SMART FINTRY – Year 2
Innovation Workstream Findings

Project Details

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*Innovation Streams Key:

Innovation Theme	Acronym
Building Community Capacity	BCC
Active Energy Consumers	AEC
Demand-Side Management	DSM
Policy and Regulation	P&R

Project Leads are indicated in **bold**

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1. Executive Summary

The SMART Fintry project aims to demonstrate a simple, low risk and replicable local energy economy that links local, sustainable generation with consumption and which can be beneficially adopted by other communities across the UK. SMART Fintry was developed and delivered by a consortium of five partners: Fintry Development Trust (project lead); Veitch Cooper Limited; Energy Assets plc; Good Energy Limited and Heriot Watt University. The £1.25m project, which was delivered over two financial years (2016/17 and 2017/18), received £841,000 of funding from the Scottish Government Local Energy Challenge Fund (LECF). The partners contributed the remaining £409,000.

The project seeks to balance local renewable electricity generation with community needs by introducing near real time management of both electricity generation and demand of energy which offers far greater functionality and potential cost savings for the end user.

This report is a summary of the work completed within Year 2 of the project, which has focused on the exploration of four key innovation topics. It includes an analysis of data collected via a near real-time, half hourly, measurement and control platform which was designed, and deployed, during year 1 of the project[1]. The four innovation topics are illustrated below:

Figure 1; SMART Fintry Innovation Work streams have investigated various key elements within the local energy economy

[1] SMART Fintry – Year 1 Operation Report, J Smith, 7th April 2017, included as appendix 1

1.1. Methodology

The Community Capacity and Active Energy Customer innovation work streams conducted research via the SMART Fintry Focus Group meetings, the Year 1 and 2 surveys and community events which were hosted in the village. A dedicated social scientist was recruited to the team to bring academic rigour to the work streams and review available academic research and publicly available papers and other local community energy project documents.

The Community Capacity work stream was particularly focused on communication with stakeholders and the identification of clear roles and responsibilities for both community and commercial team members.

The Active Energy Customer work stream combined energy usage Data from the metering and control platform with weather data and demographic and socio-economic data (occupancy and electric vehicle ownership) to enable sophisticated modelling to be conducted.

The Demand Side response workstream combined data analysis with detailed network modelling with the aim of developing new community income linked to forecasting risk reduction and distribution network service provision.

The Policy and Regulatory Work stream combined an in-depth knowledge of the regulatory and policy marketplace with the evidence gained from the project in terms of forecasting and data modelling.

1.2. Key Innovation Stream Findings

1.2.1. Community Capacity Key Findings

The Community Capacity work stream identified that:

- an established, reputable and embedded community organisation contributes significantly to project success
- ongoing messages to the community are very important to retain both interest and trust
- end users benefit from one-on-one conversations
- roles and communications should be clearly defined within and between the partners
- commercial partner's 'business as usual' approaches and back office systems can become barriers to community led innovation projects

The following guidance on roles and responsibilities has been prepared for other community projects to adopt:

1. Innovation projects require partners who bring an in-depth knowledge of the energy industry
2. Choose partners that complement each other without overlap to avoid potential conflicts
3. Engage with key stakeholders (such as grid operators) early

4. Provide a real tangible service to the community that is beneficial and recognizable and communicate outcomes to all stakeholders
5. Respect partners' commercial sensitivities
6. Be accessible - notice boards, project website social media, invite members of the community to get involved, coffee mornings, partner events with other community organisations, have a presence central to community life
7. Develop communications plan with commercial partners. Identify and define clear roles – who communicates, where and when.
8. Offer tangible add-on benefits - such as household energy monitors or LED bulbs
9. Have conversations with people within the community - these may be of an informal casual nature but often provide valuable insight into the opinions or feelings of the general community.
10. Governance - dedicated staff, steering group meetings, consumer focus groups, regular project management meetings and project plan
11. Manage expectations

1.2.2. Active Consumer Key Findings

Active customer engagement via switching from their existing energy suppliers to the 100% renewable community tariff proposition, known as the 'Fintry Local tariff' required:

1. Actively engaging customers to switch tariff and supplier required significant effort in the form of local campaigning, events and communications. FDT were essential in driving up support within the village and engaging with the harder to reach villagers.
2. Price remained a factor in decision making but it was not the only driver and many villagers signed up to Fintry Local Tariff to support the village itself and because of the interest in the renewable energy
3. In the longer term the price offered by Good Energy is not sustainable (sub market cost) and will increase in March 2018. To date only one household has left the SMART Fintry tariff (due to a tenancy change) and it will be interesting to track how many villagers remain on the tariff or switch to alternative suppliers.
4. The exploring of how to engage with customers to alter their own behaviours to impact upon their household energy consumption discovered that:
5. The villagers were interested in changing their energy behaviours but wanted more information and knowledge about how and when to switch.
6. Residents were interested in being able to monitor their own energy usage and wanted to be able to see the data from their own meters
7. A personalised energy dashboard may influence customer energy behaviours but we did not implement this within the project so we had no in-depth supporting evidence

8. The use of timers and remote control of domestic devices provide opportunities for switching to cheaper energy times and residents were interested in trying them but again require more information about the most advantageous time to use such devices.

1.2.3. Demand Side Management Key Findings

The Demand Side Management workstream

- Brings together technical and commercial elements of the project to identify new demand-side management business models
- Aligns with aims of the Energy Networks Association (ENA) open networks project[2]
- Uses a combination of qualitative and quantitative (both measured and simulated) data to provide a view of load characteristics across the village.
- Includes network modelling activity to investigate the impact (and opportunity) of Electric Vehicle load growth

The key issues explored focussed on potential revenue generation via:

- Community ownership of a near real time measurement and control platform
- Localised Half Hourly Tariff Development
- Provision of Distribution Network Services (DNS)

The Demand-side Management work stream identified that:

1. Installation of a Community Owned Platform offers the opportunity for communities to access new revenue from new distribution services although further work is required to quantify the benefit, reduce unit costs and optimise data processing.
2. The nature of the services offered is locational and should be approached on an area basis across a primary sub-station area.
3. Community cluster groups should be formed to develop co-ordinated energy area plans based around detailed network models
4. Temperature sensors, installed at the same time as smart meters, offers an opportunity to identify heating types without the need for additional surveys
5. Generally accepted assumptions around electric storage heating availability to participate in demand-side management are open to challenge
6. On-site monitoring of generator output can reduce forecasting errors by up to 10%.
7. A local TRIAD system offers the opportunity to develop new, customised, power purchase agreements.

[2] http://www.energynetworks.org/electricity/futures/open-networks-project/

1.2.4. Policy and Regulation Key Findings

The objective of the policy and regulatory workstream has been to take the findings from each of the other innovation streams and relate them directly to existing UK policy and regulation with the aim of feeding into current debates and shaping future developments. Highlights include:

Metering Recommendations for Policy Makers

- Ofgem should make clear that it will not expect advanced meter solutions used as part of a local energy project to be replaced within the context of the "all reasonable steps obligation" where there was no viable alternative at the time of installation. This is important to avoid creating unnecessary uncertainty around community energy projects.
- DCC should look to learn from the experience with different communications technologies in Fintry as it looks to extend coverage in remote areas.
- BEIS and Ofgem should ensure that pressure is maintained to deliver the functionality to support CADs and load control, recognising that incumbent suppliers (who tend to dominate industry working groups) may not want this to be prioritised where it supports innovative business models. Ofgem should ensure suppliers are complying with licence obligation to support CAD installation.
- BEIS should conduct research into the consumer protection issues associated with the use of consumer broadband to deliver some of the important benefits of the smart meter rollout and to ensure that all customers are able to benefit.
- BEIS should consider alternative use cases to ensure that the SMETS specification keeps up with evolving thinking on energy system developments. In particular BEIS should test some of the ideas for local energy markets reflected in its Smart Flexible Energy System work, together with evidence from SMART Fintry, against the SMETS specification.
- Ofgem should work with the SO to ensure that domestic customers are not precluded from participating in the provision of ancillary services by concerns about the robustness of granular data provided as a supplement to the half hourly data which is subject to strict metrology standards.
- Ofgem should be open to the provision of prepayment functionality through non- standard models where this would enable such customers to participate in local energy projects using alternative metering technology.

Half-Hourly Settlement Recommendations for Policy Makers

- It is essential that in thinking about reforms to network charges that Ofgem takes account of how these might realistically be reflected by suppliers into retail tariffs. This means thinking about them in the context of the wholesale cost structures that suppliers face (and which are themselves changing).

- Alongside its work on half hourly settlement Ofgem needs to revisit the thinking it did on consumer empowerment and protection for smarter markets which touched on tariff innovation. While Ofgem is unlikely to want to take a prescriptive approach in this space there needs to be a dialogue to help build a common understanding of how Ofgem's principles would apply in this area and its risk appetite.
- Given the risks to suppliers in moving to elective half hourly settlement Ofgem should make clear whether it is open to them to revert to using profiles in future if they find these risks too difficult to manage at this stage.
- Ofgem needs to put further effort into understanding the distributional impacts of a move to half hourly settlement building on the approach taken above. There is justified concern from consumer groups about the potential impacts on vulnerable and low-income customers which if not addressed risk de-railing the project. [While it is not necessarily an issue for some groups e.g. those at home all day – further work is needed to understand where problems may arise and hence what additional protections or support may be needed].

Load Balancing Recommendations to Policy Makers

- Ofgem should continue to look at removing barriers to local balancing and peer-to- peer trading, recognising their benefits in terms of consumer engagement and as a longer term potential source of flexibility.
- In particular Ofgem and Elexon could helpfully provide clarification around the status of the "complex sites" regime and how this could be evolved to facilitate community energy projects and peer to peer trading. Given that small suppliers and community groups do not have the resources to readily progress code modifications (in particular ones that incumbents may resist) Ofgem and Elexon should play an active role in progressing such changes
- Ofgem should continue to support network innovation projects that seek to increase understanding about the opportunities in this area.

Network Charging Recommendations to Policy Makers

- BEIS and Scottish government should provide a clear steer to Ofgem on the importance of network charging decisions (and in particular the allocation of the residual) supporting local energy. Consideration should be given to the designation of community energy projects which government (either Scottish government or Westminster) consider bring wider public policy benefits, reflected for example in their receipt of Local Energy Scotland funding. This designation could then be considered by Ofgem in network charging arrangements or in an updated version of the "complex sites" regime, allowing some dispensation from network charges.
- Ofgem should support further work being done to demonstrate the benefits of local energy for the local distribution network looking in particular at an area

based approach to distribution system losses and constraint management.

- Ofgem should be cautious about making changes to network charging which disadvantage local energy ahead of steps being taken to credit local energy for the benefits it delivers. In particular it should pay due regard to the need to avoid large swings in charges which risk confusing customers or undermining longer term attempts to engage consumers in demand side response.

Virtual Storage Recommendations to Policy Makers

- BEIS and Ofgem should review how network charging arrangements and FIT provisions could be revised to facilitate new business models around shared ownership of storage and other DERs. In particular Ofgem should ensure that there is not a perverse incentive to pursue domestic scale solutions when community scale solutions would (absent the distortions of the charging regime) be more economic and inclusive.

Other Recommendations

- Scottish government should review its treatment of IP when funding projects, drawing on experience of other innovation funding streams, to ensure that it is not imposing unnecessary barriers.
- Ofgem and BEIS should keep under review how smart meter data collected via the internet (rather than through the smart metering system) is treated from a privacy perspective to ensure consumers remain protected while not imposing undue barriers.
- As part of its thinking on alternative business models and the future of retail regulation, Ofgem should ensure it considers the community energy opportunities.

1.3. Recommendations for Future Work

The project has delivered across the original objectives however further work is required to fully realise the potential benefits of the project. The community wish to make best use of the SMART Fintry infrastructure (and minimise project risk for other Scottish Government projects) by establishing Fintry as a national living laboratory facility for demand side management which will attract technology developers, suppliers and social scientists to the area to test new technologies and business models in a real life setting before rolling them out across the country.

The aim will be to create a social enterprise which is –

- community led;
- supplier independent;
- highly innovative;
- capable of operating subsidy free.

In this way the project will empower and engage communities and consumers in local energy systems.

It is recommended that additional work be carried out in addition to the above to:

- Develop **New Area Based Community Energy Business Models** (develop the new local energy business models that will deliver longer term financial sustainability for communities across Scotland)

In addition, to achieve this, some of the challenges met in the first two years of the project will need to be overcome –

- Address **Customer Service** Challenges (specifically the role of the community group in customer engagement, recruitment and management to minimise billing errors)
- Streamline **System Operation** (standardise metering installs to avoid multiple versions and optimise the control platform to minimise errors and improve response time)
- Further lobbying for change to the **Policy and Regulatory** framework to avoid unfair charging structures.

Contents

2. Introduction

SMART Fintry is a £1.25m local energy project which began in May 2016 with the aim of developing and demonstrating a replicable means of trading and charging for electricity that allowed UK consumers to buy their power direct from local generators -without the need to install duplicate grid infrastructure. The project received £841k of funding from the Scottish Government's Local Energy Challenge Fund over two financial years (2016/17 and 2017/18). The remaining funds (£409k) were provided via matched funding from the partners, a consortium of five organisations:

- Fintry Development Trust (Lead partner and Community Organisation)
- Veitch Cooper Limited (Innovation Intermediaries[3] and Project Managers)
- Energy Assets (Metering and control platform providers)
- Good Energy (Electricity Suppliers)
- Heriot-Watt University (Research Support)

The project has been carried out in the rural Stirlingshire village of Fintry; an off-gas grid community of approximately 350 households (c700 inhabitants). A total of 115 households (>30%) participated in the project. 1 household left the project (as a result of a house move).

2.1. Progress Against Original Project Deliverables

Deliverable	Status	Highlights	Challenges
New Community Tariff	Partial Delivery	• A tariff rate was agreed which offered an 18% price reduction when compared with standard electricity prices available in the postcode. • Price Purchase Agreements (PPA's) were put in place with 4 local generators. • Potential revenue streams from provision of Distribution Services and demand shifting identified and discussed with key stakeholders	• No transparency on supplier pricing strategy making direct quantification of benefits difficult • Lack of back office system functionality led to customer service challenges • Peer to Peer trading capability lost to project due to IP conditions imposed by Grant conditions

[3] Innovation Intermediaries are defined as bridging organisations. According to According to Trist (1983), innovation intermediaries are vital as they help enable organisational collaboration and bring organisations, universities and governments together to address long term issues

Trist, E. (1983) Referent Organizations and the Development of Inter-Organizational Domains. Human Relations, Vol. 36(3), pp.269-284.

Deliverable	Status	Highlights	Challenges
Real Time Measurement and Control	Achieved	• Zigbee based measurement and control platform deployed • Real time control demonstrated (storage heaters)	• Weak Zigbee mesh lead to bespoke workaround metering solutions which will require to be rationalised • Manual intervention required to transfer data to supplier for billing and/or purposes
Improved Generation Forecasting	Achieved	• Real time monitoring of generation assets combined with advanced forecasting algorithms resulted in a 10% reduction in forecasting error	• Requires further analysis to quantify monetary benefit
Demand Side Management Policy Framework	Achieved	• Comprehensive policy and regulatory document produced highlighting specific areas of policy that require to be adapted to facilitate distributed energy and local energy economies	• Further analysis required to provide evidence to policymakers

• SMART Fintry Highlights

The SMART Fintry project has:

- Established Scottish Community Energy Groups as being influential energy industry players by offering the possibility of supplier independent business models
- Identified clear winners and losers from half hourly settlement highlighting the need for a socialisation of benefits
- Delivered a reduced tariff for consumers
- Identified potential revenue streams from low voltage grid services
- Enhanced community cohesion
- Developed a community network map
- Delivered a community owned asset (the measurement and control platform)

2.2. Alignment with Energy Strategy Priorities

SMART Fintry fits directly with many of the priorities in the Scottish Government's Energy Strategy –

Strategy	SMART Fintry
Consumer engagement and protection	• Consumers coming together in community • Increased awareness of energy and climate change • Create a community asset and building a community owned business around it • Community-owned consumer dashboard giving consumers control over their own usage data
Energy efficiency	• Smart systems using generation, storage and consumption assets more effectively • Intelligent use of energy so it's responsive and used when needed, and not when it's not needed
System security and flexibility	• Help to form a better understanding of how distribution assets are being used • Learn where flexibility lies in the system
Innovative local energy systems	• Development of community-owned data platform • Commercialise a community asset by providing a service to industry • Bring money into the local community through a commercial service
Renewable and low carbon solutions	• Using local renewable generation plants • Installation and integration of low carbon domestic systems

3. Innovation Stream Findings

3.1. Community Capacity

3.1.1. Workstream Overview

The Community Capacity innovation work stream wanted to identify the 'community ingredients' that have made the project a success in Fintry and:

- address how this could be replicated in other communities across the UK.
- Identify and discuss the key challenges and potential methods to overcome them.

The work stream explored the key roles, processes and community engagement required to make a community energy project a success:

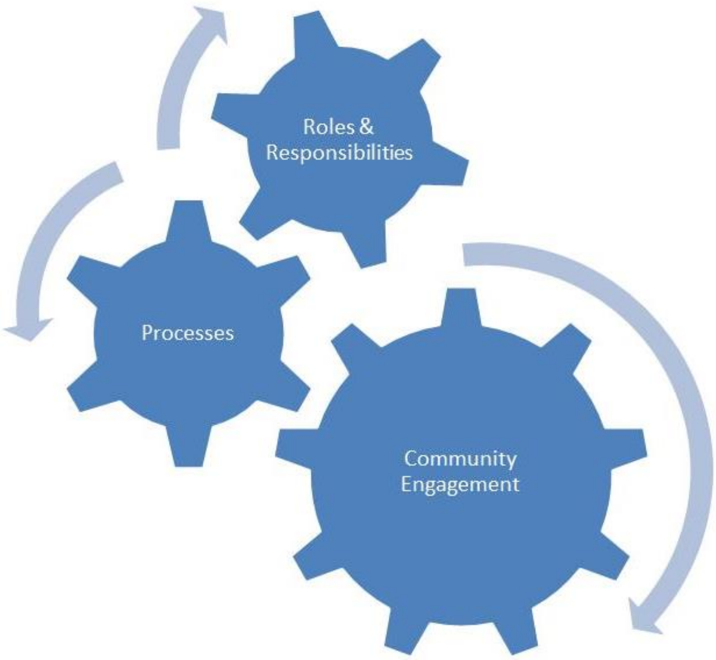

Figure 1: Elements which lead to a successful community energy project; delivering benefits to all project partners

Work stream Rationale:

To realise the benefits of local energy economies and replicate projects similar to SMART Fintry throughout the UK it is important to consider the varying factors such as demographics and roles within the community which impact upon project success. It is therefore important to understand the core elements and the challenges which the project has faced and how the learnings from SMART Fintry can be adopted by others.

Work Stream Objectives:

1. Gather information on the role of the community organisation from FDT and from the other project partners, especially Good Energy and Energy Assets who had direct customer facing roles.
2. Define the roles of the community organisation and the commercial partners and the benefits of the partnership to both.
3. Define the community success ingredients.
4. Discuss with another rural community how a similar project might work in their community

Method:

The project collated a range of data to carry out the Community Capacity workstream objectives. A dedicated social scientist was recruited to the team to bring academic rigour to the work stream and review available academic research and publicly available papers and other local community energy project documents.

The workstream includes information from:

- **Surveys:** Surveying customer experiences of the project both in Years 1 and 2.
- **SF focus groups**: Consumer focus group which meets every second month to discuss the project with a select community resident committee
- **Events**: Project events held to collect further feedback from the community
- **Sign up events**: Signing up Fintry residents to the Fintry Tariff
- **Community conversations**: As a community project many useful points of engagement occur in casual informal conversation with community members. The FDT office is situated in the Sports Centre, essentially the village hub, including shop cafe and bar. Residents can easily find staff to discuss any issues.
- **Preparation of customer service process diagrams** prepared with contributions from Good Energy, Energy Assets, FDT and Veitch Cooper
- **Previous engagements with FDT**; The history, development of the trust and role of the trust, as it has been working within the Fintry community since 2007. The previous work of the trust will provide insight into the existing role within the village.
- **Project team workshop sessions** : both the first year planning session and the final year lesson learned session
- **Communication** – Communications carried out by FDT including local press, newsletters, notice boards, website, social media, full village postal coverage, leaflet drops, light bulb surveys. Access to FDT staff emails and phone numbers.

3.1.2. Overview of Key Findings – Community Capacity

The Community Capacity work stream key findings are summarised below:

1. The community are key to the project and must be engaged via as many types of communications and active interventions as early as possible within the project
2. A variety of roles are required within a local energy project and all parties have to flexible and adaptable to change.
3. Project partners need to be selected with care to compliment the community organisation skillset and prevent conflicts of interest.
4. Customer support processes have to be clearly defined and the role of each project partner defined and established
5. Energy Suppliers should ring-fence or place project participants within an incubator unit to ensure that they receive customer service tailored to the project requirements
6. An established, reputable and embedded community organisation is integrall to project success
7. Villagers benefited from having one-on-one conversations with the project team who were available within the village
8. Roles and communications should be clearly defined within and between the partners
9. Commercial partner's 'business as usual' approaches and back office systems can become barriers to community led innovation projects
10. All communities are different therefore there is 'no size fits all'. However, valuable learnings from SMART Fintry can help shape future UK projects

3.1.3. Project Roles and Responsibilities

Complex, innovative community energy projects such as SMART Fintry require to access a range of knowledge and skills, some of which can be highly specialised depending upon the solution or innovation being trialled. Key personnel should be recruited early in the project definition stage and retained, as far as practical, to provide continuity as the project moves from initial feasibility through to delivery.

Within SMART Fintry the project team comprised of five main partners with additional specialist advice being procured where required.

Working with a large range of partners can be challenging but the SMART Fintry project found that the **creation of a General Agreement** at the outset of the project assisted greatly with defining the roles of the partners and ensuring that all partners were legally aware of their project obligations. Seeking legal advice to help with the creation of the General Agreement document smoothed this process and ensured that the commercial organisations own legal departments were far more amenable to signing.

The list of potential roles provided below is not exhaustive but provides an illustration of the broad range of roles a project may have to consider when developing its project.

