CarbonCo–op

WP4 D3: RetroMeter Beta Phase Plan and contractor engagement

RetroMeter Alpha (SIF)

Date: 28 March 2024

Author: Helen Grimshaw, Matt Fawcett

Contents

Executive summary: the need for multiple pilot options

As our Alpha stage project has progressed it has become apparent that multiple potential pilots will be needed. While a demonstrator project could focus narrowly on one or two specific delivery models, the analysis explored below highlights the variation and complexity within even one delivery model - so such a narrow focus may not offer the depth of learning around scaling potential that a wider pool of projects could offer.

The engagement work we have undertaken with partners delivering publicly procured retrofit has been challenging for many reasons. Large scale schemes like SHDF have a very large number of stakeholders and moving parts, and are aligned with timescales that are often restrictive and fast paced. For Metered Energy Savings (MES) to be effectively integrated with large programmes like this, there is significant effort that needs to go into the early stage planning of projects. Much of this is around relationship building and stakeholder engagement, to ensure that both front and back end roles understand what we are trying to achieve so that we can bring them along in 'how we get there.' Whilst we believe this 6 month Alpha project has laid the groundwork for this with partners such as Manchester City Council and their contractors, we have been constrained by factors beyond our control - in particular resource constraints with the council's teams and significant programme delays.

Private retrofit models are not without their challenges too. Whilst our own Area Based Scheme offers a very good test bed for a different kind of model, with much higher levels of support for individual households, these schemes are still innovative and much learning is being generated. Over the last 6 months significant work has been undertaken by the wider Carbon Co-op team, exploring the scaling and replicability potential of such models[1]. We believe this strategic work, alongside the streamlining of systems and processes, offers good potential for a MES-linked pilot in the near future. In terms of data access and engagement materials required, this is likely to be easier on this kind of scheme. Other projects being piloted over the next 2 years (such as those under the Green Homes Finance Accelerator, or GHFA) also offer potential.

In summary we believe that RetroMeter will benefit from exploring multiple pilot possibilities, aiming for those medium in size (tens of homes). The methodology work to date by Energy Systems Catapult has been done on 15 dwellings (from a SMETER set), with another 15 hopefully to follow. It would be sensible to require 15 homes as the minimum, but allowing a 20% contingency. Working with a larger programme like Manchester City Council's SHDF boiler replacement programme, we may get between 50 and 100 homes with the level of quality required to run the MES methodology. However, only 15 of these will have heat pump power monitoring.

[1] Carbon Co-op has been working with Connected Places Catapult on the feasibility for health and resilience framed Area Based Schemes, with a white paper due to be released by the Catapult in June 2024.

Glossary

Area Based Scheme (ABS): Area based retrofit involves undertaking retrofit projects in large numbers in one local area. Definitions vary, but when we talk about an ABS approach, we refer to the bringing together of innovative forms of finance, contractor training and householder and community engagement for a closed-loop economic system for local domestic retrofit. By combining different tenures in similar properties, the process is more cost-effective because bulk procurement facilitates one process for design and delivery. This creates a model for neighbourhood energy action that places householders and collective action at the centre of the process.

BS 40101:2022 *Building performance evaluation of occupied and operational buildings (using data gathered from tests, measurements, observation and user experience). Specification.*
BS 40101 is concerned with the evaluation of the performance of buildings at any point during the operational stage of their lives. BS 40101 provides a tailored and graduated approach enabling the specification to be used across all building types and uses and for a wide range of project or study objectives. BS 40101 covers the planning of building performance evaluation studies, including timing for new buildings or those subject to major refurbishment or retrofit and content based on the purpose of the evaluation and the use and complexity of the buildings.

Building Performance Evaluation (BPE): Building performance evaluation is a form of Post-Occupancy Evaluation (POE) and can be used at any point in a building's occupation to assess how it is performing. It usually covers themes such as energy use and the comfort and satisfaction of occupants as a minimum. As part of a BPE exercise, comparisons are often made against design targets. It is an activity deployed for recently built homes and those retrofitted. BPE exercises can use a range of different methods and monitoring techniques depending on the scope and level of detail required.

Community Intermediary: The role of a trusted intermediary is crucial to an ABS. Carbon Co-op acts as the client community intermediary within the ABS in Levenshulme. This role involves negotiating finance, detailing designs and construction works on the behalf of clients and upskilling the supply chain involved in the retrofits. It should be noted that the intermediary also plays a key contractual role in the project, entering into agreements with multiple householders on one side and a lead contractor on another. This results in a greater degree of control for the intermediary and the ability to manage work specification and quality, but also results in increased risks for the intermediary, for example in the instance of cost or time overruns.

Community Interest Company (CIC): A CIC is a special type of limited company which exists to benefit the community rather than private shareholders.

Department for Energy Security and Net Zero (DESNZ): DESNZ is a ministerial department. It has responsibilities to deliver security of energy supply, ensure properly functioning energy markets, encourage greater energy efficiency and seize opportunities in net zero to lead the world in new green industries.

Distribution Network Operator (DNO): Distribution Network Operators - licensed companies that own and operate the electricity network from the National Grid intake (132kV) to the end users. Please note that whilst DNOs traditionally operate reactive or passive grids, in this case various forms of active management are discussed, usually segregated under the role of the Distribution System Operation (DSO). For simplicity, the term “DNO'' has been used throughout reports as a catch-all for both DNO and DSO functions.

Energy Performance Certificate (EPC): EPCs are Energy Performance Certificates (EPCs) are needed whenever a property is built, sold or rented. An EPC contains information about a property’s energy use and typical energy costs and recommendations about how to reduce energy use and save money.

EnerPHit: EnerPHit is the Passive House Certificate for retrofits. This is a particularly high standard and scope of retrofit. It was developed in recognition that it is not always possible to achieve the Passive House Standard (new construction) for refurbishments of existing buildings, even with adequate funds.

Heat Transfer Coefficient (HTC): The Heat Transfer Coefficient is a widely recognised metric for describing building heat loss expressed as the rate at which heat is lost per degree Celsius air temperature difference between the inside and outside of a building in units of W/K. It includes the heat loss by conduction through the fabric and by infiltration and ventilation. A lower HTC demonstrates a lower rate of heat loss and therefore better thermal performance (BEIS, 2022).

Green Homes Finance Accelerator (GHFA): The Green Home Finance Accelerator (GHFA), is part of the UK Government’s Net Zero Innovation Portfolio (NZIP) and is providing funding to support the design, development and piloting of a range of finance propositions which encourage domestic energy efficiency, low carbon heating, and micro-generation retrofit in the owner-occupied and private rented sectors.

Passive House Planning Package (PHPP): The Passive House Planning Package (PHPP) is primarily used in designing Passive House standard homes. PHPP prepares an energy balance and calculates the annual energy demand of the building based on the user input relating to the building's characteristics.

PAS2035: 2023: PAS2035 is a retrofit process standard. It is hosted by BSI. The full title is 'Retrofitting dwellings for improved energy efficiency - Specification and guidance.'

SAP and RdSAP: The Standard Assessment Procedure (SAP) for the energy rating of dwellings is the methodology currently used by the government to estimate the energy performance of homes. Reduced data SAP (RdSAP) was introduced in 2005 as a simpler and lower cost method for assessing existing dwellings. An RdSAP assessment will use a set of assumptions about the dwelling.

Smart meter enabled thermal efficiency ratings (SMETER): The SMETER Innovation competition funded the development and testing of new methods for measuring the thermal performance of homes using smart meter and other data.

Social Housing Decarbonisation Fund (SHDF): A funding programme administered by the Department for Energy Security and Net Zero (DESNZ) to improve the energy performance of social homes in England.

