Apteno Consulting

# HOME RESPONSE PROGRESS UPDATE JULY 2021: CURRENT POSITION AND EARLY INSIGHTS

This report details the status of the Home Response project as at the 17 July 2021
The report highlights the activities taken as part of a project consolidation review, and the recommendations that followed that informed the updated proposals submitted in July 2021.
Any findings and insights should be treated as interim only, and the full project conclusions will be captured in the final insights report by Element Energy.

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Contact Details
Robert Friel
rob@aptenoconsulting.co.uk
Tel: +44 (0)7935670800

Apteno Consulting

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## Contents

# 1 Background and Objectives

This progress report covers project progress up to July 2021, including a summary of activities taken as part of a project consolidation review (June 2021), and the recommendations that followed.

The report forms one half of two interlinked deliverables, to be read in conjunction:

- Part 1 covers progress to date and early insights (deliverable D26)
- Part 2 covers the pipeline of opportunities (deliverable D25).

This report, Part 1, includes a review of project progress and insight to date which was important in creating the two revised project plan proposals - version 1 and version 2 – submitted to the project monitoring officers on 17 July 2021. Section 1 provides a recap of initial objectives, and a summary of the project challenges that led partners to undertake a 'consolidation review' exercise in June 2021. Sections 2 and 3 highlight the current position and interim project insights gathered as part of that review. While section 4 briefly concludes and introduces the scale up and pipeline activity covered in D25).

Please note, any findings or insights stated in this report are for the purposes of progress update and should be treated as interim only. The full project conclusions will be captured in the final insights report (D31).

## 1.1 Home Response Initial Objectives

Home Response (HR) set out to demonstrate "*how electrical hot water heating and solar PV with battery storage technologies can be used in social housing to help Londoners' cut their energy bills, financially reward flexible use of energy, reduce emissions and contribute to a smarter, cleaner energy system for London. By using innovative business models and customer engagement, combined with controlling when and how hot water heating and batteries are used with energy efficiency support, the project team aims to supply 0.5MW of additional, flexible electrical power to local and national electricity networks by June 2020. This will increase low carbon electricity capacity and improve security of supply to meet Londoners' variable demands for power, i.e. at peak times of the day*"[1].

The original objectives were to:

- *Engage and recruit households by using innovative engagement methods that have been tried, tested and improved upon through the development of community energy projects.*

[1] Sections in Italics are as stated in the Home Response Progress Report Oct 2020

- *Remotely control households' flexible demand for electrical hot water heating and solar PV combined with battery storage technologies by using Moixa's GridShare software and hardware technologies.*
- *Give households a share of the profits and rewards received from energy trading.*
- *Moixa to manage everything for households. Once they have signed up to GridShare there's nothing they need to do. Moixa will sell the energy, collect payments from network operators, and once a year send customers their share.*
- *Develop and trial business models that provide replication potential for commercial energy businesses and community energy organisations.*
- *Meet UK Power Networks (UKPN) need for local level electricity grid capacity flexibility (which includes increasing supply and reducing demand for electricity) at times of critical need for Londoners (i.e. peak times of the day between 4pm and 7pm).*
- *Demonstrate and disseminate to communities with similar opportunities how to implement domestic demand flexibility by producing detailed materials, events and learning experiences.*

The intended outcomes were to:

- *Provide greater levels of demand flexibility (up to 0.5MW) by controlling electrical technologies and testing the usefulness of smart meters for control actuation in 160 social housing households, managed by Housing Associations and London Boroughs.*
- *Create new business and customer engagement models to reward Londoners' flexible use of energy.*
- *By demonstrating and disseminating project learnings and opportunities this kick starts household flexibility markets, with the aim to provide up to 1MW of flexibility services by December 2022.*
- *Realise a range of energy system benefits.*
- *Deliver the Mayor's policies and proposals to develop clean and smart, integrated energy systems utilising local and renewable energy resources.*
- *Accelerate collaboration and partnerships between energy users, technology and supply chain providers, researchers and policy makers to provide technical, commercial and environmental solutions and benefits.*

### The Initial Bid Commitment

The original objectives were to be demonstrated by delivering installations and testing the usefulness of smart meters for control actuation in 160 social housing households,

anticipated to be 130 hot water controls and 30 battery installations in houses with PV already installed.

