VEITCH COOPER LIMITED

Feasibility Report on

Use of Smart Meters to Supply Local Energy in Fintry

PREPARED FOR

FINTRY DEVELOPMENT TRUST

June 2015

1. Executive Summary

Fintry Development Trust (FDT) aims to promote sustainability and improve energy efficiency in the village of Fintry, Stirlingshire. FDT have delivered a number of energy projects to support these objectives. To achieve a step-change in delivering renewable energy to an engaged community, FDT wish to source electricity from the nearby Strathendrick AD plant and supply it to residents using smart metering technology to match consumption and production. This report examines the technical and regulatory factors and the economic benefits that dictate the feasibility of this potential project.

Supplying demand from local generation is made technically possible through the use of smart meter technology. In addition, software and control systems can deliver Active Network Management to create benefits for the distribution system and avoid costly network upgrades. A number of similar projects are detailed to demonstrate that the required technology exists and has been successfully deployed.

The current structure of the electricity supply industry and the incentives it creates on participants does not naturally support a multi-stakeholder project as proposed for Fintry. However, this is starting to be recognised and a number of innovations, for example 'Licence-Lite' Suppliers, and non-traditional business models are being introduced to resolve this. In addition, network operators are now being incentivised to innovate and funding from this, and other sources, offers some useful potential benefits to pursue the project. The costs of installing smart meters and electric heating to replace oil/lpg systems is substantial. However, the benefits to residents in terms of reduced costs and improved sustainability balance these costs. Further financial support could make this a highly attractive project, delivering lessons that could be applied elsewhere. The report sets out the potential future paths to move into project implementation and concludes by detailing that this is feasible, given the right levels of support.

2. Project Background and Objectives

Background

Fintry is a village of 335 households and a population of over 700 residents located in Stirlingshire. It is in a relatively isolated rural position between the Campsie and Fintry hills, despite being only 20 miles North of Glasgow. The centre of the village runs along the Endrick Water with many outlying houses and clusters of houses.

Fintry Development Trust was set-up with the aim of making Fintry a carbon-neutral sustainable community. Fintry Development Trust (FDT) was set up in 2007 with 150 members and subsequently became the first community in the UK to enter a joint venture with a windfarm developer. FDT owns 1/15th (2.5MW) of Earlsburn Windfarm. FDT set up this project and manages the resulting income, allowing each home in Fintry to access a £500 grant to use for home energy efficiency measures.

FDT has since embarked on many projects including the installation of heat pumps, biomass boilers, and solar thermal and solar PV systems. FDT has installed a biomass district heating scheme to provide affordable renewable heat to 10% of the village. FDT have also commissioned a biomass district heating scheme for Balgair Castle Caravan Park, the first of its kind in the country, with a capital investment of £600k. Through these projects they have reduced carbon emissions, alleviated fuel poverty and provided an additional income to the local community that can be used for further environmental projects.

In support of their objectives, FDT approached Veitch Cooper in September 2014 to examine the possibility of directly connecting the village of Fintry with a nearby Anaerobic Digestion plant to provide renewable energy to residents. The 1MW AD plant, owned by Strathendrick Biogas and located 4 miles to the West of the village at Claylands Farm, takes silage from local farms and distillery waste to produce biogas for power generation (and produces fertiliser and animal bedding as by-products of the AD process). Direct connection of customers in this manner is, unfortunately, not practical but it was considered possible to develop a 'virtual connection' between the generator and local customers. Funding was sought from the Infrastructure and Innovation Fund element of CARES (Community and Renewable Energy Scheme) and was awarded to produce this high-level feasibility report.

Objectives

Fintry Development Trust itself has four key objectives, the two most relevant being summarised as:

1. to advance environmental protection, in particular through more efficient use of energy
2. to prevent and relieve poverty by providing energy conservation measures to the disadvantaged in the community

Along with their original objective of making Fintry a zero-carbon, sustainable community, the aim of this feasibility study is to support FDT by detailing the prospects for delivering low-cost, renewable energy from a local generator to residents in the village.

The proposed means to achieve this is by 'virtually' linking consumption of power in the village with production at the Strathendrick AD plant. The primary means to establish this link is through the installation and use of smart meters in the village to continuously monitor and record the electricity consumption at individual properties and to match this with production from the plant (with appropriate mechanisms to deal with any mismatches). Additional benefits, in terms of reduction of fuel poverty and a reduction in the carbon footprint of the village, can be achieved by converting properties using oil/lpg heating to using the locally produced electricity in their heating systems via storage heaters or heat pumps. This could have the unintended consequence of triggering significant costs for the Distribution Network Operator to upgrade the distribution system to accommodate such an increase in load. However, by linking control of the electric heating systems to a ‘smart grid’ system, these costs and, potentially, costs associated with upgrading the network to accommodate increased capacity at Strathendrick AD plant, may be avoidable.

This feasibility study will examine the technical, regulatory and financial aspects dictating how the proposed scheme could work and any barriers that they pose before detailing a road-map to progress the project in future.

3. Technical Issues

The technical solution to deliver energy from the Strathendrick AD plant to customers in Fintry consists of two elements; smart meters installed at properties in the village and an Active Network Management (ANM) system interfacing with the DNO. Both of these elements are existing technology, deployed in other locations and projects and no technical barriers have been identified to prevent them from being deployed in this instance. The following sections describe the operation of these technologies individually, their associated benefits and their use in similar projects.

