Community Heat Development Unit

Bishop's Castle Case Study

A Report on behalf of

Shropshire and Telford Community Energy

Funded by the Energy Redress Scheme

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1. Executive Summary

1.1. Introduction

The focus of the Community Heat Development Unit[1] (CHDU) project is on centralised district heat networks. However, there will be many communities who wish to create heating schemes to decarbonise domestic heating where the physical constraints of a centralised district heat network make the project too expensive or impractical.

Taking the town of Bishop's Castle as an example, this case study reports on an alternative and potentially more flexible approach for communities to adopt to deliver low carbon heat, referred to here as a "Distributed Air Source Heat Pump (ASHP) and Wind Scheme".

1.2. Proposed Distributed ASHP and Wind Scheme

The proposed Distributed ASHP and Wind Scheme is an adaptation of the Energy Local[2] model. The scheme members are a local wind turbine generator and local domestic households which are supplied much of their electricity from the wind turbine via an Energy Local Club type arrangement. This Energy Local arrangement is currently the subject of an amendment to the Balancing and Settlement codes known as P441. Under P441 the generator must normally connect to the same primary substation that supplies the scheme customers (although some exceptions may apply) but they do not have to be at the same voltage. It will be impossible to firm up on this proposed scheme until P441 is finalised and the energy suppliers have worked out their P441 offerings.

[1] https://communityheat.org.uk
[2] https://energylocal.org.uk

The proposed scheme supplies discounted wind generated electricity behind the meter to the SpArC leisure centre and to domestic properties within Bishop's Castle. Discounted wind generated electricity is matched with local demand on a half hourly basis, with the remaining electrical demand of the customers met using electricity imported from the nation grid. Approximately 50% of the domestic customers are assumed to join as 'heat and electricity' customers, who will receive an ASHP installation, with the remainder joining as 'electricity only' customers.

The income that the scheme receives from the local sale of wind generation, matched on a half-hourly basis, is used to pay off the interest on loans used to cover some of the capital costs of installing individual ASHPs in 'heat and electricity' domestic customers' homes. Reducing the upfront capital investment of installing individual ASHPs is hoped to improve uptake of the technology, increase the income received by the local scheme generator and provide domestic customers with a low carbon heating system which is price competitive compared to oil based central heating.

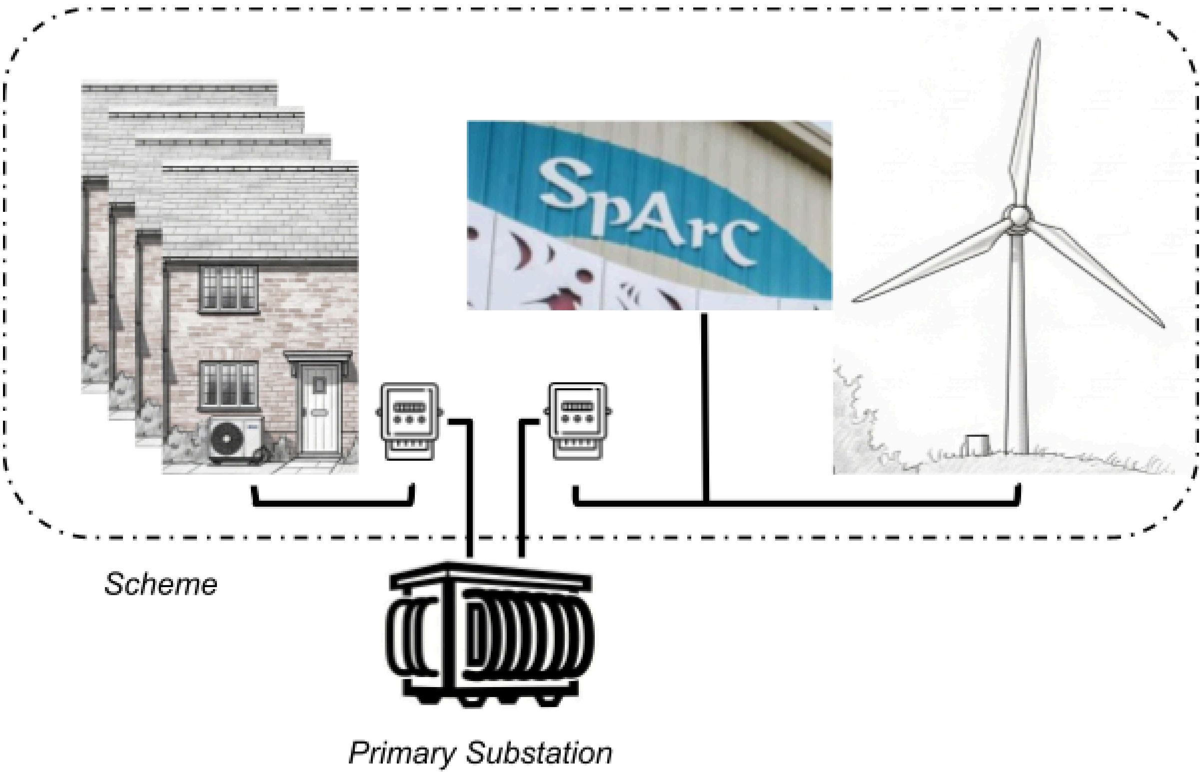

Figure 1: Illustration of Distributed ASHP and Wind Scheme

1.3. Financial Performance

Scheme revenue is generated from behind the meter sales of wind generated electricity to SpArC and local domestic sales to customers who join the Energy Local style scheme. Electricity generated from the planned 900kW wind turbine is estimated to be able to meet 49% of the annual electrical demand of a scheme including 115 domestic customers.

If 115 domestic customers joined the scheme, the initial scheme payback period is estimated to be 15 years, with a 30 year project IRR of 10% on an initial capital investment of £1.7 million. The projected 30 year project balance is £1.9m. Of these 115 customers, 58 customers are assumed to have their existing heat system replaced with ASHPs by the scheme, 44 customers are electricity only customers (and retain their existing non-electrified heating system), and 13 customers join as electricity only customers but are assumed to have a pre-existing ASHP heating system.

Annual electricity sales are predicted to create enough revenue to partially fund the ASHP installations in the properties of the 58 heat and electricity customers while ensuring the annual energy bills of these customers do not increase when compared to their existing oil heating systems, assuming a heating oil price of 64.51p/litre (equivalent to 7.42p/kWh of heat delivered by an oil boiler). The scheme requires these 'heat and electricity' customers to pay a £3,000 joining fee, roughly equivalent to replacing an existing oil boiler and an annual fee of £339. The scheme manages and funds the annual maintenance of the ASHPs installed in each of the properties and replaces them after 15 years of operation at no extra cost, saving customers ca. £3,000 overall.

The 44 'electricity only' domestic customers who retain their non-electrified heating system are predicted to experience annual cost savings of £85, without an ASHP, and the remaining 13 electricity only customers with existing ASHP installations are expected to save £475 per annum, compared to paying an Octopus Cosy tariff. These electricity only customers will not be charged an initial fee to join the scheme.

A sensitivity study has indicated that the scheme could expand to supply up to ca. 230 domestic properties with discounted electricity, 115 of which would receive partially funded ASHP installations, if the scheme chose to minimise its surplus. Further sensitivity studies have been completed which illustrate how the success of the scheme varies with: different heating oil prices, different PPA export prices, supplying electricity to Bishop's Castle Community College (BCCC) which neighbours the SpArC leisure centre and choice of electricity tariffs.

The scheme's main financial challenge is matching or reducing the annual energy cost of domestic customers who upgrade their heating systems to use ASHPs, compared to their existing oil heating systems. The modelling reported in this study has assumed a heating oil price of 7.42p/kWh which is equal to the average heating oil price over the last two years. Currently heating oil prices are lower than this, averaging 6.8p/kWh[3] over the last year, but we do not expect this price to continue for long.

The annual energy bill of domestic heat and electricity customers on the scheme has been compared against customers who have installed an ASHP and are on an Octopus Cosy tariff. The comparison suggests that customers could save ca. £137 per annum by joining the scheme compared to completing their own ASHP installation and using an Octopus Cosy tariff. This equates to ca. £10,300 over the 30 year life of the scheme including the cost of replacing the ASHP after 15 years.

1.4. Governance

If the scheme progresses a new Community Benefit Society (CBS) could be set up to own the wind turbine and manage the scheme or it could be taken on by Shropshire and Telford Community Energy (STCE). A CBS would enable a share offer to be launched ensuring community ownership of the scheme, including the wind turbine.

The CBS would need to act as a license exempt Class A Small Supplier[4] which limits the generation which they can supply to a maximum of 5MW (or 2.5MW supplied to domestic customers), hence individual CBSs may need to be set-up if this model were replicated across other sites.

[3] Assuming an oil boiler efficiency of 85%.

[4] https://www.legislation.gov.uk/uksi/2001/3270/schedule/4#:~:text=Class%20A%3A%20Small%20suppliers,is%20supplied%20to%20domestic%20consumers

It is possible that the Energy Club, composed of the scheme's customers, would need to be a separate organisation to the CBS owning the wind turbine. The Energy Club could then focus on the needs of its members whilst the CBS focuses on managing the wind turbine.

