floor insulation		• Up to 50mm insulation on solid floors. Install earlier if necessary to reduce heat load if opportunity arises.
WP5 Resident electrics		• Low energy appliances and smart energy controls. Advice given.

Short term priority 2: Expanding capital projects | Golden Lane | Summary

The estate can be summarised as seven similar blocks with slightly different façade articulations, and two more distinct blocks: Crescent House, which is Grade II* listed, and Great Arthur House, which is a tower block. All of them are Grade II listed except Crescent House.

All blocks are challenging to retrofit due to their listed status and complex façades. The buildings are also in high need of retrofit due to their poor energy performance and considering that some tenants are also in fuel poverty.

Despite the challenges there are some opportunities for retrofit. The windows or window systems can be upgraded, and there is currently a project to assess and upgrade these across the estate. Alongside these works, the ventilation systems should also be assessed and upgraded to MVHR wherever possible. There is also the opportunity to insulate flat or barrel roofs and install PV to some extent, to most of the blocks. Walls are difficult to insulate generally, but there are some examples of end walls which may be possible to insulate on the outside. There are also some exposed soffits that can be insulated on the outside. Crescent House is currently undergoing an extensive retrofit and many of these strategies are proposed. This is a learning opportunity, with lessons that can be applied to other blocks.

Basterfield House, Stanley Cohen House, Bayer House, Bowater House. Attached blocks to the east of the estate.

Basterfield and Bowater have most complex window articulation

Stanley Cohen House has possibly the least complex façade

Crescent House

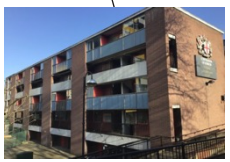
*Grade II**

Very complex façade & Barrell roof.

Hatfield House and Cullum Welch House are attached to Crescent House but are much less complex. Callum Welsh one of the least complex façades.

Great Arthur House

15 Storey tower. Mostly windows and panels, solid wall on "ends". Complex roof



Cuthbert *Harrowing*

Detached block. Similar to Bayer/Hatfield. 4 Storeys

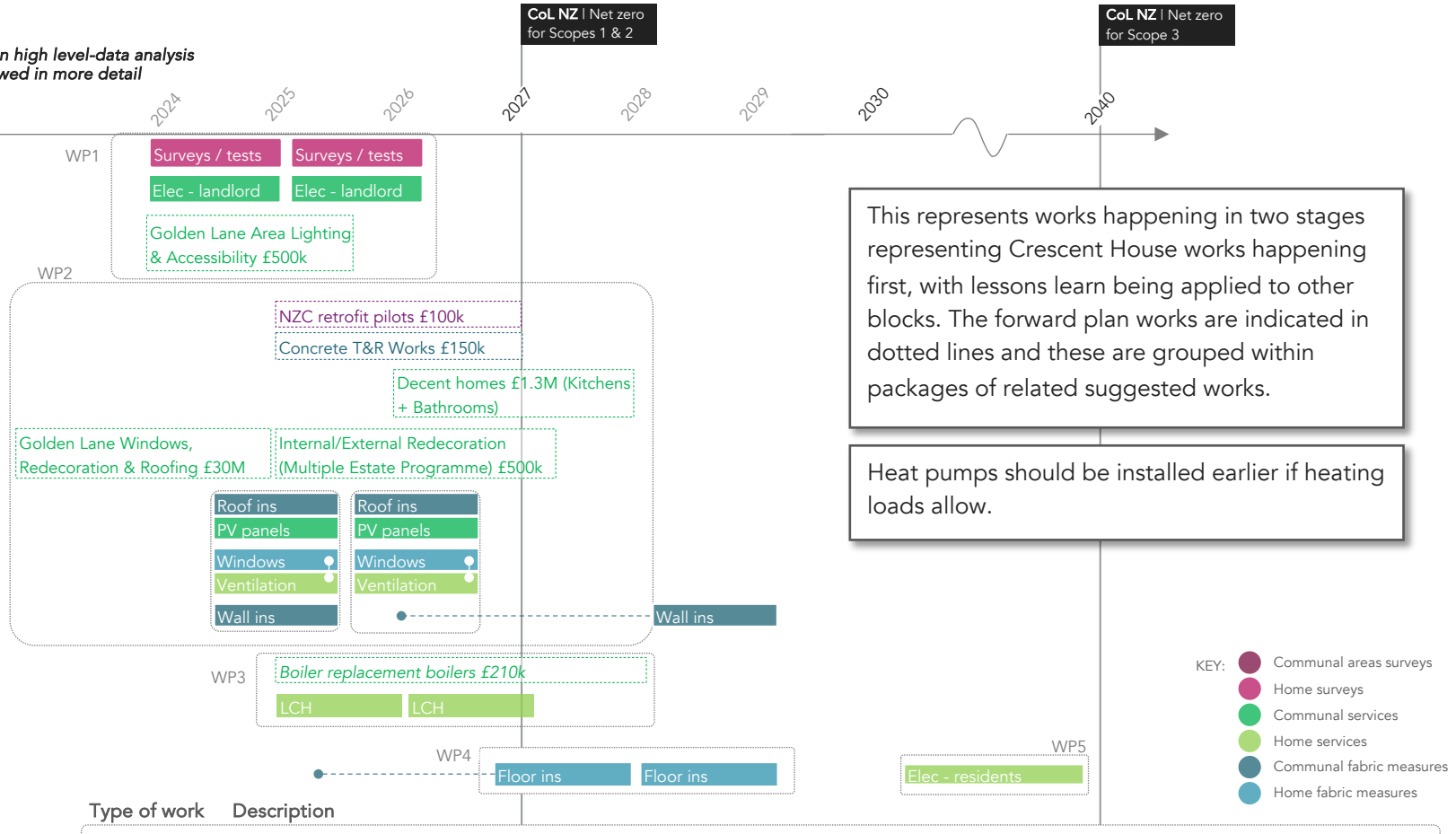
Short term priority 2: Expanding capital projects | Golden Lane | Example plan

**Prioritisation has been identified in high level-data analysis – the prioritisation should be reviewed in more detail*

Archetypes

Blocks*

Crescent House
Cullum Welch House
Bayer House
Stanley Cohen House
Cuthbert Harrowing House
Great Arthur House
Basterfield House
Hatfield House
Bowater House



This represents works happening in two stages representing Crescent House works happening first, with lessons learn being applied to other blocks. The forward plan works are indicated in dotted lines and these are grouped within packages of related suggested works.

Heat pumps should be installed earlier if heating loads allow.

Fabric watch points

Archetypes A4, A4a, A5. Façade is highly glazed, internal wall insulation may be possible in places. Roofs, soffits and some walls could be insulated on the outside. There are multiple complex junctions around windows.

	Type of work	Description
WP1 Surveys Landlord electrics		• Stock condition | Thermography • Energy monitoring | EPCs | Blower door | Heat emitter survey • LED lighting upgrades to fixtures, lift refurbishment inc. regen. motors, replacement of pumps inc. VFD, upgrade of electric meters allowing for PV connection.
WP2 Roof + PV + Windows +vent EWI		• Flat roof, insulation up to 400mm. Soffit insulation, up to 150mm. • At least 450kWp panel power, maximum possible on all roofs • High quality triple glazed windows, and equivalent spandrel panels, insulated reveals • High quality MVHR (or dcMEV if MVHR not possible), with or before windows • Up to 200mm EWI or 50mm moisture safe IWI where possible. Install earlier if necessary to reduce heat load if opportunity arises.
WP3 Heat		• Replace gas boilers with individual heat pumps as early as possible.
WP4 Floor insulation		• Up to 50mm insulation on solid floors. Install earlier if necessary to reduce heat load if opportunity arises.
WP5 Resident electrics		• Low energy appliances and smart energy controls. Advice given.

Short term priority 2: Expanding capital projects | Avondale | Summary

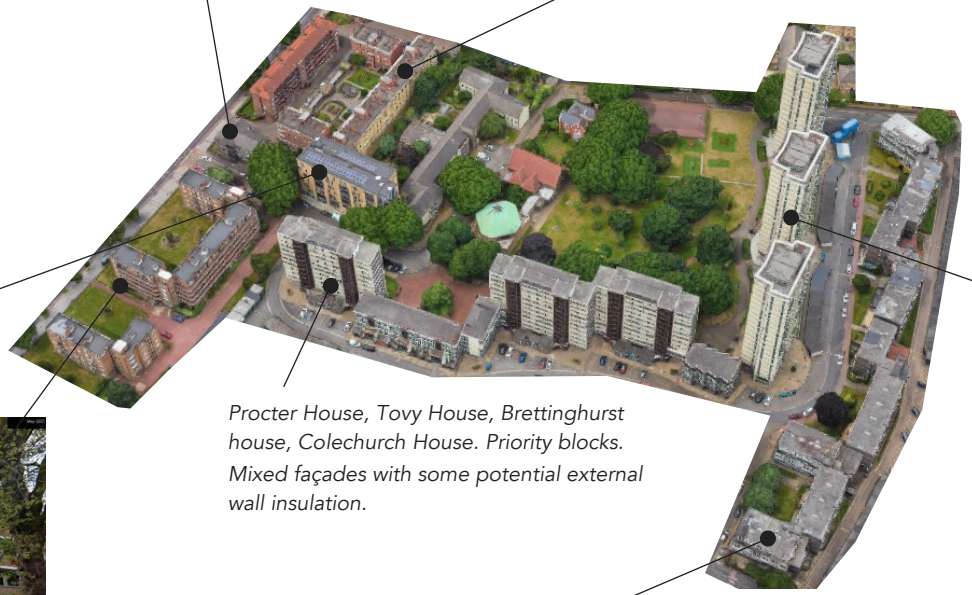
Avondale Square Estate is the largest of the decentralised estates, with 14 blocks, 6 of which are 10 storeys or more, and a total of 687 dwellings. Apart from Twelve Acres House with a communal heating system and Harman House, with direct electric heating, they are all heated by individual gas boilers. Although this is not primarily a communally heated estate this should still be considered priority due to the scale of the estate and upcoming works.

Although some are complex, most facades could be insulated on the outside. The priority for Avondale estate is to get the necessary surveys in place and upgrade efficiencies for landlord electrical services. The next priority package would be roof insulation with maximum PV panel coverage, and windows with ventilation upgrades. This should ensure that the bocks are Heat pump ready. If necessary and possible, install external wall insulation and floor insulate at the same time.

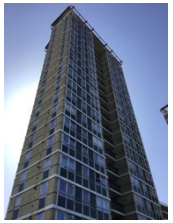
The works are set out in more detail on the next page.

Tevatree House: a high priority block with relatively straightforward retrofit opportunities

Avondale House : A priority block. Slightly more complex façade but opportunities for window replacements, some wall insulation, roof insulation and PV



Procter House, Tovy House, Brettinghurst house, Colechurch House. Priority blocks. Mixed façades with some potential external wall insulation.



The three towers: more challenging due to height, but upgrades, particularly to windows and wall insulation would have a large impact.

Twelve Acres House: A newer block. Opportunity for low carbon heat, fabric measures could be upgraded if surveys find this to be necessary.

George Elliston House: A priority block. Slightly more complex façade but opportunities for window replacements, some wall insulation, roof insulation and PV

Longland court: Potential for external wall insulation, window replacements, flat roof insulation and PV

Short term priority 2: Expanding capital projects | Avondale | Example plan

**Prioritisation has been identified in high level-data analysis – the prioritisation should be reviewed in more detail*

Archetypes

A2

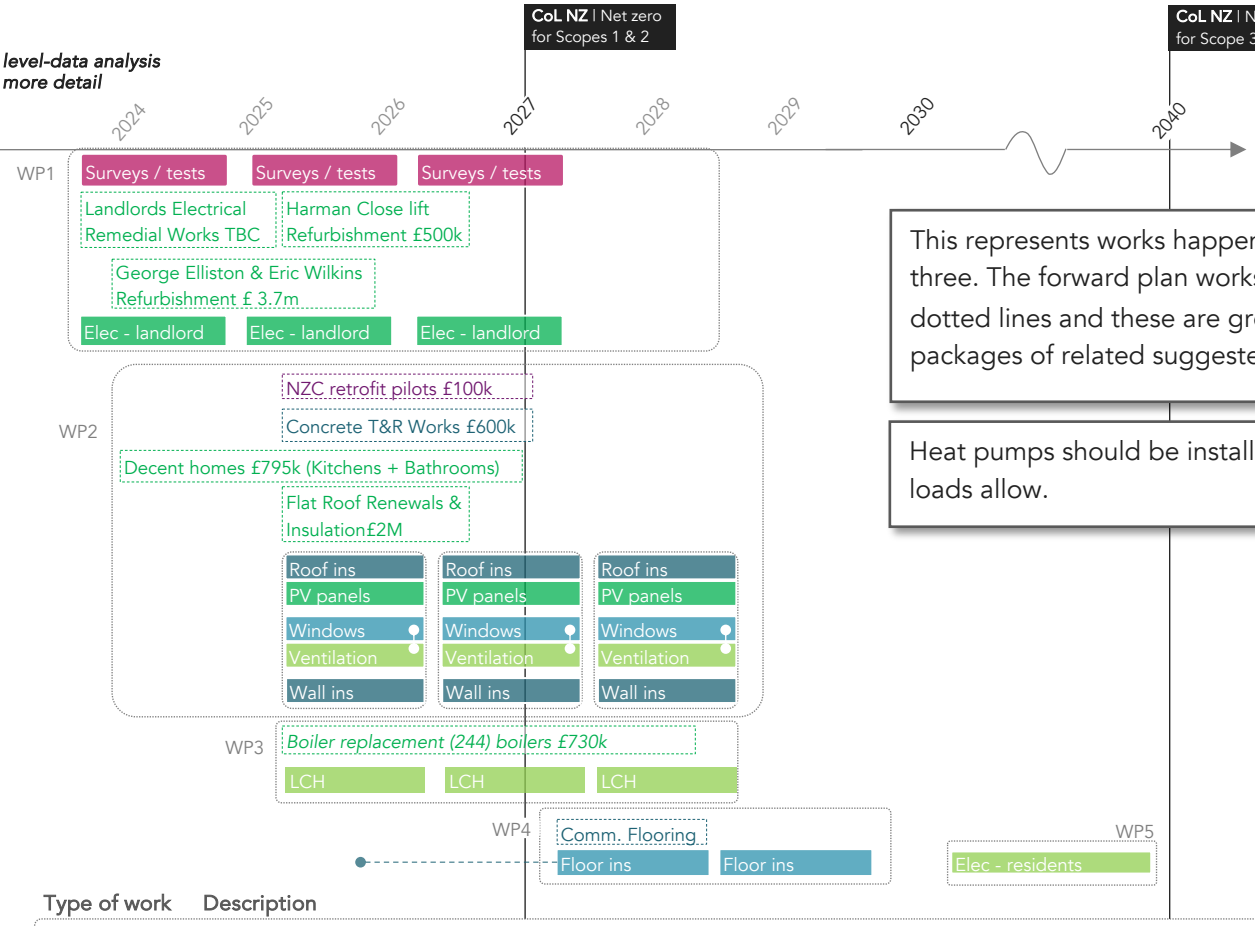
A3/ A6

Opportunity blocks*

Tevatree House
Avondale House
George Elliston House
Proctor House
Eric Wilkins House
Tovy House
Brettinghurst house
Colechurch House

Other blocks*

Centre Point
Longland Court
West Point
East Point
Harman Close
Twelve Acres House



Fabric watch points

Archetypes A2, A3, A6. These blocks could be generally insulated externally, but complex junctions include balconies, stair cores and parapets.
Some A6 blocks have a high proportion of windows on main façades.