Royal Institute of British Architects (RIBA): The RIBA is a global professional membership body. The RIBA Plan of Work (sometimes referred to as stages) organises the process of briefing, designing, constructing and operating building projects into eight stages and explains the stage outcomes, core tasks and information exchanges required at each stage.

The link to UK retrofit standards and evaluation practice

In considering next steps for piloting MES it is important to consider the context for these activities in terms of existing Retrofit Standards and frameworks. The table below summarises the two main British Standards for retrofit process and evaluation, as well as guidance considered 'best practice' in the field of Building Performance Evaluation (BPE) - and which may have relevance in terms of the wider adoption of MES methods and approaches.

Standard or guidance	What is it and where is it used?	Notes and relevance to MES
PAS2035: 2023 Retrofitting dwellings for improved energy efficiency - Specification and guidance. Timescales: Basic evaluation must be completed and reported within 3 months of handover.	PAS2035 is a retrofit process standard[2]. It is a requirement for publicly procured retrofit in the UK, but elements are also used by others (such as One Stop Shops working with private households). PAS2035 requires a whole dwelling assessment. Data collected forms the basis of a RdSAP/SAP or PHPP energy model, as well as actual occupancy (where data is available).	PAS2035 requires monitoring and evaluation to determine whether intended outcomes have been realised, plus to identify and learn from any specific or systemic problems. Intended outcomes should be agreed and recorded at the outset of a project. ***The most relevant intended outcome for MES (from the non exhaustive list) is a) reductions in energy use.*** In setting intended outcomes, Coordinators are expected to consider how these can be verified, and encouraged to identify those that are SMART (specific, measurable, achievable, relevant and time bound). ***MES outputs could play a role in evidencing whether the intended outcome of energy savings is achieved. If a physics based MES methodology was pursued this may also be able to provide insight on the level of comfort take-back.*** 'Basic' is the minimum level of evaluation under PAS2035 and should be applied to all homes in a project. ***The 3-month 'basic' evaluation window is problematic for optimal MES reporting (which would usually occur at 1 year post-works), although savings estimates could be reported with lesser accuracy within the first 3 months.*** 'Basic' evaluation includes a 'measures-specific' questionnaire to occupants and clients - this is to capture multiple aspects such as satisfaction with process, but also to identify whether intended outcomes have been achieved. More substantial evaluation is required if 'basic' identifies a substantial deviation from expected outcomes, the initial evaluation plan specified it, or more detailed performance measurement was requested by the client, Evaluator or Coordinator. Further monitoring and evaluation is expected to be in accordance with BS40101 (see below for further explanation of this standard). ***MES outputs could play a role in flagging a need for further investigation (if savings less than anticipated).*** Findings are to be collated and summarised, and shared with the team. ***MES reporting may need to be in a format that a Retrofit Evaluator/Coordinator can integrate with evaluation summaries.***

[2] PAS2035: 2023 Retrofitting dwellings for improved energy efficiency - Specification and guidance. DESNZ & bsi.

		As PAS2035 evaluation is approached at a project level, the methodology leaning to portfolio level could be advantageous.
BS40101 - Building performance evaluation of occupied and operational buildings (using data gathered from tests, measurements, observations and user experience) Timescales: The timescales set-out for different categories are more conducive to a MES reporting output. As is the flexibility to use the standard at any point in the 'in-use' phase.	BS40101 is a British Standard development for building performance evaluation. It was designed to cover all types and uses of buildings, based on actual 'in-use' data with an emphasis on 'in the round' evaluation.	BS40101 includes 3 main levels: - 'Preliminary' evaluation - 'Light' Building Performance Evaluation (BPE) - 'Standard' BPE Plus for all 3 routes an option of Investigative BPE (pursued in parallel or following). It includes 8 categories, which includes 'energy use and generation.' Energy use and generation is described as annual meter readings (i.e. 12 months), with a year's based of 30-minute data if looking at individual buildings or a sample (10%) within a project. ***The 'Standard' BPE level is the most relevant to MES as both the 'preliminary' and 'light' routes only include building parameters and occupant/user experience categories where all buildings (100% of cohort) are being evaluated. 'Standard' BPE includes the most relevant MES categories of energy use and external condition monitoring.*** ***However, for the physics-based methodology, the lack of internal condition monitoring (including temperature) as standard may be problematic.*** If 'investigative' BPE was utilised, under 'building fabric performance' Heat Transfer Coefficient (HTC) measurement is optional. The SOAP Occupancy Survey[3] meets the requirements of BS40101 and PAS2035, but may need additional tweaks if it was used in the post-works period as a means of capturing non-routine events also.
Wood Knowledge Wales BPE guide and toolkit Timescales: For a useful energy use audit, it requires at least one full year occupation. Notably (in	Guidance aimed at housing clients and anyone interested in BPE. It includes both a 'Core' and 'Detailed' scope, with an accompanying toolpack of methods.	***The 'Core' BPE approach suggested in this toolkit includes several categories, most notable for MES is:*** - ***Energy use audit*** - ***User surveys*** 'Detailed' BPE includes more substantial energy monitoring, amongst other things. For external conditions, they view local weather station data as sufficient for a 'Core'

[3] https://www.soapretrofit.com/occupant-survey

comparison with PAS2035) they advise excluding the first year when users are 'settling in.' Likewise user surveys should be based on minimum 1 year of occupation, and ideally after the first year.		BPE exercise. Energy use audits for the 'Core' BPE should include annual readings as a minimum. At the time this toolkit was published SMETER results were not available - they acknowledge this and highlight that less intrusive methods of calculating HTC may be feasible and could usefully form part of a 'Core' BPE. **This offers an opportunity for MES methodology.** This guide highlights the usefulness of standardised user surveys, as they add value through using considered and well phrased questions and allowing benchmarking results against similar projects. This could be a consideration if there is a requirement for non-routine events capturing.

The current landscape for evaluating energy savings from retrofit is highly variable.
The following two tables show the general approach for the private household and social rented sectors.

Private household route	Description	Likely evaluation approach
Owner occupier for a high end, large budget project	Bespoke, high end, large budget projects (for example, extensive overhaul of a property to a high performance standard like EnerPHit). Professionals are likely to be involved in design, planning and delivery.	The owner occupier may be willing to commission an expert consultant to look purely at evaluation of the project. In the context of the project scope and budget, this is likely to be considered a good investment. However, this kind of evaluation may be more focused on detailed BPE techniques (e.g. measures of thermal performance, in-depth internal monitoring). The skills and experience required would depend on the scope and depth of evaluation activity. For example, you would need specialist expertise if you want to deploy certain detailed BPE techniques (like a blower door air tightness test). But people coordinating an overarching BPE exercise, or something lighter touch, often come from a range of backgrounds and experience.
Owner occupier for a substantial retrofit (i.e. taking whole house approach)	Working to a whole house plan (either in one go, or phased over several years). The performance targets on these retrofits may vary - some may be modest (e.g. Building Regulations equivalent, or small improvement), some may be ambitious but lack the budget to do it as one large project. The majority of households in this category are considered 'early adopters' - open to innovation, but likely to want a degree of certainty in methods and outputs.	The household is likely to be interested in whether the retrofit meets 'intended outcomes' but the level of detail they want is likely to vary significantly. Likewise their appetite for evaluation will be shaped by their motivations and priorities - e.g. for a householder concerned primarily with improving comfort or air quality, they may have little interest in energy saving metrics. A tiered evaluation offer is likely for this section of the market. If finance was available that had certain requirements, the costs and benefits of these would likely be factored into the householder's decision making process. If these were considered overly burdensome they may look for other sources of finance or reduce the scope of their project accordingly.

