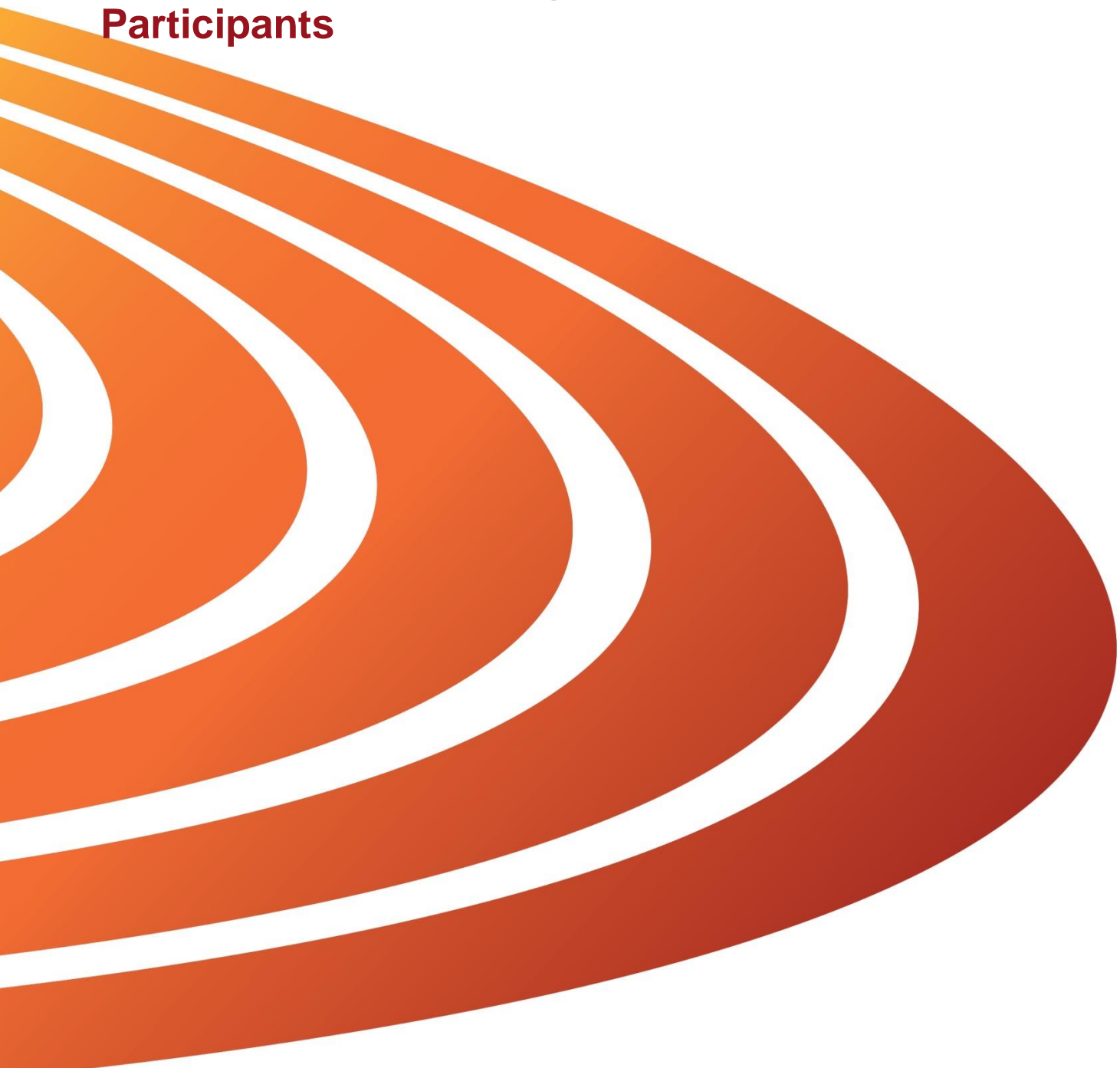


# **Vulnerable Customers and Energy Efficiency**

## **Low Carbon Network Fund**

**SDRC 9.1 – Trial Design & Identification of Trial  
Participants**



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## Definitions

Term	Description
<b>Control Group</b>	The group that does not receive the intervention in Trial 1, and is used for comparison to the intervention group to see if the interventions had any effect.
<b>Customer Panel</b>	A participant panel set up to ensure that there is ongoing feedback from participants.
<b>Energy Social Capital</b>	Context-specific social capital: purposively seeking information from people known to the respondent on the topic of energy efficiency in a home.
<b>External Control Group</b>	A group that does not receive an intervention as part of the project, but has had a smart meter installed previously. The external control group will enable generalisations to the wider population and enable understanding of influence of external factors on energy consumption, for example fuel price changes.
<b>Customer Field Officer (CFO)</b>	The intermediary hired by the project to be the contact for participants, and the 'face' of the project. The Field Officers duties will include recruiting and engaging participants along with gathering data.
<b>Datalogger</b>	A non-fiscal meter that measures electricity consumption. It also referred to as secondary electricity meter.
<b>HAN</b>	Home Area Network.
<b>Intervention Group</b>	This is the group exposed to the treatments (interventions) in Trial 1.
<b>MDU</b>	Multiple Dwelling Unit meaning a building housing more than one premises with physical disparate metering such that a wireless MDU Communication Infrastructure is required.
<b>MDU Communication Infrastructure</b>	The wireless communication infrastructure that will be tested, installed and commissioned in certain categories of buildings.
<b>Pilot study</b>	A small scale preliminary study that usually takes place before full investigation in order to test certain elements of, e.g., a research design.
<b>Purposive Sampling</b>	Purposive sampling is a type of non-random sampling that is done for a certain 'purpose'.
<b>SMETS</b>	Smart Meter Equipment Technical Specifications.
<b>Self-disconnection</b>	Means a scenario where a customer is unable to use power because they have run out of credit in a fiscal meter which is not a Smart Meter.
<b>Sample</b>	The segment of the population that is selected for the research. It is a subset of the population <sup>1</sup> .
<b>Sampling Frame</b>	Sampling frame is "the listing of all units in the population from which a sample is selected.
<b>Self-disconnection diary</b>	This diary has place for 6 entries of self-disconnection. It is a diary given to all prepayment customers, who are asked to complete one entry each time they disconnect, including the date and time and reason for disconnecting, and how much they topped up with afterwards.
<b>Smart Energy Display (SED)</b>	The display unit that accompanies the Smart Meter that displays the energy consumption and cost of energy unit. It is also known as In Home Display (IHD)
<b>Smart Energy Expert</b>	The appropriately trained engineer of British Gas tasked to install smart meters according to the Smart Meter Installation Code of Practise (SMICoP) and internal British Gas processes.
<b>Smart Meter</b>	The advanced meter offered by British Gas as part of their business as usual activities offering advanced functionality compared to a traditional meter.
<b>Smart Metering System</b>	The British Gas Smart Meter solution installed by British Gas including the electricity Smart Meter (credit or prepayment), gas Smart Meter, In Home Display, Communications Hub, Home Area Network (HAN), Wide Area Network (WAN), head end data management system. Smart Meters will be compliant with SMETS 1.

<sup>1</sup> Department of Energy and Climate Change (DECC), "Annual Fuel Poverty Statistics Report, 2014," London, 2014.

<b>Time of Use Tariff</b>	The tariff containing different pricing bands depending on the hour of the day.
<b>WAN</b>	Wide Area Network being the mobile network that connects the communication hub installed at the customer premises with the head end data management system of the back office of British Gas. The WAN allows the transmission of the consumption data from the customer premises to the central data collection system of British Gas.

## Executive Summary

UK Power Networks' Vulnerable Customers and Energy Efficiency (VCEE) Low Carbon Networks Fund (LCNF) project was awarded £3.3 million in 2013 as a LCNF Second Tier project. The project started in January 2014 and runs through to the end of 2017.

The project will investigate how Distribution Network Operators (DNOs), in collaboration with an energy supplier, charity groups and local community actors can engage with fuel poor customers in order to facilitate energy efficiency and demand side management.

The overarching aim of the project is to understand the energy needs of fuel poor customers (a group with significant overlap with those who are vulnerable) and explore the means to encourage their increased participation in energy efficiency and demand side response. This will provide DNOs and suppliers with evidence-based learning on how to work with third party agencies to deliver energy efficiency and demand side response campaigns to fuel poor customers and whether these are cost effective. It will determine the extent to which fuel poor customers are willing and able to use demand reduction and time-shifting measures and whether these are significant for the DNO.

DNOs are forecasting increasing and more uncertain demands on their networks as the result of the electrification of heat and transport, increased reliance on micro- and distributed generation and a desire for a low carbon economy. Enabling and encouraging as many customers as possible to change their pattern of demand and participate in Demand Side Response (DSR) and other energy saving activities will help to mitigate this substantial challenge.

To date, with regard to DNOs, there has been little direct research and operational attention directed at supporting vulnerable or fuel poor customers regarding DSR. This group of customers can benefit from the low carbon transition but have the least ability to access these benefits. The project will support this group and allow them to fully participate in energy saving and DSR opportunities.

This report is the first Successful Delivery Reward Criteria (SDRC 9.1). The report is focused on the trial design, encompassing research, technical and customer perspective and also addresses the methodology for identifying fuel poor customers. It presents definitions of fuel poverty adopted by UK Government and the project, discusses the challenges associated with identifying fuel poor customers and concludes with a list of indicators that are going to be used in order to identify the customer base of the project.

Section 1 of the report provides an introduction to UK Power Networks, an overview of the project, the project's drivers, scope, objectives and partners. The anticipated learnings and innovative technologies that the project is going to install are also discussed. Section 2 describes the trial area where the project is going to be implemented. Section 3 provides the definitions of fuel poverty and presents the indicators the project is going to adopt in order to identify the eligible customers for participation in the project.

Section 4 continues with describing the design of the trials and the suite of interventions that the project is going to provide to eligible customers and discusses the architecture of the interconnection of the different technical elements. The journey that the customer is going to experience as part of his/her participation in the project and the role of the Customer Field Officers are then addressed in section 5.

The report continues with section 6 which focuses on the anticipated learning outcomes from the customer, research and technical aspect. Conclusions are presented in section 7.



## 1.0 Introduction

### 1.1 What does UK Power Networks do?

UK Power Networks owns, operates and manages three of the fourteen electricity distribution networks in Great Britain and delivers electricity to over eight million customers. UK Power Networks own the licensed distributors London Power Networks plc, Eastern Power Networks plc and South Eastern Power Networks plc. UK Power Networks is a network operator and does not generate or buy electricity nor does it sell it to end customers. UK Power Networks' networks operate in the most challenging, fastest growing, and highest cost part of the country.



**Figure 1: Area of Operations of UK Power Networks**

### 1.2 Project Overview

The VCEE project (the project) was awarded £3.3 million in 2013 as a LCNF Second Tier project. The project started in January 2014 and will run through to the end of 2017.

The project intends to:

- Engage fuel poor customers to understand how they can benefit from energy efficiency<sup>2</sup> and participate in demand side response;
- Quantify the demand reduction and time-shifting that these customers could provide; and
- Understand the challenges and best approaches to engaging with this group of customers.

The project will provide Distribution Network Operators (DNOs) and suppliers with evidence-based learning on how to work with third party agencies to deliver energy efficiency and demand side response campaigns to fuel poor customers. It will also determine the extent to which fuel poor customers are willing and able to provide demand reduction and time-shifting services to alleviate network constraints and assist DNOs in their management of increasing and uncertain demands forecasted on the electricity network.

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<sup>2</sup> In this report the term “energy efficiency” also encompasses “energy conservation”.

The project will run in the London Borough of Tower Hamlets, which is one of the most deprived areas in England, with high penetration of fuel poor customers, social housing and tower blocks. The project aims to recruit and maintain the participation of up to 550 households (being Tower Hamlets Homes or Poplar HARCA tenants who are also British Gas electricity customers). The project will initially conduct a pilot study followed by two trials:

1. **Trial 1: Energy efficiency:** identifying the magnitude of energy savings and the impact on the electricity network when customers have access to smart metering solutions, simple affordable energy saving devices and energy saving advice.
2. **Trial 2: Demand side response:** assessing the level, and impact on the network, of demand shifting, achieved through the introduction of a 'time-of-use' (ToU) tariff in parallel with energy-saving activities.

The pilot study will be conducted prior to the commencement of trial 1 and will be focused on a limited number of identified fuel poor customers. It aims to provide learnings that will shape the recruitment, engagement and operational strategy of the main project trials.

The trials will research the effectiveness of techniques and capture learning on:

- the level of response from the fuel poor to smart metering data and time-of-use tariffs;
- energy cost savings achieved from customer interaction with trial interventions;
- the impact on network reinforcement from reduction or shift in energy consumption;
- improved demand profiling for these customers; and
- engagement materials and channels effective in supporting their behaviour;

to enable sharing and dissemination of best practice.

### 1.3 Project Drivers

#### **Fuel poor customers have the potential to deliver technical benefits through their interaction with energy efficiency and DSR**

The technical potential for various segments of the community to shift their electricity usage or to achieve energy efficiency savings were explored through the Household Electricity Usage Study (HEUS) household report that was undertaken on behalf of DECC and DEFRA using data collected from 250 households<sup>3</sup>. Focusing on household types from the HEUS study representative of the project's targeted households, it is estimated that fuel poor customers could provide the following technical potential: demand reduction at 655kWh/annum per household and 100-200MVA technical peak shifting available across GB<sup>4</sup>. This provides the basis for further investigation under trial conditions to determine an approach for this technical potential to be accessed.

It should also be noted that the HEUS household data was the best available information in the UK for researching fuel poor technical opportunities; however it had two limitations/deviations to UK trends:

- A fairly low representation from Experian Mosaic Groups representative of those that the project is targeting.
- HEUS households were limited to easily accessible owner-occupiers in England. Therefore, no social housing tenants captured. The project will be targeting only social housing tenant customers.