Type of work	Description
WP1 Surveys Landlord electrics	• Stock condition | Thermography • Energy monitoring | EPCs | Blower door | Heat emitter survey • LED lighting upgrades to fixtures, lift refurbishment inc. regen. motors, replacement of pumps inc. VFD, upgrade of electric meters allowing for PV connection.
WP2 Roof + PV + Windows +vent EWI	• Flat roof, insulation up to 400mm • At least 450kWp panel power, maximum possible on all roofs • High quality triple glazed windows, and equivalent spandrel panels, insulated reveals • High quality MVHR (or dcMEV if MVHR not possible), with or before windows • Up to 200mm EWI where possible. Install earlier if necessary to reduce heat load if opportunity arises.
WP3 Heat	• Replace gas boilers with individual heat pumps as early as possible.
WP4 Floor insulation	• Up to 50mm insulation on solid floors. Install earlier if necessary to reduce heat load if opportunity arises.
WP5 Resident electrics	• Low energy appliances and smart energy controls. Advice given.

Short term priority 3: Information gathering | Its importance

Confirmation of brief and assessment of risk

The City are aiming to apply for funding wherever possible to support their decarbonisation work. Not all funding schemes require PAS 2035 compliance but some of the key ones do, including the Social Housing Decarbonisation Fund. Following the PAS 2035 process rules should be the default at least until the intended procurement and funding of the works has been confirmed.

The first step that should be undertaken for each block is to identify the goals. Carbon reduction is a common aim for all properties, fuel poverty reductions apply to some, rectification of defects or replacement of equipment at the end of its service life will be identified by the capital works programme on a block-by-block basis. EPC targets will also generally apply as part of the CoL overall targets for housing.

The next step is to assess the risk pathway as defined by PAS. For CoL. This is relatively simple – all communally heated blocks (and most others) will be Pathway C.

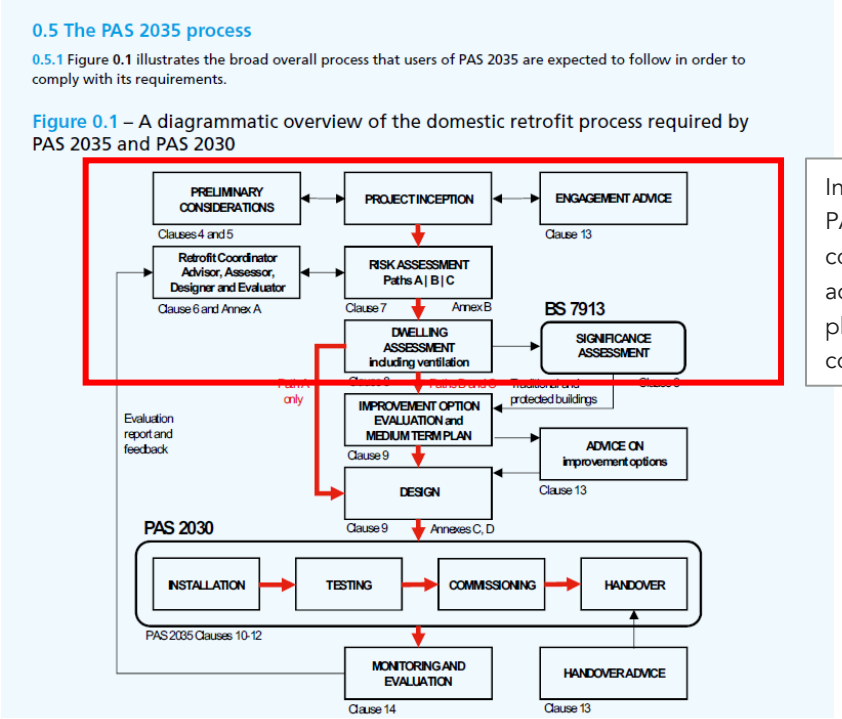
Physical Surveys

As part of the PAS process, various surveys are needed to identify the particular risks for each property before retrofit work plans are developed (refer to following page), specifically to avoid unintended consequences of retrofit, such as increased condensation.

Resident Engagement

The SHDF requirements include a strong emphasis on resident engagement. The residents, including leaseholders should be surveyed or consulted about planned retrofit works and their views recognised and reflected in the final designs wherever possible.

Leaseholders can represent a significant risk to major retrofit works and the approach to their concerns and consent should be an early part of the process of planning the work.



Initial stages of the PAS 2035 process could be in place in advance of works planned commencement

Summary of the PAS 2035 process from BS PAS2035:2019

Table B.1 – Risk assessment table for determining PAS 2035 Path

Criterion 1: Number of dwellings in the project		
The number of dwellings to be improved	Risk grade	Assessed grade
1–10	A	
11–30	B	
More than 30	C	
Criterion 2: Number of measures per dwelling[A)]		
The average number of improvement measures per dwelling	Risk grade	Assessed grade
1–2	A	

Risk Assessments under PAS 2035 – the majority of City projects will be graded 'C' on the basis of the number of dwellings

Short term priority 3: Information gathering | Survey types

Monitoring and thermography

When planning retrofit works, irrespective of whether PAS compliance is needed, thermographic surveys of the buildings would provide the basis for the brief, particularly to identify defects and also to direct where air permeability testing could be most useful.

Monitoring of systems and conditions will allow better understanding of how the CoL buildings are operating, facilitate the reporting required as a heat network provider and also enable accurate assessment of the savings and benefits of retrofit measures. This will help CoL to learn from the pilot projects and to target the most effective retrofit works as the programme advances.

Surveys required as part of the PAS2035 Risk Assessment process

General

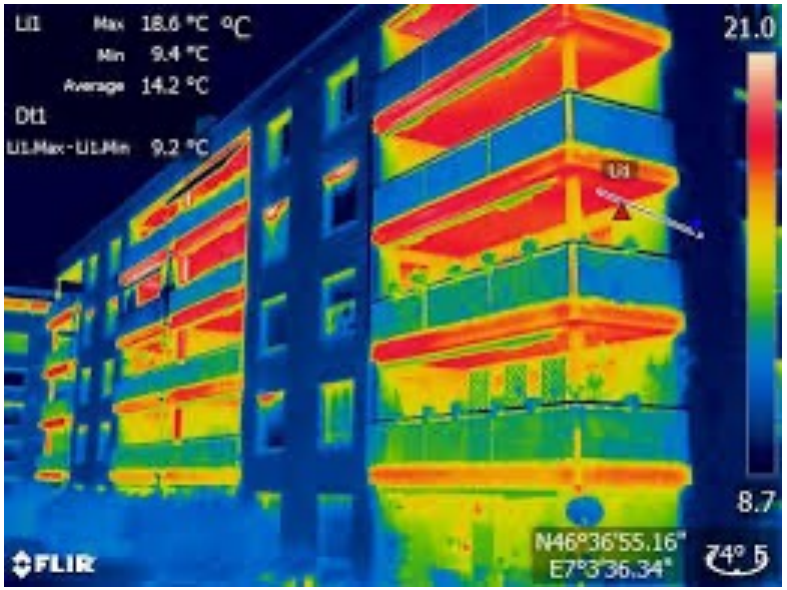
- A strategic assessment of planning risks, heritage and other constraints for each estate.
- Measured surveys of the buildings and confirmation of the main construction materials of each individual building. This may require a review of the information held by the CoL that is not in digital format, either centrally or on each site.
- Surveys of the installed heating and other systems. Elevate Everywhere and Beveridge have carried out surveys to determine the nature, extent and condition of installed communal systems.

Stock condition

- Identification of defects.
- Air tightness testing of each building is required, either as a whole or by type testing dwellings as a representative sample.

EPCs

- Current SAP or RdSAP assessments are required for all properties being retrofitted. Currently around a third are missing.



Thermographic surveys can show specific defects, such as failed double-glazing seals, and identify air leakage paths

Short term priority 4: Void programme | Opportunities

Opportunities that could be offered by voids

When voids occur across the City's housing stock, they could be used for many purposes, including:

- **Pilot projects** to test measures, techniques and products and how well they can be integrated into the building and identifying risks. Showcasing both the process and the outcomes to residents and others in the city. Training of CoL project team and contractor teams.
- **Preparation**. Survey work and preparatory works such as changing radiators to allow a later change to low carbon heating.
- **Reduce disruption**. Where works are likely to be highly disruptive to residents, carrying this out while some flats are empty limits the number of residents who will be affected. Decant space for residents whose flats are being worked on – as at Crescent House.

What needs to be in place

In order to maximise the usefulness of the voids, a whole building retrofit plan needs to be in place for every block across the estate. The plan will identify which measures could be undertaken in individual flats, in isolation. The whole building plan also sets out the sequence and interdependencies of the works. This establishes when in the overall process the voids process can be implemented and whether there is a minimum package of measures that need to be done in every void flat.

Issues to consider

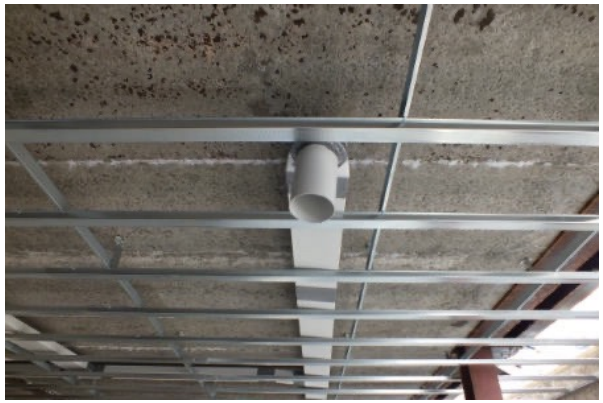
Using the voids to carry out reasonably significant works, such as MVHR installation will extend the void period and therefore affect revenue. Having the whole building plan in place will allow a judgement to be made about when the interventions will be most effective at reducing other disruption (and potentially consequent rent reductions) in order to balance the commercial considerations with practicalities and necessity of the upgrade work.

Add internal wall insulation.

For elevations that are not suitable for external wall insulation, the void offers the chance to strip back the existing finish, prepare and repair, and then install and appropriately specified internal wall insulation.

Install mechanical ventilation with heat recovery (MVHR) ideally, or dcMEV systems and ductwork.

Including intake/exhaust interface with the external wall and fan unit.



Replace existing radiators with higher output emitters suitable for a lower temperature heating system.

Short term priority 4: Void programme | Connection to other standards

The design standards that have been developed can be used as a basis for measures undertaken as part of the voids works.

Net Zero Design Standard

For buildings that are not listed or restricted by heritage considerations, the Net Zero Design Standard sets out objectives and elemental performance targets. These can be used as a baseline to develop a preferred standard for upgrading the fabric in void properties. The performance standards (Appendix 1) set both limiting and target U values for the principal elements.

Heritage Building Retrofit Toolkit

For historic and listed buildings, the retrofit toolkit sets out a process and the different factors that need to be considered. It includes summaries of areas where energy is often wasted in buildings, potential mitigation measures and improvement measures. It also advocates creating whole building retrofit plans.

These summaries provide a useful checklist for every void to eliminate waste, for each building to have a retrofit plan in place and appropriate mitigation and improvement measures to be identified that could be implemented with suitable voids.

Design Standards

CoL have developed design standards for different building types, including housing.

The heritage building toolkit includes a summary of the areas to focus on to eliminate energy wastage.

Short term priority 4: Void programme | Testing and small works

Void flats can be used to make incremental steps towards the optimal net zero retrofit specification.

There are some works that should be done everywhere, in all voids. These are reasonably quick to do and don't affect fixtures or finishes in the properties. They can also all be carried out independently of neighbouring properties.

1. Update EPCs
2. Install monitoring and/or update metering
3. Carry out blower door tests, and draught proofing. In the case of blower door tests, it is useful to carry out a number of tests in every building as a sample, but it wouldn't necessarily be essential to do in every void property.
4. Upgrade meter and/or electrical systems to allow connection to roof mounted PVs where appropriate.

All voids

Type of work	Description
WP1 Surveys	• Stock condition | Heat network monitoring | Thermography • Energy monitoring | EPCs | Blower door | Heat emitter survey
WP2 Roof + PV + Windows +vent	• Flat roof, insulation up to 400mm • At least 450kWp panel power, maximum possible on all roofs • High quality triple glazed windows, and equivalent spandrel panels, insulated reveals • High quality MVHR (or dcMEV if MVHR not possible), with or before windows
WP3 Heat and landlord electrics	• Replace communal gas boiler system with communal heat pumps. • Replace heat emitters with compatible system. OR • Replace individual gas boilers with individual heat pump systems. • LED lighting upgrades to fixtures, lift refurbishment inc. regenerative motors, replacement of pumps inc. VFD, upgrade of electric meters allowing for PV connection.
WP4 EWI	• Up to 200mm EWI where possible. Install earlier if necessary to reduce heat load if opportunity arises. OR • Up to 100mm IWI
WP5 Resident electrics	• Upgrade meters and enable PV connections where appropriate • Low energy appliances and smart energy controls. Advice given.
WP6 Floor insulation	• Up to 50mm insulation on solid floors. Install earlier if necessary to reduce heat load if opportunity arises.

Short term priority 4: Void programme | Upgrade works

There are some works that could be carried out in void properties as part of necessary preparatory work for new tenants. There is an emerging Housing Letting Standard (currently in draft) which describes the condition and facilities that would be a minimum standard for City properties. In some cases, these would be a trigger for upgrades to meet the design standard specification or to install (or prepare for the installation of) new components or systems.