Private household route	Description	Likely evaluation approach
Owner occupier for single measure interventions	Those who just want to do a single improvement. For example, take the opportunity to insulate a floor when replacing the floor covering, but are not working towards a whole house plan.	Very minimal or no evaluation. For some single measures the overall cost is relatively low and wouldn't justify the cost of evaluation activities. A lot of single measure retrofit activity also happens outside of formal retrofit schemes or programmes (e.g. as part of general home improvements). These may not have any particular energy saving aspirations or motivations.
Portfolio level evaluation is rare currently, but there is likely to be growing demand due to an increasing number of services (such as One Stop Shops) that aim to offer advice, support and in some cases 'end to end' solutions for households.		

Publicly procured retrofit route	Description	Likely evaluation approach
Retrofit procured in response to specific funding opportunities (e.g. Social Housing Decarbonisation Fund - SHDF, Green Homes Grant Local Authority Delivery)	Measures to bring properties up to a particular standard - for example, Energy Performance Certificate band C, a particular space heating demand target (e.g. 90kWh/m2/year). Procurement routes will vary, but professionals are likely to be involved in design, planning and delivery.	The evaluation approach currently tends to be driven by the funding criteria of the programme. For example, on SHDF demonstrator projects extensive evaluation was required, and housing providers were likely willing to commission an expert consultant as part of the team. This kind of evaluation may be more focused on detailed BPE techniques (e.g. measures of thermal performance, in-depth internal monitoring). In later phases of SHDF, evaluation requirements were relaxed and could be delivered as part of standard PAS2035 activities. A MES metric could be integrated as part of these activities but in the short-medium term it needs to acknowledge that data would not be available for all homes in a programme.
Retrofit procured as part of planned stock	Opportunity taken to install measures alongside other improvement works (for example,	There may be minimal evaluation (e.g. tenant satisfaction). This is likely to be done in-house, or required of the contractor through procurement processes.

Publicly procured retrofit route	Description	Likely evaluation approach
improvement programmes.	roof replacement with insulation, gable wall repairs with external wall insulation ventilation with kitchen/bathroom replacements).	
Retrofit procured as part of an energy performance contracting type programme (such as energiesprong[4] , although approaches can vary).	The contractor/solution provider signs a performance guarantee.	This model of delivery may require closely monitoring the energy consumption (and other metrics) post-completion - in the case of energiesprong this includes segregating end uses sufficiently. Relevant metrics: - Net energy consumption - Space heating energy demand - Resident electricity use allowance In other sectors (such as public sector buildings) energy performance contracts are already in use - an example being the Re:fit framework[5]. In this case energy savings, usually in kWh and £s, are agreed and contractually guaranteed, and once the measure has been installed or delivered, they must be measured and verified.
These types of programmes are well suited to portfolio type analysis, although the depth of these activities is currently variable.		

[4] An example of this being Energiesprong. See Gill, Z (2022) Energiepsrong UK performance overview 2021/2022. Available from: https://uploads-ssl.webflow.com/59944999990f53000134107e/63175084c0bf475d361544f4_220906%20Energiesprong%20UK%20performance%20report%202022_PUBLISHED.pdf

[5] Re:fit framework: https://localpartnerships.org.uk/our-expertise/re-fit/

Potential pilots for Metered Energy Savings

Area Based Scheme (community intermediary model)

Project overview

Carbon Co-op is currently delivering an Area Based Scheme in Levenshulme in Manchester. Working with 7 households[6] across three streets in a network of terraces, this pilot project seeks to bring together innovative forms of finance, bulk procurement, contractor training, and householder and community engagement to pilot a closed-loop economic system for local domestic retrofit through a community client intermediary. The approach taken can be characterised as:

- enabling progress towards a whole house retrofit plan (and not piecemeal or single measures)
- the centering of residents in design and delivery
- area and neighbourhood based approaches
- bringing together innovative forms of finance
- a high degree of control around design, specification and installation
- a focus on high quality works.

In early engagement the approach was tenure agnostic - with openness to a mix of tenures (including private rented). However, the first phase includes owner-occupiers only. Evaluation work will seek to further understand the barriers to participation by private landlords.

As at March 2024, all homes in the programme have secured planning permission and are in the process of receiving full Building Regulations approval. In parallel, applications have been processed for loan funding (where required), heating controls and monitoring kits are being installed, and planning for on-site works (disruption planning etc) are underway.

Geography

The streets within the current phase sit within an area highlighted by Electricity North West Limited (ENWL) as possibly requiring flexibility services in future. There may be value in focusing a beta pilot ABS on similar housing archetypes. Also capitalising on awareness of the current phase amongst immediate neighbours and those in surrounding streets.

[6] As of December 2023 this was 6 due to a dropout.

Physical characteristics

Housing typology	• Mid and end terrace • Two storey outriggers to rear • Walls finger/rat trap cavity with facing brick to front. • One home has a mid 20th century single storey extension to rear. • Gas central heating and radiators. • Limited or no planned ventilation systems.
Measures within scope	Working to a whole house retrofit plan (assessments delivered by People Powered Retrofit) and taking a fabric first (demand reduction) approach. The programme is providing a set package of retrofit works, with small adjustments to fit the home and household's priorities. Measures include: • loft and roof insulation • replacement doors • high performance double glazing • draught proofing • decentralised Mechanical Extract Ventilation (MEV) • external wall insulation to rear and gable elevations • heating control upgrades • cap and fill chimney, chimney balloon.

Procurement approach

Households will be consolidated into a single contract, with Carbon Co-op sitting between the householder and contractor, and commissioning designers and other professionals.

Retrofit assessments	Sub-contracted (People Powered Retrofit, who developed and delivered the preferred whole house assessment and scenario planning tool).
Design and supporting surveys	Retrofit assessments - sub-contracted. Architect (Royal Institute of British Architects (RIBA) stages 2 to 5 including Construction, Design and Management (CDM)) (sub-contracted) Supporting surveys (sub-contracted): • Airtightness • Measured surveys • Asbestos survey • Condition/structural surveys
Installation	Procured and engaged on the supply chain training side of the programme.

Evaluation

The current phase of the programme has the following areas of activity relating to evaluation:

- broadly a mixed methods approach - in-depth qualitative data collection with householders and stakeholders (e.g. surveys, interviews around perceptions of comfort, health impacts, affordability etc to satisfaction with process).
- quantitative data collection[7]:
    - Air quality sensor
    - Particulate matter (dust and air pollution)
    - Volatile Organic Compounds (VOCs), chemicals and gases
    - Carbon dioxide, to evaluate airflow
    - Temperature and humidity sensors
    - Smart heating controls

  A small HEMS (Home Energy Management System) to link everything together. The aspects of quantitative data collection, including the HEMS, are overseen by Carbon Co-op's in-house expertise.
- Where testing of the smart meter service onboarding is successful, the team will also be able to analyse smart meter data pre/post-works, comparing this with any bill data collected before work, and against the energy modelling scenarios. A metered energy saving metric would provide an additional data point. As the current phase will not be on site until spring 2024, the focus during the alpha project has been on testing and documenting the process.

Key points for a potential beta pilot with metered energy savings

- We know from our own experience of evaluating schemes, but also from feedback from stakeholders and members of the advisory group, that a metered energy savings metric is one part of a broader suite of tools employed to gauge the success of a scheme.
- It is important for us to have sight of this wider context so we can assess the evaluation/data request on householders as a whole - and this has the potential to provide a richer picture of the success or otherwise of any given scheme. While some of these metrics may be desirable from a broader business model and Data Warehouse proposition (see WP3 deliverables), the standardisation, data access, consents and basis for sharing with third parties would need establishing. This goes beyond the scope of our work on RetroMeter Alpha, which has needed to focus on the data points required to validate the MES methodology.