Therefore there is great value for a project being undertaken to deliver findings to fulfil this gap in insight, using academic research and trial demonstration.

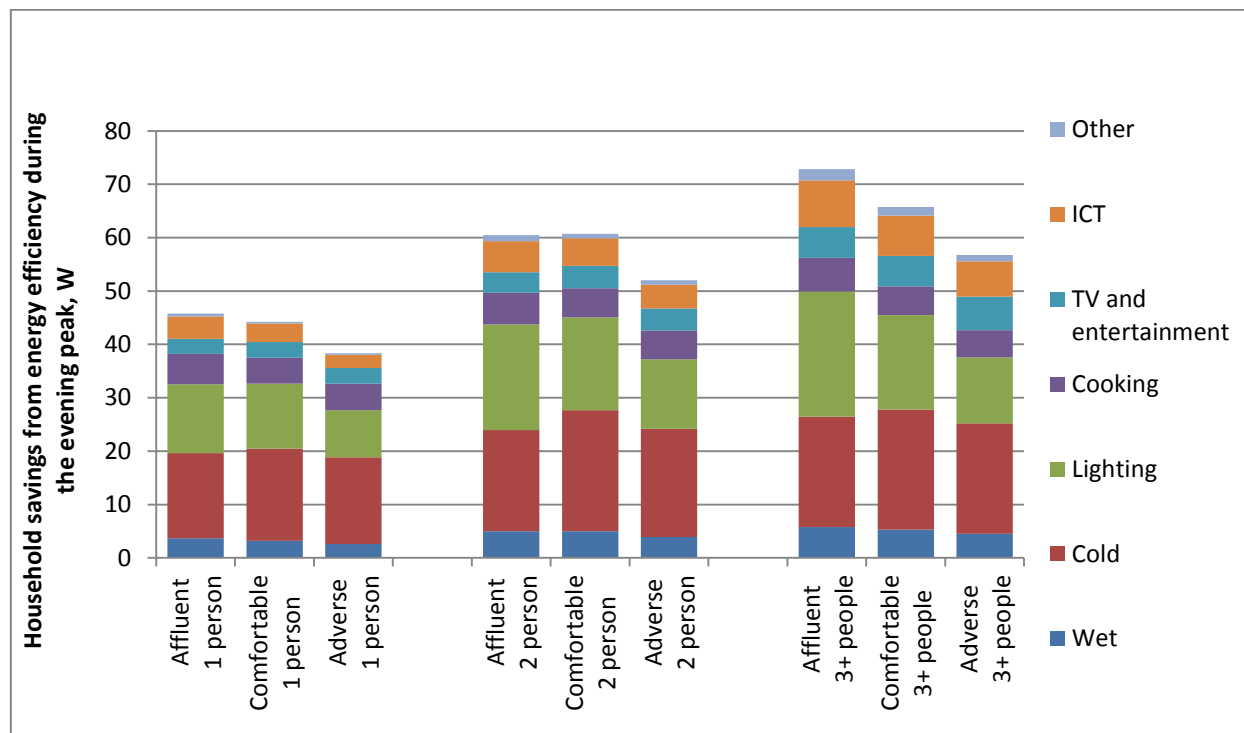
Moreover, Low Carbon London (UK Power Networks' Low Carbon Network Fund Second Tier project) investigated network impacts of energy efficiency at scale and it was found that household occupancy and income were strong drivers for domestic lighting and appliance energy efficiency savings. Focusing on the Low Carbon London household type 'Adverse' (representative of the projects' targeted households), the energy efficiency opportunities among these households are sizeable, particularly among higher occupant (three or more people) households. Please see Figure 2: **Appliance energy efficiency savings for different household types during the evening peak in 2020 – 'future policies' scenario**.

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<sup>3</sup> Source: DECC, Defra and the EST (2012), "Household Electricity Survey: A study of domestic electrical product usage".

<sup>4</sup> Low Carbon Networks Fund submission from UK Power Networks – Vulnerable Customers and Energy Efficiency, 28th November 2013





**Figure 2: Appliance energy efficiency savings for different household types during the evening peak in 2020 – ‘future policies’ scenario**

To conclude, as fuel poor customers have the potential to provide such energy efficiency savings and shift of their electricity usage, it is important to undertake a further study to explore and qualify their domestic usage behaviours; their ability, willingness and responsiveness to energy efficiency and demand side response to ensure that this group is appropriately targeted in such network services and their technical potential is realised.

### **Fuel poor customers need the benefits from the low carbon transition the most but have the least ability to access the potential benefits**

The government's Low Carbon Transition Plan necessarily has an impact on customers' energy bills. Those with the potential to be hardest hit include the 4.5 million fuel poor in the UK<sup>5</sup>, of which a significant number are also vulnerable in some way. It is widely accepted that fuel poor customers are the group that:

- are least able to access the potential benefits from the low carbon transition;
- need these benefits the most; and
- requires the most assistance to realise them.

It is particularly important that these customers are able to realise the potential benefits from industry initiatives, which include the smart meter rollout programme, as they are least able to absorb any bill increases since many may already be experiencing significant difficulty with their energy bills.

### **Fuel poor customers need to be approached in a different and more appropriate manner**

It is frequently argued that fuel poor customers require additional help and support to engage with smart meters and energy efficiency devices to enable them to access the range of benefits available to them. Significant strides will need to be taken to assist the fuel poor to use smart meters to manage their energy, as experience has shown that these customers are the most difficult to engage with and the best approach has yet to be

<sup>5</sup> Department of Energy and Climate Change (DECC), "Annual Fuel Poverty Statistics Report, 2014," London, 2014.

determined. UK Power Networks' management of its Priority Services Register (PSR) and the Low Carbon London project, indicates that these customers need to be approached in a different and more appropriate manner. In the Low Carbon London trials, the Inner City Adversity ACORN group was the most prevalent to refuse to have a smart meter, owing to it being too technical / confusing.

### **New era for DNOs to have direct liaison with end customers**

As part of RIIO-ED1, Ofgem is placing new obligations on DNOs, requiring them to play a proactive role in addressing consumer vulnerability. DNOs should therefore take an active role in the assistance of the vulnerable customers and develop best practise operational processes to support them. Direct liaison between UK Power Networks and its end customers is predominantly a new area (except in the resolution of power outages and new connections). Historically, apart from their PSR obligations, DNOs have had a limited role in initiatives addressing the needs of vulnerable customers as contact with these groups has been minimal and primarily via suppliers. To date initiatives to alleviate fuel poverty and address vulnerable customer needs have focused on government and supplier efforts.

### **Collective responsibility to support fuel poor customers through the transition to a low carbon economy**

The government has proposed a new fuel poverty strategy<sup>6</sup>, with the current target of ensuring that as many fuel poor homes as possible will have energy efficiency improvements implemented at their homes<sup>7</sup>. It is also legally bound to cut emissions across the whole UK economy by 50% by 2025, and further by 2030 as part of the move to a low carbon future. Moreover, the government has embarked on a multi-billion pound programme to rollout smart meters to all customers by 2020<sup>8</sup>. This creates a mechanism through which customers can participate in energy saving and shifting activities, with the potential to make energy cost savings through better understanding and control of their energy use.

This collective responsibility of the wider energy industry, including DNOs, to support fuel poor customers through the transition to a smarter energy system is significant, and to date has received little direct research and operational attention. It has been the focus of considerable interest from charities, social enterprises, consumer groups and the media and will be an issue on which the success of the smart meter rollout and the realisation of customer and network benefits are judged. Although some smart meter trials and energy efficiency studies have been undertaken previously, the project firmly believes that the project takes an innovative approach to assisting the fuel poor customer groups as a whole, providing benefits to both customers and networks. Furthermore, this is the first LCNF project to specifically address the need of fuel poor customers with smart metering systems.

## **1.4 Project Purpose**

The overarching aim of this project is to understand the requirements of the fuel poor and explore the means to encourage their increased participation in energy efficiency and in Time-of-Use (ToU) tariffs. The project reflects UK Power Networks' desire to support the fuel poor customer groups and allow them to fully participate in DSR and energy saving opportunities, reducing their own bills, accessing cost reduction offers, and playing a small but socially important role in supporting the network. It will provide DNOs with evidence-based learning on the extent that fuel poor can engage in energy saving initiatives and demand side response and consequently

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<sup>6</sup> Department of Energy & Climate Change (DECC) and The Rt Hon Edward Davey MP, "Future fuel poverty framework: target, strategy and advisory group," 22 July 2014. [Online]. Available: <https://www.gov.uk/government/speeches/future-fuel-poverty-framework-target-strategy-and-advisory-group>.

<sup>7</sup> Department of Energy and Climate Change (DECC), "The Fuel Poverty (England) Regulations 2014," London, 2014.

<sup>8</sup> Department of Energy & Climate Change (DECC), "Smart Metering summary plan," 2013.

whether their move and reduction in demand benefits the network by deferring or avoiding network reinforcement.

### 1.5 Project Objectives

The project's six core objectives are to research and build evidence-based learning on:

- how to identify and use existing networks which the customers trust to effectively engage fuel poor customers in the adoption and use of smart metering technologies;
- the amount of energy savings (in energy and monetary terms) arising from a set of intervention measures tailored to the specific resources and needs of the trial area community;
- the amount of energy shifting arising from a package of intervention measures tailored to the specific resources and needs of the trial area community;
- the potential impact on network reinforcement from reduction or shift in energy consumption;
- improved demand profiling for these customers; and
- what engagement material and communications channels were effective in reinforcing and supporting their behaviour.

### 1.6 Project Trials

The project aims to recruit and maintain the participation of up to 550 households during the trials. The project will focus on the fuel poor and this customer group has significant overlap with those people who are vulnerable. The customer recruitment pool will be fuel poor residents of Tower Hamlets Homes and Poplar HARCA both of which are located in the London Borough of Tower Hamlets. In addition, some of these residents reside in apartments in block of flats (with meters residing on communal areas, ground floor cupboards, basement areas, etc.) which present challenges on the implementation of the smart metering systems and a proportion have Pre-Payment (PPM) services. In the context of the smart metering implementation programme, these specific apartments and flats are referred to as Multiple Dwelling Units (MDU) and we use this terminology in the remainder of the report. These buildings are also known as 'Tall and Difficult' due to the technical challenge they present and are described in section 4.5.3.

A key element of the smart meter roll out is the Smart Energy Display (SED), potentially augmented by improved customer billing information. The SED is normally 'connected' to the smart meter by a short range wireless communication link. This communication method cannot function properly in the MDU flats and an alternative communication solution should be investigated in order for the aforementioned benefit of the smart meter roll out to be delivered.

The same 550 households divided into two groups will participate in two sequential 12-month trials.

- **Trial 1 – Energy efficiency:** identify the magnitude of energy savings when participants have access to smart metering solutions, simple affordable energy saving devices and energy advice.
- **Trial 2 – Demand side response:** assessing the level, and impact on the network, of demand shifting, achieved through the introduction of a 'time-of-use' (ToU) tariff in parallel with energy-saving activities.

An additional learning benefit of trial 2 is testing roll out approaches: the 'big bang', when the smart meter, SED, energy saving & shifting products, Time-of-Use (ToU) tariff and energy advice are provided all at once, compared with the 'drip feed' approach where they are staggered.

		Trial 1 – Energy Saving	Trial 2 – Energy Saving & Shifting
With-in the VCEE trials	Group 1	<b>Intervention Group</b> <i>Intervention package:</i> Provision of SMETs meters with IHDs, energy saving devices and energy advice.	<b>Intervention Group</b> <i>Intervention package:</i> Provision of energy shifting devices and Time of use tariffs (ToU). This is in addition to the previously installed equipment for Trial 1 (SMETs meters with IHDs and energy saving devices).
	Group 2	<b>Control Group</b> Only the installation of data loggers.	<b>Intervention Group</b> Provision of SMETs meters with IHDs, energy saving devices, energy advice, energy shifting devices and ToU tariffs.
	Monitoring	<b>Network Monitoring:</b> Monitoring at both Primary and Secondary level.  <b>Temperature monitoring:</b> For both trial participant groups, to ensure that they maintain an acceptable level of warmth whilst reducing and shifting their energy consumption.	
Outside the VCEE trials	Smart meter customers	<b>External Control Group</b>	<b>External Control Group</b>

Figure 3: Trials structure

### 1.7 Partners – who are we working with?

The project is adopting a method of working collaboratively with a key energy supplier (British Gas), academia (University College London) local community actors (Tower Hamlets Homes, Poplar HARCA,), charitable bodies (Bromley by Bow Community Centre , National Energy Action, Institute for Sustainability) and partners (CAG Consultants) that are specifically engaged with fuel poor customers, to enable them to participate in the demand-shifting and energy efficiency market to realise the maximum benefit from smart meters.