1.5. Conclusions

A heat and wind scheme is proposed at Bishop's Castle which aims to offer an affordable solution to decarbonising the heating of domestic properties through matching local wind generation with local electrical demand. The scheme offers to use local wind generation to reduce customers' annual electricity costs and use some of the revenue generated from electricity sales to partially fund the installation of individual ASHPs within half of the domestic properties who join the scheme.

Customers who join the scheme can receive an ASHP installation for a buy-in price equivalent to the cost of replacing an oil boiler (ca. £3,000). The initial buy-in cost is effectively repaid to these domestic customers over the 30 year life of the scheme since the scheme can fund the replacement of ASHPs after 15 years of operation. The scheme then enables customers to heat their homes without increasing their annual energy bills compared to retaining existing oil heating systems, assuming a heating oil price equal to the average of the last two years. Further savings may be possible depending on the number of customers who join the scheme and if the cost differential between oil and electricity reduces. Local wind generation also offers all scheme members some insulation from the price shocks of the global oil and gas markets which have been experienced in recent years.

The viability of such a scheme is reliant on updates to the proposed P441 modification to the Balancing and Settlement Code which is expected to define "local" as being the distribution network area supplied by a primary substation. The scheme has a significant dependency on a Licensed Electricity Supplier that is willing to: facilitate half hourly matching of local wind generation and domestic electrical demand, purchase wind generation which is not consumed locally, and supply customers' electrical demand which cannot be met with local generation.

Centralised heat network finances can be counter to insulation / efficiency measures since their finances depend on being able to deliver the maximum amount of heat per length of trenched pipework. If a building connected to a heat network reduces its heat demand, the revenue received by the scheme from this customer also reduces, which may require the scheme to outlay significantly more capital to connect additional customers to use this newly available capacity. It is also expected to be cheaper to connect buildings at the time the network is first constructed, rather than adding connections at a later date. The proposed Distributed ASHP and Wind Scheme is more flexible at accommodating additional users since domestic customers could join the scheme as and when they are due to replace their existing oil boilers or simply to reduce the cost of their existing electricity bills, although those fitting heat pumps or with existing heat pump installations will be prioritised. It is also worth noting that the overall project capital outlay per dwelling for the proposed scheme is significantly less compared to a centralised district heat network.

The financial performance of this scheme should improve at sites with multi-megawatt turbines since the £/MW CAPEX of multi-megawatt turbines is lower than the turbine at Bishop's Castle.

2. Introduction

The focus of the Community Heat Development Unit (CHDU) project is on centralised district heat networks however there will be many communities who wish to create heating schemes where the physical constraints of a centralised district heat network (availability of high domestic heat density, adjacent anchor loads and local renewable generation) make the project too expensive or impractical. The main reason for a poor business case in rural or rural / urban locations is a lack of suitable heat density and appropriate anchor loads. This in turn implies that individual heat pumps are a preferable low carbon heating solution for many, though not all, houses.

Taking the town of Bishop's Castle as an example, some houses will struggle to find space for a conventional ASHP installation. For example, some terraces have no front garden, and cramped or non-existent rear gardens where placing an air source heat pump (ASHP) would frequently not meet the MCS noise abatement requirements due to the proximity of the heat pump exterior location to neighbouring bedrooms. These buildings are good candidates for connecting to

a centralised district heating network and are being considered as part of the Bishop's Castle Heat and Wind project[5].
Conversely, there are many areas in the town where individual ASHPs would be a viable solution and these areas are mostly less suitable for a centralised district heat network due to the lack of heat and building density making connections more expensive.

Using Bishop's Castle as a case study, this document reports on an alternative and potentially more flexible approach for communities to adopt to deliver low carbon heat, referred to here as a "distributed ASHP and wind scheme", where electricity generated locally using wind turbines is used to power domestic ASHPs which are located on an electricity distribution network supplied by the same primary substation.

3. Distributed ASHPs and Wind Scheme Concept

3.1. Smart Local Energy Schemes - Energy Local Model

Use of the existing electrical distribution network requires significantly less construction works and CAPEX than installing a private wire network to transfer electrical energy from the local renewables generation (i.e. a wind turbine) to customer's properties, or trenched pipework to deliver heat to customers via a centralised district heat network. There are also far less stakeholders involved.

There is however, a cost incurred for using the distribution and transmission networks and trading in the wholesale electricity markets. Energy Local[6] have managed to set-up Clubs which match local generation with local demand to reduce the overhead costs associated with electricity distribution.

Households and small scale renewable generators as members form an Energy Local Club as a co-operative. Each household has a smart energy meter installed to show when and how much power they were using on a half-hourly basis. The local renewable generator(s) also have smart meters installed, measuring output/export.

[5] https://stcenergy.org.uk/bishops-castle-heat-and-wind-project
[6] https://energylocal.org.uk

Members (households and generators) agree a price ("match tariff") that will be paid to the generator when they match their electricity use to when electricity is generated locally, for example, turning their washing machine on when they know the local wind turbine is operating.

The Club works with a licensed electricity supplier: to date, Octopus Energy and 100Green have both been involved in these schemes. These retail suppliers sell the extra power required to each household when there is not enough local electricity generated. The supplier is also responsible for reconciling the generation, export and retail energy flows, and sends each household normal bills for the balance of their total energy use.

3.2. Energy Local Clubs Limitations

There are some important considerations when setting up an Energy Local Club:

- Energy Local Clubs are currently limited to matching generators and customers at the same voltage level on the distribution network. This means that MW+ generators could not currently be part of the same Club as domestic customers given domestic properties are connected to the low voltage (LV) distribution network.
- The tariffs available for end users are called "Time of Use" tariffs, and may not suit everyone. For an extreme example, if a home is heated with a heat pump, it's unlikely that much matched cheap solar energy would help reduce the running cost, whereas the seasonal profile of wind generation is a much better match with heat demand. Customers who join a Club are likely to pay more for peak electricity when local generation is not available, but should be able to achieve substantial savings overall, particularly if they adjust their demand to match times when electricity is being generated locally.
- Matching supply and demand are key, the purpose is to modify behaviour of club members to use energy at advantageous times of day. Note that proactive shifting of electrical demand to explicitly match wind generation has not been modelled in this case study report.
- Over-subscribed clubs (i.e. too many users matching with a small renewable asset) mean benefits would have to be spread very thinly. For this reason clubs might limit membership numbers.

The key limitation for the proposed distributed ASHP and wind scheme is the voltage level at which Club generators and consumers must connect to the distribution network at. The viability of such a scheme is dependent on the definition and implementation of the proposed P441[7] modification to the Balancing and Settlement Code (BSC). P441 is expected to define when the BSC and its Code Subsidiary Documents (CSDs) permit the netting of Imports from Exports through a Complex Site arrangement (i.e. Energy Local Club) and the scenarios in which this netting is permissible. It is anticipated that this will allow generators and consumers to join an Energy Local style Club if they are served by the same primary distribution substation (e.g. 11kV-33kV substation) which would enable a multi-megawatt wind turbine to be part of the same club as domestic customers (<2.5MW of demand).

Progress is being made towards implementation of the P441 modification with the concept of Complex Site Classes being consulted on during October and November 2025[8].

3.3. Proposed Distributed ASHP and Wind Scheme

The proposed Distributed ASHP and Wind Scheme is an adaptation of the Energy Local model. The scheme members are a wind turbine generator and local domestic households which purchase much of the electricity generated by the wind turbine via an Energy Local Club style arrangement.

The increased income the scheme receives from the local sale of wind generation, matched on a half-hourly basis, is used to pay off the interest on loans used to cover some of the capital costs of installing individual ASHPs in domestic customers' homes. Reducing the upfront capital investment of installing individual ASHPs is hoped to improve uptake of the technology, increase the income received by the local scheme generator, and provide domestic customers with a low carbon heating system which is price competitive compared to oil based central heating.

As part of the Bishop's Castle Heat and Wind Project[9] planning permission has been granted for a 900kW wind turbine located to the south east of the town. Bishop's Castle is potentially well suited to the proposed distributed ASHP and

[7] https://www.elexon.co.uk/bsc/mod-proposal/p441

[8] https://www.elexon.co.uk/bsc/consultation/p441-assessment-procedure-consultation-on-complex-site-classes

[9] https://stcenergy.org.uk/bishops-castle-heat-and-wind-project

wind scheme since there is a single primary substation which feeds the whole of the town, Figure 2.