[7] The current phase is participating in a European research project called EBENTO, so some of the metrics (e.g. air quality) have been driven by their research areas.

Baseline and potential savings

The technical brief for the project defined the fabric first approach with an indicative list of measures in scope. It also set the ambition to reduce the performance gap and avoid thermal bridging. The following energy efficiency targets were set, although the ability of a home to reach these were not a requirement for involvement:

- Space heating demand (after works) of between 50 and 100 kWh/m2.a
- Air tightness (after works) of 5 m3/m2.hr
- EPC rating C or above (after work).

The retrofit assessments consist of a baseline energy model based on full Standard Assessment Procedure (SAP), but with some adaptations. The main divergence from SAP is that it allows more bespoke occupancy and target temperatures to be set. lt also collects actual bill data where possible for comparison against the model.

Key points for a potential beta pilot with metered energy savings

It would be beneficial for the Retrofit Provider (in this case Community Intermediary) to consider including:

- a target MES metric for the project as a whole (such as a Metered Energy Saving of x %)
- Energy Use Intensity as a key metric in technical briefs and target setting.
- Peak Heat Load as a key metric in technical briefs and target setting.

Costs and funding

It is difficult to place a cost on the data procurement/metering, analysis etc due to the stage of the current phase. The piloting/demonstration nature of the current phase means that staff time spent to date will not be indicative of a rolling programme. For example, a lot of work has gone into establishing systems and processes - and there would be savings in this second time around etc.

We have provided input to ep group's work package around costs of the works involved on an Area Based Scheme focused on fabric improvements.

On the current phase costs are as follows:

- enabling costs approx £5,100/home (this includes design fees and other surveys, such as structural, asbestos and measured surveys)
- other costs (e.g. planning, Building Regs applications) approx £400/home
- construction/capital costs at approximately £30,200 for a mid-terrace, £43,000 for an end-terrace

- total average costs (including 10% contingency which may not be required in all cases, but is prudent to allow for): mid-terrace £39,100, end-terrace £53,000.

Project status for a MES pilot

Levenshulme

The current phase Carbon Co-op ABS in Levenshulme has contributed to RetroMeter development to date through:

- Access to householder engagement materials and surveys
- Feedback from project teams on a range of aspects, from delivery to the detail of engagement approaches
- Access to anonymised energy modelling data to support business model development work
- a process of smart meter service sign-up and agreeing to host monitoring kit, allowing these components of a MES method to be tested
- Insight from the project team on learning that could inform future phases in Levenshulme or elsewhere.

We consider the following to be key advantages of a MES pilot including an ABS model:

- Householders can be engaged earlier in research - and MES criteria could form part of eligibility and selection criteria
- Smart meter service onboarding can be conducted as early as possible, with dedicated engagement resource in-house to support
- Early onboarding offers an additional data point to refine baseline energy modelling and decision making on the most suitable retrofit measures
- Contractual milestones between the community intermediary and householder offer formal points for securing data access and any additional data points we decide would be useful
- The re-consent process for smart meter data can be aligned with ongoing engagement and ties in nicely to broader evaluation activity
- Potential for other key ABS stakeholders, and residents themselves, to derive additional value from the MES metrics and their smart meter data.

A note on targeting of a subsequent ABS
For the current phase in Levenshulme a report on housing archetypes was completed by an architectural practice (sub-contracted) - this set out a representative set of archetypes for the Levenshulme area. Five house types were identified that could then form the basis of exploratory energy modelling. If a subsequent phase was located in the same or neighbouring streets, this exercise may not need to be repeated.

Oldham

Carbon Co-op is also involved in a project with Connected Places Catapult and Oldham Council, looking at the feasibility for a **Health and Resilience focused ABS**

in Oldham. This feasibility project runs until the end of April 2024, with a dissemination event likely in May. This will be closely followed for MES pilot project potential.

Retrofit Provider feedback

In early 2024 we held an internal session with members of the Levenshulme and Oldham project teams, to scope out what a RetroMeter integrated ABS project could look like. We focused on five key areas:

1. Scale
2. Eligibility
3. Scope
4. Location
5. Funding

The outcomes of this discussion are summarised below, and have fed into the work done by ep group as part of the business modelling work package.

Theme	Questions posed	Summary of responses	Synergies with methodology findings	Further development needed
Scale	What scale of an ABS is feasible for a community intermediary like Carbon Co-op to deliver?	The key point raised was about the number of relationships in a project as this is the pertinent point for managing the project and engaging householders. In this sense there may be some range between this and the number of homes in a scheme - for example, you could aim for 20 to 50 homes, but with only 25 to 30 owners.	ESC's comparison group methodology findings suggest that we would be looking at portfolios in the 10s, rather than hundreds for acceptable accuracy.	Managing a mix of tenures (homes: relationship ratio) is relatively untested in this sector, so the assumption around efficiencies requires validation with real scheme data. While a lower ratio of owners to homes may drive efficiencies in overall scheme management, there may be limits in an engagement sense as tenants will still need to consent individually around their personal smart meter data etc. There is also limited data about the additional costs (above capital costs) of running these kinds of schemes - due to the innovative/early stage nature of ABS retrofit projects.

Theme	Questions posed	Summary of responses	Synergies with methodology findings	Further development needed
Eligibility	Could the cohort include both smart meter households and non-smart meter households?	There was variation in views on the smart meter question. Members of the team who have done a lot of householder facing work, particularly with under-represented and under-served communities, highlighted that there are a lot of social issues around smart meters and negative perceptions. A purely smart meter focused scheme could exclude many householders[8] which would have energy justice implications. A broadly focused ABS but with only a portion with eligible smart meters would see the size of the total pool needing to grow - which has knock-on implications for the intermediary. The potential to support householders around smart meter installation as part of early stage ABS engagement (myth busting etc) was discussed as a possibility, and a community intermediary may be more trusted and accepted. The other view presented was that excluding non smart meter households may be an acceptable limitation at this stage, given the demonstrator nature of any beta scheme. Linked to this, lead in times were discussed, with these permutations shown diagrammatically in the figure below.	Including fuel vulnerable households is not likely to be problematic in terms of validating the MES methodology (indeed, in testing savings at an aggregate level there's a suggestion that it needs to target widely to smooth out comfort take-back – assuming no additional HTC method that can estimate the degree of comfort take-back). However, there may be more engagement with households required, as distrust in smart meters and In Home Displays tends to be higher in these groups (see discussion in WP4 deliverable 1).	As above, the limited engagement of mixed tenures to date may impact targeting, eligibility and resourcing.

[8] At the end of March 2023, more than a decade after the rollout started, only 57% of all electricity and gas meters were smart, with the target for 74.5% of homes by June 2025. See House of Commons Committee Report on the rollout of smart meters: https://publications.parliament.uk/pa/cm5803/cmselect/cmpubacc/1332/report.html#heading-2

Theme	Questions posed	Summary of responses	Synergies with methodology findings	Further development needed
Scope	What scope of works could we target: As per Levenshulme, a package of fabric (demand reduction) with ventilation? More advanced/deeper demand reduction? As either, but with electrification of heating too? Scope of monitoring kit? Scope of energy modelling tools? Technical/performance brief?	Discussion highlighted that: - Appetite for spending money is very variable across householders in an ABS, so a scope in line with the current phase of Levenshulme makes funding more feasible - There is a trade off between the level of intervention and ease of application - The similarity of homes has a bearing on this, and part of an ABS is about minimising design work and achieving efficiencies in these enabling costs - There were questions about the degree of similarity in housing types as you start to increase numbers in an area, but this also offers possibilities - e.g. to bring in other types of buildings within an area (like old community centres), which may leverage regeneration aspects and tie in with the aspirations of other 'outcomes based funders', including public bodies. - Monitoring kit could be scaled back from the current approach in Levenshulme, with low cost data loggers used for temperature data. - The engagement officer pointed out that people generally have more	The current scope of measures on the Levenshulme scheme more than covers the data points required for RetroMeter. Even a scaled back (cheaper) version of this would suffice, and there is evidence that householders are generally receptive to sharing this data, especially where the rationale is well explained.	If the scope of an ABS was extended to ASHP the sub-metered power consumption data from these would be needed too. The group approach to procurement would be advantageous here, minimising the need to interface with different manufacturer systems. The issue of goodwill in hosting monitoring equipment, and the generation of direct benefits for a householder needs consideration. What can smart meter data, and potentially temperature data, offer residents longer term? And how can this be done cost effectively?

		goodwill for monitoring if they can see something back from it. - There was strong agreement that the assessment and scenario modelling approach used on the current phase in Levenshulme should be used again, with the team having confidence in the thoroughness and robustness of this in aiding decision making and providing strong baseline data.		