Role	Potential Participants	Fulfilled in SMART Fintry Project by	Responsibilities
Community	The community could be geographically wider than the original area / village	Fintry Community	Actively participate in the project
Community Organisation	Housing Association Community Trust , Group	Fintry Development Trust	Harnessing the power of the community Lead project organisation
Design & specification of systems technology infrastructure	Dependent upon the solution required	Veitch Cooper Ltd Energy Assets Heriot Watt University	Ensuring quality technical designs which pass any regulatory checks required
Technology Providers	Dependent upon the solution required	Energy Assets Veitch Cooper Ltd	Providing quality technology solutions / assets
Energy Supplier	Licensed Retail Energy Supplier Ultimately this could be the Scottish Government or the Community Group themselves	Good Energy	Develop & Administering Energy tariff , ongoing customer support Power Purchase Agreements with local generators
Meter Operator	installing and maintaining electricity and gas meters	Energy Assets	Providing the meters , managing the installations & removals if required
Data Collector	Collecting Consumption data from the installed meters to be passed for billing to supplier	Energy Assets	Gathering & Verifying consumption data
Legal Advice	Specialist commercial lawyer	Harper MacLeod Veitch Cooper Ltd	Creation of contracts and general agreement

Financial Management	Local accountant	Veitch Cooper Ltd	Management of project finances
Academic analysis and support	Wide range of academic institutions with interests in working with community projects	Heriot Watt University	Forecasting, modelling
Project Management	Cares Framework	Veitch Cooper Ltd	
Industry Specialists	Regulatory and Policy Specialists Social Impact Specialists	Veitch Cooper Ltd	Provide specialist advice and guidance

3.1.4. The role of the Community

"Communities are more than simply a sum of all of its parts (or individual members). Communities are the relationships between and within the people living there: what each one brings from their own history, and the interconnectedness of the members themselves."[4]

At least 5,000 community groups have undertaken energy initiatives in the last five years alone.[5] Each community is unique and has its own dynamics and social drivers. Previous research, however, carried out by Edinburgh University - Community Energy in Scotland[6] has noted that energy projects in general are more likely to be successful in areas that are:

- less deprived
- have carbon saving motivations as well as financial ones
- carried out by long standing/existing groups rather than groups set up specifically for the new project
- already have a sense of community cohesion and shared identity

In larger, more deprived communities, it is imperative that things are not done to communities, but done with communities. Collaborative engagements where communities become part of solution making can be transformative to individual, families and community groups. These types of practices also help projects to succeed in the long term by empowering communities and promoting a sense of identity with the project. It is also important that communities have a right to share in the knowledge that emerges from such projects.

Engaging communities to actively join projects can be challenging and the role they choose to take will vary with each project/ innovation type.

The Fintry Community is located in a relatively remote hillside location 20 miles north of Glasgow and 15 miles west if Stirling. The village has a population of around 700 (335 homes). There is

[4] Maggie Laidlaw , Smart Fintry Social Impact Report

[5] Community Energy Coalition , https://www.ukcec.org/start-your-own-community-energy-project

[6] The Social Factors for Success (Haggett, Creamer, Harnmeijer, Parsons, Bomberg et al.2013)

no access to mains gas, very limited public transport and broadband and mobile phone reception can sometimes be intermittent. The village has a large elderly population but is also home to many young families.

The SMART Fintry project was reliant on gaining consumption and generation data from the local community so it was a key driver that members of the community signed up to the SMART Fintry tariff and that local Generators signed Power Purchase Agreements with Good Energy. By signing up to Good Energy a segment of the community became "active project participants" and the project requested that they:

- Allow their data to be used for project purposes within data protection rules
- Take part in the consumer focus group.
- Attend community project events.
- Agree to participate in surveys and providing feedback to the project.
- Allow electricity monitoring in their homes (anonymously).
- Be aware of the renewable generators selling electricity to the project via PPAs and allowing generation monitoring to take place.

During the lessons learned session (Appendix 2) the project team recognised that focus on gaining sign ups to the Fintry Local tariff may have left other members of the community feeling excluded. The project recognised that engaging with the whole community through communications and other engagement tools is necessary to give non-Tariff customers a project role.

In hindsight it was discussed at the focus group meetings that the participants felt more engaged and excited about the project having been made aware of the technical and innovating aspects of the project. It was highlighted that if the whole community was also made aware of the technical aspects as well as the wider innovative implications of the project throughout they would become more engaged through greater understanding. It is accepted that this can be a difficult aspiration to achieve, given the limited technical understanding of those not immediately involved in the project or the wider energy industry.

Within SMART Fintry we will be providing a wider engagement presentation to the broad community and a summary of this report, published on the website, thereby encouraging a further shared community understanding and vision.

3.1.5. The Role of the Community Group

The community itself needs a voice to activate and lead a project. Once a group has formed and begun to shape a project the community group must be constituted in an appropriate, formally constituted body or, in project development terms, a Special Purpose Vehicle (SPV).

The role of the community group can be wide- reaching depending upon the scope of the project and may include:

1. establishing and maintaining relationships within the community with generators, businesses, key community members, residents and project partners as well as external organisations such as Local Energy Scotland and Scottish Government

2. assisting commercial partners on the ground with appointments/the installation and/or maintenance of equipment
3. assisting commercial partners with community information
4. communicating with the community (telling people what is happening, when and why, encouraging residents to sign up to the tariff and engage with the project). Support and advice through the customer journey through informal conversations
5. conducting surveys, holding community meetings, engaging with other communities
6. The day to day operation of the project on a community level.
7. Fund management if income is derived for the community.
8. Establishing an office base from which to operate and provide drop in opportunities for the residents and a community base for partners to utilise.

The role of the community group can provide key benefits in delivering on the ground support to the community and project. Key factors to ensure that the community group is effective may include:

1. how established the groups is
2. its legacy and track record,
3. how the group is perceived within the community,
4. its governance,
5. established staff and community presence.

If the community group takes a project manager role this could involve:

- input into the overall direction and aspirations of the project from a community organisation perspective
- acting as the conduit between the commercial partners and the community
- facilitating the installation of equipment in conjunction with project partners
- providing energy advice/customer service - talking to customers whose queries/issues may not be satisfied by the commercial partner
- facilitating community project events
- actively engaging the community with progress and updates

Within the SMART Fintry Project Fintry Development Trust (FDT) was the Community Group. FDT was established in 2007. The main aim of the trust is to develop Fintry as a low carbon sustainable community by addressing energy use, carbon emissions and fuel poverty. The trust is also responsible for the fund management of income from the Earlsburn Windfarm of which the Fintry community owns 1/15th.

Since 2007, FDT has successful ran several energy projects within the village with the main objective to provide energy advice to households and reduce the overall carbon output of the community. As a direct result of these activities the trust has been successful in establishing itself within the community as a reputable, trusted, resourceful and approachable organisation which is embedded within the community identity striving for positive change within Fintry.

Fintry Development Trust has acted as the lead organisation and community organisation on the project.

Liaison between the Community Group and Commercial Partners:

- as intermediary between the commercial partners and the community it is important that roles between community group and commercial partners are clearly defined
- within research and development community projects for commercial partners 'business as usual' does not apply. A disruptive/experimental approach is required. There is scope for further investigation as to how strictly regulated commercial partners can work within the rules yet still be flexible thereby opening up an innovative methodology in community projects to maximise benefits for both parties:
- 'business as usual' approaches can limit the project effectiveness.
- satisfaction on customer service can have a real negative impact on the project and community group

The Community Group engagement with the wider Community:

- Specialist project partners will ensure that the technical aspects of the project are well conceived and delivered. However, these aspects can also act as a barrier to community engagement. If the community do not understand the objectives and how they are achieved how can they become engaged? This may be particularly difficult in bigger communities.
- The wider community must remain as an "informed project partner" throughout the project so they need regular engagement through a variety of channels. Within SMART Fintry more engagement/clearer communication may have helped when metering and billing problems occurred which caused considerable confusion amongst tariff customers.
- Groups need to carefully track customer expectations and manage them carefully, active engaging in community participation gathering regular feedback.
    - In SMART Fintry confusion was caused by our use of the descriptor of our meters as "Smart Meters". Our customers viewed national media messaging about the generic Smart Meter rollout programme and expected our meters to resemble the media campaign meters which they did not.
    - SMART Fintry project participants expected to see their electricity consumption data that was being collected for the project. Participants did not have the ability to do so until towards the end of the project. In retrospect one idea would have been to offer each participating household a domestic energy monitor upon sign up. However, an online dashboard or portal has the added benefit of not running out of batteries and potentially having additional functionalities to a traditional electricity monitor.

3.1.6. Community Engagement Approach

It is recognised that the SMART Fintry project benefited from a well-established and trustworthy community organisation in place to deliver key aspects. Guidelines are suggested to help other communities develop a success community engagement approach for similar projects:

Establish community connections with other community groups, activities, residents, businesses and energy generators

1. Provide a real tangible service to the community that is beneficial and recognisable
2. Build up a track record of project delivery
3. Involve the community in projects highlighting the benefits to the area as a whole
4. Project plan to achieve deliverables along with community engagement activities
5. Be accessible - notice boards, project website social media, invite members of the community to get involved, coffee mornings, partner events with other community organisations, have a presence central to community life
6. Engage with industry experts at an early stage
7. Develop communications plan with commercial partners. Identify and define clear roles
8. Offer tangible add-on benefits - such free as household energy monitors or LED bulbs for participating households
9. Have conversations with people within the community - these may be of an informal casual nature but often provide valuable insight into the opinions or feelings of the general community.
10. Set up a formal Governance structure - dedicated staff, steering group meetings, consumer focus groups, regular project management meetings
11. Manage expectations
12. Governance - dedicated staff, steering group meetings with a formal terms of reference, consumer focus groups, regular project management meetings

For community groups inspired to embark on a project similar to SMART Fintry a considered a step by step community engagement process is recommended in the diagram below. Although every community and every project is different the recommendations outlines the high level steps that should be considered.

Community Engagement Flow Process

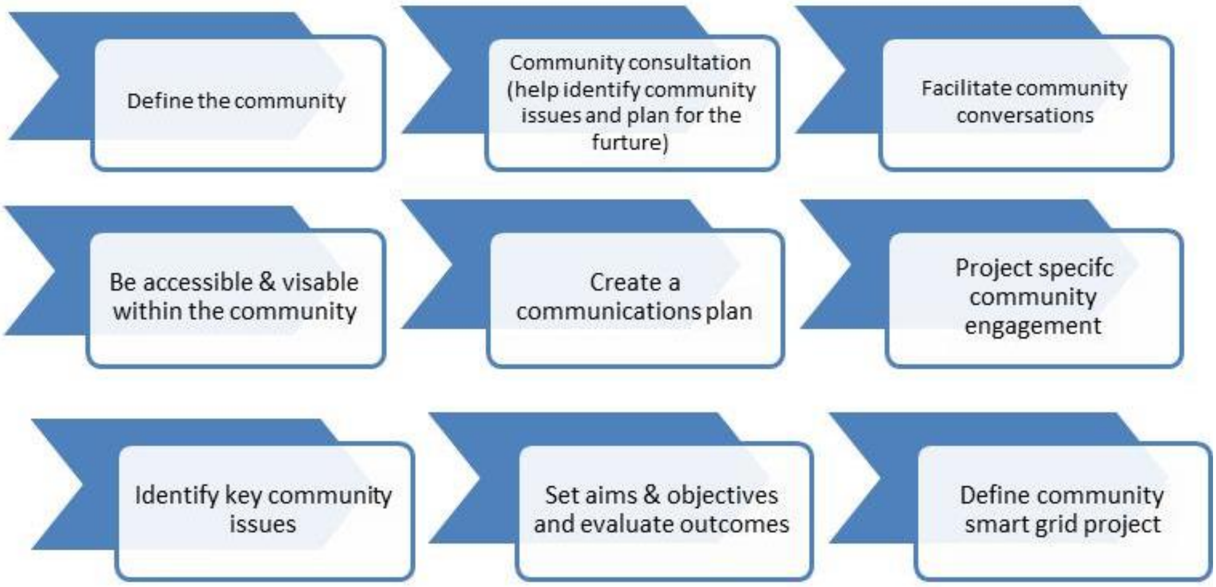

Figure 2 :SMART Fintry experienced a Community Engagement process which could be replicated within other community projects.

From conception the project requires an understanding by the community organisation of renewable energy and local energy systems as well as a good local knowledge of community. It should also be noted that in addition to community engagement and project development process in also required. This may or may not involve consultation with a technical project partner or stakeholder.

Community projects and the energy industry:

1. The energy industry norms and standard practices can act as a barrier to disruptive or experimental and flexible innovation within community projects. Further investigation and discussion is required to find out how these can be addressed in the regulated energy retail sector. (refer to section 6 of this report)
2. It is recommended that energy suppliers set up projects within an incubator unit or segregated area so that standard practices and approaches are tailored. These practices include but are not limited to: Legacy metering (such as E7, E10, prepayment, restricted, THTC), call centre approaches , automated billing and communications to customers, how meters talk to the supplier/provider, remote readings, reliability of meters to sending communications in rural areas.
3. 'business as usual' approaches can limit the project effectiveness. For example the Energy Suppliers CRM system may not recognise the special circumstances of the local tariff an automatically send inappropriate standard letters

3.1.7. The role of the Energy Supplier

If an Energy Supplier is required for your project it is worth clarifying the boundaries between the supplier and the community group. It would be beneficial to discuss data sharing arrangements and develop detailed customer service process maps so all parties are clear and the customer has a smooth experience.

From the supplier's perspective,

- the participating residents are considered by the regulator and by the legal contract to be their customers and as such the supplier is obligated to protect their identities and data. Furthermore,
- the supplier sees the customer service activities as solely belonging to the supplier and requiring little or no input from the community organisation.

From the perspective of the community organisation -

- the participating residents are:
  - members of the community to whom the community organisation is answerable to
  - participating in an innovation research project led by the community organisation which requires the responsible collection and analysis of end user data and;
- the community group has often received queries from participants not satisfied with the customer service from the supplier and have therefore approached the community group for help.

It may be worth considering arranging an **Assignation of Rights** where the customer gives their explicit permission to share data – or indeed for the community to act as agent. This is explored within the Regulatory and Policy Section 6.

Firstly, the innovation project is not 'business as usual' for the supplier or the customer. As such the standard industry processes such as automatic written communications, estimated billing and short retention call centre staff operations are redundant. An alternative more coordinated approach is required. The project community requires a dedicated service and the supplier should be able to provide this. There may be additional cost implications here for the supplier.

Secondly, the failure in some instances of the chosen communication methods to send remote meter reads to the supplier within the rural location has triggered automated responses from their CRM system which has resulted in confused messaging, requests for manual reads from customers and direct debit amounts being changed due to failure of reliable monthly meter reads.

The blurred roles between the community organisation and supplier require further discussion and investigation.

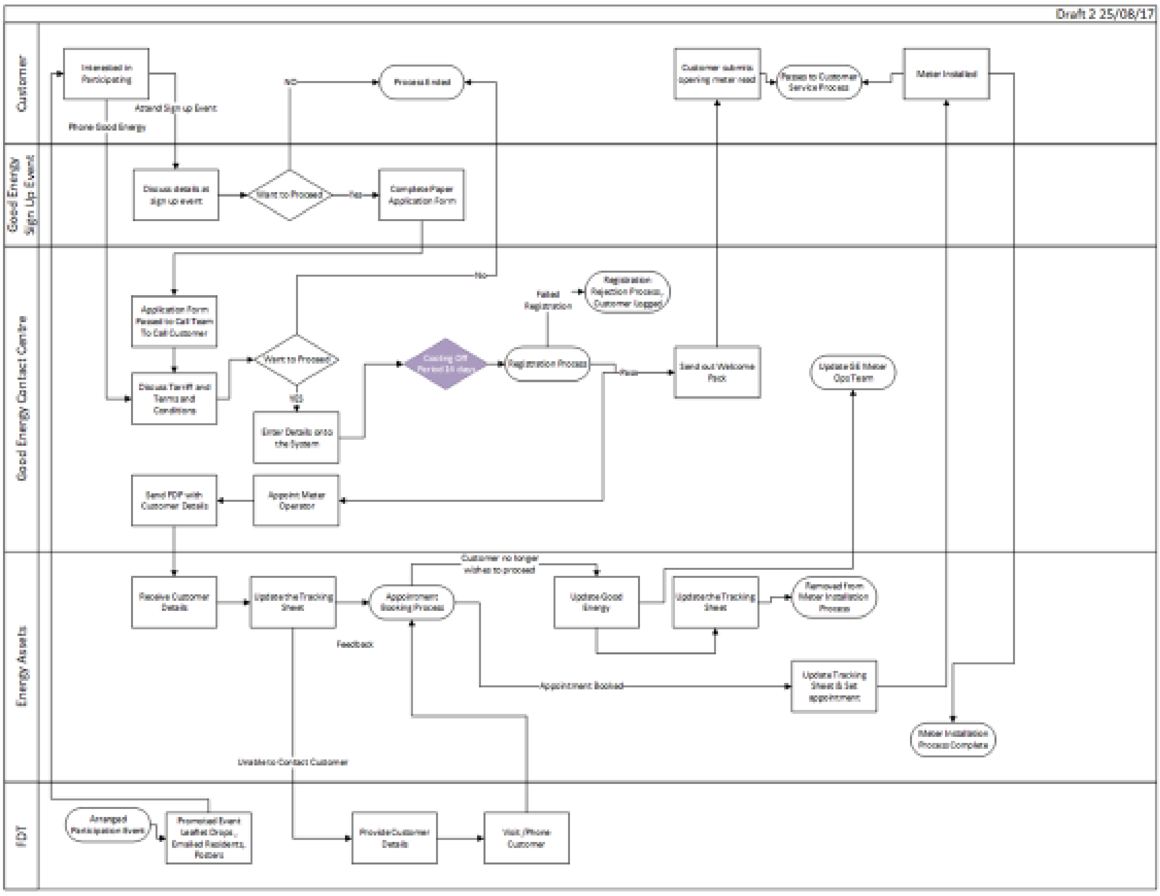

Figure 3: SMART Fintry Process Maps

3.1.8. The role of Energy Industry Experts

Community Energy Projects often include complex explorations of new and innovation business models and ideas. Specialist skills and expertise are required ranging from Regulatory to Technical skills. Veitch Cooper's role as innovation intermediaries was to ensure that specialist project partners were brought into the partnership with the right skills and expertise and the networks to liaise successfully with key stakeholders such as BEIS, OFGEM and the Scottish Government.

3.1.9. How has partnership between FDT and partners worked?

FDT has been the interface between the community and the commercial partners.

Whenever, a partner has required something of the community FDT has been able to utilise its existing position and relationships within Fintry to initialise development. Examples of this include adding monitoring equipment to generators; EV charging stations; interface with the Culcreuch castle hotel ;assisting Energy Assets in gaining access to residential properties to fit meters, and encouraging residents to become engaged with the project.

Many residents find it easier to discuss their thoughts, requirements and issues with FDT staff which then requires relaying to the appropriate partner for consideration or resolution. The position of Community Project Manager plays the key role in these circumstances and smooths the communication between the project partners and the community.

Some of our issues occurred when this step was overlooked by project partners. FDT has developed credibility with the community over their 10 years of delivering successful projects and at some junctures this credibility was put at risk by misleading information or false expectations presented by project partners.

3.1.10. Potential benefits from Community Involvement

An engaged community organisation in place within the village proved crucial to many aspects of the project. On several occasions Energy Assets had problems getting in touch with residents to book appointments for meter installations. FDT has a firm knowledge of people and personalities in the community (developed over the last 10 years) and were able to use this to contact participating residents for meter installation appointments. Energy Assets assisted by providing flexible 'out of hours' appointments.

This was also crucial for installing electricity sub-metering and/or monitoring equipment at commercial sites as FDT staff knew the Culcreuch Castle Hotel staff, Fintry Sports Club staff and generation site operators. This allowed the project to approach these sites to ask permissions to install monitoring equipment required to obtain electricity flow data across the local network.

FDT played a key role in communicating with the community about the project and inviting residents to sign up to the Fintry Tariff. Feedback from the community has showed that one of the main reasons for residents for signing up to the Fintry Tariff was that they wanted to support the local community and FDT. There is a sense of pride in the community energy projects that FDT deliver and ownership of the SMART Fintry project. The impact of the legacy had positive implications for residents signing up to the Fintry Tariff.

Due to the historical legacy of FDT and the nature of previous projects conducted, FDT was able to provide some historical data which help the project such as: transport data; homes with electric vehicles; insulation levels; f heating systems as well as demographic data. All valuable information which fed into data analysis by project partners.

3.1.11. Community Toolkit

Several documents have been produced during the SMART Fintry project which contribute to the Local Energy Scotland (LES) community toolkit library and prevent duplication of effort in the future. These include the General Agreement (which includes comprehensive clauses covering data protection, intellectual property and data handling); a project handbook and a generic supplier tender specification.

Please contact LES for access to these and other available project documents.

Appendix 2 provides specific feedback and lessons learned from the SMART Fintry project.

4. Active Energy Customers

4.1. Workstream Scope, Rationale and Objectives

The Active Energy Customer innovation work stream explored what SMART Fintry and other community energy projects could use to motivate consumers to engage in their energy consumption decisions and investigated, within different customer segments, what factors would influence their behaviour changes.

The project focused on exploring how Customers engage in their energy consumption through:

- Switching from their existing energy suppliers to the 100% renewable community tariff proposition, known as the 'Fintry Local tariff', provided by Good Energy
- Altering their own behaviours to impact upon their household energy consumption

Work stream Rationale:

Encouraging customers to take an active control over their energy consumption has proved to be a challenge across the UK. It is difficult to influence customer behaviours when more than half the population don't even return their meter readings to their suppliers. SMART Fintry has explored how to engage with customers and assist them to make the logic shift and change their behaviours.

Work Stream Objectives:

As illustrated below the project explored three key types of mechanisms:

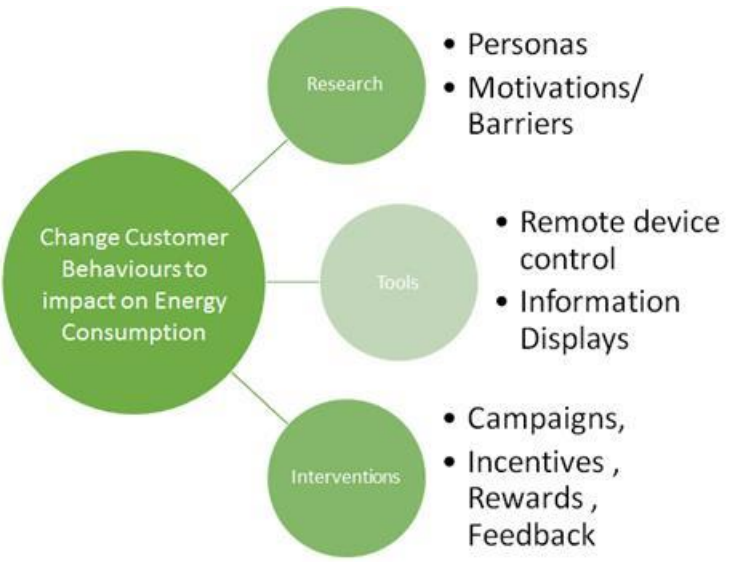

Figure 4: SMART Fintry explored several mechanisms to identify influencing factors relating to consumer behaviour and energy consumption

Research

The project conducted research via the SMART Fintry Focus Group meetings, the Year 1 and 2 surveys and events which were hosted in the village. We also reviewed available academic research and publicly available papers and documents. Energy usage data from the metering and control platform was combined with demographic and socio-economic data and electric vehicle ownership to enable sophisticated modelling to be conducted.