### Scope Changes

The project has faced a number of challenges, which will be reflected on later:

- Gaining participation agreement with landlord clients took longer than anticipated due to differing perceptions of risk and internal procedures.
- The impact of Covid-19 restrictions in 2020 making it harder to reach tenants and having to cancel the recruitment of two local champions to sign-up tenants.
- A significant proportion of the electric hot water systems required remedial work before installation could take place, which required additional coordination with the social landlords participating in the project.
- Lack of availability of SMETS2 infrastructure from DCC for control of DSR

These challenges and the ongoing Covid pandemic resulted in an agreed scope reduction and a reprofile of the project plan which was signed off in January 2021.

Further covid delays and associated challenges have led the HR consortium to prepare a further iteration to the project plan – submitted for review and discussion on 17th July.

## 1.2 'Consolidation Review' Objectives

These challenges necessitated a review to consider how best to still meet the project's objectives and to review the prospective pipeline of deployment opportunities (identified by the HR consortia), prioritising based on the value they could provide. The latter has informed D25 'Post project pipeline of opportunities'.

The review sought to take stock of the current position of the project, and identify opportunities during the remainder of the project to enhance:

- the data that can be gathered to inform the energy system benefits and insights delivered by the project
- the legacy of the project to London energy consumers through the use of the remaining technology.

This was undertaken by

- Reviewing the key learning points, installation experience and tenant feedback achieved to date, ensuring the learning informs the reframed objectives

- Reviewing the opportunity pipeline to ensure it had the potential to support a scale-up in development of up to 1MW by end of 2022, and also assessing the pipeline for *feasible* installation opportunities able to gather additional data during 2021 and early 2022.

### The Process

The review and consolidation process has comprised of:

- Interviews with the project partners; Moixa (and Connected Response as the subcontractor engaged for the control of hot water resources), Repowering and Element Energy; to collect information ahead of the workshops on potential opportunities for the remainder of the project.
- Two online workshops with the project delivery partners to review current status, project insights to date, explore opportunities identified through the interviews and secure consensus on the project direction and objectives through 2021.
- The first workshop reviewed key learning points to date and reviewed the opportunities (scale, use-cases available, landlord-tenant energy relationships) at potential deployment locations known to the project partners (including subcontractor Connected Response). The workshop brainstormed the prospective strengths and weaknesses of locations from the perspectives of:
    - Ability to deliver new data and insights within the project timescales
    - Ability to provide a realistic mid-term scale up pipeline
    - Providing a lasting legacy to the consumers who participate
    - Level of engagement and interest from Landlords
    - Synergy with existing kit installed by the project or Connected Response.
- The second workshop reviewed the outcomes of the first workshop, agreed the priority deployment opportunities and extrapolated the potential insights that could be developed from those.

## 2 Current Position

This is a high level summary of the current status of the project and highlights key learning points which we identified as important during this exercise and that should be captured in the final insights report for the HR project. This summary does not seek to replicate the comprehensive detail provided in the project progress reports. The learning points are expanded on in Section 3.

## 2.1 Current Position

### Installed Equipment

The current position regarding equipment installed under the Home Response project includes:

- 23 battery installations in properties with photovoltaic panels
- 40 hot water (HW) switch installations in properties with electric immersion heaters. Alongside the switch, two hot water tank temperature sensors, and a dedicated KWh meter (to record the consumption of the off-peak immersion heater) are installed, as well as a Zigbee comms module and (optionally) a 2G internet gateway. The equipment provides the ability to remotely monitor and control the operation of the off-peak immersion heater, and to monitor the top and bottom hot water tank temperatures. The exact number of gateways installed was to be confirmed. (50 issued for installation and Connected Response were still in the process of registering all the active gateways, awaiting confirmation from Carbon3 on the exact number and match the equipment serial numbers to the respective properties. Due to the low density of HW installations the number of active gateways is expected to match or be very close to the number of HW installs).

