CNCA grant deliverables report

Mayor of London Energy Leap Project (Energiesprong) – Lessons learned

Greater London Authority
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Executive Summary

Introduction

The London Environment Strategy sets out the Mayor's vision of making London a zero carbon city by 2050, while at the same time protecting the most vulnerable by tackling fuel poverty. The Mayor's £34 million Energy for Londoners programme is helping to deliver this, with the aim of making London's homes warm, healthy and affordable, its workplaces more energy efficient, and supplying the capital with more local clean energy. The Mayor is keen to facilitate the development of a thriving market for home energy efficiency, and has allocated £10m funding to increase retrofit activity.

Through this programme, the Mayor is seeking to understand whether the Energiesprong model can be successfully transferred to London. Therefore, the Mayor has allocated match-funding for the delivery of up to ten demonstrator homes through the Energy Leap project.

In addition to the capital funding allocated to Energy Leap by the Mayor, the Carbon Neutral Cities Alliance (CNCA) is supporting the demonstrator projects through its Innovation Fund.

This report sets out progress on the project to date, and lessons learned, with the aim of sharing information about the initiative across the CNCA network to help other cities develop their own projects.

Context

As part of the Energy for Londoners programme, the Energy Leap project is seeking to adapt the Energiesprong model for the UK, testing innovative ways to deliver net zero energy refurbishments for up to ten demonstrator properties, and helping overcome some of the barriers to delivering zero carbon retrofit at scale.

Energiesprong is a revolutionary whole-house approach, which was pioneered in the Netherlands for the refurbishment of homes, but can also be applied to new-build housing. It installs energy efficiency measures, like insulation, and low carbon energy generation technologies, like renewables. To date, most of the homes that have been refurbished are in the social housing sector.

The Energiesprong approach focuses on creating comfortable and desirable homes that are also affordable to run. The key elements for the model are occupant satisfaction, building energy performance and financial viability.

The Energiesprong approach is technology neutral, meaning solutions providers are responsible for meeting an energy performance standard for the whole house in the way that works best for the building and its occupants. This can help stimulate innovation, helping to control costs and ensuring that performance can be guaranteed.

To date, solutions have tended to include off-site manufactured components and insulated panels – to improve performance and speed up delivery - and renewable energy technologies, to provide the zero carbon energy needed to power and heat homes.

Because the approach also guarantees real life energy performance, maintenance costs and comfort standards for up to 40 years, Energiesprong aims to increase confidence in the energy costs and returns for building owners, investors, and occupants alike.

The purpose of this report is to summarise progress to date and share the lessons learned from the project within the CNCA network. Given that procurement and delivery of projects is ongoing, some details have been withheld from publication of this report due to commercial sensitivity, and organisations or details are sometimes not named specifically.

To date, most of the activity has been led by social housing providers, focusing on post-war (1945) housing, and predominantly houses and low-rise flats. However, there is scope for the model to be extended to other housing tenures and typologies.

The aims of the Energy Leap project are to:

a) develop the first home energy performance contract for a zero-energy refurbishment in London
b) design a template for successful large-scale demonstrator projects involving thousands of retrofits
c) demonstrate how London's energy efficiency market and supply chains should be (re)organised to deliver whole house retrofit solutions
d) evaluate the impact on social, environmental and economic factors through evaluation of the refurbishments (e.g. technical and financial performance, and impact on the health and wellbeing of tenants)
e) kick-start innovation and encourage solution providers to prepare for the future
f) provide evidence to inform the way the Energiesprong model could be applied to new build developments in London.

The Mayor has allocated £450,000[1] match funding to help housing providers in London to deliver these demonstrator projects[2] through the Energy Leap project. In addition, the CNCA has allocated USD169,200 (approximately £120,000) revenue funding to support the delivery of the project, covering the cost of a fixed term project officer, procurement and legal advice, and evaluation.

Progress to date

The project has encountered a number of issues to date, which have pushed back completion of the demonstrator properties. These have related primarily to issues with finalising stock selection and successfully signing up tenants, but other issues in relation to procurement, surveys and resourcing have also played a role. Many lessons have been learned, which will help to speed up processes for future projects, and has helped develop a much clearer understanding of what will be needed to implement a project successfully, within the UK. As a demonstrator, this learning is a fundamental part of the purpose of this project.

Conclusions and lessons learned

The full report below sets out these lessons in detail, but key lessons from the project are as follows:

- while the Energiesprong concept is fundamentally simple, the level of detail required to ensure successful implementation of the project is not, and the time and resource requirements to develop and understand this detail at a project level should not be underestimated. The same applies to the time required to engage people, including building occupants, in the process, familiarise them with it and gain their support. It is worth committing time to planning for the required stakeholder engagement and processes at the early stages of the project, even if this entails extending delivery deadlines overall

[1] approximately USD600,000

[2] Social housing in London is owned by London boroughs, the City of London and housing associations, but the Greater London Authority does not own any significant volume of housing

- competing priorities and limited resources mean that while many housing providers are interested in the potential benefits, few are currently well placed to be able to commit the necessary resources to deliver a demonstrator project
- given the project is seeking to address several existing barriers to delivery, it is important not to add unnecessary complexity, for example through property selection or choice of procurement route
- for the demonstrator projects, the aim has been to select properties that are not too challenging technically, in order to be able to demonstrate the concept successfully. This has limited the availability of suitable dwellings, and a number of common technical or logistical issues have been identified. Many of these issues are not unique to London, but given the way London has been developed, the diversity of its housing stock, and the density of housing, it is believed that these make property selection particularly challenging
- early tenant engagement is critical to the success of projects and should be approached in a way that allows the tenant to communicate their likes and dislikes about their home, and to understand how Energiesprong might be able to address any problems (including, but not limited to energy consumption, comfort, and liveability). Giving tenants an active role in the procurement and design process can help lead to better outcomes, and secure support throughout the project
- Energiesprong seeks to improve housing performance by requiring the delivery partner to meet minimum standards as part of an output-based specification. This provides clarity and challenges industry to be innovative. However, it is also important to engage with industry to understand what can practically be achieved and what this means for costs and maintenance, particularly at the small scale of a demonstrator project
- for a demonstrator project, is it advisable to take a more flexible procurement approach, as bidders may put forward approaches and solutions that the housing provider has not yet considered
- when publishing tender documents, housing providers should include as much information as possible on the dwellings (including detailed survey information), maintenance expectations, and tenant requirements, to reduce uncertainty for bidders on costs, reduce risk, and help develop more appropriate proposals
- where planning permission is required, this can lead to delays. One way to ensure that proposed solutions are likely to be acceptable is to include a planning pre-application meeting as part of a tender process to ensure that expectations and policy requirements are clear
- in an area like domestic energy efficiency, where there is still a lot of work to do to make projects investible, seed funding is critical to help develop and demonstrate new propositions in the absence of an existing market, and ensuring there are sufficient resources for project evaluation. Without the willingness of the CNCA and the Mayor of London to back projects such as these, it would be very challenging to make any progress in this area
- when attempting to develop a new product or initiative, peer learning and cross-sector collaboration is essential. One of the great positives of the project has been the willingness of Registered Providers (housing associations and local authority landlords) and Energiesprong UK to share both documentation and experiences and for the supply chain to provide clear and honest feedback
- for future phases of the project it will be important to consider whether the concept can successfully be applied to blocks of flats with multiple tenure types, given that these buildings account for a high proportion of the potentially suitable homes in London

Next steps

The GLA will continue to support its partner organisations through their demonstrator projects and the evaluation process, to work with Energiesprong UK and the CNCA to share learning and address barriers to the wider roll out of Energiesprong.

Early analysis based on typology and tenure of homes in London indicates that as many as 160,000 homes (approximately 5 per cent) in London could be suitable for refurbishment under the Energiesprong model and the initiative could therefore play a role in improving housing standards and making London a zero-carbon city by 2050.

While this is still a large number of homes, and could be larger still, it is important to highlight that the Energiesprong model is likely to be one of several approaches to retrofit that will be required to achieve the improvements needed to ensure the 2050 target is met.

The Energy Leap demonstrators therefore continue to represent an important first step to show what is achievable and point the way to delivering refurbishments at greater scale, quicker and at a lower cost.

1. Introduction

While advances in technology and building standards have pushed new residential buildings closer to net zero energy performance[3], energy consumption from existing buildings accounts for a huge proportion of global energy consumption and carbon dioxide (CO_2) emissions.

Yet many existing homes will still be occupied in 2050 and beyond. It is estimated that in the UK, which has one of the least efficient housing stocks in Europe[4], 70-80 per cent of existing homes will still be standing in 2050[5]. Achieving the necessary improvements in building fabric and services with occupants in situ is problematic and costly at the individual building level, let alone at scale. The retrofitting of existing homes to reduce CO_2 emissions and help meet national and local climate change targets presents a huge challenge because of the social, technological, policy, financial and logistical aspects.

Energiesprong is an initiative developed in the Netherlands that aims to address these issues in one leap, by applying the principles of energy performance contracting to existing homes and aggregating demand from building owners for zero energy refurbishments to drive innovation.

The London Environment Strategy sets out the Mayor's vision of making London a zero carbon city by 2050, while at the same time protecting the most vulnerable by tackling fuel poverty. The Mayor's Energy for Londoners programme aims to make London's homes warm, healthy and affordable, its workplaces more energy efficient, and to supply the capital with more local clean energy. The Mayor is keen to facilitate the development of a thriving market for home energy efficiency, and has allocated £10m funding to increase retrofit activity.

Through this programme, the Mayor is seeking to understand whether the Energiesprong model can be successfully transferred to London. Therefore, the Mayor has allocated match-funding for the delivery of up to ten demonstrator homes through the Energy Leap project.

In addition to the capital funding allocated to Energy Leap by the Mayor, the Carbon Neutral Cities Alliance (CNCA) is supporting the demonstrator projects through its Innovation Fund. While the project is ongoing, and a full evaluation will be made available upon completion and monitoring of the projects, there have been several delays which have pushed back completion.

This is to be expected up to a point; demonstrator projects are an attempt to overcome a number of barriers and uncertainties around delivery, so we should not be overly surprised when difficulties arise. Nevertheless, London's experience to date has helped it learn many lessons which will inform how the Energiesprong model can be rolled out across London at greater scale, and may also provide useful learning for other cities seeking to follow the same path.

[3] Defined as where a building's operational energy demand does not exceed the energy it produces over the course of a year

[4] https://www.ukace.org/wp-content/uploads/2015/10/ACE-and-EBR-briefing-2015-10-Cold-man-of-Europe-update.pdf

[5] https://www.raeng.org.uk/publications/reports/engineering-a-low-carbon-built-environment

The purpose of this report is to summarise progress to date and share the lessons learned from the project within the CNCA network. Given that procurement and delivery of projects is ongoing, some details are not currently in hand at the time of the release of this report.

2. Context

2.1 About Energiesprong

Energiesprong is a revolutionary whole-house approach, which was pioneered in the Netherlands for the refurbishment of homes, but can also be applied to new-build housing. To date, most of homes that have been refurbished are in the social housing sector.

The Energiesprong approach focuses on creating comfortable and desirable homes that are also affordable to run. The key elements for the model are occupant satisfaction, building performance and financial viability.

To minimise disruption to occupants, the target for completing each refurbishment is no longer than ten days, and in some cases in the Netherlands, the main refurbishment elements have been completed in a single day.

The Energiesprong approach is technology neutral, meaning solutions providers are responsible for meeting a performance standard for the whole house in the way that works best for the building and its occupants.

Solutions providers are required to achieve a minimum performance standard within a fixed price envelope. This can help stimulate innovation, helping to control costs and ensuring that performance can be guaranteed.

Experience from the Netherlands shows how the outcome-based specification and time limits for refurbishment have helped to drive innovation effectively, for example stimulating investment in facilities for the manufacture of pre-fabricated insulated panels, and energy service "pods", incorporating a range of efficient new building services.

Because the approach also guarantees real life energy performance, maintenance costs and comfort standards for up to 40 years, Energiesprong aims to increase confidence for building owners, investors, and occupants alike.

