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Humshaugh Net Zero CIC

RCEF

Low Carbon Feasibility Study

Workstream 5 – Smart Meter Feasibility

Final Report

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Report for
Humshaugh Net Zero CIC

Main Contributors
Rich Grant – Purple Renewables
John Cowburn – Smart Energy Networks

Issued by

……
Geoff Robinson

Approved by

……
Paul Haverson

D3 Associates Limited

Mallan House
Bridge End
Hexham
Northumberland
NE46 4DQ

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1 Introduction

Humshaugh Net Zero CIC (HNZ) are engaged in the process of reducing the Parish's carbon footprint and tackling climate change and to achieving the Government and Northumberland County Council Net Zero targets. They have consulted with the local community to ascertain their views and are looking to identify a viable approach to low carbon energy generation, particularly electricity, in the Parish of Humshaugh.

The Rural Community Energy Fund (RCEF) is a £10 million programme to support rural communities in England to develop renewable energy projects. HNZ have been successful with a stage 1 application, the funds being used to deliver this feasibility study. Stage 2 grants are available to further develop identified feasible projects for business development and planning.

1.1 Description of the Brief

HNZ can see the potential for an integrated approach to local electricity generation, demand management and possibly storage, but does not know what is realisable in the short to medium term.

HNZ is seeking tenders for the provision of a study, technical advice and assistance in reviewing the utilisation of Smart Meters in the Parish now and over the next few years. The consultant will provide technical advice and assistance to help the local community optimise its utilisation of local, low-carbon, energy resources, with the aims of supporting the Government Net Zero Target, in a cost effective manner for the local community and increasing employment opportunities in the locality.

HNZ indicated interest in smart metering systems for individual properties and groups of properties are of interest including those where the generation is not local to the demand. In discussions it was determined that both national UK smart meter rollout and other metering systems were of interest.

1.2 Scope of Work

This report describes the feasibility of possible smart metering technologies and initial discussions with possible suppliers of metering systems. It identifies possible routes to a metering system across the community to determine energy usage at a granular level and outline the next steps needed to progress in this area.

2 Smart Meter Technologies in UK

Smart metering, including automated meter reading (AMR) and more advanced metering infrastructure (AMI) incorporating monitoring functionality have been available since the 1970s. The key aim of the technology is matching consumption with generation and the provision of energy and utility management functionality.

One of the more complex requirements of mass AMI is the provision of infrastructure to host the technology, and this has historically ranged from hardwired telephone connectivity (first meters used a variant of caller ID technology) to dedicated meter radio networks.

Smart Meters have been deployed in the UK to date under two programmes colloquially referred to asSMETS1 and SMETS2 which relates to the technical version of the smart meter technology used.

In a nutshell the first version of smart meter rollout in the UK (SMETS1) relied on proprietary systems different to each energy supplier – resulting in problems when changing suppliers.

The second version of smart meter rollout (SMETS2) which commenced in 2018 overcame a lot of the limitations of SMETS1, including the use of a standardised national infrastructure operated by UK Government (DCC) that allows for simplified transfer between suppliers. It is possible for suppliers to easily access data from SMETS2 meters and some suppliers allow access to live usage data e.g. Octopus Energy, which could be used as a mechanism to understand energy consumption at a community level (e.g. if dwellings are happy to share this information).

It is possible to tell the version of SMETS supported by the meter from its serial number.

2.1 Smart Meter Implementation Programme

In the UK, as part of the Smart Meter Implementation Programme (SMIP) OFGEM started rolling out smart meters under the SMETS1 standard in 2011 initially to non-domestic customers. SMETS1 meters relied on simpler smart metering technology using GSM mobile technology. It is possible to identify existing SMETS1 meters by their serial number starting 19P. One of the issues with SMETS1 meters were the fact many went “dumb” when electricity suppliers were changed - operating in “traditional mode” – due to the fact that they were configured to talk to a specific supplier in proprietary ways rather than using a standard that all suppliers could use. This was due to the fact suppliers were individually responsible for procuring the means to communicate with their own meters – a Smart Metering System Operator (SMSO). On changing to a supplier

that has no relationship with the existing SMSO, there is no contractual way for information to be exchanged.