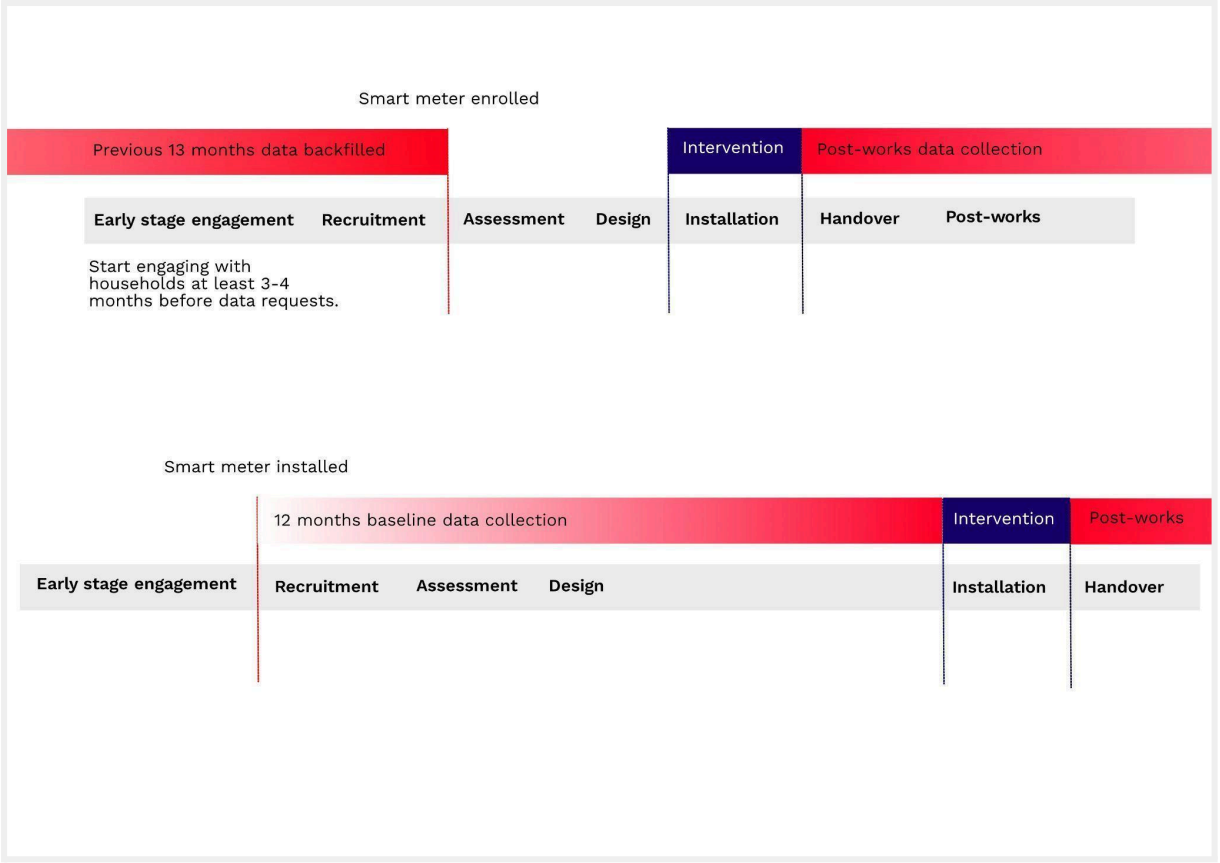
Theme	**Questions posed**	**Summary of responses**	**Synergies with methodology findings**	**Further development needed**
Location	A further phase in Levenshulme, building on the first phase? Alternative potential in	There was strong agreement about the potential to build on the current phase in Levenshulme. This was considered advantageous due to: - Lots of similar housing archetypes to the current phase, including on surrounding streets - Carbon Co-op and the contractor are taking a partnership approach over the long term, with	The area of Levenshulme where the current ABS is operating has been identified by ENWL as a possible future constraint zone. This may offer good	The timescales and severity of the predicted network constraint in the area could be explored in

	Oldham given Health and Resilience ABS work?	risk sharing remedies - which is quite different to conventional approaches to procuring retrofit. This has the potential to build capacity and skills in the supply chain through investing in consistent and sustainable retrofit programmes. - A lesson needs to be shown around housing investment over time delivering the desired benefits - another phase in a geographic location has the potential to demonstrate this well. Carbon Co-op's work with Oldham is generating a firm commitment to make an ABS scheme happen there, and lots of learning around how you take the next incremental, realistic, steps from a scheme of 6 householders (e.g. on Levenshulme). As part of this work they have also been assessing a range of finance options, including municipal/council lending as well as 3ci[9] type models. One potential issue with Oldham is the lack of network constraint zones, which may add to challenges around delivering network benefits.	synergy for any piloting with a subsequent phase of homes on the same or neighbouring streets.	more detail with the DNO.

Theme	**Questions posed**	**Summary of responses**	**Synergies with methodology findings**	**Further development needed**
Funding	How is thinking on finance evolving across	There was recognition that the finance products in use on the current Levenshulme scheme are relatively unique. The two financial options available (full funding or a significant low cost	Metered Energy Savings underpinned finance mechanisms	While stacking more finance options is felt

[9] 3ci is an innovation collaborator with the local government and the private sector. They set out a case for neighbourhood based financial mechanisms for retrofit ('UK Net Zero Neighbourhoods'). Available from: https://www.3ci.org.uk/publications/

	projects, and what implications might this have for a project integrated with a MES pilot?	loan - via land charge - from the local authority) have worked to incentivise both fuel vulnerable and very fuel secure household types to retrofit their homes. However, our experience from working with some less fuel secure (but technically non fuel vulnerable) households suggests that there is a need for further options to incentivise this group. Match funding or different loan terms may be needed. However, while specific products have been unique, the mix of grant and loan funding generally is not. In this sense, there is precedent. Including other parties in financial aggregation was treated with caution - needing to be an organisation that was trusted. This caution was through the lens of protecting householders, but also for Carbon Co-op in managing any relationships (a lack of a good working relationship or trust in the systems and processes of the aggregator would impact on project management and delivery). Others believe this is not an external role, but a specific finance role that needs to be resourced in-house. However, there was agreement that finance is a critical piece of the ABS puzzle. The work in Oldham and Manchester does highlight commitments to lend out Local Authority reserves. Lending products could be more complex, with a 'fuzzier' line between grant and loan pots.	would use model confidence to expand the potential funding available to an ABS. For example, through unlocking revenues from a network operator.	to be manageable, the knock-on effects for project management and complexity of reporting for the Retrofit Provider needs consideration.