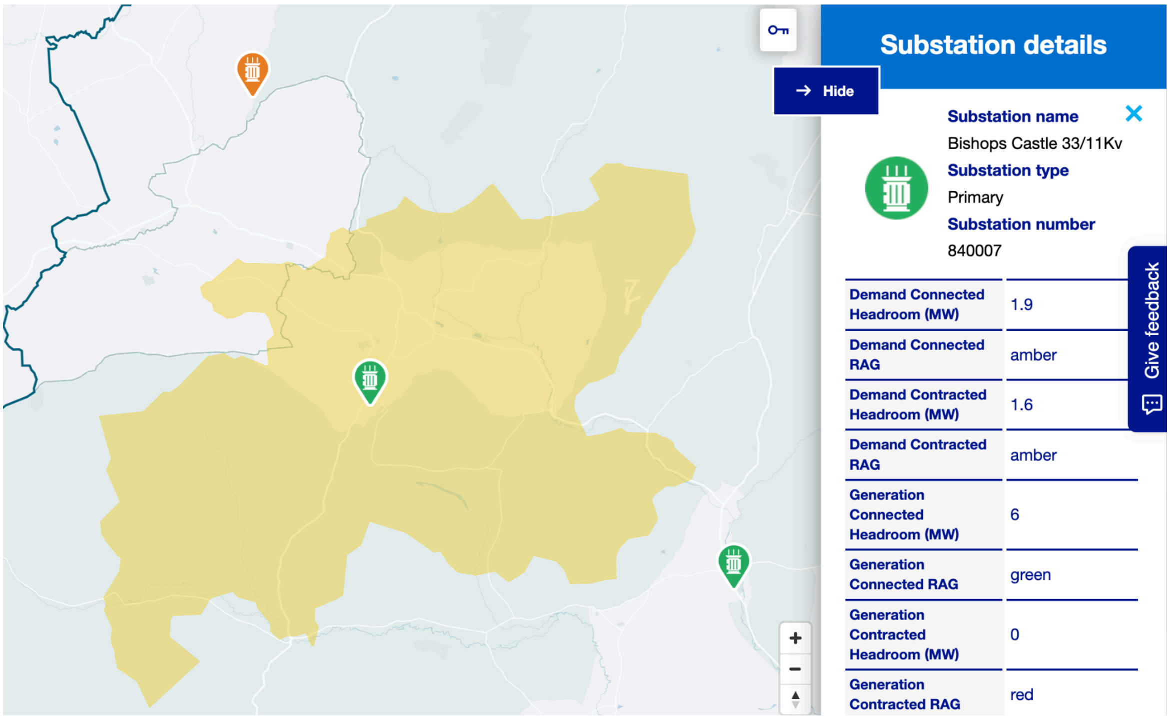

Figure 2: Area Served by Bishop's Castle Primary Substation[10]

There is also potential for the wind turbine to use the same connection to the electrical distribution network as the SpArC leisure centre and hence supply the building with electricity behind the meter.

4. Proposed Business Structure

If this scheme were to proceed, Shropshire and Telford Community Energy (STCE) or a new **Local Community Benefit Society (CBS)** could be established to take on ownership and management of the wind turbine and provide funding for individual customers to purchase heat pumps. The CBS would act as a license exempt electricity supplier[11]. The **Customers** within the scheme will own their individual heat pumps which enables them (or the property owners) to access the Boiler Upgrade Scheme[12]. Electricity will be purchased through the licensed electricity supplier that the scheme partners with.

[10] https://www.nationalgrid.co.uk/network-opportunity-map-application/
[11] A new CBS may need to be formed if STCE register as a license exempt supplier for their Twemlows solar farm and hence would not be eligible to claim an additional exemption for the proposed scheme at Bishop's Castle.
[12] https://www.gov.uk/apply-boiler-upgrade-scheme

There may be a need for the Energy Club, composed of the scheme's customers, to be a separate organisation from the CBS running the turbine. The Energy Club could then focus on the needs of its members whilst the CBS focuses on managing the wind turbine.

There may be a requirement for a **Central Body** to be formed which will provide some of the ongoing management and maintenance services and support access to finance. It is expected that this organisation will identify and work with a licensed electricity supplier to agree terms based on a pipeline of local schemes at different locations. If a Central Body is formed then a federation model may be a suitable structure to promote sharing knowledge and services between different sites. This model is illustrated below.

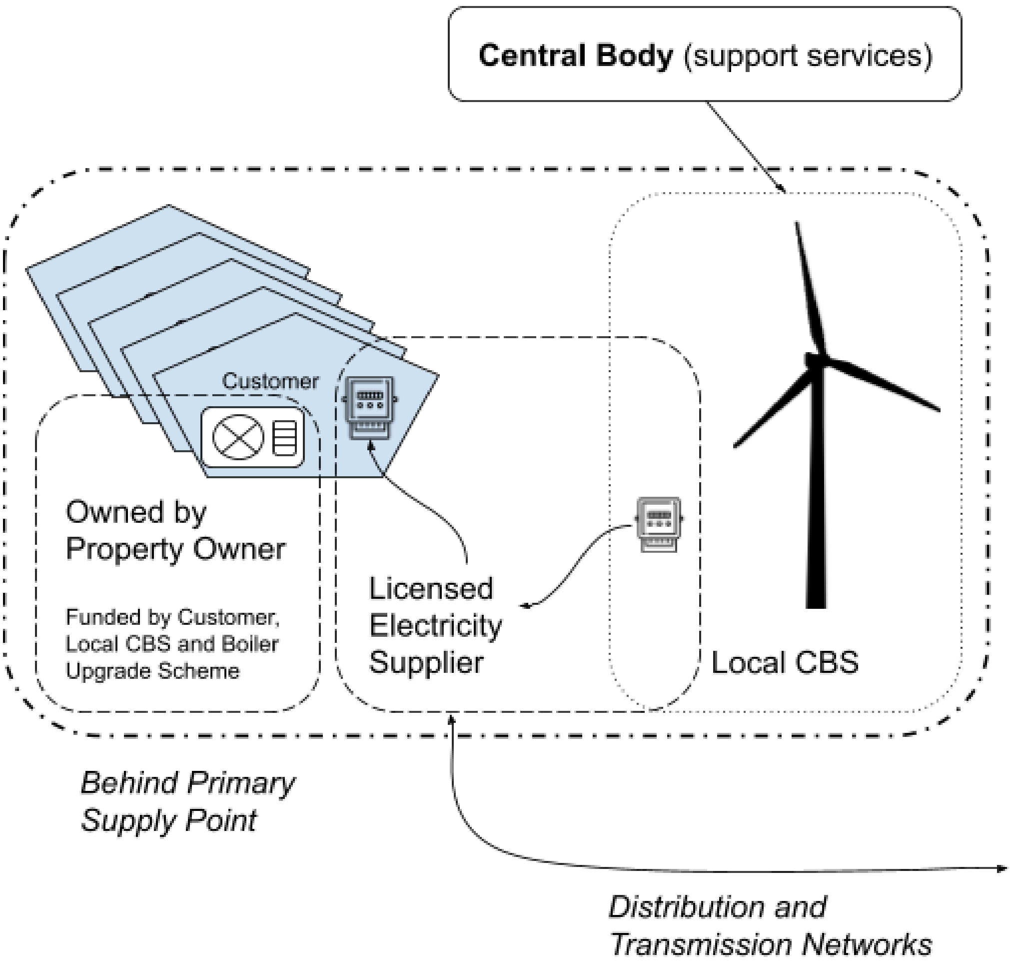

Figure 3: Schematic of Distributed ASHP and Wind Scheme

4.1. Wind Turbine Ownership

The Energy Act limits the generation owned by a Small Supplier to 5MW installed, up to 2.5MW of which can be supplied to domestic properties. Ownership of the wind turbine(s) by the Central Body would result in these generation limits being reached once the model had been extended to multiple sites. Since the aim of the CHDU project is to establish a scalable business model it makes more sense for the wind turbine(s) to be owned by a Community Benefit Society local to the turbine site. This CBS would also act as a ***Class A Small Supplier***[13] who would supply electricity generated by the wind turbine locally to customers of the scheme.

4.2. ASHP Ownership

The base case is to assume that the ASHPs will be owned by the customer/property owner to ensure that Boiler Upgrade Scheme[14] funding can be accessed. The Central Body would work with the local CBS to engage with local installation and maintenance contractors to install the ASHPs and any heating system improvements.

Access to the control system of the ASHPs by the Central Body could be explored since aggregating the electric demand of the ASHPs and thermal storage across multiple sites could potentially open up opportunities to compete in flexibility markets.

4.3. Domestic Customers

Domestic customers and small business customers who join the scheme as electricity only members will not be charged a fee for joining the scheme.

Individual domestic and small business customers who join the scheme and request an ASHP installation will be required to partially fund the purchase of their ASHP and its installation in their property. The cost of purchasing and installing each ASHP will be covered by a customer contribution of £3,000[15] and £7,500 from the Boiler Upgrade Scheme with any remaining costs covered by a low interest loan from the scheme (equivalent to inflation). The customer

[13] https://www.legislation.gov.uk/uksi/2001/3270/schedule/4#:~:text=Class%20A%3A%20Small%20suppliers,is%20supplied%20to%20domestic%20consumers.
[14] https://www.gov.uk/apply-boiler-upgrade-scheme
[15] Roughly equivalent to the cost of replacing a gas/oil boiler.

contribution of £3,000 is equivalent to the cost of installing a new gas or oil boiler. The scheme will purchase and install replacement ASHPs after 15 years.

The heat and electricity customers will own the ASHP installed in their property. Heat and electricity customers will be required to pay an annual fee which covers loan repayments for the ASHP finance and ongoing maintenance costs. Customers could also have the option of fully funding their own ASHP and managing annual maintenance of the ASHP themselves, in which case customers will not be required to pay a standing charge to the scheme.

It is expected that all customers will be required to switch their electricity supplier to a common licensed supplier (e.g. 100Green) who will supply electricity generated by the CBS (Small Supplier) and grid electricity. Customers will also have to pay the normal electricity standing charge to the licensed electricity supplier.

If an ASHP customer leaves the scheme they will be required to pay off the remainder of the loan used to fund the ASHP installation.