To get around this issue, standards were upgraded to SMETS2, with UK Government creating a new independent organisation to handle communications with all smart meters. Smart DCC (DCC) was granted a license in 2013 to establish and manage the smart metering data and communications infrastructure in Great Britain. SMETS2 built upon learning from SMETS1 and was published in 2012, with national rollout commencing in 2018. It is possible to identify existing SMETS2 meters by their serial number starting 19M.

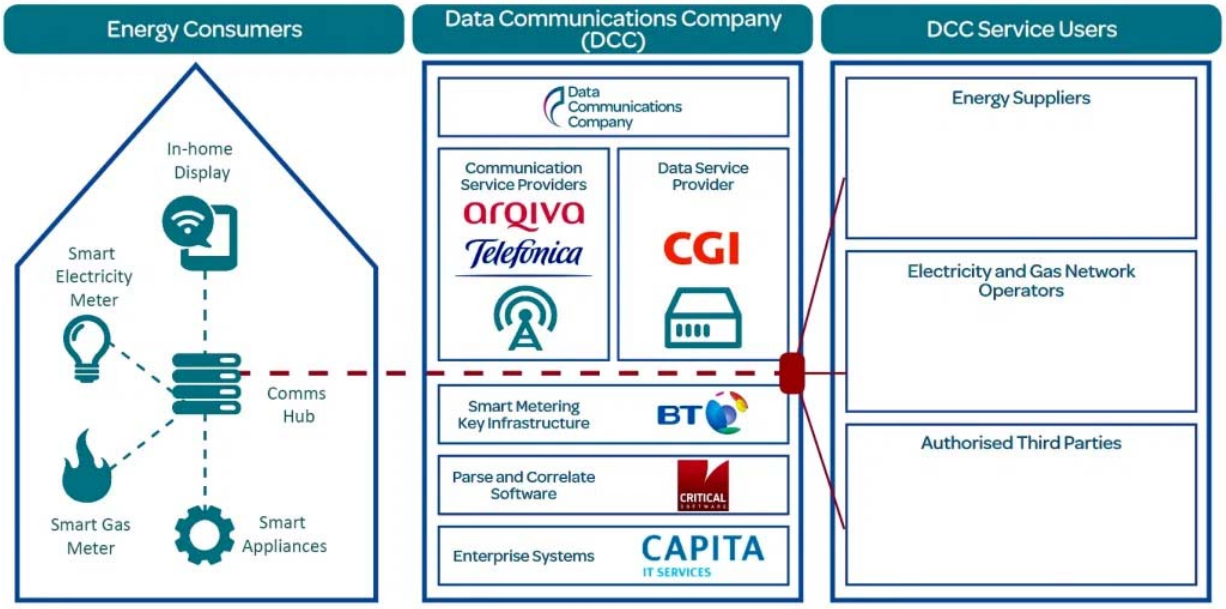
Suppliers were obliged to stop installing SMETS1 meters in 2018/2019 however over 12 million have already been deployed. DCC is now working with SMSOs to reactivate “dormant” meters that are currently operating in dumb mode by having SMOS act as gateways to existing SMETS1 meters and passing the information back to DCC (enrolment and adoption).

The Smart Energy Code (SEC) was created in 2013 which defines the rights and obligations of energy suppliers, network operators and other relevant parties involved in the end to end management of smart metering in Great Britain. SEC are responsible for administering interoperability standards across the industry.