Other delivery models for private tenures

Other routes and delivery models for private householder retrofit also offer potential for a MES pilot. For example, projects under the DESNZ funded Green Homes Finance Accelerator (GHFA) programme.

One project within this programme is being led by People Powered Retrofit, with partners Carbon Co-op, LocoHomes, MetroMoneywise, ABCUL (Association of British Credit Union Lenders), Care and Repair Manchester and Julie Godefroy Sustainability. The project will pilot two Credit Union financial products for household retrofit measures in two pilot markets - Manchester and Glasgow.

1. Green Home Improvement Loan product for relatively simple measures - piloted by a consortium of Greater Manchester Credit Unions directly to members and also via a home improvement agency
2. One Stop Shop for Retrofit product - piloted by People Powered Retrofit in Manchester and Loco Homes in Glasgow.

During the Discovery phase MES was identified as one of a suite of metrics that One Stop Shops and Credit Unions could use to verify the work delivered. This will be further explored in the pilot phase which runs until early 2025.

Publicly procured retrofit models

Publicly procured retrofit overview

Publicly procured retrofit is an umbrella term for a variety of funding models, including the following:

- Social housing (e.g. SHDF)
- Local authority delivery of funding (e.g. Home Upgrades Grant, Local Authority Delivery)
- Other 'public' funding (e.g. Great British Insulation Scheme, Boiler Upgrade Grants)
- Energy Supplier Obligations (ECO).

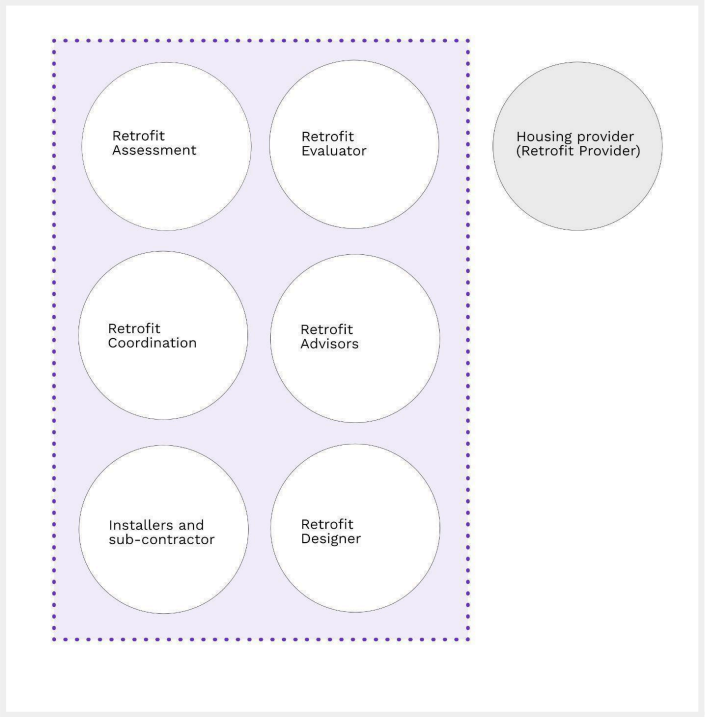
This section focuses on the social housing/housing provider route, but similar principles apply to local authority delivery of public funds where there is a requirement to follow PAS2035. We have not looked at energy supplier funding specifically as part of this Alpha phase project, but acknowledge it is a potential avenue for scaling MES and may warrant more detailed analysis of householder engagement during any follow-on projects.

Publicly procured retrofit has some key differences from an ABS type scheme:

- The timing of stages in the householder journey differ slightly as the assessments play a key role in understanding which properties can be included
- The whole process must be aligned with PAS2035 requirements – this introduces a strong driver for MES parties to align with these standards (as discussed further in ep group's milestone 3 deliverable)
- On recruitment to the programme the dynamic is different given the landlord/tenant relationship - however, there is still a requirement to secure householder consent otherwise access for works will be problematic. This stage also needs to capture householder specific needs and ideally vulnerabilities, as on an ABS type scheme.
- Specification of works is often heavily influenced by the procurement approach taken. For example, a particular manufacturer of heat pump, or in the case of a 'design and build' model the contractor has greater influence.
- There may be differences in contracting approach within the programme (as summarised in the following section) - which increases the potential complexity for any MES pilots.
- Evaluation timescales are generally shorter - with a post-works occupant survey/verbal feedback the basic requirement.
- Multiple providers may be engaged to provide monitoring equipment and services - which increases the potential complexity for any MES pilots.
- While evaluation outcomes are fed back to funders, householders are rarely an audience for reporting.

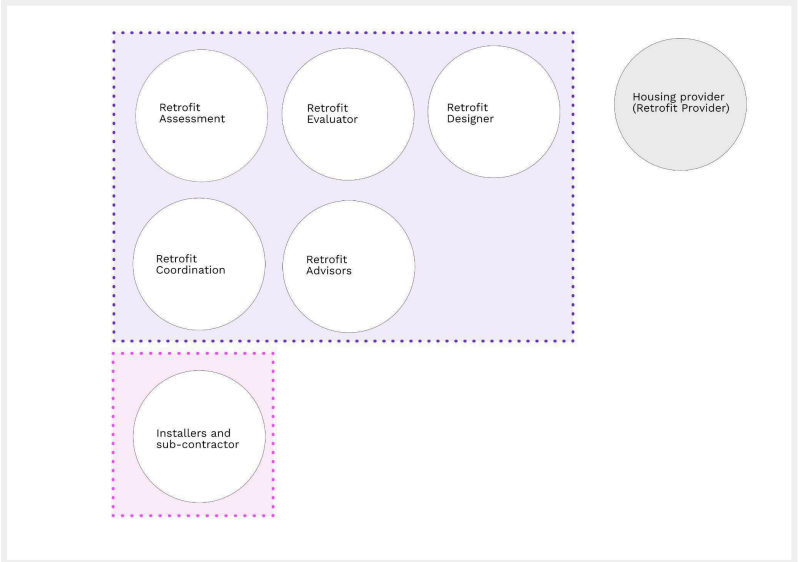
Housing providers and funders can choose to deploy different procurement models. They can be broadly categorised as the following, but more detail can be found in the Retrofit Academy CIC and Local Energy North West Hub publication 'Contracting for PAS2035 compliant retrofit: guidance for local authorities.'

1. **Turnkey provider 'all in' (Contractor Led Turnkey Retrofit)**



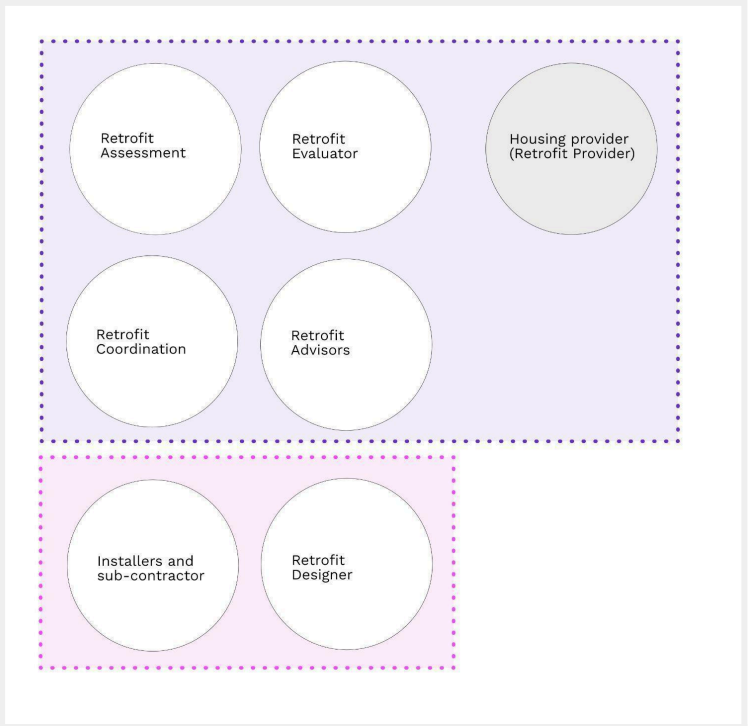
In this model *all* parts of the process from Resident Advice to Evaluation are contracted to one installer-led organisation.