1. Install MVHR ductwork (and fan units)
2. Repair cracks and gaps that are allowing infiltration (uncontrolled ventilation)
3. Review the airtightness strategy and carry out draughtproofing
4. Install internal wall insulation to prevent damp and mould. Ensure that an appropriate specification is selected to avoid unintended consequences.
5. Address cold bridges
6. Replace windows, where planning permission is not required or install secondary glazing if the whole house plan includes this approach. Ensure adequate ventilation is provided to property.
7. Replace gas fired kitchen appliances with electric alternatives
8. Replace and upgrade the distribution pipework and radiators to suit the intended new heating system.
9. Install Waste Water Heat Recovery (WWHR)
10. Install or prepare space for a domestic hot water cylinder or thermal battery where these are integral to the final retrofit DHW system or replace HIUs with modern units to suit the future system.
11. For homes with individual gas boilers, replace gas boilers with low carbon alternative.

Type of work	Description	Potential void works
WP1 Surveys	• Stock condition | Heat network monitoring | Thermography • Energy monitoring | EPCs | Blower door | Heat emitter survey	✓ ✓
WP2 Roof + PV + Windows +vent	• Flat roof, insulation up to 400mm • At least 450kWp panel power, maximum possible on all roofs • High quality triple glazed windows, and equivalent spandrel panels, insulated reveals • High quality MVHR (or dcMEV if MVHR not possible), with or before windows	✓ ✓
WP3 Heat and landlord electrics	• Replace communal gas boiler system with communal heat pumps. • Replace heat emitters with compatible system. OR • Replace individual gas boilers with individual heat pump systems. • LED lighting upgrades to fixtures, lift refurbishment inc. regenerative motors, replacement of pumps inc. VFD, upgrade of electric meters allowing for PV connection.	✓ ✓
WP4 EWI	• Up to 200mm EWI where possible. Install earlier if necessary to reduce heat load if opportunity arises. OR • Up to 100mm IWI	✓
WP5 Resident electrics	• Upgrade meters and enable PV connections where appropriate • Low energy appliances and smart energy controls. Advice given.	✓ ✓
WP6 Floor insulation	• Up to 50mm insulation on solid floors. Install earlier if necessary to reduce heat load if opportunity arises.	

Example whole building plan. Blue tick indicates the work that could be done as part of a voids process

Short term priority 4: Void programme | Other work opportunities

There are some works that could be carried out in void properties as part of necessary preparatory work for new tenants. There is an emerging Housing Letting Standard (currently in draft) which describes the condition and facilities that would be a minimum standard for City properties. In some cases, these would be a trigger for upgrades to meet the design standard specification or to install (or prepare for the installation of) new components or systems.

Ceilings and walls

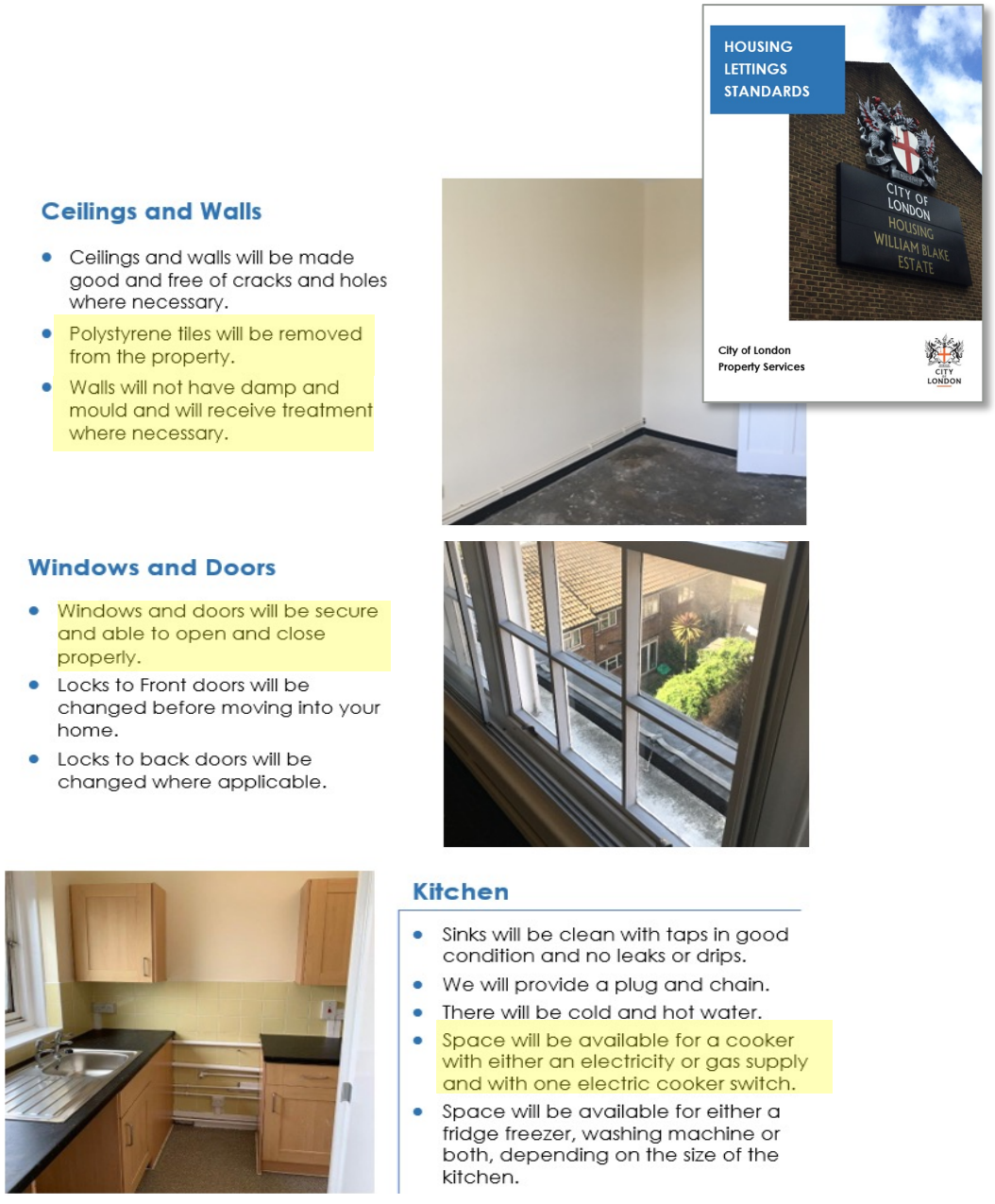
1. Where polystyrene tiles or other deleterious materials are removed from ceilings, install MVHR ductwork as part of the replacement ceiling installation.
2. When damp or mould are found (and necessary repair work has been completed / leaks and ingress resolved) add insulation and/or address cold bridges that are causing the problem.
3. Where major redecorations are needed, internally insulate. Carefully consider the material used and detailing to avoid moisture risk.

Windows and doors (subject to planning permission for some properties)

1. Where window furniture is broken, consider whether a replacement window unit (with a better standard of glazing) could be installed rather than repair the existing.
2. Replace windows or prepare for their future installation

Kitchens

1. Only provide electric connections for cookers and remove gas hobs to eliminate fossil fuels from homes.



Extracts from CoL emerging voids programme specification

Short term priority 4: Void programme | Other work opportunities

Specific measures that can be carried out in voids as part of the normal preparation works.

Heating

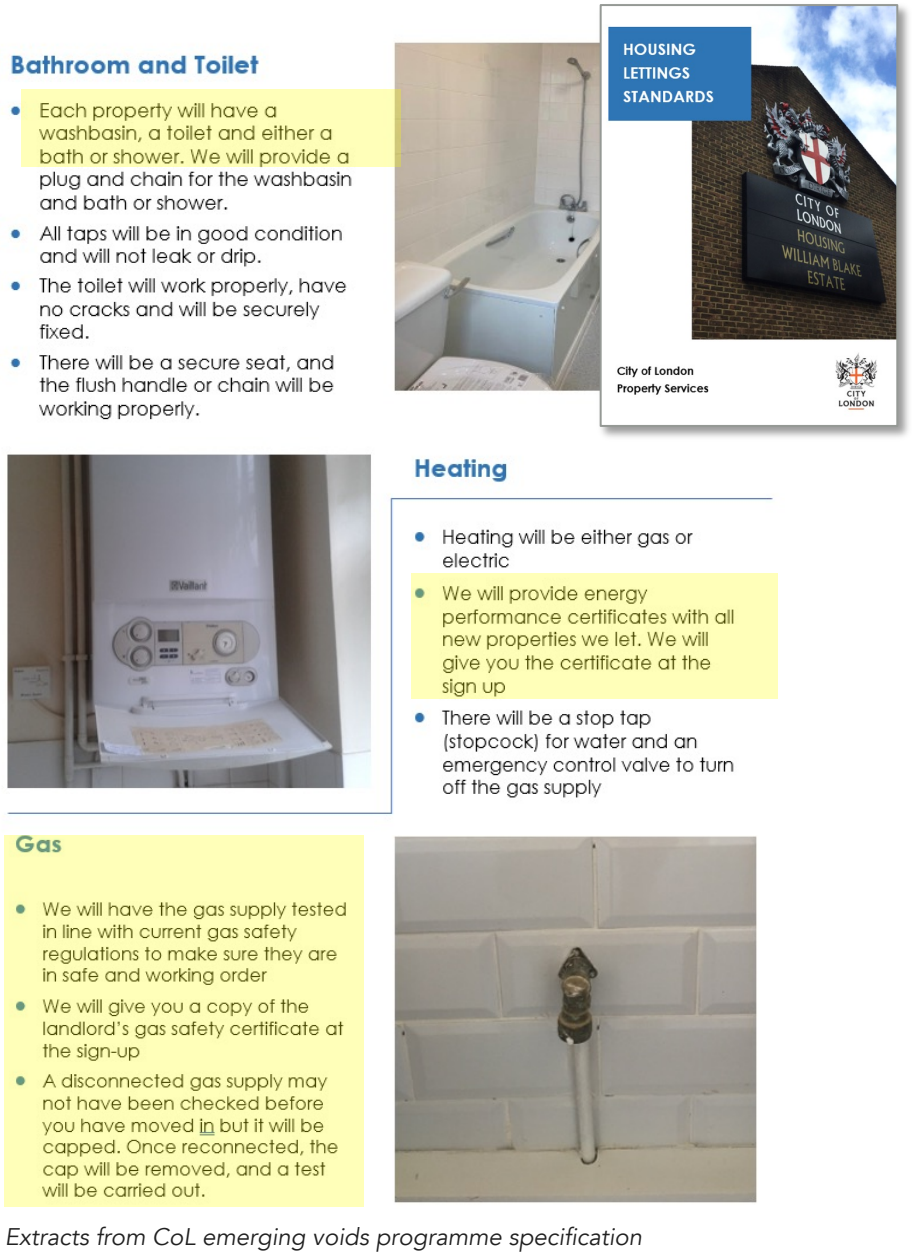
1. Update all EPCs and carry out survey work to check air tightness and insulation continuity.
2. Replace and upgrade the distribution pipework and radiators to suit the intended new heating system.
3. For homes with individual gas boilers, replace gas boilers with low carbon alternative.

Bathrooms

1. Install Waste Water Heat Recovery wherever baths or showers are replaced
2. Install or prepare space for a domestic hot water cylinder where these are integral to the final retrofit DHW system or replace HIUs with modern units to suit the future system.

Gas

1. Aim to remove all gas supplies and provide electric replacement equipment.



Extracts from CoL emerging voids programme specification

Short term priority 4: Void programme | Possible costs

Costs of measures

The costs of the individual measures are indicated in the finances section of this HDP. The piecemeal nature of the work will mean there generally won't be economies of scale, although it may be possible to procure some measures across multiple estates (e.g. survey work). For some work, such as HIU upgrades, the voids may be pilot projects for later roll outs to occupied flats, in which case there may be an opportunity to procure more of the materials than only those for the current voids, subject to having suitable storage.

Costs of lost revenue

Where the void works only include the 'all voids' measures, the time taken to carry out the void programme, if planned in advance, should not exceed the normal void turnaround times. However, in other cases, where more extensive installation or repairs are undertaken, the void period will be extended. The revenue loss associated with this period needs to be discussed with the City.

Cost savings

Using the void programme to carry out surveys and preparation work will reduce the lead in time for major retrofit projects. Retrofit projects can often be challenging to programme and price for, due to the unforeseen issues that can arise when opening up existing fabric and components. Using the voids as pilot projects will provide better certainty on the scope and detail of the work needed, enabling a more defined specification and potentially lower contingency.

Indicative costs of example void measures

	Measures	Cost range
Surveys	Blower door test (per home)	Circa £200
Windows and doors	E.g. Advanced secondary glazing (per m2)	£900 - £1,400
	New entrance door (per unit)	£1,400 - £5,000
Air tightness and ventilation	Draught proofing (per home)	£300 - £800
	New MVHR and ductwork (per unit)	£5,000 - £10,000
Insulation	40 – 80mm Internal wall insulation (per m2)	£200 - £500

Indicative costs only – refer to Finances section for more comprehensive list of potential retrofit measures and costs

Survey work such as blower door tests will not disturb neighbouring homes and will provide valuable data on the overall building condition for following retrofit programmes

Short term priority 4: Void programme | Possible risks

There are risks associated with any retrofit and these would apply to physical installation works carried out as part of a void programme. There are also some specific risks associated with the voids strategy.

Generally, the risks for non-invasive and survey work are negligible, so the 'all voids' works proposed don't present any significant additional risks.

Damp and mould growth

Damp and water ingress are the major risk for all types of retrofit work. Adding insulation can exacerbate cold bridge effects and increase the risk of condensation and associated mould growth. Any insulation work should be planned as part of a whole building installation but designed to be undertaken in individual homes by a competent retrofit designer. PAS2035 highlights this risk and provides advice on how to mitigate it.

Abortive work

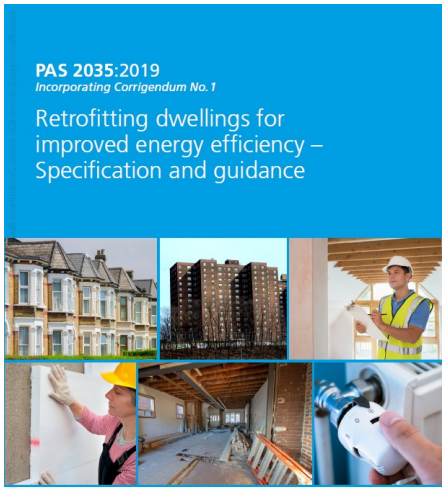
There should be an agreed and developed whole building retrofit plan in place in order to mitigate the risk that measures carried out in voids do not combine to a satisfactory overall retrofit of the building. In particular, works to the fabric and associated with communal heating systems should be planned with an understanding of the medium term overall intended outcome for that building.

Disruption to neighbouring properties

Noisy work such as fixing to walls and ceilings can potentially be disruptive to neighbouring properties, including on the floor above as well as to either side or close by.