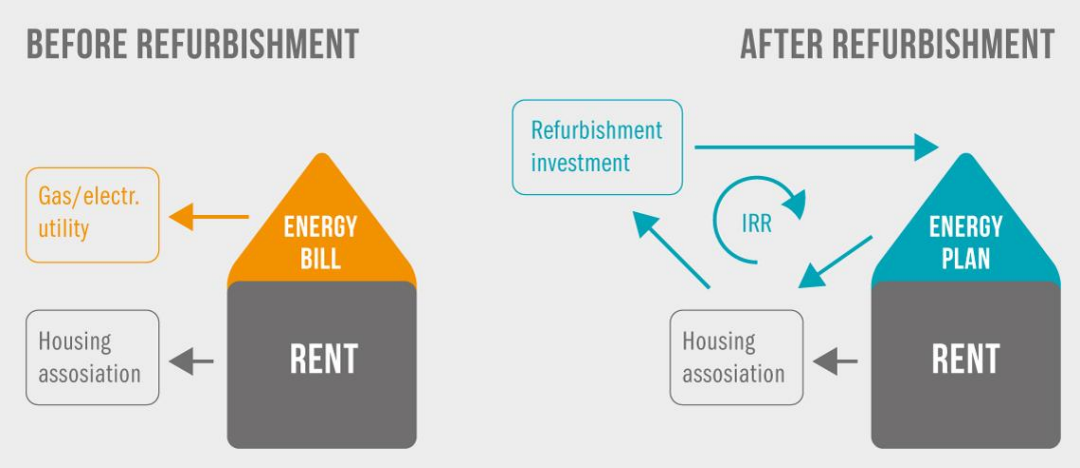
This performance guarantee is an important element of the financial model. Housing providers have sometimes been reluctant to invest in low-energy refurbishments, on the basis that while they are responsible for paying for works, it is the occupants who benefit from the energy savings (the so-called split incentive). Local authorities currently also have very limited budgets to invest in energy efficiency. Because the energy savings from an Energiesprong refurbishment are guaranteed, and subject to regular monitoring, it allows the housing provider to charge an energy service plan to the property, which includes guaranteed indoor temperature, plus an allowance for hot water use, lighting and appliances.

The energy charge is set to be less than the occupant's energy bills before the refurbishment and allows the housing provider to recover its up-front investment over time. The guaranteed energy plan, together with maintenance savings, increases long-term certainty about lifecycle costs and income and may allow the housing provider to borrow money for the refurbishment at a lower rate.

Figure 1 shows how the energy plan helps to make the Energiesprong model financially viable. Whereas before the refurbishment, the occupant is buying energy from a utility

company, after the refurbishment, they are paying for light, heat and power through an energy plan, which then goes to pay back the cost of the refurbishment.

Figure 1: The Energiesprong model (courtesy of Energiesprong UK)



Over four thousand[6] Energiesprong refurbishments have been completed in the Netherlands, and the model has also been applied to new-build homes. Monitoring carries out on completed homes to date indicates they are meeting performance expectations and are net energy suppliers[7]. Energiesprong projects are now also being delivered in France, where the first volume deal for 3,600 homes has recently been announced[8], Germany, Luxembourg, the UK and the USA. In the UK, activity is led by Energiesprong UK.

The first Energiesprong demonstrators were completed in the UK in Nottingham in 2018 by Melius Homes, working on behalf of Nottingham City Homes[9].

To date, most of the activity has been led by social housing providers, focusing on post-war housing, and predominantly houses and low-rise flats. However, there is scope for the model to be extended to other housing tenures and typologies.

2.2 About the Energy Leap project

In the London Environment Strategy, the Mayor sets out his ambition for London to be zero-carbon by 2050, while at the same time helping the most vulnerable in society by addressing fuel poverty. This implies that every homes needs to be retrofitted to a high standard - 100,000 homes every year from now until 2050[10]. Achieving this requires a step-change in the pace, scale and quality of retrofitting activity within London.

[6] http://energiesprong.eu/
[7] P.13, http://energiesprong.eu/wp-content/uploads/2017/04/EnergieSprong_UK-Transition_Zero_document.pdf
[8] https://www.energiesprong.uk/newspage/energy-plan-needed-for-success-of-net-zero-energy-refurbishments
[9] https://www.energiesprong.uk/newspage/energiesprong-uk-bbc-news
[10] For more detail on London's Zero Carbon Roadmap, please see pp. 211-219 of the London Environment Strategy: https://www.london.gov.uk/sites/default/files/london_environment_strategy_0.pdf

The Mayor's Energy for Londoners programme aims to make London's homes warm, healthy and affordable, its workplaces more energy efficient, and to supply the capital with more local clean energy. As part of the Energy for Londoners programme, the Energy Leap project is seeking to adapt the Energiesprong model for the UK, testing innovative ways to deliver net zero energy refurbishments for up to ten demonstrator properties.

The initiation of the Energy Leap project follows the completion of an Energiesprong transferability assessment in 2016, and engagement of stakeholders across London, including housing providers. In February 2017, the Mayor decided to allocate £450,000[11] match funding to help housing providers in London to deliver these demonstrator projects[12] through the Energy Leap project. In addition, the CNCA has allocated USD169,200 (approximately £120,000) revenue funding to support the delivery of the project, covering the cost of a fixed term project officer, procurement and legal advice, and evaluation.

The aims of the Energy Leap project are to:

g) develop the first home energy performance contract for a zero-energy refurbishment in London
h) design a template for successful large-scale demonstrator projects involving thousands of retrofits
i) demonstrate how London's energy efficiency market and supply chains should be (re)organised to deliver whole house retrofit solutions
j) evaluate the impact on social, environmental and economic factors through evaluation of the refurbishments (e.g. technical and financial performance, and impact on the health and wellbeing of tenants)
k) kick-start innovation and encourage solution providers to prepare for the future
l) provide evidence to inform the way the Energiesprong model could be applied to new build developments in London.

Upon completion of the evaluation, an assessment will be made of the best ways to encourage further development of the model in London. However, based on the age, type and tenure of housing stock in London, it is estimated that at least 160,000 homes in London may be suitable for the Energiesprong approach, and with a need for London to build 66,000[13] new homes every year to a zero-carbon standard, there is also significant scope to apply the model to new build housing.

2.3 London Energiesprong Transferability Assessment

Prior to developing the Energy Leap project, the Greater London Authority (GLA), with support from the CNCA, commissioned the first independent report looking at the potential transferability of the Energiesprong model to the UK and assessing the barriers to the model's roll out.

The report[14] concluded that while the model would be transferable to London and the UK more generally, there were several barriers that would need to be overcome. These barriers can be prioritised according to their importance at different stages of roll out.

[11] approximately USD600,000
[12] Social housing in London is owned by London boroughs, the City of London and housing associations, but the Greater London Authority does not own any significant volume of housing
[13] https://www.london.gov.uk/press-releases/mayoral/sadiq-calls-for-drastic-government-action
[14] https://carbonneutralcities.org/wp-content/uploads/2018/05/1-London-Energiesprong-Transferability-Assessment.pdf

The barriers identified as being most important for trial projects to succeed focused on the following areas:

- ability to set an energy plan to be paid by tenants to recoup some or all of the investment
- ability to achieve net zero energy performance
- having an outcome-based specification
- being able to ensure that tenants accept the measures installed and can use them properly
- ability to monitor, measure and guarantee performance.

2.4 Original project deliverables

Following completion of the London Energiesprong Transferability Assessment, the Mayor approved the funding and delivery of up to ten demonstrator projects through his Energy Leap project. Mayoral approval for the project was given in February 2017[15].

Following engagement of registered providers of social housing (RPs) in London over several months to gauge interest in participation, a funding prospectus was issued setting out funding availability and conditions and inviting applications.

To help address the barriers identified as being most important for the pilot phase, a number of deliverables were set for each project:

- **near net zero energy consumption**, defined as where a minimum of 60 per cent of the dwelling's total energy consumption can be met through on-site generation, through a combination of energy efficiency measures and low and zero carbon technologies Note this is a minimum expected standard. While we believe that this will be exceeded for pilot projects, we did not want to set a target that might not be technically achievable for certain housing typologies. The longer-term aim is to achieve zero net energy consumption.
- **a performance guarantee**, whereby the energy performance of the dwelling is guaranteed by the contractor for a period of up to 30 years
- **proven speed of delivery,** with installation of pilots completed in 10 days or less
- **the ability to recoup some or all the capital cost of the refurbishment work** through an energy plan charge, paid by the tenant. The cost of the energy charge and remaining energy bills paid by the tenant should not exceed the tenant's existing energy bills.
- **high levels of tenant satisfaction** with both the completed refurbishment and the design and installation process
- **application of innovative technologies** to improve energy performance and achieve the other outcomes listed above. Examples of this might include battery storage and hybrid solar PV/thermal systems
- **an in-depth understanding of how each refurbished dwelling is performing** through a post-completion evaluation, to include in-use monitoring and verification of energy savings and tenant feedback

[15] https://www.london.gov.uk/decisions/md2080-energy-leap-project

- **an improved living environment** through better internal air quality, thermal comfort and other home improvements including new kitchens and bathrooms, subject to affordability
- **homes that are adaptable to future climate change,** through provision of water efficiency measures, protection from overheating and, where appropriate, protection from increased flood risk[16]
- **an open market valuation** to determine the level of value uplift
- **delivered within a fixed price envelope:** Following consultation with Energiesprong UK and the supply chain, the maximum cost for each demonstrator home was set at £80,000 (excluding VAT), with the GLA funding up to 50% of this cost. In the longer term, the aim is to reduce this cost significantly to enable the initiative to become viable without subsidy. The exact threshold where an Energiesprong refurbishment becomes viable depends on a number of variables including type of dwelling, existing condition, current maintenance costs, size of energy plan and cost of finance, but is thought to be in the region of £30,000 to £40,000 per dwelling.

The deliverables for the GLA to access CNCA funding were as per Table 1 below.

Table 1: Original CNCA grant deliverables

Deliverable	**Description**	**Status**
1. Outcome-based procurement specification	Performance specification for demonstrator projects, setting out standards to be achieved in terms of: • Internal temperature and comfort • Energy allowance(s) • Installation time and commissioning • Warranty, maintenance and monitoring	**Completed** August 2017
2a. Building specification report	Details of demonstrator homes	**Completed** August 2017 (though has subsequently required revision)
2b. Home energy performance contract	Draft contract setting out how demonstrators will be delivered and how performance will be guaranteed over 30 years	**Completed** October 2017
3a. Ten net-zero energy retrofits	Completion of demonstrator projects	Completion date TBC

[16] Flood maps for London can be found here: http://maps.environment-agency.gov.uk/wiyby/wiybyController?x=357683.0&y=355134.0&scale=1&layerGroups=default&ep=map&textonly=off&lang=_e&topic=floodmap

3b. Monitoring report	Report setting out details of demonstrator home performance over first three months of operation	Completion date TBC
3c. Evaluation report	Evaluation report setting out: • Details of projects • Successes and failures • Lessons learned To be shared with wider CNCA network	Completion date TBC
4a. Final Grant Products	Final grant report	Completion date TBC

At the outset of the project, several key risks were identified as having the potential to have an impact on project timescales and deliverables. These are set out in Table 2 below.

Table 2: Risks identified at beginning of Energy Leap project

Risk description	**Mitigation plan**
Planning authorities are unwilling to grant permission for proposed solutions, or permission is delayed	1. Early engagement with planning authorities required. 2. Property shortlisting to date has aimed to avoid potentially sensitive areas and focus where possible on places where there is potential for wider roll out.
Costs for implementation are significantly higher than expected	3. Seek to engage with supply chain though pre-programme round table to ensure cost estimates are in right area. 4. Identify any key price sensitivities e.g. how inflation will affect the cost of components or services. 5. Ensure procurement specification includes a clear and robust process for site surveys and costing. 6. Adopt learning from Energiesprong UK work and trials in Nottingham.
Supply chain appetite for undertaking projects is low	7. Engage market on timescales, appetite and procurement process to understand.
Procurement delays push back completion	8. Identify procurement strategy and secure agreement as early from RPs as early as possible.
Tenant consultation unsuccessful, meaning new pilot properties need to be found	9. Encourage prompt tenant engagement to ensure delays are minimised.