2. **Key PAS roles separate from installer**



In this model, the funding body contracts the Assessment, Coordinator and Evaluation parts of the process to one organisation. This ensures that the Coordinator function, primarily a client and resident protection role, is divorced from the Design and Install. In some cases the Design role is also separated (as shown).

3. **Client retains key PAS roles in-house (Local Assessment, Coordination and Evaluation)**



In this model, the original client and funding body retain the Coordination function as the overarching protection for client and resident.

4. A further variation is a **Managing Agent led** approach, where the funding body contracts *all* parts of the process from Resident Advice to Evaluation to one organisation, who usually then go on to sub-contract design and install.

Manchester SHDF project overview

This potential MES pilot relates to social housing managed by Manchester City Council Housing Services. The council's current Social Housing Decarbonisation Fund (SHDF) programme includes 6 projects across different parts of the local authority. The outline programme, as a whole, includes:

- Anita and George Leigh Street (30 low rise flats and terraces in a conservation area)
- Newton Heath (4 towers, 24 low rise cottage flats)
- Monsall high rise (3 tower blocks)
- Riverdale maisonettes (28 properties)
- Boiler replacement (across 1037 terraced, semi and parlour houses)
- Voids (10 homes only).

During RetroMeter Alpha we progressed with the assumption that the main element in scope for a pilot was around 1,000 homes in areas with postcodes M9 and M40. These were defined as the 'boiler replacement strand' of the programme, and earmarked for Air Source Heat Pump and some fabric works. The breakdown was approximately as follows:

- 126 homes in postcode area M40
- 911 in postcode area M9

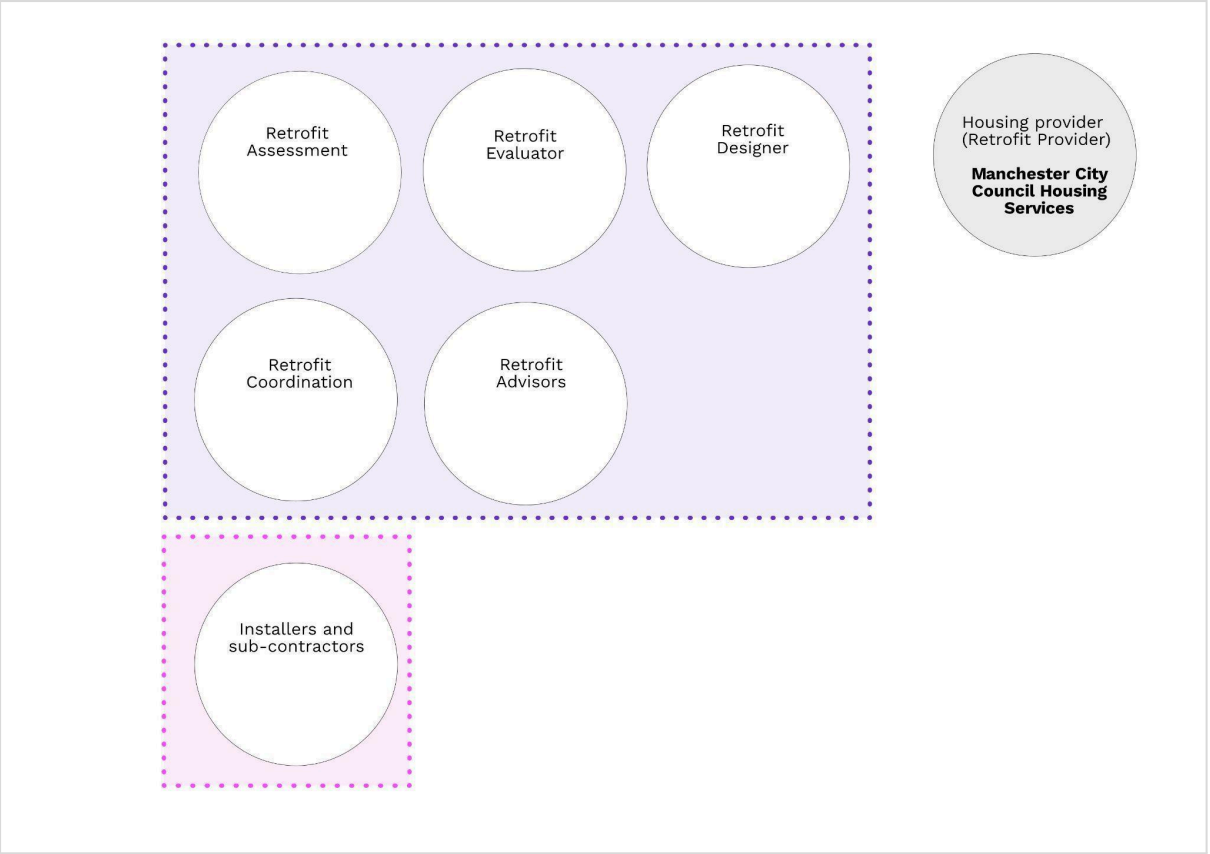
These properties are spread predominantly across North Manchester covering Charlestown, Beswick, Moston and Higher Blackley. Of the 1037 homes (including 10 void properties), 200 have been given the go ahead to progress with works (at March 2024).

As at the end of March 2024 we understand that the boiler replacement programme now has 550 homes within scope. This downward revision is due to some properties no longer being eligible after retrofit assessments and surveys were completed, with some further refusals by households. Installations on the first homes started in mid-March 2024, and will continue until June/July.

Left: image of the type of housing for inclusion in the programme (Booth Hall Road, Charlestown, Manchester)

The properties are managed by MCC Housing Services within which the Design & Delivery team are responsible for delivering the retrofit project. Digitalisation of around 100 properties (e.g. Switchee, Daikin monitoring) is being coordinated jointly between Zero Carbon Housing Team and Design & Delivery Team.

The procurement model adopted in this case is key PAS roles contracted separately to the installer (model 2 above).



Above: Key delivery roles for the SHDF boiler replacement programme

Baseline and potential savings

The scope of works during planning and feasibility stage were:

- External wall insulation
- Air source heat pump (ASHP) and heating controls
- Ventilation
- Low energy lighting

Based on these measures the following potential savings were:

	Semi-detached	Terraced
Baseline - modelled Heat Transfer Coefficient (W/K) (average)	194	199
Post Measures Installed - modelled Heat Transfer Coefficient (W/K) (average)	170	180
Baseline - Space Heating Demand in kWh/m2.a (average)	98	116
Post Measures Installed - Space Heating Demand in kWh/m2.a (average)	86	96

However, following completion of Retrofit Assessments and cost appraisals the scope changed to:

- Air Source Heat Pumps
- Cavity Wall Installations
- Loft insulation

Other capital works are being planned for the same time which include:

- Ventilation, Fascia and Soffit replacement, Rainwater Goods replacement
- Switchee Monitoring Equipment - Switchee Receiver Unit, Switchee Thermostat

Feedback suggests fabric works in particular came in over budget (in a way this would strengthen the case for levering other investment for fabric works because of the impact on peak load if only heat pumps are fitted).

The ASHP units being installed are Daikin R32 Monoblock (6kw for 2 bed homes, 8kw for 3 bed homes).

The boiler replacement programme is working to a cap of approximately £19,700 per home. This includes both SHDF funding and contributions from the council's Capital Works budgets.