Storing and transport of materials in communal areas, access for workers and interruptions to power and/or heating systems could also cause disruption to homes with common access to the void property.

Cold bridges at junctions can be worse after a retrofit, leading to condensation and mould.



PAS2035 includes advice on mitigation of risks and the preparation of whole house retrofit plans.

Short term priority 4: Void programme | Example – Isleden House

Isleden House is an estate in Islington, comprising 77 residential units, some of which are managed for vulnerable residents (sheltered housing). It does not have conservation or heritage status and it has gone a number of refurbishments and upgrades through its life. It has a communal heating system.

A whole building retrofit plan

A draft decarbonisation strategy for Isleden House was prepared in summer 2023, which identified a set of retrofit measures that could be implemented in two stages to allow early replacement of the communal heating boilers with heat pumps. The strategy is predicted to reduce the energy consumption of the building overall by between 70 and 80%.

A void strategy for Isleden

A number of the proposed works in step 1 of the proposed strategy could be carried out using voids, as set out in decarbonisation report:

- Carry out blower door testing to determine the characteristic leakage paths and to set a deliverable target for all properties.
- Carry out draught proofing, including sealing passive vents
- Replace windows and front doors
- Replace radiators with larger units where possible,
- Install MVHR

	Existing Specification	First step Specification	Optimal Specification
Building fabric			
Floor	No insulation assumed	-	25mm, 0.019 W/mK
Walls *		150mm, 0.035 W/mK*	100mm, 0.035 W/mK
Soffit		-	100mm, 0.035 W/mK
Roof main		300mm, 0.035 W/mK	300mm, 0.035 W/mK
Roof bay		100mm, 0.035 W/mK	100mm, 0.035 W/mK
Deck		-	25mm, 0.019 W/mK
Windows	Metal frame with double glazing	Excellent triple glazing	Excellent triple glazing
U-values (W/m^2K)	Glazing: 2.9 Frame: 5	Glazing: 0.6 Frame: 1.5	Glazing: 0.6 Frame: 1.5
Doors U-values (W/m^2K)	Door: 2 Frame: 2	Equivalent door quality to new windows	Equivalent door quality to new windows
Air change rate (ach)	8	5	3
Ventilation Heat Recovery (%)	0%	90%	90%
Heating and hot water			
Heating system T supply (° C)	We have tested communal ASHP with a high temperature circulation (70°C) and a lower temperature circulation (45°C) with Sunamp cylinders		
Renewable energy			
Solar panel (number)	No PVs assumed	PV panels to the ESE roof	PV to both roof elevations of the block (ESE & WNW)

Specification assumed for the energy analysis, showing the assumed current performance, a 'first step' option which seeks to meet the heating load reduction needed for the communal heat pumps, and an optimal specification which should be targeted in the longer term. For a building with individual heat pumps proposed, fewer initial fabric improvements may be necessary to achieve a suitable space heating load.

4

Future steps | Looking beyond the urgent priorities

In Section 3 the HDP explored the urgent priorities to avoid missing opportunities across the housing estate. To reach net zero a more proactive approach to retrofitting homes will be needed. This should build upon the work completed as part of the short-term priorities but should also be considered now so that teams are ready and plans are in place

Future steps | Overview and rationale

Getting the retrofit programme on the front foot

The short-term priorities represent an urgent need to avoid missed opportunities and deliver on quick wins. Achieving them would represent a significant improvement, but further work would be needed to continue the improvement across the rest of the homes.

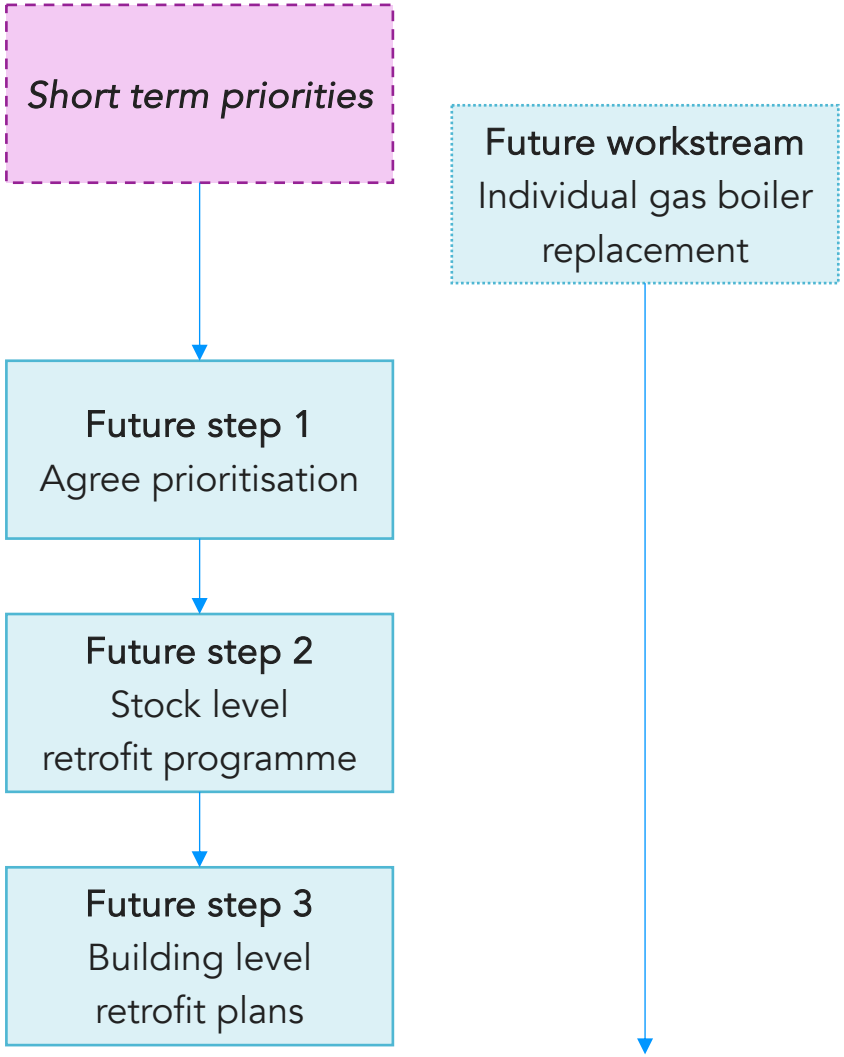
The future steps would represent a pivot from reactive retrofit projects to proactive ones, which are well informed and prioritised in a way that provides more benefit to the City and its residents.

The work completed as part of the short-term priorities will inform any future steps, so these are a snapshot of where the City is expected to be in 2 or 3 years time. The outline future steps are summarised below and discussed in more detail on subsequent pages:

- Future step 1 – the retrofit projects currently being considered are because of an urgency in terms of cyclical replacement. In future the priority set for retrofit could be based on other factors, such as resident needs, energy costs, comfort etc.
- Future step 2 – Once the priorities are agreed, the City along with external consultants can begin to map out a programme that meets the net zero objectives.
- Future step 3 – Building level retrofit plans will be needed so that the teams are ready to start incremental works on voids and to inform future capital works programmes.

Tackling the gas boiler issue

One of the biggest obstacles to overcome to meet the 2040 objective is the many individual gas boilers in the homes. Replacing these with a low carbon heat source in a considered way must be a focus of a future workstream, and something that can not afford to wait much longer, as boilers are replaced continually.



Future step 1: Prioritising the greatest need | What are the needs and opportunities

Prioritising retrofit based on needs and opportunities

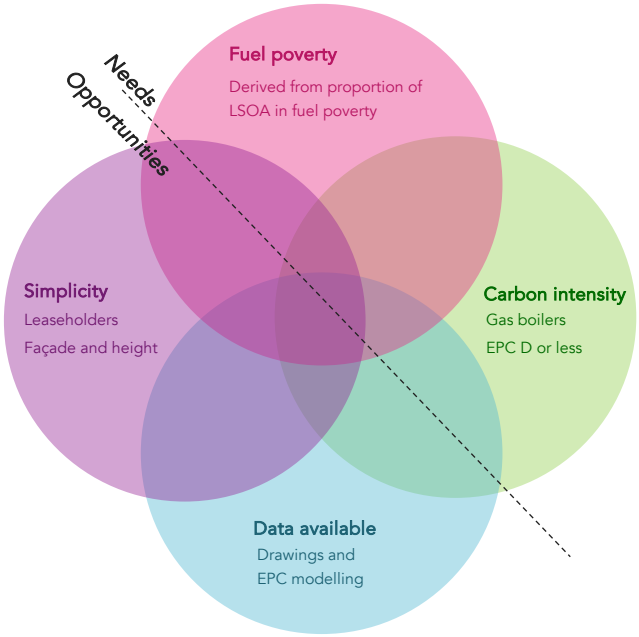
We have started developing a prioritisation tool which presents a clear overview of the properties within the housing stock that are particularly well-suited for retrofitting interventions. This tool highlights properties that warrant immediate attention given the timescale to achieve the Corporation's Net Zero targets. The properties are scored based on the following metrics:

- Fuel poverty (proportion of LSOA in fuel poverty).
- Simplicity (based on number of leaseholders, number of storeys and wall type, identified during our work on Archetypes).
- Data available (drawings and EPC modelling).
- Carbon intensity (Percentage gas boilers and EPC ratings).

Within the prioritisation system there are some "red flags", e.g. the heating system must be gas, and the building should not be listed.

This gives a table of potential priority properties that could be used alongside other information to decide on retrofit priorities i.e. the capital works and repairs programmes.

Further development of the tool incorporates the heating system as a parameter to prioritise properties, so it aligns with the City of London's decarbonisation of communally heated estates.



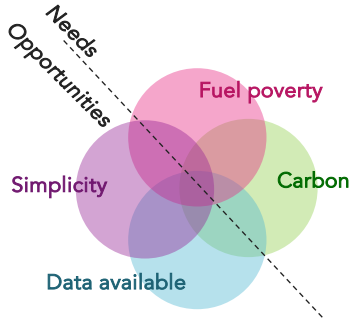
Key themes of needs and opportunities

Archetype	Block Name	Estate	Fuel poverty	% Tenant	No. of Storeys	Simple Façade	% EPC coverage	Drawings Available	% Gas Boilers	EPCs rated D or below	Communal Heating System	Prioritisatio
A2	Tevatree House	Avondale Square Estate	17%	100%	4	Y	71%	Y	100%	57%	-	13
A2	Avondale House	Avondale Square Estate	17%	71%	4	Y	55%	Y	100%	41%	-	11
A3	George Elliston Hou	Avondale Square Estate	17%	84%	5	Y	58%	Y	100%	38%	-	11
A2	Hilton House	Holloway Estate	16%	38%	3	Y	79%		100%	63%	-	11
A2	Whitby Court	Holloway Estate	16%	35%	2	Y	100%		100%	81%	-	11
A3	Eric Wilkins House	Avondale Square Estate	17%	60%	5	Y	45%	Y	100%	30%	-	10.5
A3	Dron House	Dron House	16%	54%	4	Y	99%		100%	30%	-	10.5
A6	Proctor House	Avondale Square Estate	17%	77%	10	?	94%		100%	56%	-	10
A6	Tovy House	Avondale Square Estate	17%	75%	10	?	90%	Y	100%	31%	-	10
A2	Great Suffolk Street	Southwark Estate	19%	80%	3	Y	44%		100%	31%	-	10
A6	Brettinghurst house	Avondale Square Estate	17%	68%	4	?	56%	Y	100%	39%	-	9.5
A2	Fairweather House	Holloway Estate	16%	59%	4	Y	63%		100%	32%	-	9.5
A3	Bazeley House	Southwark Estate	19%	69%	4	Y	59%		100%	31%	-	9.5
A3	Markstone House	Southwark Estate	19%	59%	4	Y	53%		100%	31%	-	9.5
A6	Colechurch House	Avondale Square Estate	17%	89%	10	?	64%	Y	100%	33%	-	9
A6	Lambfold House	York Way Estate	15%	84%	7	?	100%	Y	100%	32%	Communal	9
A3	Sumner Buildings	Southwark Estate	19%		5	Y	59%		100%	30%	-	9
A6	Shepherd House	York Way Estate	15%	47%	4	?	100%	Y	100%	47%	-	9
A3	Blake House	William Blake Estate	12%	58%	3	Y	92%		100%	42%	-	8.5
A3	Windsor House	Windsor House	9%	69%	4	Y	53%		100%	33%	-	7.5

Prioritisation tool - Identifying needs and opportunities across City of London Housing Stock. Showing the top 20 properties.

Future step 1: Prioritising the greatest need | Developing the retrofit process

Prioritisation



Developing solutions

Decisions on individual measures

Decision trees (generic) — Details & specification

Fabric	Windows – Triple glazing	✓
	Wall – External wall insulation	✓
	Wall – Internal wall insulation	
	Roof – Loft insulation	✓
	Roof – Flat roof insulation	
	Floor – slab insulation	✓
	Floor – suspended insulation	
	Junctions – insulated	✓
	Airtightness – improved	✓
	Ventilation – MVHR	✓
DHW	Hot water use – WWHR	✓
	Hot water storage tank	✓
LCH	Individual HP	✓
	Communal heat pumps	
	Direct electric	
Elec	Appliances – improved	✓
	Landlord lighting improvements	✓
	Landlord lift improvements	
	Smart energy controls	✓
Generation	Solar PVs	✓

Design standards

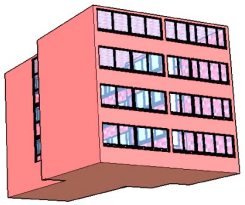
Case studies

Confirm if standards are enough, develop timeline

Challenges and interdependencies

	Windows – Triple glazing	Wall – External wall insulation	Wall – Internal wall insulation	Roof – Loft insulation	Roof – Flat roof insulation	Floor – slab insulation	Floor – suspended insulation	Junctions – insulated	Airtightness – improved	Ventilation – MVHR	Hot water use – WWHR	Hot water storage tank	Individual HP	Communal heat pumps	Direct electric	Appliances – improved	Landlord lighting improvements	Landlord lift improvements	Smart energy controls	Solar PVs
Windows – Triple glazing																				o
Wall – External wall insulation					J		J													
Wall – Internal wall insulation																				
Roof – Loft insulation		J																		
Roof – Flat roof insulation																				o
Floor – slab insulation		J																		
Floor – suspended insulation																				
Junctions – insulated																				
Airtightness – improved																				
Ventilation – MVHR	!									!										
Hot water use – WWHR	Heating load dependent																			
Hot water storage tank																				
Individual HP																				
Communal heat pumps																				
Direct electric																				
Appliances – improved																				
Landlord lighting improvements																				
Landlord lift improvements																				
Smart energy controls																				
Solar PVs	o			o																

Energy modeling



Whole house retrofit plan (block by block)

Simplifying stock into archetypes and refining the plan for archetypes

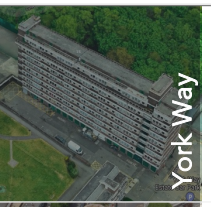
Template plans for Archetypes

Project triggers & funding

- Voids
- Repairs
- Planned maintenance
- Internal funding
- Capital works
- Internal funding
- External funding
- Delivery plan

Future step 2: Developing the net zero roadmap | Communally heated estates

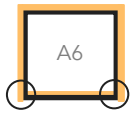
This page sets out a strategy for the communally heated estates, based on our understanding of technical priorities, other strategic priorities will need to be incorporated. The order in which estates are retrofitted will depend on the prioritisation established in Future Step 1. Low carbon heat should be delivered earlier if possible.