### Engagement

The envisaged approach to tenant engagement had originally been to recruit local Energy Champions. These would be local residents or tenants who would receive training, support and oversight from Repowering to undertake face-to-face engagement with tenants. The restrictions and social distancing required by the onset of the COVID pandemic required switching to an alternative non-physical engagement approach.

Battery installations were recruited from Waltham Forest housing tenants and members of Repowering's mailing list. A total of 14 of the 23 battery installations are Waltham Forest Housing residents. All of the 40 hot water installations are L&Q tenants.

For hot water installations:

- Initial screening identified 2406 suitable properties with tenant customers who were all written to.
- This included 1405 customers targeted for hot water flexibility and 1002 customers with properties suitable for batteries
- 105 expressions of interest for hot water installs have been received
- 67 expressions of interest for batteries have been received
- Repowering followed up with tenants by email and phone contact, converted expressions of interest into agreements to install, and arranged the installs.

- Repowering recruited a Waltham Forest tenant and project participant to be an Energy Champion, who worked remotely to follow up with potential and actual participants.

A potential factor in the lower than expected level of expressions of interest, especially in hot water controls, was an expressed preference by tenants for solutions that covered space heating and hot water. This is believed to be because space heating was considered to have larger costs and/or quality issues for occupiers. This initial insight needs to be verified through further survey responses and/or interviews, which is part of the ongoing qualitative research between Element Energy and Repowering.

### Installations

The SMETS2 smart meter infrastructure from DCC has proven too challenging to access and too immature to be a useful communications and control platform for DSR for this project. Testing and evaluation is ongoing so that the future potential and challenges of this platform can be evaluated.

An alternate communications and control solution provided by Connected Response was implemented and their controls were integrated with Moixa's Gridshare platform. It is able to measure and communicate half hourly consumption data, without the need for a meter change.

The inability to visit all the suitable households in a block and the reliance on voluntary sign up has made it hard to generate clusters of installations, when compared to Connected Response's experience elsewhere of landlord lead heating-system or control upgrades that allow efficiencies to be generated by creating clusters of installations. The dispersed pattern of sign-ups has significantly increased installation costs and required more communications gateways than anticipated. Costs to date have averaged £450-500 per installation compared to a budget of £150 (which is still believed achievable with clustered installations).

The dispersed nature of the installations to date has not allowed the benefits of the Zigbee networking technologies inherent in the Connected Response solution to be realised. The local mesh technology allows one communication gateway to serve many dwellings, but the dispersed installations have averaged almost 1 gateway per property. Alternative communications technologies (e.g. LoRa radio) are now available for dispersed housing but were not considered relevant at the outset of the project because of the belief that clusters of installations would be achievable.

There has been valuable learning about ensuring high quality installations, screening dwelling suitability, identifying defects with heating systems, and avoiding aborted visits. From the visits for planned installations of HW controls:

- 4 locations (10%) were found to be ineligible for the controls due to not having electric hot water or being on inappropriate tariffs
- 7 locations (17.5%) needed revisits or were unable to proceed due to defects located on site which the landlord was unaware of. It is worth noting that these have resulted in the significant benefit of expedited essential repairs to resident services. The installed controls also allow for ongoing monitoring and defect identification.
- 8 aborted visits (20%) where occupiers were not present. Landlord led installations (rather than tenant lead) could reduce aborted visits as the Landlords can access flats for works after giving appropriate notices to tenants.

All the installations have been for tenants on Standard or Economy7 retail tariffs. This significantly limits the times available for flexing demand and the ability to provide direct financial benefit to customers (or the landlord) from time shifting when hot water (or heating) is charged. On Economy 7, any load shifting has to be confined within the overnight off-peak time zone otherwise the tenant faces higher power costs; this inhibits daytime charging of heaters or hot water which could otherwise be beneficial (e.g. from time of use tariffs or for demand side response).

### Data

*Home Response Installations:*

Data from the battery and hot water installs (including water temperature) is available. Hot water energy data is limited to the E7 off-peak consumption (separate element in hot water tanks with separately measured electricity supply). This is sufficient to demonstrate the ability to move hot water demand. The hot water temperature sensors should be able to indirectly reveal any use of additional water heating using the secondary element in the hot-water tank (hot water tanks typically have two elements with one dedicated to off peak heating).

