Decarbonising heating in Shenstone Parish - Executive Summary

Executive Summary

1. The Task

- The goverment has set a target that the United Kingdom will become a net zero carbon emission country by 2050. It is the responsibility of all individual home owners, community organisations, business and industries as well as the government to now take action to contribute to achieving the target.
- With funding provided by the government's Rural Community Energy Fund (RCEF), an initial review of the options for minimising residential heating carbon emissions in Shenstone and Stonnall has been completed. The review includes the technical and financial viability of developing either a whole village or individual home renewable heat energy solution.

2. Outline of Current Position in Shenstone and Stonnall

- Shenstone has around 950 homes also with community, commercial and industrial buildings surrounded by outlying farms and homes. Stonnall has around 550 homes also with community and commercial buildings surrounded by outlying farms and homes.
- Older and larger homes and buildings in both villages require more heating because they are more inefficient than newer homes and buildings. As a result the heating carbon emissions are 30% higher from homes in Shenstone and Stonnall than the UK average.
- This total village demand for heating could be significantly reduced through energy efficiency measures on individual homes. Further significant reductions could be achieved through the implementation of a community heating system.
- Following a technical and economic evaluation, two preferred options have been identified as offering a viable route to a community led decarbonised heating system.

3. Option 1: Centralised Community Heating Provision

- This first option uses a new, centrally located, energy centre building; one in each village which extracts heat from water in the underground aquifer below both Shenstone and Stonnall. To meet the heating energy demand the energy centre will also extract heat from the air through air-source heat-pumps, and on the very coldest days will further use large electric boilers to meet the higher demands of exceptionally cold weather. Homes will receive a guaranteed output temperature of 55 degrees into their home heating systems.
- The hot water would be pumped from the energy centre and travel through new highly insulated pipes introduced into roads in both villages to reach each home. The pipes would extend to the boundaries of each village, but are not proposed to serve buildings outside of the main villages.
- Further gains to the community could be achieved through a local wind turbine and solar farm providing electricity to the energy centres.

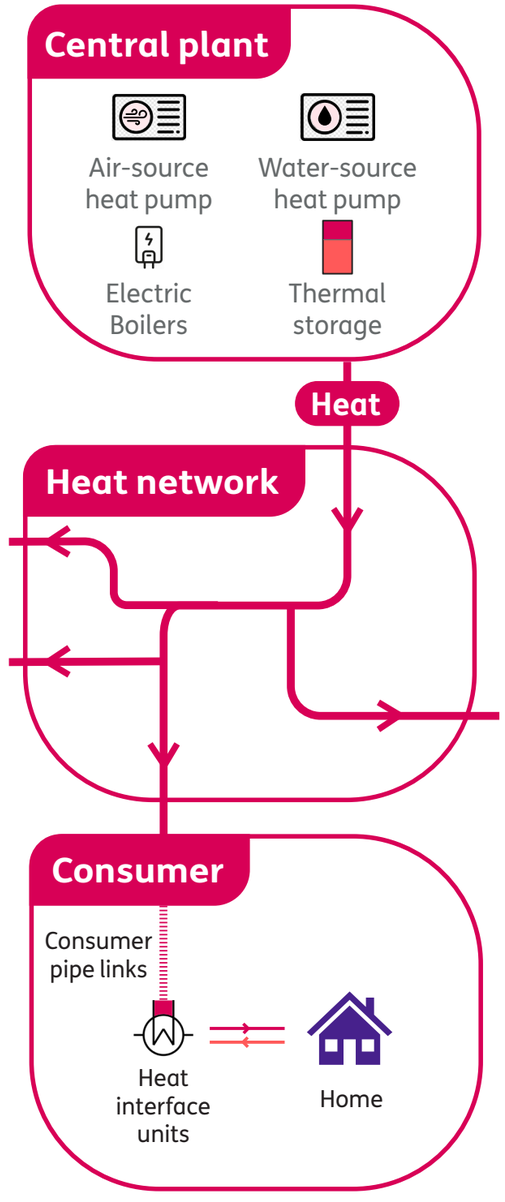
4. The Benefits of Option 1

- The majority of heat required to serve each Shenstone home's needs will come from an existing borehole to a large aquifer below the village. The majority of heat required to serve each Stonnall home's needs will come from the same large aquifer below the village, but will require a new borehole to be drilled. In this latter case, although drilling a borehole is a well established process, there is always a risk that the yields may not be as high as predicted.
- This scheme would deliver zero carbon emissions from heating all residential homes possible by 2035, and upfront a carbon reduction of over 70% will be delivered in comparison to an existing gas boiler system in a home.
- The financial benefits of local renewable energy generation are likely to become significant with the increase in energy costs that that are predicted for the immediate future.