P441 agreements are likely to be for up to three years. There is a risk that the P441 cannot be renewed on an acceptable basis. If this were to happen the club would need to be dissolved. This poses a risk to the heat and electricity customers in that they would be back on a normal tariff but we do expect the gap between electricity and oil prices to narrow in the future which would mitigate this risk.

If the club were to be dissolved the income to the society would drop. The effect of this would depend on when this event occurred and the PPA prices available for general export at the time. This is a risk that the share offer document would need to consider and it may put people off investing.

4.4. Non-domestic Customers Behind the Meter

At Bishop’s Castle, there is potential for the wind turbine to use the same connection to the electrical distribution network as the SpArC leisure centre, therefore there is the possibility for the turbine to supply electricity to these buildings behind the meter. Moreover, SpArC has received Public Sector Decarbonisation Scheme (PSDS) funding to electrify their heating system using onsite ASHPs, thus increasing their electrical demand.

5. Demand and Generation Modelling

The distributed ASHP and wind scheme has been investigated at Bishop's Castle using site specific building heat demand and wind generation data derived during the Bishop's Castle Heat Network feasibility work[16].

5.1. ASHP Performance Modelling

The performance of individual ASHPs installed in customers' properties is modelled using a standard test regression coefficient of performance (COP) model. The performance figures are based on ASHP data used in the Bishop's Castle heat network project, originally sourced from Solid Energy datasheets. An ambient air temperature profile (from the Birmingham area) generated using Renewables Ninja[17] is used as an input into the COP model.

The seasonal COP (SCOP) is modelled as 3.24 assuming a maximum flow temperature of 55℃ and an average flow temperature of ~40℃. A maximum flow temperature of 45℃ would lead to higher ASHP efficiencies and reduced bills for properties but may not be sufficient for some properties.

5.2. Domestic Customer Demand

The annual heat and electrical demand of each domestic customer is defined in the table below.

Annual Average Demand	**Value**
Electrical[18] (lighting, appliances etc.)	2,700 kWh
Heat[19]	16,503 kWhth
Electrical (heat, using ASHP COP model)	5,093 kWh
Total Electrical Demand (per customer)	*7,793 kWh*

Table 1: Domestic Customer Household Annual Electrical Demand

[16] https://stcenergy.org.uk/bishops-castle-heat-and-wind-project
[17] https://www.renewables.ninja
[18] https://www.ofgem.gov.uk/information-consumers/energy-advice-households/average-gas-and-electricity-use-explained
[19] Based on Bishop's Castle data of 2.393 GWh/year for 145 domestic properties.

Heat demand data has been used for the buildings in the heat network proposed at Bishop's Castle. A number of these buildings may not be well suited to installing individual ASHPs however using this heat demand data is considered reasonable for the purposes of this study.

5.3. Non-Domestic Customer Demand

The annual heat and electrical demand of SpArC is presented in Table 2. This demand data is derived from historical gas and electricity bills.

Annual Demand	**SpArC**
Electrical	121 MWh[20]
Heat (*electrified, using ASHP COP model, estimated post PSDS figure*)	279 MWh
Total Electrical Demand	*400 MWh*

Table 2: Non-domestic Annual Electrical Demand

It is unlikely that the scheme will meet all of the electrical demand listed in table 2 since variable wind conditions may mean that there is little wind generation at times when SpArC has a reasonable electricity demand. It is estimated that the scheme could supply 77% of SpArC's annual electricity demand.

5.4. Wind Generation

Planning permission has been granted for a 900kW wind turbine at a site to the south east of Bishop's Castle. It has been proposed that a refurbished Vestas V52 wind turbine could be purchased at a considerably lower upfront cost compared to purchasing a new turbine. It has been advised that the proposed refurbished turbine will have a remaining operational life of 20 years. The monthly wind generation profile for the proposed wind turbine site has been used in this assessment and is presented in Figure 4 alongside the electrical demand profiles.

[20] Derived from planned future electricity usage.

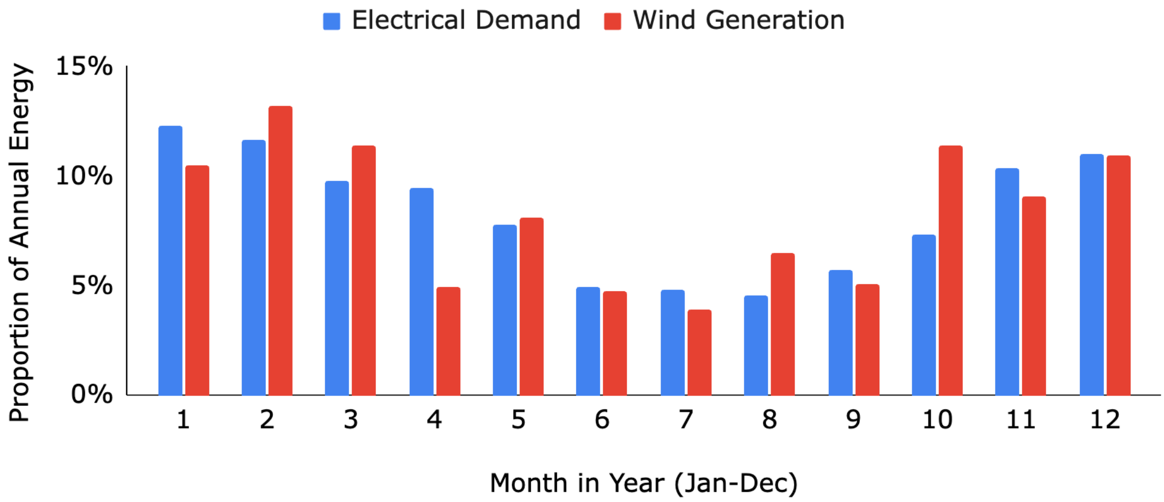

Figure 4: Comparison of Wind Generation and Electrical Demand Profiles

Wind generation is modelled as being consumed preferentially behind the meter by SpArC, before supplying domestic customers, with any excess exported to the grid.

The annual yield of a new 900kW wind turbine is assumed to be 1577 MWh (capacity factor of 20%) at the proposed site in Bishop's Castle, as modelled in the Bishop's Castle heat network assessment. A degradation factor of 1.2% has been applied to the annual wind turbine generation due to aging of components within the turbine.

5.5. Customers

The scheme is focussed on supplying wind generated electricity behind the meter to the SpArC leisure centre and electricity to domestic customers via the distribution network. The inclusion of SpArC improves the overall project finances but reduces the number of domestic customers who could connect to the scheme, since their electricity consumption results in less wind generation being available for domestic customers.

5.6. Tariffs

The following tariffs are modelled. The tariffs paid by the customer are based on the Corwen Energy Local club[21] tariffs although the overall conclusions of this report are similar if tariffs for different Energy Local clubs are used.

[21] https://dashboard.energylocal.org.uk/corwen

Name	Paid By	Paid To	Tariff
ASHP Standing Charge	Customer	Local CBS	£338.60/year[22]
Electricity Standing Charge	Customer	Supplier	£224.69/year
Unmatched Electricity Unit Rate (day, peak, night)	Customer	Supplier	26.04p/kWh 41.90p/kWh 23.84p/kWh
Matched Electricity Unit Rate	Customer	Local CBS	13.65p/kWh
Matched Electricity Behind the Meter Unit Rate	SpArC	Local CBS	20.00p/kWh
Export Unit Rate	Supplier	Local CBS	9.0p/kWh
Matched Unit Handling Fee	Scheme	Supplier	2.0p/kWh

Table 3: Energy Tariffs and Standing Charges used in Financial Modelling

Note that the "Matched Unit Handling Fee" is intended to represent the fee the licensed supplier charges to facilitate matching of local generation to local demand.

5.7. ASHP Capital Costs

The average cost of installation is estimated to be £14,754 per domestic property. This has been calculated using monthly average ASHP installation costs reported on the MCS dashboard[23] from June 2022 to July 2025 and taking the projected value on the 01/08/2025 of £13,198. This cost is reported to cover the "full cost of the installation that is charged to the customer"[24] including materials and labour and is recorded before any reduction due to the Boiler Upgrade Scheme grant[25].

An average cost of £1,556 per property has been added to the £13,198 to cover some radiator and insulation upgrades to enable the maximum required flow

[22] Reduces to £130/year for annual maintenance if customers pay for the entirety of their ASHP installation.
[23] https://datadashboard.mcscertified.com/InstallationInsights
[24] https://www.nao.org.uk/wp-content/uploads/2024/03/Decarbonising-home-heating-HC-581.pdf
[25] https://www.gov.uk/apply-boiler-upgrade-scheme/what-you-can-get

temperature of the properties' heating systems to be reduced to 55℃. These retrofit costs are based on estimates by Marches Energy Agency[26] who are a partner of the CHDU project. The costs of installing an ASHP in a domestic property is summarised below.

Cost	**Value**
ASHP Purchase and Installation	£13,198
Building Improvements	£1,556
Customer Contribution	-£3,000
Boiler Upgrade Scheme Grant	-£7,500
Total (cost to scheme)	£4,254

Table 4: Assumed Cost of ASHP Installation

5.8. Wind Turbine Capital Costs

The capital costs associated with the wind turbine purchase, installation and grid connection are itemised in Table 5. It is expected that a second hand wind turbine will be purchased at a reduced cost compared to a new turbine however it is expected that the useful operational life following installation will be reduced to 15 years.