The research was conducted to:

- Determine the key factors which influenced villagers to switch to the Fintry Local Tariff
- Identify Villagers attitudes to energy usage and what would motivate them to alter their behaviour and which barriers would have to be overcome
- Enable the creation of New Community Consumer Profiles to represent key user groups within the village) and model tariffs which could suit their lifestyles

Tools

The project explored the use of automated methods to assist customers to change their behaviours:

1. The provision of data via dashboards to increase customer knowledge about consumption and renewable generation:
    - The Fintry User Interface built upon an Origin project and developed by Heriot Watt University, including real time generation data.
    - Personal consumer dashboard (wireframe mock ups were developed for review, but the dashboard was not implemented)
2. The use of central remote control – the project modelled the impact this could have on the energy consumption within the Fintry Local Tariff customers and the impact upon the renewable energy generation. Modelling the use of electric storage heaters, electric vehicles and localised storage batteries. (more information contained within the DSR Section)
3. The use of household appliances with timers and remote-control functionality – research was conducted to gather customer's potential willingness to use such devices.

Interventions

Finally, SMART Fintry explored the impact which the community campaigns and incentives (the free LED Lightbulbs) had on the energy behaviours of customers.

4.2. Active Energy Customer Findings

Research was conducted to:

- Determine the key factors which influenced villagers to switch to the Fintry Local Tariff
- Identify Villagers attitudes to energy usage and what would motivate them to alter their behaviours and which barriers would have to be overcome
- Enable the creation of Personas (Fictional Profiles to represent key user groups within the village) and model tariffs which could suit their lifestyles

4.2.1. Factors influencing villagers to switch to the Fintry Local Tariff

Within the UK there are still 35% of households who did not change gas or electricity provider between 2012 and 2017 despite advertising campaigns, promotions and heavy marketing.[7] A recent YouGov poll for the Big Energy Savings week campaign identified that 33% of people have remained with the same energy supplier for the last 5 years as they do not see the point in switching because they believe all suppliers are the same.[8]

Fintry has a very active local community with a great interest in making the village a carbon-neutral and sustainable community. The village has **no access to the gas grid** and the majority of the residents rely on electric, oil or LPG heating. Over 85% of the houses in the village are owner occupied and 64% of the village are in Social groups AB and C1 making it a more affluent area than the rest of Stirlingshire.[9]

In 2007 Fintry Development Trust (FDT) was created and has 237 individual members. Over the years FDT have successfully implemented various forms of renewable energy generation including Solar PV, Biomass and Wind.

Within the SMART Fintry project Good Energy developed a special **Fintry Local Tariff** for the villagers and had two separate launch events one in Year 1 and one in Year 2. The Tariff could not accept prepayment meter customers which prevented some villagers from signing up but was price competitive within the marketplace.

In Fintry there are just over 717 residents and 339 homes.[10] Over the two years, the Fintry Local Tariff has signed up **115 customers** which equates to **34%** of the total houses in the village.

The project wanted to discover if purely members of the FDT had signed up to the Fintry local tariff but on comparison with the membership list it was discovered that actually only 60 % of the residents who signed up to the tariff were part of the development trust which revealed that the

[7] OFEM

[8] YouGov

[9] 2011 Census Fintry, Stirling https://www.stirling.gov.uk/__documents/democracy/governance/cc-information/cc-information/fintry.pdf

[10] 2011 Census Stirling , Fintry – as above

Project and the tariff was successful in tapping into other villagers who FDT did not normally work with.

The project was interested to discover what had ultimate motivated villagers to switch supplier and sign up to the Fintry Local Tariff. According to OFGEM:

- Price remains the key motivator when switching, looking for a tariff, or choosing a supplier, despite a general reduction in energy prices. Consumers feel they need to save, on average, just under £300 per year to make it worth changing their supplier or tariff. However, there is a small proportion of consumers for whom price does not seem to be a strong motivator, particularly amongst the less engaged.
- Those in the most engaged segment are more likely to accept a lower saving (£218) to prompt them to switch than the most disengaged, and they are also more likely to be looking for savings.

During the December Event we asked villagers who had switched to the tariff their reasons for doing so and received mixed comments that it was not always the price which drove their decision making:

- "I signed up to support the project first thing – and actually lost money compared to my previous supplier but I signed because I wanted to support the community."
- "I am on the Fintry tariff, I signed up because I saw it as being cheaper – I like to prove money savings"
- "Price was a big factor in my signing up"
- "I thought it was a good deal "
- "It helps my Bank Balance "
- "The personal gains may be slight, but I am happy as this project is for the greater good "
- "I am really interested in renewable energy and wanted to make a difference"
- "I wanted to join in as we are a small community and it adds to our community pride to be part of things like this"

During the course of the project only **1 customer** switched away from the Fintry Local Tariff and that was because of a change of occupier rather than a dis-satisfaction with the tariff.

Conclusions

- Project reached villagers who would not normally engage with the Fintry Development Trust (this may be linked to the campaign approach taken see section 2.5)
- % sign up was positive and did reach villagers who would not normally have switched supplier

- Price remained a factor in decision making but it was not the only driver and many villagers signed up to support the village itself and because of the interest in the renewable energy
- In the longer term the price offered by Good Energy is not sustainable and will increase on 1st April 2018 – it will be interesting to track how many villagers remain on the tariff or switch to alternative suppliers. (something for Year 3 of the project to track)
- Fintry itself is an affluent area with a high percentage of owner occupiers so the level of signs up to the tariff may not be so easy replicated in other more challenged areas.

4.2.2. Identify Villagers attitudes to energy usage

"Changes in consumer behaviour can lead to important savings in energy use. A literature review of 2000 references in 37 articles and books made clear that the changing energy related behaviour can potentially save about 19% (±5%) of our energy consumption (Kok et.al., 2007) The savings are due to changes in conservation, lifestyle, awareness, low-cost actions, and small investments."[11]

Research conducted by National Energy Action Northern Ireland revealed that the key barriers to changing energy behaviours included:

- Low prominence of energy efficiency – energy is 'invisible' and saving energy is often a low priority
- Price of energy efficiency – efficiency measures can be, or are perceived to be, relatively expensive
- Hassle factor of installing efficiency measures, such as the need to clear out the loft before insulation
- Aesthetics, for example where people are concerned about the attractiveness of energy saving products
- Social norms (what other people are doing around you) – norms influence people's behaviour and can prevent them from adopting a new efficiency measure[12]

The project wanted to explore and identify Villagers attitudes to energy usage and what would motivate them to alter their behaviours and which barriers would have to be overcome. During the December event which was hosted in the Sports Club we asked 14 attendees a series of questions designed to elicit what motivated them change their energy behaviours.

QAE1: Would you adjust your energy use at certain times if it saved you money?

- 80% responded that they would be interested in adjusting their energy usage if it saved them money.

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[11] Changing energy behaviour , guidelines for behavioural change programmes, Intelligent Energy Europe, Bo Dahlbom, University of Gothenburg

[12] Achieving energy efficiency through behaviour change , Paul Wallace, National Energy Action Northern Ireland

Reasons given for not adjusting energy usage included comfort, convenience and having the knowledge of when to switch:

- "I hesitate as I won't adjust if I am colder!"
- "I already use my dishwasher during the night only, but all other things I need to do during the day"
- "With the correct amount of guidance as to timings."

QAE2: How do you feel you would be able to adjust your household's energy use?

- Only 60% however felt confident that they could adjust their own household's energy use.

Reasons for not being able to switch their energy use included concerns over having sufficient knowledge and being able to communicate remotely with household devices:

- "The activity would need to be understood by all family members"
- "It would require a lot of thinking about and organising. You need to know when it is cheaper, so information is important"
- "Wi-Fi – not that good here to control technology"
- "My husband is on night shift, so I can't use the washing machine or tumble dryer during the day "

Possibly the difficulty in adjusting their own household energy use could be related to the decline in people's disposable time. "Rises in austerity mean that there are more double earners in the home, resulting in less time for domestic chores and/or leisure."[13]

Conclusions

- The villagers were interested in changing their energy behaviours but wanted more information and knowledge about how and when to switch

4.2.3. Tools

The project explored the use of automated methods to assist customers to change their behaviours:

- The provision of data via dashboards to increase customer knowledge about consumption and renewable generation:
- The use of central remote control – the project modelled the impact this could have on the energy consumption within the Fintry Local Tariff customers and the impact upon the renewable energy generation. Modelling the use of electric storage heaters, electric vehicles and localised storage batteries.

[13] Maggie Laidlaw , Energy Use in the Home, "Shifting patterns of behaviour & energy time use attached to the home" http://www.veitchcooper.com/newsAndContact.php

- The use of household appliances with timers and remote-control functionality – research was conducted to gather customer's potential willingness to use such devices.

The Provision of Data via Dashboards

It was critical that the community became actively involved in the SMART Fintry project, so the team commissioned an Energy Dashboard, similar to that used by the Findhorn community to try and provide valuable data and knowledge to the villagers and encourage discussions around energy usage and renewables. The principal aim of the dashboard was to provide a user-friendly interface for hosting forecast information. The development of the dashboard was managed by the HWU research group and the interface was displayed via the project website (http://smartfintry.org.uk/dashboard/) and on tv screens within the Fintry Sports Club. As illustrated below:

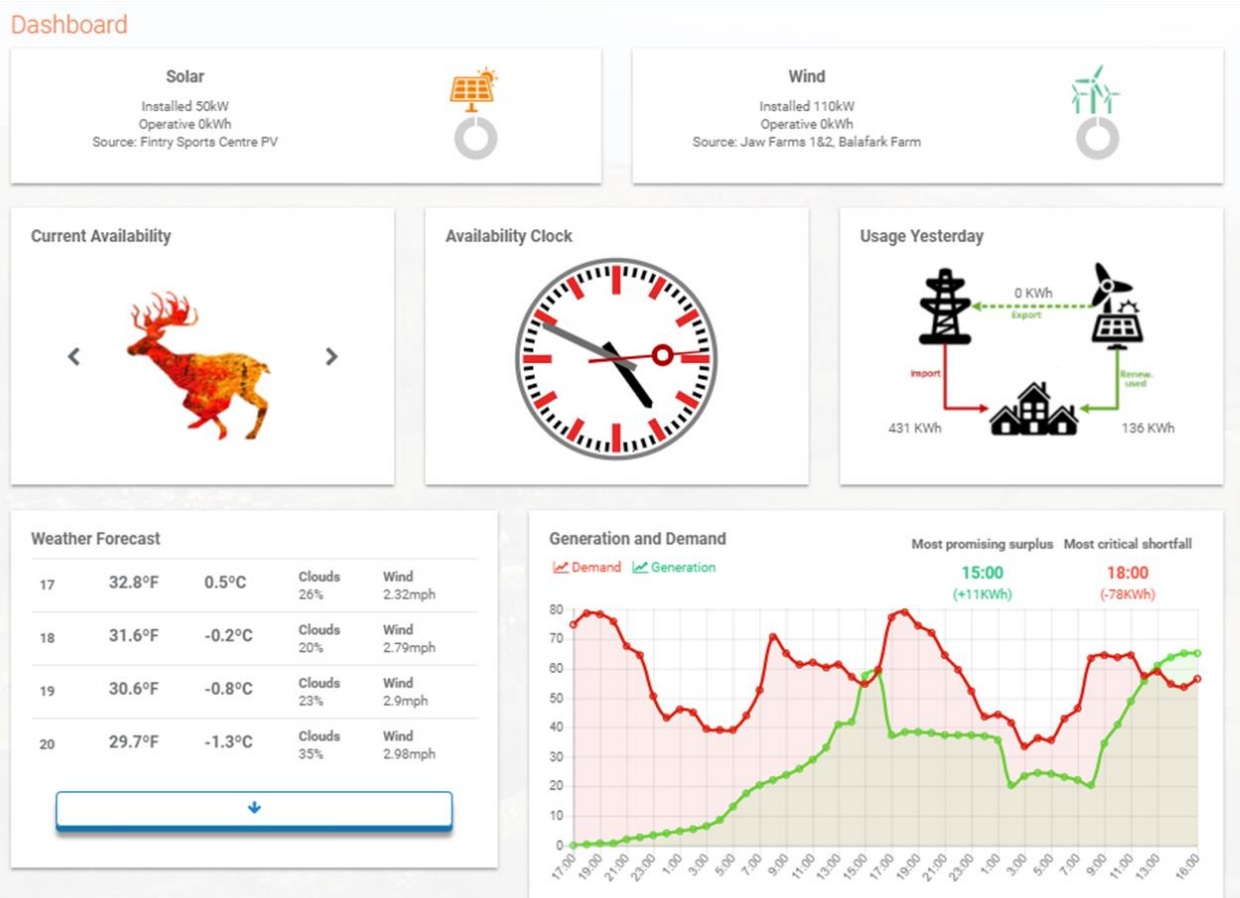

Figure 5: SMART Fintry Energy Dashboard

The dashboard shows the renewable energy being generated and is source 9 (e.g. Wind, Solar), the weather forecast and the usage. This helps to show where on some days the village has a surplus of renewable energy and in other days a shortfall.

The project gathered feedback on the dashboard via the Years 1 and 2 surveys and via the SMART Fintry Christmas Event hosted in December.

YEAR 1 Survey Question 6: We are considering developing an online user interface which allows residents to see where they are getting their electricity from. Do you think this is a useful tool?

Online user interface: 89% of survey respondents thought that an online user interface would be useful. The purpose of this online tool would be to demonstrate that local supply and demand is matched.

YEAR 2 Survey- Question 6: The energy dashboard is available on the SMART Fintry website and is displayed at the sports club. It shows local supply and demand. Please tell us what you think about the dashboard?

The comments received back on this question were mixed including:

- We think that the dashboard needs to give us a lot more information, and that information needs to be based upon integration of data. Our main criticism of the current dashboard is that it's too granular, and doesn't cross-refer data, either within the kWh + cost datasets or to other data, e.g. meteorological data such as temperature for Fintry. It's not much more than a snapshot of energy use. For an excellent example of how this might be improved, see https://www.fusioncharts.com/dashboards/energy-consumption-dashboard/. This is exactly the sort of data board that we need to understand and reduce our energy consumption. Note the toolbar at the top of the page - snapshot, power now, cost, comparison, etc. Not only do we get given the snapshot (which is more informative than the Fintry snapshot) but we can drill into the data in much more depth, and receive predictions, too. As this article points out, back in 2010, http://www.greenbuildingadvisor.com/blogs/dept/musings/home-dashboards-help-reduce-energyuse, if energy users are given the right information in the right way, we tend to reduce our consumption, and that reduction tends to remain lower.
- It’s interesting but our good energy experience is beginning to turn us of the whole idea!
- Haven't seen it yet
- Not used it
- I am not sure how it works
- It's great, once I learned how to read it!
- I need a better understanding of what it means!
- Not formally taken notice of it yet
- Yet to view
- Must have a more serious look at the dashboard.
- A bit confusing and I am not sure exactly what it is showing me

- Bit limited, as fails to show Earlsburn generation and no idea about domestic solar contributions, also really ought to show AD input as that's where most of our power is coming from
- Good

Conclusions

- The Project didn't explain the dashboard sufficiently either online or with commentary or a description under the TV screens in the Sports Centre
- Residents were interested to view the Energy Dashboard once it had been explained to them but it didn't provide much assistance to customers to amend their own behaviours – that data did not link enough to their own personal usage

Smart Meters

A key part of the SMART Fintry metering and control system required the installation of new Energy Assets Zigbee enabled smart meters linked to a central control database. Communications with customers signing up to the Fintry Local Tariff described the meters as "Smart Meters" but this led to an unanticipated confusion. Customers thought that the "Smart Meters" would be very like the ones beings actively promoted via TV and press advertising by OFGEM. See illustration of inhouse smart meter display below:

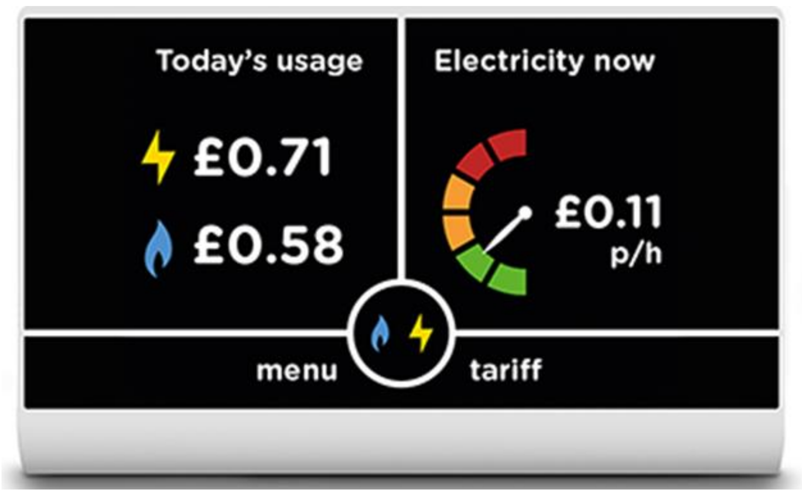

Figure 6: Typical In house user display

The SMART Fintry meters did not have an in-house dashboard and this caused confusion with some customers. As demonstrated by the feedback gathered in the Year 2 survey:

- I don't understand the benefit of having a smart meter installed
- I have had no access to smart meter info that is being collected for me property. How do I get access to this info to make decisions about how to optimise my electricity usage?

- We now have a smart meter. So what?
- Still no idea when I can get access to my data

Similar comments were raised at the SMART Fintry Christmas Event including;

- Wants to know when he is getting a smart meter / dashboard for the house – so he can see how much energy the wife is using when she boils the kettle.

During the Focus Groups members raised concerns about the data which was being collected via the meters and how it was being used and managed:

- Ethics around data sharing and system security.
- "All data has a value – it is a form of intellectual property".
- "We would like to have known about this beforehand"
- "How secure are your data systems"
- Data ownership will be important in the future

Conclusions

- Residents were interested in being able to monitor their own energy usage and wanted to be able to see the data from their own meters

Personal Dashboard

Within the original scope of the project a 'Time-of-Use' portal (Selectricity), was going to be developed to encourage residents to view their electricity consumption and choose where it was sourced from. The idea was to encourage residents to take an active control of their consumption. This unfortunately did not occur due to contractual issues so the project decided to prepare a wire frame version to facilitate discussions with users on how they would use a personal energy dashboard and what if any benefits it would bring them. The wire frame is illustrated below.

The wire frame was presented at the Focus Group to gather their feedback:

- Generally quite useful
- Perhaps more useful to also have it as a phone app.
- Include costs and usage.
- Weather and external temperature be useful. Local accuracy would be important.

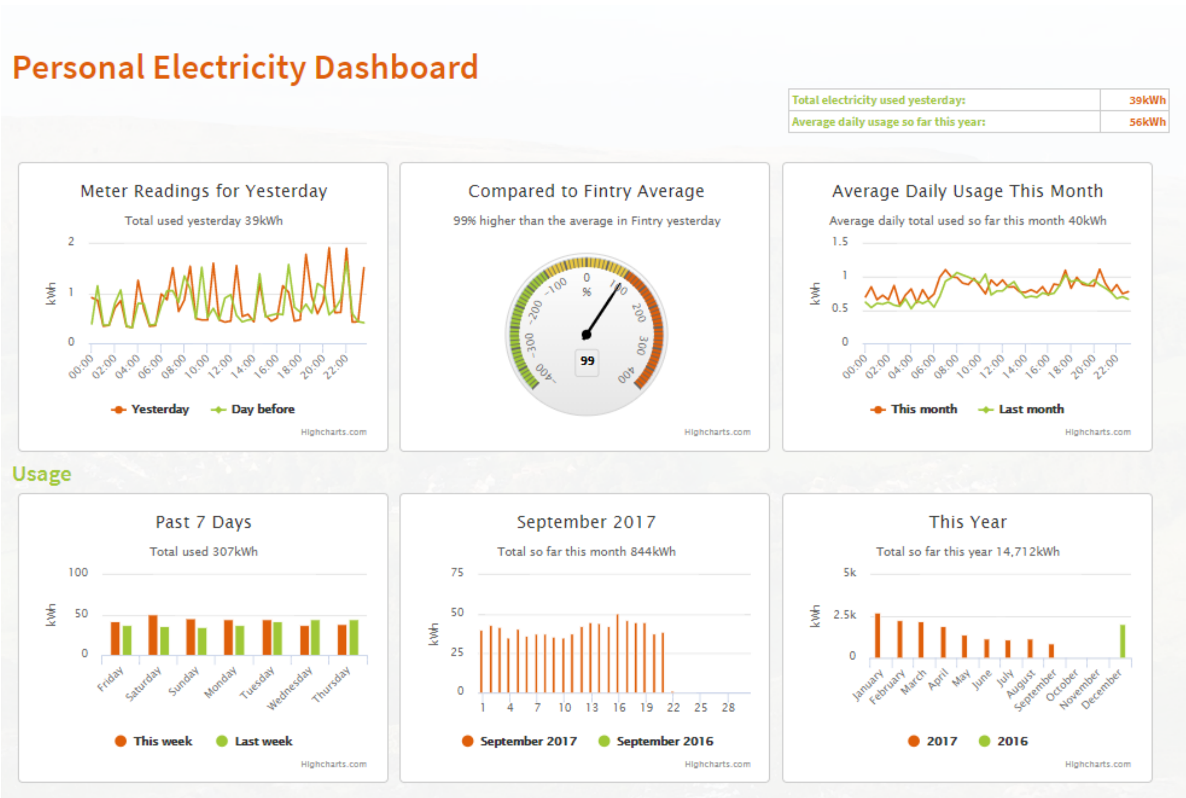

Figure 7: SMART Fintry Individual Customer Dashboard Wire Frame

Conclusion

- A personalised energy dashboard may influence customer energy behaviours but we had no research from the project to prove this assumption

Central Remote Control of customer devices within their home

No discussion on active energy participation would be complete without considering consumer views on remote control of their household appliances. Appendix 3 presents some of the current research on this subject.

The main opportunity for demand shifting in Fintry at the present time lies with Electric Storage heaters. This is anticipated to change in the next few years as both heat pump and electric vehicle use increase.

Storage heaters charging is managed remotely at the moment therefore customers who use the technology tend to be more open to centralised control.

The project team carried out modelling of storage heaters using data collected during year 1 of the project (see section 5 below). This was presented to the focus group.

Some residents were happy to embrace the idea of flexible energy use but still wished to retain control and have options

The use of household appliances with timers and remote-control functionality

The project asked the Fintry residents during the December event for their views on using more technology to help them within the house control when they used devices.

QAE3: Would you consider a greater use of timers for household appliances to utilise cheaper available energy?

66% of respondents said they would be willing to use timers and some had already done so:

- “I have a washing machine – specifically bought one with a timer when I replaced the old one”

One resident was concerned about safety of leaving devices on when they weren’t in the house and several wanted to know better information about when would the best time to put devices on.

Conclusion

- The use of timers and remote control of domestic devices provide opportunities for switching to cheaper energy times and residents were interested in trying them but again require more information about the most advantageous time to use such devices.

4.2.4. Interventions

Finally, SMART Fintry explored the impact which the community campaigns and incentives had on the energy behaviours of customers.

Campaigns

Prior to the launch of the Fintry Local Tariff FDT and Good Energy conducted an awareness campaign within the village and hosted two sign up events in the Sports Centre. Over 100 people turned up to the launch events including residents from other villages up to 4 hours away.

In the Year 1 survey:

Q1- How did you feel about the pre-sign communication i.e. marketing and information? Did you know that the Fintry Tariff was coming and what it means for Fintry?

- Community participants reported that the tariff was well communicated and that the sign-up process was easy. The paper and digital copies of the sign-up leaflet produced by Good Energy and Fintry Development Trust meant that residents knew details in good time for the sign-up event. Around 60% of participants attended the sign-up event.