Smart Meters

Conventional electricity meters, either analogue or digital, simply record aggregate consumption over time, providing no information on level or timing of use between manual readings. Smart meters, in contrast, retain a digital record of minute-by-minute consumption that can be retrieved remotely by a supplier. This time-series data provides the supplier with additional information to analyse their customer’s demand and to charge appropriately with time-of-use tariffs, while remote reading removes the expense of physically reading the meter. In addition, the smart meter can drive and in-house display of current and recorded consumption providing customers with information that they can use to monitor and reduce their energy usage. Trials have demonstrated that consumers can save between 5-15% of their energy consumption through having access to this information alone (£25-75 annual saving on an average bill).

In addition to this information storage and communication function, however, smart meters exist with additional functionality that can provide control over individual consuming appliances in the home. Commercial products, such as Google’s Nest thermostat and British Gas’ Hive, exist that provide a degree of intelligence and remote operation (via the internet) to the control of domestic heating. Costing £2-250, these products can provide savings of up to £150 paying back the initial investment within two years. However, these products are not integrated with the electricity (or gas) meter and so do not provide access to time-of-use energy pricing to increase financial savings beyond those obtained from reducing consumption.

Energy prices in the wholesale market can vary enormously depending on the time of delivery, with times of low demand and surplus generation, such as overnight or over weekends, significantly lower than peak demand periods or times when there is a low margin of generation. In addition, charges for taking supply from the distribution system follow a similar pattern, with peak consumption periods attracting higher charges relative to overnights by a factor of two. Historically, electric storage heating, metered separately and controlled by radio-teleswitching (off-peak, white meter or ‘total control’ tariffs) allowed consumers to obtain the benefits of these lower prices by charging storage heaters overnight. This service will end, however, in 2016 when the current BBC charter runs out as the BBC operates the transmitters providing the switching signals.

The government, via Ofgem, have mandated a programme of smart meter installation by energy suppliers with a target to have one in every domestic property by 2020. The smart meter equipment specified will provide for in-house displays and remote meter reading. It does not, however, have the full control functionality and access to dynamic pricing that delivers the full benefits available to customers. Smart meters that do possess this functionality are available and are increasingly installed in commercial premises, where businesses can take advantage of the energy and financial savings available. As technology and large-scale manufacture advance, these meters are falling in price to a level that would make them attractive for householders. A digital smart meter with control over up to 9 different circuits now costs around £500, achieving payback in just over four years based on the same value of energy saving as commercial intelligent thermostats.

It is in combination with control over significant loads that offer flexibility in their time of operation, such as heating, where smart meters can deliver their largest benefits, as detailed in the next section.

Active Network Management

The various components that make up the power distribution network, such as overhead lines, transformers and switchgear, have technical limits in terms of thermal capacity or fault levels that dictate how much consumption or generation can be delivered through them. Where an increase in load or generation on a part of the network occurs that would exceed one of these limits, the network requires reinforcement with additional equipment or elements with a higher capacity for delivering power. The capital investment for this network reinforcement is often substantial and is either charged directly to the network customer that triggers it (usually new distribution connected generation) or, where it is triggered by a gradual increase in power demand in an area, to all distribution customers and recovered through use of system charges. As a local example, an application to increase export from Strathendrick AD plant to 1.2MW was quoted a charge for network reinforcement of £450k. As a result, capacity at the AD plant was limited to 1MW export, a level below that required to trigger significant network reinforcement costs.

Active Network Management seeks to utilise monitoring, communication and control equipment within a network such that the need for expensive network reinforcement is removed. Using Strathendrick as an example, if 200kW of additional demand was placed within the distribution network to match the additional 0.2MW of desired export from the plant, net flows of power out of the local distribution system through the constrained distribution equipment would not change and no reinforcement would be required. It is critical, however, that this 200kW of additional load is consuming at all times while the generating plant is exporting at full capacity (and vice versa) otherwise the technical limit on the distribution system will be violated with potentially severe consequences (local black-out, equipment failure). This is the role of the ANM system, to monitor and control both the output of the generator and consumption of the load such that they match at all times and maintain the integrity and stability of the network.

ANM software, combined with appropriate control equipment on generation plant and on flexible demand (such as heating) is the key element for delivering ‘smart grids’. Smart grids are expected, in future, to deliver significant benefits in terms of allowing increased levels of renewable generation to connect to the grid, integrating large scale energy storage, improving grid stability, reducing outages and losses. A number of projects are in operation already or are being installed in SSE’s distribution network to demonstrate and gain experience with this technology and these are outlined in the following section.

Example Smart Grid Projects

Shetland is the only part of the British Isles that is not connected to the national transmission system. With the bulk of power produced by ageing diesel generation at Lerwick and Sullom Voe, Shetland presents some challenges in maintaining a secure, reliable supply of power for the islanders, particularly with a drive to reduce carbon emissions and improve sustainability. (There is no gas supply on the islands). The Northern Isles New Energy Solutions (NINES) project uses smart grid technology to integrate new renewable generation with controllable space and hot-water heating demand in 234 homes, a 4MW thermal store for a district heating scheme and a 1MW electric battery. The project objective is to deliver improved system security and affordable energy for residents in the Shetland Islands.