Cost	**Value**
Wind Turbine Purchase and Installation	£800k
Grid Connection	£300k
Total	*£1,100k*

Table 5: Wind turbine capital and installation costs

5.9. Existing Oil Heating and Electrical Costs

The overall aim of the heat and wind scheme is to provide low carbon heat to domestic customers without requiring them to front the full capital cost of installing ASHPs and without increasing the operational costs of heating and powering their properties. The annual costs of customers participating in the

[26] https://mea.org.uk

heat and wind scheme are compared against estimates of the current costs customers pay to heat and power their homes.

Bishop's Castle is an off-gas grid area with most properties having oil or LPG boilers installed. Costs have been estimated for customers with oil heating since these are most prevalent. The tariffs used in the calculation of current costs are presented below.

Name	Tariff	Annual Demand	Annual Cost
Oil Boiler Servicing[27]	£150/year	-	£150
Heat from Oil Unit Rate[28]	7.42p/kWh	16,503 kWh	£1,225
Electricity Standing Charge	£224.69/year	-	£225
Electricity Unit Rate (Octopus Cosy)	25.14p/kWh 37.71p/kWh 12.33p/kWh	2,700 kWh	£616
		Total	**£2,215**

Table 6: Energy Tariffs and Standing Charges for Existing Heating System

The history of heating oil price over the last three years is presented in Figure 5.

[27] The oil boiler standing charge is based on an annual service fee of £150 per year.
[28] The heat from oil price is based on a unit rate of 64.51p/litre, 10.35kWh of energy per litre of heating oil and an oil boiler efficiency of 85%.

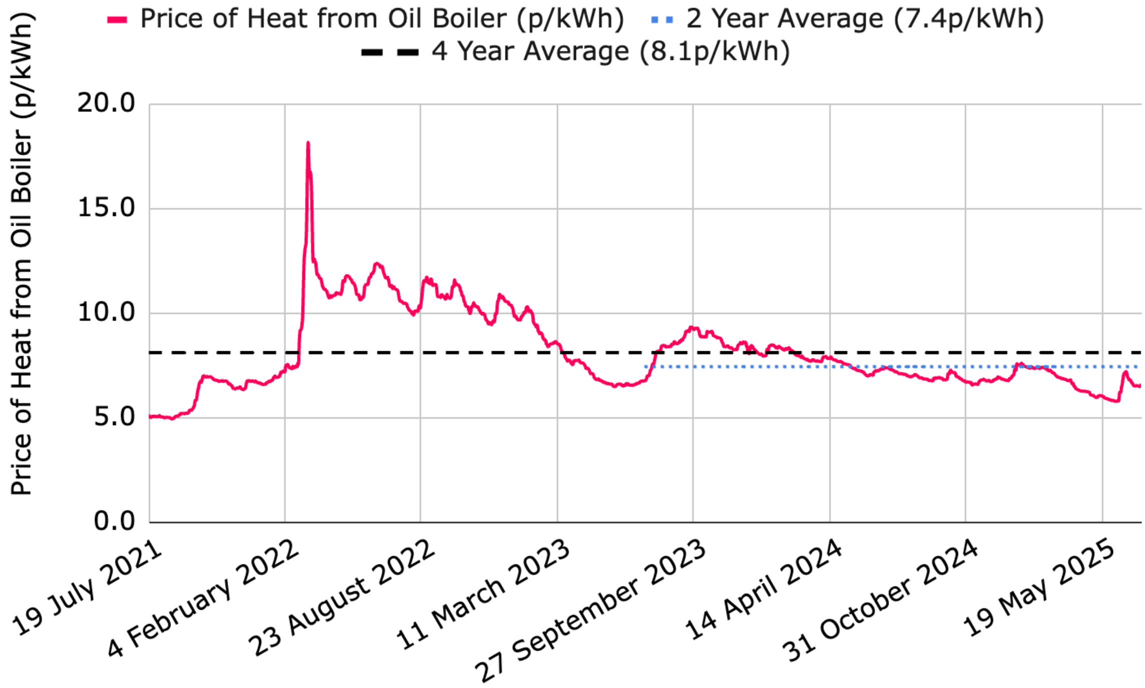

Figure 5: Four Year History of Price of Heat from Heating Oil[29]

The price of heat from heating oil is close to the lowest of the last four years with a one year average of 6.8p/kWh vs a four year average of 8.1p/kWh, accounting for an oil boiler efficiency of 85%. A price of 7.42p/kWh, equal to the two year average, has been chosen for the baseline assessment and a price sensitivity is discussed in section 8 of this document.

5.10. Electricity Supply

This financial model includes a 2p/kWh fee paid by the scheme to the licensed electricity supplier to cover the expense of facilitating the supply of matched electricity. It is understood that the time of use tariff the supplier charges to supply non-matched electricity may also enable the supplier to generate additional income, compared to a standard domestic tariff.

5.11. Upgrades to the Distribution Network

It is assumed that the scheme will not necessitate upgrades to the distribution network to enable domestic customers to install individual ASHPs.

Reviewing the DNO's constraint map, Figure 2, the primary substation demand headroom of 1.9MW suggests there may be capacity for up to ~600 domestic properties to install ASHPs assuming an average ASHP power rating of 6kWth (3.2kWe peak).

[29] Assuming an oil boiler efficiency of 85%.

5.12. Loan Interest Rates

The initial development loan is modelled as having a rate of 8% over a 1 year period, requiring interest only repayments.

It is assumed the project will refinance at an interest rate of 5.5% after the first year following the wind turbine being installed with the initial development loan capital being lumped into a longer term loan. This 5.5% loan has a term of 15 years and covers finance raised to purchase the heat pumps, paid off by scheme members via a standing charge, and capital raised to purchase the wind turbine.

An interest rate of 5.5% has been used to represent 50% of capital investment being provided by community shares at a rate of 5%, and 50% from loans at a rate of 6%.

5.13. Equipment Replacement

It is expected that the ASHPs will need to be replaced after 15 years of operation. The intention is for the scheme to pay for these to be replaced, rather than the scheme customers financing the replacement upfront, although some of the funding will come from the standing charge paid by customers. It is assumed that this will cost £5,000 for the heat pump and £1,200 for the installation, totalling £6,200 per heat pump, inflated using a rate of 2.5%.

The wind turbine is expected to require replacement after 20 years of operation. A cost of £525k is allowed for covering: purchase of the replacement turbine, delivery, construction of the temporary access track, installation and commissioning. All replacement costs are inflated over 20 years using a rate of 2.5%.

5.14. Ongoing Costs

Ongoing annual costs are listed in Table 7.

Annual Cost	Value
ASHP Maintenance (per heat pump)[30]	£130
CBS Operation	£10,000
CBS Business Rates (900kW wind turbine)	£2,250
Wind Turbine Land Rent	£10,000
Wind Turbine O&M	£25,000

Table 7: Ongoing Costs for Operating CBS and Wind Turbine

5.15. CAPEX Summary

The capital costs assumed in this report are listed in the table below assuming a total of 115 domestic customers join the scheme.

Description	Capital Cost £k
Wind turbine installation and grid connection	£1,100
Contribution to ASHP Purchase	£247
10% Contingency	£135
Sub-total	£1,481
15% Commercialisation	£202
Total	**£1,683**

Table 8: Summary of Capital Costs paid by Scheme

6. Financial Performance

Financial modelling of the scheme and domestic customer energy costs has been completed to estimate the financial performance of the scheme and assess whether domestic customers benefit financially by joining the scheme compared to their existing energy costs. The scheme base case models 115 domestic customers joining the scheme. The 115 total customers are made up of 58 customers who contribute to the installation of new ASHPs, 44 customers who

[30] This is covered by the standing charge paid by the customer.

join as electricity only customers (and retain their existing non-electrified heating system), and 13 customers who also join as electricity only but have a pre-existing ASHP heating system. 115 is the maximum number of domestic customers which can be connected to the scheme without increasing domestic energy costs while also ensuring the scheme achieves a 30 year project IRR of 10%.

6.1. Scheme

The income and expenditure of the scheme CBS at the end of the first year of operation is presented in the table below.

Year 1 Scheme Finances	**Value**
Number of Domestic Customers	Total: 115 *Heat and Electricity Customers:* 58 *Electricity Only Customers:* 44 *Existing Heat Pump Customers:* 13
Non-domestic Customers	SpArC
Domestic Electrical Demand	672 MWh
SpArC Electrical Demand	400 MWh
Local Domestic Electricity Sales	£49k
SpArC Electricity Sales	£61k
Grid Electricity Sales	£82k
ASHP Standing Charge	£20k
Gross Income	***£212k***
O&M	£62k
Net Income	***£151k***
Total Loan Repayments	£130k
Cashflow	**£20k**

Table 9: First Year Financial Results of Scheme

At the end of the first year of operation the scheme is estimated to have a positive cashflow of £20k if 115 domestic customers join the scheme.

Table 10 reports the financial performance of the scheme after 30 years of operation. A period of 30 years has been modelled since this is twice the length of the expected ASHP lifetime, with the scheme covering replacement of the ASHPs after the first 15 years of operation.