Poor technical implementation. Project benefits are not realised	10. Output-based specification puts onus on contractor to deliver a high standard of installation. 11. Procurement process will identify strength and weaknesses of approach. 12. Monitoring programme, contract arrangements and post occupancy evaluation will ensure quality.

3. Progress to date and lessons learned

3.1 Overview

Since completing the selection of RP partners at the end of May 2017, the project has experienced a number of delays, meaning the project is behind schedule (approx. 16 months). At the time of writing, one of the GLA's partner RPs is close to finalising procurement of a solutions provider, while the second will commence procurement in the coming weeks.

These delays have been caused primarily by issues with finalising stock selection and successfully signing up tenants, but other issues in relation to procurement, surveys and resourcing have also played a role. At the same time, many lessons have been learned, which will help to speed up processes for future projects, and engagement with Energiesprong UK and the supply chain to date has helped develop a much clearer understanding of what will be needed to implement a project successfully, within the UK.

Table 3 below sets out the original project timetable, and the current expected completion date:

Table 3: Original and current project timetable

Milestone	**Target completion date**	**Expected completion date**
Appoint RP delivery partners	End May 2017	End May 2017
Complete tenant consultation and finalise property list	End June 2017	June 2018
Solutions providers appointed to deliver demonstrators	End September 2017	November 2018
Designs finalised and installation commences	December 2017	March 2019
Demonstrators complete	January 2018	May 2019
Project evaluation complete	End April 2018	August 2019

This section of the report sets out progress to date, why and where delays have been encountered, and the lessons that have been learned.

3.2 Partner selection

Energiesprong has attracted a great deal of attention from housing providers in the UK given its potential to transform the way housing stock is refurbished and maintained, and because the financial model is potentially cost neutral. Initial engagement with London housing providers ahead of the Energy Leap project saw approximately 15 organisations express an interest in this project, out of which four put in a bid for match funding.

To bid for funding, organisations were required to submit details of their project plan, homes selected and proposed match funding, as well as providing senior-level commitment to undertaking the project.

The quality of applications from the four organisations that applied for match funding was sufficiently high to justify awarding grant funding to all four organisations. However, two of these organisations were forced to drop out of the project, one at the start of the project, and one after several months, primarily due to unforeseen changes in resourcing. This means that the GLA is now working with two organisations, Moat and Sutton Housing Partnership, who will deliver two and six pilot properties respectively.

In addition, the GLA has committed to supporting demonstrator projects in the London Borough of Croydon, to be delivered by Croydon Council and Optivo Housing, subject to the success of a separate bid for European funding.

The main reason for organisations not bidding was a lack of resources, both in terms of finding capital funding within existing budgets, but also officer time. This was not entirely unexpected given that RPs in London have experienced significant resource and budget pressures in recent years, which has seen a reduction in the amount of retrofit activity across the social housing sector. This caused by, among other things, a one per cent rent reduction in rent revenue for RPs, leading to redrawing of investment plans; and lower levels of government-backed funding for retrofit and low carbon energy generation through the Feed-in Tariff and Energy Company Obligation; cuts to local authority budgets, meaning that many organisations have lost expertise in energy efficiency.

Since then, the consequences of the Grenfell Tower fire in June 2017 has meant that organisations have needed to focus staff time and investment plans on fire safety, which has meant significant changes to many existing investment programmes, with delivery of planned investment programmes being pushed back.

A further reason for organisations not bidding, albeit linked to the above, was that some organisations were uncertain in relation to their plans for long-term investment in their housing stock, and would have needed more time to familiarise colleagues with the concept and gain the necessary internal support.

The process of selecting partners for the Energy Leap project has highlighted some useful lessons:

- to get organisations to a stage where they were prepared to bid, several months lead in time was required to familiarise organisations with the Energiesprong model and start the process of selecting properties and allocating resources. Without this lead in, it is difficult to secure the level of commitment required to undertake pilot projects
- while funding for project management resources in RPs remains limited, particularly for retrofit projects, undertaking pilot projects of this kind will remain challenging, even with capital match funding in place. While many organisations are engaging with the Energiesprong model across London and the wider UK, much of the progress made is contingent on a relatively small number of skilled individuals, and stronger provision is needed across the sector if Energiesprong is to reach its full potential.

3.3 Property selection

Properties for the Energy Leap project have been chosen based primarily on their physical characteristics, though financial viability, accessibility and pre-existing investment requirements have also been considered. The GLA has worked with RPs to select suitable properties, which is typically done through a three-stage approach:

1. The RP's entire stock list was filtered to identify a long list of potentially suitable homes. Properties that met the following criteria were sought:
    a. **located in Greater London**
    b. **built between 1920 and 1980:** This date range was chosen on the basis that Energiesprong is currently less likely to be suitable for traditional buildings (which can be defined as buildings constructed in 1919 or earlier), given greater technical complexity, and because more recently built homes are less likely to have sufficient investment requirements.
    c. **in groups of two or more:** Single homes were not considered they would have greater site and design costs and would not be attractive to the supply chain. The ideal would be to have a row or cluster of homes which are relatively uniform and where there are no significant obstacles to providing a new building envelope
    d. **Energy Performance Certificate (EPC) band D or below**[17]**:** Homes with high current energy performance were not considered suitable as the scope for reducing energy bills would not be as high, which would reduce the viability of the project
    e. **low rise**: no more than three storeys, to reduce technical demands of pilots and likely cranage costs
    f. not bungalows: Bungalows were not considered to be the most suitable demonstrators, partly because that their high envelope to floor area ratio would increase costs, but also because of the relatively small number of bungalows in London, meaning more limited scope to scale up solutions for this type of home.
    g. Right-to-buy: Some housing associations sought to avoid choosing properties for trials which have a Right to Buy[18] option, given current uncertainty over how the value of an investment to upgrade a property can be partly or wholly recouped when that property is sold
2. These long-listed properties were then reviewed using Google Street View and aerial maps to identify any potential issues and compile a shortlist of suitable properties. Examples of issues that might make a property unsuitable included: complex built form; very narrow, or restricted access; sharp changes in gradient across a site. It should be noted that the technical issues identified do not mean that a property is unsuitable, though these may have some cost implications. It has been invaluable to have the opportunity to speak to solutions providers about stock selection and understand the implications of these issues prior to finalising selection.
3. Shortlisted properties were prioritised according to their current condition and investment needs. For example, a property requiring a new roof, windows and heating system over the next two years would typically be prioritised over one where this work had recently been carried out. Any tenancy suitability issues were also identified at this stage (see table 4).

[17] The Energy Performance Certificate provides an indication of the home's energy performance, with A being the highest performing homes and G being the least efficient. The most common EPC band in the UK is D, though due to investment through Decent Homes and other programmes, which have seen significant programmes to upgrade windows, loft and cavity insulation,, much of the UK's social housing stock has above average performance.
[18] This scheme helps eligible local authority and housing association tenants to buy their home with a discount of up to £108,000 in London (£80,900 elsewhere)

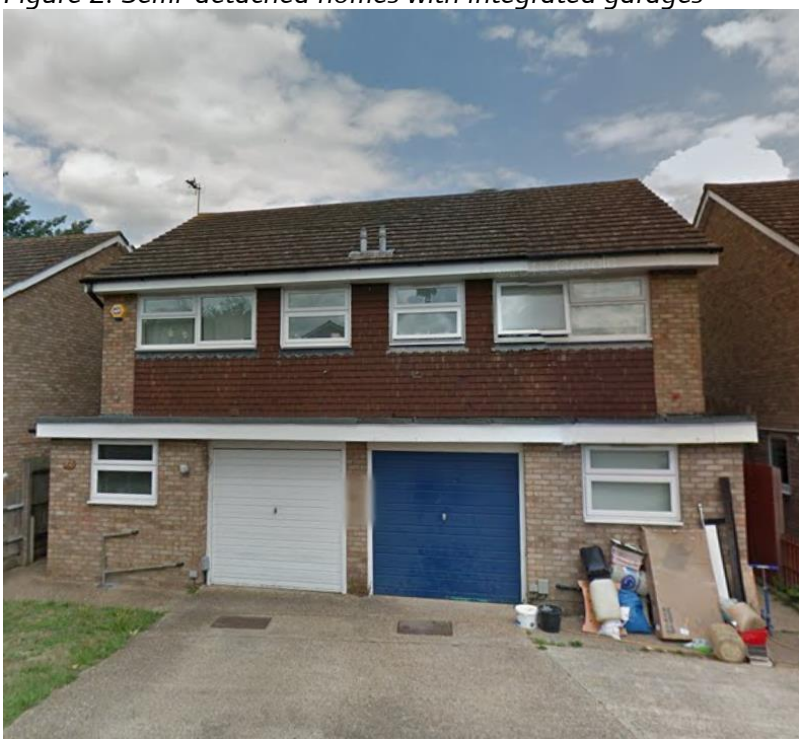
Housing stock analysis was undertaken with several RPs, which helped to identify common issues, set out in Table 4 below. Many of these issues are not unique to London, but given the way London has been developed, the diversity of its housing stock, and the density of housing, it is believed that these make property selection particularly challenging.

Table 4: Issues identified during property selection

Issue	**Description**
Ownership	Due to right to buy legislation in England[19], there are many freehold properties on streets which were once predominantly RP-owned, and leasehold properties in blocks, which breaks up continuity of ownership and makes it difficult to identify contiguous rows or clusters of suitable properties. For example, in a suitable terrace of six properties which would have once been owned by the same housing provider, it would not be uncommon for two to three of these to be owned privately. In the longer term, for Energiesprong to reach its full potential, finance offers will need to be developed which cater to the requirements of owner-occupiers and private tenants.
Tenant suitability	Several properties were ruled out based on pre-existing issues with sitting tenants that would make it harder to deliver an Energiesprong retrofit, for example health-related issues, previous behavioural issues (for example refusal to allow access for maintenance or anti-social behaviour) and long-term rent arrears.
Accessibility	In many cases properties were potentially suitable, but suffered from accessibility issues, meaning it would be very challenging to deliver and install components on site. Some common accessibility issues included: • site is on a red route[20] or very busy road, with limited or no scope for delivery and site set up • site access is very narrow or on a footpath, which would impede the use of a crane or access by lorries • site is located behind a row of other buildings, e.g. garages, meaning access for a crane is more difficult, and costs are likely to be higher for a demonstrator project.
Garages	A number of homes with integrated garages were identified, where the garage was outside the existing thermal envelope of the building. While this issue is not insurmountable, it was considered that it would add complexity and cost to demonstrator projects. Similar typologies to the one shown in Figure 2 are relatively common, particularly in Outer London. If Energiesprong is rolled out to its full potential, design challenges posed by properties such as these will need to be addressed.

[19] The Right to Buy scheme helps eligible council and housing association tenants in England to buy their home with a discount of up to £108,000 (£80,900 outside London)

[20] Red lines are used on some of the main and important roads in London instead of yellow lines. The double and single red lines used on Red Routes indicate that stopping to park, load/unload or to board and alight from a vehicle is prohibited.