Lambfold house
Kinefold house
Penfields house

Surveys and tests (WP1) | Roof insulation, PV panels, Windows, Ventilation (WP2) | Low carbon heat, Electrics - landlord (WP3) | Wall insulation (WP4) | Electrics - residents (WP5) | Floor insulation (WP6)

Generally insulated externally, but complex junctions include balconies, stair cores and parapets. High proportion of windows on main façades.



Bishop St
Prebend St
Coleman Fields

Surveys and tests (WP1) | Roof insulation, PV panels, Windows, Ventilation (WP2) | Low carbon heat, Electrics - landlord (WP3) | Wall insulation (WP4) | Electrics - residents (WP5) | Floor insulation (WP6)

Walls insulated externally and cavity wall insulation replaced. Complex junctions include balconies, bay windows and continuity at eaves / parapets.

Petticoat square
Petticoat tower

Surveys and tests (WP1) | Roof insulation, PV panels, Windows, Ventilation (WP2) | Low carbon heat, Electrics - landlord (WP3) | Wall insulation (WP4) | Electrics - residents (WP5) | Floor insulation (WP6)

Generally insulated externally, but complex junctions include balconies, stair cores and parapets on low rise and complex detailing around windows on tower.

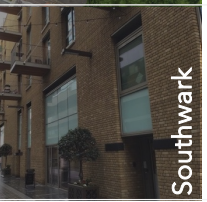
Frobisher Crescent

Surveys and tests (WP1) | Roof insulation, PV panels, Windows, Ventilation (WP2) | Low carbon heat, Electrics - landlord (WP3) | Wall insulation (WP4) | Electrics - residents (WP5) | Floor insulation (WP6)

Façade is highly glazed, internal wall insulation may be possible in places. Barrell roof insulation is possible. There would be multiple complex junctions.

Twelve Acres House

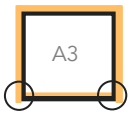
Surveys and tests (WP1) | Low carbon heat, PV panels, Ventilation (WP2) | Electrics - landlord (WP3) | Electrics - residents (WP4) | Windows, Wall insulation, Roof insulation, Floor insulation (WP5)



Horace Jones House

Surveys and tests (WP1) | PV panels, Ventilation (WP2) | Electrics - landlord (WP3) | Low carbon heat (WP5) | Electrics - residents (WP4) | Windows, Wall insulation, Roof insulation, Floor insulation (WP6)

Relatively new buildings. Assumed to be "heat pump ready". Horrace Jones House connected to district heating network not controlled by CoL, so changing to heat pump system may be complex. Thermography may identify problem areas for fabric. Top up roof Insulation and install EWI if necessary / possible. Replace windows with high quality triple glazed when possible.

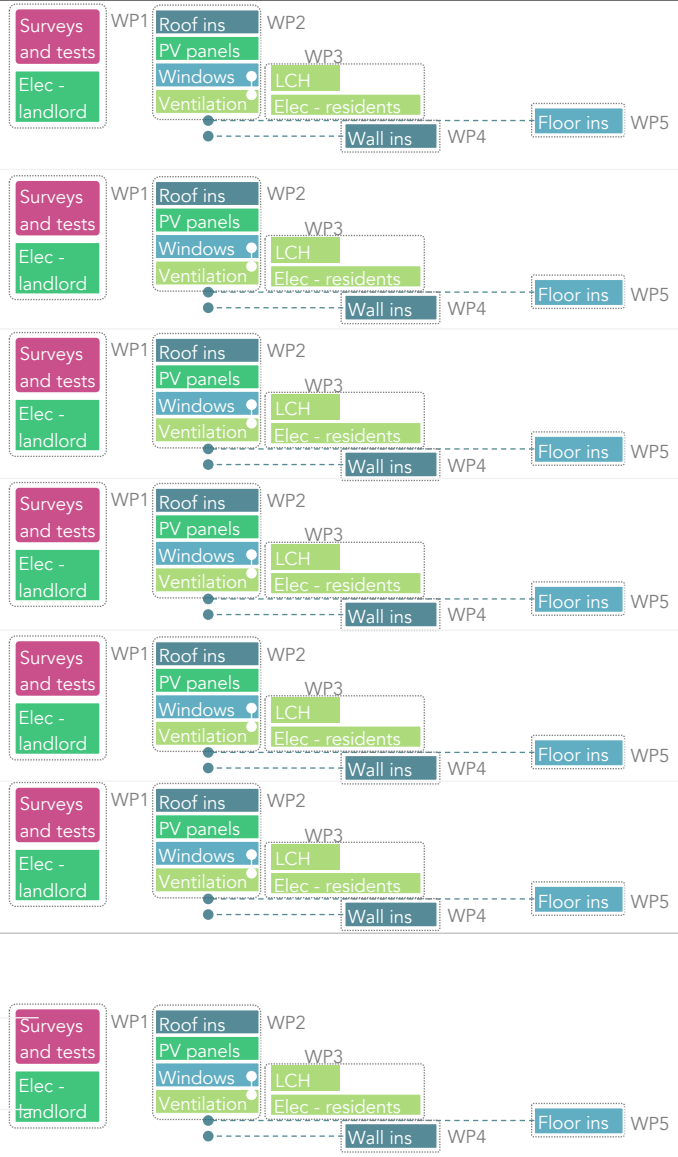


KEY:
- Communal areas surveys
- Home surveys
- Communal services
- Home services
- Communal fabric measures
- Home fabric measures
- Measures to renew if surveys suggest necessary
- Measure to be installed renewed earlier if necessary, e.g., for low carbon heat strategy

Future step 2: Developing the net zero roadmap | Non-communally heated estates

This page sets out a strategy for the **non-communally** heated estates based on our understanding of technical priorities, other strategic priorities will need to be incorporated. The order in which estates are retrofitted will depend on the prioritisation established in Future Step 1.

	Archetypes and notes	Opportunity blocks*	Other blocks*
Avondale	 Can be insulated externally	Tevatree House Avondale House George Elliston House Proctor House Eric Wilkins House Tovy House Brettinghurst house Colechurch House	Twelve Acres House Centre Point Longland Court West Point East Point Harman Close
Southwark	 Can be insulated externally	Great Suffolk Street Bazeley House Markstone House Sumner Buildings Stopher House	Pakeman House Horace Jones House Collinson Court
Holloway	 Can be insulated externally	Hilton House Whitby Court Fairweather House	Barnersbury House McMorran House Crayford House Bunning House
York Way	 Can be insulated externally	Shepherd House (recommend programmed to fit with the communally heated blocks)	Lambfold House Kinefold House Penfields House
William Blake	 A3 blocks can be insulated externally	Blake House Donnelly House	Lynton Mansions McAuley Close St James Mansions York House
Small estates	 Can be insulated externally	Dron House Windsor House	Isleden House
Sydenham Hill A2 blocks can be insulated externally		-	Otto Close Lammas Green
Barbican Golden Lane All difficult to insulate		- -	20 blocks 9 blocks
Ferndale Spitalfields Difficult to insulate		- -	2 blocks 3 blocks



Prioritisation has been identified in high level-data analysis – the prioritisation should be reviewed in more detail

The estates towards the top are those with most opportunity blocks, these have been ranked on the basis of needs (e.g. fuel poverty, low EPC rating, gas boilers) and opportunity (e.g. simple façade, number of floors, proportion of tenants

Those towards the bottom are more challenging to insulate. However, in order to meet the 2030 and 2040 targets, measures that can be installed should be installed as soon as possible on these blocks too.

All sites are shown as starting immediately, as this is the ideal scenario. This page does not take into account any planned works or previously identified works. These will be addressed in the estate by estate pages, and should evolve as more information becomes available.

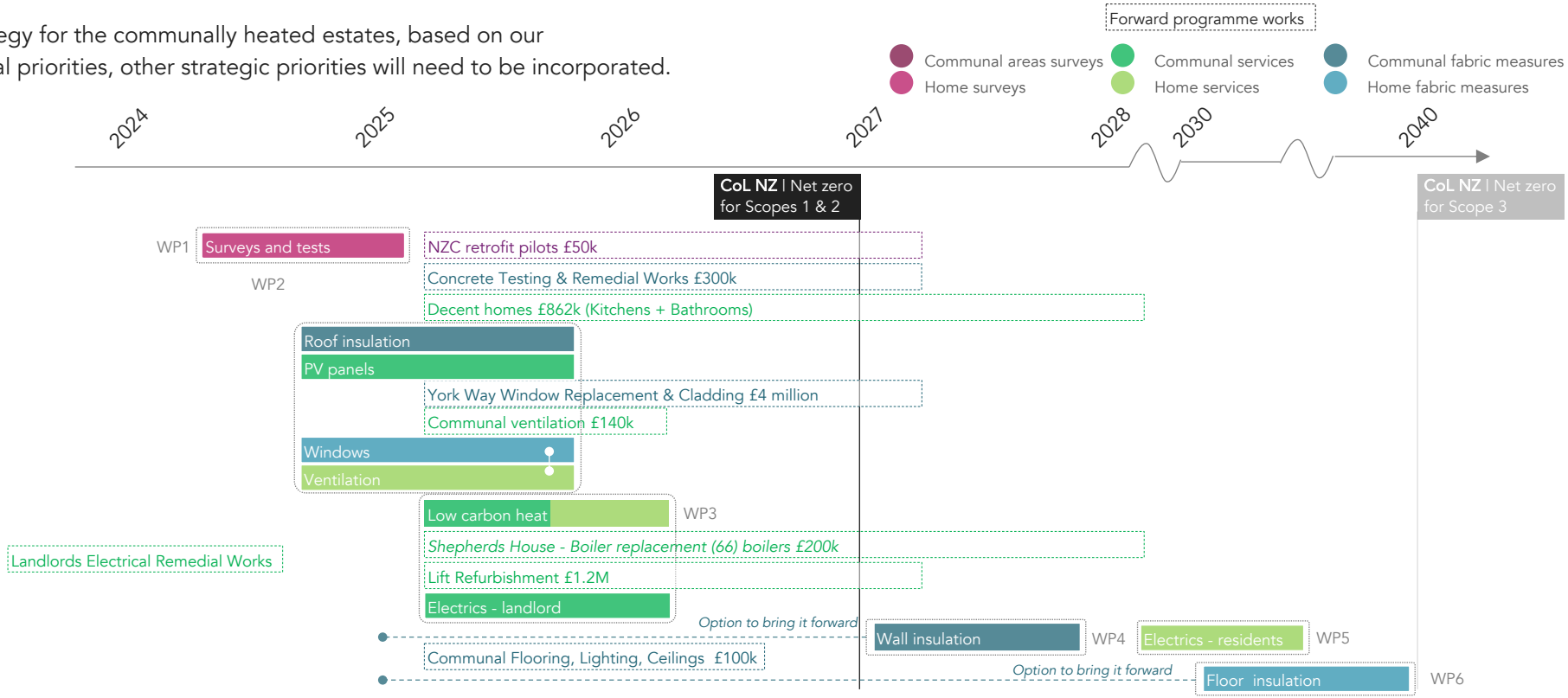
Heat pumps should be installed earlier if heating loads allow.

Communal areas surveys
Home surveys
Communal services
Home services
Communal fabric measures
Home fabric measures

Future step 3: Create building retrofit plans | York Way example | Overview

This page sets out a strategy for the communally heated estates, based on our understanding of technical priorities, other strategic priorities will need to be incorporated.

- Lambfold house
- Penfields house
- Kinefold house
- Shepherds House
(not communally heated, but opportunity to include in works)



Fabric watch points

Archetype A6. This blocks could be generally insulated externally, but complex junctions include balconies, stair cores and parapets.
There is a high proportion of windows on main façades.

	Description
WP1 **Surveys**	• Stock condition | Heat network monitoring | Thermography • Energy monitoring | EPCs | Blower door | Heat emitter survey
WP2 **Roof + PV + Windows +vent**	• Flat roof, insulation up to 400mm • At least 450kWp panel power, maximum possible on all roofs • High quality triple glazed windows, and equivalent spandrel panels, insulated reveals • High quality MVHR (or dcMEV if MVHR not possible), with or before windows
WP3 **Heat and landlord electrics**	• Replace communal gas boiler system with communal heat pumps. Associated works to pipework and hot water storage. • Shepherds House likely to require individual heat pump systems – surveys required. • LED lighting upgrades to fixtures, lift refurbishment inc. regenerative motors, replacement of pumps inc. VFD, upgrade of electric meters allowing for PV connection.
WP4 **EWI**	• Up to 200mm EWI where possible. Install earlier if necessary to reduce heat load if opportunity arises. • Up to 50mm insulation on solid floors. Install earlier if necessary to reduce heat load if opportunity arises.
WP5 **Resident electrics**	• Low energy appliances and smart energy controls. Advice given.
WP6 **Floor insulation**	• Up to 50mm insulation on solid floors. Install earlier if necessary to reduce heat load if opportunity arises.