Overall Scheme Finances	**Value**
Number of Customers (all domestic)	115
Proportion of Customers' Electrical Demand Supplied by Local Generation	49%
Proportion of Local Wind Generation Consumed by Scheme Customers	42%
Initial Payback Period	15 years
30 Year Balance	£1,855k
30 Year IRR	10.0%

Table 10: Overall Financial Metrics of Scheme

After 30 years of operation the scheme is predicted to have a positive balance of £1.9m which could be used to help fund future replacement of ASHPs and the wind turbine (at the start of year 31).

The relationship between the number of domestic properties in the scheme and the overall scheme finances is presented in Figure 6. Note that these figures present the financial performance of the scheme for 100s of customers, however analysis of customer finances suggests that energy costs for individual customers will increase if over 115 customers join the scheme due to them each receiving a decreasing share of the available wind generation.

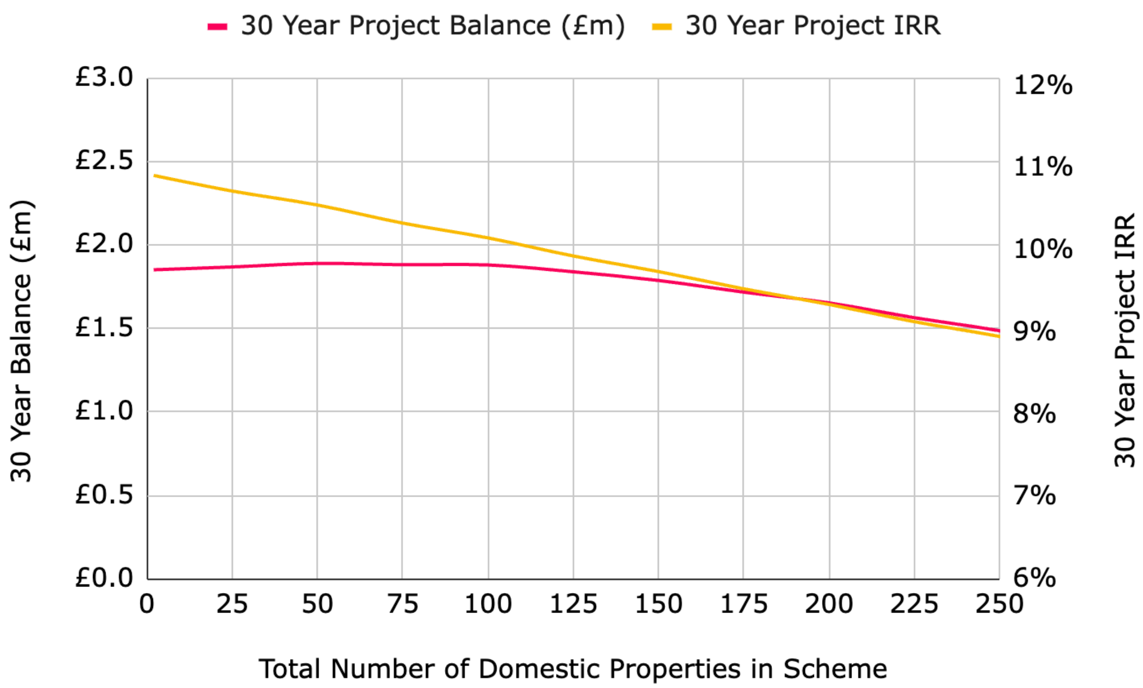

Figure 6: Relationship between scheme financial metrics and number of domestic properties

The scheme is expected to be financially viable supplying electricity to SpArC, with excess generation exported to the national grid, without connecting to any domestic customers.

The 30 year project balance is estimated to be at a maximum if 50-100 domestic customers join the scheme and the predicted scheme IRR drops below 10% if the scheme is extended beyond 115 customers. This is because the cost of repaying the loans to fund the ASHP installations increases at a higher rate than the income from selling locally matched wind generation as the scheme expands to more customers.

Figure 7 compares the number of scheme domestic customers and the proportion of wind generation consumed locally by the scheme customers (including SpArC).

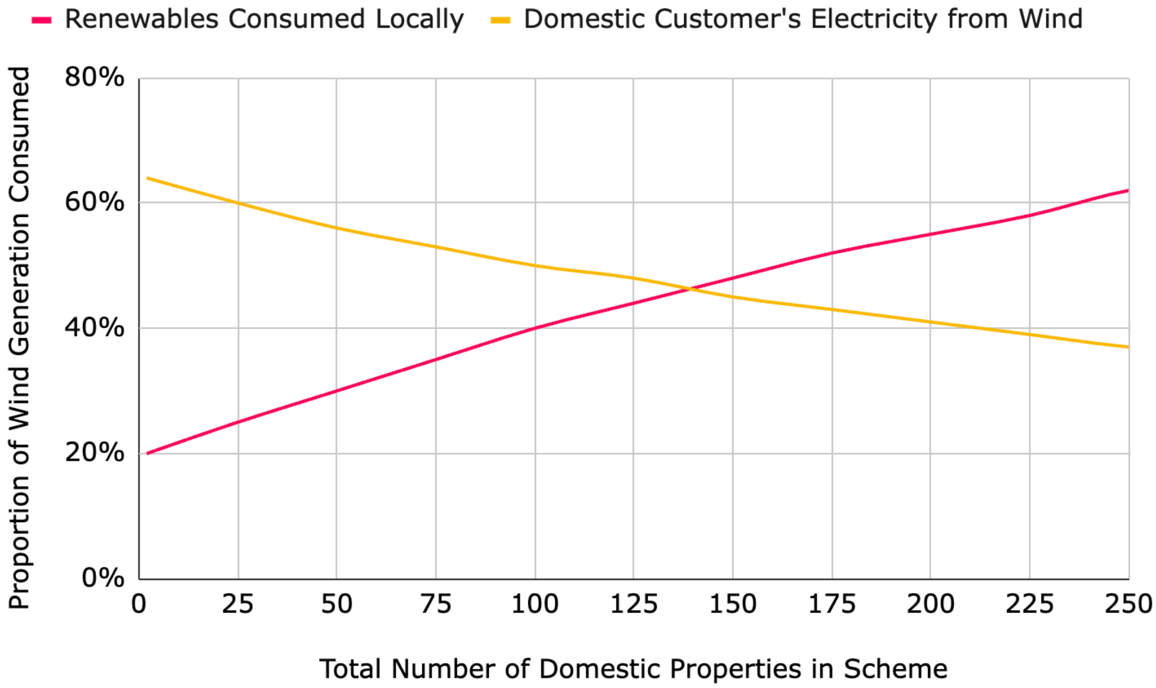

Figure 7: Relationship between the proportion of wind generation matched with local generation and number of domestic properties

Local consumption of wind generation is estimated as 42% if 115 domestic customers join the scheme, alongside supplying SpArC.

The proportion of electricity consumed by each domestic customer which is sourced from the local wind turbine is inversely proportional to the number of customers connected to the scheme since each customer can consume a larger proportion of the available wind generation. If 115 customers join the scheme, the proportion of their electricity which is generated locally is 49%

6.2. Domestic Customers

6.2.1. Domestic Heat Pump Customers

Table 11 itemises the annual energy costs of each domestic customer who signs up to the scheme and receives a new ASHP installation. These figures assume that 58 customers receive ASHP installations, out of a total of 115 customers who join the scheme.

Year 1 Domestic Customer Finances	Value
Number of Domestic Customers with New ASHP Installations	58 *(115 domestic customers in total)*
Scheme Standing Charge	£339
Electricity Connection Standing Charge	£225
Electricity Purchase	£1,650
Total Expenditure	**£2,214**
Customer Savings (compared to Oil[31])	£1
Customer Savings (compared to ASHP with Octopus Cosy tariff)	£277

Table 11: Summary of Year 1 Customer Finances

It is estimated that the annual energy cost of each domestic customer who has joined the scheme and received a new ASHP installation is approximately equal to their current energy costs, assuming oil central heating. After 15 years, the initial loan for the ASHP installation is paid off and the standing charge customers pay to the scheme is used to partially fund replacing the ASHPs. The majority of the ASHP replacement cost is covered by the scheme. It is also expected that the gap between the price of oil and electricity will reduce over the coming decade, so further savings in running costs should materialise.

Compared to customers installing their own ASHP and using an Octopus Cosy tariff, the scheme is expected to save each customer ca. £136 per year, which equates to ca. £10,300 over the 30 year lifetime (incl. ASHP replacement).

The annual energy cost saving of each domestic customer compared to oil heating increases if less customers join the scheme due to each customer having access to a greater proportion of wind generation. This is because the amount of wind generation available to each member during each half hour interval is directly proportional to the number of members in the scheme. For example, if 10 members join the scheme, each member has access to up to 1/10th of the

[31] Including annual maintenance cost of the oil boiler.

available wind generation. If the demand of all the members is greater than the available wind generation during a half hour interval, the wind generated electricity gets split equally between these 10 members, and all members top-up their electrical demand using imported electricity at a higher rate.

The change in annual energy costs for each domestic customer who joins the scheme as a heat pump customer (and receives a new ASHP installation) is presented in Figure 8 based on the total number of customers who join the scheme.