The use of active network management to facilitate increased connection of renewable generation capacity was pioneered on Orkney with the Orkney Smart Grid project. The Orkney Islands have a significantly larger wind resource than there is local demand to make use of the power during periods of peak production, even with 50MW of export capacity through submarine connections to the Scottish Mainland. In addition, generation on the individual islands can be limited by the capacity of the submarine cables linking them together in the network. Installation of the Smart grid has allowed an additional 20MW of renewable generation to be connected on the islands above what would be permitted in a conventional system. Implementing the grid has cost £500k but it is estimated that the cost of conventional upgrades to the grid would have cost £30m with considerably longer timescales and greater environmental impact (for cable laying and line upgrades).

SSE and Mull and Iona Community Trust are partnering on the ACCESS (Assisting Communities to Connect to Electric Sustainable Sources) project which received Local Energy Challenge Fund funding. This project is attempting to deliver many of the same benefits as are sought in Fintry, matching local energy demand with local renewable generation. ACCESS involves an ANM system taking control over new electrical heating in 100 households and matching it with the output of a 400kW hydro generator to avoid breaking a 50kW network constraint. Participating homes receive a £200 incentive fee for taking part and enter into a direct commercial arrangement with the generator. ACCESS aims to demonstrate the technical feasibility of the ANM in practice and point the way towards commercial arrangements that would support wider deployment of this system.

The ARC project (Accelerating Renewable Connections) is a partnership between ScottishPower, Heriot Watt University and Smarter Grid Solutions. The project aims to use smart grid technologies in East Lothian and the Borders to support the connection of new renewable generating capacity by linking it with local demand. ARC also examines ways that local communities can increase their use of electricity to enable even greater access to the grid for renewable generators.

These projects all demonstrate that the required technical solution for matching generation and demand at Fintry exists and is being implemented in real network situations. Remaining challenges to deployment of smart meters and ANM in Fintry centre on the regulatory structure in place in the energy industry and the commercial viability of a scheme without additional funding.

4. Regulatory Issues

Industry Background

Since privatisation in 1990, the key elements of delivering electric power to consumers have been split between different companies to improve competition and efficiency. These elements are generation, transmission and distribution and sales to end-users and each company involved in these activities, above a certain scale, holds a licence to operate from Ofgem (the energy regulator).

The generation market for the production of electricity is fully competitive, although there are now a variety of payment mechanisms for generators to receive income for their production and capacity. These include: Feed-in-tariffs and Renewable Obligation Certificates (FiTs and ROCs) for renewable energy; income from bilateral contracts and the balancing mechanism for energy; payments from the capacity mechanism for the ability to provide firm generation on instruction; contracts from National Grid for the provision of other services such as reserve, reactive power and black-start capability.

National Grid operates the high voltage (>275kV in England, >132kV in Scotland) network for the delivery of bulk electric power and owns the assets in England and Wales (SSE and ScottishPower are the asset owners in their licenced territories in Scotland). This system was designed to transport power from large generators and feed it to the lower voltage distribution systems for onward delivery to final consumers. All consumers and generators pay transmission use of system charges to cover the cost of this network and these charges provide a strong locational signal to locate generation close to demand in the South of England (and vice versa for demand). These charges are regulated by Ofgem as transmission is a natural monopoly with limited scope for competition.

The distribution network operators (DNO) own and operate, again under licence and regulated pricing mechanisms governed by Ofgem, the lower voltage distribution networks in their franchise territories. These distribution networks were again originally designed to transport power in one direction, taking it from the grid supply points connected to the transmission network and shipping it through progressively lower voltage lines to final consumers. Again, consumers and generators connected to this system pay connection and use of system charges to cover the costs of construction and operation of this system.

Licenced suppliers undertake the business of purchasing energy on the wholesale market or under contract and selling it to final consumers, with the associated tasks of customer service, obtaining meter readings, financial settlement and billing. All consumers are free to contract with any supplier, although special protections exist for domestic consumers, ensuring that they are offered tariffs fairly and that they are free to switch suppliers within a month (although the process of registering with a new supplier can take longer).

This market structure, together with its associated licence obligations and charging mechanisms, provides incentives on the participants to operate in certain ways and, sometimes, disincentives to operate outwith their normal scope of business activity. On occasion, there can be specific prohibitions within licences that completely prevent businesses from operating in certain ways, for example DNOs cannot discriminate in their terms of business to favour particular generators or suppliers. The following sections detail the impact of these licence obligations and incentives on the proposed activities at Fintry.

Supply Licences

All businesses engaged in the sale or supply of electricity to final customers require a supply licence. Supply licences are 450+ page documents imposing a number of obligations on suppliers, to ensure solvency, non-discrimination against customers and compliance with market and industry operating codes and procedures. It is unlikely that Fintry Development Trust, or a subsidiary operating company, would find it profitable or attractive to seek a full supply licence in order to offer a smart meter tariff to the households in the village. In order to make these electricity sales, FDT would require to engage a licenced supplier to make the sales on their behalf or to operate a 'Licence-Lite' as explained below.