In the Year 2 survey:

Question 1: How did you feel about the pre-sign communication i.e. marketing and information? Did you know that the Fintry Local Tariff was coming and what it means for Fintry?

- Most respondents replied positively to the question. Sample response: “Good” “OK” “Short notice but fine”. One negative response “No” (YEAR 2)

The local sign up events had Good Energy staff to talk customers through the tariff and sign up process supported by FDT staff who could explain about the project and aims. The most successful approach for gaining sign ups was via the events.

Sign up Method	Year 1	Year 2
On Phone	40.7%	28%
At sign up event	59.3%	72%

Conclusions

- Community events to raise awareness and help with the sign-up processes were successful for SMART Fintry as they helped to contact the harder to reach members of the community

Incentives

The project provided LED lightbulbs to households who signed up to the Fintry Local Tariff but we did not measure the impact that this had upon persuading customers to join the tariff.

5. Demand Side Management (DSM)

5.1. Overview

5.1.1. Background

The electricity grid across Great Britain has traditionally been built around a centralised generator model. Large power plants such as Torness, Cockenzie and Peterhead generated electricity from a mixed fuel base and exported it onto the National Grid transmission system for subsequent distribution at a local level. Rules and regulations were put in place to manage this successfully from a technical perspective and the government regulator, OFGEM, was appointed to regulate the electricity (and gas) markets, control how the energy was distributed, and protect electricity consumers in the process.

During the 20th century, the demand for electricity was relatively stable, generation was predictable, and the electricity industry role was simple; provide suitably sized infrastructure to deliver the electricity the people of Great Britain[14] needed (i.e. meet their demands).

A range of economic and environmental factors introduced over the last few decades have changed this position dramatically, leading the electricity industry into the current period of disruptive change. There is now a lot of uncertainty in the marketplace as old generating plant is decommissioned to be replaced by intermittent generating technologies - such as solar and wind - and energy efficiency measures are introduced across the UK housing stock to reduce demand. Such change creates challenges as industry players look beyond traditional business models to find new ways balance the system and meet demands effectively.

It also introduces opportunities as grid operators are becoming increasingly willing to pay for services that help manage demand to maintain continuity of supply and help alleviate constraints without the need for expensive infrastructure upgrades. One way of achieving this is through demand-side management also known as demand-side response which encourages consumers to reduce their energy use and/or move consumption to more favourable times. This is usually achieved via a combination of price incentives, education and energy efficiency measures.

Two areas where community scale demand-side management have the potential to make an impact, and reduce costs to consumers, is by contributing to a reduction in wholesale costs and by participating in distribution grid services.

Please note that before agreeing to any demand-side service it is very important that the community organisation seeks specialist advice to make sure they understand both the required level of commitment and the associated risks.

5.1.2. The Power Price

Within Great Britain, electricity is bought and sold on the wholesale energy market. Wholesale costs make up the largest part of a consumer's bill (see below) and are traded on a half hourly basis.

[14] Ireland has its own electricity market. See http://www.sem-o.com/Pages/default.aspx for details.

Table 1: Typical Electricity Bill Breakdown

Breakdown of a typical Electricity bill	Source: Ofgem
Wholesale costs	36.3%
Network costs	27.59%
Environmental and social obligation costs	14.79%
Other direct costs	1.19%
Operating costs	16.46%
Supplier pre-tax margin	-1.09%
VAT	4.76%

A detailed explanation of the market is beyond the scope of this report however, should community members wish to learn more, there are many publicly available resources which can provide the necessary background. The regulator's website[15] which is an excellent source of independent information and a good starting point for those who are new to the industry.

Power Prices are currently set on a whole system basis. They are directly linked to the cost of generation via a merit order which is, in turn, based on the cost to produce energy. SMART Fintry partners, Good Energy, have produced a useful summary explaining how this operates and highlighting the effect of adding renewables into the mix[16]

5.1.3. Network Services

Network costs are the second biggest component of consumer electricity bills. These costs are socialised and applied to every household equally regardless of energy use. A different approach is adopted for commercial consumers.

National Grid, the GB transmission operator, procure a range of reserve services[17] which communities are now being encouraged to participate in. At the moment these are mostly related to GB wide wholesale price changes, and the TRIAD system in particular[18], however a new range of distribution services are now being investigated which could turn out to be more relevant at the community level.

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[15] https://www.ofgem.gov.uk/consumers/household-gas-and-electricity-guide/understand-your-gas-and-electricity-bills

[16] https://www.goodenergy.co.uk/blog/2016/10/20/demand-side-response/

[17] https://www.nationalgrid.com/uk/electricity/balancing-services/reserve-services

[18] nationalgridconnecting.com/triads-why-three-is-the-magic-number/

Table 2: A number of techniques have been developed to incentivise demand reduction

Technique	Acronym	Description	GB Examples
Real Time Pricing	RTP	Prices vary by a given interval linked to a trading platform (currently half hourly in GB – hence 'half-hourly tariffs'). RTP exposes the customer to changes in the wholesale market.	Typically Industrial and Commercial Tariff structures https://www.flexitricity.com/en-gb/
Time of Use Pricing	ToU	Introduces different fixed pricing periods encouraging customers to consume energy during this time.	Economy 7 Economy 10 https://www.sse.co.uk/help/energy/meters/types-of-meter#item1
Critical Peak Pricing	CPP	Introduces a much higher price during times when the electricity grid is most constrained	TRIAD Management Services https://ukpowerreserve.com/services/triad-management-services/
Direct Load Control	DLC	This tariff structure allows utilities to control devices automatically to avoid times of peak load. Signals are despatched centrally	Total Heat Total Control (https://www.sse.co.uk/help/energy/meters/types-of-meter#item1)

5.2. Workstream Scope

The Demand Side Management workstream

- Brings together technical and commercial elements of the project to identify new demand-side management business models
- Aligns with aims of the Energy Networks Association (ENA) open networks project
- Uses a combination of qualitative and quantitative (both measured and simulated) data to provide a view of load characteristics across the village.
- Includes network modelling activity to investigate the impact (and opportunity) of Electric Vehicle load growth

The key issues explored focussed on cost reduction and potential revenue generation via:

1. Community ownership of a near real time measurement and control platform (Community Owned Aggregator Platform or COAP)

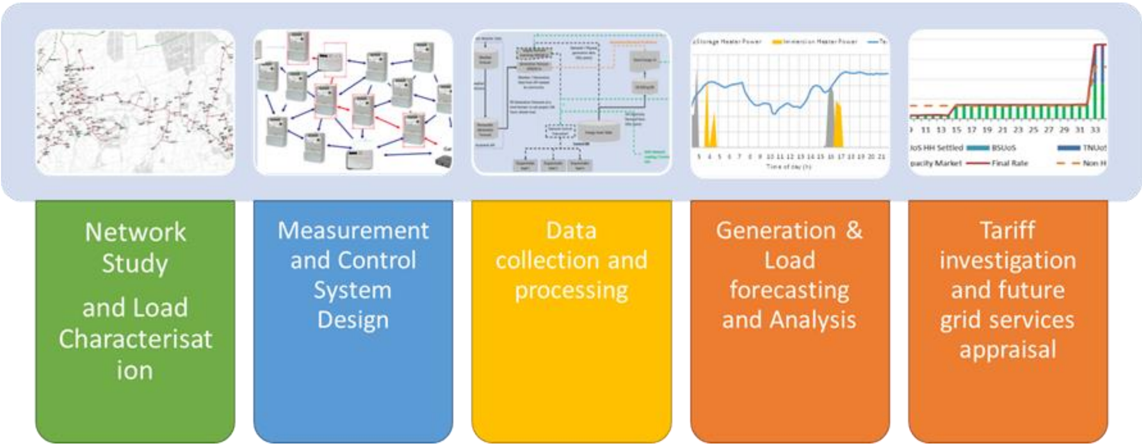
2. Provision of Distribution Network Services (DNS)
3. Localised Half Hourly Tariff Development

5.3. Development of DSM Components

Demand Side Management is an umbrella term that covers a number of different approaches to delivering a reduced consumption. There is no one size fits all approach which can be confusing – it is best to adopt a contextual approach and choose to focus on areas which have the potential to provide the greatest impact for the community. Consequently, before settling on a plan of action it is important to carry out a detailed analysis to understand local opportunities and constraints.

5.3.1. DSM Analysis Methodology

Figure 8: DSM Analysis Methodology



The methodology used to investigate the potential for demand side management within Fintry was as follows:

Note: Steps 1 and 2 were carried out during year 1 of the project. See Appendix 1 for details.

Step 1 – Network Study and Load Characterisation

The incumbent electricity Distribution Network Operator (DNO) in Fintry is SSE Networks (SSEN).

Prior to starting the project, the team carried out a short network study, in consultation with SSEN, to determine where additional electric load (in the form of air-source heat pumps) could be deployed. As a result, two potential street wide deployments were identified – one at Culcreuch Avenue; the other in Dunmore Gardens. In the end only one scheme, at Dunmore Avenue, was progressed due to funding constraints.

The preliminary network study used a approved industry methodology based around After Diversity Maximum Demand (ADMD)[19] and proprietary software. Fintry Development Trust provided data to the project team which allowed early identification of the heating types in use across the village. All of the information was plotted on a GIS map and subsequently used to inform year 2 network studies, electric load calculations and heat pump design.

Step 2 – Measurement and Control System

Future DSM services at Fintry have been enabled by the deployment of near real-time half hourly measurement and control platform which was designed to collect data from generators, the electricity grid and consumer metering points providing a rich dataset form which to build new community business models.

Energy Assets were responsible for the design, development and deployment of the core metering and control platform for billing purposes. This involved taking half hourly data reads from consumer meters to a central data access point, processing the feed into a standard industry flow then communicating this onwards to Good Energy under an existing meter operator (MOP) arrangement.

The timing of the SMART Fintry project coincided with the GB Smart Metering programme however the specified meters did not offer sufficient functionality to allow the near real-time control required by the project. Consequently, a bespoke Elexon approved AMR meter was deployed which, although acceptable in the short term leaves a legacy position which will need to be monitored and managed in the future – especially if households choose to leave the Fintry Tariff in the future (see section 6, Policy and Regulation, for details).

Temperature sensors were deployed in 3 households with storage heating.

The original design proposed the use of Zigbee communications throughout however this was based on several key assumptions pertaining to:

1. the density of mesh that could be formed by the individual consumer meters
2. the ability to provide a signal boost where required

Unfortunately, whilst 114 households (out of a 150-house target) were recruited to participate in the study, they were somewhat scattered and failed to provide sufficient density to support the Zigbee mesh. Furthermore, perceived commercial complications prevented deployment of externally mounted antennae leading to the adoption of GSM technologies in the majority of cases. By the end of the project 102 households were reliably sending data to the Good Energy billing platform on a monthly basis. 89 using GSM; 13 using Zigbee communications. 4 installs were aborted due to lack of space or householder objections and 1 household left the project (change of ownership). 7 households have outstanding data communication issues.

[19] http://www.networkrevolution.co.uk/project-library/diversity-maximum-demand-admd-report/

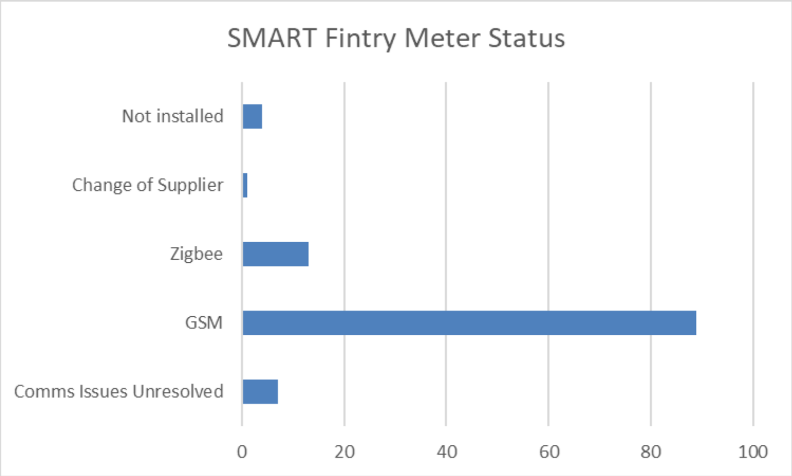


Figure 9: Data communications summary

The use of consumer wi-fi was proposed as a solution on several occasions however the designers were asked to only consider this as 'a technology of last resort' as it can potentially introduce additional cost and commercial risk as well as detracting from the overall customer experience.

Active switching via the platform has not yet commenced however the capability has been tested/demonstrated via an isolated test.

Step 3 – Data Collection and Processing

Data was collected centrally by Energy Assets and made available to the team via a dedicated SQL database and/or their Web Analyser tool (depending on user preference). The Web analyser platform is currently used by the company in commercial applications and is a very intuitive, easy to use tool; ideal for non-technical team members.

A number of additional meters were installed during the SMART Fintry project to monitor generator output (3/4 sites) and electric charging point use at the sports centre. Data from these installations are sent directly to a cloud-based server[20] and accessed by Energy Assets as required. Finally SSEN installed monitoring equipment at the Culcreuch Avenue sub-station which subsequently fed into the Culcreuch Avenue Network study (see below).

[20] LESense platform provided by Logic Energy

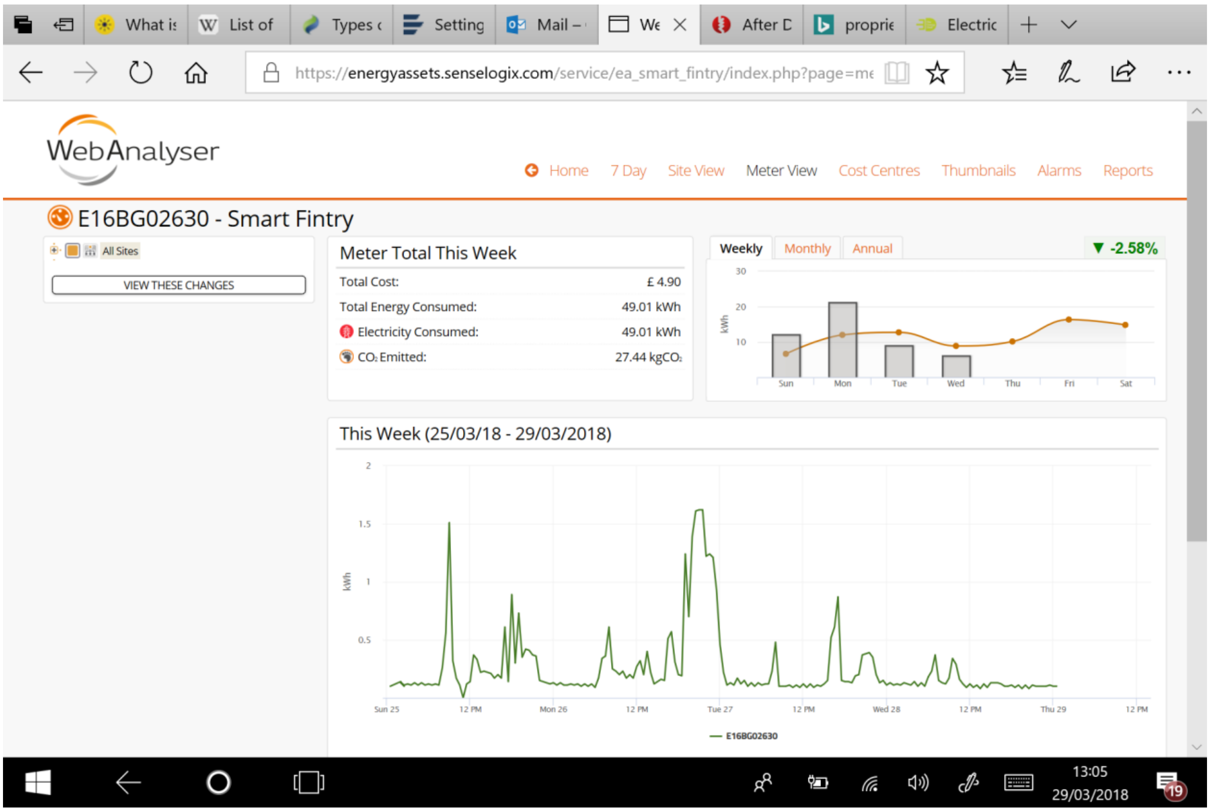


Figure 10: Web Analyser was used by non-technical team members for analysis purposes

Step 4 – Generation and Load forecasting and analysis

Energy suppliers are penalised if they fail to predict energy use and consumption correctly. This ‘imbalance’ risk can be costly but at present it is minimised by relatively predictable supply and standardised domestic profiles which predict energy consumption. The move to half hourly settlement combined with more local use of energy from renewable sources makes accurate forecasting more important but also more difficult. The Fintry data offered an opportunity to explore how new approaches to forecasting (and load control) can help with this by comparing and contrasting different forecasting techniques using measured data to validate the results.

Load side management also has it’s part to play. Current load shifting opportunities within Fintry are limited with electric storage heating providing the only real opportunity for analysis. During step 4, Heriot Watt University analysed data relating to consumption and temperature on houses together with consumption data to explore the potential for storage heating to be used as a source of local flexibility.

Results relating to both forecasting and load analysis are presented below.

The workstream was delivered by Heriot Watt University who have produced comprehensive reports detailing their work (see appendices 4 & 5).

Forecasting

The workstream focussed on forecasting of various signals (demand, weather and renewable generation) using different algorithmic models validated by measurement wherever possible. The aim being to reduce forecasting error and monetise the resultant reduction in risk.

Specific tasks included:

1. Localised Weather forecasting
2. Forecasting generation from Fintry wind turbines
3. Forecasting generation from Fintry PV
4. Forecasting demand from Fintry residences
5. Enhanced forecasting techniques (comparing HWU methods with existing GE forecasting techniques)

Main findings are as follows:

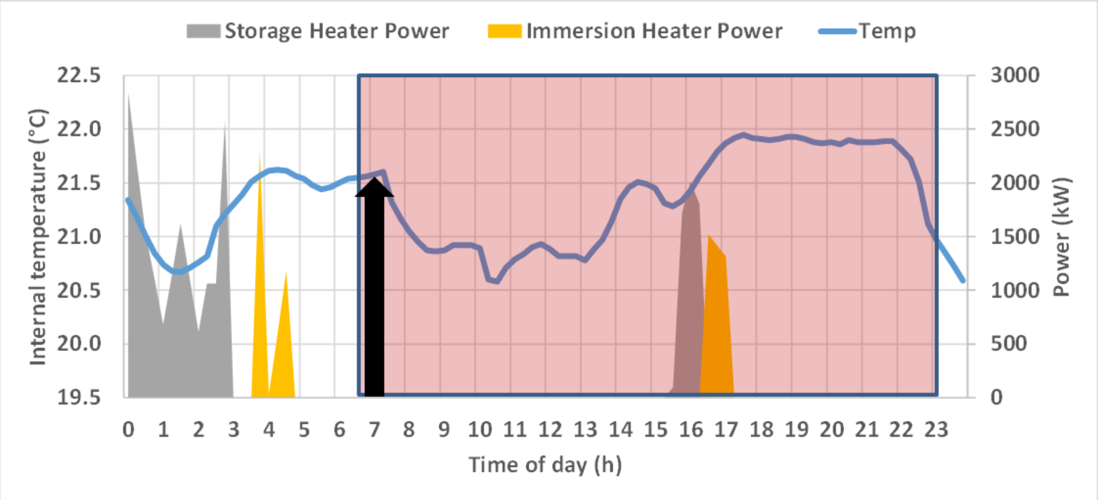
1. Weather Forecasting
    a. Baseline weather forecasting leads to errors of 25%-35% for wind-speed measurements. Exploiting onsite wind-speed measurements and using machine learning reduces this to 10-15% errors
    b. HWU approaches to wind-speed forecasting reduce the chance of major wind generation forecasting errors by 60%
    c. Cloud cover error varies between 15%-35% with the HWU approach typically 5% closer than baseline
2. Generation Forecasting
    a. Use of onsite generation data and weather data reduces the turbine forecasting error from 3.1kWh per half hour period to 0.5kWh per half hour period (84% improvement)
    b. Use of onsite generation data and weather data reduces solar PV forecasting error from 2.1kWh per half hour period to 0.8kWh per half hour period (64% improvement)
    c. HWU generation forecasting approach has potential to improve GE forecasts by an circa 10% (estimated) if onsite weather data is available.
3. Demand Forecasting
    a. Half hourly forecasting errors of 6.6% (4.0kWh) were achievable; this was consistent for 1-48 hrs ahead
    b. Mean absolute errors were improved by 17% over baseline.

Direct Load Control

As stated above, load control opportunities in Fintry were limited to Storage Heating although this is expected to change in the near future with the introduction of a community scale battery and deployment of a street scale heat pump system.

The metering infrastructure allows the SMART Fintry project to control when electric storage heaters charge. Existing operation

- Currently charged in the very early morning
- Storage heaters leak heat once charged – peak morning temperature at 04h00
- This is long before the house wakes up – storage heaters are almost empty by the time the house is active and the temperature starts to drop



To improve thermal comfort and reduce bills we can move the charging period forward to better match the way the house is occupied. The temperature of the house now better matches the requirements of the occupants. Energy consumption may reduce – depending on whether the occupant has a secondary heating device.

- Heriot Watt carried out an extensive analysis of the data to understand How much flexibility there is with electric storage heating when we set improved thermal comfort as a priority
- How algorithms can be used to split or shift charging whilst ensuring that desired internal temperatures are delivered

Conclusions and recommendations are as follows:

- The number of dwellings with clean data that incorporates electricity consumption and thermal comfort temperature is too small in this sample to make conclusive statements
- However, the value of having these two datasets to describe dwelling energy systems is imperative if sensible, dwelling centric conclusions are to be reached regarding the identification of a dwelling as a candidate for load control.

- There are a number of well-rehearsed descriptions of the inadequacy of legacy electric storage space heating systems in meeting their primary objective, i.e. provision of thermal comfort to the dwelling.
- The results found here, all be it from a small sample reach similar conclusions. Poor insulation leads to heat leakage from the unit. To a large degree then these units should be viewed primarily as point heaters and control should shift from a storage paradigm to one that seeks to locate the charging period as close to thermal comfort periods as possible.
- The research group have previously investigated methods of defining when these thermal comfort periods may occur. This has applied Hidden Markov Modelling approaches to half hourly electricity consumption data to determine likely periods of active occupancy. These approaches in combination with monitored internal temperatures would result in well-defined forecasting of thermal comfort requirement.
- These forecasts could then be used to impose improved control regimes on legacy electric storage heating systems to deliver better thermal comfort outcomes for residents. This would be a major step forward for the 0.3M consumers who use these as their primary space heating systems.
- The metering infrastructure coupled with this control development would allow this to be achieved. Diversity of load could be maintained within these thermal comfort improved charging envelopes using conventional approaches.
- Load flexibility from legacy electric storage heating systems should only be explored once these improved control regimes have been deployed as a secondary control feature.
- Initial results from clustering approaches using k-means has returned potentially useful results. Initial, simple methods of feature selection using the timing of half hourly metered electricity consumption has identified, from a dataset of 59 dwellings those that are detached and use heat pumps as their primary source of space heating. These may be represent dwellings that have a high potential for load shifting.
- Further feature selection processes that investigated consumption, load variability and cost functions were carried out. These brought forward distinct load profiles for different customer segments.
- Clustering using the cost feature identified three customer segments that could be defined as being high, medium and low with respect to supplier cost of supply. This reflected both consumption level and the proportion of consumption that occurred during periods 33-38 where cost of supply is highest.
- Further feature selection will be conducted by the HWU research group to investigate these clustering approaches more extensively. These will seek to isolate aspects of load variability and investigate different time blocks to determine whether demand response flexibility opportunity can be quantified for the participating dwellings.