Issue	Description
	Taking the example below, there might be two ways of dealing with an integrated garage. The first would involve excluding the garage from the thermal envelope, which would involve insulating the ceiling and internal garage walls. This approach would involve greater complexity in design and installation, and would likely result in a reduction in the garage's volume. The second approach would involve including the garage within the thermal envelope, which would likely result in a change in function – i.e. it would stop being a garage – and would involve enveloping the garage door alongside the rest of the dwelling. There is evidence to suggest that many garages are primarily used today as storage rather than parking (partly due to the increased size of cars), which means that this change in use would theoretically be acceptable to tenants, though this is yet to be tested through extensive engagement. *Figure 2: Semi-detached homes with integrated garages* 
Semi-detached homes	Of the homes that met the criteria for the project, a high proportion are semi-detached. The UK overall, though not London, has a very high proportion of semi-detached housing compared with Europe as a whole[21] This is not an obstacle in itself, but does pose several challenges:

[21] While directly comparable figures are not available, evidence shows that around 25% of the population across Europe as a whole lives in semi-detached or terraced houses (http://ec.europa.eu/eurostat/statistics-

Issue	Description
	• a semi-detached house, as opposed to a mid-terrace property with the same floor plan, has a greater external envelope that requires more insulation, and therefore higher cost • many the semi-detached homes identified as potentially suitable through initial filtering were found to have other features which would add complexity to design, including e.g. hipped roofs, rear extensions and bay windows • in many cases, semi-detached homes are very close to neighbouring properties, which may impact on performance. To keep sufficient distance between two properties to maintain access to the side of the properties, insulated panels cannot exceed a certain depth. The properties featured in Figure 2, where the front door is at the side of the property, are a particularly good example of this. This situation effectively means a choice between reduced performance and using a material with exceptionally low thermal conductivity, which would be prohibitively costly, unless a more innovative solution can be developed.
Gradient and topography	Many sites identified as potentially suitable through initial filtering were found to be more challenging on closer inspection due to site topography. Figure 3 below is a good example of this. While these houses appear to be ideal candidate for Energiesprong at a first glance (particularly as there would be scope for the external boiler housing to be replaced by a new services pod), the step-up in level from house to house, as well as the lack of a continuous façade, poses a challenge in terms of detailing and performance.

explained/index.php/Urban_Europe_%E2%80%94_statistics_on_cities,_towns_and_suburbs_%E2%80%94_housing_in_cities#Types_of_housing), while in England, 30% of homes are semi-detached alone (15% in London).

Issue	Description
	Figure 3: Terraced homes on a steep gradient – note the lack of a continuous façade and roof line  While this is something that could potentially be dealt with, this detailing would be of a bespoke nature and would add cost, with relatively little wider benefit due to the unique combination of typology and site characteristics. There was a strong preference from RP partners and the supply chain to select properties for the demonstrators that were as straightforward as possible.
Overhead power supply	Many homes have an overhead power supply or telecommunications connection, which would require re-routing at a cost, or leaving a gap in the thermal envelope, thereby reducing performance.
Flats	London has a very high proportion of flats compared with other UK cities (approximately 70 per cent). It is very common to have multiple ownership types (social rent, private rent, leasehold) in a single block, which poses a significant challenge in securing agreement of occupants and financing a project. Developing solutions for flats is essential to realising the potential for Energiesprong in London, however given the budget for the demonstrator projects, it has proved difficult to identify suitable blocks that were small enough to be funded, and did not have multiple tenures. Any future phase of the Energy Leap project may also want to consider its potential in flats.
Bay and dormer windows	Many homes were found to have bay and dormer windows, which would increase the amount of bespoke detailing required for projects, and therefore cost. One way off addressing these issues might be to remove these feature, but while this might make it more straightforward to achieve the required energy

Issue	Description
	performance, it could cause issues in terms of tenant acceptance and securing planning permission. Energiesprong UK estimates the additional cost of dealing with a dormer window to be £500-1000 (approximately one per cent of the total cost of a demonstrator property)
Hipped roofs	Hipped roofs, such as those in Figure 4, are common to many homes in the UK, but present a challenge both in terms of detailing, but also being able to accommodate the required area of solar PV panels to meet the performance specification. Subject to planning, it may be possible to change the roof structure to a gable roof, though this will increase delivery costs. *Figure 4: Semi-detached homes with hipped roof* 
Extensions	Some homes were found to have extensions or adjoining outbuildings which have been built at different times and therefore lack uniformity, which limits the scope to replicate designs from property to property. It may be possible to overcome these challenges to an extent by replacing existing extensions with new modular ones.
Data confidence	While it was not an issue for RPs working with the GLA, many RPs are experiencing issues with accuracy of the housing stock data they hold, which can impede planning programmes such as the Energy Leap project, which require good data to be able to quickly filter and shortlist suitable properties. A lack of up to date survey information can also increase uncertainty for solutions providers.
Investment requirements	In some cases, homes were considered unsuitable for the Energy Leap demonstrators because their condition was such that no further major investment was required for many years, and existing components such as roofs, windows and heating systems

Issue	Description
	did not require replacing imminently. When seeking to identify suitable properties, it is important to consider forward maintenance plans and consult planned maintenance teams. This extends to plans for disposal or demolition of properties, though in some cases an Energiesprong refurbishment may help to extend the life of a home that was previously earmarked for demolition.
Funding	While it did not affect selection of properties for demonstrator projects, it became clear that certain properties which have previously been part of a stock transfer may be subject to pre-existing conditions relating to grant funding, meaning certain types of grant funding could not be used to fund repairs or upgrades.
Tenancy issues	In some cases, further assessment of shortlisted properties has identified existing issues with tenants, for example anti-social behaviour, or severe rent arrears, which highlight potential difficulties in carrying out demonstrator projects. While these issues might be linked to an individual property, is can mean that a whole cluster of homes is ruled out, as it would not be practical to refurbish only some of the properties in the cluster.

In addition to these issues, evaluation carried out by the Energiesprong UK Market Development Team (MDT) identified several additional considerations that are relevant to property selection, through financial modelling and stakeholder engagement. These include:

- investment decisions may be based on the potential for the refurbishment to deal with other existing issues, including anti-social behaviour for example, or the need for neighbourhood regeneration
- the ratio of external envelope (i.e. roofs and walls) to floor area is an important determinant of financial viability. Above an external envelope/floor area ratio of 0.8:1, the investment envelope is significantly reduced, as the cost per square meter of floor space increases
- the presence of undercrofts under homes poses similar problems to those with integrated garages, in that improving thermal performance needs to be considered against the costs and technical complexity of the different approaches to this issue
- over 500 key property archetypes have been identified in the UK, which is a barrier to developing uniform solutions
- rerouting or accommodating existing services into design, for example external soil pipes, overhead power supply and telecommunications services, adds cost and poses a technical challenge. The costs of re-routing a soil vent pipe for example can be £500-£1000 (approximately one per cent of the total costs of a demonstrator property)

3.4 Tenant engagement

Tenant engagement is critical to gaining buy-in to projects; it helps improve understanding of tenants' existing issues with homes, explain what Energiesprong is and how the process might be able to address these issues, and also provides tenants with a chance to contribute to the design process.

For the Energy Leap demonstrators, the success of tenant engagement has been mixed. In some cases, engagement has brought to light existing behavioural[22] or health issues, which has ruled out households from participating in demonstrator projects, while in other cases it has taken a long time for tenants for become comfortable with the Energiesprong concept.

Given the aim of refurbishing buildings as a single group, having one tenant unable or unwilling to participate in a project can lead to increased costs and performance issues – for example additional detailing requirements around junctions between a property that is refurbished and one that isn't – or end with a group of properties being ruled out.

This issue has added delay of approximately 16 months to this project and uncertainty to the overall process for some RPs, as the process of stock selection and tenant engagement has needed to be repeated a number of times. In the future, it may be possible to avoid this by carrying out initial wider engagement for all shortlisted properties to understand any issues tenants might have at an early stage, though this requires committing greater resources to the earlier stage of the project, which might be difficult for some RPs where resourcing is an issue. However, it is highly likely that this issue will recur, which may necessitate the development of design approaches that can accommodate the potential performance issues this causes, or mean that performance standards have to be compromised.

In other cases, early tenant engagement has ensured that tenants have developed a good understanding of the aims of the refurbishment and the potential changes to the property, enabling them to buy into the project's aims.

Successful engagement to date has typically involved two key steps:

- the first step is to meet the tenant(s) and understand their expectations and needs regarding their home. This can be done without referencing Energiesprong specifically, as the main purpose is to gain the tenants' trust and discover what they do and don't like about their home, and whether there are any outstanding issues which might need resolving before continuing with the project. Some of these issues might relate to energy efficiency – for example cold walls and windows, issues with damp, high bills – while others might relate to the aesthetic feel or usability of the home, for example wanting to have a bathroom upstairs, or liking a particular feature of the home that they would not want to lose. Examples from Nottingham's demonstrator projects include providing new doorbells, or installing an outside tap. These may seem like small things, but can make a big difference to tenants, and are important to include in the design brief to ensure that the proposals solutions providers put forward will be acceptable. Given Energiesprong is a long-term whole-house approach, it is also a great opportunity to identify any necessary reconfiguration of layout – for example converting a garage into storage or moving a bathroom - and consider how this could be accommodated into the project
- the second stage is to introduce the Energiesprong concept to tenants and explain how it works step by step. This may require several meetings and it is important to give tenants the chance to provide feedback and ask questions. To gain acceptance of the proposal, it is important to explain what disruption might occur during the works, but also the likely improvement to living conditions following their completion
- Providing hard copies showing details of any proposals or presentations can be very useful to tenants to allow them time to consider the changes and how they will affect their home

[22] This may include anti-social or aggressive behaviour towards housing officers or contractors

As the Energy Leap demonstrators progress, it will be important to maintain engagement during construction, handover and the early stages of operation.

In gaining wider acceptance of the project among tenants in a community, it is invaluable to identify a tenant champion who can provide support to their peers, increase confidence in the scheme and provide feedback to the housing provider. This has been the experience in Nottingham City Homes' Energiesprong project, and is mirrored through experiences with Energy Leap to date. Nottingham have developed and shared a tenant engagement manual, which contains many useful insights and experiences. A section of this manual is reproduced at Appendix 1.

3.5 Specification

The performance specification is a central element of the Energiesprong model as it sets out the design parameters which solutions providers must adhere to and the basis for the ongoing performance monitoring and guarantee.

Unlike a typical energy efficiency specification, which might include a lot of detail about product standards, U-values, product choice and installation procedures, the Energiesprong specification focuses on key outputs, and it is the solutions provider's role to develop a whole-house approach which they can achieve and guarantee.

This provides clarity and sets a high standard for retrofit which challenges industry to be innovative. However, it is also important to ensure that bidders are clear on what can practically be achieved and what this means for costs and maintenance. Proposed solutions for refurbishment and maintenance should be modelled to gain a clear understanding of the impacts.

Energiesprong UK has developed a performance specification for demonstrator project, which can be found at Appendix 2, and covers the following areas:

- energy
- water
- comfort and health
- installation
- warranty
- design
- fire risks
- sustainable construction
- security
- drainage and flood risks.

The sections on water consumption, drainage and sustainable consumption were added by the GLA, as these are seen to be relatively minor additions that should be straightforward to achieve, but are important in terms of ensuring homes continue to be able to adapt to the risks of a changing climate, and helping reduce the environmental impacts of construction.

While the specification that had been developed sets clear performance standards, it is also important at this stage to allow some flexibility in the assessment of the performance specification.

Some elements of the specification may need to change depending on the existing stock investment requirements and the preferences of the RP. For example, it may be possible to achieve higher standards for water efficiency and hot water consumption where kitchens and bathrooms are being replaced, than it would be where they are to be retained.

One element of the specification that requires further development in the future relates to the choice of materials and embodied carbon for Energiesprong projects, given that as a greater proportion of a home's energy is generated from zero carbon sources, emissions from construction materials become a much more important element of a building's whole life carbon footprint[23]. The balance between energy generation, comfort, material use, energy use reduction and cost is complex and requires greater understanding. In the longer term, this may necessitate rethinking construction techniques and restructuring the supply chain to achieve greater reductions in the environmental impacts of construction.

The demonstrator projects both from Energy Leap and the wider UK will provide useful feedback about how the specification can be achieved, and where the key price and performance sensitivities are for different housing typologies.

3.6 Contract arrangements

Contracting is key to translating the Energiesprong performance specification into a legal document. This included not only the initial retrofit but also how underperformance is contractually managed, the rectification of any initial issues, and then ongoing maintenance or performance issues. The starting point for the demonstrator projects is to use established standard construction contracts with suitable amendments.