Organisation	Role in the Project
<ul style="list-style-type: none"> <li>British Gas</li> </ul>	<ul style="list-style-type: none"> <li>The role of British Gas in the project is related to technical enablement and will provide the smart meters, SED, and ToU tariff required for the targeted customer group to engage with demand side response. British Gas will also install (in cooperation with its contractors) the appropriate communication infrastructure required in MDUs as explained below.</li> </ul>
<ul style="list-style-type: none"> <li>University College London</li> </ul>	<ul style="list-style-type: none"> <li>Since its foundation in 2009 UCL-Energy has developed a strong national and international reputation for research in energy demand and energy systems. University College London is the research authority of the project and its aim is to ensure that the results of the trials are statistically rigorous and the findings could be replicated in future.</li> </ul>
<ul style="list-style-type: none"> <li>Institute for Sustainability</li> </ul>	<ul style="list-style-type: none"> <li>An independent charity established in 2009 to support cross sector collaboration and innovation. Institute for Sustainability will capture and communicate lessons learnt over the course of the project and support the project in knowledge dissemination activities. The project envisages that the lessons learnt captured during the course of the project will support the replication of the project findings.</li> </ul>



Organisation	Role in the Project
<ul style="list-style-type: none"> <li>Tower Hamlets Homes and Poplar HARCA</li> </ul>	<ul style="list-style-type: none"> <li>Tower Hamlets Homes and Poplar HARCA are social housing associations which are going to provide to the project team the list of eligible tenants. They will also provide insights into the area and local intelligence that has shaped the customer engagement strategy.</li> </ul>
<ul style="list-style-type: none"> <li>Bromley by Bow Community Centre</li> </ul>	<ul style="list-style-type: none"> <li>Bromley by Bow community Centre will provide knowledge of best practise during customer engagement and will be also tasked to employ the customer field officer team, which is going to be a team dedicated to the recruitment and engagement with the trial participants (prospective and actual).</li> </ul>
<ul style="list-style-type: none"> <li>CAG Consultants</li> </ul>	<ul style="list-style-type: none"> <li>CAG Consultants is a sustainability, climate change and community engagement consultancy which is going to represent the voice of the customer in the project. CAG Consultants will provide specialist support, guidance, mentoring, training and evaluation of recruitment and engagement with vulnerable and fuel poor customers.</li> </ul>
<ul style="list-style-type: none"> <li>National Energy Action (NEA)</li> </ul>	<ul style="list-style-type: none"> <li>NEA is the national fuel poverty charity which aims to eradicate fuel poverty and campaigns for greater investment in energy efficiency to help those who are poor and vulnerable. NEA will provide expertise in energy efficiency and customer focus due to its continuous engagement with fuel poor customers</li> </ul>

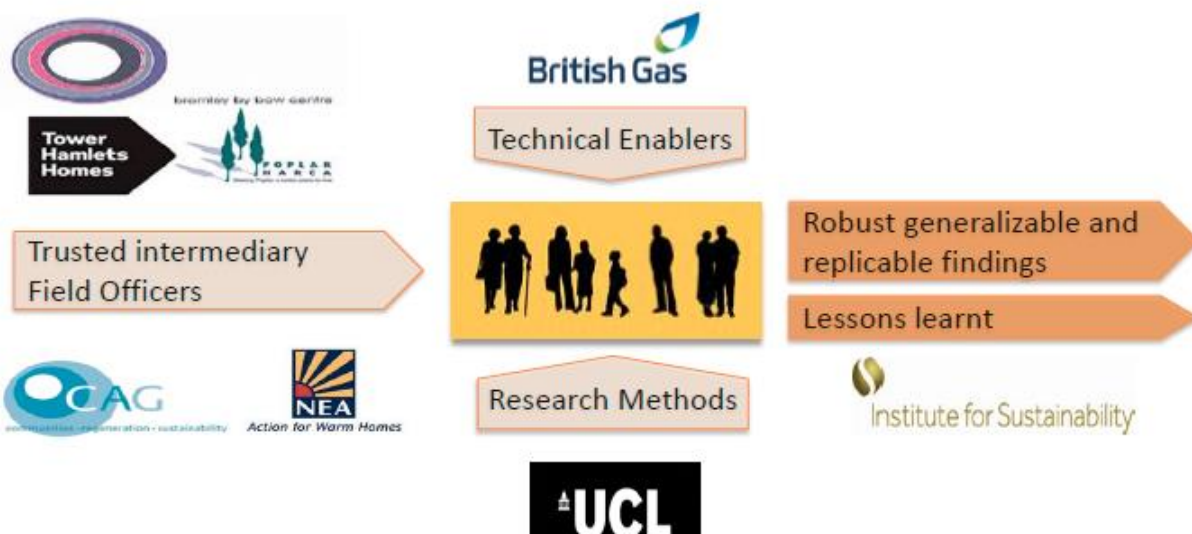


Figure 4: Project partners

## 1.8 What is innovative about the Project?

### Learning Outcomes and SDRC

The learning outcomes of the project are stipulated in the Successful Delivery Reward Criteria of the project (listed below) and the main categories where learning outcomes are anticipated are analysed below.

- SDRC 9.1: Trial Design and identification of customer participants (this report).
- SDRC 9.2: Customer Recruitment
- SDRC 9.3: Energy Saving trial
- SDRC 9.4: Customer Engagement
- SDRC 9.5: Energy Shifting trial
- SDRC 9.6: Knowledge dissemination



### Customer Insights

The project will explore how fuel poor customers can respond to energy efficiency and DSR and what opportunity is created in order for them to reduce their energy bills. Furthermore it will investigate what opportunities can be created for the customers through an end-to-end coordinated approach between different parties in the value chain (i.e. exploration of enhanced services during a power outage). Also, the needs of the fuel poor will be further analysed, identified and profiled and such learning can tailor services offered.

### Network Insights

The project is going to investigate the engagement of fuel poor customers with energy efficiency and DSR and identify and quantify if this customer group can offer network services which can defer network reinforcement. The project will support DNOs to realise the potential contributions and benefits of energy efficiency and load shifting from these domestic customer groups in a sustained manner to help DNOs to manage the increasing and uncertain demands on the network. The project will identify the technical potential and scale in which fuel poor customers can engage in energy efficiency and DSR and can influence the strategy of DNOs for future network planning.

### Customer Recruitment & Engagement Strategy

The project will understand and develop the specific customer engagement measures that are required to ensure that fuel poor customers are effectively assisted as smart technology and energy saving and shifting devices evolve. In addition, the project is going to provide insights on the challenges faced and best practises identified when recruiting and engaging with fuel poor customers and this learning will be used in order to tailor the services offered from the DNOs and other stakeholders participating in the project.

### Wider Learnings

The project will generate and capture as much additional learning as possible. Wider benefits are also expected to result from the project as a result of a better understanding of fuel poor customers, both for the DNO and across Great Britain due to its social theme and replicability. As Ofgem has noted, consumer vulnerability is influenced by a wide range of life factors that include, but extend beyond, aspects of energy use.

### Innovative Partnerships

The project brings together a unique set of project partners, including social housing landlords and third party organisations, who work with and support fuel poor customers. The project's delivery and learning outputs will build a much better understanding of how DNOs and suppliers can work together with these stakeholders to better serve such customers. The overall solution from the project will provide a strategy for DNOs to work collaboratively with electricity suppliers and community actors to better identify, understand the needs, assist and deliver services to the fuel poor, within existing obligations.

As part of the project, an energy supplier British Gas will also be exploring the effectiveness of working with local and trusted third parties such as the housing provider and community centre in order to carry out a locally targeted, community-led installation programme of smart meters. It is anticipated that this approach will lead to improved access rates for British Gas' Smart Energy Experts, greater community engagement and increased customer awareness of the benefits of smart metering, whilst lowering missed appointment and no-access rates.

### Testing key parts of the smart meter infrastructure

To achieve the national smart meter roll out there are a number key technology challenges that must be overcome, to ensure the maximum number of customers can enjoy the benefits of smart metering.

- **Prepayment smart meters:** as part of the project British Gas will be installing some of its first SMETS1 compliant smart meters with prepayment functionality outside of their trial environment. This will provide an opportunity to gain some valuable early insight as to the extent prepayment customers engage with smart meters. Smart prepayment will also bring about a range of innovative mechanisms for payment to customers with over the air top ups (e.g. via mobiles, internet) meaning no more interaction directly with the meter and not having to worry about losing their key card. It will also open up a number of new, more convenient ways to top up such as over the phone, online and via their in home display.
- **Multiple Dwelling Units (MDU):** British Gas has already conducted a high level visual inspection of the housing stock in the trial area of Tower Hamlets and identified a potential number of properties with challenging metering arrangements such as the meter being in a ground floor cupboard, which may be eligible for MDU Communications Infrastructure. As part of the Project British Gas will be looking to install a MDU Communications Backbone in eligible building(s) which would enable the smart meter HAN services to be extended to 100% of homes in these building(s). Not only will this be a valuable technical learning, but it will provide insight into the cost of this type of infrastructure as well as the commercial arrangements required between energy supplier, the landlord and the customer. This is something that has not been fully concluded as part of the smart meter implementation programme.

## 2.0 Trial Area

The project will be recruiting and engaging with fuel poor customers in the London Borough of Tower Hamlets (Figure 5: Tower Hamlets area). Tower Hamlets is an inner London borough located in east London and covers much of the traditional east end, as well as part of the redeveloped Docklands region.

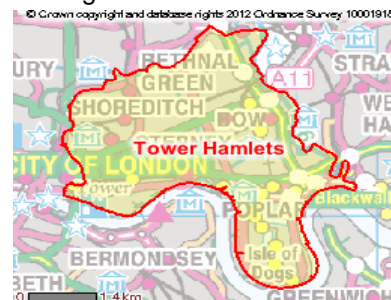
The borough<sup>9</sup> has a population of 254,000 (102,000 households). According to the Department of Communities and Local Government, the London Borough of Tower Hamlets is ranked the third most deprived borough in England (out of 326)<sup>10</sup>.

The trial area was chosen because UK Power Networks wanted to assess a number of factors that would either contribute to fuel poverty, or indicate that the residents were potentially vulnerable. For this purpose, UK Power Networks drew data from a study conducted by

NEA that was commissioned as part of the work UK Power Networks is carrying out in order to help identify vulnerable and fuel poor customers.

Some measures that are related to domestic energy use and would indicate the risk of vulnerability or fuel poverty are as below:

- Ethnic background and language barriers
- Employment
- Age
- In receipt of Pension Credits
- Health and disability
- Low income – high costs
- Child poverty
- Excess Winter Deaths (EWD – reflects how many more deaths there are during winter months compared with the non-winter months of the year).



Source: Office for National Statistics, Neighbourhood Statistics, 2013

**Figure 5: Tower Hamlets area**



**Figure 6: Part of Poplar HARCA's Lansbury Estate.**

According to the 2011 UK Census, 6.1% of Tower Hamlets residents are 65 or older. With over 47% of the 60+ population in Tower Hamlets in receipt of pension credit, their low incomes would likely put them at risk of falling into fuel poverty.

The combination of an aging population and fuel poverty can contribute to EWD. Over the last five winters for which data is available, there have been 52 annual EWDs in Tower Hamlets<sup>11</sup>. Winter deaths in Tower Hamlets exceeded non-winter deaths, on average, by 15.63%<sup>8</sup>.

<sup>9</sup> Information in this section is taken from a study conducted by National Energy Action (NEA) for UK Power Networks Profiling report for selected London Boroughs in the London Power Networks Area

<sup>10</sup> Department for Communities and Local Government (DCLG), "Indices of Deprivation," 2010.

<sup>11</sup> 'Excess winter deaths' is defined as the difference between the number of deaths which occurred in winter (December to March) and the average number of deaths during the preceding four months (August to November) and the subsequent four months (April to July).

It is not of course only those of pensionable age who can be vulnerable. In total 13.5%<sup>8</sup> of Tower Hamlets population have a long term health issue, or disability that limits their day-to-day activities.

Language barriers can also leave customers vulnerable, especially during an emergency. Tower Hamlets is a multi-cultural borough with 8%<sup>8</sup> of the population either not being able to speak English well, or not at all.

Low income is a key factor contributing to fuel poverty. Two indices that are indicative of low incomes are those that measure employment and child poverty. 13.4% of economically active (employed or seeking employment) in Tower Hamlets<sup>12</sup> are unemployed; this is a higher rate of unemployment than both London (8.9%) and Great Britain (7.8%) as a whole. This figure contributes to the level of child poverty within the borough. Child poverty is measured using a relative definition of poverty, the poverty threshold for which is set at 60% median household income. Within the borough of Tower Hamlets, 41.5% of children live in poverty against a national average of 30%. Although the revised definition (Low Income, High Cost) has changed the distribution, Tower Hamlets still has 3.8%<sup>8</sup> of its population known to be in fuel poverty.

## 3.0 Trial Participants

### 3.1 Introduction

This section is focused on addressing the definition of fuel poverty that the project takes into consideration and the resulting indicators that are used in order to identify the prospective trial participants.

### 3.2 Definition of fuel poverty

Recently, the UK Government changed its definition of fuel poverty, based on a review by John Hills<sup>13</sup>. Previous to the adoption of the recommendations in the Hills Review<sup>12</sup>, fuel poverty and fuel poor people were defined as those who needed to spend more than 10% of their income on fuel to maintain a satisfactory heating regime (typically 21°C in the living area, and 18°C in other occupied rooms). The Hills Review concluded that some of the assumptions in the 10% definition were slightly outdated. The new definition suggested by Hills is a 'Low Income High Cost' (LIHC) definition. In this definition, a household is considered to be in fuel poverty if the residents have fuel costs that are above average (the national median level), and were they to spend that amount (for the fuel cost) they would be left with a residual income below the official poverty line<sup>14</sup>. This definition measures the extent of fuel poverty. It is also used with a 'fuel poverty gap' measure that measures the depth of fuel poverty. The new definition resulted in a change in the number of those people considered to be fuel poor. This definition is also the definition that this project has adopted, specifically looking at LIHC. However, the project also acknowledges the 10% definition, as the Government continues to measure according to that indicator as well.

### 3.3 Fuel poverty indicators

Notwithstanding the recent Hills Review of fuel poverty and the construction of the LIHC measure, fuel poverty remains a complicated and ill-defined concept reliant on many modelling assumptions about the construction of the properties, technology performance (e.g. boiler efficiency) and occupant behaviour. It also requires knowledge of the household income. In the absence of knowing the full details of a household's income, housing quality, energy behaviour and energy costs in advance, proxies must be used to identify the fuel poor. The project has always sought to be as specific as possible about who was in fuel poverty, based on

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12 Office for National Statistics, "Official Labour Market Statistics (NOMIS)," August 2013. [Online]. Available: <https://www.nomisweb.co.uk/>.