Future step 3: Create building retrofit plans | York Way example | Work packages

Communal areas surveys · Home surveys · Communal services · Home services · Communal fabric measures · Home fabric measures

	Type of work	Description	Access/enabling works	Cyclical opportunities	Timescale	Cost	Carbon
WP1 Surveys		• Building condition, airtightness and EPCs– *aim to identify defects and focus for measures* • Communal and flat services – *aim to highlight heating system upgrades needed for low carbon heat*	• Minimal • Access to several homes & landlord areas	• No relevant opportunities in forward programme	9 months	£	→
WP2 Roof + PV + Windows +vent		• Remove existing roof covering and install flat roof insulation up to 400mm on top of roof slab • Install maximum possible PV across the 3 taller buildings • High quality triple glazed windows, and equivalent spandrel panels, insulated reveals inside flats • High quality MVHR (or dcMEV if MVHR not possible), with or before windows	• Full height scaffolding, temporary shelter for roof • Resident decant for ventilation system install c. 2 weeks per flat? Align with Decent Homes	• Window and cladding replacement – 2025 • Communal ventilation – 2025 • Decent Homes – 2025 • NZC retrofit pilots - 2025	**D**: 6 months **C**: 2 years	££££	↘
WP3 Heat and landlord electrics		• Replace communal gas boiler system with communal heat pumps. Shepherds House likely to require individual heat pump systems – surveys required. • LED lighting upgrades to 307 fixtures, upgrade 12 fans to VFD, lift refurbishment	• TBC	• Communal ventilation – 2025 • Shepherds House boiler replacement 2025 • Lift refurb – 2025 • Communal lighting - 2025	**D**: 6 months **C**: 2 years	££££	↘
WP4 EWI		• Up to 200mm EWI where possible. Install earlier if necessary to reduce heat load if opportunity arises.	• Similar to WP2, opportunity to carry out at same time	• WP2 works	**D**: 6 months **C**: 2 years	£££	↘
WP5 Resident electrics		• Low energy appliances and smart energy controls. Advice given.	• TBC	• WP2 works	1-3 years	££	↘
WP6 Floor insulation		• Up to 50mm insulation on solid floors. Install earlier if necessary to reduce heat load if opportunity arises.	• Access to flats needed, could be completed same time as WP2 + 3	• Communal flooring & Concrete testing/remedials	**D**: 3 months **C**: 1 year	££	↘

Commentary

York Way represents one of the most promising schemes for comprehensive retrofit given its current capital works programme. Most areas of the building's external envelope are due for some form of renewal, inspection or repair before 2028. In addition to this the Decent Homes scheme will mean that bathrooms and kitchens are renewed in many properties and this offers the opportunity to install new ventilation systems in the flats.

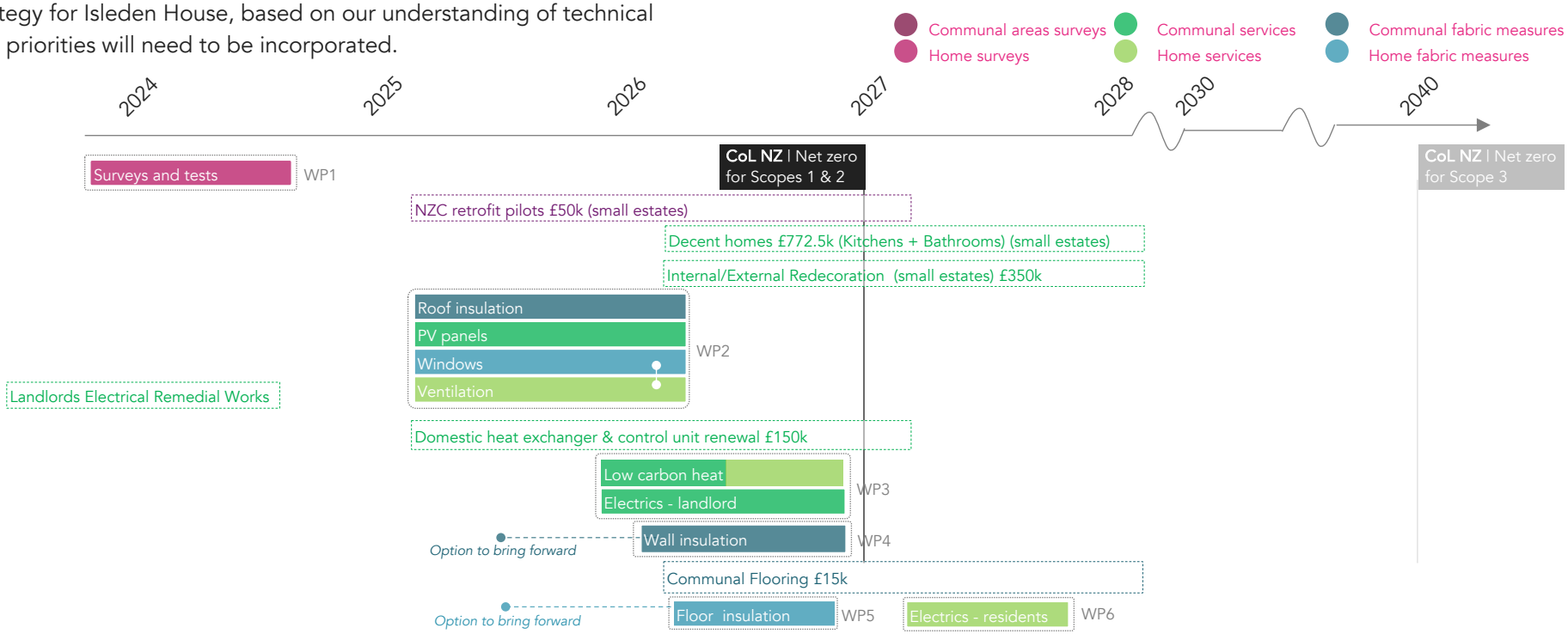
York Way has recently had its heating system renewed but this has led to the installation of new gas boilers. The retrofit works offer the opportunity to build in the measures needed to decarbonise this heat supply looking at changes to the distribution and the systems in the flats themselves. The gas boiler system should be switched to a heat pump-based system as soon as possible. Shepherds House is the smallest block and not connected to the main heating system and instead has individual gas boilers which are due for replacement in 2025 (unfunded). It's likely these homes could be switched over to an individual heat pump system.

Minor changes to landlord services including lift upgrade/replacements and lighting changes could also be completed within the scheduled programme of works but would give minimal savings.

Future step 3: Create building retrofit plans | Isleden example | Overview

This page sets out a strategy for Isleden House, based on our understanding of technical priorities, other strategic priorities will need to be incorporated.

- Bishop St
- Prebend St
- Coleman Fields



Fabric watch points

Archetype A2. The walls could be insulated externally, and cavity wall insulation replaced. Complex junctions include balconies, bay windows and continuity at eaves / parapets.

	Type of work	Description
WP1 **Surveys**		• Stock condition | Heat network monitoring | Thermography • Energy monitoring | EPCs | Blower door | Heat emitter survey
WP2 **Roof + PV + Windows +vent**		• Flat roof, insulation up to 400mm • At least 450kWp panel power, maximum possible on all roofs • High quality triple glazed windows, and equivalent spandrel panels, insulated reveals • High quality MVHR (or dcMEV if MVHR not possible), with or before windows
WP3 **Heat and landlord electrics**		• Replace communal gas boiler system with communal heat pumps. Associated works to pipework and hot water storage. • LED lighting upgrades to fixtures, lift refurbishment inc. regenerative motors, replacement of pumps inc. VFD.
WP4 **EWI**		• Up to 200mm EWI where possible. Install earlier if necessary to reduce load and /or if opportunity arises.
WP5 **Floor insulation**		• Up to 50mm insulation on solid floors. Install earlier if necessary to reduce heat load if opportunity arises.
WP6 **Resident electrics**		• Low energy appliances and smart energy controls. Advice given.

Future step 3: Create building retrofit plans | Isleden example | Work packages

Communal areas surveys · Home surveys · Communal services · Home services · Communal fabric measures · Home fabric measures

	Type of work	Description	Access/enabling works	Cyclical opportunities	Timescale	Cost	Carbon
WP1 Surveys		• Building condition, airtightness and EPCs– *aim to identify defects and focus for measures* • Communal and flat services – *aim to highlight heating system upgrades needed for low carbon heat*	• Minimal • Access to several homes & landlord areas	• No relevant opportunities in forward programme	9 months	£	→
WP2 Roof + PV + Windows +vent		• Remove existing roof covering and install flat roof insulation up to 400mm on top of roof slab • Install maximum possible PV across the 2 taller buildings and a row of bungalow terraces • High quality triple glazed windows, and equivalent spandrel panels, insulated reveals inside flats • High quality MVHR (or dcMEV if MVHR not possible), with or before windows	• Full height scaffolding, temporary shelter for roof • Resident decant for ventilation system install c. 2 weeks per flat? • Align with Decent Homes	• Landlords Electrical Remedial works -2024 • Decent Homes – 2026 • NZC retrofit pilots - 2025	**D**: 6 months **C**: 2 years	££££	↘
WP3 Heat and landlord electrics		• Replace communal gas boiler system with communal heat pumps. • LED lighting upgrades to 117 fixtures	• TBC	• Domestic heat exchanger & control unit renewal - 2025 • Communal lighting - 2025	**D**: 6 months **C**: 2 years	££££	↘
WP4 EWI		• Up to 200mm EWI where possible. Install earlier if necessary to reduce heat load if opportunity arises.	• Similar to WP2, opportunity to carry out at same time	• WP2 works	**D**: 6 months **C**: 2 years	£££	↘
WP5 Resident electrics		• Low energy appliances and smart energy controls. Advice given.	• TBC	• WP2 works	1-3 years	££	↘
WP6 Floor insulation		• Up to 50mm insulation on solid floors. Install earlier if necessary to reduce heat load if opportunity arises.	• Access to flats needed, could be completed same time as WP2 + 3	• Communal flooring • Internal/ External Redecoration - 2026	**D**: 3 months **C**: 1 year	££	↘

Commentary

Isleden House represents one of the most promising schemes for short-term comprehensive retrofit given its current cyclical replacements programme. Most areas of the building's external envelope are due for some form of renewal, inspection or repair before 2028. In addition to this the Decent Homes scheme will mean that bathrooms and kitchens are renewed in many properties, and this offers the opportunity to install new ventilation systems in the flats.

Retrofit works offer the opportunity to build in the measures needed to decarbonise the heating supply by looking at changes to the distribution and the systems in the flats themselves. The gas boiler system should be switched to a heat pump-based system as soon as possible. The bungalow terraces could be switched over to an individual heat pump system.

Minor changes to landlord services including lift upgrade/replacements and lighting changes could also be completed within the scheduled programme of works but would give minimal savings.

Archetypes to case studies

The last section described the potential of archetypes to simplify the retrofitting process. For the housing action plan our analysis of the CoL stock was high-level and gave a strategic route to retrofitting a large number of buildings. To develop this further, individual examples of each archetype can be examined in more detail, the proposals tested and modelled, and the predicted energy and carbon saving and any potential issues fleshed out.

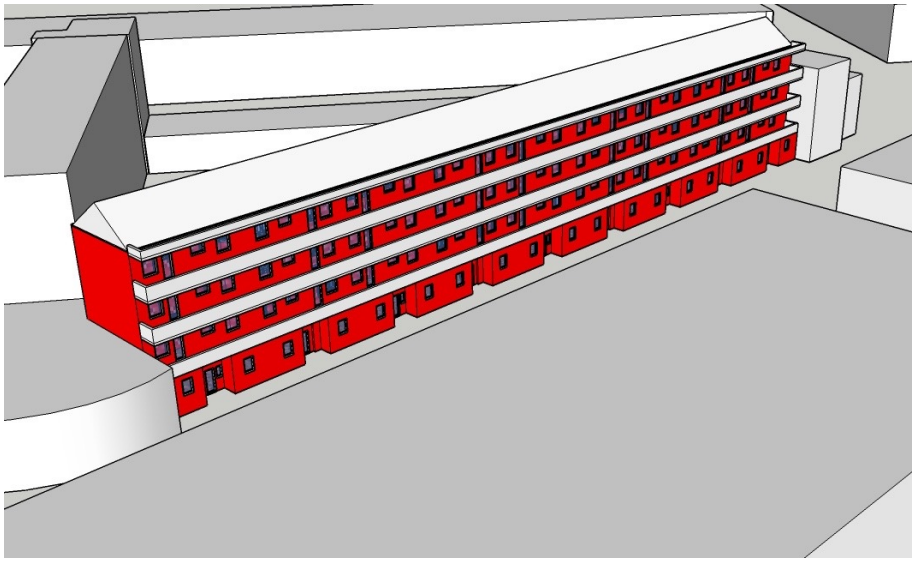
Strategy to detail

Once a specific strategy is refined for a building, details would be produced as part of the retrofit, which would help to inform other buildings within the same Archetype – leading to a standard set of details that were broadly relevant to all blocks within an archetype. Variations could also be explored, e.g. different types of balcony arrangement, different unheated spaces or vertical circulation. These could then be adapted as appropriate for individual blocks. Technical challenges should be identified both across whole archetypes and gradually for each block.

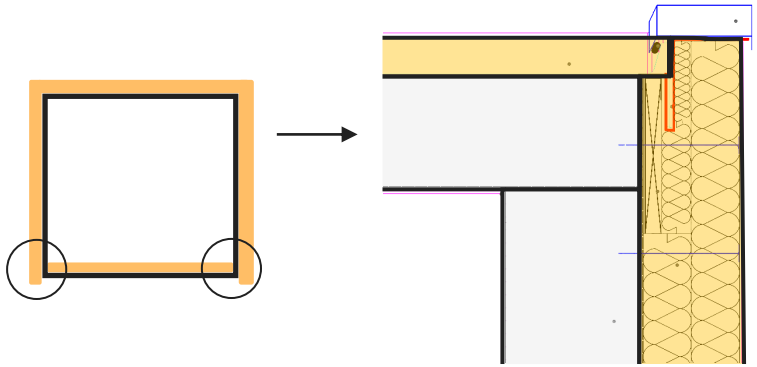
Stock retrofit process

At the beginning of this section is a stock retrofit process, this indicates:

- Prioritisation process – used to identify useful pilot projects and projects to tackle first.
- Case studies feeding into Archetype knowledge and used to develop template Archetype plans.
- Case study insight into individual measures used to inform CoL design standards.
- Individual building plans combining with CoL specific triggers and funding to develop a coherent delivery plan.



Example of an energy model – DesignPH model of the Bishop Street block of Isleden House



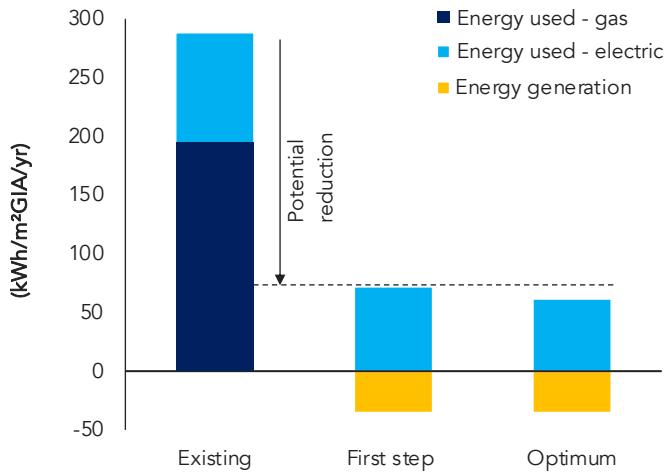
From strategy to detail – Diagram of Archetype 3 insulation locations and example insulation detail (adapted from retrofit pattern book – retrofit.support/detail/19/)

Isleden House is a priority

Isleden House meets several of the prioritisation criteria: it has an old communal gas heating system in need of replacement, it is an area that has relatively high levels of fuel poverty and low EPC banded properties, and it fits within Archetype 3, which is relatively easy to retrofit.