Data on installation volumes, repeat visits and associated costs and charges from contractors is available.

*Subcontractor's Prior-Project Data:*

Connected Response (contracted to Moixa to provide hot water control services) have agreed to make anonymised data from their existing managed hot water and space heating services in Westminster Social Homes available to support HR insight development. This data is from around 230 flats equipped to date across 8 blocks (these contain a total of 900 flats which will eventually all have smart controls installed). CR has half-hour meter data for some dwellings going back 6 years.

### Technology Demonstration

The Moixa interface with UK Power Networks flexibility dispatch platform was not in the HR scope but has been demonstrated using Moixa installations outside HR. A simulated DSR response event using HR assets is still outstanding.

Moixa has established an interface with the Connect Response system to enable demonstration of controlled demand shifting.

A testing programme for hot water DSR was yet to be established. The objective of any programme would be to demonstrate the capability to move HW charging within the off-peak period(s) that the installed switches can control. It may be possible to investigate the impact of charging hot water later in the off-peak period on both hot water temperature and end energy consumption. If temperature sensors were to be installed in existing Westminster customers managed by Connected Response it would be possible to compare the impact of moving charge times within three off-peak periods on hot water temperature profiles.

The project has established that there remain significant challenges accessing DCC SMETS2 infrastructure to demonstrate any capabilities for deploying domestic DSR. The project still aims to assess the feasibility of using SMETS2. To achieve this the project intends to work with DCC in their labs to undertake demonstrations of the capabilities of using SMETS2 subject to the DCC Boxed service being suitable.

Further exploration and tests are planned for late 2021/early 2022.

# 3 Initial Insights

## 3.1 Insights Learning to inform next steps

We have summarised the key learning points that the workshops identified were important in taking forward the Home Response project:

- **Customer Acquisition and Installation needs to be in clusters (for HW installations)**
  Any further installations would be much more efficient, and could only be cost effective for wider roll-out, if clusters of installations can be achieved. For hot water (and potentially space heating) this would be better achieved through landlord driven engagement and providing tenants with a standard upgrade to heating systems rather than through individual tenant opt-in. The sub-contractors experience is that Landlord led projects have resulted in both much higher engagement and lower average installation costs per dwelling.

- **A Space Heating offer is needed in addition to Hot Water**
  Occupiers identified that a solution offering better controls for both space heating and hot water was more attractive. Tenants are more motivated by 'Smart' if it leads to better space heating outcomes.

- **Evidence that tenants on E7 tariffs and on Heat-with-Rent contracts are using supplementary heaters - which is undesirable for both tenants and the energy system.** From Home Response, 80% of respondents to initial surveys have reported using supplemental heating to top up Economy7 off peak heating. Connected Response also reported high levels of supplementary heater use by tenants on Heat-with-Rent contracts (before smart controls are introduced). Supplementary space heating or hot water top up can significantly increase energy bills and leads to dissatisfaction with electric storage heaters that are only charged at fixed times set by tariffs (paid by tenants) or by landlords on (inflexible) commercial time of use tariffs.

- **Existing domestic retail energy tariffs limit the benefits that can be realised**
  The HR project can demonstrate the ability to time shift or turn down/off energy use for charging hot water tanks or space heaters (while not compromising and potentially improving heat service). However, the ability for ongoing financial benefit to be passed back to consumers is very limited with simple Economy 7 type two-period (on-peak/off-peak) tariffs; this problem is overcome by the use of Economy 10 type tariffs which offer up to three charging periods per day and can be used with smart meters and a traditional settlement profile, ahead of mandatory half hourly settlement.

  Sophisticated use of demand side control for grid services (whilst outside the original scope) is possible through Moixa's VLP (Virtual Lead Party) status, particularly with batteries, but this is only possible on half hourly settled tariffs which most customers do not have (even where smart meters are installed). Agile half-hour tariffs are available, but these present a volatile price risk for some consumers who might struggle to pay bills in certain circumstances. This presents a significant future opportunity to introduce different forms of 'fair-flex' time-of-use tariffs for residential consumers once market wide half hourly settlement is established.