13 J. Hills, "Getting the measure of fuel poverty," London, 2012.

14 Department of Energy and Climate Change (DECC), "Annual Report on Fuel Poverty Statistics, 2013," London.



characteristics of people's homes and other indicators related to income, age, number of people in a household, etc. However, due in part to the research design methods (random selection of a number of persons from the sample frame), and to a far greater extent to the lack of publicly available data on the population, the fuel poverty indicators for this project are limited and include the following:

- **Area-based:** The London borough of Tower Hamlets is an urban area, which has been identified as having high levels of deprivation<sup>7</sup>.
- **Income:** Living in social housing will be used a proxy for the income<sup>15</sup> as half of residents in social housing have been determined nationally to be of low-income when compared to owner-occupiers<sup>16</sup>.
- **Building information:** The project is using publically available data on Energy Performance Certificates (EPCs), which rate dwellings on their energy efficiency, with A being the most efficient and G being the least. The greater risk of fuel poverty is identified at buildings with lower EPC rating since low EPC rating indicate greater heat loss<sup>17</sup>. The summary data from the social housing organisations which are partners to the project indicated an insufficient number of properties in bands D-G. Therefore, the project is including bands C to G, but where possible only targeting those in band C based on area-based methods which will encompass indicators of income (e.g. taking into account Lower Super Output Areas (LSOA) data).

It is important to stress that before recruitment of eligible customers into the project, and therefore before consent is given from the customers to use their personal data, only publically available data can be used to screen for eligible participants. These publicly available fuel poverty indicators will not guarantee that households will be in, or even necessarily near, fuel poverty. However, without knowing further details of households' income, fuel costs and building fabric (or proxies, such as receipt of benefits), this is the best method available.

It is also worth noting that, similar to the Hill's LIHC definition of fuel poverty which acknowledges that fuel poverty is a spectrum and not a binary distinction, it is expected that energy behaviours in response to fuel poverty will lie on a spectrum, and therefore there will be no sharp distinction between those just in fuel poverty and those just outside it.

### 3.4 The Project Eligibility Criteria

The aim of the eligibility criteria is to identify the pool of customers that can be considered as candidates for participation in the project and to whom an invitation for participation will be sent.

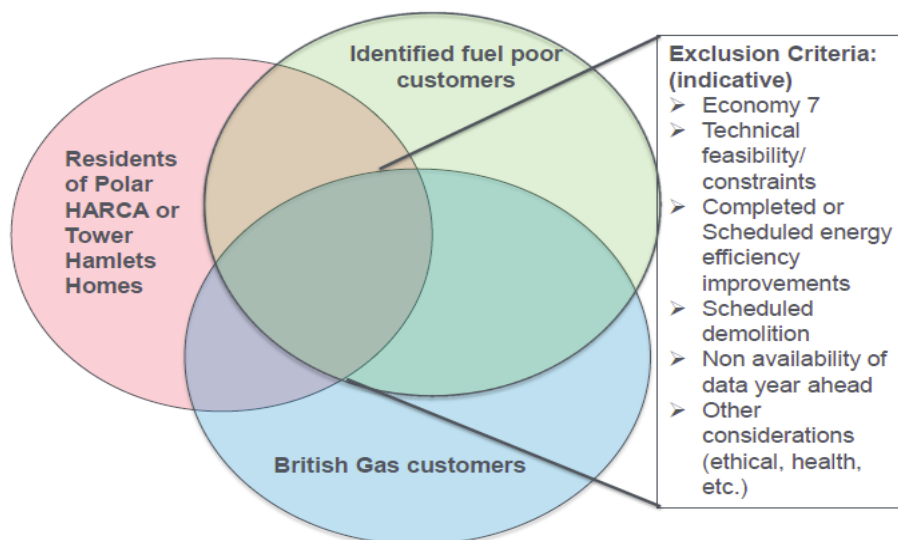
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<sup>15</sup> F. M. Pinkster and B. Völker, "Local Social Networks and Social Resources in Two Dutch Neighbourhoods," *Housing Studies*, vol. 24, no. 2, pp. 225-242, 2009.

<sup>16</sup> "Polarisation by housing tenure," 22 September 2014. [Online]. Available: <http://www.poverty.org.uk/76/index.shtml>.

<sup>17</sup> Department of Energy and Climate Change (DECC), "Annual Report on Fuel Poverty Statistics, 2013," London.





**Figure 7: Identification of trial participants**

Criteria for inclusion of customers in the project are the following:

- British Gas dual fuel and British Gas electricity only customers
- Social tenants of either Poplar HARCA or Tower Hamlets Homes
- Property EPC rated D, E, F or G; Property EPC rated C if more numbers needed, taking into account area-based methods encompassing income indicators. For the pilot study, EPC Band C properties will be included without reference to the LSOA or other criteria.

Once the potential trial participants are identified through the inclusion criteria described earlier, the project will apply a set of exclusion criteria aiming to exclude potential participants due to technical/technological and other constraints.

- **Households in dwellings that have had recent energy efficiency improvements.** This criterion aims to exclude potential participants who have had energy efficiency improvements implemented at their premises as part of recent energy efficiency schemes. The reason for this exclusion is for consistency amongst the sample base of properties that are included in the trial so that analysis can be performed to observe only the changes made through the introduction of project interventions.
- **Households in dwellings that are known to be scheduled to have energy efficiency improvements over the course of the project.** This criterion aims to exclude potential participants which will experience a change in the EPC of their dwelling which can potentially change their fuel poverty status and may challenge the research findings.
- **Households in dwellings scheduled for demolition over the course of the project.** Households that will be demolished will not provide consumption data for the duration of the project and may challenge the research findings.
- **Leaseholders and other non-social tenants.** Exclusion criterion related to the income indicator of fuel poverty.

- **Households for which British Gas does not have annualised electricity consumption data for the year before the start of trial 1.** Should no electricity consumption data exist for the year before the start of trial 1, the project won't be able to quantify the variation in total annual consumption of each group compared to the previous year, and won't be able to check the randomisation process and thus won't be able to reach one of its research objectives..
- **Households in dwellings that had different occupiers the year ahead of trial 1.** This exclusion criterion serves the same purpose as the previous one and ensures that the project will reach its research objectives.
- **Households that have Economy 7 tariff (and circuit) for electricity.** British Gas' current operating capacity does not yet allow for installation over Economy 7 circuits and as a result the customers relying on Economy 7 need to be excluded.
- **Households in dwellings that rely on communal heating, district heating or other form of heating that does not include individual gas meter.** As the project targets customers able to control their electricity and gas consumption directly, those who do not have control over their gas consumption need to be excluded to avoid affecting the validity of the research results.
- **Households that have given notice to British Gas to switch supplier.** If the customer is no longer a British Gas customer, their electricity consumption data won't be available to the project and won't contribute to the research outcomes.
- **People who are blind, visually impaired or reliant on electrically supplied medical equipment.** The reason for excluding potential participants who are blind or visually impaired is related to the technological feasibility of the SED that will be deployed for the project and does not allow for sound messages that can serve this customer group. People relying for medical reasons to electricity supplied equipment are considered too vulnerable for participation in the project and will be excluded. Should the customer field officer team approach by accident such customers (due to unavailability of updated information in datasets), it will kindly disengage them from the project and provide them a leaflet and information on available support programmes provided by identified organisations.
- **Households that are considered too vulnerable.** Based on information provided by the social housing associations (post customer consent) on sensitive data of the trial participants, or identification of vulnerability signs by the Customer Field Officers (during the recruitment and engagement phase), households that are considered too vulnerable or pose a safety risk to the project's Customer Field Officer team will be excluded from the project.
- **Historical customer behaviour.** A number of potential trial participants will also be excluded either if they have requested not to be contacted by British Gas for any reason other than account related communications or if they are in high debt situations.

The project recognises that this method is imperfect in terms of identifying householders in fuel poverty due to the non-availability of all information about the household income and fuel costs and partially due to the research method, but presents the best method available. After recruitment of householders to the trial, fuel poverty status can be more thoroughly assessed through surveys.

### 3.5 Identifying, Selection & Allocation of Trial Participants

The method of participant selection for trial 1 that will be employed by the project is similar to what has been referred to as ‘randomised controlled trials with opt-in enrolment’ by SEE Action (2012)<sup>18</sup>, who drew a diagram to explain this (see Figure 8: Randomized control trial with opt-in enrolment). The study population in Figure 8 constitutes those who consent to agreeing to be in the VCEE project. Specifically for this project, the following elements are taken into account for participant selection:

- **Population:** the fuel poor consumers of the United Kingdom.
- **Sampling frame:** proxies of fuel poverty described in section 3.3 are used to identify fuel poor households in a given area.
- **Sample size:** 550 is the target sample size (number of customers recruited to the project), and as a 33% consent rate is assumed, the project will target 1,650 households (to whom an invitation will be sent). The assumption of a 33% response rate will be tested in the pilot study and the number of the potential participants that will be approached for participation in the project trials will be adjusted accordingly.
- **Sampling method:** a simple random sample will be utilised when selecting the 1,650 (or other number as realized post the pilot study), with possible purposive sampling<sup>19</sup> to account for potential participants residing in MDUs.
- **Random allocation:** post participants’ consent to participate in the project, they will be randomly allocated to either group 1 or group 2, using a method known as ‘allocation concealment (using envelopes)’ with blocked random allocation<sup>20</sup>.

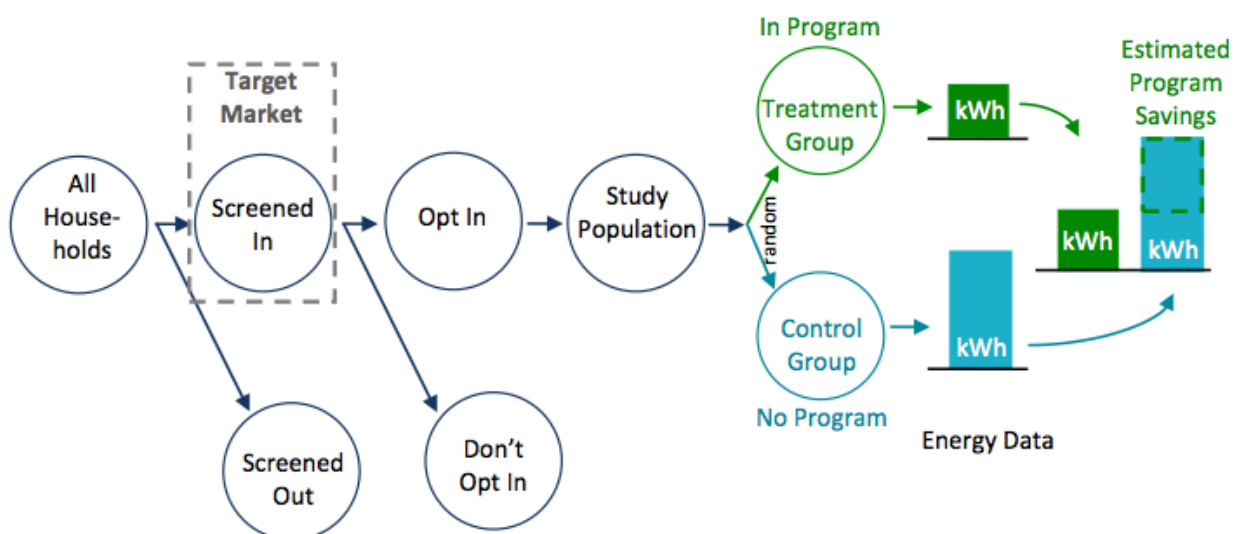


Figure 8: Randomized control trial with opt-in enrolment<sup>16</sup>

<sup>18</sup> State and Local Energy Efficiency Action Network (SEE Action), “Evaluation, Measurement, and Verification (EM&V) of Residential Behavior-Based Energy Efficiency Programs: Issues and Recommendations (Prepared by: A. Todd, E. Stuart, S. Schiller, and C. Goldman),” 2012.

<sup>19</sup> Purposive sampling is a type of non-random sampling that is done for a certain ‘purpose’.

<sup>20</sup> In simple words, envelopes will be pre-allocated to either group 1 or group 2 in batches and then randomly distributed to participants as they sign up to the project. By opening the envelope, participants, and the project, will find out if they are in group 1 or group 2.

## 4.0 Project Trials

### 4.1 Pilot Overview

Prior to commencement of the main project trials a pilot study will be undertaken in order to test project protocols and clarify some key project parameters.

The pilot study has the following objectives:

1. Test response rate (positive response to participate in the project, which will shape the strategy in regards to the number of people that will be approached for the project trials and validate the initial assumption that 1,650 individuals will be approached in order to achieve 550 recruited customers)
2. Test customer recruitment strategy and materials
3. Test access rates for equipment installation and operational processes
4. Test questionnaire development

The inclusion of a pilot study is standard procedure in field-trials in order to capture learnings from an initial trial of the research and technical design, and to make any adjustments necessary prior to the commencement of the full trials.

The pilot study will also provide the opportunity to the project to test and ensure that processes and dependencies are applied and understood. As the pilot study aims to be a close approximation of the actual trials, the technology to be installed is intended to be the same as with trial 1. However, the project is currently in discussion with third party suppliers for the temperature monitoring equipment and dataloggers which will influence whether or not a control group is included within the pilot study.

### 4.2 Project Trials Overview

The project will be structured around two sequential trials of approximately one year within the area of Tower Hamlets. The trials aim to have participation from the same 550 households divided into two groups throughout (see **Error! Reference source not found.Figure 3: Trials structure**). Each trial will have an intervention and a control group, with random allocation of participants between groups.

Both trials will test a package of interventions provided to an 'intervention group' against a 'control group' that does not have access to them. Participants will be randomly allocated to each group ensuring their initial comparability. In trial 1, the intervention and control groups will be drawn from the up to 550 prospective participants (up to 275 per group) and the findings will be determined by 'between-subject' comparison between the groups. An external control group will be introduced in order to determine whether there has been any contamination of the internal control group within trial one arising from their close proximity to the intervention group. In trial 2, the findings will be primarily determined by assessing 'within-subject' changes i.e. pre and post intervention comparison, with the external control group provided to aid generalisation to the population and to control for external shocks such as energy price rises. In trial 2, the learning benefit between the two roll out approaches ('big bang' or 'drip feed') will be determined based on between-subject comparison. Each group will experience a different customer journey as part of the project but ultimately all participants by the end of the two trials will have access to energy saving and shifting solutions that could lead to them economising on their household energy usage and spend. Participants that are part of the within-trial groups will receive compensation payments for disruption. The trials will be structured as shown in **Figure 3: Trials structure**.