It is possible to be exempt from the requirement to hold a supply licence provided that all electricity sold is generated by the supplier and no more than 5MW of peak demand (with a maximum of 2.5MW demand from domestic properties) is supplied. As FDT is not generating the power itself (and Strathendrick AD plant is unlikely to wish to become the supplier) this route is not open to it. In any case, peak demand in the village currently is estimated to be close to the 2.5MW limit, and a high uptake of the tariff or conversion of a significant proportion of fossil-fuel heating systems to electric, might exceed this exemption.

Licence-Lite is a new arrangement introduced by Ofgem to facilitate the entry of new supply companies to the market. A licence-lite supplier must still comply with all the conditions of a supply licence, however it is able to contract out the compliance of the most onerous industry code obligations (listed under Supply Licence Condition 11.2) to a third-party fully licenced supplier. However, licence-lite suppliers must still apply for and obtain a full supply licence before entering into this arrangement and, for this reason, it is again unlikely that FDT would seek, at least initially to go down this route to offer a tariff to residents.

One of the original intentions of opening up the retail market for suppliers was to stimulate competition and innovation in tariffs to meet the needs of differing customers. Unfortunately, as the industry consolidated into six major suppliers, competition was felt to be lacking and the variety of tariffs on offer was considered to have become a mechanism to discriminate between customers (particularly between incumbent customers and those more willing to switch). As a result of an inquiry into the workings of the retail market in 2008, Ofgem published its Retail Market Review (RMR) in 2013 in an attempt to protect customers and produce the perception of a fairer market.#

The key result of this RMR, as regards supply activity in Fintry, is the requirement for suppliers to offer no more than four standard tariffs for electricity and to make these available nationally. As the intention in Fintry is to provide local energy to local consumers, this requirement would prohibit the offering of a Fintry-only tariff. However, since RMR, Ofgem have recognised some of the unintended consequences of the four-tariff rule, in restricting innovative local tariffs and collective switching schemes, and have relaxed this requirement to allow different tariffs to be offered in defined geographical areas (provided all customers in the area can access them). This effectively removes the barrier represented by the four-tariff rule to offering a local energy tariff to Fintry residents.

Unfortunately, the requirement to permit domestic customers to switch suppliers does still prohibit supply businesses from 'locking in' these customers to long-term contracts. This makes it difficult for a supplier to take the risk of incurring significant fixed costs, such as those for installing smart meters or network management software, with no guarantee it will be able to recover those costs over an extended period of time from customers who initially signed up. In addition, this would also make it difficult for a supply business to sign a long-term purchase contract for all energy produced by Strathendrick AD plant with no guaranteed customers for this power. In practice, consumers are likely to wish to remain on a tariff for local energy that offers a clear discount, and other benefits, compared to other available tariffs but as this cannot be guaranteed (some residents could move house, for example), any supply business involved must take account of this risk. An alternative would be to seek a derogation from Ofgem to allow domestic customers in Fintry to sign up for longer term contracts. It is likely that Ofgem would seek robust proof that consumers understood what they were agreeing to in taking on a long term tariff and additional guarantees from the supplier to ensure customer protection.

DNO (SSE)

Distribution Network Operators are responsible for constructing, maintaining and operating the lower voltage distribution networks to deliver power to customers. As this is a monopoly business, the methods they use to recover their costs through charges and the overall level of those charges is heavily regulated by Ofgem. DNOs levy Distribution Use of System (DUoS) charges on both generators and consumers connected to their networks on a p/kWh basis dependent on the quantity of power used or produced by each customer. Revenue from DUoS covers the costs of maintaining and operating the network and of expanding and upgrading it to cover increases in demand from consumers. The level that DUoS is set at is regulated to allow the DNO to recover their reasonable costs and to make a regulated level of return on the capital represented by the total asset value of the network. The DNO's charging statement uses a methodology to allocate this total sum of money across charges to users connecting at different voltage levels. For domestic customers, the licenced supplier collects DUoS as part of the customer's bill and pays the DNO such that there is no direct cash flow between the domestic customer and the DNO.

For new connections or new upgrades requested by connected customers for their connection to the network, the DNO makes a connection charge. New connections covers both new generators connecting to the network and new demand in the form of new housing and commercial or industrial premises. Connection charges are also regulated, with the DNO obliged to produce a quote within a defined period of time, not to discriminate between customers and to base their quote on the actual costs, based on installing an approved design, of connection for the customer. The costs of connection, however, also includes the costs of replacing or upgrading equipment elsewhere in the network required to accommodate the increased power flows in the network from or to the new connecting customer. These costs can be substantial dependent on the equipment required and the level of energy flow expected, for example the quote of £450k for a connection to accommodate 1.2MW of generation (200kW more than was actually installed).