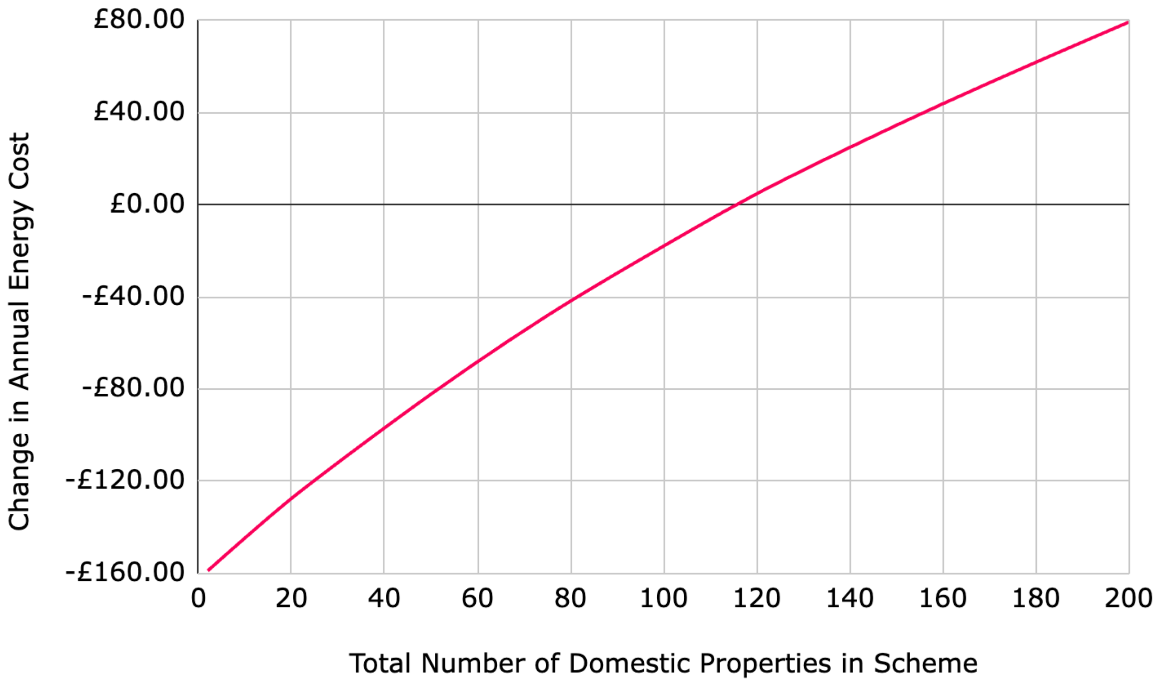

Figure 8: Change in Annual Domestic Customer Energy Cost

6.2.2. Domestic Electricity Only Customers

It is assumed that ca. 38% (44 customers) of the 115 domestic customers who join the scheme retain their existing non-electrified heating system. It is anticipated that the annual electricity cost of these customers will reduce by £85 if they join the scheme.

6.2.3. Domestic Customers with Existing ASHP Installations

It is assumed that ca. 12% (13 customers) of the 115 domestic customers who join the scheme have already installed ASHP based heating systems and are using an Octopus Cosy electricity tariff. It is anticipated that the annual electricity cost of these customers will reduce by £475 if they join the scheme.

6.3. SpArC
SpArC is expected to fund their own ASHP installations. Their only interaction with the scheme is that the scheme will supply electricity generated by the local wind turbine via a direct wire, behind the meter. The electricity tariff of 20p/kWh is expected to save them ~20% on the units of electricity consumed via direct wire.

7. Sensitivity Analyses

7.1. Heating Oil Price
The ability of the scheme to match or reduce the annual energy costs of domestic customers is directly linked to the price of heating oil. A sensitivity analysis has been performed which assesses the number of domestic customers who could join the scheme at a range of heating oil prices, while ensuring the annual cost of energy remains competitive with existing costs.

Table 12 presents the change in the annual energy bill of a domestic customer. As the price of oil rises, the savings each scheme customer makes on each unit of locally generated electricity increases. This means each customer can consume a smaller proportion of locally generated electricity while still achieving cost parity with an oil based heating system, which enables the scheme to accept more customers. For example, if the price of heat delivered by oil boilers increases from 7.42p/kWh to equal the four year average of 8.08p/kWh, the scheme could include up to a total of 235 domestic customers, of which 118 customers receive a new ASHP installation to decarbonise their heating without increasing their annual energy costs.

7.2. Wind Generation Export Price
The price of wind generated electricity that is exported to the grid affects the financial performance of the scheme. The base case assumes an export price of 9p/kWh.

Table 13 presents the scheme's estimated cashflow (in £k) for a range export PPA prices and number of domestic customers. As expected, higher PPA prices result in the scheme being feasible for a wider range in the number of domestic customers, and leads to a higher annual cashflow.

Number of Domestic Properties in Scheme	Price of Heat from Heating Oil (p/kWh of heat from oil)											
	6.8	7	7.2	7.42	7.6	7.8	8	8.2	8.4	8.6	8.8	9
115	£101	£68	£35	-£1	-£31	-£64	-£97	-£130	-£163	-£196	-£229	-£262
125	£112	£79	£46	£10	-£20	-£53	-£86	-£119	-£152	-£185	-£218	-£251
150	£136	£103	£70	£34	£4	-£29	-£62	-£95	-£128	-£161	-£194	-£227
175	£160	£127	£94	£57	£28	-£5	-£38	-£71	-£104	-£137	-£170	-£203
200	£182	£149	£116	£79	£49	£16	-£17	-£50	-£83	-£116	-£149	-£182
225	£201	£168	£135	£99	£69	£36	£3	-£30	-£63	-£96	-£129	-£162
250	£221	£188	£155	£119	£89	£56	£23	-£10	-£43	-£76	-£109	-£142
275	£239	£206	£173	£137	£107	£74	£41	£8	-£25	-£58	-£91	-£124
300	£257	£224	£191	£154	£125	£92	£59	£26	-£7	-£40	-£73	-£106
325	£274	£241	£208	£172	£142	£109	£76	£43	£10	-£23	-£56	-£89
350	£291	£258	£225	£188	£159	£126	£93	£60	£26	-£7	-£40	-£73
375	£307	£274	£241	£205	£175	£142	£109	£76	£43	£10	-£23	-£56
400	£323	£290	£257	£221	£191	£158	£125	£92	£59	£26	-£7	-£40

Table 12: Change in annual energy bill of domestic heat and electricity customers on scheme

		Export PPA Price (p/kWh)											
		6	6.5	7	7.5	8	8.5	9	9.5	10	10.5	11	11.5
Number of Domestic Properties in Scheme	115	-£7	-£2	£2	£7	£11	£16	£20	£25	£29	£34	£39	£43
	125	-£7	-£2	£2	£7	£11	£15	£20	£24	£29	£33	£37	£42
	150	-£6	-£2	£2	£6	£10	£14	£18	£22	£26	£31	£35	£39
	175	-£6	-£3	£1	£5	£9	£13	£16	£20	£24	£28	£32	£35
	200	-£6	-£3	£1	£4	£8	£11	£15	£18	£22	£25	£29	£32
	225	-£7	-£4	£0	£3	£6	£9	£13	£16	£19	£23	£26	£29
	250	-£7	-£4	-£1	£2	£5	£8	£11	£14	£17	£20	£23	£26
	275	-£8	-£5	-£3	£0	£3	£6	£9	£11	£14	£17	£20	£23
	300	-£9	-£6	-£4	-£1	£1	£4	£7	£9	£12	£14	£17	£20
	325	-£10	-£8	-£5	-£3	-£1	£2	£4	£7	£9	£11	£14	£16
	350	-£11	-£9	-£7	-£5	-£2	£0	£2	£4	£6	£9	£11	£13
	375	-£13	-£11	-£9	-£7	-£5	-£3	-£1	£2	£4	£6	£8	£10
	400	-£14	-£12	-£10	-£9	-£7	-£5	-£3	-£1	£1	£3	£5	£7

Table 13: Change in annual scheme cashflow based on number of domestic heat and electricity customers and export PPA price

Number of Domestic Properties in Scheme	**Annual Discount in Domestic Customer Standing Charge**								
	£0	£25	£50	£75	£105	£125	£150	£175	£200
	Change in Annual Energy Cost of Heat and Electricity Customers after joining Scheme (£)								
115	**-£1**	**-£26**	**-£51**	**-£76**	**-£106**	**-£126**	**-£151**	**-£176**	**-£201**
150	£34	£9	**-£16**	**-£41**	**-£71**	**-£91**	**-£116**	**-£141**	**-£166**
175	£57	£32	£7	**-£18**	**-£48**	**-£68**	**-£93**	**-£118**	-£143
200	£79	£54	£29	£4	**-£26**	**-£46**	-£71	-£96	-£121
230	£103	£78	£53	£28	**-£2**	-£22	-£47	-£72	-£97
250	£119	£94	£69	£44	£14	-£6	-£31	-£56	-£81
	Scheme Annual Cashflow (£k)								
115	**£20**	**£19**	**£17**	**£16**	**£14**	**£13**	**£12**	**£10**	**£9**
150	£18	£16	**£15**	**£13**	**£10**	**£9**	**£7**	**£5**	**£3**
175	£16	£14	£12	**£10**	**£7**	**£5**	**£3**	**£1**	-£1
200	£15	£12	£10	£7	**£4**	**£2**	£0	-£3	-£5
230	£12	£10	£7	£4	**£0**	-£2	-£5	-£8	-£11
250	£11	£8	£5	£1	-£2	-£5	-£8	-£11	-£14

*Table 14: Figures in **bold black** type show the options that meet both criteria, non-bold type means it fails one or both criteria, though the CBS could choose to give a greater discount and accept a reduction in surpluses if the project is doing well.*

Assuming the scheme connects to 115 domestic customers, the export PPA price could drop to 6.8p/kWh without resulting in negative annual cashflow. At this PPA price, the 30 year IRR of the scheme would reduce to 8.4% with an initial payback period of 26 years, and the 30 year project balance would reduce to ca. £828k.