2.2 System Aspects of Smart Metering in the UK

The key elements of the current smart metering programme in the UK include the following key components:

- Electricity Meter
- Home Area Network (HAN) – wireless connectivity around the home to smart appliances and between the IHD and Comms Hob
- Wide Area Network (WAN) – radio network in the relevant geographic region. Arqiva Limited operates northern areas using proprietary radio at 423, 454 and 869MHz, Telefonica operates southern areas using cellular / mesh radios on GSM 900, 2100 and 2400MHz LTE frequencies.
- Communications Hub (ICHI) – owned by DCC which sits on top of the meter and provides HAN and WAN services. These are area dependant as they operate on different WAN radio frequencies/operators in the geographic region
- In-home Displays (IHD) – Primary means of conveying information to the household.
- Data Communications Company (DCC) – National organisation that coordinates and implements national smart meter infrastructure
- DCC Service Users – organisations who send and receive data to smart meters



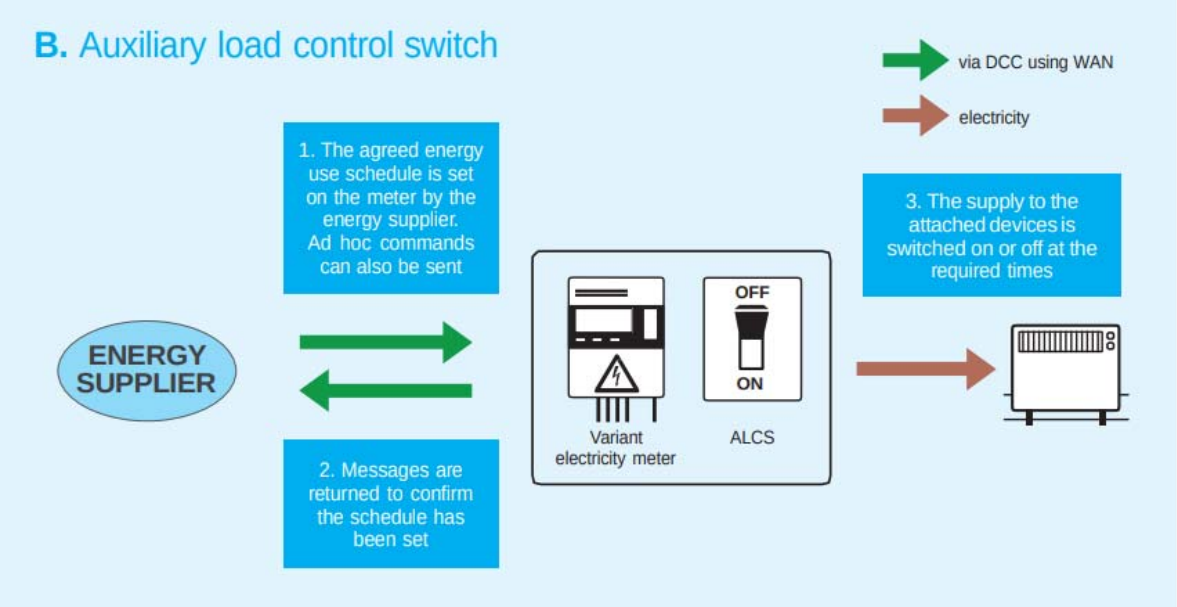
The data and communications infrastructure will:

- operate consistently for all consumers regardless of their energy supplier
- provide smart metering data to network operators in support of smart grids
- allow authorised third parties to provide services to consumers who have granted them permission to use their data. Consumers can benefit by receiving energy services and advice on how to reduce their energy usage.