These types of contracts are recognised by industry and RPs and therefore provide a familiar starting point to which the Energiesprong performance specification can be added.

The Energiesprong UK team has complied a full list of contract documents and schedules to be used for demonstrator projects, which can be found at Appendix 3. However, it is worth summarising some of the key documents:

- **heads of terms:** this acts as a precursor to signing contract documentation and sets out how the relationship between the RP and the solutions provider will work and their respective responsibilities
- **standard contract with amendments:** this will typically be a standard JCT (Joint Contracts Tribunal) or NEC (New Engineering Contract), which are standard contract types used across the industry, with a schedule of amendments to make the contract better suited to carrying out Energiesprong refurbishments.
- **Energiesprong performance specification:** see section 3.5 above.
- **monitoring and reporting protocol:** this sets out the minimum requirements for ongoing monitoring and reporting of how the refurbished properties are performing against the specification.
- **operations and maintenance plan:** this sets out how the refurbished properties should be maintained following their refurbishment and is critical to ensuring that the performance standards continue to be met across the full contract term. Deviation from the maintenance plan may mean that performance can no longer be guaranteed, or may invalidate the warranty of individual components. In terms of who carries out this maintenance, there are two main options; (1) the solutions provider takes responsibility for maintenance, in which case a separate maintenance

[23] https://www.mdpi.com/2075-5309/5/1/1/pdf

contract may be required; or (2) the RP's existing maintenance provider undertakes maintenance, with appropriate training and oversight from the solutions provider[24].

While contract arrangements will vary from country to country, the Energiesprong UK team has identified some key considerations in relation to contract drafting and implementation:

- while the contract is between the RP and the solutions provider, it's also important to ensure that tenants are aware of what energy allowances are and what behaviours could lead to higher than expected energy consumption. This feedback to tenants will remain important throughout the contract period. While it may not be possible to include this in contracts, RPs should consider what additional processes may be required where there is, for example, a change of tenancy
- "soft" solutions, such as testing installations at the completion of the retrofit may help identify and deal with any problems quickly, avoiding future conflict, and can help ensure better partnership working in the long term. However, it is also important to have clear penalties for where underperformance might occur
- a clear performance measurement framework is essential to identify underperformance and manage any potential conflict
- while standard contracts are a useful starting point, they may need a large number of amendments to make them suitable for an Energiesprong refurbishment
- clear boundaries are required to define the solutions provider's maintenance responsibilities and those of the RP's existing maintenance provider; this may require amendments to existing contracts and processes.

3.7 Procurement

Given that the Mayor's Energy Leap demonstrators are among the first in the UK and that Energiesprong overall is an initiative involving a high level of innovation around its specification and contract structure, there is not yet a single established procurement approach.

Public bodies in the EU such as RPs are subject to public procurement legislation, which requires that a suitable and fair process is followed to appoint a contractor, but this may also hinder a more open and flexible form of engagement with solutions providers.

In choosing a suitable procurement process, RPs need to consider several issues including:

- **scope** – including a greater number of properties in a tender will make it more attractive to the market and will reduce the need to carry out further procurement exercises. Where there is uncertainty about future phases or funding, it may be appropriate to take a phased approach, with maximum cost per property and minimum performance standards set for future phases. For example, in Nottingham City Homes' project, a decision was taken to procure a contract for approximately 200 homes, with ten completed during a demonstrator phase, and the remainder to be completed for a fixed price at a later date. This will allow Nottingham to assess the performance of the demonstrators, while having an option to proceed with other phases without requiring an additional procurement exercise

[24] A third option was considered, where the solutions provider would be responsible for maintaining any components that were part of the Energiesprong refurbishment, and the existing solutions provider would retain responsibility for standard responsive and cyclical repairs. However, this was not considered viable due to the high risk of uncertainty or miscommunication in relation to repairs responsibilities, leading to performance standards being missed

- **procurement value thresholds** – above a certain contract value, it is necessary to follow one of a more restricted list of processes[25]. For the two procurements to be completed through the Energy Leap demonstrator project, both contract values are below EU procurement thresholds
- **balancing of effort vs reward for the contractor** – where the process bidding is too onerous compared with the benefits of winning a contract, this may put off solutions providers from submitting a tender response
- **replicability** – given the amount of work that needs to go into preparation of contract documents and running a procurement process for even a small demonstrator project, it is desirable that processes and documentation are replicable to make things more straightforward both for RPs and bidders. One way in which processes could be made more replicable would be to set up a procurement framework, which would allow organisations to call off from a panel of contractors using a set suite of tender and contract documents. However, given that the demonstrator projects are likely to yield a great deal of learning for the purposes of the demonstrator projects, it would not be worth the additional effort to set up a framework at this time given that contract requirements and delivery approaches might change
- **joint procurement** – partnering with other RPs to aggregate several smaller projects may have its advantages in creating a more attractive proposition to the market and sharing documentation and workload. However, this also requires a great deal of coordination between different organisations in terms of aspirations and timescales. For the Energy Leap project, while discussions were held about the possibility of a joint procurement process, in the end organisations' different timescales meant that this was not practical. It was felt that for a larger project there would be clear benefits from joining together to create greater scale, where the potential difficulties in coordinating between several organisations would be outweighed by economies of scale
- **flexibility** – given uncertainties about what the market may be able to deliver for demonstrator phases, it is important to choose a process that allows for dialogue or iteration to allow mutually acceptable proposals to develop

To date, Energiesprong projects in the UK including Energy Leap have followed slightly different approaches, though have allowed to a degree of dialogue or negotiation, which has allowed the RPs involved to provide feedback to bidders and help shape proposals. The two approaches that have been tested, by Moat and Nottingham City Homes, are "competitive procedure with negotiation", and "competitive dialogue" respectively[26].

Nonetheless, there has been a degree of similarity in terms of the procurement documentation used, for example specifications and evaluation approaches, which can help make bidding more straightforward.

In the future, it would be desirable to see this process of standardisation continued, to help speed up procurement processes and make bidding easier, but the experience across the UK to date has provided some valuable lessons:

- providing as much information as possible about properties in the tender documentation provides greater certainty to bidders, which can help reduce cost uncertainty

[25] https://www.ojec.com/thresholds.aspx
[26] https://www.designingbuildings.co.uk/wiki/OJEU_procurement_procedures

- involving tenants in procurement is useful to understand which elements of proposals are particularly popular or potentially problematic
- there may be some value in carrying out a planning pre-application involving bidders and the local planning authority during the procurement process to understand what might be required and avoid developing solutions that might not be acceptable
- housing associations are typically required to pay Value Added Tax (VAT) on certain types of work, while local authorities are not; it is the solution provider's responsibility to set out what tax must be paid, but this can mean that the actual cost of deliver may be higher than expected – in the UK a reduced rate of VAT may be payable on energy efficiency works, but where this are part of a larger refurbishment, the full rate of 20 per cent is applicable[27]
- it is important to set out clearly who is responsible for carrying out any additional surveys and who must pay for these; for example, a contractor might require a specific survey to be able to price more accurately, but might be unwilling to carry this out without a contract. One way to avoid this might be for the RP to cover the up-front cost of additional surveys, but require the winning bidder to take this cost off the final price. A second option, and one that is used in energy performance contracting for commercial buildings, would be to select a preferred bidder based on an outline proposal, and then for that bidder to work up an investment grade proposal at their own cost to be agreed with the RP. In this situation, the RP would be liable to pay for the additional survey costs if they decided not to proceed with the investment grade proposal.
- Pre-selecting properties for a tender may make things more certain in terms of tenant engagement, but the properties selected might not be those that industry would have selected, given a choice. To avoid any surprises, it is worth carrying out soft market testing to ensure that property choices are sensible
- Where contract documents do not have to be ready at the beginning of a procurement procedure (for example competitive dialogue), finalising documents after a procurement has been completed can add significant time to a project

3.8 Surveys

The availability of accurate data from surveys can help with stock selection and can help solutions providers understand how a property is performing and what design approaches might be most suitable. This is essential not only to help ensure the performance requirements are met but also in costing different approaches and removing price uncertainty and risks.

Surveys can be carried out at various stages of the stock selection and procurement process, but it is recommended that the following reports are made available alongside tender documentation:

- energy performance certificate (including site notes and measurements where available)
- electrical condition report (EICR in the UK)
- asbestos survey (refurbishment and demolition survey in the UK)
- structural survey
- ground penetrating radar survey – to help identify any buried services.

[27] https://www.gov.uk/vat-builders/energy-mobility

During the procurement, it is recommended that a site visit is carried out with bidders, and experience from Energy Leap demonstrators and wider UK Energiesprong projects to date suggests that solutions providers may also find the following useful:

2. digging trial pits to inspect foundations
3. ground condition report
4. invasive structural survey to understand interfaces between different building elements, e.g. roofs and walls

Some of these surveys may be more difficult to carry out with tenants in situ, which may require additional tenant engagement, or careful scheduling.

Where survey data is not made available, it may lead to delays in solutions providers being able to finalise costs and proposals, which can extend project timetables, or pricing in additional risk due to unknown factors.

During a procurement process, it is important to set out where responsibility for carrying out and paying for surveys lies, as otherwise this can cause uncertainty and delays.

3.9 Planning

Early engagement with planning authorities is recommended to understand what the policy requirements are in each area and to help planners understand what an Energiesprong refurbishment entails and why it is being carried out. This can normally be done through a planning pre-application, which is an opportunity to explain the project and get feedback on some possible design approaches to help inform the design process, rather than to present a finished design.

Most Energiesprong projects will fall outside what are known as "permitted development" criteria[28], where a planning application is not required. A full planning application will normally take 8-13 weeks to be determined, not including the time taken for pre-application and preparing the application itself.

The most important planning policy document in England is the National Planning Policy Framework (NPPF) and the central principle in this document is a "presumption in favour of sustainable development". However, interpretation of this principle varies from area to area depending on local planning policy and the way in which individual officers apply this.

At times, this can lead to a conservative approach, where planners are keen to ensure that the refurbished building resembles the existing building as closely as possible. Adhering closely to a building's existing appearance can add complexity and cost to designs without any real benefits in energy performance or usability, for example where brick slips are proposed to resemble the existing walk finish, or complex window types are retained.

To help mitigate this, and find compromise, it is important to talk to planners at an early stage in the design process, but also to provide a clear policy and design justification for the project when submitting an application.

[28] https://interactive.planningportal.co.uk/

3.10 Evaluation

The GLA is partnering with Imperial College London to undertake the evaluation of the Energy Leap demonstrators. This evaluation will consist of a full quantitative and qualitative review of the project and performance of the demonstrators with a view to informing the wider roll out of the Energiesprong initiative in London.

Initial stakeholder interviews have been completed, and the final evaluation will be ready three to our months after the refurbishment of the demonstrator properties is complete. An outline structure of the evaluation can be found in Appendix 4.

4. Conclusions and next steps

4.1 Progress against deliverables

The majority of the GLA's Energy Leap project deliverables set out in section 2.4 relate to the performance of the completed dwellings. Given none of the demonstrators have been completed, it is not possible to say whether these deliverables will be met. However, several important steps have been taken that will give the project a good chance of succeeding. These are:

- the development of an output-based performance specification sets out clear performance standards to help shape design proposals
- the contract documents and monitoring protocol drafted to date provide the basis for a performance guarantee
- legal advice to date has provided guidance on how an energy plan could be charged to tenants though a service charge
- where tenant engagement has taken place successfully, it has helped develop an understanding of requirements and should ensure high levels of satisfaction further down the line
- the approach and working arrangements for the evaluation have been put in place and pre-refurbishment stakeholder interviews have taken place.

Taken together these steps have either overcome the demonstrator phase barriers set out in the London Energiesprong Transferability Assessment, or shown how these barriers can be overcome.