In trial 1, the target recruited (up to) 550 participants will be randomly allocated into two groups: group 1 (intervention group) and group 2 (control group). At the end of trial 1, which will run for one year, the group 2 (control group) will then be offered all the interventions that group 1 (Intervention group) had already received. This means that all participants will receive the same interventions, but at different times. As Vine et al define it, this is a 'Randomised Controlled trial but delay treatment' design, which means that the control group also eventually gets the interventions and any associated benefits after a given time. In trial 2, both groups (group 1 and group 2, which both now constitute intervention groups) will also receive the energy shifting interventions. There will also be an external control group running throughout both trials from British Gas customers who already have smart meters installed, and will act as the only control group for trial 2.

<b>Trials</b>	<b>Group 1</b>	<b>Group 2</b>	<b>Sample of British Gas smart meter customers</b>
Trial 1 – Energy Efficiency	Intervention group (energy saving interventions offered)	Control group (no interventions)	External control group
Trial 2 – Demand Side Response	Intervention group (energy shifting interventions offered)	Intervention group (energy saving & energy shifting interventions offered)	External control group

**Table 1: Groups in two trials of the project and their role**

The difference between the two within trial groups is the timing of the release of the interventions. Group 1 will experience the 'drip feed' approach whereby the time of use (ToU) tariff and energy shifting devices will have been provided after the customers will have access to a smart meter, smart energy display and energy saving devices for a year. Group 2 will experience the 'big bang' approach whereby the participants of this group will receive all the energy saving and shifting interventions at once (prior to the commencement of trial 2). Comparisons will be made between the two within trial intervention groups to identify if providing participants with energy saving, and energy shifting interventions at different times has an effect on their energy saving, shifting and subsequent network impacts. The impact of the demand side response interventions in trial two will be primarily determined by assessing 'within-subject' changes i.e. pre and post intervention comparison, with an external control group provided to aid generalisation to the population and to control for external shocks such as energy price rises. In determining the impact of the 'drip-feed' versus the 'big-bang' approaches, between-subject comparison will also be used.



### 4.3 Project Trials Elements

The trials will encompass the elements described in this section, some of which are considered interventions, whose impact will be tested cumulatively. The images below (**Figure 9: Trial 1 Equipment Requirements**, **Figure 10: Trial 2 Equipment Requirements**) display the equipment that will be installed at the customers' premises and the prerequisites for the successful installation and operation of the proposed technologies. However, the full package of interventions that will be provided to the project participants will span further to the technologies installed, as it includes advice and customer engagement through relevant parties (see section 4.4).

## What are we installing in Customer's Homes?

### Trial 1

#### Prerequisites Trial1 Group1

- Broadband Routers with Spare Ethernet Port
- Telephone Lines
- GSM /BPL Routers (where applicable)
- 2x Mains socket for comms hub and PLC plugs

#### Prerequisites Trial1 Group2

- Mains Isolation Switch – UKPN Operations
- Broadband Routers with spare Ethernet port
- Telephone Lines
- GSM/BPL Routers (where applicable)
- 2x Mains socket for comms hub and PLC plugs

#### Energy Saving Devices

#### Whole House Monitoring Trial1 Group1.

- SMETS1 Smart Meters
- Temperature sensors
- PLC Plugs (link to customers router)

#### Whole House Monitoring Trial1 Group2

- Secondary meter on mains supply
- Temperature sensors
- PLC plugs (link to customer router)



**Figure 9: Trial 1 Equipment Requirements**

**Figure 9: Trial 1 Equipment Requirements** displays the devices that the project is going to provide and install at the trial 1 participant's premises. Specific devices such as the dataloggers (secondary electricity meters) and temperature monitoring equipment (temperature sensors associated with a communications hub) require certain elements to be pre-installed at the property in order to function properly.

## What are we installing in Customer's Homes? Trial 2

### Prerequisites Trial2 Group1 & 2

- Broadband Routers with Spare Ethernet Port
- Telephone Lines
- GSM /BPL Routers (where applicable)
- 2x Mains socket for comms hub and PLC plugs.



Energy Efficiency and Shifting devices

### Whole House Monitoring Trial1 Group1 & 2

- SMETS1 Smart Meters
- Temperature sensors.
- Time of Use Tariff

**Figure 10: Trial 2 Equipment Requirements**

**Figure 10: Trial 2 Equipment Requirements** displays the devices that the project is going to provide and install at the trial 2 participant's premises and the associated requirements. When the trial 2 commences both groups will have access to the same suite of interventions and as a result some requirements are becoming redundant due to the fact that the dataloggers will become redundant.



**Figure 12: Smart Meter** Meters (Figure 12: Smart Meter) and smart energy displays (Figure 11: Smart energy Display) will be installed in the intervention group (group 1) in trial 1 and then be offered to the control group (group 2) at the beginning of trial 2.

**Smart Metering Systems with smart energy display:** Following the GB Government's announcement of a nation-wide roll-out of smart meters and smart energy displays to all homes by 2020, but with little evidence on what this means for fuel poor homes, this project examines the effect of installing smart metering systems which can help aid energy management and hopefully both energy saving and energy shifting in homes. Though the focus of the project is on electricity smart meters, British Gas will also install gas smart meters in their dual fuel customer homes, as this is what will be done nationally and doing otherwise will not inform the replication model of the project or future projects correctly. Smart



**Figure 11: Smart energy Display**

The frequency of which the half hourly smart meter data is collected by British Gas' head end metering system is every 24 hours. It is envisaged that the third party's dataloggers' half hourly data will also be collected daily, with batched data being supplied in regular cycles throughout the project's life span.



**Figure 13: Datalogger**

**Dataloggers:** In trial 1, data loggers (secondary electricity meters, Figure 13: Datalogger ) will be installed by a third party next to the electricity meter of the participants in the control group (group 2). These will simply relay back (to researchers but not to participants) half-hourly electricity consumption information at the same temporal frequency as the electricity smart metering system. The purpose of these devices is to provide a baseline against which to judge the interventions of the intervention group, as the dataloggers are not considered an intervention.

The installation of a datalogger requires the isolation of the main supply of the property which can be achieved through switching off the isolation switch (located between the meter and the consumer unit). Once the datalogger is installed, it communicates wirelessly with a communications hub (which collects the electricity consumption information) and transmits it into the third party' data collection system via the internet. Therefore, in order to retrieve the consumption information from a datalogger, it is required that the trial participant has a fixed broadband line and a spare Ethernet port in its (internet) router in order to connect the communications hub that will be provided along with the datalogger. It is worth mentioning that the Customer Led Network Revolution (CLNR) Low Carbon Network Fund project identified that circa 47% of social housing tenants did not have fixed line broadband and therefore, no data collected from the dataloggers (or the temperature monitoring equipment) could be transmitted to the collection system of the appointed third party. The project, although based on a different geographic area, is dealing exclusively with social housing tenants and anticipates similar problems to occur, will investigate the feasibility and cost effectiveness of alternate broadband solutions should the customer does not have fixed line broadband, and such solutions will include GSM routers or Broadband over Powerline (BPL) solutions.



**Figure 14: Temperature Sensor**

**Temperature monitoring equipment:** These will be installed by a third party in both the intervention and control group during trial one, and will be maintained throughout the entirety of trials 1 and 2. The installation of the temperature monitoring equipment, and the installation visit by the third party, is not intended to form part of the intervention in the trial, as it is conducted in both group 1 (intervention group) and group 2 (control group), which makes it a common interaction not unique to any participant. The objective of installing temperature logging equipment is two-fold: to alert the project to the potential of low temperatures (under-

heating) and to make sure the project does not adversely impact participants as a group (see section 4.6).

It is envisaged that two temperature sensors will be provided to each trial participant and will be placed in two rooms of their household. The second sensor would provide a backup solution should the primary sensor fail and also may be used to validate the observed temperatures. Similar to the datalogger, the data collection from the temperature sensors requires a wireless connection to a communications hub and transmission of collected data via the internet and similar arrangements as per the datalogger solution will be investigated.



**Energy saving devices:** The project intends to provide participants with a range of energy saving devices. These devices are intended to serve three broad functions, from the participant's perspective:

1. support the participants to realise their energy saving full potential;
2. increase the participants awareness of energy efficiency; and
3. provide an incentive for customers to participate in the trial.

**Figure 15: Eco Kettle** These are interventions in trial 1 (group 1) and trial 2 (group 2) and will likely include low-energy lighting (i.e. LED bulbs) and eco-kettles. The selection of the energy saving devices will take into account their power saving potentials from different perspectives:

- estimated power savings per household;
- estimated project savings (aggregated figure for all trial participants); and
- power savings for the DNOs during peak load (therefore network impacts).

The assessment will be also supported by qualitative information, including device's usability, desirability, reliability, and their likelihood of promoting customer engagement and raising energy awareness.

The energy saving devices will be handed over to the trial participants by the Customer Field Officers.



**Figure 16: Time switching device**

**Energy shifting devices:** The project will also provide energy-shifting devices to all project participants (excluding the external control group) in trial 2. In addition to the reasons stated for energy saving devices, these devices will support participants to achieve their energy shifting potential, thereby taking peak load off the network and benefitting from cheaper tariffs when combined with ToU tariffs. Currently the project is looking at timer sockets for washing machines, dish washers, and tumble dryers, but the final selection of time-shifting tools will be made in the light of which appliances the participants have in their homes (this information will be collected during trial 1). Selection criteria similar to the ones used for the selection of energy efficiency devices will be applied.

**Customer Field Officers (CFOs):** The team of CFOs will be the 'face' of the project, leading customer engagement. The intervention will be anything the Customer Field Officers administer to the intervention group (group 1, trial 1) which is different from their interaction with the control group (group 2, trial 1). The CFOs will be responsible for recruiting participants, answering questions from participants on the project and on simple energy (electricity) efficiency matters, attending the smart meter installations along with the British Gas Smart Energy Expert, attending events, attending customer panels, administering surveys, collecting qualitative data and communicating with trusted third party organisations to explain the project.

**Surveys:** Surveys will be administered to all trial participants, though some of them will be administered to certain participants depending on the occasion or event:

- An Initial survey comprising of an electrical devices inventory and socio-demographic element which will be administered during the datalogger or smart meter installation;



- An energy social capital survey, which collected information on trusted sources of information and where people get energy related information, and will be sent via post to all participants at three point in time over the course of the project;
- A non-participation survey which asks about why people do not join the project and will only be administered to those who choose not to join the trial(s);
- An exit survey to understand why people leave the project early, and will only be administered should this occur; and
- A self-disconnection diary which is a survey of when and why prepayment customers self-disconnect.

**Stakeholder mapping:** The project will conduct stakeholder mapping in trial 1 that will result in a number of trusted organisations in the Tower Hamlets area being identified. The team of Customer Field Officers will investigate the need to contact trusted organisations in the area which can, if they wish to, support our project if they are approached by participants

**Energy Efficiency Advice:** During the visit at the trial participant's premises for installing the smart metering systems (group 1 trial 1, group 2 trial 2), advice in relation to improvement of efficiency in electricity consumption will be provided by the visiting Customer Field Officer.

**Other communication means:** There will be a number of events held as part of the project and will aim to enhance the recruitment and continuous engagement with the potential and actual participants. There will also be a participant panel that will aim to provide feedback on project activities and place the fuel poor customer closer to the decision making process. Furthermore, there will be a regular newsletter for all intervention participants that will inform them on project progress, next steps and brief details of the findings (See Customer engagement plan of the Project<sup>21</sup>).

**Network data collection:** Though it will not be considered part of the interventions, there is another form of data collection as part of the trials and part of the data analysis. Substation monitoring data will be collected from each substation which has a participant connected to it. The substation data will be used along with the electricity consumption data within the research analysis aiming to identify benefits resulting from the project.

#### 4.4 Project Interventions

**Table 2: Intervention of trials 1 and 2 (interventions labelled yes)** summarises the list of interventions that will be offered in both trial 1 and trial 2 to the respective groups. An intervention, as listed in the left hand column, is only an intervention if labelled 'yes'. In trial 2, there are some occasions where interventions will be given to participants of both groups and as result the intervention is 'cancelled out'.

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<sup>21</sup> Vulnerable Customers and Energy Efficiency, "Communications Plan for Pilot Study and Project Trials," 2014.



Intervention	Trial 1		Trial 2	
	Intervention group (group 1)	Control group (group 2)	Intervention groups (Groups 1 & 2)	External control group
Electricity smart meter	Yes		Both receive / have received	
Gas smart meter	Yes <sup>i</sup>		Both receive / have received <sup>i, ii</sup>	
Smart Energy Displays	Yes		Both receive / have received <sup>ii</sup>	
Time-of-use tariff	Not applicable	Not applicable	Yes	
British Gas Smart Energy Expert	Yes		Both receive / have received <sup>ii</sup>	
Energy efficiency booklet	Yes		Yes <sup>ii</sup>	
Energy saving devices	Yes		Yes <sup>ii</sup>	
Energy shifting devices	Not applicable	Not applicable	Yes	
Advice on energy efficiency & energy shifting devices	Yes		Yes	
Customer Field Officer electricity efficiency advice	Yes	<sup>iii</sup>	Yes	
Referrals by Customer Field Officer to further information	Yes	Yes	Yes	
Newsletters	Yes		Yes	
Stakeholder support	Yes		Yes	
Dissemination events <sup>iiii</sup>	Yes		Yes	

**Table 2: Intervention of trials 1 and 2 (interventions labelled yes)**

<sup>i</sup> Gas smart meters only constitute part of the trial due to the business as usual smart meter rollout at dual-fuel customers who will receive both an electric and gas smart meter as part of the standard customer journey. It is envisaged that this strategy will have positive effects related to the replication point of view.