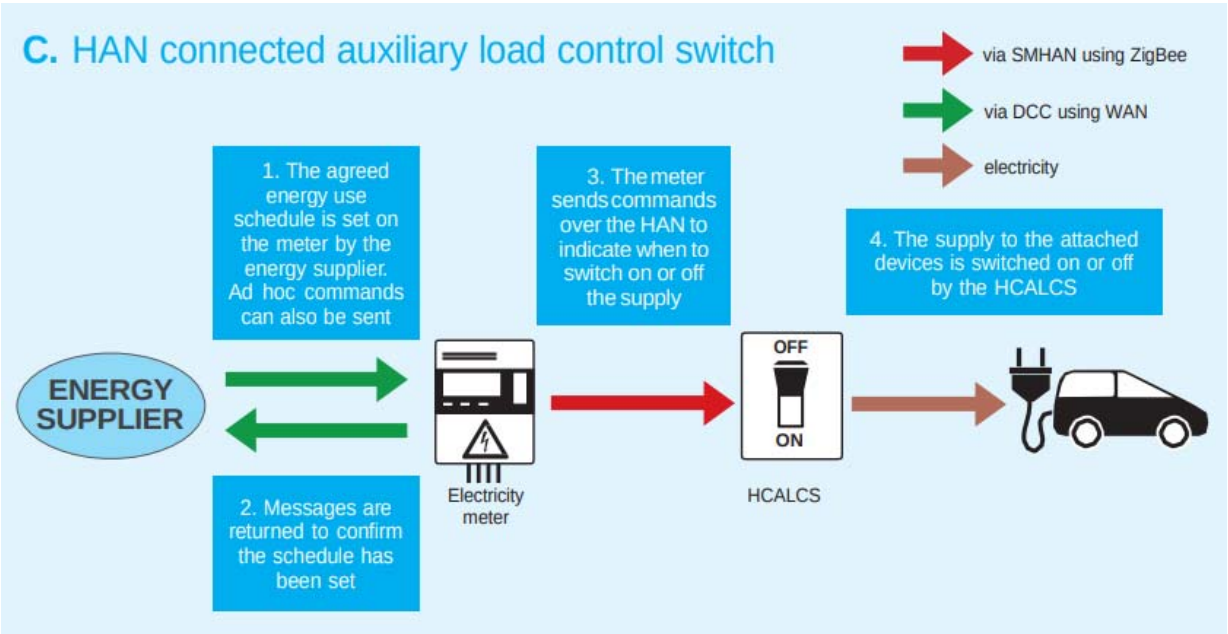
2.3 Smart Meters and Demand Side Response

SMETS2 specifications allow for two types of demand side response functionality:

- ALCS – Auxiliary Load Control Switching – this functionality is available on variant smart meters (usually with 5 terminals) which allows a switching pattern to be sent from the supplier to the smart meter to during time windows enabling remote control of large loads as part of a tariff agreement. This allows storage heaters for example to be switched on in a similar way to Economy7. In addition, the supplier may agree with the consumer that they are able to control the load as part of a demand side response action in an ad-hoc way to respond to wider power network conditions. The supplier will install a meter supporting this functionality if the suppliers' tariff explicitly needs this Time of Use (ToU) or demand side response functionality. Currently most suppliers are trialling this functionality with closed groups.



- HCALCS – HAN connected ALCS - operate in a similar way to a regular ALCS, this allows switching of a remote load via the HAN network. For example, this functionality could be implemented in an electric vehicle charger.



- ALCS switching is currently a binary on or off output, however current draft SMETS specification also detail a proportional control mode – where a load can be modulated between 0 and 100% via a control signal.