In addition, experience from Nottingham City Homes' Energiesprong demonstrators has shown how the supply chain can meet the performance requirements of Energiesprong and innovate to achieve these standards. At the same time, early indications are that the supply chain is currently some way short of being able to meet the ten-day target period for installations to be completed, and if this turns out to be the case for the Energy Leap demonstrators, then further analysis will be required to understand where delays occur and what can be done to reduce these in the future.

4.2 Conclusions

Experience from the Energy Leap project to date has provided some headline learnings, which could be applied to other projects of this type:

- while the Energiesprong concept is fundamentally simple, the level of detail required to ensure successful implementation of the project is not, and the time and resource requirements to develop and understand this detail at a project level should not be underestimated. The same applies to the time required to engage people in the process, familiarise them with it and gain their support.
- It is worth committing time to planning for the required stakeholder engagement and processes at the early stages of the project, even if this entails extending delivery deadlines overall
- given the project is seeking to address several existing barriers to delivery, it is important not to add unnecessary complexity, for example through property selection or choice of procurement route
- when attempting to develop a new product or initiative, peer learning and cross-sector collaboration is essential – one of the great positives of the project has been the willingness of RPs and Energiesprong UK to share both documentation and experiences and for the supply chain to provide clear and honest feedback

- in an area like domestic energy efficiency, where there is still a lot of work to do to make projects investible, seed funding is critical to helping to help develop and demonstrate new propositions in the absence of an existing market, and ensuring there are sufficient resources for project evaluation. Without the willingness of the CNCA and the Mayor of London to back projects such as these, it would be very challenging to make any progress in this area.
- for future phases of the project it will be important to consider whether the concept can successfully be applied to blocks of flats with multiple tenure types, given that these buildings account for a high proportion of the potentially suitable homes in London.

The GLA will continue to support its partner organisations through their demonstrator projects and the evaluation process, to work with Energiesprong UK and the CNCA to share learning and address barriers to the wider roll out of Energiesprong.

Early analysis indicates that as many as 160,000 homes (approximately 5 per cent) in London could be suitable for refurbishment under the Energiesprong model and the initiative could therefore play a role in improving housing standards and making London a zero-carbon city by 2050.

While this is still a large number of homes, and could be larger still, it is important to highlight that the Energiesprong model is likely to be one of several approaches to retrofit that will be required to achieve the improvements needed to ensure the 2050 target is met.

Nevertheless, the Energy Leap demonstrators continue to represent an important first step to show what is achievable and point the way to delivering refurbishments at greater scale, quicker and at a lower cost.

Appendix 1: Extract from Nottingham City Homes tenant engagement manual

It is really important that the tenants are bought into the project fully from the start. The following text is copied from a tenant engagement manual that has been developed to capture the experience of the first Energiesprong demonstrators in Nottingham, UK:

Stage 1 – Initial Scoping and Property Selection

- *Warm the tenants up – this is when you are selecting the properties, so you don't want to promise anything, but you do need to give enough information that tenants will allow you to access the property, so that you can assess suitability.*
- *Our tenants initially heard about the project and the fact that we were looking for tenants who would like to take part in an energy efficiency project. We didn't at this stage promise timescales or that it would definitely be their properties. We didn't tell them about the concept of Energiesprong.*
- *This was around a year before we got final approval for the project and moved on to stage two. During this time, we continued to visit the properties for various surveys and investigations, which meant there had been plenty of time for excitement to build.*
- *In terms of the property selection, we picked a terrace of properties where there was already a great community. Some of the tenants have lived in their homes for more than 30 years. This had real benefits for the engagement process, and for the project. Tenants who have lived in their properties a long time know a lot about the homes, which means they can be clear about what they want fixing as part of the project. (See wish list point below). The properties we picked were difficult, but they were desperately in need of regeneration, which means people are more excited about the transformation.*

***Top Tip**: Pick properties which really need the work to be done, but ones which tenants love living in. If tenants love their homes but they are cold and can't afford their heating bills, they are exactly the right type of tenants for Energiesprong!*

Stage 2 – Sign Up

- *If there is one person in the community who knows everyone, engage them as early as possible as a champion. Find out what you can about the community from them.*
- *Arrange a meeting to explain the project and concept. Check with tenants where they want to meet. We offered to take the tenants out for dinner, but we were advised by our tenant champion that the timings would be difficult for people and some people wouldn't go too far away from home. She suggested we did a fish and chip supper in her lounge instead, and this worked really well as people could come and go when they had to collect kids, start work etc.*
- *Agree how to communicate, and ideally if you can, do this in a quick way (email / text) – in our case most had email and agreed for us to set up an email group so that everyone was emailed at the same time. The people who didn't have email were notified by their neighbours before we had chance to ring them on most occasions.*
- *Explain the aims, and the process.*
- *Don't over promise.*
- *Tell people it will be a lot of work and very disruptive!*
- *Show the videos from the Netherlands (and now the Nottingham project).*

- *Keep it simple, but be prepared to talk about detail – tenants may surprise you with their interest and knowledge. One of our retired tenants is a bit of an energy expert and knows exactly what energy consumption all of his appliances have. He's also the resident handy man, so was able to give some good insight into the properties, for example that they require diamond drilling into the party walls. He even lent the contractor his drill!*
- *Explain the process. What happens next, what are the proposed timescales?*
- *Find the hook. What is wrong with the home that needs to be fixed? What is good about it?*
- *We asked tenants for a wish list. We made it very clear that we couldn't promise anything on the wish list, but as the people who live in the properties, they have the best understanding of what needs to change, and what the problems are, as well as the positive things which you may want to enhance further. This was an important part of setting our brief for contractors to bid against. We did this at the joint session so that the tenants could agree on the things which were and weren't important. The things our tenants suggested included warmer homes, more light in the stairs, outside taps, a door bell, and a Juliette balcony. The latter was suggested as a bit of a joke, so tenants were thrilled when they found out they were going to get one!*
- *Take notes and share these afterwards in an easy to understand and very clear format. We tend to do ours as Frequently Asked Questions.*

***Top Tip**: Engage a community champion early, and ask tenants how they would like to be engaged with. Tenants will know what is right and wrong with their house, so ask them to help set the brief for the contractor through developing a wish list. This gives them ownership.*

Stage 3 – Surveys

- *Our surveys ended up taking longer than hoped, and partly this was about difficulties in arranging access on the same day. This wasn't because of tenants being particularly difficult, but one tenant had just had a baby, and others had differing work commitments / hospital appointments. Having to do repeat visits cost more money too.*
- *Nottingham City Homes has a dedicated team of Project Liaison Officers and we usually require contractors to provide Resident Liaison Officers, who are responsible for day to date engagement with our internal officers overseeing them. We had not allocated this project to one of our Project Liaison Officers at this stage, but we definitely would in future.*

***Top Tip**: Use a dedicated Project Liaison Officer from the start. Ensure they understand Energiesprong. Let them lead on comms and form the relationship with the tenants. This will help when trying to make access arrangements for surveys and also mean a smoother transition once the project starts.*

Stage 4 – Procurement

- *There are a few options about how tenants can feed into evaluating the tender, but it's crucial for them to feel involved from the start so that they have ownership over the project. This has helped with the tenant and contractor relationship on our site as when things have been challenging or difficult, the tenant feels as though they made, or at least fed into the decision.*

- *We explained to tenants the process of the tender at the sign-up stage, when asking them for their wish list. It was made very clear that this wasn't guaranteed, but it would be something which would help us choose the successful contractor.*
- *Our tender was based on a fixed price, with evaluation of the design forming 60% of the score, although split across various parts. 10% of this was on tenant engagement, with 10% on design principles and 10% on aesthetics. All of these sections included elements of how close the bidder had got to the tenants' aims.*
- *In terms of how tenants feed into the evaluation process, the options we considered are below:*
    - *They can be part of the evaluation team and sit on a panel to help evaluate design, how closely the contractor has met the design brief, perhaps via a nominated lead*
    - *They can do a tenant evaluation which then feeds into the scoring*
    - *They can informally comment, without this being reflected in scoring*
    - *They can give feedback to the bidders and the evaluation team during the process*
- *We initially thought about asking one tenant to be on the evaluation panel to feed in everyone else's views, but eventually decided not to let tenants formally evaluate the tenders, and instead arranged an opportunity for them to feed back to us and bidders about their views of the proposals.*
- *The risk at this stage is that tenants will choose a contractor which subsequently doesn't win the tender due to other reasons. It is important to explain to tenants that this may be the case.*

***Top Tip**: Get tenants involved in the procurement as this will give them ownership of the project.*

Competitive Dialogue

- *We started our second stage of the competitive dialogue with two full day workshops, one focused on contracts and performance, the other on tenants and design.*
- *For the second day, we wanted to be site based, and were looking for a venue. We asked tenants, and one of the tenants who had lived in the property for 35+ years suggested the pub across the road. This was a great suggestion as it was so close tenants were all able to attend, and it felt as though we were supporting the local community. The important thing is to ask the tenants – they will have more local knowledge than you. And the pub only charged a fiver a head for the venue with tea, coffee, and home cooked hot and cold buffet, so it was a bargain too!*
- *During the day, the bidders were invited to walk around tenants' homes, to meet them informally, and then to chat to them over lunch in the pub about their requirements and their homes. This gave the tenants a good chance to get to know the bidders, as well as for bidders to get to know what was important to tenants.*
- *It also gave bidders a chance to have a good look at the homes – access to the loft etc. Because our tenants were engaged, and we did have a particularly helpful tenant who made everyone cups of tea, this meant access was easier and bidders got a real feel for living in these properties.*

- *The tenant wish list had been incorporated into the design brief, so after lunch, the tenants left, and the design brief was shared with bidders. The planning team also fed into this.*

***Top Tip**: Let the bidders meet the tenants during the tender process. Also, tenants have more local knowledge than you do, so ask for their help in finding venues for meetings.*

Tenant Feedback Session

- *This was arranged as two-hour long presentation slots, around a week before the final Invitation to Tender was issued, and bidders were expected to have progressed their designs to a stage where they could present them to tenants for feedback.*
- *The tenants commented on the designs proposed directly to bidders, but then also had a chance to tell the project team what they thought after the bidders had left and we fed back to bidders individually. A local councillor also attended this session, as well as planning colleagues.*
- *In our case, it was clear at this session which of the bids the tenants preferred.*
- *Following this session, the final ITT was issued and dialogue stopped.*
- *On the receipt of tenders, the project team evaluated them.*
- *The successful bidder was the one which the tenants had preferred.*

Stage 5 – Contract Award

The Big Reveal

- *We wanted to find a way of telling the tenants the decision, and thought it would be a good opportunity to bring them back together for another event in the local pub.*
- *Unknown to us at this stage, the tenants had taken a passing comment as confirmation that the bidder they didn't want had won the tender.*
- *We called the event the 'Big Reveal'. Tenants came along to the pub, and were really hostile, as they expected the bidder they didn't want.*
- *In some ways, this was great as when the bidder walked in, they were thrilled and really overwhelmed. However, it was great because it was the bidder they wanted. At this stage, we realised the potential impact of our decision not to use tenants' opinions for scoring. If the other bidder had won, the project would have been set off on a completely different path, and the contractor would have found it very difficult to turn this around.*
- *Feedback from the tenants about the bidder which did not win was that they came across as too impersonal – they were a very experienced contractor and they talked about their experience of working on thousands of homes to the tenants, rather than talking about the tenants and their experience and what they wanted. This is helpful for bidders to understand in terms of the way they approach the residents.*
- *At this event, the successful bidders discussed their more detailed design proposals with tenants. They asked for tenants' opinions, and genuinely wanted these. In fact, design changes were made after this meeting, including selecting a colour for flashings and window surrounds which is the favourite colour of two of the tenants.*

***Top Tip**: Hope that the contractor the tenants prefer wins! Whichever contractor does win needs to listen to the tenants and show that they have listened through their designs.*

Stage 6 – Mobilisation

Induction

- *NCH standard practice is to carry out an induction for residents. This did not happen at the very early stage of our project, but I would recommend this in all projects in future.*
- *The induction allows the contractor and the Housing Provider to find out whether the tenant has any additional requirements as well as giving an opportunity to get to know the tenants, and to introduce the programme of works.*