7.3. Annual Discount on Domestic Customer Standing Charge

The base case scheme is expected to match the annual energy costs of up to 58 domestic customers who also receive an ASHP installation, and reduce the annual electricity costs of a further 57 domestic customers, who do not receive a new ASHP installation. The base case achieves this while also generating a positive cashflow of ca. £20k per annum for the scheme. If the aim of the scheme is to maximise the number of customers who transition their heating systems away from fossil fuel boilers to ASHPs, rather than generate income for a local community benefit fund, this positive cashflow could be used to reduce the annual standing charge that heat and electricity customers are required to pay. As more customers join the scheme the proportion of reduced cost electricity from local wind generation that each customer receives reduces, which can be offset by a reduction in the standing charge.

Table 15 reports the outputs of a sensitivity analysis which adjusted the annual standing charge paid to the scheme by domestic heat and electricity customers.

Year 1 Domestic Customer Finances	**Value**
Number of Domestic Customers	Total: 230 *Heat Pump Customers: 115* *Electricity Only Customers: 87* *Existing Heat Pump Customers: 28*
Scheme Standing Charge	£234
Electricity Connection Standing Charge	£225
Electricity Purchase	£1,755
Total Expenditure	**£2,213**
Customer Savings (compared to Oil)	£2
Customer Savings (compared to ASHP with Octopus Cosy tariff)	£137

Table 15: Summary of Year 1 Customer Finances with Standing Charge Reduction

The maximum total number of domestic customers joining the scheme increases from 115 up to a limit of 230 if the annual standing charge paid by customers who receive ASHP installations is reduced by £105, as the reduction in savings per household from sharing the locally generated electricity across more households is balanced by reducing the standing charge. Assuming 230 customers join the scheme, the scheme is estimated to have an initial payback period of 27 years, a 30 year balance of £822k (55% less than for the baseline scheme with 115 customers) and a reduced 30 year IRR of 8.1%, Table 16.

Overall Scheme Finances	**Base Case**	**Reduced Standing Charge**
Max number of Domestic Customers	115	230
Proportion of Customers' Electrical Demand Supplied by Local Generation	49%	39%
Proportion of Local Wind Generation Consumed by Scheme Customers	42%	59%
Initial Payback Period	15 years	27 years
30 Year Balance	£1,854k	£822k
30 Year IRR	10.0%	8.1%

Table 16: Overall Financial Metrics of Scheme with Reduced Standing Charge

It should be noted that this scheme is reliant on external initial investment to afford the capital costs of installing the wind turbine and ASHPs. Demonstrating a surplus is important to attract investment and allow room for unexpected reductions in income or high costs so it may be preferable to maximise the financial performance of the scheme initially. Once the scheme is running and performing as expected there is the possibility of it being expanded to include additional customers.

7.4. Electricity Supplied Behind the Meter to SpArC and BCCC

There is the possibility that the scheme may also be able to supply Bishop's Castle Community College (BCCC) in addition to SpArC with electricity behind the meter. The annual electrical demand of BCCC is presented in Table 17 assuming BCCC installs its own ASHPs.

Annual Demand	BCCC
Electrical	188 MWh
Heat	205 MWhth
Heat (electrified, using ASHP COP model)	63 MWh
Total Electrical Demand	*251 MWh*

Table 17: Annual Electrical Demand of BCCC

The overall scheme finances are presented in Table 18 and are comparable for the two scenarios while targeting an IRR of 10% to attract external investment, and matching the annual energy costs of heat and electricity customers prior to joining the scheme.

Overall Scheme Finances	Base Case	With BCCC
Max number of Domestic Customers	115	170
Heat and Electricity Customers Annual Standing Charge	£338.60	£218.60
Proportion of Customers' Electrical Demand Supplied by Local Generation	49%	39%
Proportion of Local Wind Generation Consumed by Scheme Customers	42%	57%
Initial Payback Period	15 years	15 years
30 Year Balance	£1,854k	£2,084k
30 Year IRR	10.0%	10.0%

Table 18: Overall Financial Metrics of Scheme

Supplying electricity to BCCC is beneficial to the college since its electricity bills will be lower and beneficial to the scheme as it will generate more income from electricity sales behind the meter compared to sales to domestic customers. Selling wind generated electricity behind the meter to BCCC also enables more domestic customers to join the scheme, 170 vs 115, while still achieving a project IRR of 10%. This is due to the additional income from electricity sales to BCCC enabling the standing charge paid by domestic customers to be reduced.

7.5. Bridport Energy Local Club Prices

The financial performance of the scheme has been reviewed using electricity tariffs reported on the Energy Local Dashboard for the Bridport club[32]. The tariffs are presented in Table 19.

Electricity Unit Rate	Paid By	Paid To	Tariff (p/kWh)
Unmatched	Customer	Supplier	Day: 23.63 Peak: 44.10 Night: 22.26
Matched	Customer	Local CBS	15.75

Table 19: Electricity Tariffs, Bridport Energy Local Club

The base case scheme using these tariffs could include up to 145 customers while delivering a 30 year project IRR of 10%, which is comparable to the base case scheme assuming the Corwen club tariffs. A comparison of the overall scheme finances for the different tariffs is presented in Table 20.

Overall Scheme Finances	Corwen	Bridport
Max number of Domestic Customers	115	145
Heat and Electricity Customers Annual Standing Charge	£338.60	£224.69
Proportion of Customers' Electrical Demand Supplied by Local Generation	49%	46%
Proportion of Local Wind Generation Consumed by Scheme Customers	42%	47%
Initial Payback Period	15 years	15 years
30 Year Balance	£1,854k	£1,970
30 Year IRR	10.0%	10.0%

Table 20: Comparison of Scheme Finances Targeting a 30 Year IRR of 10%

[32] https://dashboard.energylocal.org.uk/bridport

8. Conclusions

A distributed ASHP and wind scheme is a potentially viable solution for decarbonising the heating of some domestic properties at Bishop's Castle while also supplying electricity behind the meter to the SpArC Leisure Centre. As part of an Energy Local style scheme, the electricity generated from the planned 900kW wind turbine is estimated to be able to meet 49% of the annual electricity demand of 115 domestic customers. These customers would be supplied with discounted wind generated electricity matched on a half-hourly basis with their remaining electrical demand met by the national grid.

Annual electricity sales are predicted to create enough revenue to partially fund ASHP installations in up to 58 of these domestic properties, if targeting a 30 year project IRR of 10%, and supply electricity locally at a discounted rate while achieving cost parity with their existing oil heating systems, assuming a heating oil price of 64.51p/litre (equivalent to 7.42p/kWh of heat delivered by an oil boiler). The scheme requires these 58 heat and electricity customers to pay a £3,000 joining fee, roughly equivalent to replacing an existing oil boiler. The scheme manages and funds the annual maintenance of the ASHPs installed in each of the 58 domestic properties and replaces them after 15 years of operation at no extra cost, saving customers ca. £3,000 overall.

The remaining 57 domestic customers who join the scheme are expected to retain their existing heating systems, with 13 of these customers assumed to have already installed their own ASHPs. These groups of domestic customers will not be charged a fee to join the scheme and are predicted to experience annual cost savings ranging from £85, without an ASHP, to £475, with an ASHP.

The viability of such a scheme is reliant on updates to the proposed P441 modification to the Balancing and Settlement Code to define "local" as being the distribution network area supplied by a primary substation. The scheme has a significant dependency on a Licensed Electricity Supplier who is willing to: facilitate half hourly matching of local wind generation and domestic electrical demand, purchase wind generation which is not consumed locally, and supply customers' electrical demand which cannot be met with local generation.

Sensitivity studies have been completed which illustrate how the success of the scheme varies with: different heating oil prices, different PPA export prices, reducing the scheme surplus[33] to extend the scheme to more domestic customers, and including BCCC in the scheme. Once the scheme is up and running and performing as expected, members could choose to prioritise decarbonising the heating of more domestic properties, over maximising surplus, and expand the scheme to supply discounted electricity to up to 230 domestic properties and install ASHPs in 115 of these properties without increasing their annual energy costs.

The scheme's main financial challenge is matching or reducing the annual energy cost of domestic customers compared to oil heating systems. The modelling reported in this study has assumed a heating oil price of 7.42p/kWh which is equal to the average heating oil price over the last two years. Currently heating oil prices are lower than this, averaging 6.8p/kWh[34] over the last year, but we do not expect this price to continue for long.

The annual energy bill of domestic customers on the scheme has been compared against customers who have installed an ASHP and are on an Octopus Cosy tariff. The analysis suggests that customers could save ca. £137 per annum by joining the scheme, which equates to ca. £10,300 over the 30 year life of the scheme including the cost of replacing the ASHP after 15 years.

[33] Over and above that needed to create a fund for replacing equipment beyond the initial 30 year lifetime of the scheme.
[34] Assuming an oil boiler efficiency of 85%.