5. The Costs of Option 1

- The feasibility study cost estimates for Shenstone show the centralised community energy centre option will cost a total of £6.2 million for a water, air and electric energy centre and £9.9 million for pumping and piping. A total of £ 16.1 million.
- The feasibility study cost estimates for Stonnall show the centralised community energy centre option will cost a total of £4.2 million for a water, air and electric energy centre and £5.3 million for pumping and piping. A total of £9.5 million.
- The feasibility of both schemes is reliant on around 80% of residents connecting to each District Network over a period of 10 years, with an start-up connection requirement of at least 200 households
- Connections to the scheme would cost households £3.2k on average.
- Households would pay an average standing charge of £450 per annum to service the debt of the initial scheme development, and cover on-going maintenance and replacement costs. For the purpose of modelling the unit price of heat was locked to 10% below the gas price, but different pricing options could be explored by the community in any subsequent study.

Greater benefits could be delivered if local renewable energy generation is provided to the energy centre, but this is beyond the scope of this project and would need to be explored in a more detailed follow up study.



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6. Option 2: Decentralised Community Heating Provision

- This second option is based on individual home heat generation through air source heat pumps. The air source heat pump provides space heating at temperatures between 35 and 65 degrees centigrade and hot water up to 65 degrees centigrade.
- The air source heat pump can operate at temperatures matched to the level of insulation and heating systems .Installing energy efficiency measures to reduce the heating load in older homes would lead to significantly improved heat pump performance.
- Air sources heat pumps use electricity to generate heat and the electricity costs could be reduced by community electricity purchasing and distribution solutions, such as through a local private electrical grid

7. The Benefits of Option 2

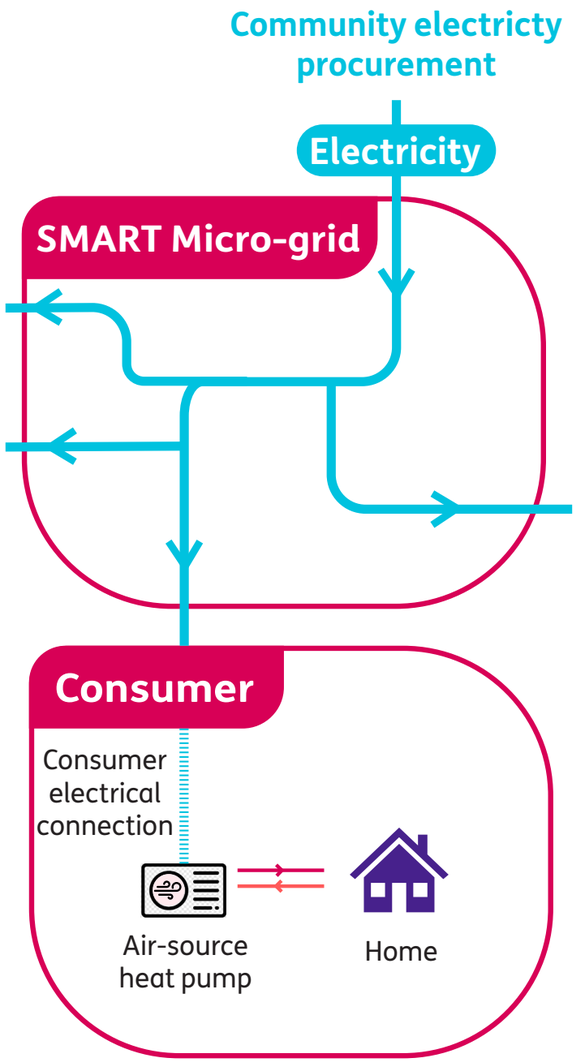
- Option 2 requires less disruptive work around the village to install compared to installing a heat network. Installing a local private grid would require small trenches to house the electrical wires, as opposed to the larger and deeper trenches required to house the pipework of Option 1.
- Air source unit heat pump capacity and temperature specification could be matched to each unique Shenstone and Stonnall home.
- This scheme would deliver zero carbon emissions from heating all residential homes possible by 2035, and upfront a carbon reduction of over 60% will be delivered in comparison to an existing gas boiler system in a home.
- As this solution distributes heating systems into each home, a smaller proportion of the village would need to connect for the scheme to be judged viable. This threshold would likely be around 40-50% of the village.