2.4 Smart Meter Data Access

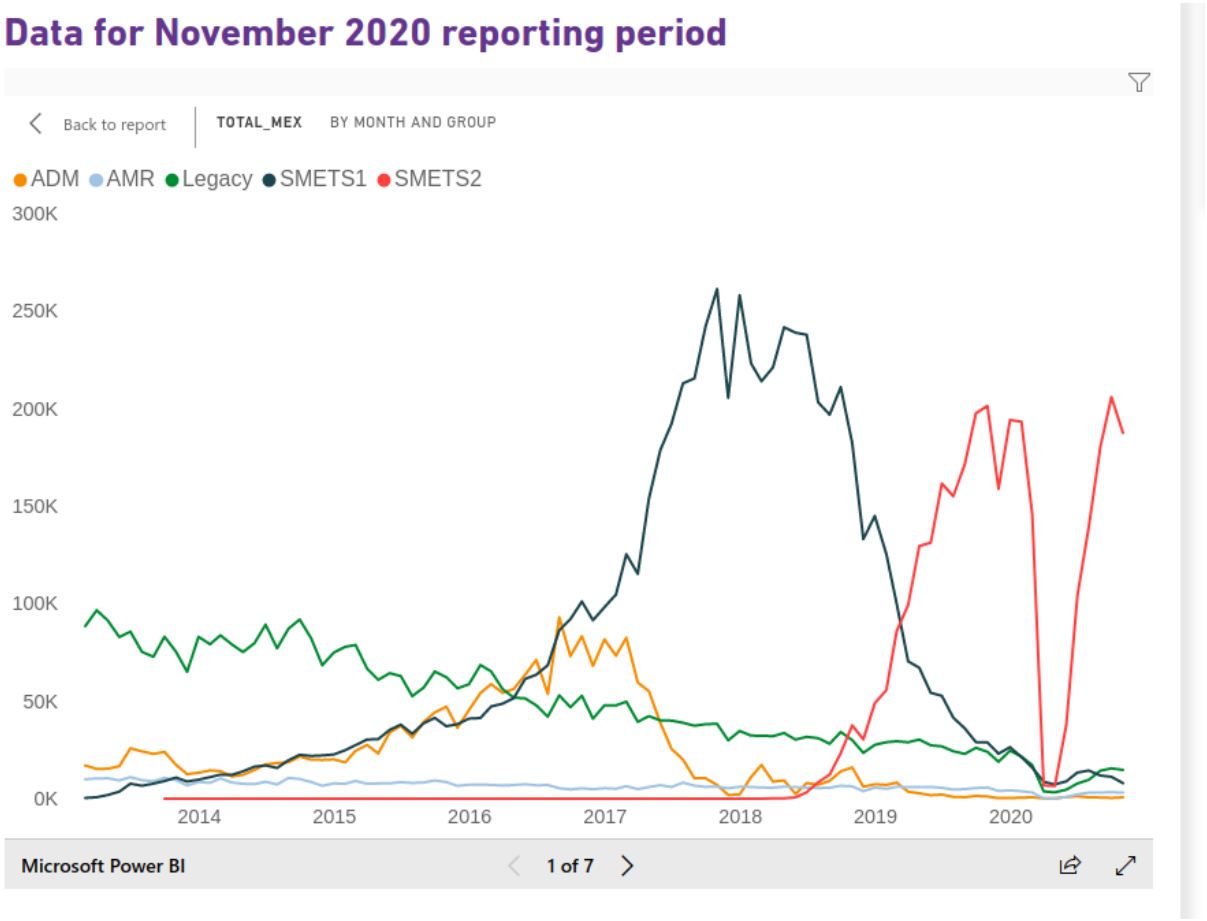
Smart meter data access is challenging as the architecture of the system only allows a customer's energy supplier to see the complete energy picture. The Data Access and Privacy Framework sets out the data access requirements which can be restrictive. Some recent developments may provide useful however:

DNO access - in Feb 2020 OFGEM has started approving limited access to DCC from Distribution Network Operators (DNOs/DSOs). This data is primarily to be used for network management and must be anonymised/aggregated to ensure it cannot be associated with individual customers.

Third Party Access – in 2018 non-licensed organisations such as energy service companies and switching sites were allowed access to DCC data with permission of the consumer. This is an opt-in mechanism where the user has to positively allow the third party ongoing data access. Whilst it is possible to register with DCC and become a member of SEC in order to access data, this can become prohibitively expensive for small community projects, so partnering with pay-as-you-go data access services such as https://data.n3rgy.com/home can be beneficial. These organisations can supply data via a bespoke software platform to create data insights and for use in aggregation/virtual power plants etc. (note Purple Renewable's sister company Milliamp Technologies can provide further technical assistance here if required).

2.5 UK Smart Meter Rollout

Data shown below showing national installation volumes of smart meters
https://www.elexon.co.uk/data/key-data-reports/smart-meter-technical-detail-report/



3 Public vs Private Energy Metering Aspects

There are a number of approaches that can be taken to meter energy, with pros and cons, and varying levels of design and integration required.

Different approaches will allow access to data in different ways at different granularity levels.