This framework of regulation and incentives does drive the DNOs to minimise their operating costs, in terms of manpower and materials required to maintain the network, leading to lower DUoS charges for all customers. The nature of the regulatory framework and, in particular, the obligation not to discriminate make it difficult for DNO's to strike individual or non-standard deals with customers or to clearly identify and share the benefits of doing so. This can make it difficult for the DNO to work with customers or groups of customers to introduce new, beneficial technologies such as those involved in smart grids, although they have historically been proactive in supporting demonstration projects (see earlier section). This has been recognised by Ofgem and the latest regulatory settlement (RIIO-ED1 form 2015 to 2023) has introduced a number of mechanisms designed to support the DNOs in implementing new technological solutions. These are not, however, 'business as usual' to accommodate all customers and circumstances with a clear set of rules and commercial framework for implementation. In addition, some of the potential benefits of smart grids and innovation, e.g. reduced network flows and consequential losses, cannot be recognised because the DNO itself has no financial incentive or mechanism to provide recognition and reward for them.

In previous years, Ofgem introduced a number of mechanisms, including the Low Carbon Network Fund (LCNF), Innovation Fund Incentive (IFI) and Registered Power Zones (RPZ), to assist DNOs in trialling, developing and introducing innovation into their business. These mechanisms have historically funded the Orkney Smart Grid and NINES on Shetland amongst other projects. The new regulatory framework provides three mechanisms to support innovation for DNO's going forward.

These are the Network Innovation Allowance (NIA), the Network Innovation Competition (NIC) and the Innovation Roll-out Mechanism (IRM).

The IRM is currently being consulted on but is intended to support taking the learning from previous innovation projects and integrate them into normal business practices. It is expected that this consultation will deliver its recommendations next year. The NIC is effectively an annual competition among the DNOs to bring forward to Ofgem innovation projects to receive a grant for their funding from a common pot. The NIA offers the most promising route for projects, such as that proposed for Fintry, to obtain some funding from the DNO. The NIA is an allowance (0.5-1% of DNO revenue or £1-3m per annum) that DNOs are allowed to spend (and recover from all customers via DUoS) to support innovative projects that will lead to cost reductions. Spending under the NIA must, however, meet certain requirements, for example the NIA cannot be used to fund the installation of smart meters as suppliers are obliged to undertake this anyway. Spending under the NIA does not generally need prior approval from Ofgem, but in the case of Fintry, where it involves domestic customers and, potentially, the DNO making incentive payments to customers, Ofgem approval would be required.

There are, however, some signs that the situation with DNOs looking to implement innovative solutions is improving. SSE recently opened a Pre-Qualification Questionnaire for companies that could bring forward projects to alleviate constraints in six 'Constraint Managed Zones' in its Southern Electric Power Distribution area. This tender will seek services in the areas of automatically dispatchable generation, energy storage and demand and the installation of equipment that can provide these services. Other DNOs are similarly involved in implementing innovative network solutions either by themselves or working with partners.

Non-Traditional Business Models

Ofgem have recognised that technology and consumer demands have moved on and that the current arrangements may be acting to delay or prevent the implementation of innovative means of delivering energy. Early in 2015 they set up a 'Non Traditional Business Models' (subtitled: 'Supporting Transformative Change in the Energy Market') to examine issues and prospects in this sector. The brief of this workstream is twofold. Firstly to ensure that regulation does not stand in the way of organisations who can deliver lower bills, lower environmental impact, improved reliability and safety, better quality of service, and better social outcomes versus the current market structure. Secondly, to protect the interests of existing and future electricity and gas consumers and by more fully understanding the benefits, costs and risks of any change to regulation. This process is in the relatively early stages of fact-finding and consultation. However it is indicative that there is some willingness by the regulator to consider and support customers with aims beyond a cheap and reliable delivery of commodity gas and power via networks. The following table details some of the costs and benefits Ofgem recognise that might arise from more widespread employment of non-traditional business models, many of which are applicable to the situation in Fintry.

Direct energy system benefits	Economic	• Consumer bill reductions through increased engagement and competitive pressure • Avoided/reduced network costs: losses, connection, reinforcement, transmission, distribution • System balancing cost reductions: eg if NTBMs enable greater demand management • System diversity, flexibility and reliability/resilience • Innovation effects: new products, services and processes may drive down costs and enhance consumer choice • Increased market engagement may have knock-on effects: eg, success rates for energy efficiency projects, demand reduction, behavioural change, etc
	Environmental	• Carbon impacts through both fossil fuel and demand displacement • Additional environmental impacts: eg air quality (and associated health effects), impact on natural beauty
	Social	• Increased energy 'literacy' may lead to greater support for renewables deployment and demand-side programmes • May focus particularly on vulnerable, fuel poor or 'hard to reach' energy consumers
Direct energy system costs	Economic	• Additional grid connection costs (connection and potential reinforcement) • System integration costs: eg more back-up generation required or better distribution system management (such as local balancing) • Higher coordination costs due to increase in number of market participants • Equipment costs: eg in consumer premises • Increased costs associated with managing greater system flexibility eg reliance on higher levels of intermittent and distributed generation • Potential risks to personal data, privacy, consumer protection, etc
	Environmental	• Carbon impacts • Additional environmental impacts eg air quality (and associated health effects), impact on natural beauty
	Social	• Potential marginalisation of vulnerable consumers and others not able to access new (digital) services and products
Wider indirect benefits	Economic	• New jobs and enhanced local skills • Economic development (potentially in areas with fewer opportunities) • Regeneration of local areas and enhancement of investment potential
	Environmental	• Greater understanding of low carbon energy may have knock-on effect on other behaviours: eg heating and transport choices • Community and municipal energy projects may lead to broader environmental awareness and schemes focused on the enhancement of green infrastructure and biodiversity
	Social	• May provide funds for non-energy-related projects through community funds/trusts • Wider social impacts on local communities: eg social cohesion or community development