Applying the retrofit principles to Isleden House

We conducted site surveys to understand the current building fabric and services in more detail and assessed the current and potential heating capacities of the radiators in example flats through visual inspection. This enabled us to propose the extent of fabric improvements required as a 'first step' to enable a heating system with a lower distribution temperature. This has a significant impact on total energy use, carbon emissions, cost and comfort. This has also indicated that more than half of the energy consumption for the Bishops street block could be matched by renewable energy generation from PV panels.



This graph shows the potential energy reduction and generation from interventions at the first step and 'optimum' stages of retrofit. More detail on what is included on those stages is provided in the following pages.

Top to bottom: Isleden house from above, Coleman fields elevation, steel beams, metal framed windows, hot water insulation condition and original steel structure.

Isleden house building fabric

Isleden House currently has a steel frame superstructure with reinforced concrete slabs. The roofs are precast concrete slabs which are sheltered by the pitched roof above and uninsulated. The facing walls appear to be solid brick, but there is evidence suggesting the headers are false with a 50mm cavity which was insulated at some point. Steel beams traversing the block are visible as bulkheads in all the homes. These could be a source of increased heat loss.

Windows – the current steel framed windows were installed as part of a renewal project in 2008 and were manufactured for the estate by Crittal. Although described as insulating double glazed units, given the age and build-up of them we would expect them to still be a point of thermal discomfort for residents and a possible risk of condensation.

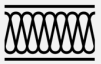
Infiltration – the homes are likely to be draughty, there are many paths for air infiltration. Fire places are vented, lots of passive vents through walls, old windows and doors, and trickle vents on the windows (residents may actually close these though).

Isleden fabric improvements

Our proposals include new triple glazed windows, MVHR, roof insulation and external wall insulation as part of the 'first step' and floor soffit and deck insulation in the optimal scenario. The graph to the right shows the proportions of the heat loss for the existing building and two retrofit stages. The potential reduction in heat loss through the walls, roofs and windows are particularly notable.

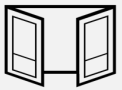
The 'first step' measures were selected to deliver nearly 60% reduction in average space heating load per flat, in order to allow a reduced hot water circulation temperature with the same size radiators and to reduce overall energy consumption. Our modelling shows that the set of measures identified in the optimal scenario would deliver approximately 70% reduction in heating load on average per flat. This is an average for this block and flats in different locations will have different energy balances.

Roof insulation



- ☑ Cold roof → Loft insulation
- ❑ Flat / warm roof → insulate on the outside. Install PV at same time

Windows



- ☑ Single glazed or old double glazed? → Replace with triple.
- ❑ New double or triple glazing? → Spot check performance and air-tightness and leaky windows

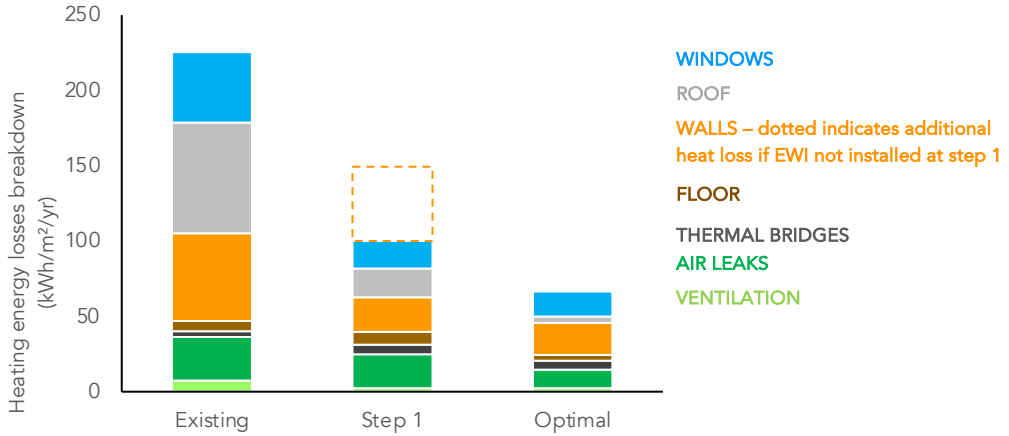
Ventilation

- ☑ Install mechanical ventilation with heat recovery (MVHR) in all dwellings where possible.
- ❑ Limited potential for intakes and extracts on façade? → consider centralised MVHR, dcMEV where MVHR is not possible

Wall insulation

- ☑ Simple external form? → External wall insulation
- ❑ Post-1920s → External wall insulation where possible
- ❑ Pre-1920 / Complex façade / Listed or conservation area → Internal wall insulation, external insulation where possible

Decision processes for fabric improvements applied to Isleden House. The dotted line indicates that ventilation must be upgraded with window improvements (or before)



This graph shows the breakdown of heat losses per TFA m² for the existing building and the two retrofit stages

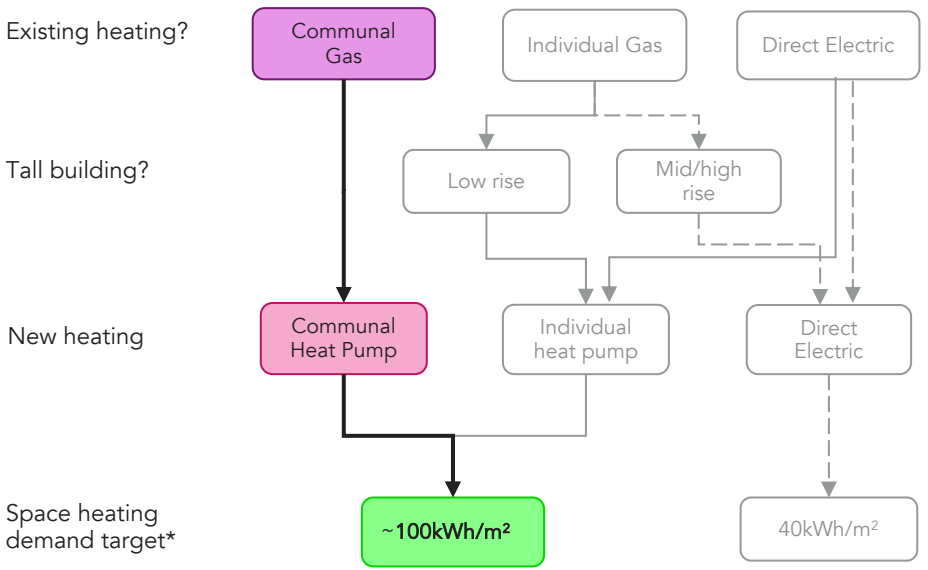
Isleden house heating system

The gas communal heating system is 20 years old. Space heating pipework distributes at roof level and drops through risers between pairs of flats, serving heat interface units (HIUs) in kitchens. From the HIUs, pipework drops to low level into channels running through the floor to serve radiators. In some cases, the pipework in the floor has been replaced with pipes at skirting level, suggesting there may be some issues with access to replace the pipework in the floors (e.g. pipes cast in, or possibly that the parquet floors are difficult to remove and replace).

Domestic hot water is supplied instantaneously via the HIUs. There are cupboards which may have housed storage cylinders in the past.

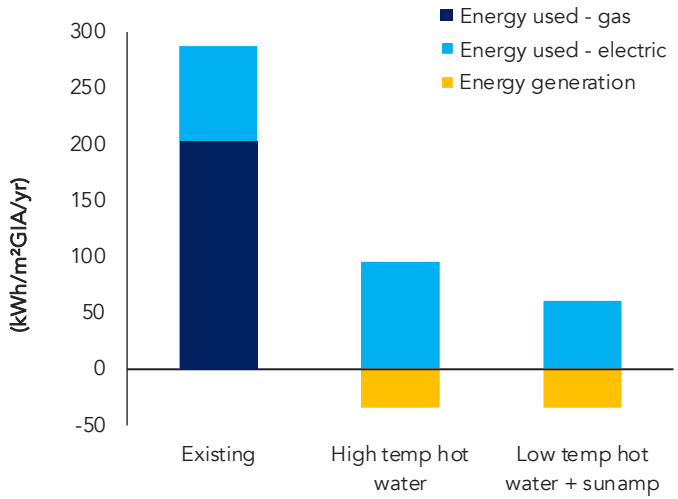
Isleden house heating system improvements

Alongside fabric and ventilation improvements, two heating options were modelled: central heat pumps with high temperature circulation and central heat pumps with lower temperature circulation and SunAmp thermal batteries. The graph below shows the impact of the lower temperature hot water circulation compared to a high temperature hot water scenario. This makes it possible to get closer net zero carbon and reduces overheating risks.



*Where space heating targets are unachievable in the short term, an interim step may be to use a hybrid heat pump while fabric improvement works are undertaken

Decision processes for low carbon heat, bold arrows show preferred route
**note that this should be assessed on a case-by-case basis as the threshold for heat pumps is often higher*



This graph shows the impact of the lower temperature hot water distribution compared to high temperature hot water distribution, both at the 'optimum' stage of retrofit.

PV strategy in order to achieve Net Zero

Improved levels of energy efficiency through the proposed 'optimal' retrofit strategy would be the first step towards achieving a net zero energy balance on-site. A net zero energy balance would only be possible if solar PV were installed on the roofs and the renewable energy generated in a year matched the energy used in a year (the EUI). The results show that it is possible to generate 50% of the energy consumption for the block modelled.

Key Assumptions

The analysis was based on the following:

- Panel Sizes: 1.1 x 1.7 m (i.e. Longi Hi-MO6 Scientist)
- PV Module Type: Monofacial Crystalline Mono-Si with microinverters or DC optimisers
- Assumed system Loss: 10%
- PV Peak Power: 450 Wp

Maximised PV option

The roofs on the block modelled (roof A) can accommodate 210 PV panels, which is proportionally more than could fit on the other two blocks (roofs B and C). Half are assumed to be on the East-SouthEast facing roof and the other half on the West-NorthWest roof. This number of panels uses all the available roof space for PV generation. Based on our site visit to Isleden House the supported living bungalow roofs (roof C) were fairly wide and could allow for three rows of landscape panels in order to maximise the number of panels. PV installers typically prefer to mount the modules portrait rather than landscape, though both options are possible.

Maximum PV array highlighted in green for the block modelled (pitched roof arrangement at 30 degrees tilt)

Example of PV panels installed on an existing roof. (Source: Alamy Stock Photo)

5.0

Finances | The costs and savings associated with retrofitting

Retrofit plans will need a comprehensive costing exercise. We have provided indicative figures based on our experience on previous projects.

Finances | Example costs of measures

Considerations and costs of a retrofit measure

It is notoriously challenging to provide an accurate assessment of the cost of retrofit. It depends on a building's characteristics and construction type. There is a significant difference in the size and complexity between apartments and houses which will produce variance in the costs – more for some and less for others.

Sequencing and batching work packages based on the retrofit measures covered in this guide as well as other works are also factor influencing cost. A list of indicative costs for key energy retrofit measures is provided on this page. They are expressed per measure and in different units, therefore, amalgamate the cost for a project requires geometric data of a building.

How much will it cost to retrofit? (Isleden case study)

There are two steps of specifications given for the retrofit of Isleden. The first step is designed to meet a 60% heating load reduction per flat. This allows for a reduced hot water circulation temperature and reduced energy consumption while keeping the same size radiators.

We have estimated the cost of retrofitting the block of flats on Bishop Street using the cost ranges of singular measures (on the right). The cost is estimated to be between £800,000 and £1,500,000 to get to step 1 and an additional £300,000 to £500,000 to get to optimal specification. Therefore, the total retrofit cost would range from **£1,100,000** to **£2,000,000.** These costs include installation, but exclude other project costs such as prelims, contingencies, VAT and attendances such as scaffolding. A reduction factor of 20% has been applied to the total cost of the retrofit measures to account for price reduction when doing works in bulk. The refurbishment of the heating system - separate to the total retrofit cost report – has been estimated to range between **£1,500,000** and **£1,700,000** by Beveridge Associates.

For the solar panels, the cost was estimated using "Annual cost of small-scale solar technology summary - May 2023" from BEIS.

Indicative costs of a range of retrofit measures

	Measures	Cost	
Windows & doors	Advanced secondary glazing with refurbishment of existing window (per m^2)	£900	£1,400
	Evacuated glazed sash (per m^2)	£900	£1,600
	Double glazed sash (per m^2)	£900	£1,500
	Double glazed casement (per m^2)	£800	£1,200
	Triple glazed 'mock' sash (per m^2)	£1,300	£1,500
	Triple glazed single casement (per m^2)	£900	£1,300
	New entrance door (1 unit)	£1,600	£5,000
	Rooflight (per m^2)	£700	£1,000
	Improved draught proofing - New window sealing, filling cracks and taping junctions	£300	£800
Airtightness & ventilation	Mechanical ventilation system - MEV with associated ducts	£1,200	£2,800
	Mechanical ventilation with heat recovery - MVHR with associated ducts	£5,000	£10,000
Insulation	Front façade - 40-80mm internal insulation (m^2)	£163	£465
	Rear façade - 100-200mm external wall insulation (m^2)	£152	£326
	Roof (slope+loft) - 100-400mm + 25-50mm insulation (m^2)	£125	£500
	Suspended floor - 100mm insulation (m^2)	£39	£98
	Solid floor - 25-50mm insulation (m^2)	£157	£255
Solar PV	Photovoltaic panels, pounds per kWp	£938	£1,034

The costs above are only indicative. A specific cost plan must be undertaken for each retrofit.

Finances | Example costs of survey works

Considerations and costs of surveying

Surveying provides a baseline assessment of the housing stock and plays a critical role in the prioritisation and scheduling of measures outlined in this delivery plan. Some estates might need less or more survey work relative to one another. The following list outlines valuable surveys and their indicative costs:

- External whole building thermography £5,000 - £10,000 per medium rise building.
- Airtightness testing £200 per area tested (this might be a flat or a core of a building).
- EPCs – required for each flat, cost £100 per property – it is important to note that the accuracy of results are proportional to what you pay.
- Heritage Impact Assessments – variable depending on building size, location and architecture but assumed to be £2,000 for smaller estates, £6,000 for medium estates and £10,000 for larger estates.
- Stock condition survey – variable depending on building size, location and architecture but assumed to be £2,000 for smaller estates, £6,000 for medium estates and £10,000 for larger estates.
- Heat network monitoring - £30,000

	Isleden	York Way	William Blake	Avondale – Tevatree House
Thermography	£20,000	£20,000	£20,000	£5,000
Airtightness*[1]	£2,000	£2,000	£2,000	*[2]£600
EPC	£3500	-	-	*[3]£200
Heritage Impact Assessment	£10,000	£10,00	-	-
Stock condition survey	£10,000	£10,000	-	£2,000
Heat network monitoring	£30,000	£30,000	-	-
Total	£75,500	£72,000	£22,000	£7,800

Indicative survey costs for Isleden, York Way and William Blake estates and Tevatree House (which was highlighted as priority for retrofit on the prioritisation table and would serve as a good net zero pilot project)

[1] **Air test cost typically for 10 sample flats*

[2] ** Air test for 3 sample flats out of the total of 7 in the building*

[3] ** EPC for 2 flats in the building*

Finances | How this impacts on residents - their energy bills and costs from the CoL

The cost of switching from gas to electricity

The UK has announced that it is aiming to increase the number of heat pump installations from 55,000 a year in 2021 to 600,000 a year by 2028. Heat pumps run on electricity, which releases fewer emissions than gas. This hasn't always been the case but is true now since just under 43% of UK electricity comes from renewable sources.