3.1 SMETS Smart Metering

Utilising smart metering via a licensed energy supplier is the lowest risk, low cost simplified method however this limits metering the availability of data from the energy supplier (if it is possible to engage them in any pilot projects) or alternatively

3.2 Sub-Metering

Whilst accessing DCC data via a PAYG Third Party access provider if one possibility, sub-metering may enhance the visibility of energy consumption at a more granular level, without relying on access to DCC data. MeterIX (see below) has a possible offering in this area.

3.3 Private Wire and other systems

In addition to the use of meter systems, it is also possible to use similar power usage technologies to assist energy usage at a highly granular community level. Utilising off the shelf technology and current transformer clamps (CTs) it is possible to passively monitor domestic energy usage in a more passive simplistic way, without requiring reconfiguration of electrical supplies (as passive clamps are used). This is a popular approach when working with academia who often prefer to

install their own custom hardware to allow more advanced software processing to be carried out. Milliamp Technologies are able to advise further in this area.

4 Smart Metering in Humshaugh

The Humshaugh net zero project is a Parish and village based mini grid project featuring embedded generation and smart appliance control to balance the generation with loads. A link to the national grid will supply any shortfall and export any excess energy.

A community display will be provided in the community centre to inform residents about the performance of the system and a billing facility will be established to finance the operation.

4.1 Humshaugh Suggested Directions

During initial discussions a number of general suggested areas of focus were made by HNZ

- Opportunities for smart metering
- Further discussions with suppliers such as Octopus energy
- HNZ wish to engage with pilot schemes

4.2 Existing Smart Metering Capability

35% of Humshaugh households have smart meters (Humshaugh Carbon Footprint Household Survey 2020) however it is unclear which version of meter they may be or if they are actively enrolled on an energy supplier's system in "smart mode". It is suggested to do a village wide audit of installations – the versions of meters can be determined by looking at the serial number as suggested above – supplying Purple Renewables with camera phone photos of meter installations could be a way for us to determine specifications. It is assumed all meters are single phase installations.

Understanding the versions of smart meters installed may allow better decision making to be made in the most appropriate course of action to be taken. For example, if most meters are of SMETS2 type there is immediate scope to undertake a quick and simple aggregation of energy usage across the community via a website for example using Internet mechanism made available by suppliers such as Octopus Energy. If most meters are SMETS1, this may require meters to be upgraded before any such development could take place.

4.3 Supply point meter

The village is supplied from 11kV substations (refer to WS 6 Report).

Energy supplied into/exported from the supply point must be measured. This may be on the primary (MV) side of the transformer with a CT/VT (transformer connected) meter or on the LV side on the bus bars using a CT connected industrial meter.

The meters will be compliant with the relevant Elexon Code of Practice (CoP 5) to measure imported and exported energy of up to 1MW at ½ hourly intervals and fitted with a communications module to enable remote reading.

Regulations dictate that this meter will have to be supplied and fitted by the Half Hour Data Collector meter operator.

4.4 Consumer Meter Technical Requirements

Smart meters are being rolled out across the UK that comply with the Smart Metering Equipment Technical Specification (SMETS2) that suppliers are required to install as part of their supply license. These meters communicate with the Data Collection Company (DCC) to send daily readings. Although the readings are stored in ½ hourly intervals in the meter, they are not normally collected. The billing registers containing tariff rate readings are read for billing purposes.

The billing data is sent to the energy supplier and not available to other parties except by special agreement. The DNO is not authorised to receive billing data but does have access to network parameters such as under/over voltage alarms.

SMETS2 meters are not guaranteed to supply calibrated voltage readings as these are not a legal requirement under the MID. Voltage values may have the same accuracy as the meter (+/- 2%) but this is not guaranteed. The values cannot be supplied in real time by the DCC even if they were available as the communications system does not have sufficient bandwidth. The system in the northern region is provided by Arqiva via a dedicated private network, not compatible with GSM.

SMETS2 meters are not therefore suitable to support this project and hence a secondary meter will be required in the consumers' premises.

The secondary meter shall be capable of providing near real time data to allow the microgrid to be controlled. The communications must be independent of the consumer and may be GSM or other radio technology such as LoRaWAN, NB-IoT or WiSUN.