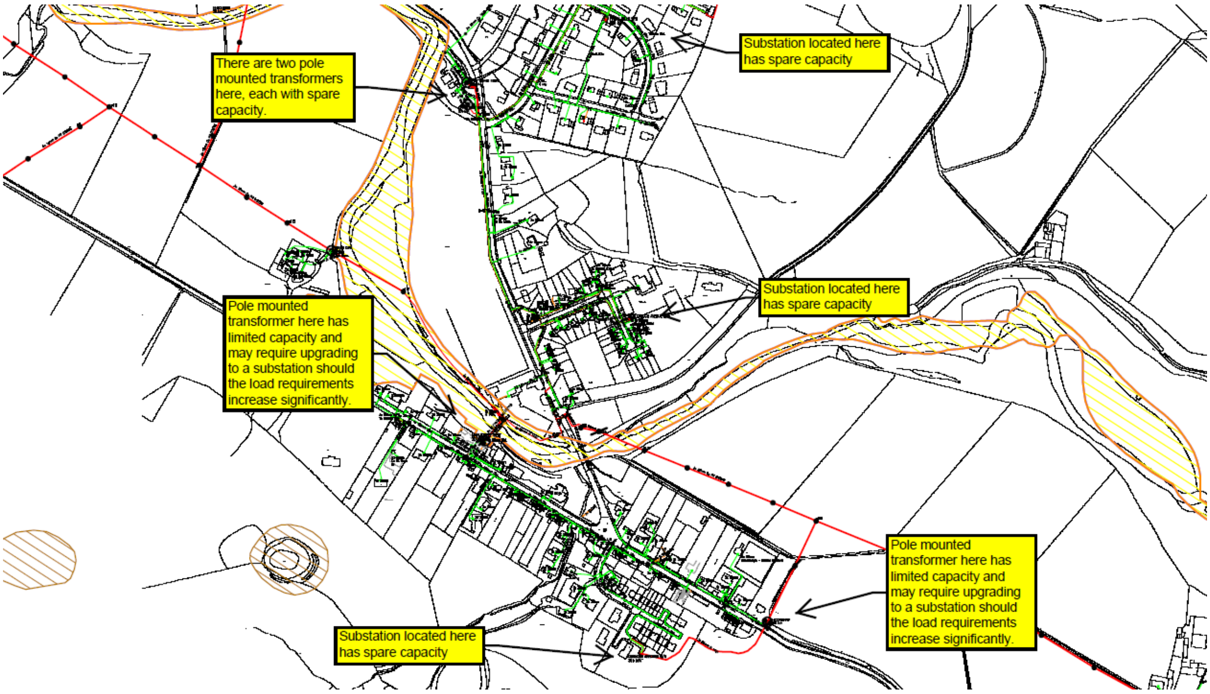
5. Financial Viability

At present, there is no firm indication of the number of households in Fintry that would be interested in signing up to the proposed local renewable energy tariff and converting to electric heating. Without this information, it is difficult to obtain firm estimates of the cost of network upgrades that would be required to support the increased heating load and that could be avoided through the use of Active Network Management software to match generation and consumption. However, most of the other costs and benefits of the scheme can be estimated to provide an indication of the financial viability of the project and the associated risks.

Installation Costs

The costs of installing individual smart meters with the required functionality is estimated at £500 per household, based on quotes from equipment manufacturers, although it is likely that a discount could be applied to this figure for purchasing in bulk and installing as part of a programme. Similarly, air source heat pump installation costs are estimated at £6000 per household but this could again be reduced for mass installation. Total installation costs for the entire village (excluding properties with heat pumps installed at present) would reach £170k for the meters and £1.75m for heat pumps. However, this installation cost would be offset by an estimated £4675 of Renewable Heat Incentive income per household paid over seven years for a total net installation cost of £552k (assuming RHI income is retained by FDT to cover the installation cost).

In addition, the cost of the ANM software, based on SSE estimates from their network innovation publications, would be expected to cost around £150k. The following diagram displays an assessment of the distribution network in Fintry provided by SSE providing an indication of capacity of key pieces of equipment to accommodate an increase in load from conversion to heat pumps.



As shown, there are two pole-mounted transformers that would need to be upgraded to substations, dependent on the location of the new load. This upgrading would cost an estimated £200k in total for substation equipment and civil works and it should be noted that the process to acquire land and wayleaves to site any new substations could add significant delay to the project. Strathendrick AD plant has also been quoted £450k for network reinforcement costs to provide capacity for an additional 200kW of generation export. It is expected that most, if not all, of these network reinforcement costs could be avoided, or at least deferred for some time, through the use of ANM software controlling any additional heating load and AD plant generation to avoid stress on the network.

The costs of insulation upgrades to individual homes to make them ready for heat-pumps as their source of heating is difficult to estimate as it depends on the requirement of each house, most of which will be different. It is expected that most of these costs, particularly for vulnerable customers would be met through grant and ECO funding. Where this is not the case, the householder might be expected to make a contribution to this element, potentially financing it through the Green Deal, with the knowledge that future energy cost savings will quickly pay back the investment.