- **Rewarding DSR directly likely to be too costly** (according to Moixa):
  It appears too costly to arrange bank credits to individual tenants specifically for the value of their demand side response. DSR value therefore either needs to be pooled to the landlord or embedded into supplier offerings. It will be

challenging to embed DSR value in energy supplier offerings to tenants if the DSR is managed through a separate VLP. Pooling DSR value to the landlord may be possible even if the DSR is managed independently of other energy suppliers to the properties (whether those were landlord selected and paid or tenant selected and paid).

- It has also become clear that for those interested in providing grid support services (e.g. STOR, FFR) it is easier to make use of PV and batteries to generate flex value without impacting customers. Whereas using heat and hot water for flexibility requires a greater understanding and active monitoring of the impact on energy consumption and on consumer heating outcomes. Connected Response have been contracted by Moixa to enable this with existing participants, because their solution already provides understanding and management of heat needs.

## 3.2 Forward Opportunities for project to demonstrate valuable insights

A large map of potential HR project insights was developed during the workshops. These were distilled into three groups. Some form part of the project plan submitted to Mott Macdonald on 17th July, while others are less certain and may be explored further – either at a later stage in the project (if permitted), or as part of follow on research.

Group 1 represents the quantitative insights that align with the original project scope:

1) Reframed **core project objectives/questions** using quantitative modelling:

- What is the potential use case (or service provision) for electric (i) HW immersion heaters/switches, (ii) PV + battery systems? Are the use cases feasible?
- What is the financial value (and underlying potential business model) that can be brought to the consumer?
- What is the technical potential for scale up in London?

Groups 2 and 3 represent additional insights that might be possible:

2) Potential for **additional quantitative insights**:

- What are the differences between Heat-with-Rent vs. Tenant Pays energy bills?
    - What are the heating service benefits that CR have generated in their Heat-with-Rent installations?

- What is the effect on secondary heating of shifting to a smarter heating and hot water charging profile (e.g. via the use of a half-hourly settled ToU tariff)?
    - Do ToU tariffs provide an incentive to avoid secondary heating, when compared to economy 7?

Secondary heating is often at peak hours addressing poor evening heat from storage heaters and to offset hot water temperature loss during the day. In looking at the second question it may be possible to gain insights into:

- How much better off would customers be if they were on Economy 10 type or ToU tariffs?
- What is the benefit to the networks or eliminating secondary heating from the evening peak demand?

The initial Home Response installations and follow-up visits have confirmed that some residents still rely on using their immersion heaters at the evening peak because their night-charged water does not last until the following evening - this costs significantly more because it is charged on the On Peak tariff, at a time that is much less favourable for UKPN.

Using data collected to date it may be possible to assess the impact of alternative hot water charging profiles (eg 05:00-07:00) on energy and hot water heating outcomes, using hot water temperature changes to reveal information about secondary heating actions by tenants.

The data provided by Connected Response (CR) provides the opportunity to compare Landlord Supplied heat-with-rent energy consumption patterns, flexibility opportunities and customer outcomes with standard E7 off-peak water heating.

Better use of the data shared by Connected Response could be made if the HR project is able to further engage with some of the London Borough of Westminster's tenants currently receiving the CR service (under a landlord energy supply arrangement) to install hot water temperature sensors to allow a more direct comparison of their hot water temperature profiles.

3) Potential for **additional qualitative insights** (i.e. less quantitative/data-driven):

A qualitative assessment of the value chain in particular:

- Why do/would consumers engage?
- Why do/would landlords engage?
- What is the effect of smart control and flexibility on the use of secondary heating?
- What is the business case for the landlord?

- How does value get split across the value chain?

## 3.3 Further opportunities to add additional value to customers

**Upgrade existing Home Response hot water installs to control space heating and hot water**. This would provide customers who participated in Home Response the opportunity to make use of smarter tariffs as they emerge. It could also provide the Landlord (or their M&E contractors) with real-time alerts to heating or hot water defects or help identify households at risk of fuel poverty. Enabling control of both heating and hot water charge times is expected to require moving the switches installed and adding isolators between the switch and incoming supply meter. A supporting tariff /service offering would be needed to optimise value for tenants. The existing commitment is to remove the hot water controls at the end of the programme. The cost benefit of maintaining the controls in the absence of large clusters needs to be considered.