8. The Cost of Option 2

- Option 2 has lower initial capital investment costs compared to Option 1 – however, as the equipment would be positioned on the property of those residents connected to the scheme, the upfront costs to customers could be higher. Developing a commercial model of a scheme of this sort would need to be explored in more detail to properly quantify the costs to individual households.
- The feasibility study cost estimates show that air source heat pump purchase and installation costs for 80% of households would be £12.5 million for Shenstone and £7.2 million for Stonnall
- If a local private grid was developed to power each households air-source heat pump installation, it is estimated that the grid would cost £3-5 million to develop and install. This upfront cost would increase if the grid incorporated battery storage.
- The heat-pump installations in individual homes have a service life of between 15 and 20 years. Around this age, all heat-pumps would need to be replaced, however it is possible that equipment and installation costs could be significantly lower in 15 years' time due to technological advances.
- A standing charge around £300 is estimated to be required to cover the costs of the network and the system replacement if the entire system was debt financed at no upfront cost to customers
- There are two ways of structuring the on-going energy costs and payments of this system options:
  - Individual energy tariffs – the heat pumps could be installed behind the households current meter, and paid for through an electrical consumer retail arrangement. This option would likely lead to an increase in heating costs of around 30% over an existing gas boiler system.
  - Community energy tariff from local private grid – a local private grid could bulk purchase electricity at a reduced price to individual consumers. In addition, the local private grid could incorporate local renewable generation to further save consumers money on their energy bills. The bill saving depends on the quantity of local renewable generation. Wind power would be the preferred solution, due to the good power generation potential in winter.

9. Provision for More Isolated Homes.

- It is likely that connecting isolated homes to either of the community networks would not be cost effective.
- The preferred option for these properties would be the installation of individual air source heat pumps.
- Traditional older and larger remote homes may need improved insulation and radiator resizing



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10. Conclusions and Recommendations

- Two options have been identified for decarbonising the heating demands for each of the villages of Shenstone and Stonnall:
  - Option 1: a central energy heating centre with a communal supply network;
  - Option2: an individual air source heat pump for each household with the ability to attach community electricity purchasing and distribution solutions.
- For Option 1, the existing un-used borehole in Shenstone provides an opportunity to exploit the aquifer beneath the village as a heat source. Drilling a new borehole could provide a similar heat source for Stonnall. Utilisation of the aquifer provides a more stable and reliable source of heat than relying on air, and the higher efficiency of this source would deliver security and savings to consumers. To be resilient and sustain heating provision during very cold winters and very hot summers heating from the aquifer would be supported by additional communal air source heating and communal electricity boilers. These would provide a flexible central plant capable of providing heat at high efficiency all year round.
- For both preferred options it is assumed that the majority of household radiators will operate with temperatures of 50 to 60 degrees centigrade. However, many older and and more vulnerable households in Shenstone and to a lesser extent Stonnall may require additional insulation upgrade measures and radiator size adjustments.
- It is recommended that further funding is sought to enable the two Options to be taken forward for a more detailed evaluation of their technical and financial viability.
- It is also recommended that any further assessment of Option 1 consider the potential of sinking a second heat source borehole at Shenstone.
- Further consideration of Option 2 should include the viability of community renewable power generation coupled with a smart grid distribution system.

11. Next Steps

- The Parish Council will share the findings of this Feasibility Study to the respective communities and seek their support for further detailed evaluation of the two recommended options

- Further central government, local government and private sector financial support will be sought to allow a more detailed exploration of the viability of the two identified Options.

- The potential for collaboration with Whittington and Fisherwick will be explored.

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