Stage 7 – On Site

- *Our contractor proposed one main person to be the communication officer and the site manager. This made us a bit nervous to begin with, but the character of the individual meant that he formed a good relationship with all of the tenants, and communication was often in person on an ad hoc basis. This is also fine for 10 homes, but it is likely that a dedicated liaison officer will be required for roll out.*
- *Nottingham City Homes has a Project Liaison Officer on the project. They have been heavily involved in the project, ensuring that everyone is happy and that they have someone outside of the contractor to talk to about any concerns with the works.*
- *Tenants have been given the opportunity to use the site office as respite accommodation when works are happening on their property. There are some works which required them to vacate the property. We combined the site office and respite accommodation in the end terrace, which we have held as a void for the duration of the project. For roll out, we would have a separate site office, and hold a void as respite accommodation where possible.*
- *The work is very intense. There have been challenges with access and ensuring this is safe and open for residents at all times. It is important to think very carefully about how tenants move around the site and in and out of their homes and to have a clear plan for this, with everyone understanding where the 'site' starts and resident access ends. Tenants must be made aware of this.*
- *During the project, the contractor introduced a text messaging system. Each morning a group text is sent with details of the work planned for that day. The programme is subject to change at short notice due to the nature of the works, and therefore the daily text message keeps people updated.*
- *Coffee mornings are held fortnightly. Our tenants got together and wrote questions and comments beforehand for some of the earlier coffee mornings, which really helped to focus discussions. It is worth encouraging / facilitating this to happen.*

***Top Tip**: This type of innovative retrofit work has lots of changes to programme, so you need to have a way of communicating with residents quickly, whether they are at home or not. It is also crucial to think about maintaining safe access.*

Appendix 2: E=0 monitoring protocol

	Performance Criteria	Requirement	Comment	References
Energy	Space heating demand	<30 kWh/m^2/yr While the modelling is based on standard heating regimes the system must have the capacity to be able to achieve 21°C in living room when outside temperature is -5°C. Use SAP 2012 defaults: • Appendix U for local climatic data. • All the rooms of a house are heated • A demand temperature of 21°C in the living area and 18°C elsewhere • A weekday heating pattern of 2 hr on, 7hr off, 7hr on, 8hr off – • A weekend heating pattern of 16 hr on, 8 hr off Use gross internal floor area for this metric.	<30 kWh/m^2/yr should be an achievable average across the demonstrators which will help future proof Energy Leap solutions and mitigate risk of high energy prices, policy and high consumers. Potential <40 kWh/m2/yr may be possible for the demonstrators given different archetypes.	NL range is 0 – 50 kWh/m2, Passivhaus is 15 kWh/m2. EnerPHit 30 kWh/m2. BREDEM SAP 2012.
	Energy allowance for lighting, cooking and sockets	2,300 kWh/yr. Solution provider to update lighting and standard appliances at installation so it is	2,300 kWh/yr achievable with low-energy lighting and replacement fridge. This is not a limit or maximum but a central figure that will be used in modelling usage and net consumption in a typical home. There will need to be careful	NEED suggests 3,500 kWh & 10,250 kWh as mean gas & electricity consumptions in 2012/2013 in social housing. Ofgem TDCV is 3,100 kWh. Electricity figures will include some

		reasonable that tenants can achieve 2,300 kWh/yr.	engagement with tenants around this allowance and energy bills, in particular to ensure that tenants do not switch off essential equipment, e.g. ventilation systems in order to meet energy budgets. Tenant will be responsible for replacing lighting and appliances on failure. Consider 'fair use' policy to manage risks around irregular consumption.	heating and social housing is smaller than average 67m^2 vs 94m^2. Annual allowance of approx. 2,500 kWh has been achievable in NL with some new appliances and lighting. Willmott Dixon have shared paper on consumption in ES properties.
	Hot water	System has the capacity to deliver 200 litres at greater than 45°C (or equivalent at higher temperatures) in one hour. Hot water consumption to be scaled by typical number of occupants (N) 64+26N. Housing provider sets typical number of occupants so for N=3, 142 litres per day at a tap temperature not less than 45°C. Legionella risks must be addressed by the contractor in the design of their solution and the proposals for how this will be dealt with must be acceptable to housing provider.	'Tap' temperatures are preferable as they are more user relevant but difficult to continuously monitor at every outlet so performance will be recorded at commissioning. Scale consumption for typical number of occupants (N) 64+26N to provide ~95% confidence water will meet demand. Max and typical no. of occupants to be set by housing provider. Some providers have min temperature of 50°C to provide some assurance that if water is being stored it is at a safe temperature higher than this.	British Standard recommends 35-45l/person @ 60°C. Also SAP2012 Table 1b. 55°C at tap point is spec in NL. Measuring HotWater Consumption in Dwellings found N(umber) of occupants was only significant key factor and suggested 64+26N. Delivery temp of 51.9°C ±1.3°C. Only factor influencing DHW is no. of occupants. New build regs require bath outlet temperatures to be <48°C. *system capacity TBD
	Net energy consumption	Net zero should be achievable on certain well orientated archetypes, allow <1,500 kWh/yr for others. Net consumption is import (kWh) minus export (kWh).	Reasonably ambitious target which will help future proof Energy Leap solutions and mitigate risk of high energy prices, policy and high consumers. Allow flexibility in demonstrator procurement given different archetypes, orientation and shading. Consider inter-annual variability of generation.	SAP 2012 Appendix U. PVGIS or Microgen Database for PV. Solar PV degrades by up to 0.5%/year.
	Feedback	Provide feedback to tenant against each of the allowances for heat, hot water and	Example specification:	

		small power. Provide real-time and historical feedback to enable comparison.	- Daily small power, lights etc energy real time and v daily target - Daily hot water consumed v daily target - Internal temperature(s) – real time	
	Payments from housing provider	State upfront payment, any ongoing (maintenance/ other) payments and incomes from tariffs over the life over the warranty period.	Will need to cost maintenance plan if done by other party, see maintenance. Average cost of capital rate to be provided by housing provider to enable solution provider to optimise NPV.	
	Tenant payments	Outline the energy service plan, cost, provisions and additional charges. Illustrate impact against pre-retrofit spend for the low, central and high case.	Central case as per heating, hot water and kWh allowances. Low and high cases to be identified by housing provider. Consider setting maximum tenant cost which could be based on imported electricity costs.	Consumer profiles are being developed to consider minimum energy budgets, JRF research and impact on fuel poverty.
Water	Water consumption	Reduce estimated water consumption to <107 l per person per day (l/p/d) where bathroom and kitchen is replaced, and to <118 l/p/d where fittings are adapted rather than replaced Compliance with this standard will be based around specification of measures rather than in use performance and will not be monitored for these pilots.	This is required because London has been classified as an area of serious water stress by the Environment Agency and that this situation is likely to become more serious under future climate scenarios.	The standard is based on BREEAM Domestic Refurbishment WAT 1 requirements: http://www.breeam.com/domrefurb2014manual/#07water/wat_01_internal_water_use.htm%3FTocPath%3D07%2520Water%7C_____1
Comfort & Health	Temperature in living room	21°C achievable when outside temperature is -5°C.	There may advantages to using a single time/temperature zone or multiple zones depending on heating technology. Model to demonstrate that solution will achieve target internal temperatures when external temperature is -5°C.	Use RdSAP standard (average) heating pattern of 9 hours heating a day during the week and 16 hours a day on the weekend. See pages 219-221 ofhttps://www.bre.co.uk/filelibrary/SAP/2012/SAP-2012_9-92.pdf.
	Temperature elsewhere	18°C achievable when outside temperature is -5°C.		
	Heating controls	Provide options around heating pattern and whether zoning would be appropriate. Provide an override or 'boost' function.		

				New-build and system replacement regulations for up to 150m^2 require two zones with independent temperature control.
	Summer overheating	Designed such that no more than 108 hours over a comfort temperature of 28°C living areas and 26°C bedrooms. Assume median climatic conditions for 2050 (this would assume more dynamic modelling e.g. PHPP?).	Some (non-Energy Leap) low-carbon solutions have suffered from overheating. Household behaviour has significant impact on overheating so make sure advice is offered. 108 hours is 1% of summer hours. Consider additional summer shading to meet targets. DCLG regulation work in progress. Add 3°C onto summer monthly mean maximum, use closest Met Office weather station data for last 5 years.	NHBC Foundation, NF 46, Overheating in new homes, 2012, use 1% of occupied hours. NL use 300 hours rather than 1% of occupied. NCM parameters: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/7762/1016185.pdf % occupied hours over 27°C. CIBSE use 3% hours. ZCH report and CIBSE TM52. UKCP09 - typical increase in average summer maximum temperatures of between 2 and 4°C by 2050, so use 3°C as median. Met OfficeWeather Stations. Review CIBSETM59.
	Maximum air velocity (draughts)	<0.2m/s where people can be reasonably be expected to sit or sleep.	High air velocities can lead to occupants feeling draughts/cold. Check on commissioning of demonstrators. Measured in-situ using a handheld anemometer.	Dutch regs/guidelines suggest < 0.15m/s. No Passivhaus guidance found. CIBSE < 0.1m/s. 0.2 m/s < ASHRAE/ISO thermal comfort.
	Indoor air quality	Comply with Part F for New Dwellings.	Relative humidity should be measured and monitored For the demonstrators, we will run with the assumption that air-change rates will resolve air-quality issues relating to VOCs and CO_2, but	REMI suggests 40 – 60%. Building Regs Part F set moving average maximums of 65, 75 & 85% for periods of 1m, 1w & 1d respectively. CO_2 levels between 800 to 1000 ppm - CISBE Guide B, 2005

			proposals showing how these can be monitored cost-effectively will be welcome. Attention should be paid to design, commissioning and handover of ventilation systems to avoid unintended consequences including inadequate ventilation and increased noise	See Zero Carbon Hub report on common design, installation and commissioning errors for ventilation systems: http://www.zerocarbonhub.org/sites/default/files/resources/reports/ZCH_Ventilation.pdf
	Daylighting	Daylight is not reduced by more than 10% without agreement.	Potential reduction of day lighting as new windows likely to have: thicker frames, lower G-value and greater shading. Glazing is occasionally over provided. Housing providers might prefer to state a maximum daylight factor reduction.	Daylight factor between 2 and 5 - CIBSE Lighting Guide 10. ES NL use no reduction in net glazed area.
	Internal lighting	Existing internal lighting provision will be assessed prior to installation using measurements and tenant feedback. The proposed lighting solution will aim to improve current lighting levels where possible and must avoid any drop in internal lighting quality	If not designed properly, provision of low-energy lighting has the potential to decrease lighting levels or lead to a reduction in light quality, which may lead to increased electricity consumption from unfixed lights. Lighting with a lower output in lumens than existing light fittings is likely to lead to dim conditions, while light with a colder or bluer quality (i.e. greater than ~3,500 K) is likely to encourage occupants to seek other light sources.	Guidance on lighting for domestic buildings can be found here: http://www.cibse.org/getmedia/b5d969ef-16bf-425c-b68f-d825cc285657/Lighting-Factfile-9-b.pdf.aspx
	Noise from services inside the dwelling	30 dB absolute limit in living rooms/ bedrooms or where background noise is higher use relative limit of <2 dB @ 1 m distance.	Consider use of attenuators should be used to reduce fan noise and prevent cross talk between rooms.	BS 8233 no adverse issues < 30 dB. Passivhaus requires sound level exposure through ventilation system less than 25 dB(A). Dutch building regs (since 2012) < 30 dBA. Building regs Part F suggest < 35 dB.