Operational Costs

Operational costs of the project post-installation would be expected to be low. Ongoing supplier costs would be estimated in the range £100-150p.a. for the tariff, to cover costs such as settlement and billing, bad debt, trading and balancing actions and customer service. However, these costs, as well as annual servicing costs for heating equipment, would not be unique to the local renewable energy tariff.

Benefits

There are many intangible benefits arising from the establishment of a local renewable energy tariff for Fintry and conversion of houses to utilise electric heating. In addition to the residents knowing that they are purchasing 100% renewable energy and contributing to the sustainability of the local community and environment, it is estimated that the project could save 980 tonnes p.a. of CO_2 emissions as compared to the current situation (worth £18k at current carbon floor prices).

Installation of smart meters with their associated in-house energy use displays are estimated to save an average home up to 15% of electricity use, worth around £70 p.a. Cost savings from conversion of fossil-fuel heating to heat-pumps, along with the benefits of improved insulation (including improved comfort and health benefits) are substantial, in the range of £500-800 p.a. These savings can be secured at the top end of the range by ensuring that the household has access to time-of-day pricing, particularly for distribution use-of-system charges, and uses overnight/off-peak energy to run the heat pumps, storing energy as heat for later use.

For Strathendrick AD plant, some financial benefits would accrue from any enhancement that could be offered above the current PPA price. These benefits would be offered in return for securing a long-term energy price for the residents and for involvement in the scheme. However, a much greater benefit would arise from the ability to increase capacity by 200kW without incurring the cost of a network upgrade (quoted as £450k). While a full financial analysis of such an increase in capacity is beyond the scope of this report (and would, in any case, be the responsibility of Strathendrick to perform their own due diligence on) it is possible to estimate the additional revenue available from the output. Based on the current PPA price and the Feed-in-Tariff for large AD plant (9p/kWh) as sources of this income, it is estimated that Strathendrick could expect an additional £230k p.a. of income and the additional generation would provide a further 880 tonnes p.a. of CO_2 emissions savings (compared to grid supplied electricity).

6. Future Path

The future path of this project depends on whether FDT receive LECF funding from their recent application (expected mid-July 2015). In the event that Phase 1 funding is granted, FDT will receive £25k to cover the costs of consultants and legal advisers to engage with potential project partners and suppliers, including the DNO, and to fully plan a detailed delivery and implementation project complete with draft commercial agreements. Phase 2 funding can provide up to £6m to cover the cost of implementation, although the costs of electric heating installations, smart meters and control software would be closer to the minimum £1m award that LECF can provide.

Following on from the LECF funding programme, the Scottish Government announced in March 2015 the launch of the Low Carbon Infrastructure Transition Programme to provide a range of support mechanisms including project development, expert advice and funding (where applicable) to support the development of substantive low-carbon projects across Scotland. The principal aim of the LCITP is to contribute to the Scottish Government's long-term target of reducing greenhouse gas emissions by 42% by 2020 with a total of £33m funding from the ERDF.

The LCITP will consider support for projects in the following areas:

- Low carbon and/or renewable electricity and heat generation.
- Local energy economies.
- Heat recovery (eg district heating).
- Energy storage and distributed energy systems.
- Hydrogen.

- Demand side management and active network management.
- Innovative/ local finance solutions and investor readiness for low carbon projects.
- Energy efficiency (eg non-domestic building retrofit)
- Resource efficiency.
- Materials recycling and re-use.

It is anticipated that eligible projects will demonstrate the following benefits:

- An innovative approach to cross sector collaboration to ensure successful project delivery.
- The potential to deliver significant reductions of greenhouse gas emissions (MtCO2e) and/or energy consumption.
- The ability to attract other sources of funding that make a significant contribution towards the cost of the project.
- A positive and significant social and economic impact on Scotland.

Ideally, projects will include community involvement and/or potential for community investment, as well as the ability to demonstrate directly the added benefits that can be delivered through LCITP support. Projects can be presented at any time and the proposed project for installation of smart meters in Fintry would appear to be a very strong match for many of the criteria listed above.

In the event that LECF or LCITP funding is not awarded, FDT might have to consider taking the project forward on a purely commercial basis. The first step on this journey would be to engage with local residents to ensure that the proposed project meets their requirements and that there is sufficient interest in installing electric heating and signing up to a local renewable tariff to justify proceeding. In the event that there are enough interested residents, details of their expected increase in heating load would be taken forward to the DNO to discuss the potential costs of network upgrades and savings that can be made on these costs by making use of ANM software and smart meters to control this load. With the DNO's co-operation, the project could be taken forward under the Network Innovation Allowance, providing funding for the control software at least (but not the smart meters as these are specifically excluded from the NIA). In the event that the DNO believes there are sufficient benefits and learning opportunities in the project, it could be taken forward under the Network Innovation Competition (NIC), which can provide up to £81m in funding for innovative projects, although this would not be possible till 2016 as the 2015 competition closes in July.