The secondary meter must meet the requirements of the MID to be used for customer billing.

The voltage measurement from the meter shall be calibrated to be better than +/- 1% (ideally 0.1%) for use with the micro grid system control.

The energy readings shall be collected remotely by a head end billing system capable of supporting the population of the village.

4.5 Community Display

A community display is required to allow the residents access to information about the performance of the system. This will be located in the village hall.

Data from the billing system will be fed remotely to the community display but must be anonymised to be compliant with GDPR regulations.

4.6 Meter IX Presentation

Meter IX specialises in providing secondary metering systems to communities.

The meters comply with the MID and are fitted with communications.

The head end billing system takes meter readings for billing purposes and could read other parameters for grid control purposes such as voltage.

The billing system can operate a prepay function if required.

The head end system could supply data to the community display. It could also supply data to individual consumers to show how much they are importing/exporting and their billing status if required.

The Meter IX system could also remotely read the meters at the grid supply point(s) to provide ½ hourly data to the DNO if required.

5 Regulatory Restrictions

Some comments are made below on the grid connection aspects of sites and installation assessed within the other Workstreams.

5.1 Private Wire Systems

If private wire systems including metering are implemented, it is important to avoid any possible regulatory or legal issue that could arise, for example any IDNO requirements.

5.2 Smart Meter Rollout

As the smart meter rollout in the UK continues, there is growing pressure for smart meters to be mandated in domestic dwellings, perhaps as a condition of receiving any subsidy towards an EV chargepoint for example under the OLEV grant scheme. This would enhance the capability of any community energy management scheme if data access could be arranged, however it may also complicate matters further if a sub-metering or private energy monitoring approach is chosen.

5.3 Funding Restrictions

With significant investment made into the SMIP, there is significant pressure from the UK Government and BEIS to demonstrate successful use cases centered around DCC operated smart meters. This can create barriers to accessing funding that may be more relevant to non-DCC use cases.

6 Funding Schemes for Demonstrator Projects

Funding is available from a variety of sources for smart meter demonstrator projects:

- UK Gov BEIS tenders - There have been a number of UK Gov commercial funding opportunities made available for smart meter projects in the UK over the past few years, with the focus on exploiting further functionality in the smart meter network. They are all listed on https://www.contractsfinder.service.gov.uk/. These tenders are often focussed on supplier led consortia with >10k customers – smaller project however may be possible by negotiation with consortia parties.
- UK Gov OLEV funding - related to Electric Vehicles e.g. partnering with organisations such as ChargeMyStreet.
- DNO NIA - There is also funding available via network operators via a “Network Innovation Allowance” Northern Powergrid invite discussions for proposals that align with their priorities https://www.northernpowergrid.com/innovation. Areas including Customer-led Distribution System (CLDS) may be of interest. Further discussions with existing trial participants may lead to the discovery of appropriate collaboration opportunities.
- Horizon 2020 funding - in collaboration with research establishments and universities.
- Academic Research funding research collaboration with Universities such as Newcastle or Lancaster University

As a small community it is suggested that the most optimal way to explore funding is to partner with existing trial participants in the programmes above who may have interest in undertaking remote community trials away from urban centers. Engagement with suppliers is difficult as they are often looking for the commercial opportunity / ability to engage tens of thousands of new customers.

7 Development Risk and Mitigation

Risk	Probability	Mitigation Measure
Existing Smart Meters may be SMETS1 and not upgradable	Medium	Audit community – serial number check required.
MeterIX solution may not be suitable	Medium	Detailed use case analysis required
Access to smart meter data not possible	Low	Using DCC Third Party access as long as consumers can clearly opt-in this should be OK.
Smart Meter Availability	High	In order to rely on any trials requiring advanced smart metering, a SMETS2 meter is required. Supplier installation schedules should be closely examined.
Lack of participation	Medium	Making a step change in a rural community can be challenging. The data shows that 35% of the village has a smart meter installed so significant engagement will be required to bring people onside with energy saving and technology solutions.