The analysis is included at Appendix 5.

Step 5 Tariff Investigation and Future Grid Services Appraisal

Following initial analysis, half hourly settlement; local balancing and delivery of network savings were identified as being of potential benefit to a local energy system. Actions taken to achieve this included specific studies to investigate:

- Development of a customised Dynamic Tariff
- Participation in Network Services

Development of a customised Dynamic Tariff

The project investigated the possibility of introducing a half hourly, dynamic time of use tariff which could provide a direct cost benefit for Fintry residents. The methodology, developed by Good Energy is detailed in Appendix 6

The impact of this is discussed in section 6 below.

Heriot-Watt then applied using a local TRIAD derived from data analysis to understand what this might look like if de-coupled from the GB wholesale market. Although incomplete, the analysis does introduce a possible area for further investigation.

Case study – constructing local tariff conditions

Prepared by Andrew Peacock, HWU

The monitoring and forecasting infrastructure that has been deployed in Fintry has been designed to support the development of a Local Energy Market. This market would reflect the costs and benefits associated with localised supply demand matching, accounting for localised penetrations of embedded, renewable generation and localised load growth e.g. hot spots of EV ownership. Mechanisms do not currently exist that would permit the development of revised, localised tariffing arrangements. It is nevertheless useful to explore how specific these tariffing arrangements may emerge.

One example that is explored here is the creation of a localised Triad scheme. Triads are the three half-hours of peak electricity demand between the beginning of November and the end of February each year. The dataset created for this analysis covered the period January to December 2017. A minor amendment is therefore applied to the analysis in this thought piece with the data period covering January, February, November and December 2017. The dataset for this period was scaled to represent the 115 dwellings who participated in the Smart Fintry project, i.e. who had signed up to the Good Energy tariff.

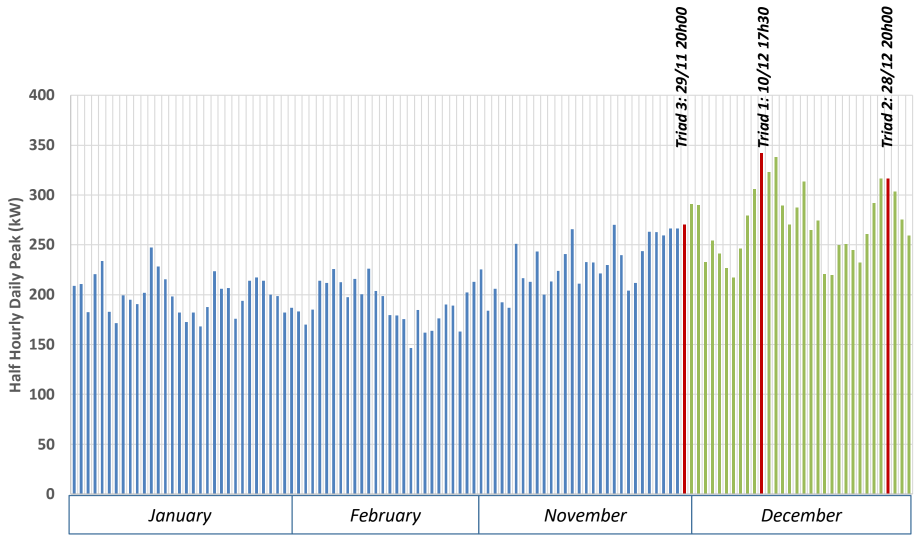
The procedure described for calculating Triads laid out by National Grid[21] was used to determine the three Triad periods. Namely;

- Triad Period 1 is the peak half hourly demand from the Smart Fintry dwellings for the candidate period
- Triad Period 2 is the peak half hourly demand from the Smart Fintry dwellings for the candidate period excluding the 10 days before and after Triad Period 1

[21] https://www.nationalgrid.com/sites/default/files/documents/44940-Triads%20Information.pdf accessed March 2018

- Triad Period 3 is the peak half hourly demand from the Smart Fintry dwellings for candidate period excluding the 10 days before and after Triad period 1 and Triad Period 2.

The exclusions ensure that the Triad Periods are not clustered around a single event, i.e. cold weather in the case of this residential dataset. The results are shown in Figure 1.



The implementation of the Local Triads would be accompanied by a Localised Use of System Charge that would reflect the cost burden to maintain the distribution grid placed on the DNO (→ DSO) by the local load and embedded generation situation. Minimum demand criteria may have to be created for residential dwellings as zero load may be difficult to achieve (as a consequence for instance of cold appliances). Community scale storage solutions could be put in place whose emphasis would be in covering these minimum loads during Triad periods. Following the response logic used by National Grid, dwellings whose demand fell below this minimum demand would not have to pay the Local Use of System Charge for the entire year.

The Smart Fintry platform includes demand forecasting. Accuracy of absolute demand in any half hourly forecast was found to be 6% over a 48 hour horizon. The platform would therefore be capable of providing a Triad forecasting service to notify the occurrence of a likely Triad period.

Influence of Local RE Capacity on Triad Time and Scale

The current local RE capacity considered within the Smart Fintry project is 130kW of wind and 50kW of solar-PV. These units are being monitored and forecasted through the Smart Fintry platform.

This capacity had no influence on the timing and load magnitude of Triad Periods

The deployment of 3kW of PV (The average UK FIT capacity) on each participating dwelling would have no impact on the timing or magnitude of the Triad periods as determined using demand data only. Triad periods in the four candidate months were considered.

Wind Capacity

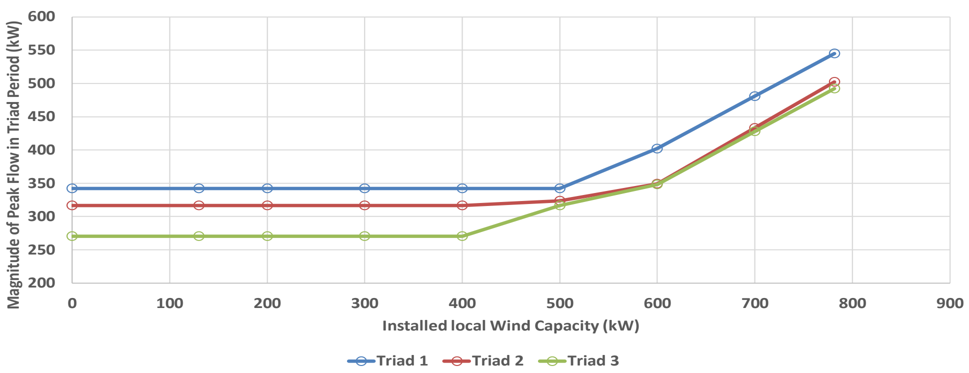
The impact of steadily increasing wind capacity until such time as the total RE output (from wind and 50kW solar) was equivalent to the total demand from the 115 dwellings was explored. At this point the dwellings could claim to be CO_2 neutral, with localised generation equivalent to demand. The results of the triad period timing are shown in Table 1 with the magnitude of peak flow (export or import) shown in Figure 2.

Installed wind capacity would have to reach 440kW (circa 3.4 times existing capacity) for the Triad periods determined by using only original household demand to be shifted. If the community were to install wind capacity sufficient to confer CO_2 neutrality, the peak flow would be circa 1.6 times the original demand led flow.

Wind capacity (kW)	Triad 1	Triad 2	Triad 3
Demand only	10/12/2017 17:30	28/12/2017 20:00	29/11/2017 20:00
130	10/12/2017 17:30	28/12/2017 20:00	29/11/2017 20:00
200	10/12/2017 17:30	28/12/2017 20:00	29/11/2017 20:00
300	10/12/2017 17:30	28/12/2017 20:00	29/11/2017 20:00
400	10/12/2017 17:30	28/12/2017 20:00	29/11/2017 20:00
500	10/12/2017 17:30	14/11/2017 10:30	28/12/2017 20:00
600	14/11/2017 10:30	28/02/2017 23:30	30/01/2017 09:00
700	14/11/2017 10:30	30/01/2017 09:00	28/02/2017 23:30
781.52	14/11/2017 10:30	30/01/2017 09:00	28/02/2017 23:30

Table 1: Impact of installed wind capacity on the timing of each local triad period

Figure 2: Peak flow magnitude during each triad period for different



5.3.2. Participation in Network Services

A stated above, community scale deployment, of connected generation and demand offers the opportunity for grid services to help manage distribution losses, voltage swings/violations and solar induced reverse power flows. This can potentially be achieved by the active management of connected loads such as electric vehicles, electric batteries and electrically activated heating (storage heating, heat pumps and electrochemical heat batteries).

The Fintry data platform offered the opportunity to explore this in detail consequently SSE Network commissioned a more in-depth network study to investigate how such a grid service might be developed at Fintry[22].

The study, which was based on the original network model developed during stage 1 of the project, focused on the secondary sub-station located at Culcreuch avenue which serves 44 homes. The Culcreuch Avenue sub-station is fed from the Kippen primary substation.

The project team provided a mix of measured and forecast data to allow detailed modelling. The existing network model information was transferred to a different platform to allow unbalanced loads to be analysed.

A number of scenarios were considered each of which was focused on supporting the distribution network (voltage, thermal ratings and reverse power flows).

Baseline Scenario

Baseline loads were simulated for Summer, Winter and Autumn conditions and validated against measured values from the substation. The results were used as the basis for the rest of the scenarios.

Load Growth Scenarios

Potential pinch points in the network were then identified by following an anticipated load growth pattern associated with further penetration of solar PV, future electric vehicles uptake based on existing car ownership and use patterns (to 2040) and the introduction of both domestic and commercial scale electric batteries within the same timescales.

EV Scenario

The EV scenario was based on existing transport data provided by Fintry Development Trust which identified current car ownership and usage patterns for the village. Assumed charging profiles were provided by VCL.

Load growth to 2040 was considered with 50% of existing vehicles assumed to be replaced by EV’s by 2030 rising to 70% by 2040. It was assumed that 30% of the casr will charge in a centralised car park with 50% battery. Second cars were assumed to be charged at home.

Distributed storage/generation scenario

Load and generation profiles were assumed from the baseline scenarios. Load growth assumptions were as follows:

- Domestic level Batteries installed in 50% of homes by 2040 and 70% by 2050
- PV installed on 50% of homes by 2040 and 70% by 2050

Centralised Storage scenario

- 5kW battery installed at sports centre by 2030
- 20kW battery installed at sports centre by 2040

All in scenario

- Combines PV, Domestic Storage and EV's

Conclusions and Recommendations

Fintry lies in a generation constrained zone. Demand in the village is not constrained at this time however the anticipated load growth associated with the roll out of electric vehicles was expected to introduce some capacity constraints at some time in the future however the results showed that:

1. The existing network is robust and offers no opportunity for services based on voltage or power flow adjustment
2. EV load stays within network limits up to 2040
3. There is a clear opportunity combine generation, EV's and storage to better manage losses around the network
4. It is recommended that the study be repeated at a 11kV level to better understand the cumulative effects of load growth across several villages connected to the same sub-station
5. An area based approach could then be developed to better manage resources.

5.4. Main Findings of the Demand Side Management Activity

The Demand-side Management work stream identified that:

1. Installation of a near Real-time measurement and Control platform offers the opportunity for communities to access new revenue from new distribution services although further work is required to quantify the benefit, reduce unit costs and optimise data processing.
2. The nature of the services offered is locational and should be approached on an area basis across a primary sub-station area.
3. Community cluster groups should be formed to develop co-ordinated energy area plans based around detailed network models
4. Temperature sensors, installed at the same time as SMART meters, offers an opportunity to identify heating types without the need for additional surveys
5. Generally accepted assumptions around electric storage heating availability to participate in demand-side management are open to challenge
6. On-site monitoring of generator output can reduce forecasting errors by up to 10%.
7. Development of a local TRIAD system offers the opportunity to develop new, customised, power purchase agreements

6. Regulation and Policy Workstream - Summary

With the move to a more decentralised, digitalised and democratised energy system, the expectation has been of a growing role for local energy. However, the loss of reliable revenue streams from FITs has made it harder to establish a commercial case for local energy projects. The SMART Fintry project has provided an opportunity to explore how local energy could play a more central role in the energy system of the future and what the regulatory and policy changes are that are needed to facilitate that.

While there were no regulatory barriers to delivering the SMART Fintry project, it has highlighted the difficulties in taking forward such projects on a commercial basis. The consensus of all involved is that local energy does deliver real benefits that should be rewarded. However these benefits are diffuse and spread across the value chain and as such are not rewarded as policy tends to focus on each element of the value chain in turn and local energy is a minor element in each case when viewed in isolation.

The potential areas for benefit are through moving to half hourly settlement; through providing local balancing; through delivering network savings and through enhanced consumer engagement.

H**alf hourly settlement** is key as it is what would allow suppliers to be rewarded for any load shifting away from peak and other times when energy is short – Ofgem is progressing the changes needed to support first elective half hourly settlement and ultimately market wide.

What the SMART Fintry project has highlighted is that half-hourly settlement is risky for suppliers and carries downside as well as upside opportunities. Over time all suppliers will need to work out how to operate under this new regime. However, in the meantime any future local energy projects should look for supplier partners who are already exploring or actively using half hourly settlement and hence have the systems and understanding of how to maximise the benefit from these arrangements.

In parallel it is clear that Ofgem could provide more support to suppliers looking to go down this path to reduce risks and challenges where they can. Discussion around what would be deemed acceptable in terms of tariffs which mirror wholesale price peaks would help suppliers as they look to innovate. Understanding whether they can revert to profiles if they find the risks too hard to manage would make it easier to make that step. And thinking through the interplay of half-hourly settlement and network charging for retail tariffs would help suppliers deliver meaningful offers to consumers.

The SMART Fintry project also adds to the available evidence on the critical question of the distributional impacts of half-hourly settlement. Although based on a small sample there is some evidence that low users tend to have more peaky profiles and hence would face a higher unit charge under half-hourly settlement. This needs further exploration.

On **local balancing**, the expectation is that if you can balance locally that must help with the ultimate task of balancing nationally. However where a local energy project is a small part of a supplier's portfolio the benefits in terms of managing their overall cash out risk are small. These benefits may grow over time if local energy becomes more prevalent. But given the difference in resources and demands across the country it seems likely there will still be a need for balancing actions at a national level.

Probably the bigger potential beneficiary from local balancing is the distribution network. Where there are local network constraints it is only action at a local level that can address them and the model of a DSO almost invariably assumes some local balancing role. However, there are only really commercial opportunities here if the local network is constrained. There are no constraints in Fintry but the methodology used to explore the question should help in identifying areas where there may be opportunities going forward, in particular as EVs start to take off.

That said what has been clear from SMART Fintry is that it takes time to build capability in the local community and a DNO could not rely on looking for such flexibility once a constraint becomes evident. Building capability in areas where there is at least some risk of constraints would be relatively low cost and would give the DNO options going forward. DNOs should be required to identify potential constraints and to look at the range of options for meeting them, including more speculative investment to build capability as necessary.

Ofgem should support such a move as a pragmatic step to unlocking the potential of local energy which would bring wider benefits but which are all hard to monetise at present.

The other element of network benefits for local energy projects concerns the **network charging** arrangements and the work that Ofgem is currently leading. This is complex and Ofgem's focus is on trying to ensure charges are cost reflective and do not create distortions in the system.

From a cost reflective viewpoint one of the hurdles facing local energy projects is that there is nothing in the network charging arrangements currently that takes account of "distance". It is well known that losses increase with the distance energy travels but this is not reflected in current network charges. Also, the threat of private wire projects duplicating assets only exists where distances between the sites are short – but again this is not reflected in distribution network charges creating a distortion in incentives which Ofgem should be looking to address by, for example, supporting virtual private wire arrangements.

The other distortion that arises from current charging arrangements is that in terms of network charging (and the allocation of policy costs) it is cheaper to put storage and distributed generation behind the meter rather than providing community scale solutions. However this is actually less efficient once allowance is made for diversity (different households consuming at different times) and economies of scale. Moreover community scale solutions are likely to be more inclusive and able to benefit a wider cross section of the community than if it is left to individual householders.

Ofgem is grappling with how to ensure a fair allocation of network costs and one that sends the right signals. At the minute local energy risks losing out from these changes. Ofgem should ensure that it looks properly at the distortions identified here (rather than just worrying about embedded generation gaining an advantage) and itt should not make further changes which disadvantage local energy until it has properly identified and found ways to reward the benefits it delivers.

For future projects there is the potential on a trial basis to utilise Ofgem's "regulatory sandbox" which provides innovative projects with a dispensation from regulatory rules. To apply for such dispensations – in particular around network charging arrangements – projects would need to be clear what changes they needed and what they hoped to demonstrate.

Finally, on **consumer engagement** the SMART Fintry project has demonstrated that there is the potential for community interests to be a motivator to want to participate in such schemes, although consumers also expect to make a saving. If the community model is effective in getting consumers to switch (and then remain loyal) then suppliers should be willing to offer community projects a competitive price. While not yet demonstrated in Fintry, the expectation is that this would also be reflected in a greater readiness to participate in DSR which provides another reason that policy makers and others should want to see local energy succeed.

As well as these vital changes needed if local energy is to be commercially viable, there are also some important practical learnings around **smart metering** in particular.

As part of the requirement for smart meters to be installed in all homes and small businesses by 2020, BEIS has prescribed a meter specification known as SMETS to ensure meters will all be interoperable going forward.

Because of the timings on SMART Fintry it was not possible to use SMETS meters and alternative smart meters were used provided by Energy Assets. One reason for not using SMETS meters was lack of coverage by the DCC (the national communications infrastructure). While ultimately DCC is expected to provide 99.5% coverage, many community energy projects will be in rural locations and may not have access to the DCC. In such cases SMETS is not an option.

The Energy Assets meters used in Fintry have the benefit of enabling communication in more remote areas and allowing for robust real time monitoring and control. Although they do not offer prepayment functionality or an in-home display, data can in principle be provided via a web portal.

The SMETS meters should in future have the capacity to effect load control in response to a signal from the supplier but this is modelled more on a centralised system rather than local energy which, with local balancing, would require more real time data. In theory this can be accommodated with the SMETS meters using a Consumer Access Device (CAD) to send real time data over the consumer broadband.

While this may be workable it is important that BEIS continue to press for this functionality to be delivered (given it may not be a priority for the conventional incumbents) and to monitor whether consumer broadband is seen as sufficiently robust to allow it to provide the basis for ancillary services. BEIS should review the use cases that they developed in the light of their developing understanding of how the smart, flexible energy system needs to evolve, to ensure that the SMETS meters are capable of providing the required functionality going forward.

Other practical challenges included the importance of being transparent about any data sharing (and recognising that consumers may not pick up on this initially if that information is provided alongside other messaging).

Thought also needs to be given as to how best to structure the commercial relationships to allow communities to effect a collective switch if the chosen supplier ceases to offer good terms or other opportunities arise. Absent a contract with the community group itself, the consumers will all need to switch individually to any new supplier.

Overall local energy has not been a priority area for Ofgem to date, notwithstanding the policy commitment from Scottish Government and the EU. In the future as we move from large scale generation to a greater use of renewables the benefits of local consumption of the energy will only increase, including to help manage constraints on the distribution network. This report aims to bring together in one place the range of regulatory issues and challenges impacting the commercial case for local energy in the hope that Ofgem will give this greater priority and take a broader view going forward.

6.1. Regulation and Policy Workstream Scope

The aim of this workstream was to explore the various regulatory issues raised by the use of locally generated energy and to bring together evidence to support future changes to the regulatory / government policy regime that would benefit future community energy projects. A number of recommendations are made which would help local energy play its part in the low carbon energy system of the future.

There is a strong basis for believing that community energy schemes can help reduce overall system costs but the current regulatory framework does not acknowledge this, in part because the value is fragmented across a number of areas. To flourish community energy projects need to be able to access the full stack of value, in the same way that storage is acknowledged to need to do.

While there have been no absolute regulatory barriers to the development of the SMART Fintry project it is clear that in some areas for things to be replicable on a commercial basis (rather than with government funding) would require changes to the regulatory framework and the way that costs are allocated. There are also other issues, for example around metering, which could impact on the replicability of the scheme in future.

Finally, as energy systems evolve new challenges will arise which will require a regulatory response.

While primary policy responsibility sits with BEIS and Ofgem it is assumed that the Scottish government would be interested in understanding potential barriers given its broader commitment to local energy.

The key regulatory / policy issues that are explored in more detail in the sections that follow are:

- Half hourly settlement
- Local balancing
- Network charging
- Virtual storage and similar concepts
- Metering
- Other issues.

For each of these areas we provide an overview, set out the regulatory position, the issues for local energy, the evidence from Fintry and then make recommendations for regulators and policy makers and recommendations for further work

6.1.1. Half hourly settlement

Overview

As a part of the electricity market arrangements there is a process known as settlement whereby suppliers have to ensure that they have contracted for enough energy to match that used by their customers. If they don't they have to pay a "cash out" price which can be very high at times of overall system shortage.

Currently domestic customers are settled on the basis of "profiles" of usage. This means that even if consumers reduce their peak usage (either because of direct load control or in response to price signals or information provided) the supplier will not actually benefit, and that benefit of reducing peak demand cannot be passed on to customers. Ofgem have made changes to the arrangements to support elective half hourly settlement (ie if an individual supplier wishes to settle some or all of their customers based on actual usage) and ultimately are looking to introduce this market wide for residential customers. Moving to half hourly settlement allows the supplier to gain commercially from encouraging load shifting – a benefit which could then be passed onto customers in terms of a time of use tariff for example.

Although settlement is concerned with the allocation of wholesale market costs (ie energy), a consequence of moving to half hourly settlement is that network charges are also recovered on a time of use basis rather than a flat pence /Kwh which applies currently to domestic customers. While there are wider debates ongoing around the future of network charging (see below) it cannot be seen as a wholly separate issue from a supplier's perspective.

Given the timescales of this project Good Energy did not expect to be able to move to half hourly settlement but we have explored with them some of the practical challenges and used the data to model the impact it would have (in particular for customers with direct load control). This analysis and modelling has then been used to:

- Inform thinking on the options for DSR in Fintry going forwards (see also the DSR workstream);
- Provide insights which could help shape the regime going forwards (including evidence on the distributional impacts of half hourly settlement which is an area that Ofgem are interested in).

Current regulatory position

Ofgem has been clear for some time that it wants to see a move to half hourly settlement in order to provide the right price signals to suppliers and ultimately to customers about their energy usage[23]. This move is dependent on the rollout of smart metering and is also seen as one of the key benefits that smart metering enables with the potential for more innovative tariffs. The Competition and Markets Authority (CMA) in its review of the energy market reinforced that view and recommended that BEIS and Ofgem develop and consult on a plan for half-hourly settlement. The BEIS / Ofgem Smart Systems and Flexibility Plan reiterated the importance of half-hourly settlement.