<sup>ii</sup> Denotes interventions that are only offered to group 2 participants, as group 1 participants have already received them in trial 1.

<sup>iii</sup> Please note, if a control group participant asks for energy efficiency advice, the Customer Field Officer will refer them to standard sources of energy efficiency information.

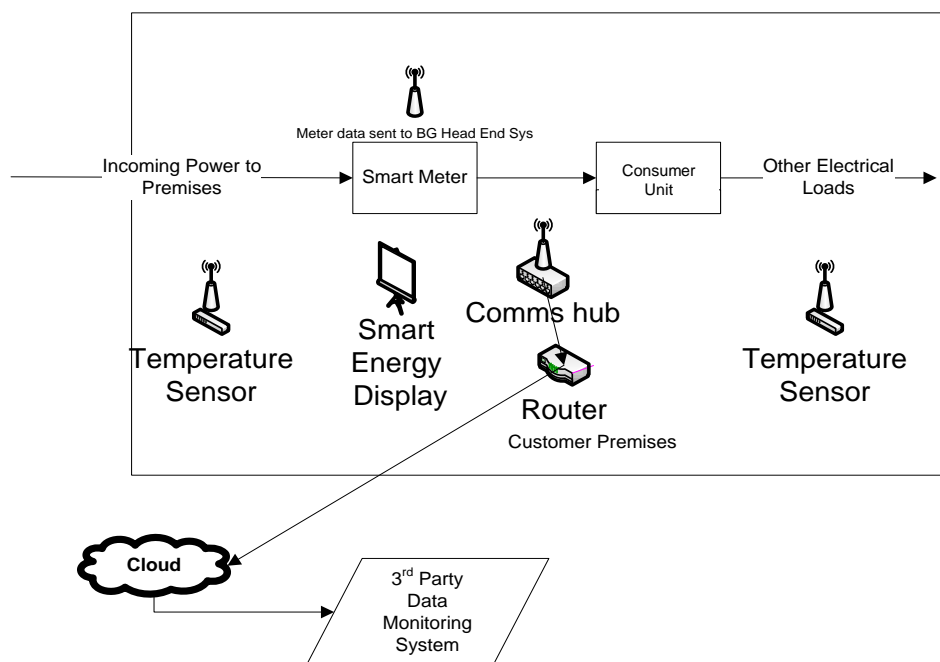
<sup>iiii</sup> In addition to dissemination events, some participants will attend participant panels. These are not considered part of the intervention in the trial, as it is not envisaged that they will apply to all participants or would be replicated by other DNOs under the replication model.

It is important to note that this project is testing a suite of interventions together, rather than any one individually. It will not be possible to determine the impact of any individual or sub-set of the interventions and only the aggregate impact of all interventions will be quantifiable. The results of energy use will be analysed through electricity consumption data from smart meters and dataloggers in order to understand the success the interventions.

### 4.5 Project Pilot Study and Trials Architecture

This section aims to address the topic of how all elements of the provided solution are connected and function together. The project aims to test the proposed connectivity architectures in the pilot study that will be undertaken prior to the project trials.

#### 4.5.1 Intervention group



**Figure 17: Architecture of intervention group of trial 1 & 2**

The devices that will be installed in each household of the intervention group of trial 1 are depicted in **Figure 17: Architecture of intervention group of trial 1 & 2** above and are listed below:

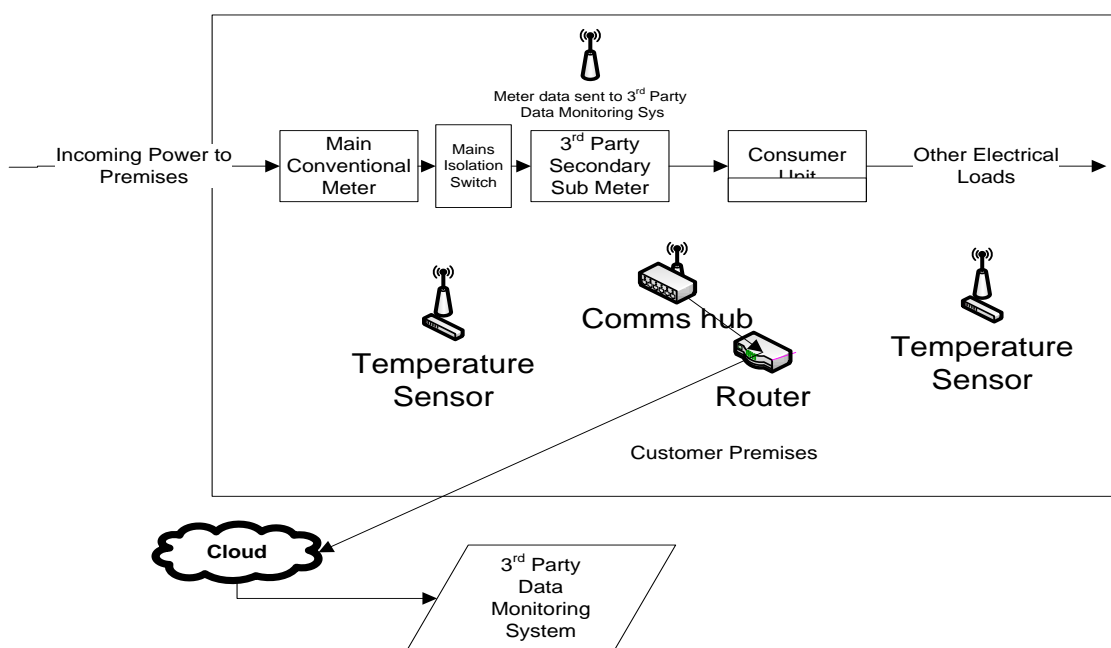
- SMETS1 compliant Smart Meter (Credit and/ or Pre Payment)
- Smart Energy Display
- Two Temperature Sensors
- Communications hub
- Energy Saving devices handed over by the Customer Field Officers were excluded from the image above since they are not connected with the other components of the provided solution.

British Gas will install smart metering systems consisting of an electricity smart meter, possibly a gas smart meter (depending on type of customer – dual fuel or electricity only and the number of positive responses the project receives), a communications hub and a smart energy display. The smart meter(s) communicate with the communications hub and the smart energy display wirelessly through the ZigBee network. The end user of the smart energy display is the customer who is able to see their consumption, cost, historical profiles and (in trial 2) price signals. In order for the data to be communicated from the customer's premises at the head end system (HES) of British Gas (which is a data collection system), the communications hub transmits the data through a General Package Radio Service (GPRS) network operated by Vodafone.

Apart from the electricity consumption data, the trial participant will be provided with temperature monitoring equipment consisting of two temperature sensors, able to sense internal temperature, and a second communications hub to transmit the data to the data collection system of the third party supplier that is providing the temperature monitoring solution, over the internet. As explained earlier, the project may face problems with the broadband connection and alternative solutions are being investigated.

It is worth noting that the above architecture will be the one implemented in trial 2 across both groups which will consist of a common intervention group. In addition to the devices shown to be interconnected and the energy saving devices which stand alone, the participants of trial 2 will also be provided with a package of time shifting devices and an innovative time of use tariff. The time of use tariff will be configured remotely in the smart meters of both groups.

### 4.5.2 Control group



**Figure 18: Architecture of control group of trial**

The devices that will be installed in each household of the control group of trial 1 are depicted in **Figure 18: Architecture of control group of trial** above and they are listed below:

- Dual Pole Isolation Switch (where applicable)
- Third Party datalogger (secondary electricity meter)
- Two Temperature Sensors
- Communications hub

The selected third party supplier will install a datalogger and a communications hub in order for half hourly electricity consumption data to be collected. The dataloggers will communicate with the communications hub wirelessly (in cases where wireless connection cannot be established, the project will investigate wired connection solutions, such as power line carrier plugs). In order for the data to be communicated from the customer's premises to the data collection system of the third party supplier, the communications hub transmits the data through the internet. Similar to the intervention group, the trial participant will be provided with

temperature monitoring equipment consisting of two temperature sensors, able to sense internal temperature and the data will be transmitted as explained previously. It is worth noting that this architecture will be implemented only for control group of trial 1, which prior to trial 2 commences will move to the architecture shown in the intervention group of trial 1 (Figure 17: Architecture of intervention group of trial 1 & 2).

### 4.5.3 MDU/Tall and Difficult Buildings

Alongside individual dwellings the project intends to acquire a number of customers who reside in MDUs – these are also known as Tall and Difficult Buildings. MDUs present challenges in the installation of smart meters compared to smart meter installation in single dwellings, given the physical distances between the meter point and the customer's dwelling/flat and the wireless range to connect to the SED. An alternative wiring solution will be used in the project to cover the majority of this distance.

In MDUs meters are ordinarily located in communal areas and/or basements and not within the dwelling/flat itself and therefore the HAN connection between the smart meter and SED is difficult and often problematic. This is mainly due to the extended distance and variety of building fabrics, between the smart meter and the SED.

In order to address this and align, with the GB's smart meter Implementation Programme, the project aims to evaluate and trial a wired communications backbone solution, to extend the HAN network. If the project is successful, this solution could be used to address an estimated 5% of the UK's domestic housing stock.

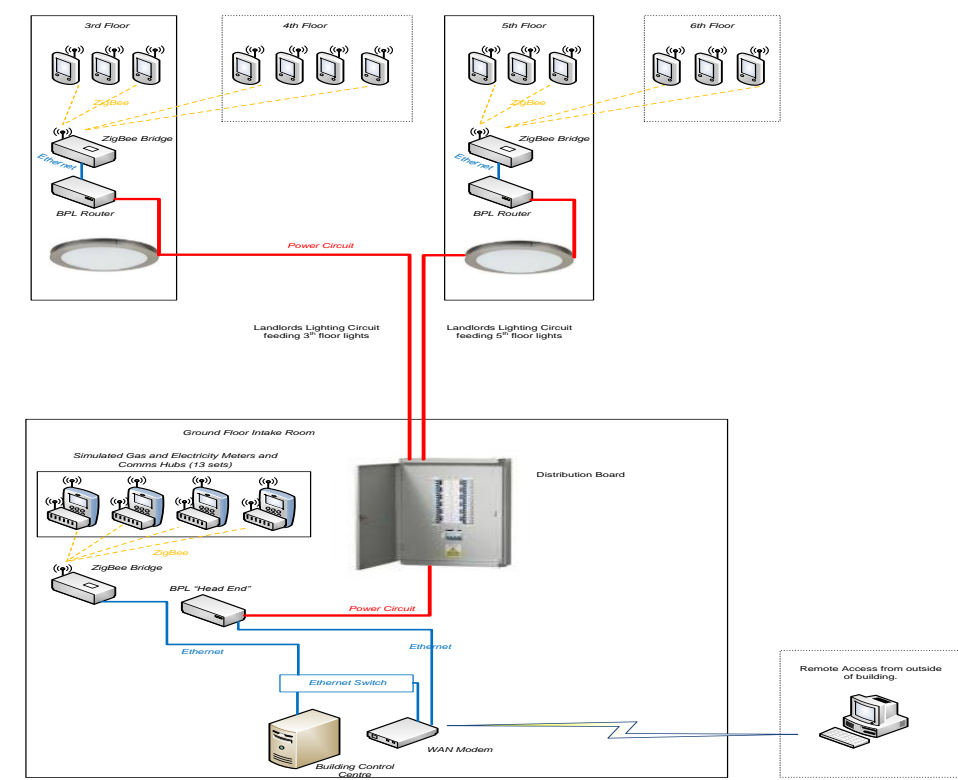


Figure 19: Example of MDU Communications Infrastructure



The solution uses a broadband over Powerline (BPL) backbone integrated with ZigBee radio technology. BPL is the preferred technology as it provides high performance and bandwidth connectivity to meters in difficult positions whilst utilising the existing wiring in buildings. ZigBee connectivity ensures that standard smart metering assets can be installed in MDUs, simplifying the process and supply chain. The WAN gateway may then be positioned where the best signal can be received.

The buildings of Tower Hamlets Homes and Poplar HARCA have been assessed in an attempt to categorise the building types and the assessment resulted in a number of potential MDU buildings where the meters were found to be located in the ground floor electrical intake area. Other properties with meters in communal areas are also potentially suitable, but require further technical assessment. The actual number of MDU Buildings enrolled into the project will depend upon the uptake of recruited customers, with a target between one and three MDU buildings. Once the tenants living on the identified eligible for MDU buildings are enrolled into the project the building(s) will be surveyed, the landlord(s) engaged and the planning phase will get underway followed by installation and commissioning of the MDU communications infrastructure. Specific to the commissioning of smart meters on site, the aspiration is that the Smart Energy Expert installation and commissioning processes will be the same for a MDU building as it is for single dwellings and as result the customer experience will remain the same. This is because the MDU infrastructure operates as a technical enabler and not as a driver for behavioural change.

## 4.6 Customer Protection

### Temperature Monitoring

The project has identified areas that may cause risks to participants and has put in place customer protection protocols to mitigate this. Firstly, the involvement of people who may already be under-heating their homes due to fuel poverty in energy efficiency and demand side response initiatives could result in participants putting themselves at risk for the sake of the project, by, for example, further under-heating their homes. In order to protect participants, the project will therefore monitor internal temperatures and carry out analysis to alert the project for potential under-heating and to ensure that the project does not adversely impact the participant's wellbeing.

### Complaints

Customer Field Officers will be trained to interact with participants in a sensitive manner, avoiding any language or behaviour that may be conceived as harmful. If participants are not happy with anything, there is a complaints procedure in place. In order for the project to be proactive, customised to the customer groups it is targeting and minimise the amount of complaints, careful consideration of wording will be taken when developing questionnaires, particularly if they pertain to a sensitive topic, and confidentiality will be assured.