PAS2035 assessment requirements must be followed, this means the retrofit assessment cannot just be an EPC. Specifically, it must be:

- a whole dwelling assessment (so also consider its heritage, architectural features, structure, construction, condition and services. It must include enough images and detail to determine its suitability for improvement).
- a degree of occupancy information - this can be used to estimate annual fuel use, fuel costs and carbon dioxide emissions, under actual occupancy (where data is available) or standard occupancy.

It's worth noting while the assessment must be more holistic, the energy modelling can still be based on RdSAP which has limitations around accuracy. RdSAP is a quicker way of creating an energy model of a home but involves more assumptions about the type of construction (e.g. based on the age band of the home). The core calculation of any RdSAP or SAP based assessment is also based on standardised assumptions of occupancy, and does not include 'unregulated' energy uses (i.e. appliances and plug loads). This is significantly different to an energy modelling exercise that adjusts for actual occupancy patterns and behaviours, and that includes actual bill data.

Costs and funding

In comparison with retrofit to private tenures, the funding mix is often less complex as there is no householder contribution. SHDF will only fund 50%, with the remainder needing to be co-funded by the housing provider (in this case MCC). The total estimated cost of the whole SHDF Programme (at Sept 23[10]) was £49.71m:

- £41.15m of which relate to grant eligible works
- SHDF grant of £11.65m,
- MCC contribution to works is £29.5m (just over 71% of the total costs).

This covers the entire programme, a potential beta pilot would only involve a subset of these homes.

This tranche of SHDF funding must be spent by March 2025, with council co-funding spent by Sept 2025.

We understand that budgets for retrofit are guided by a funding cap per property. This is not a standard figure across housing providers as it is ultimately dictated by the amount of SHDF (and other funding like capital works) money secured and how many homes are within scope. In the case of MCC the funding cap for the boiler replacement programme is around £19,700 per home.

[10] From publicly available information: https://democracy.manchester.gov.uk/documents/s41836/Housing%20Retrofit%20Update.pdf

Energy and performance data requirements

The measures under SHDF are guided by the requirement to follow PAS2035[11]. The principles within this require a fabric first strategy (i.e insulation and heat loss prevention). There is an expectation that such fabric measures will also mean improved ventilation systems. Renewable heating technologies are within scope, provided that the overall strategy will mean this will not increase bills for households. SHDF will only fund measures that take a home up to EPC band C (band D is permissible if strong justification).

In addition, consideration must be given to achieving space heating demand of 90 kWh/m2/year, where reasonable and cost effective. Acceptable evidence for this are the outputs from modelling (e.g. using Standard Assessment Procedure - SAP, or Passive House Planning Package - PHPP).

While we have requested anonymised assessment data to supplement this section it has not been possible to date.

Integration with social housing retrofit engagement guidance

As part of Alpha stage contractor engagement with MCC the draft engagement guidance for their social housing retrofit programmes was shared. We have been able to review this and consider how it might support the integration of a Metered Energy Savings methodology. We presented this analysis to MCC for consideration. Please refer to WP4 D1 (RetroMeter Engagement Summary (final report) for this.

[11] PAS2035 is a BSI process standard for 'Retrofitting dwellings for improved energy efficiency – Specification and guidance'

Key stakeholders for MES pilot projects

Key ABS roles to engage with as part of a MES pilot

Role	Function	MES involvement
Community intermediary organisation - Carbon Co-op		
> Carbon Co-op Programme Manager	Project sponsor, board liaison, partnership development, financial product development, fundraiser/budget holder	Planning
> Carbon Co-op Project Manager	Coordinating stakeholder input, day to day Project Management, developing approaches to key project challenges, commissioning third parties, working alongside engagement coordinator, establish approach to measuring impact	Planning
> Carbon Co-op Engagement Officer/Resident Liaison	Key point of contact for households, support finance applications, communications with households, undertake householder evaluation, coordinate assessments and survey visits, safeguarding, bridge between design team and householders.	Planning Data access Ongoing data collection (where required)
> Carbon Co-op Research and GIS officer	Research and data sourcing, GIS mapping and spatial data visualisation, data analysis and criteria scoring of areas, engagement with LA policy and GIS teams, final area selection	Planning
Feasibility study funder	Fund and may influence scope of feasibility studies	
Local authority	Planning, Building Regulations, may have other roles in neighbourhood engagement and potentially funding	May have limited role in planning phase
Research team (if applicable)	Various	Sensor installation if applicable. Smart meter service support. Sensor deinstallation if applicable.

Role	Function	MES involvement
Households	Central to scheme	Data access Ongoing data collection
Assessor	Energy and scenario modelling, initial high level appraisal of measures and indicative costs	May benefit from pre-works data collection Pre-works data collection for context
Designer	Enabling surveys, design and specification of measures, Planning and Building Regs applications, act as Principal Designer for CDM, Contract Administration, liaison with householders	
Contractor	Quote based on specification, mobilise workforce and project, Install measures, invoice, handover, recruitment and training of apprentices	Completion dates May have a role in encouraging data access on demonstrator. Longer term may have a stake in financial models linked to MES. Handover and quality of work play an important role in realising savings.
CDM Coordinator	Securing the health, safety and welfare of those carrying out construction work and protecting others who the work may affect, from harm.	

Key SHDF roles to engage with as part of a MES pilot

The variety in contractual models employed on these publicly procured schemes introduces complexity in the stakeholders any MES pilots or scaled programmes

will need to engage with. The example below is from the MCC programme we have engaged with during RetroMeter Alpha. This will vary across Retrofit Providers and their partners.

Organisations	**Roles**	**Relevance to MES**
Manchester City Council		
> **Zero Carbon Housing Team**	Includes: - SHDF Engagement Lead - SHDF Engagement Support	
> **Design & Delivery Team**	Includes: - Project Manager - Project Officer	
> **Housing Services Team**	Includes: - Housing Manager - Neighbourhood Strategic Lead - Neighbourhood Managers (in this case, potentially up to 4 covering the wards within the programme)	
> **Climate change Officer**		
Engagement contractor to MCC (in this case Forever Consulting)	Includes: - Engagement Officer	
Digitalisation contractor to MCC (in this case Switchee)	- Account Manager - Engagement Officer (Customer Success Manager)	
Local authority - other functions	Planning, Building Regulations	
Research partners (e.g. Carbon Co-op)	- Energy systems team lead - Research and evaluation lead - Citizen engagement officer (in recruitment)	
Households	Central to scheme	
PAS contractor to MCC	Fulfil multiple PAS2035 roles of: Advisor, Assessor, Co-ordinator, Designer, Evaluator The most relevant for MES include Assessor and Co-ordinator/Evaluator.	
Contractor	Quote based on specification, mobilise	Co-operati

Organisations	Roles	Relevance to MES
(installer) to MCC	workforce and project, Install measures, invoice, handover, recruitment and training where required. Includes: - Contract Manager - Resident Liaison Officer - Engagement/Social Value Lead	on
> Sub-contractors to installer (e.g. heat pump supplier)	Includes: - Contract Manager - Engagement Officer	

References

BS 40101:2022 *Building performance evaluation of occupied and operational buildings (using data gathered from tests, measurements, observation and user experience). Specification.*

BSI. PAS2035: 2023: *Retrofitting dwellings for improved energy efficiency – Specification and guidance.*

Royal Institute of British Architects (RIBA) *RIBA Plan of Work*. Available from: https://www.architecture.com/knowledge-and-resources/resources-landing-page/riba-plan-of-work

Wood Knowledge Wales (2021) *Building Performance Evaluation guidance.* Available from: https://woodknowledge.wales/building-performance-evaluation-guide