As noted above, over recent years Ofgem have been working to remove any barriers to suppliers electing to settle customers on a half hourly basis. While this has been technically possible for some time, until recently there were strong disincentives (such as the risk of double charging of transmission network costs as the basis for network charging for half-hourly settled customers is

[23] https://www.ofgem.gov.uk/electricity/retail-market/market-review-and-reform/smarter-markets-programme/electricity-settlement

different). As of June 2017, these barriers have been addressed and processes streamlined[24]. However, as discussed below, there may still be practical or commercial reasons why suppliers choose not to settle half hourly.

Recognising the importance of providing an accurate cost signal to suppliers and ultimately end customers, Ofgem is now exploring the options for a move to market wide half hourly settlement. This would be a major project involving significant system changes for industry central systems and for individual suppliers. Ofgem have launched a significant code review to take this forward and the current timeframe is for a decision to be taken by the second half of 2019 on if, when and how to move to market-wide half-hourly settlement. As a part of this project Ofgem are currently exploring the privacy issues around access to data for half hourly settlement (given that customers have a choice about the level of data they allow their supplier to access). They have also tried to look at the distributional impacts given concerns that the move could adversely impact vulnerable customers although this work was inconclusive and arguably missed the main issue that ultimately there will be winners and losers from such a change and the challenge is to identify who those are likely to be.

Issues for local energy

As noted above Good Energy were not expecting to be able to move to half-hourly settlement within the timeframe of this project. However the data available from Fintry has allowed a number of issues to be explored which should help inform policy thinking in this area. In most cases these apply more generally but there are also some that are particularly relevant to local energy.

The key conclusion from a local energy perspective is that to secure commercial benefit from attempts to shift load requires the supplier to settle half hourly. However, a history of half-hourly data is needed in order to be able to identify what the impacts of such a move would be and to develop suitable local propositions. It may be that not all customers would benefit from being settled half-hourly (eg if they do not have controllable loads).

In exploring with Good Energy the potential for time of use tariffs a number of risks were identified that a supplier would need to manage in moving to half-hourly settlement. For policy makers having an appreciation of these real commercial issues may help explain why suppliers have been slow to move to half-hourly settlement notwithstanding the opportunity to provide more innovative tariffs. It will take time for suppliers to learn how best to manage these risks. These risks are that:

- The usage profile of their customers may differ from the standard creating an immediate loss or gain;
- The supplier is exposed to a greater risk in terms of price volatility – whereas currently they know what profile they need to buy for when faced with a potential price spike, with half hourly settlement they face additional risks if customers use more than expected at a time of high prices. Forecasting their position is more difficult for actual half hourly consumption than for a standard profile.

[24] https://www.ofgem.gov.uk/system/files/docs/2017/07/half-hourly_settlement_update_july_2017.pdf

On a more positive note the expectation is that local energy projects could be more effective in securing responses from customers at time of system stress (if they feel ownership of the energy involved) but this has not been tested in Fintry and the challenges of consumer engagement should not be underestimated (as reflected in the Active Energy workstream report). While automation is expected to help in the longer term the opportunities currently are limited.

Finally, on a practical level, given that we are still only at the start of the journey in terms of half hourly settlement, the IT providers who offer systems to small suppliers (who are typically the ones pursuing local energy projects) do not yet have a standard offering for billing and support that could accommodate any sort of time of use tariffs.

Evidence from Fintry - Combining network and energy costs

The different cost structures for network charges versus wholesale energy are not readily combined into a simple but meaningful retail tariff

As noted above moving to half hourly settlement results in changes to both the basis of network charging and the wholesale energy costs.

Figure A shows the profile of network charges for Fintry (for 2017/18)[25]. This reflects:

- the red / amber / green time bands that are used for DUOS charging and shows in particular a markedly higher level of charges in the red period (8.7p/kWh) compared to the green (0.7p/kWh) ;
- the peak charging for TNUOS and recovery of capacity market charges. For SHEPD the time period aligns with that for DUOS – which is not the case for all DNOs – but it should be noted that these charges only apply for winter months (November to February inclusive) unlike DUOS which are year round

Given this pattern of network charges, the natural approach in developing a time of use tariff would be to reflect this in a static time of use charge (with a seasonal element).

[25] For profile class 0 – LV domestic customers that are half hourly settled

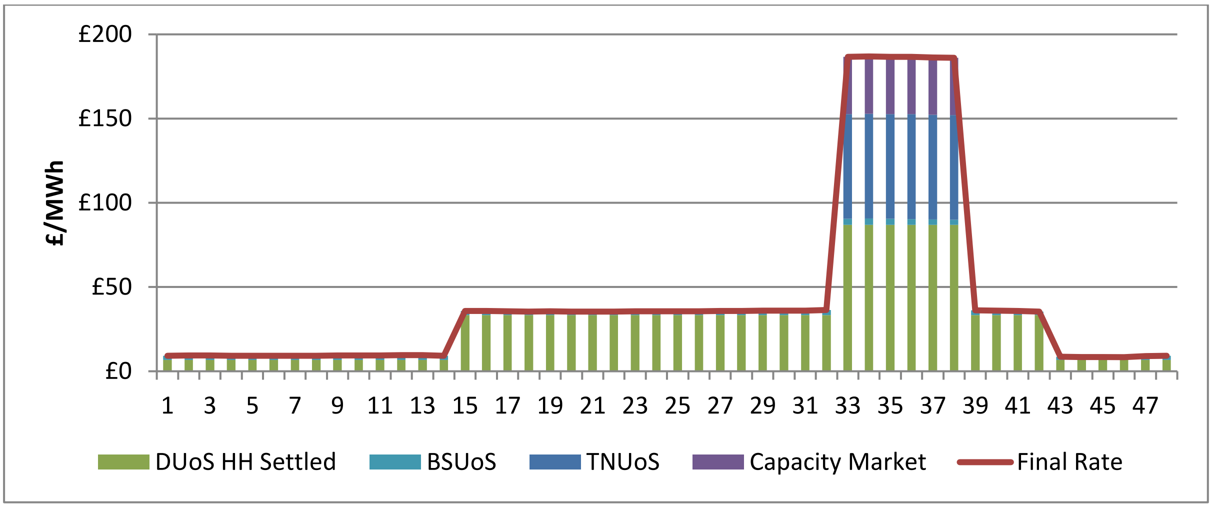


Figure 11: Composition of network charges by time of day (£/MWh)

Source: Good Energy analysis using prices for winter 2017 weekday

Figure B shows the profile of day ahead wholesale energy costs using Nordpool data. Again this shows a peak during roughly the same period which at first blush would suggest that a static time of use tariff could work. However the critical feature of wholesale energy prices is their volatility and while this chart shows the average the actual price faced by suppliers can vary very significantly from day to day. Given that for suppliers the critical issue is managing their exposure at times of peak pricing this then points to having some sort of dynamic price.

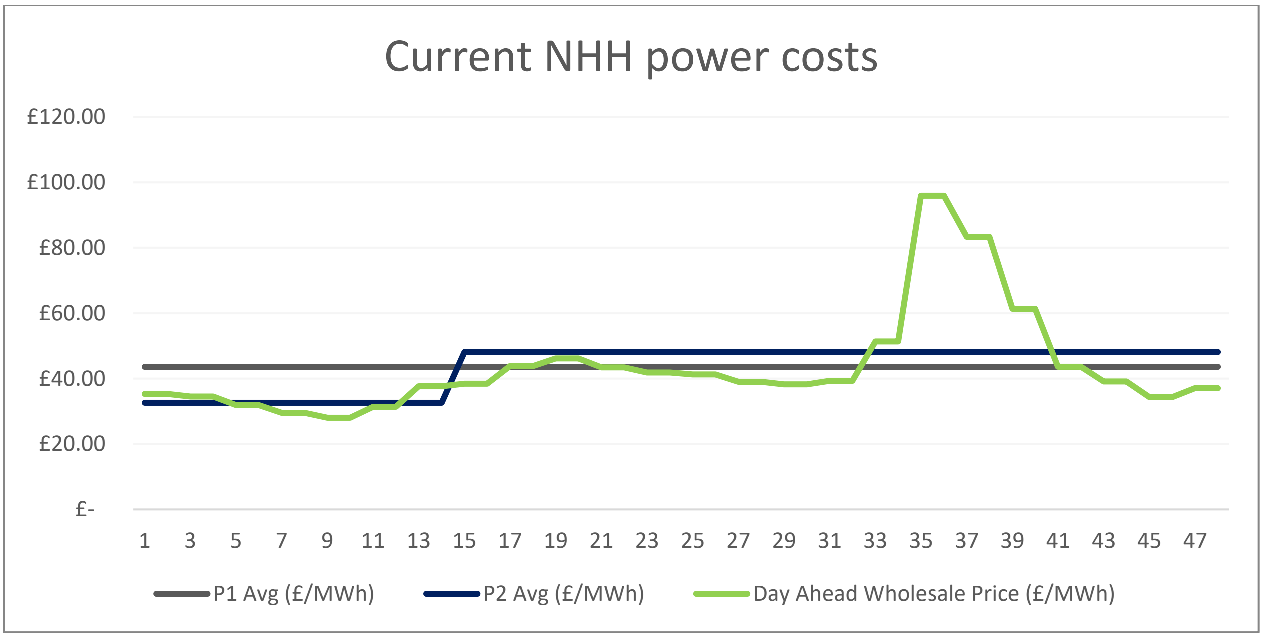


Figure 12: Energy costs by time of day (£/MWh)

Source: Good Energy analysis using average day ahead wholesale price for winter 2016

The issue that then arises is one of consumer acceptability and what might be seen as acceptable in regulatory / policy terms. It is expected that for the overwhelming majority of customers linking prices to spot market prices would leave them exposed to too much risk that they would not be able to manage (at least absent a much higher level of automation). Citizens Advice (in their report on the value of time of use tariffs[26]) advocated the use of rewards for cutting use at critical peak times rather than penalties (ie Critical Peak Rebate). This would seem to have merit from a consumer perspective but falls short of fully "cost reflective" pricing.

One supplier has just launched a tariff linked to day ahead wholesale prices (Agile Octopus). Their offer includes a cap on the maximum level of prices to provide some protection to customers.

A broader debate on these consumer protection issues would help suppliers tread an acceptable path. The obligation sits with suppliers to determine what "treating customers fairly" means in this context given their licence obligations. However some steer from Ofgem in what is a new area would be likely to give suppliers more confidence to move ahead.

The immediate impact of HHS for a supplier

Simply moving to half hourly settlement can result in higher or lower costs for suppliers depending on the profile of usage of their customers

The "profile" that is used for settlement currently is based on a sample of 2500 meters with adjustments then made to that profile to take account of temperature, sunset etc leading to a daily profile for each Grid Supply Point (GSP) area and for different meter classes (single rate, economy 7, small non-domestic etc).

Different communities may have profiles that differ from this nationally derived "profile" which means that on moving to half-hourly settlement the supplier might see their underlying costs rise or fall (even before there is any demand response). Large suppliers are more likely to have a statistically representative sample of customers and hence their profile is likely to align well with the national picture. However for small suppliers – and in particular for individual local energy projects – this may well not be the case.

Figure C below shows how the profile of customers on the Fintry tariff compares with the Elexon profile for the relevant GSP averaged across the week in October / November 2017.

While the profiles map quite well onto each other it is noticeable that there is an 8am peak in Fintry that is not so marked in the Elexon profile and also that the evening peak appears to be shifted half an hour earlier.

The fact that the profile of Fintry customers differs from the Elexon profile means that the network (and other) charges that would be incurred on a move to half hourly settlement will also be different from the norm.

[26] 26 https://www.citizensadvice.org.uk/Global/CitizensAdvice/Energy/The%20Value%20of%20TOU%20Tariffs%20in%20GB%20-%20Volume%20I.pdf

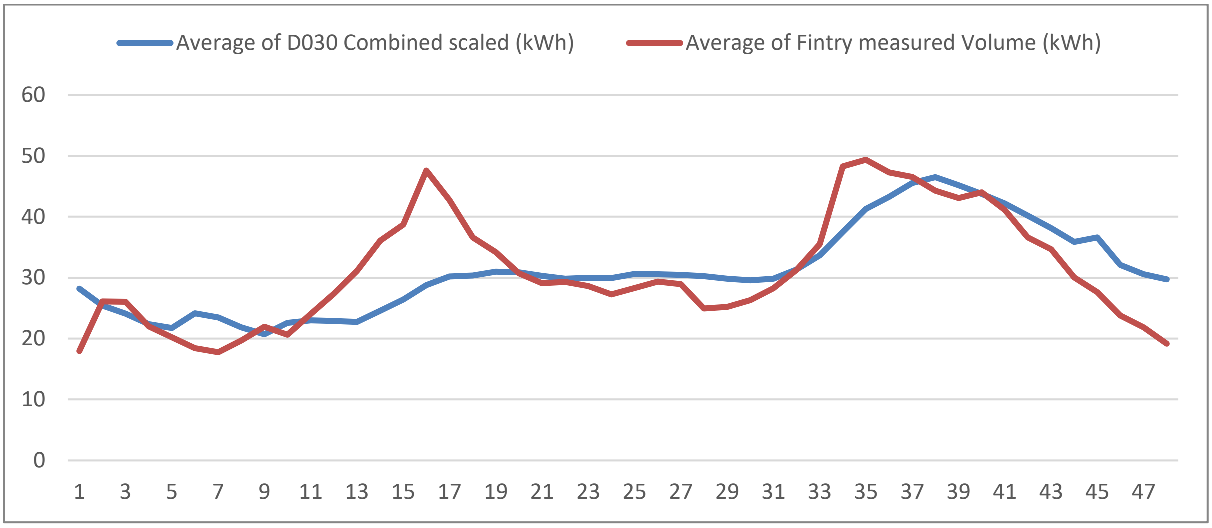


Figure 13: Figure C – Fintry consumption compared with Elexon (D030) profile

Source: Good Energy Analysis (average across the week)

Local energy projects considering moving to half hourly settlement will want first to understand what the effect of this would be on the underlying costs (ie before any effect from load shifting).

Winners and losers

This applies even more markedly at the level of individual households. Understanding the distributional impact in terms of winners and losers is difficult but critical.

Ofgem has previously acknowledged the importance of understanding the distributional impacts of a move to half hourly settlement but has struggled to make progress on the issue.

In 2014 it commissioned work from CSE[27] who identified different types of profiles within the population (one standard profile, one that had a much more marked evening peak and one that was much flatter) and showed how different static time of use tariffs would impact these groups, before making any allowance for behaviour change. This showed the potential for quite large changes in bills (+/- 10%) simply as a result of having different profiles. What this work was unable to do however was link these profiles with demographic information.

More recently in 2017 Ofgem commissioned CEPA[28] to look explicitly at the demographic angle. However what CEPA did was to focus on the propensity of different demographic groups to take up such tariffs and to change behaviour. It assumed that only those who would benefit would take up the tariffs and hence implied there would be no losers (while in reality the charges for

[27] [27] https://www.ofgem.gov.uk/sites/default/files/docs/2014/04/tou_tariffs_and_clustering_-_report_vfinal_160414.pdf

[28] https://www.ofgem.gov.uk/system/files/docs/2017/07/distributional_impact_of_time_of_use_tariffs_1.pdf

those left on a conventional tariff would have to increase to allow suppliers to recover their total costs). It also did not generally have household level demographic data but instead used postcode level data, which diminishes the value of the analysis significantly. The conclusion was that the variations were greatest within demographic groups rather than between them – and that further work was therefore needed.

Although the Fintry sample is small compared with these other studies we have the advantage of having demographic data for individual households that will allow this issue to be explored more fully going forward.

Initial analysis by Good Energy reinforced the importance of this by showing that across a sample of 62 customers (with data for October / November) the differences in actual usage profiles would result in a significant difference in the time-of-use weighted network charge that customers would incur. Specifically the minimum (ie the largest "winner") across the sample was an average (winter) network charge of 3.73p/kWh[29] while the maximum (ie the largest "loser") was an average charge of 8.20p/kWh, reflecting purely differences in profile. Once differences in wholesale costs are taken into account these variations in cost to serve would be even more marked.

Heriot Watt University's analysis reinforces this point. Using statistical clustering techniques (based on looking at a number of dimensions of the consumption pattern) they identified three clusters of users. The clusters had different levels of total consumption with a larger peak to off-peak ratio for lower use households. The time-of-use weighted (winter) networks charge for the three clusters was 6.29p/kWh, 5.50p/kWh and 4.71p/Wh. They could not identify any links between these clusters and demographic characteristics (eg retired / working, number of bedrooms in property). However they acknowledge this may reflect the fact that demographic data was not available for all properties and that the households covered are quite similar (high homogeneity). That said this remains a valuable data source and further analysis can be done as more consumption data becomes available.

Another valuable insight coming out of the Heriot Watt analysis is that a simple metric of the proportion of usage in the peak period provides a very robust predictor of the "cost to serve" (reflecting the very peaky nature of network charges currently). This offers a simple methodology that could be applied to some of the other smart meter data sets in the public domain and looking to understand better the characteristics of winners and losers. Thinking of this in terms of "cost to serve" makes clear that even if customers do not opt in to time of use tariffs they can be expected to ultimately face higher charges if there is a move to half-hourly settlement.

Although only based on a small sample, the fact that lower use customers in Fintry appear to have a more "peaky" profile and hence would face a higher time-of-use weighted network charge (and higher wholesale energy costs) highlights why distributional issues are so important in the debate on half-hourly settlement.

Improved forecasting can help with imbalance risk

As discussed above one of the risks for suppliers in moving to half hourly settlement is the increased exposure to imbalance risk and the increased difficulty in forecasting actual demand rather than a profile. This makes it all the more important that – if they are to move to half hourly

[29] Figures are for the winter period when TNUOS and capacity charges apply

settlement - suppliers are able to forecast as accurately possible both the energy being generated and the demand within a community project. The point here is that forecasting will be increasingly important but more difficult. Learning how to make the most of more disaggregated data to help with that challenge is a priority. Heriot-Watt University have been exploring how different approaches to forecasting could help with this.

The potential for automated load shifting is currently limited

Aside from any serendipitous benefits from having a different base load profile (discussed above), the commercial benefits from moving to half hourly settlement come if loads can be moved away from peak times (and in particular critical peaks) or shifted to make better use of the system resources overall.

Other projects (including a number funded through Ofgem's Network Innovation Competitions) have looked at the potential impacts of customers responding to time of use tariffs. While this has shown some potential, the consensus has always been that greater automation would be needed to deliver full benefits.

One aim of the Fintry project was to explore through simulation what might be achievable in terms of shifting electric storage heating loads.

As part of SMART Fintry information on internal temperatures was collected and Heriot Watt University used this together with consumption data to explore the potential for storage heating to be used as a source of local flexibility. What the Heriot Watt analysis showed was the extent of "leakiness" of the storage heating in the properties examined. This was reflected in the fact that internal temperature increased overnight (linked to the charging cycle of the heaters). Their conclusion is that there is significant potential to improve the thermal comfort provided by these storage heaters by controlling the charging cycle. This would need to be done in such a way as to avoid any negative impacts on the diversity of load on the network.

Assuming that priority is given to improving thermal comfort and managing diversity there would then be relatively little opportunity for load shifting to support local matching of supply and demand given the poor thermal retention properties of the storage heaters currently used.

However there could still be the potential to use them to deal with exceptional events on the system at a national level, if a level of thermal comfort were sacrificed or more widely if modern storage heaters with much improved insulation were used. Some other projects[30] have been more positive about the opportunities for using (modern) storage heaters to provide flexibility to the system but even if the gains are primarily in terms of thermal comfort this should still be considered an important benefit.

The potential for shifting water heating loads has not been explored but is likely to offer more potential as water tanks are typically better insulated and water heating is used all year round. In principle water heaters are separately controllable through the Energy Assets meters although this may require re-configuration of some internal wiring. An initial indication of the water heating load could be obtained by comparing demand patterns between seasons.

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[30] Sarah Darby – Smart Electric Storage Heating and Potential for Residential Demand Response

Water heating was proved successfully as a source of flexibility in the NINES project on Shetland where SSEN managed 100 homes with domestic hot water which was a crucial resource in summer when there was little heating load[31].

Identification of Flexible Loads

One of the other areas explored by Heriot Watt University was the extent to which individual load profiles could be used to identify where there were flexible loads – specifically electric heating. They found that overnight consumption was a good predictor of the presence of a heat pump. Being able to identify such loads from the data could be of benefit to suppliers wanting to target tariffs aimed at encouraging DSR or to networks interested in understanding and forecasting demands on their network.

Recommendations for regulators and policy makers

It is essential that in thinking about reforms to network charges that Ofgem takes account of how these might realistically be reflected by suppliers into retail tariffs. This means thinking about them in the context of the wholesale cost structures that suppliers face (and which are themselves changing).

It is also important that Ofgem ensures that the benefits of flexibility are appropriately valued.

Alongside its work on half hourly settlement Ofgem needs to revisit the thinking it did on consumer empowerment and protection for smarter markets which touched on tariff innovation. While Ofgem is unlikely to want to take a prescriptive approach in this space there needs to be a dialogue to help build a common understanding of how Ofgem's principles would apply in this area and its risk appetite.

Given the risks to suppliers in moving to elective half hourly settlement Ofgem should make clear whether it is open to them to revert to using profiles in future if they find these risks too difficult to manage at this stage.

Ofgem needs to put further effort into understanding the distributional impacts of a move to market wide half hourly settlement building on the approach taken above. There is justified concern from consumer groups about the potential impacts on vulnerable and low-income customers which if not addressed risk de-railing the project. While it is not necessarily an issue for some groups eg those at home all day – further work is needed to understand where problems may arise and hence what additional protections or support may be needed. There will clearly be challenges engaging vulnerable consumers and take-up of TOU tariffs may be limited – but this should not preclude those who are interested in taking them from so doing.

Recommendations for further work

The potential benefits of shifting water heating loads should be explored, including reconfiguring internal wiring where necessary and practical.

Further work could usefully be done on distributional impacts as more data becomes available in Fintry.

[31] www.ninessmartgrid.co.uk

6.1.2. Local balancing

Overview

At present the settlement process discussed above is carried out at a national level. There is limited commercial benefit currently in trying to match supply and demand at a local level despite the fact that intuitively there is benefit in balancing locally where possible. This links with the discussion on network charging below given that one benefit (though not the only one) would be a real reduction in distribution network costs.

Other community energy projects have sought to use what might be considered loopholes in the current rules (in particular the “complex sites” arrangements) so that they can benefit from local balancing and to support peer to peer trading. This can deliver significant savings as it effectively puts both supply and generation behind the meter and treats them as if they were a single site. This results in lower network charges and avoids many of the social and environmental policy costs that are levied through bills. However Ofgem is concerned because in the absence of a real system saving other consumers will have to pick up these costs and as part of its Targeted Charging Review is looking at how to close such loopholes.

Given this, the SMART Fintry project has not sought at this stage to go down the “complex sites” route but has instead looked to provide the evidence around potential benefits from local balancing (in particular for network costs below) and to understand the potential to match supply and demand in practice and to develop tools to help with this.