### Technical Enquiries & Support

Technical equipment will be installed by British Gas and their contractors who will operate a telephone based support centre with appropriately trained customer service agents able to respond to technical enquiries. In addition, energy efficiency devices will be handed over to participants. If there are any risks associated with the placement or use of these items, the Customer Field Officers will assess the risks and possibly arrange for mitigation actions (e.g. arranging for help to change an inaccessible light bulb).

### Data Protection

Maintaining the confidentiality of respondent data is central to the project. The Customer Field Officers are required to work in accordance with the confidentiality requirements of the Data Protection Act. Information obtained about the trial participants during the course of the project, whether through home visits, phone calls or

drop in events will be shared with specified parties and through structured processes as covered in the Data Privacy Strategy of the project.

### Safeguarding

In rare instances, the Customer Field Officers may encounter a situation during a home visit where:

- they feel that the safety and wellbeing of an individual (whether the trial participant or someone else within their home) could be at risk (e.g. due to physical abuse, unsafe/unsanitary conditions);
- they are concerned for the welfare of an animal or animals within the home; or
- they may have concerns about illegal activity which could harm the public.

As a result, the Customer Field Officers may feel that information about an individual or individuals should be passed on, for example to social services or to the police. A policy has been developed outlining what should happen in these situations. This includes referring decisions to a panel of senior staff that are experienced in such matters, who will carefully consider and agree upon the appropriate action. The panel will meet within three days post report of a less serious incident and within one day for extremely serious incidents.

### ToU Trial Refunds

During trial 2, the project is going to offer an innovative time of use (ToU) tariff to the trial participants which will aim to investigate if fuel poor customer can shift their demand from peak hours into non-peak hours and engage effectively in DSR. The design of the tariff has not yet been determined and the options explored are either a punitive or non-punitive tariff (see customer engagement plan for the project). For the purposes of the trial where it found that the trial participant is worse off, when compared to British Gas' standard tariff, the trial participant will be contacted and be entitled to a credit in their account. This will be done on quarterly basis, in line with British Gas customer's billing cycle.

## 4.7 Constraints of the Project Trials

As the trials are part of an innovation project, it was always anticipated that constraints will be faced and dealt with. The following list includes some constraints encountered or be anticipated (not exhaustive):

- Information that could be used in order to identify fuel poor customers according to the fuel poverty definition is not publicly available and the project does not have the customer consent in order to use such information. As a result, the project is using proxies of fuel poverty in order to identify eligible trial participants.
- Analyses of the eligible trial participants from the social housing associations partnering in the project has shown that there is insufficient number properties in D-G rating properties and the project will include households between C-G. The project aims to mitigate the risk, by taking additional factors into account when selecting C rated properties where possible (area-based methods which take into account income indicators).
- The project is facing a risk of not having suitable number of eligible participants who sign up to the project and live in MDU dwellings. In order to mitigate the risk, the project has completed a visual inspection of the available housing stock and completed a categorisation of the buildings. In addition, purposive sampling to account for limited number of eligible participants participating in the project is incorporated in the research methods of the project.

## 5.0 Customer Journey

### 5.1 Customer Journey Overview

The purpose of this section is to outline the customer journey from the point of identifying and recruiting the customer until the end of the project.

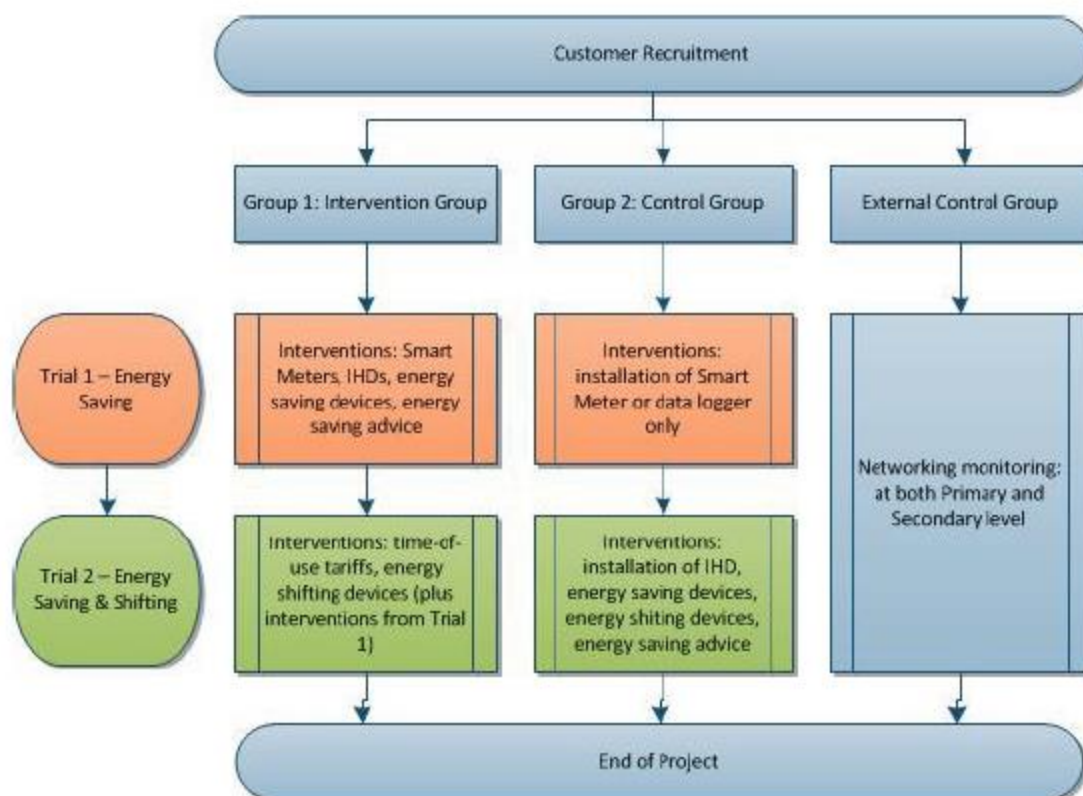


Figure 20: Life time customer journey

### 5.2 Customer Selection

Following the selection process outlined in section 3.0, the project will identify the potential trial participants. This list of eligible customers will form the sample frame, from which a subset of 1,650 (or another number of realised through the pilot study) potential customers will be drawn as the sample. The remaining customers that meet the eligibility criteria will be allocated to a 'reserve list' for recruitment in the event that the project does not meet its 1:3 response rate. These 1,650 customers will then be invited to participate in the trials, with recruitment continuing until either all recruitment steps are exhausted or 550 participants are recruited. Once recruitment has finished, the participants will be randomly allocated between the intervention and control groups for trial 1. During this stage of the customer journey, no customer interaction takes place.

The project also undertook necessary steps in order to categorise the housing blocks/estates of the eligible customers in certain groups related to the position of the meters, characteristics of the building and potential for MDU Communications Infrastructure. No customer interaction took place as the initial identification consisted of visual inspection of the housing stock of Tower Hamlets Homes and Poplar HARCA.

Category	Initial Assessment findings	Smart meter Installation Classification
A	meter in Dwelling unshielded	Standard smart install
B	meter in Dwelling in Steel cabinet	Majority are Elec meter, WAN & HAN range TBA <sup>22</sup>
C	meter in cupboard on communal landing	Potential difficult building, HAN range TBA
D	meter In ground floor cupboard	Difficult building. WAN TBA

**Table 3: Building Categorisation**

For the purposes of the pilot trial the project is solely focussing on category A building/meter point types, as these represent business as usual smart meter installations. A more technical assessment is needed, following on the initial visual inspection, to qualify the HAN and WAN signal range for categories B, C & D. The follow on technical assessment will be completed prior to the commencement of the project trials and will not involve customer engagement.

### 5.3 Customer Recruitment

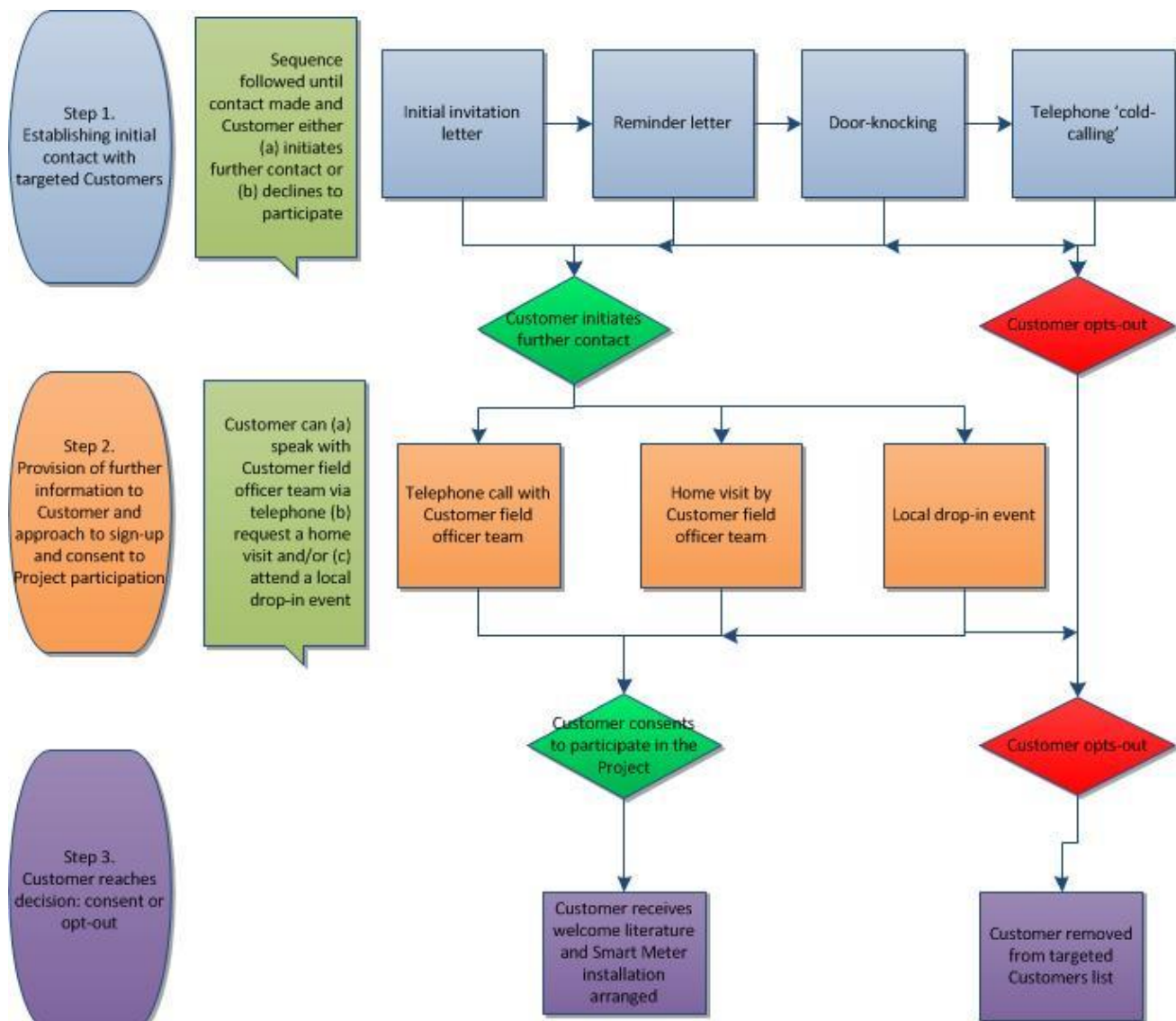
A project name, brand and marketing materials have been developed, which will be used to recruit participants to the project. The effectiveness of the communication materials will be tested through the pilot study which will generate valuable learning in relation to the engagement with the targeted customer group.

The customer recruitment process of the trial 1 is described in detail in the customer engagement plan of the project and is presented in summary in the following diagram.

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<sup>22</sup> TBA stands for To be Assessed and denotes that further investigation from technical experts is required





**Figure 21: Customer Recruitment Journey**

Should the customer consent to taking part, they will be issued a welcome pack. An installation appointment, no less than 14 days from the point of consenting, will be made with them for the installation of the trials' monitoring equipment. The appointment duration will depend on the type of dwelling the customer lives in as some installations might take longer due to the physical distances that may be involved (e.g. MDU). The Customer Field Officer will explain to the signed up trial participant what the installation process will involve.

### External Control group

The External Control group is to be a demographic representation of British Gas' existing smart meter customer base. These customers will be engaged via an Opt Out process whereby a letter informing them of the project and its objective, will be sent to them. The letter will also explain that the project wishes to collect their consumption data, which will form part of a pool of statistical data, and its importance in helping to understand energy use. This approach has been successfully used in other LCNF projects.

### 5.4 Installation Fulfilment

The Appointment booking made by the Customer Field Officer will be passed to British Gas in order to confirm appointments with the customer. For each of the trial 1 groups the installation journey differs slightly, as described below. Note, the installation of both a smart meter and datalogger takes approximately an hour per meter (minimum interruption is 30 min per meter), and during that time the power will be turned off. The customer will be fully informed of this on the installation visit.

#### 5.4.1 Trial 1 Intervention group

As depicted below; customers are to be taken through British Gas' 'What to Expect' journey for the installation of the trials' monitoring equipment. The customer will receive a call from British Gas' contact centre to confirm the appointment time and date and who to expect on the day of install. They will then receive a text message and email (or letter) to confirm their appointment the day after this has been booked. Five days prior to their appointment, the customer will receive an email (or letter) referred to as What To Expect, which will remind them about what will happen on the day and what they need to do to prepare for the install, e.g. clear out cupboards. Finally, three days prior to their appointment, the customer will receive an email and text message reminder.



Figure 22: British Gas What to Expect Journey<sup>23</sup>

On the day of the appointment the Customer Field Officer (CFO) will also be in attendance to ensure that the customer is fully informed with the installation process and to administer the initial survey. The CFO will also hand over to the customer the energy saving devices and provide the customer with energy efficiency advice related to electricity.