	Noise attenuation from outside and neighbours	Noise attenuation from outside and between dwellings is the same or greater than existing.	In quieter houses occupants notice noise from neighbours, so may need to explain that noise from neighbours may seem louder.	
	Noise from ES services outside	Noise from Energy Leap equipment will not exceed 42dB(a) at 1m from window of habitable room.	The most likely source of noise would be an air-source heat pump.	MCS020 provides method for calculating noise levels.
Installation	Installation time	Installation time with occupants in-situ < 10 active working days per home. Maximum active time onsite two calendar months	For the demonstrators consider installation day as an active day onsite, on dwell days there should be no scaffolding and homes should be fully functional and safe. Consider managing works before/after and tenants who may be in all day. Consider whether speed is being driven over disruption.	
	Occupant satisfaction	As part of the overall engagement and feedback strategy obtain feedback before, during and after the installation.		
	Commissioning and testing	All dwellings to have an air tightness test carried out before and after installation Where possible (weather allowing), this should be carried out in tandem with thermal imaging to identify any air tightness issues or thermal bridges that need addressing Post-installation commissioning test to be carried out on all HVAC systems	While the solution provider is required to monitor and guarantee the performance of the dwellings, appropriate commissioning and testing will enable early identification of any potential performance issues and allow these to be corrected early on.	

Warranty, Maintenance & Monitoring	Performance warranty	Aim to provide 30year guarantee of energy, comfort and health factors so long as maintenance and occupant protocol has been met.	Consider special warranty arrangements for the demonstrators, given that first-of-a-kind solutions will provide insight and feedback, e.g. could include an initial monitoring and improvement period, latter arrangements may need to be capped. Longer term arrangements may be required to release capital funding.	
	Design life	Optimise design to satisfy performance warranty period but state which components are likely to last significantly longer and the advantages this may bring.	Client to consider the expected design life of each component with the solution provider supplying a lifecycle cost which is less than a client specified amount (based on today's lifecycle and replacement costs) Typical design life: Walls and roof – 60 years Windows – 20 years Battery - 10 years Solar PV – 25 years Air source heat pump – 12 years	
	Maintenance	Provide a fully costed planned and preventative maintenance protocol for the warranty duration. Identify cost and resource requirements for each activity so that they can be costed by a third party.		
	Monitoring	Provide sufficient monitoring and logging to be able to exercise performance warranty. Make suitable data privacy and security arrangements. Relative humidity should also be monitored in the living area	Additional funding streams may be available to cover additional requirements. The following parameters could be additionally considered: • CO_2 in living area and bedroom • Volatile organic compounds • Temperature in all habitable rooms • PV generation • Small power, lighting, cooking • Hot water consumption	Refer to E=0 monitoring specification.

			• Total energy • External temperature	
Design	Kerb appeal, highly attractive design uplift, customer satisfaction	Demonstrate how the solution meetings the design brief.	Pre-application meetings with planners shall be sought to obtain feedback on potential solutions	
Fire Risks	Fire risk	Outline how the design of the retrofit complies with fire building regulations, does not increase fire risks. Highlight the new features that will reduce the risk	Pending the outcome of the inquiry into the Grenfell Tower Fire, a precautionary principle shall be applied	https://www.gov.uk/government/publications/fire-safety-approved-document-b
Sustainable construction	Timber	All timber to be used in construction to be PEFC or FSC certified	Future phases will look to incorporate stronger requirements on e.g. material selection, embedded energy, construction waste and transport CO_2 emissions. However, for the purposes of the pilots, it is expected that the requirement for sustainable timber is something with which all solutions providers should be able to comply.	https://www.pefc.org/ http://www.fsc-uk.org/en-uk
Security	Security	Solution providers to consider PAS24 and security improvements by design.		Dutch use Police Mark standard, REMI suggests PAS24 in UK
Drainage and flood risk	Flood risk	Where properties are in or adjacent to a flood risk area (Zone 1 or Zone 2), solution providers to consider how designs can be adapted to minimise the impacts of potential flood damage.	For example, this might include specifying varied materials or a detachable panel at lower ground floor level to facilitate easy repair, drying out and replacement.	https://flood-map-for-planning.service.gov.uk/

Appendix 3: Contract documents and schedules for UK Energiesprong retrofits

Ref	Document Name	Purpose	Notes
EA	Heads of Terms	Identify the requirements of an Energiesprong build	ESUK high level available; organisation-specific information to be added for each procurement.
EB	Call off contract	Overarching contract – an agreement for use with one or more project phases	To be reused after development in pilot stages.
EC	Standard contract amendments / Bespoke Contract	The contract for the build and maintenance of residential properties	To be reused after development in pilot stages. Amended NEC3 and JCT Design & Build template contracts available.
ED	Energiesprong Performance Specification	The services to be provided under the contract	This is a core document of Energiesprong UK as it ensures standardisation.
EE	Performance Measurement Framework	How the value of the service is to be assessed	Core ESUK document using the same structure as performance specification.
EF	Monitoring and Reporting Protocol	Report definitions to be provided for the monitoring data	To include field names, units, and where appropriate source and algorithms. For reports to be delivered quarterly during defects period, then annual. And monthly summary reporting. Standardisation will enable comparison, and reduce cost.
EG	Payment Mechanism	Payment timetable and warranty claw-back mechanism	Generic template available, can be tailored to individual organisation's requirements.
EH	Communication Protocol	The contact between tenant and supplier	Currently included in the Access Protocol, mid-term goal to have separately to ensure consistent tenant experience
EI	Reasonable Small Power Allowance Assessment	The assumptions of small power calculations	To inform solution providers in their design
EJ	Pricing Evaluation Model	The model to calculate financial impact of underperformance	Core ESUK document required for some baselines

		against energy savings and maintenance cost.	in the performance measurement framework
EK	ITT Outline	Support for the procurement process	May be developed further depending on needs
EL	Problem Solving Hierarchy	Existing flow charts. May currently be too heavy	Developed for first pilot and subsequently improved for further procurement.
EM	Commissioning and Testing Protocol	For elements of the design where the Energy Measurement Framework is not sufficient in detail	To be developed in conjunction with different measure selection / requirements.
EN	Site Information	To include survey results, boundaries, existing services Energiesprong to develop a template to help consistency	List of recommended and desirable surveys to be made available at beginning of procurement.
EO	Access Protocol	To cover pre/during/post build phases To encourage off-site build	To ensure smooth and consistent tenant/customer experience and reduce disruption.
EP	Operations and Maintenance Plan	Details of all the maintenance and asset replacement required during the warranty period Template to be completed at contracting	Current template made available for assessment of bids during procurement
EQ	Sub-contractor Register	Contains details of all sub-contractors approved for use on the project Template to be completed at contracting	Standard template
ER	Key Persons Register	The people / roles that are critical to the build Template to be completed at contracting	Standard template
ES	Risk Register	Identifies and provides mitigation for risks Template to be completed at contracting	Mid-term aim is to develop a bespoke E=0 risk register learning from prototyping phase.
ET	NEC3/JCT/Bespoke contract	Choice of main contract templates. During pilot phase, different contracts are being tested: NEC3 and JCT Design & Build used for current demonstrators.	Schedule EC captures amendments to these standard contracts.
EU	Design Brief	Vision of the works to be completed	Generic approach with location-specific tailoring.
EV	Works Information	Detail of the work to be undertaken, and any constraints on that work	Site-specific information
EX	Early Warning Notice	For use with the NEC3 contract	Standard template

Appendix 4: Energy Leap demonstrator evaluation structure

Purpose and aims

The GLA requires the completion of an end of project review of the Mayor of London's Energy Leap project in order to:

1. Assess the technical performance of pilot projects;
2. Assess the non-technical elements of pilot projects (e.g. delivery time, tenant satisfaction, procurement processes);
3. Assess how the project has helped address the barriers set out in the London Energiesprong transferability assessment and which barriers still need to be addressed;
4. Review the lessons learned through the project and how these should inform future phases, and;
5. Provide recommendations for future phases of delivery

6. Assess the technical performance of pilot projects

The technical appraisal of pilot projects will need to include:

- **overview of the solution as implemented:** including a description of the technologies used and how the solution was designed to comply with the requirements of the outcome based specification
- **a review of the as designed CO_2 and energy savings for each pilot project:** this should set out: the pre-retrofit performance of each building including SAP rating, modelling results, including a breakdown of energy consumption and heat losses; actual energy bills, fabric element heat loss; air tightness, thermal bridging); a description of the package of measures applied; the post-retrofit performance of each building (including SAP rating, modelling results, including a breakdown of energy consumption; actual energy bills, fabric element heat loss; air tightness, thermal bridging)
- **details of commissioning:** including details of post-construction surveys (air tightness, thermal imaging (where possible), ventilation etc.) and any issues encountered with commissioning and handover
- **an analysis of the as built CO_2 saving and energy savings for each pilot project:** this should be based on at least three months' data initially (with a later review to incorporate 12 months' data) to include; energy consumption data (broken down where possible), degree day data, internal temperature, and relative humidity as a minimum. This will provide the basis for an assessment of how the building is performing against the standards set out in the performance contract (i.e. performance guarantee)
- **quantitative analysis of the living environment:** this should ideally include pre-and post- construction analysis of internal temperature and relative humidity (pre-installation data may be available, but this could be challenging given the timescales)
- **details of climate change adaptation measures:** including; water efficiency; mitigation of overheating risk; mitigation of flood risk (where appropriate)
- **innovation:** what innovative technologies were used (e.g. battery storage) and what issues were encountered during design, installation, commissioning and use

In order to gather this information, partners must agree to sharing data (this is provided for within the grant agreement), but should also agree to undertake and share the following:

- Air tightness tests
- SAP assessments
- Energy bill data

- Outputs from any pre- and post- construction modelling (e.g. from SAP/PHPP or similar
- Energy consumption data

7. Assess the non-technical elements of pilot projects

The appraisal of the non-technical elements of pilot projects should assess how each pilot project has performed against the performance criteria set out in the Funding Prospectus namely:

- **speed of delivery** – whether the project was delivered within a fifteen-day period and what the associated issues were
- **energy plan charge** – how the energy plan charge was implemented, whether there were any issues in setting it up and administering it, what level of charge was set
- **lifecycle costs** – including revenue, maintenance costs, tenant savings
- **tenant satisfaction** – including tenants' views on the pre- and post-construction environment: thermal comfort, design, affordability and amenity; and processes: communication (engagement), installation, post-occupancy support
- **stakeholder engagement –** to include tenants as above, but also the views of housing providers, contractors and (if possible) planners on; which elements worked well; which elements didn't; what actions could be taken in the future to avoid any issues
- **qualitative analysis of the living environment –** e.g. visual improvements, kitchens, bathrooms
- **open market valuation (pre- and post- retrofit).**

In some cases, particularly tenant satisfaction, pre-installation interviews/surveys will be required.

In addition, the non-technical review should provide:

5. An overview of the procurement process, and issues encountered and how it could be improved for future delivery phases
6. An overview of the planning process, informed by planning documents, pre-application advice and planning decisions, and setting out how the chosen approach(es) could be improved for future phases
7. An assessment of planned v. actual costs and of projected v. actual revenues, explaining where there are any differences between planned and actual values

8. Assess how the project has helped address barriers to the wider roll out of the Energy Leap Project

This should be based on the Energiesprong transferability assessment and provide an update on the status of the barriers identified in this assessment, looking at: whether barriers are still relevant; how the project has helped to address these barriers; what further actions are needed to address remaining barriers.

It should cover the issues and barriers set out in the Annex to this document.

9. Review the lessons learned through the project and how these should inform future phases

and

10. Provide recommendations for future phases of delivery

This should comprise a review issues arising and lessons learned from the project and address the following, setting out the issue, lessons learned and options for improvement in each case:

- technical issues
- tenant engagement
- procurement
- energy plan
- planning
- legal issues
- monitoring and evaluation.

This should result in a set of recommendations, with an indicative plan for how these could be implemented – timescales, resources, processes, stakeholders.

This set of recommendations should consider:

- likely cost reductions in Energy Leap projects (taking into account the national context)
- the political and financial context
- the potential size and impact of the Energy Leap retrofit market in London (including jobs, CO_2 savings and fuel poverty), taking into account alternative retrofit approaches, and considering how the approach could be widened to the owner-occupier and private rented sectors
- opportunities for applying the Energy Leap model to new build housing and estate regeneration projects.