While the project was initially interested in piloting peer to peer trading so that consumers could see the direct impacts of using local energy resources, this was not ultimately possible.

Current regulatory position

As noted above, settlement is currently carried out at a national level taking each supplier’s generation and demand portfolio into account.

As part of the Ofgem / BEIS work on a smart flexible energy system the question has been raised as to whether, as part of their transition to take on a more active Distribution System Operator (DSO) role, the DNOs should be playing a part in trying to manage local markets. A number of network innovation projects are being set up to test different models for how this might work.

While the expectation is that there must be benefits in trying to match local supply and demand, identifying the source of those benefits is difficult. In their Future Insights paper on Local Energy[32] Ofgem made a lot of positive noises but said “balancing a particular generator with a specific customer is less helpful than increasing generation or reducing demand when the system overall is short”. This ignores the fact that it may be easier to engage customers to balance locally (ie if they are thinking about how they use “their” energy) and that local balancing ultimately should help deliver system wide balancing. There are also the potential distribution

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32 https://www.ofgem.gov.uk/system/files/docs/2017/01/ofgem_future_insights_series_3_local_energy_final_300117.pdf

network benefits which Ofgem does acknowledge and which may be significant behind a particular constraint for example.

The consumer motivation angle links in closely with the current interest in peer-to-peer trading which is currently not possible within the current settlement rules. Ofgem is currently trying to promote new business models by running what it calls a "regulatory sandbox" where dispensation can be obtained from certain rules to facilitate new approaches. Of the 4 projects awarded sandbox status 2 involved peer to peer trading[33]. Although the settlement rules fall outside Ofgem's sandbox, Elexon is now seeking to establish a balancing sandbox and a code modification (P362) is being progressed to facilitate this. In the proposal Elexon talks explicitly about some of the problems community energy projects have had using the "complex sites" rules if they have a mix of meter types and also the wider problems with peer to peer trading as examples of the sorts of issues the BSC sandbox would be seeking to address.

Issues for local energy

This issue is central to local energy and community projects need to be able to secure commercial benefit from matching local supply and demand which is, in many cases, their raison d'etre.

Regen SW has identified a number of different levels at which one could think about local balancing – from the regional level (ie Grid Supply Points); across areas defined in relation to distribution network topology (either at primary / secondary substation level or linked to particular constraints); and within local communities.

These different levels link to the potential benefits. Balancing at GSP level would reduce the need for the transmission network and indeed transmission charges do already take some account of geography. Balancing within areas linked to the distribution network could help avoid the need for network reinforcement (which is not currently rewarded). Balancing at a local community level is more about consumer engagement and managing supplier imbalance risks.

Given the scale of most community energy projects it is balancing at the community level that tends to be the focus although understanding the network topology is clearly critical and may open up other opportunities.

Evidence from Fintry - Network savings linked to constraints

Network savings from local supply and demand matching are limited unless there is a local constraint when the potential savings are significant

As part of trying to identify potential commercial revenue streams for SMART Fintry we spoke to SSE, the local DNO. It was clear that they would only consider rewarding demand side response in areas where they had a constraint and were considering reinforcement. SSE have previously run tenders in constraint managed zones where they were open to a variety of solutions including demand side response. While they had not previously used domestic loads in this way, and

[33] 33 https://www.ofgem.gov.uk/system/files/docs/2017/07/update_on_regulatory_sandbox.pdf

noted the additional challenges in terms of needing an effective control system, they did not rule it out.

While Fintry currently does not have any network constraints, we have used the network analysis (discussed more fully below) to explore different scenarios for future developments to look at when constraints might start to bite and hence when local energy management could be of value. While the opportunities in Fintry are limited even under some quite extreme scenarios, this demonstrates how other projects could assess the potential.

Given there is a clear option value in having local energy schemes that can be called on to help in managing load in this way there is a case for supporting the development of these schemes even if there is not an immediate need.

Need to understand network topology

Network topology does not necessarily align with the structure of local communities

In exploring options for SMART Fintry the team were able to utilise their understanding of the local network topology to identify what might make sense from a DNO perspective. For example, the wind turbine in which Fintry Development Trust have a stake is actually run off a separate feeder and hence from a network perspective matching demand with output from that source would not deliver network benefits. Understanding these issues requires either expert input or close working with the DNO.

Some other DNOs such as SPEN provide more detail through their heat maps for generation constraints which includes geographically accurate 11kv feeder information.

Other benefits

One of the expectations in establishing SMART Fintry was that it might be easier to motivate consumers to participate in demand side response if this was linked to local balancing and the use of “their” local energy. This informed the design of the user interfaces that were developed (such as the galloping stag showing the level of local generation. While the success in signing customers onto the Fintry tariff suggested there was interest in the idea, it was not tested with consumers in practice.

One of the benefits cited by Ofgem in its Future Insights paper was that local energy could help in managing supplier imbalance risks. However balancing is currently undertaken at a national level and hence balancing at a community level would not necessarily help. Clearly if a supplier could balance its position in each region then this would result in it having a nationally balanced position but given the difference in resources between regions (eg higher levels of wind in Scotland and solar in the southwest) this is unlikely to be a cost-effective approach.

Recommendations for regulators and policy makers

Ofgem should continue to look at removing barriers to local balancing and peer-to-peer trading, recognising their benefits in terms of consumer engagement and as a longer term potential source of flexibility.

In particular Ofgem and Elexon could helpfully provide clarification around the status of the “complex sites” regime and how this could be evolved to facilitate community energy projects and peer to peer trading. Given that small suppliers and community groups do not have the resources to readily progress code modifications (in particular ones that incumbents may resist) Ofgem and Elexon should play an active role in progressing such changes

Ofgem should continue to support network innovation projects that seek to increase understanding about the opportunities in this area as part of the transition to a new DSO role for the networks. Networks should be encouraged to bring forward such projects.

Networks should be encouraged to provide information on their low voltage networks which might help local energy projects understand the network topology and potential opportunities for community projects to provide value by helping with constraint management.

Recommendations for further work

If more automated loads could be identified (eg hot water) then it would be worth testing the scope to achieve local matching.

There may also be value in testing consumer appetite for behaviour change linked to local energy surpluses or shortfalls once they are more familiar with the information being provided.

6.1.3. Network charging

Overview

The rules around network charging are currently being reviewed and questions are being raised about the extent to which locally balanced supply and demand should benefit in terms of lower network charges. This links with the local balancing issues considered above. Currently Ofgem does not seem sympathetic to arguments on the benefits of local energy (and indeed network charges for distributed generation are set to increase).

Some community energy projects have been exploring the use of private wire solutions to avoid paying network charges (and wider policy costs). This is clearly not sensible in terms of wider system efficiency but has prompted discussion around the case for discounts for “virtual private wire” solutions. While Ofgem’s Targeted Charging Review is likely to make such solutions harder to deliver there may be a case for looking for some way of taking account of distance in charging.

As noted above other projects have used the “complex sites” model which allows them to avoid network charges (and wider policy costs).

As part of SMART Fintry, SSEN have installed monitoring equipment on their network which has allowed evidence to be gathered on the network benefits of local balancing (eg in terms of reduced losses), and the impacts of increased electric vehicles in the mix.

The purpose of this workstream was to:

- Understand the network impacts of increased local supply and demand matching;
- Make the case to Ofgem (through its targeted charging review and more widely) for local energy schemes to be able to benefit from lower network charges (either using "complex sites" arrangements as discussed above or some alternative "virtual private wire" solution).

Current regulatory position

Network charges are levied on end consumers (via suppliers) and on generators. The charges are set to enable the network companies to recover their allowed revenue determined by Ofgem through the RIIO price control process. The basis for charging is set out in industry codes and for the most part changes to the structure of charges are made as a result of industry proposed charging modifications (which Ofgem then ultimately has to approve). There is also scope for Ofgem to undertake significant code reviews where it considers that there are strategic issues that it should lead the thinking on.

The general philosophy is that as far as possible network charges should reflect the long run marginal costs of providing the network. However given the high fixed costs involved in network provision, simply charging on this basis would not recover the companies' total allowed revenues. There is thus a residual element of network costs that has to be recovered. There is no "right" way of setting these charges but Ofgem (and indeed other regulators and commentators) see this as being about balancing different principles around fairness, practicality and a desire not to distort the underlying cost signals. Although Ofgem does not discuss it in its consultation document, there is in reality no reason why these residual costs should not be allocated so as to achieve wider public policy goals such as energy efficiency or helping tackle fuel poverty (or indeed the encouragement of local energy). In effect it should be a political decision. However, how these factors are weighed currently sits entirely with Ofgem which, as an economic regulator, tends to place particular weight on the need to not distort the underlying cost signals.

Ofgem is currently carrying out a Targeted Charging Review[34] looking at how the residual elements of costs are allocated. More recently it has acknowledged the need to set that in the context of wider work to review the underlying forward-looking (or cost-reflective) elements of the charges and also the access arrangements (including connection charging)[35].

While the focus above has been on network charging the other element of costs that can push projects towards behind the meter solutions is the way in which the policy costs of FITs and social tariffs etc are recovered Again these are currently recovered on the basis of net usage which means that customers who utilise their own generation do not contribute to these wider

[34] 34 https://www.ofgem.gov.uk/publications-and-updates/targeted-charging-review-significant-code-review-launch

[35] 35 https://www.ofgem.gov.uk/publications-and-updates/reform-electricity-network-access-and-forward-looking-charges-working-paper

policy costs. At present government has given no indication that this will change although links are being made in the wider debate on network charging.

Issues for local energy

In terms of the Targeted Charging Review Ofgem are particularly concerned about the fact that the current basis of charging (based in effect on net consumption) could ultimately result in customers who are able to have, for example, solar combined with storage paying little or nothing for their access to the network – although they would still expect to be able to use the network as back up or to export electricity. Given that the total costs of networks still need to be recovered this leaves other users picking up an increasing share. Moreover those customers who are best able to utilise new technologies are typically better off which means there are some important equity issues involved which Ofgem is right to tackle. However in its concern to avoid distortions, the changes that Ofgem is making are disadvantaging local energy projects – and no credit is being given for the benefits that local energy can bring.

Local energy projects are often designed to be inclusive and provide a route for those who may not be able to afford their own generation to participate in the benefits. As such the equity concerns that are driving some of Ofgem's thinking are potentially less of an issue where community projects are concerned

As the Scottish Government has acknowledged local energy projects can deliver wider public policy benefits. In deciding how to allocate the residual costs it would be open to Ofgem – in particular if given a clear policy steer from government – to take these wider policy goals into account.

Moreover, even in terms of the element of charges that is intended to be cost reflective Ofgem does not take account of the benefits of local energy projects for the distribution network. The current cost model used to set charges was developed before distributed generation was very well established and hence it is not properly taken account of in the model. However, discussions with SSEN have highlighted the valuable role that local energy can play in managing losses and dealing with constraints.

Evidence from Fintry - Network savings

As part of the Fintry project SSEN installed monitoring equipment within the Fintry network to look at the performance of the network at a secondary substation in the centre of the village with 44 households attached. While Fintry is not currently in a constrained area the data that was collected was used to model how the network would be affected in a scenario of high EV penetration and / or increased rooftop solar / storage. This model could then ultimately be used to explore how local could help the DNO avoid the need for significant reinforcement.

The baseline monitoring showed that there were issues with reverse power flows at the substation (because of the levels of installed PV). From the DNOs perspective it would be preferable if that could be avoided. However voltage was within the acceptable range and there was no thermal overloading.

As expected, modelling increases in EV numbers showed a very sharp increase in losses (with 50% EV penetration leading to a near doubling of LV losses). In contrast increased storage on the system (helping flatten the peak) reduced losses. The current structure of network charges does not reflect this effect on losses and hence under values the flexibility provided by local energy projects.

In contrast, even in the most radical scenarios of EV and solar / storage growth there was still adequate capacity on the network and no need for reinforcement. As such there was no value that the community could hope to extract from using flexibility to defer reinforcement. However the modelling approach used shows how this could be explored in other geographical areas to identify where local energy projects could provide long term value to the networks.

Stability

Frequent changes to network charges make it hard for suppliers to develop consumer centric tariffs

In the discussion on half-hourly settlement above, the DUOS charges for Fintry were quoted as being 8.7p/kWh in the red period and 0.7p.kWh in the green. However these rates are for 2017/18. Following the charging modification DCP228, the time of use profile for DUOS has been flattened (because the allocation of the residual changed from being a % uplift to a flat rate). From April 2018 SHEPD's charges will be 7.6p/kWh in the red period and 1.6p/kWh green. Although this represents a significant shift from a multiplier of 13 to 5 (for the red-green ratio) the impact is less marked than in some other DNO areas where the red rate fell by more than half. Such significant shifts can have a big impact on suppliers looking to develop tariffs that will be meaningful to customers.

Social impacts

The Scottish Energy Strategy places a strong emphasis on innovative local energy systems and the potential to benefit local economies and consumers. Some of the ideas that were discussed as part of SMART Fintry included the potential to offer rewards for behaviour change in terms of community vouchers or training local labour to support meter installations. More generally the project built on the strong community that already existed in the village as a way to engage consumers.

Climatexchange have done some work for the Scottish Government looking at the social impacts of lcal energy[36].

The existence of wider community benefits provides a rationale for the allocation of the residual element of network charging to be allocated in a way that supports local energy.

Recommendations for regulators and policy makers

BEIS and Scottish government should provide a clear steer to Ofgem on the importance of network charging decisions (and in particular the allocation of the residual) supporting local energy. Consideration should be given to the designation of community energy projects which government (either Scottish government or Westminster) consider bring wider public policy benefits, reflected for example in their receipt of Local Energy Scotland funding. This designation

[36] https://www.climatexchange.org.uk/media/1887/update_on_cxc_lecf_impact_studies_aug16.pdf

could then be considered by Ofgem in network charging arrangements or in an updated version of the “complex sites” regime, allowing some dispensation from network charges.

Ofgem should support further work being done to demonstrate the benefits of local energy for the local distribution network looking in particular at distribution system losses and constraint management. Thought should be given as to how distance could be reflected in charging given that it is clearly a driver of costs (and private wire solutions are only viable where short distances are involved).

Ofgem should be cautious about making changes to network charging which disadvantage local energy ahead of steps being taken to credit local energy for the benefits it delivers. In particular it should pay due regard to the need to avoid large swings in charges which risk confusing customers or undermining longer term attempts to engage consumers in demand side response.

6.1.4. Virtual storage and similar concepts

Overview

One option which Good Energy has explored as part of the project would be to install community scale storage which individual customers could then have a virtual share in as an alternative to each home having its own battery storage. This would be a more affordable option for many customers in Fintry who might struggle with the up-front costs and is similar to the idea of community owned generation. However under the current network charging rules there are strong incentives to put storage behind the meter (as charges are only levied on the net usage) and significant operational, regulatory and commercial barriers to installing a ‘community storage’ solution.

Current regulatory position

As noted above in the discussion on network charges Ofgem is concerned about network users avoiding paying a fair share of the network costs by offsetting demand and generation. This was an explicit goal of their decision on embedded benefits and in their Targeted Charging Review they have kept on the table the option of charging non-domestic customers based on gross rather than net usage (although they have rejected that option for domestic customers on grounds of practicality).

As a result, Ofgem is justifiably suspicious of any innovation which they see as aimed simply at avoiding network charges., notwithstanding their broad support for innovative business models. The challenge for them is to not let this cloud their view of projects which do deliver other benefits and are not primarily about avoiding charges.

In addition to the issues around network charges (which affect the overall viability of virtual storage or other DERs) there is an issue around how the benefits would be apportioned. This is similar to the debates around peer to peer trading and how to credit local communities for their use of local generation discussed above. While it would be possible to provide some credit for the services provided by virtual storage this would currently have to be outside the overall settlement and billing process.

Issues for local energy

The idea of community level DERs being "shared" by the community is one of the common features that is central to many local energy schemes. However in GB there is no specific category of such resources and no benefit from communities taking forward such initiatives as against commercial projects. This is notwithstanding the wider benefits from local energy projects in terms of engagement, local regeneration and widening participation (to help overcome the distributional and equity concerns that is a major issue with current schemes). Community involvement can also help in overcoming planning concerns.

In terms of storage specifically the interest globally has been in aggregating domestic level installations into a virtual power plant to provide additional benefit to households through participation in ancillary markets (managed by the battery provider). The community level storage concept being considered for Fintry was driven in addition by consideration of economies of scale and widening participation.

Such concepts do exist elsewhere. For example in the US, programmes are in place in 17 states to allow consumers to benefit from shared renewable energy resources. Around half of US homes are not suitable for solar PV and low-income households cannot afford the up-front costs. Being able to access the benefits through a community project widens the potential pool of those who can participate and helps address distributional concerns[37]. For example, in an affordable housing block which has solar on the roof, the individual households can access a "virtual net metering" tariff which gives them the same benefit as if they directly owned an equivalent solar facility.

The absence of clear support for such schemes in GB creates a perverse incentive for either private wire solutions to be developed (as in Gateshead) or for generation and storage to be put behind the meter even if that is not the most efficient (given economies of scale).

Evidence from Fintry

The initial analysis carried out by Good Energy highlighted that a virtual storage solution would be more cost effective than individual storage systems reflecting both the economies of scale and the diversity in load profiles. Initial discussions with Ofgem on a potential "regulatory sandbox" project were constructive.

Recommendations for regulators and policy makers

BEIS and Ofgem should review how network charging arrangements and FIT provisions could be revised to facilitate new business models around shared ownership of storage and other DERs. In particular Ofgem should ensure that there is not a perverse incentive to pursue domestic scale solutions when community scale solutions would (absent the distortions of the charging regime) be more economic and inclusive.

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[37] [37] http://www.ncsl.org/research/energy/state-policies-for-shared-renewable-energy.aspx

Recommendations for further work

There would be value in taking the virtual storage concept forward in Fintry.

6.1.5. Metering

Overview

Smarter metering is an essential element of any local energy solution that seeks to involve consumers in the way they use their energy and to enable dynamic load management.

SMETS is the UK Government's system solution for metering that allows two-way remote communication and load disconnection. Energy suppliers currently have an obligation to take all reasonable steps to install SMETS smart meters, including in-home displays, in all homes and small businesses by the end of 2020. As such the ambition for local energy projects going forwards should be to use SMETS meters wherever possible.

However this is a challenging timeline and SMETS2 meters supported by DCC are only just starting to be rolled out. As such some of the more advanced elements of the SMETS solution (variant meter types with an auxiliary load control for example) are not yet proven in the field.

SMART Fintry are using smart-type meters provided by Energy Assets. The decision to go down this path reflected the fact that when the project started the SMETS standard meters could not provide the communication coverage required in Fintry. Indeed there are still no plans for DCC coverage across the majority of postcodes in Fintry.

There are also elements of functionality which the Energy Assets meters can provide which SMETS cannot and which are seen as important to enable the more ambitious aspects of the SMART Fintry project around dynamic load control etc.

There are concerns both about whether meters already installed to support community projects will be able to remain in place and about what the right solution is for similar projects going forward. To maximise the opportunity, future projects where possible, should aim to use SMETS2 meters. However, this will require BEIS support to ensure the full range of features are available, recognising that incumbent suppliers (who dominate the industry working groups) may not wish to prioritise developments that facilitate innovative business models and that the complexity inherent in the smart metering arrangements may make it hard for non-traditional players to navigate their way through the system.

In thinking through the future options it is helpful to distinguish the billing function - which is at the heart of what utility metering has always been designed for and SMETS delivers – and the real time monitoring and control which could if necessary be delivered separately (both technically and in terms of contractual arrangements). It is also important to think about the user interface.

While the focus here has been on the consumer metering (which is where the regulatory and policy issues arise) it should be noted that the generator metering is equally important. While commercial generators will typically have real time monitoring of their assets, separate arrangements were needed to obtain 5 minute data for the solar panels on Fintry Sports Centre.

Current regulatory position

The rollout obligation – SMETS1 and SMETS2

Suppliers have an obligation to take all reasonable steps to rollout SMETS smart meters to all homes and small businesses by the end of 2020. The SMETS specification has been developed by government, working with industry, to ensure that ultimately meters are interoperable with other component parts of the smart meter installation and continue to operate on change of supplier.

The communications infrastructure is being provided by a new regulated Data and Communications Company (Smart DCC) using 2G/ 3G mobile phone solution in central and south of England (with Sub GHz mesh infill) and an Arqiva long range radio solution in Scotland and the north of England. The first tranche of meters (SMETS1) currently use whatever communications infrastructure the individual suppliers have chosen (invariably 2G/ 3G). SMETS2 meters utilising smart DCC are just beginning to be rolled out but are not expected to be installed at scale until mid-2018.

The Smart Meter project has suffered a series of setbacks and delays with DCC, originally intended to go live in 2016. As a result, although originally intended as an interim solution, as of September 2017 there were 7.67m SMETS1 meters (gas and electricity) operating in domestic properties[38] .Under the terms of their licence suppliers can continue installing SMETS1 until October 2018 (recently extended from July), and BEIS have also recently decided to provide a 3 month derogation from the SMETS1 end date for a limited volume of meters for 12 suppliers meeting certain criteria. On that basis the number of SMETS1 meters can be expected to reach around 10 million across the sector.

While SMETS1 meters currently use 2G/ 3G communications arranged by the relevant supplier, the intention is that these meters will ultimately be enrolled and adopted by the DCC which will enable them to work on change of supplier and to provide third party and DNO access. The current plan is for DCC to start enrolling SMETS1 meters from late in 2018.

Achieving the 2020 end date is known to be challenging and suppliers have made this clear in the plans that they have to submit to Ofgem on an annual basis. Government has always been clear that consumers should have a choice about whether or not they want a smart meter. However it is for Ofgem to determine whether or not the all reasonable steps test has been met, which Ofgem have said they will determine taking account of factors such as how much effort suppliers put into engaging with customers and trying to encourage take-up as well as resolving technical issues[39].

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[38] https://www.gov.uk/government/statistics/statistical-release-and-data-smart-meters-great-britain-quarter-3-2017

The figure includes small supplier data upto end 2016 only.

[39] https://www.ofgem.gov.uk/system/files/docs/2016/11/open_letter_on_suppliers_smart_meter_roll-out_planning.pdf

There is also a "new and replacement" obligation which means that from a designated date (which has not yet been confirmed) suppliers cannot replace a SMETS meter with a non SMETS meter other than in exceptional circumstances.

Communications Infrastructure

Smart DCC has targets (set out in its licence) for the level of WAN (wide area network) coverage it provides with its communications infrastructure. The target for the North region (including Scotland) is 99.5% coverage by the end of 2020 (currently around 98%). This relates to the level of coverage from DCC to the communications hub in the home.

There are in addition challenges with the reliable operation of communications infrastructure in the home. The basic HAN (home area network) standard that has been chosen by government is ZigBee operating at 2.4GHz. The HAN links the communications hub to the smart meter and to other devices including the mandated In Home Display (IHD) and the optional Consumer Access Device (CAD) discussed further below.