Prior to arriving, the British Gas Smart Energy Expert will check the job comments, which will note that the customer is part of the project and also checks vulnerability and Priority Service Register (PSR) status. Should the Smart Energy Expert come across situations where they identify that a customer is eligible to go on to the PSR, they will check the job details to see if the customer is already on the PSR. If the customer is not on the register they will explain what the PSR is and offer to call the PSR team for the customer, to explain the customer's interest and then pass the call onto the customer. If the Smart Energy Expert identifies that a customer is in urgent need of help i.e. living in particularly poor living conditions, they will also raise this with their manager.

Upon completing the smart meter installation they will also explain the Smart Energy Display and leave a welcome booklet with the customer.

<sup>23</sup> 'WTE' (image) refers to the 'What to Expect' journey of British Gas

In addition to British Gas' Smart Energy Expert and the CFO arriving, British Gas' third party supplier will also arrive to install the temperature monitoring equipment and communications hub, within the same appointed slot. Should the customer not have a broadband internet connection, available for the project, the third party supplier will also install a GSM or Powerline broadband router, for the sole use of capturing temperature data for the project.

### 5.4.2 Trial 1 Control group

Appointments for group 2, made by the CFO in communication with the customers, are to be confirmed by British Gas' third party supplier, of the datalogger and temperature monitoring equipment, directly with the customer. It is envisaged that the confirmation process will closely follow that of British Gas' What to Expect journey to ensure consistency of messaging and engagement.

On the day of the appointment it is envisaged that the Customer Field Officer will also be in attendance to ensure that the customer is fully informed and comfortable with the installation process and administer the initial survey, though this time no energy efficiency devices will be left with the customer and no energy efficiency advice will be provided to the customer

Should the customer not have a broadband internet connection, available for the project, the third party supplier will also install a GSM or Powerline broadband router, for the sole use of capturing the whole house and temperature data for the project.

### 5.4.3 Trial 2 former Intervention group

At the end of trial 1, both groups of customers are to be engaged about consenting to the Time of Use tariff. If the customer consents to continuing their participation into trial 2, British Gas will contact the customer to discuss switching onto the Time of Use tariff. In addition, the CFO will issue the customer with the energy shifting devices.

If the customer does not consent to continuing their participation into trial 2, the CFO will agree an appointment with the customer for the removal of the dataloggers, temperature monitoring equipment and communications hub. The customer will also be provided with the energy shifting devices if they wish to.

### 5.4.4 Trial 2 former Control group

If the customer consents to continuing their participation into trial 2, an appointment will be agreed with the customer for the removal of the datalogger and installation of British Gas' smart meter. The process of booking and confirmation of appointment is to be the same as described in the above sections, where the removal and installation visit will be for the same appointed slot (where feasible). On the appointed day the Field Officer will issue the customer with the energy shifting and energy efficiency devices.

If the customer does not consent to continuing their participation into Trial 2, the CFO will agree an appointment with the customer for the removal of the datalogger, temperature monitoring equipment and communications hub. The customer will also be provided with the energy shifting devices if they wish to receive them.

Once the consenting customers in group 2 have had the datalogger removed and British Gas' smart meter installed, they will be contacted about switching onto the Time of Use tariff. Due to the fact that this group will be newly acquired smart meter customers, there will be a period of 14 to 28 days from installation to being able to switch to the Time of Use tariff, due to industry processes.

### 5.5 Post Installation 'In – Life' engagement

Post the installation of the smart meter, customers will receive a smart 'Health Check' call from British Gas to see if the customer has any questions related to the smart meter and/or the SED, alternatively it may be possible for the Smart Energy Expert to revisit the customer.

Once customers have been recruited, there will be an ongoing programme to keep them engaged in the project. This will include regular project newsletters, thank you payments and regular contact with the CFO team. There will also be a 'participant panel' (the project is also exploring the option of having one participant panel per group) which all participants are invited to join. The purpose of this panel will be to provide both a structure for participant feedback and a sounding board for participant views.

### 5.6 End of Trials

Customers are free to leave the trials at any stage, should they make this decision appointments to remove any equipment will be made as is described above. At the end of the project, customers will receive end of trials communications, which will thank them for their participation and, outline the process of closure of the trials and removing the monitoring equipment. British Gas and its installation partner will contact the customers directly to arrange a convenient time to come and remove the appropriate trials specific monitoring equipment. Below is the envisaged process that will be followed:

- A fixed number of attempts to contact the customer by telephone will be made over a three week period to allow for customers who may be away on holiday.
- If a customer does not reasonably cooperate and/or a decommissioning appointment cannot be made, this will be escalated to the social landlord
- The customer will receive confirmation in writing of the appointed date
- 'Making good' actions on all properties to a safe and mutually acceptable standard
- Obtain customer approval for the completion of the works
- Confirmation of the decommissioned properties to the social landlords.

### 5.7 Customer Field Officer Team

A team of four CFOs has been appointed, comprising a field officer manager, two field officers and a field officer assistant. The team is employed by Bromley by Bow Community Centre. The team will be responsible for recruiting participants onto the trial and for maintaining their engagement throughout the trial. The team started work at the beginning of August 2014 and they have undertaken a comprehensive programme of training in preparation for starting to recruit trial participants, covering themes such as energy awareness, vulnerability, safety, social research, smart meters awareness.

The project will explore the effectiveness of such a team in recruiting and engaging with fuel poor customers and generate lessons learnt and best practices. Should it prove to be successful in recruiting and engaging trial participants, the structure and training schedule of the Customer Field Officer team will be recommended to the industry.



## 6.0 Learning Outcomes

This section completes the report by summarising how each aspect of the trial design will support the learning outcomes. The learnings of the project are categorised into customer, research and technical related learnings and are analysed in the following sections.

### 6.1 Learning Outcomes: Customer Aspect

There are several additional learning outcomes that are anticipated from the project beyond those stipulated in the SDRCs including:

- **Drip feed' versus 'big bang':** this refers to the difference between offering all energy saving and energy shifting offers all at once (the 'big bang', which will be offered to Group 2 at the beginning of Trial 2), and those who receive offers spaced out over time, specifically receiving energy saving offers one year before energy shifting offers (the 'drip feed', which will be offered to Group 1 throughout the trial). There is no hypothesis for which method will be more beneficial: it could be that the 'big bang' is more exciting and more engaging, or it could be more overwhelming; conversely, it could be that the 'drip feed' is more measured and less overwhelming, or it could be that the time lag could cause measures to be forgotten or ignored after a while. It is anticipated that any difference is likely to be small, and possibly beneath the effect size discernable by the trial design. This learning outcome will be determined mainly through electricity analysis, possibly including internal temperature analysis as well, and enhanced by social research findings from, for example, participant panels.
- **Self-disconnection:** there is limited knowledge on the particular rationale (poor budgeting, other commitments, etc.) why electricity pre-payment meter customers disconnect from their electricity supply. The self-disconnection diary will allow understanding of this phenomenon, and give support to the move toward smart meter pre-payment electricity meters which have more support for customers who are considering self-disconnecting.
- **Partnership:** the variety of partners in this project is novel, as is the method of engagement with participants, particularly through the use of Field Officers. There are several learning outcomes that could emerge in this regard, for example the conjunction of a Customer Field Officer attending an installation with a British Gas Smart Energy Expert, and how the customer can benefit from an end-to-end partnership and associated coordinated services.
- **PSR Validation:** As part of the project and post customer consent it is proposed that a comparison of UK Power Networks' and British Gas' PSR will take place in order to identify gaps between the registers. This analysis will provide insight as to whether harmonisation of the PSRs of different parties within the value chain is required, with the result being improved services for the customers.

### 6.2 Learning Outcomes: Research Aspect

- **MDUs:** this is more of a technical learning outcome, rather than a social research outcome, but it does have implications for the social research design. Technically, installations of smart metering technology in MDUs is very challenging; this project will bring any issues to light which need to be addressed and be useful for the smart meter implementation programme. As for the research design, it challenges the random sampling technique, in case there are not enough MDUs in the random sample. However, the method is relatively simple (additional purposive sampling, if necessary, which means just identifying households not randomly), and will be instructional for this type of complex research design.

- **Non-participation:** very little is known about why potential participants choose not to join energy efficiency research projects. There is anecdotal evidence<sup>24</sup>, but the research in this project will give even further, representative insights into why participants do not join.
- **Drop outs:** just as with non-participation, very little is known about why participants choose to leave energy efficiency research projects after they already joined. The learnings in the project could help all future locally-based energy efficiency projects.
- **Social resources:** there are several outcomes that may emerge from knowing where social resources (e.g. information, advice and support) exist, plus if and how they are mobilised. Learning further about where people look for information, who they trust, and if they actually speak to people for information will present novel insight that has not been elicited from such a large research population (as previous research are generally based on case-study findings)
- **Electricity-using devices:** full electricity inventories of homes are very rare, but can greatly support modelling research to understand what underlies electricity loads and profiles. Though full knowledge of how people use electricity in their homes cannot be known without monitoring every single electricity outlet, as well as monitoring behaviour, the electricity inventory in the 'initial' survey will be illustrative.
- **Ethnicity:** thus far, there is no literature to indicate that there are any differences between electricity consumption and energy efficiency take-up between households of which are comprised of various ethnicities. The findings here will be illustrative in that regard.
- **Time of Use (ToU) tariffs:** there is little evidence on the impact of ToU tariffs on the fuel poor. The findings, as demonstrated through analysis in trial 2, will shed light on this. Learnings will also emerge about the process of creating ToU tariffs that are the most appropriate to the population.
- **Fuel poverty:** As it has been demonstrated, it is very difficult to precisely identify the fuel poor prior to recruitment. This project will help understand:
  - How indicative it is to use EPC ratings of social tenants as proxies and possible future methods given the same constraints from data privacy.
  - Understand the prevalence of fuel poverty amongst social housing tenants, as compared to national statistics.
  - Understand the needs of the fuel poor as perhaps compared to any participants who are recruited and deemed to not be in or near fuel poverty. There may also be learnings about the tendencies of households to go into and out of fuel poverty, though this may be more qualitative in nature.

### 6.3 Learning Outcomes: Technical Aspect

To achieve the national smart meter roll out there are a number key technology challenges that must be overcome to ensure the maximum number of customers can enjoy the benefits of smart metering. In addition, it is assumed, that a proportion of vulnerable and/or fuel poor customers reside in premises where additional technology is required to enable smart metering installs to take place. The technology limitation in tall and difficult MDU buildings is that the 20/30 meter range of a smart meter set (otherwise known as the HAN) is insufficient to allow the meters to be fitted non-contiguously. The innovation in this project is to install MDU solutions in a number of key buildings that propagate the HAN environment, allowing customers in these

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<sup>24</sup> A. J. Summerfield et al., "Milton Keynes Energy Park revisited: Changes in internal temperatures and energy usage," *Energy and Buildings*, vol. 39, no. 7, pp. 783-791, 2007.

building to be eligible, not only for a smart meter install, but the added incremental convenience of improved services, such as smart prepayment. Innovation in this space is important in three key areas:

- Trialling the technology to give greater confidence that alternative HAN solutions can work;
- Trialling that Fuel Poor customers can be serviced sooner rather than later in the rollout; and
- Trialling incremental services (smart prepayment, time of use tariffs, etc.) in addition to basic smart metering services.

**Prepayment smart meters:** as part of the project British Gas will be installing some of its first SMETS1 compliant smart meters with prepayment functionality, outside their trial environment. This will provide an opportunity to gain some valuable early insight as to the extent prepayment customers engage with smart meters. Smart prepayment will also bring about a range of innovative mechanisms for payment to customers with over the air top ups (via mobiles, internet, etc.) meaning no more interaction directly with the meter and not having to worry about losing their key card. It will also open up a number of new, more convenient ways to top up such as over the phone, online and via their in home display.

**MDU:** British Gas has already conducted a high level visual inspection of the housing stock in the trial area of Tower Hamlets and identified a potential number of properties with challenging metering arrangements such as the meter being in a ground floor cupboard, which may be eligible for MDU Communications Infrastructure. As part of the Project British Gas will be looking to install a MDU Communications Backbone in eligible building(s) which would enable the smart meter HAN services to be extended to 100% of homes in these building(s). Not only will this be a valuable technical learning, but it will provide insight into the cost of this type of infrastructure as well as the commercial arrangements required between energy supplier, the landlord and the customer. Something that has not been fully concluded as part of the smart meter Implementation.

## 7.0 Conclusion

This SDRC 9.1 report encompasses the research design and objectives of the project, the technical solution that will be installed in order to achieve its objectives and takes into account the customer perspective.

The project has identified the definitions of fuel poverty adopted by the UK Government in order to be able to identify potential trial participants. A challenge faced was to identify fuel poor customers without having access to all necessary information and as result fuel poverty indicators have been adopted and used by the project in order to identify eligible trial participants (see Section 3.3 and Section 3.4).

A pilot study will be conducted prior to the trials commencement in order to test a) the response rate, b) recruitment materials and strategy, c) installation and operational processes and d) the development of the questionnaire. The pilot study is going to run with a limited number of identified fuel poor customers in order to control the progress, but sufficient in order to replicate the outcomes in the main trials.

The trial 1 (energy efficiency) will recruit up to 550 identified fuel poor customers and randomly allocate them to an intervention and control group. The comparison between the groups will provide valuable learnings in relation to the energy saving impact of the interventions provided both from the network and customer perspective.

The trial 2 (DSR) will aim to maintain the participation of the same 550 trial participants and provide them with appropriate interventions in order to make them a consistent interventions group. Trial 2 will provide valuable learnings in relation to the energy shifting impact of the provided interventions in the network and the customer.

The learnings that will be generated from the project are related to innovative technologies and associated customer and network insights, innovative partnerships with energy suppliers and trusted third parties, best practise in customer recruitment and engagement, which are going to be disseminated to the wider electricity industry.

The next phase of the project is to implement the pilot study and trials in order to collect electricity consumption information and generate valuable learnings.