Gas boilers, on the other hand, are powered by natural gas – a fossil fuel that's responsible for around 75% of global emissions today.

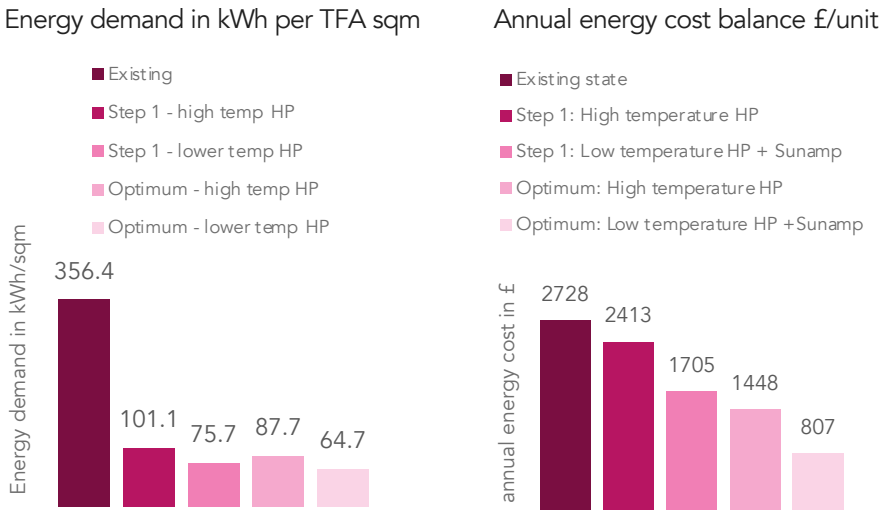
Boilers do not age very well and lose efficiency overtime; most boilers operating in the UK are around 82% efficient according to a study conducted by the Energy Saving Trust. On the other hand, heat pumps can achieve much higher efficiencies: around 350% when installed on older properties as part of a retrofit.

The average UK price for electricity is just under 29p per kWh with 42p standing charge while it is about 7p per kWh with a 28p standing charge for gas.

Different energy bills cost estimates based on level of retrofit

Using the specifications of a housing unit in Isleden, we have estimated the bills for different energy options. The energy demand of a unit in its existing state is 360 kWh/m^2 but it can be reduced to 65 kWh/m^2 with optimum retrofit measures and a heat pump led heating system. The reduction in energy demand paired with installation of PVs can significantly reduce the annual energy bill.

The average total annual energy bill (including all energy demands - heating, appliances, lighting etc.) for an Isleden unit has been estimated at £2700. This can be reduced to £1700 with Step 1 recommendations. If the optimum recommendations are performed the bill can be reduced to around £800 which represents an annual reduction of almost £2000/unit!



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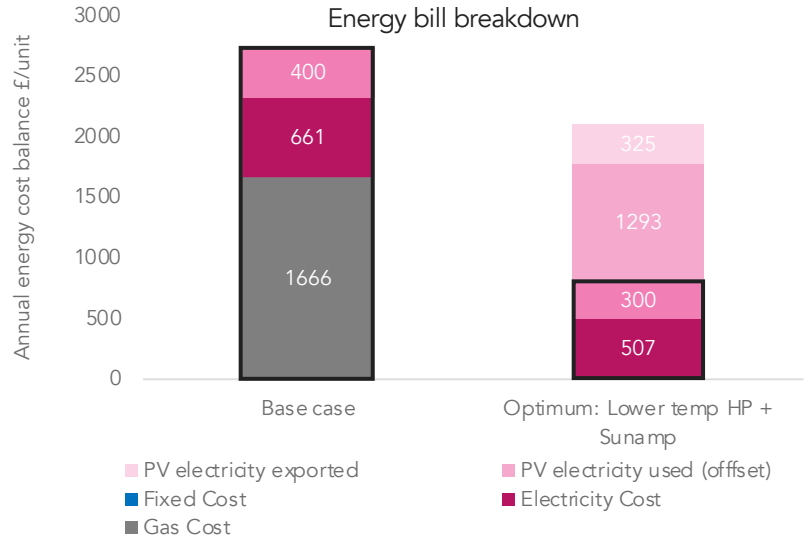


Using all of the solar panels

Social Housing Decarbonisation Fund (SHDF)

The UK Government Department for Energy Security and Net Zero (DESNZ) has provided, so far, three tranches of funding for qualifying projects. A fourth (Wave 2.2) is currently open for bids, until 31st January 2024. There is no firm timetable for future waves but the expectation is that there will be future funding rounds in this programme.

The programme rules include criteria for the current and improved EPCs, a target space heat demand threshold, a minimum number of homes (100) and a maximum time period in which to complete the work. The bid windows are generally quite short – around 2 months – and detailed project information is required in each submission.

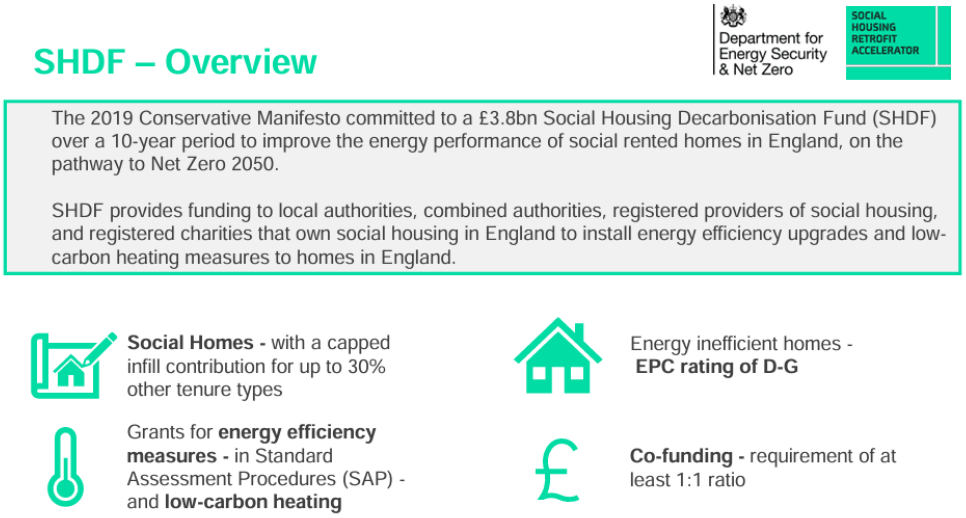
Heat Network Efficiency Scheme (HNES)

DESNZ also provide funding grants through HNES for improvements to communal and district heating systems. The scope of works covered is quite restricted, but some CoL buildings would qualify for some funding support. The awards are general fairly modest and would not support major works, but could be used for controls, monitoring and efficiency improvements such as pipework insulation. Applications have to be made by May 2024 and the funded work must be completed by March 2025. It isn't clear whether there will be future funding rounds in this programme.

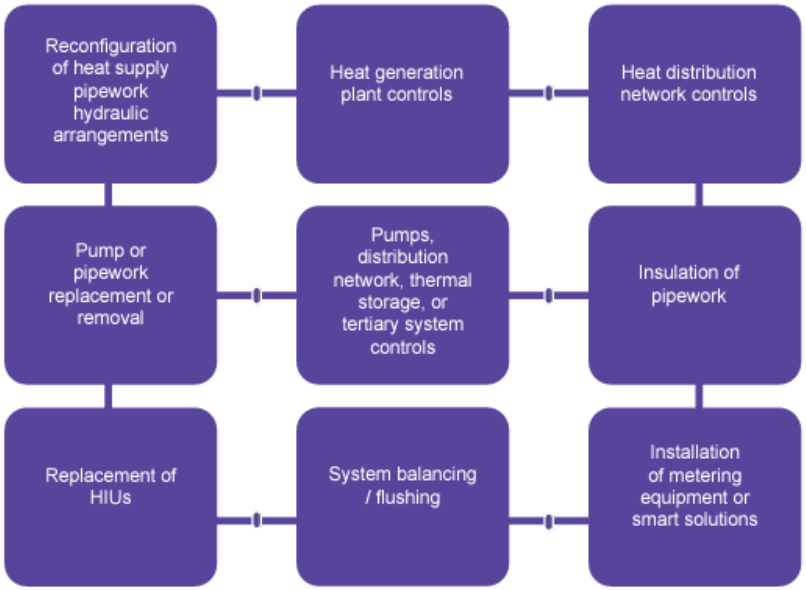
Other potential funding schemes

The Government have indicated a number of other funding schemes are planned, although details are not confirmed and, with a general election in the near term, may not be realised. Other funding schemes may be brought in as well or instead.

- A new energy efficiency grant for households to make changes such as bigger radiators or better insulation.
- A new local authority retrofit scheme to support low-income and cold homes with measures such as insulation.



SHDF scheme summary from the 'Wave 2,2 handbook' (published by DESNZ)



Summary of key measures eligible for HNES funding from HNES Scheme Overview (DESNZ)

6.0

Risks | Avoiding the mistakes of poor retrofit or not intervening

Summary of the risks to be considered by the City when discussing retrofit.

Risks | The risk of doing nothing or too little

Carbon emissions and climate change

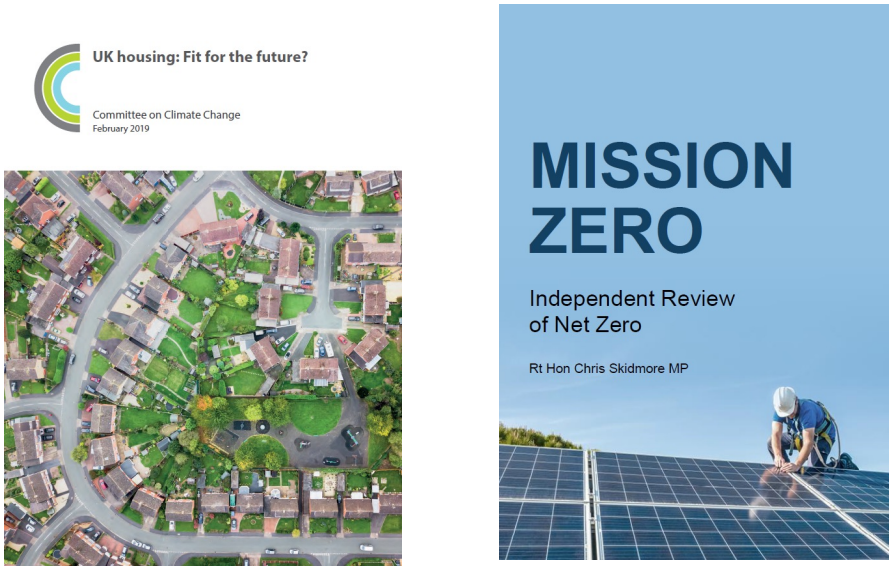
It would be impossible to attribute a specific climate outcome to the emissions from one building or estate. The climate risk for one organisation not meeting the net zero target is more in the principle than the fact; action to reduce carbon emissions does not sit with one organisation, even the Government. The public must act as well, and the leadership of Local Authorities like CoL will be crucial in persuading individuals to make the changes that, collectively, will achieve the UK's legal targets.

Legislation and Regulation

There is currently a legal minimum EPC (MEES) of Band E for all privately rented homes. Although currently social rented homes in England are exempt from the MEES target, the recommendation of both the Climate Change Committee and the government's Mission Zero report is to require a minimum standard for all housing. Although the Government has recently withdrawn proposals to tighten the MEES standard, it is likely that a higher minimum energy efficiency rating will be a legal requirement for all properties in due course. Currently around 46% of CoL homes for which there are EPCs have a rating of Band D or worse. All of these, plus any of the 31% of homes that don't currently have an EPC that fall into that category when they are assessed, should be planned to have some retrofit undertaken to avoid them becoming stranded assets if and when the rules change.

Increasing costs

As the various deadlines for action come nearer, the Government is likely to have to bring in more regulation to encourage and enforce action. This may be in the form of banning low cost, high carbon technology (gas boilers) or of setting performance targets (EESSH). As these are introduced, the constriction in the supply chain will inevitably mean demand outstrips supply, at least for a while. Costs for the most common retrofit works and installers are therefore likely to increase ahead of general inflation rates in the next ten years.



Reports to Government are emphasising the need for urgent action on Climate Change, including legislation to mandate retrofit, especially for landlords and social housing providers. More regulation in the near term seems inevitable.

Health & Wellbeing

It is also important that the sequencing and pairing of retrofit measure is thought through. Work packages for retrofitting need to be considered holistically; for instance, changes to the building fabric i.e. insulation installation and making the envelope more airtight necessitates implementing an improved ventilation strategy to avoid moisture build-up and conditions conducive to mould growth. Adequate inspections and building diagnostics is also critical to identify the trouble spots and to primitively predict where condensation and mould growth could occur.

Decanting vs Ongoing Occupancy

Although decanting allows for comprehensive and major works, it has the associated cost of temporary relocation which may fall on the residents depending on the decanting agreement set by the City of London. While retrofitting a building with residents present allows for ongoing occupancy and functionality of the building. The scope of works would be more targeted improvements, less invasive but likely be more disruptive and stressful for residents. Both approaches have their merits and considerations and are suited to different scopes of retrofit.

Cost

While retrofitting aims to improve energy efficiency, residents will likely experience temporary fluctuations in their utility bills as they adjust to the shift from gas to electricity. Depending on the financing model, retrofit could result in rent increases to cover the costs of the retrofit which some residents may not be able to afford.

It is important for the Corporation to consider these factors and work to minimize any negative impacts on residents during retrofitting. Implementing transparent communication, providing support during disruptions, and offering financial assistance or subsidies can help mitigate the potential challenges and ensure that retrofitting projects deliver long-term benefits for residents.

Example of mould growth in apartment ceiling due to moisture build-up and poor ventilation strategy