While the DNO might fund the software and control systems to facilitate the project, the cost of smart meters and installation of heating systems (and upgrading their homes to a standard that supported their operation) would have to be found elsewhere. Some residents might be able to afford the upfront costs themselves on the basis that the cost would be more than offset by savings in the following years. The Renewable Heat Incentive is currently paying domestic properties 7.42p/kWh for Air-Source Heat Pumps and 19.1p/kWh for Ground Source Heat Pumps for heat supplied over a 7-year tariff period – sufficient to offset the high up-front installation costs. The upfront cost of upgrading home insulation to a suitable standard can be avoided through the Green Deal, a Government lending scheme that allows these costs to be financed with repayments attached to the household energy bill rather than directly by residents. Some of these costs may also be offset by grant aid (or interest free finance) from the Scottish Government HEEPS (Home Energy Efficiency Programme for Scotland) scheme that offers support for the installation of insulation and energy efficiency measures in domestic properties. Certain categories of customer and hard-to-treat property may also be eligible to benefit from funding under the Energy Company

Obligation (ECO) scheme in a similar manner. Finally, FDT makes available its own grants for these activities and could organise bulk purchase and installation of measures to those taking up the tariff to reduce costs.

Between 2016 and 2020 the government is requiring electricity suppliers to install smart meters in all domestic properties at their own expense. By tying up with a supplier to manage the customer service, metering and billing elements of the local renewable tariff, FDT may be able to have this installation carried out early to support the local renewable energy tariff. However, the government's requirement only covers smart meters with functionality to provide remote meter reading, data logging and in-house energy use displays. While these elements are useful, they would not provide for the automatic control and switching of electric heating to deliver network benefits and take full advantage of time-of-use pricing offered under the local renewable tariff. Engagement with smart meter technology providers would ensure that the installed equipment meets all the necessary requirements of the tariff and the residents, although any additional cost above that which suppliers would be meeting under the Government's programme would have to be recovered through the tariff.

To sum up, engagement with the residents of Fintry is the critical next step towards realising the objectives of this project. Explaining the financial and other benefits of the local energy tariff and fitting heat pumps in their homes should generate sufficient interest to begin discussions with the DNO and present potential funders with a more detailed business plan. Once the costs and benefits are fully quantified a detailed project plan for installation and implementation can be developed and executed.

7. Conclusions

This feasibility report has examined the potential to deliver locally generated renewable energy from the Strathendrick AD plant to the residents of Fintry. Feasibility has been assessed along three dimensions: technical, regulatory and financial.

On a technical front, technology exists in the form of smart meters to match the consumption of households with production from the AD plant and achieve the objective of linking local supply and demand. In addition, this technology can be coupled with new electric heating and network management systems to provide further financial and carbon savings to residents and benefits to the distribution network. These distribution network benefits will act to improve supply security and sustainability and may also allow further expansion at Strathendrick. It is encouraging that a number of projects already exist that deploy and utilise the technologies suggested to deliver the objectives for Fintry. It should be pointed out, however, that most of these projects are focussed on increasing network access for renewable generators and none can yet be described as 'business as usual' for either a supply company or the local DNO.

Historically, the regulatory framework and industry structure has not supported developments of the type proposed for Fintry. Regulations around electricity supply have been made to protect customers by limiting the number of tariffs available from suppliers and manadating that they must be widely available on a non-discriminatory basis. In addition, the requirement that suppliers cannot tie customers in to long term contracts makes it difficult to recover the cost of long term investments in metering and control equipment involved in creating a local energy tariff. On the network side, regulations on non-discriminatory treatment of customers, network reliability and the cost-reflective price control regime have, in the past, led DNOs to be very conservative, limiting the scale and scope of services that they would contract with customers. This situation is now changing, and there are indications that Ofgem will look more favourably on non-traditional business models and that network operators are seeking to be more innovative in ways to reduce their own costs and costs of connections for customers. These moves, combined with opportunities to receive payment for services offered to the network and wider power system, support the feasibility of a local-energy tariff for Fintry.

Finally, for the project to be truly feasible and deliver the potential benefits to all stakeholders, particularly customers, it must be financially viable. As detailed there are a number of sources of grant and capital funding that could assist the establishment the proposed local energy tariff in Fintry, including installation of smart meters, electric heating, insulation, and network management and supplier systems. With the assistance of one of these funding sources and the collaboration of the DNO, a licenced supplier and, possibly, a technology provider, the establishment and operation of the project would become a financially attractive proposition. The installation of smart meters provides a number of benefits and savings to customers in and of itself. Similarly, upgrading insulation and installing new electric heating can lower customer's bills, provide improved levels of comfort and can be self-financing. Coupling these measures with a local renewable tariff can further increase cost savings to residents as well as delivering further benefits to the other stakeholders involved.

In the event that it is not possible to secure any source of grant funding, the project may still be feasible but there are increased risks associated with it. The key risk would be that an insufficient number of residents subscribed to the tariff initially, or that households that did moved to another supplier within a short timeframe. In these circumstances, any investment in the ANM system and settlement systems to control customer metering and billing would be at risk. Without the security of a large, diversified customer base, it would be difficult, although not impossible, to raise traditional third-party financing to cover the establishment of the project. However, other forms of financing such projects are available (e.g. crowd-funding) and, provided that there is an adequate level of initial interest in the local renewable energy tariff for Fintry, FDT may consider proceeding to develop the project themselves.