The challenges and limitations of point to point ZigBee operating at 2.4 GHz have been substantiated where operation of the HAN is in properties such as high-rise buildings or where the meter is remote from the property itself. To help with this a dual band comms hub which also operates at 868MHz is being developed and DCC plans for these to be available by September 2018. The 868MHz channels operate at lower data rates and should have better building penetration. Industry are also now working to develop an Alternative-HAN solution for situations where neither 868 MHz or 2.4 GHz radio is capable of point to point communication, in particular for multiple occupancy buildings where the utility meters are often located outside of the individual flats in communal spaces or basement areas. Currently around 30% of properties require dual band comms hub or Alternative HAN to provide reliable communication between the meters, IHD and Communication Hub.

Supporting demand side response

The vision for the smart metering programme includes the ability for SMETS meters to be used to support demand side response[40]. This is envisaged as being through a number of possible routes either by sending price signals to smart appliances or through direct load control which could in turn be provided:

- Using an auxiliary load control switch within the meter (ie an on/off switch for particular circuits), similar to that used currently for dynamic Radio Teleswitch meters for example. This requires an additional SMETS meter variant to be developed and tested and such meters are not yet generally available. There are also issues around who could issue load control instructions to such meters. For security reasons and to avoid conflicting signals being sent, the decision has been taken that only suppliers should be able to issue load control commands. This limits the value of such functionality for network

40 40 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/579774/291116_-_Smart_meters__Demand_Side_Response_leaflet_-_DR_-_FINAL.PDF

operators (or others) unless and until processes are in place for real time messages to be passed through the supplier, or an alternative solution is found;

- Or using messages sent over the HAN to a separate load control switch (a HAN Controlled Auxiliary Load Control Switch - HCALCS). This would allow the load control switch to be installed subsequently (so avoids the problem of the need for a meter variant) but still has constraints on who can send such signals..

A key point is that all these solutions are dependent on having SMETS2 meters (or SMETS1 meters enrolled into DCC). Given this, none of these models have yet been tested in practice and the equipment required is not yet commercially available – but BEIS remain confident that it will be.

There is also a need for cost effective real time communication. Currently, suppliers are typically collecting data on a lagged basis (eg collecting the half-hourly profile the next day) which is inadequate for dynamic load control. However the DCC service specification[41] sets a 30 second target response time for profile data so there should not be a barrier to collecting this data closer to real time. In procuring DCC services the UK government included the need to be able to scale to provide more frequent meter reads and load control messages but suppliers generally are not yet looking to do this via DCC. The costs of DCC are currently recovered through fixed per meter charges[42], reflecting the fact that the service related costs currently account for a very small proportion of DCC's total costs and fixed costs are simpler to manage. As such there would currently not be a cost barrier to a supplier wanting to obtain more frequent readings.

A related issue is the ability of third parties to access this information. Again, BEIS's vision is that third parties should be able to access the half hourly consumption data via DCC or more granular (near real time every 10 seconds) electricity data using a Consumer Access Device ("home hub") connected to the meter via the HAN, to collect the data, and then send it via an alternative Wide Area Network (WAN) such as the customer's broadband and the web to whatever service the customer chooses[43]. By linking the CAD to a home automation system separate from the smart metering system there are further options for utilising load control without the constraints, but also robustness, of doing this through the smart metering system. Home automation systems are in their infancy and currently there are a number of competing standards but this market can be expected to develop over time.

The process for connecting a CAD to the HAN will involve the DCC, meaning any service provider has to be a party to the Smart Energy Code and go through significant testing. BEIS assume that CAD support providers will emerge offering services to organisations wanting to install CADs but who are not DCC users themselves (and some of the companies supporting small suppliers currently could play that role). Suppliers also have an obligation to pair devices where requested to do so (which also applies to SMETS1 meters) but again it is not yet clear

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https://smartenergycodecompany.co.uk/the-smart-energy-code-2/

42 Ref DCC Indicative Charging Statement

43 43 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/591322/09022017_-_Smart_Meters__Data__Growth_DR_-_updated.pdf

how that arrangement would work and there are some concerns about suppliers being obstructive where third party CADs are concerned.

In addition to the DCC route, the original intention was to allow “local pairing” of CADs – in the same way devices can be associated together with Bluetooth for example. However in Feb 2017 BEIS decided, following consultation, against offering that option because of potential privacy concerns resulting from unauthorised access and the added complexity involved. Although there are other options[44] this limits the opportunity to use SMETS meters in areas where there is no DCC coverage where with local pairing alternative communications could have been used. BEIS say they are confident that remote pairing can provide an acceptable consumer experience but have committed to keep it under review.

User interfaces

The SMETS model is based around use of a standard in-home display (IHD) providing the household with real time feedback on their energy use and cost in pounds and pence. BEIS have however allowed derogations for suppliers wishing to test other interfaces (apps etc) to understand what is most effective in prompting behaviour change. The media communications around smart metering (co-ordinated centrally by Smart Energy GB) focuses on the IHD as the visible element of the smart meter.

Industry governance

The detailed arrangements around the meter specification, testing, message structures and standards are set out the Smart Energy Code (SEC) and subsidiary documents. The Smart Energy Code (SEC) is a multi-Party agreement 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. The original version was developed by BEIS working with industry but SEC parties can now bring forward modifications themselves.

The SEC runs to over 2000 pages with 37 Appendices.

The CMA in its review of the energy retail market identified the complexity of codes and code governance as a barrier to entry for new suppliers and to the development of new business models. Ofgem have recognised this for some time and have in place a Code Administrators Code of Practice (CACOP) which sets out the role of code administrators in supporting smaller players and consumer groups through the process. In Ofgem’s latest survey for CACOP the SEC came out as the code where there was the highest level of net dis-satisfaction[45].

6.1.6. Issues for local energy

[44] Using a handheld terminal (a process that is still under development)

[45] https://www.ofgem.gov.uk/system/files/docs/2017/04/code_administrators_survey_report.pdf

Communications infrastructure

A number of local energy pilot projects have taken place in rural areas where mobile coverage is poor and hence SMETS1 solutions which rely on GSM are not always practical and even DCC with its wider coverage may not reach. Outside rural areas the focus has been more on social housing where the HAN coverage issues involved with high rise buildings can create additional challenges.

As such, a number of community energy projects to date (including Fintry) have had no option but to utilise alternative smart metering solutions. While this issue ultimately should be addressed for most (though not necessarily all) future projects it does mean that existing projects that have had to utilise alternative smart meter solutions, face a risk of asset stranding as discussed below.

While it could be argued that the projects should have borne these risks in mind when deciding to proceed, the opportunity to learn from such projects has wider benefits to the energy system and it would have been wrong to expect them to hold off until a fully functional SMETS solution was available.

Functionality needed to support DSR

The ability to utilise demand side response is a key feature of local energy projects aiming to match local supply and generation. As discussed above, the BEIS vision is that SMETS2 meters should ultimately facilitate DSR. However, in practice, the equipment needed is not yet available in the field (reflecting the delays to SMETS2) and moreover there are elements of functionality that are in principle needed to support a local energy project but that are not included in the SMETS specification, in particular voltage control. This has been another factor driving projects to use alternative metering solutions.

Once the communications infrastructure is in place and SMETS2 meters are being rolled out at scale it will be harder to justify the use of alternative metering solutions and hence there is a need to consider carefully how far this functionality is critical, and whether SMETS meters could be adapted to provide it.

The critical elements of functionality are summarised in the table below:

Functionality	Why needed	SMETS position	Options
Real time monitoring	Attempting to match local supply and demand in real time requires visibility in real time of demands on the system.	Intention is that CADs will enable this sort of real time monitoring. The alternative would be more frequent polling by DCC but the system has not necessarily been designed for that model.	Utilise CAD when available
Real time load control	Attempting to match local supply and demand in real time requires the ability in real time to send load control signals	Not currently available. Intention is that load control signals can be sent but this needs a variant meter or suitable HAN enabled switch which is not yet available. Such load control signals can only be sent by the supplier.	Wait on developments or use other home automation solutions which rely on consumer broadband.
Recording consumption at a granular level	If load is to be offered as an ancillary service either to the SO or the distribution network then evidence will need to be provided on demand reductions which will need to be at a more granular level than half-hourly.	Intention is that CADs will enable this sort of granular data capture. However these rely on consumer broadband and may not be seen as sufficiently robust / reliable by the SO / network company (i.e. such measurements would not meet normal metrology standards).	Needs discussion with SO and with DSOs in future.
Voltage monitoring	Near real time voltage monitoring allows voltage control to be sold as an ancillary service to the network operator or for reactive power management.	Not currently available and no plans to provide – although there is the potential for alerts to be sent if voltage drops below a predefined level this would be configured by the DNO and would not provide the real time monitoring required.	Would need additional equipment to be installed where there are loads that could potentially provide frequency response services (or eg at substation level in the network).

Thus while the SMETS system is intended to support DSR the full functionality is not yet available in the field and, more fundamentally it is not really designed to deal with local energy markets where there is a need for much more active, real time, two way flows of data to balance load. Rather the underlying model is one of centralised control (either through tariffs or load control signals) responding to occasional system constraints.

If electric heating loads are to be used as a source of flexibility then the ability also to monitor temperature is important to enable thermal comfort to be maintained as highlighted in the Heriot

Watt University analysis. The Energy Assets solution allowed temperature to be fed back through the same system but clearly other routes would also be possible.

Use of consumer broadband

As highlighted above, the expectation of BEIS is that access to more granular data or more sophisticated forms of load management would rely on access via a CAD and the consumer's home broadband (Wi-Fi). For community energy projects this is viewed as potentially problematic for a number of reasons:

- There still is not universal broadband access. Ofcom data[46] shows that in 2017 88% of households had access to the internet in their home (including smartphones). The proportion with a fixed broadband link will be lower than this. Those without broadband access are more likely to be on low incomes or elderly. Given that many local energy projects have specific social goals it is important that solutions can be universally applicable which relying on consumer broadband currently is not.
- Consumer broadband may not be constantly reliable which it needs to be if it is to be used as the basis for commercial contracts (for e.g. ancillary services). There are still sections of subscribers who switch off their broadband when not in use or overnight. The connectivity can be lost if the owner changes the router therefore possibly resulting in a different SSID and password. Reliance on a CAD means there will be an additional device that consumers may decide to unplug, either to use the socket for something else or to save energy.

That said, this is probably becoming less of an issue over time. Moreover for services being provided through an aggregator or similar arrangement there will be a portfolio benefit (with a number of consumers together providing the ancillary service) so the occasional loss of connectivity from an individual customer does not matter so much. In any event the meter record will still be available which ensures accurate billing.

In discussion with BEIS their assumption seems to be that customers signing up to more sophisticated services would ensure that their broadband was available. However for local energy projects with broader social goals and aiming for inclusivity, the availability of Wi-Fi cannot be relied on. There is also a risk of customers playing the system which means for commercial services it is important that the customer cannot disconnect the means for a counter-party to collect the data (albeit that meter data would always still be available).

One option that has been considered in some projects (such as Access Mull) has been to provide a community broadband service (or to pay for installation of a home broadband). This clearly adds to costs but would provide wider benefits and ensure that all members of the community can participate.

[46] [46] https://www.ofcom.org.uk/__data/assets/pdf_file/0021/105438/uk-internet-online.pdf

Prepayment and Fuel Poverty

The alternative advanced meters that have been used in some local energy projects to date do not have prepayment functionality. The ability to switch readily between prepay and standard mode is a feature of SMETS meters and suppliers have an obligation to offer prepayment on request if they have over 50k customers and in particular in advance of disconnecting a customer for debt. The lack of prepay functionality to date has meant that local energy projects cannot so readily be rolled out to more disadvantaged communities.

To address this thought has been given to how some form of prepay functionality could be provided for example using a tailored app. Such smart prepay solutions have the potential to offer some consumer benefits over standard prepay but it will be important that innovative solutions in this space are not precluded by specific regulations based around a particular model of prepay.

User interfaces

The standard IHD focuses on the consumption by the consumer themselves. For local energy projects there is also a need to help the consumer understand their consumption within the context of the community generation. This is probably best achieved through a web interface which can bring together information from different sources. Clearly this also relies on some level of internet access but it is not a time critical service in the way that load control is, and it could be provided either via Wi-Fi or a smartphone.

Non-standard meter types

Across the market around 2% of customers are on non-standard energy tariffs, often making use of tele-switching to dynamically control heating loads. As noted above the expectation is that ultimately SMETS meter variants will be offered that will replace these meters. Historically these customers have been disadvantaged in the market by the limited number of competitive tariffs available and the CMA in its energy market investigation noted particular problems in this part of the market.

For local energy projects there may be a strong interest in picking up customers who buy energy against these tariffs and with this type of metering equipment, as they potentially have a significant level of controllable heating load. However the process of signing up these customers involves initially taking them on with their existing meter before changing it out. This can be problematic for suppliers.

Industry governance

In discussing some of the issues above with BEIS their response was that it was open to parties to bring forward SEC modifications to address them as necessary.

As discussed above the SEC is an extremely complex set out of arrangements and, as with all codes, governance is dominated by the traditional players. It is therefore not realistic to expect local energy projects, even with a level of industry knowledge, to be able to understand all the detail and bring forward change to support non-traditional models.

Evidence from Fintry - Communications infrastructure

At the inception of the project it was clear that an alternative communications infrastructure would be needed given the very poor and unreliable GSM coverage in the village. The Energy Assets solution was therefore chosen and based on a technical survey of the properties a meshed ZigBee solution was chosen.

Recognising the risks around stranded assets we have explored the potential for DCC coverage in the longer term. Using the postcode checker which DCC makes available to suppliers the conclusion was that in September 2017 of the 22 postcodes in Fintry, for 16 the system was showing as "not part of the current rollout plan". As such the decision to install an alternative technology is clearly a reasonable one and Ofgem should not expect suppliers to replace these meters going forwards, at least while consumers continue to benefit from the functionality provided.

That said, even using the Energy Assets technology, there have been some challenges providing connectivity across the Fintry area. The meshed ZigBee technology relies on the signal "hopping" between nodes and hence is dependent on having a certain density of customers on the network. To compensate for the lower density it was planned to install street level routers. In the event, the proportion of Fintry customers signing up was lower than original estimates and the option of using street level repeaters was explored but resisted by residents, which caused problems in communicating with some properties. The option of using consumer Wi-Fi was proposed but rejected. Secondly, the possibility of using LoRA (long range IoT radio) was also explored but would have needed further work. Ultimately, while the majority of customers were connected, often by using a hybrid solution or additional aerials, there remained a small number who could not be provided with service. This highlights the difficulties of providing connectivity in some remote areas and the need to use a combination of technologies.

Functionality needed for DSR

As discussed above the Energy Assets EDMI Mk7 meters were chosen for Fintry because SMETS coverage was not available at the time and because they provided the functionality needed for DSR as set out in the table above. The Mk7 is a single phase MID (Measuring Instruments Directive) and Elexon approved, Time of Use domestic revenue meter. The base meter supports the measurement of a wide range of metrological functions and electrical parameters. These can be read by a physical communication port, securely located, under the terminal cover. The same port also provides safe isolated low voltage DC. An intelligent ZigBee module is retrofitted to the meter and connects to the port. This allows real time reading of energy, power, voltage, current and harmonics. Communication is via the ZigBee mesh. Where load control of heating and water loads is required, a discrete ZigBee switch incorporating two 100A contactors is fitted before the consumer unit and is able to switch the whole of a heating circuit. The meter and switch both share the same mesh network and are powered before the consumer unit so there is no risk of the householder disconnecting the devices. Because standard ZigBee is used it is possible to add more downstream control devices that can also share the same mesh network. The metering and control of heat pumps to include in the DSR portfolio was investigated using such a solution.

User interfaces

The Energy Assets meter does not support an IHD but display data can in principle be delivered to a smart phone via a web site. Web related information delivery has the potential to provide a richer set of data and at the same time share community information such as level of local generation and the best time to use the locally generated energy – although as acknowledged above it is dependent on some form of internet access.

A portal was developed for Fintry by Heriot-Watt which showed graphically (with a galloping stag) the level of local renewable generation available, including forecasts for the day ahead. This was made accessible to the community at the Fintry sports centre and was intended to help the community in thinking about their energy use.

Another portal was developed by Energy Assets which provided graphical information on an individual household's use but on a historical basis.

For this stage of the project households were not provided with any real time feedback on their usage reflecting the fact that the aim of the project was to explore opportunities for automated control rather than behaviour change. However it was clear from the consumer engagement conducted in Fintry that many households had been anticipating they would get an IHD (based on the wider smart metering programme communications) and also that they would have felt that this would have given them something useful.

While it may be that alternative interfaces to an IHD would better meet the needs of local communities there is a need for some form of user interface providing real time feedback, even where alternative smart meter solutions are used. This should be explored in Fintry going forward.

Non-standard meter types

There are around 550k Dynamic Tele-Switched meters in UK (roughly 2%) but they are more prevalent in Scotland. There are challenges with them as the radio tele-switch signal is due to be switched off in 2020. The Energy Assets meters and switches provide real time equivalent functionality in terms of load control but do not currently provide for the DNO to exercise that control as they would in principle with DTS.

Within Fintry a number of customers were picked up who had Total Heating with Total Control meters, which is a particular form of DTS. Good Energy experienced some difficulty with billing these customers and noted that a number of different sorts of meters were used for THTC which meant there was no single solution. While Good Energy were able to take on these customers they did not necessarily have a suitable tariff for them (before migrating them onto the new meter and tariff) which meant they could end up paying more in the interim. Where previously suppliers might have declined to take on such customers, new Ofgem guidelines aimed at promoting competition mean that they have to do so. However the technical challenges mean that customers may still get a poor customer experience.

Recommendations for regulators and policy makers

Ofgem should make clear that it will not expect alternative smart meter solutions used as part of a local energy project to be replaced within the context of the "all reasonable steps obligation" where there was no viable alternative at the time of installation and community benefits are still being delivered. This is important to avoid creating unnecessary uncertainty and risk in the funding of assets associated with community energy projects.

DCC should look to learn from the experience with different communications technologies in Fintry as it looks to extend coverage in remote areas. In particular the potential of LoRA and other IoT technologies should be understood.

Scottish government may wish to monitor the actual level of coverage provided by DCC in Scotland.

BEIS and Ofgem should ensure that pressure is maintained to deliver the functionality to support CADs and load control, recognising that incumbent suppliers (who tend to dominate industry working groups) may not want this to be prioritised where it supports innovative business models. Ofgem should ensure suppliers are complying with licence obligation to support CAD installation.

BEIS should keep the consumer experience of DCC CAD pairing under review and consider further how local pairing could help deal with gaps in DCC coverage.

BEIS (working with DDCMS) should explore the consumer issues associated with relying on of consumer broadband to deliver some of the important benefits of the smart meter rollout, in particular to ensure that all customers are able to benefit.

BEIS should consider alternative use cases to ensure that the SMETS specification keeps up with evolving thinking on energy system developments. In particular BEIS should test some of the ideas for local energy markets reflected in its Smart Flexible Energy System work, together with evidence from SMART Fintry, against the SMETS specification.

Ofgem should work with the SO (and DSOs going forwards) to ensure that domestic customers are not precluded from participating in the provision of ancillary services by concerns about the robustness of granular data provided as a supplement to the half hourly usage data which is subject to strict metrology standards.

Ofgem should be open to the provision of prepayment functionality through non-standard models where this would enable such customers to participate in local energy projects using alternative smart metering technology.

Recommendations for further work

It would be useful to test the potential value of LoRA and IoT technology to extend WAN coverage in rural areas. This could be linked with street lighting and the proposals for co-ordinated street lighting upgrades across Scotland.

It would be useful to test the ability to link the current meters with real time switches that could be used to control EVs or other distributed energy resources.

It would be useful to explore the impact of different consumer interfaces providing real time feedback to households within a community context.

6.1.7. Other issues – Innovation Support

Overview

The Fintry project has appreciated the strong interest and support that has been provided by Ofgem as part of its commitment to facilitating innovative business models. In particular the regulatory sandbox mechanism is clearly a valuable construct. The approach taken to sandbox applications is not overly bureaucratic and the latest proposal for a sandbox in Elexon will be a further positive step.

The Fintry project is also grateful to the Scottish Government for the funding support it has received and the interest taken in this project as a model for local energy.

One issue that has arisen however has been the treatment of intellectual property. Quite reasonably any IP developed as a result of government funding becomes crown property. The problem arises where it is not possible to disentangle the new IP from existing or background IP, which can be a particular problem where existing IT systems are enhanced to support a particular project. This is an issue that Ofgem have had to deal with as part of their innovation funding mechanisms and there may be lessons that can be learned.

Recommendations for regulators and policy makers

Scottish government should review its treatment of IP when funding projects, drawing on experience of other innovation funding streams, to ensure that it is not imposing unnecessary barriers.

6.1.8. Other Issues - Privacy

Overview

The Fintry project has been very alive to the potential privacy concerns around smart metering and has taken the necessary steps to ensure that consumers data is protected, including developing a privacy impact assessment at the start of the project. The fact that SMETS meters are not being used means that the smart metering data access and privacy framework does not apply, although clearly the Data Protection Act does.

When signing up customers it was made clear to them that their data would be collected and shared with project partners as necessary. The fact that all customers have explicitly opted into the Fintry tariff and to having a smart-type meter means they have provided consent. However it was clear in the consumer round table that was held in year 2 that customers had often either forgotten or were unclear about the arrangements for data sharing. Given the amount of information being provided at sign-up this is perhaps not surprising but highlights the importance of clear communications on such topics. Consumers were not necessarily opposed to sharing data but once they saw the granularity of data and what it showed they were keen to understand who had access to it and to be reassured that it could not be sold on.

Recommendations for regulators and policy makers

Ofgem and BEIS should keep under review how smart meter data collected via the internet (rather than through the smart metering system) is treated from a privacy perspective to ensure consumers remain protected while not imposing undue barriers.

6.1.9. Other Issues - Community level change of supplier

Overview

The Fintry project has been working with Good Energy over the past two years. However as part of contingency planning the FDT has considered what steps would need to be taken if they needed to find a new supplier partner. Under current arrangements there would be a need to persuade each of the customers individually to switch to any new supplier which makes it potentially difficult for FDT to secure a new partner, as they cannot guarantee that all customers will switch.

As part of its work looking at alternative business models Ofgem has recognised the potential for customers to sign agency agreements with companies such as Flipper who will then switch you to a different supplier as and when better deals become available. This ability to be able to provide in effect a “power of attorney” or “assignation of rights” could be of value to local energy projects by allowing the community to deliver a (repeat) collective switch if the initial consumer contracts were structured in the right way.

This could also have helped with allowing FDT to engage with the supplier to help resolve billing and metering issues on behalf of customers although there may be other ways to deal with that if the customer consents (as happens now where someone else may deal with the account of an elderly relative for example).

Recommendations for regulators and policy makers

As part of its thinking on alternative business models and the future of retail regulation, Ofgem should consider the community energy opportunities.

7. Appendix

Appendix List

Appendix Number	Title	Author
1	SMART Fintry – Year 1 Operation Report, 7th April 2017	J Smith
2	SMART Fintry – Lesson Learned Report 27th March 2018	J Smith
3	Consumer Attitudes to Demand Side Response and Direct Load Control	M Frerk
4	Forecasting in the SMART Fintry project: Summary and Outcomes, January 2018	David Corne, Eddie Owens, Andrew Peacock, Prabhat Totoo,
5	Demand Flexibility at Fintry	A Peacock