**Tariffs for Social Homes on Electric storage heating and hot water.** There is scope to engage existing supplier relationships (Connected Response with Utilita and EDF, GLA with LondonPower) to develop an enduring tariff to support hot water flexibility (and potentially electric heating flexibility) in London, potentially creating a much wider pool of residential demand response for the network and consumers who can benefit.

The National Energy Efficiency Data-Framework (NEED) data for 2018 identifies over 150,000 E7 metered properties in London. Not all would be social housing, but this highlights the potential for city network level impact if an appropriate tariff could be made available to Home Response customers as smart meters are rolled out.

**Use of Smart Meters**: Moixa continue to engage with DCC over the technical requirements to make direct use of SMETS2 smart meters to send and receive control signals without the need for supplementary communication channels (ie. Zigbee mesh networks and one or more mobile network gateways at each block of flats).

# 4 Conclusions (Deliverable D26)

The programme is still able to address the Core project objectives/questions using quantitative modelling:

- What is the potential use case (or service provision) for electric (i) HW immersion heaters/switches, (ii) PV + battery systems? Are the use cases feasible?
- What is the financial value (and underlying potential business model) that can be brought to the consumer?
- What is the technical potential for scale up in London?

The revised programme will look to support the development of the new insights identified, notably:

- What are the differences between Heat-with-Rent vs. Tenant Pays? This would quantify the potential benefits of an alternative to E7 tariffs
    - What are the benefits that CR have generated with Heat-with-Rent?
    - What is the effect on secondary heating of shifting to smarter heating controls. E10 type tariff or a half-hourly settled ToU tariff?

A qualitative assessment of the value chain in particular:

- Why do/would consumers engage?
- Why do/would landlords engage?
- What is the effect of smart control and flexibility on the use of secondary heating?
- What is the business case for the landlord?
- How does value get split across the value chain?

## 4.1 Other Legacy Value Opportunities

### Upgrading existing HR Hot Water installations

The business case for upgrading existing Home Response hot water controllers to add on space heating control should be considered. There is an existing cost commitment to remove the equipment at the end of the project. This should be compared to the cost of upgrades and the legacy benefits which those could bring if left in place, especially if no installation support commitment is made to Lewisham. Enduring value to tenants would also require a supporting tariff arrangement to be available.

### Improved energy tariff opportunities to enhance flexibility

Valuable insights could be gathered regarding potential scale-up to all off-peak E7 customers (NEEDs data indicates c150,000 E7 customers in London – Element Energy noted that from earlier investigations they estimated the GLA area to have c175,000 dwellings on storage heating, c100,000 on electric resistive heating and c75,000 on HW electric immersion heaters). This needs to be alongside engagement with energy suppliers to develop tariffs that support enhanced customer offerings (better heat / hot water control) while providing windows for the use of DSR.

### SMETS2 integration

Insights into the suitability of SMETS2 HCALC to control assets are still planned to be undertaken by Moixa for the HR project via lab testing. Insights into the potential for (and interface needs of) SMETS2 meters to enable flexibility without deploying additional communications links would be important input for planning future scale-up. Particularly in regard to if and when consumers can be signed-up individually (if they have a SMETS2) or still need to be recruited in clusters to make efficient use of additional communications systems.

Based on a first discussion with SLS, Moixa will put together a scope for the testing. This will involve using a SAPC device to trigger a serial device with a load controller (https://www.ncsc.gov.uk/files/CPA-SC-SAPC-v1-2.pdf ). For the purposes of the test, the intention is to use a Moixa Hub as the asset that is being triggered. Then instead of integrating with the DCC Interface, as we originally planned, SLS software would be used to emulate it within a test environment. This should allow the demonstration of an end to end dispatch without having access to DCC systems.

## 4.2 Potential actions and timescales

Two future plans have been proposed. In both version 1 (develop learning based on installations to date) and version 2 (acceleration on the pipeline) of the proposed plan, a new short deliverable will be submitted by Dec 21 which will provide an update on progress made against the actions. It must be noted that how far GLA is able to get against these objectives will be dependent on several external factors, including decisions regarding support for version 1 or 2, plus GLA internal resource or appetite.