

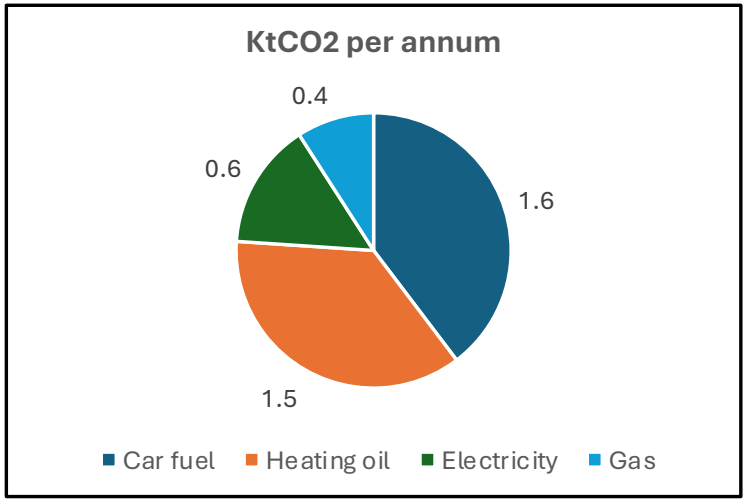
Broughton Community Energy

High-Level Decarbonisation Strategy

The BCE Programme's focus is to reduce Scope 1 & 2 CO2 emissions from fossil fuel heating, private vehicle travel, and electricity consumption. We've estimated our current emissions from the associated fuels. Our largest emissions are from cars and oil heating.

Car fuel - 7.2 GWh
(1.6 $KtCO_2$)

- Mean cars per Broughton household taken from UK 2021 census: 1.8
- Total number of households in Broughton: 485
- Assumed annual mileage per car: 7,000 (higher than the national average because of rural location)
- Assumed miles per gallon: 40 mpg
- CO_2 emitted per litre of fuel: 2.4 Kg



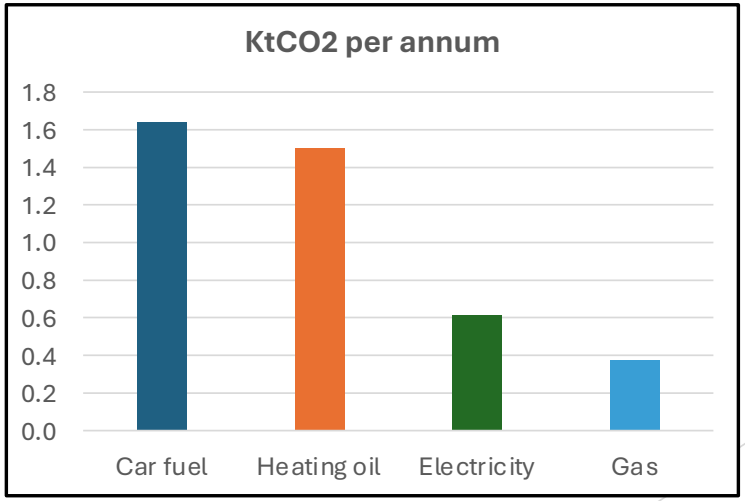
Oil – 6.1 GWh
(1.5 $KtCO_2$)

- Data taken from Broughton group oil buying scheme.
- Households are included in the sample if they have consistently ordered oil from the scheme from 2020 to 2024.
- Mean annual oil consumption (calculated from 122 qualifying households): 2,550 litres.
- Total number of households in Broughton: 485
- % of households in Broughton that use oil taken from UK 2021 census: 48%
- CO_2 emitted per litre of oil: 2.54 Kg.

Electricity – 3.0 GWh
(0.6 $KtCO_2$)

- Based on the latest data published by the Office for National Statistics – 2022 electricity consumption by UK postcode.
- Broughton postcodes obtained from www.doogal.co.uk
- 45 x SO20 8xx postcodes included in the total.
- Total usage in 2022: 3.0 GWh*
- Carbon intensity of UK electricity: 207g / kWh

* To put this in context, 3 GWh is 0.04% of Hampshire's annual consumption of 7,500 GWh



Gas – 1.6 GWh
(0.4 $KtCO_2$)

- Assumed that households using gas for heating have the same average energy requirement as those using oil.
- Energy per litre of oil: 10.4 kWh
- Total energy from oil consumed in Broughton per annum (from oil analysis): 6.1 GWh
- % of households that use oil: 48%
- % of households that use gas: 13%
- Energy required from gas: 1.6 GWh
- CO_2 emitted per kWh of gas: 0.23 Kg

We need new, sustainable solutions to reduce our CO2 emissions.

Heating & home insulation

Heat pumps are the only viable option to replace oil and gas-fired boilers[2]. Any existing electric heating (e.g., storage heaters) will be sustainable once the electricity is zero-carbon. Home insulation is important to reduce the cost of heating and maximise the availability of sustainable electricity.[3]

- Group purchase schemes (heat pumps, home insulation, etc.)
- Ambient ground source loop(s) + household heat pumps
- Central heat factory + individual heat exchangers[4]
- Household energy efficiency surveys and advice

Personal transport

Our cars will be replaced by electric vehicles (EVs)[5]. The availability of low-cost, zero-carbon electricity will encourage the transition to EVs.

- Community EV charging points

Electricity generation & storage

Heat pumps and EVs need sustainable electricity, so generation must underpin our strategy. Sustainable electricity will also reduce emissions from other electricity usage. Lower costs will encourage the uptake of heat pumps and EVs. Energy storage is needed to maintain the supply when the sun isn't shining and/or the wind isn't blowing[6].

- Community solar farm
- Community wind turbine
- Group purchase of rooftop solar PV
- Community and individual energy storage
- EV storage and supply to home/grid[7]

The local generation of zero-carbon electricity enables our decarbonisation strategy[8]

Notes

1. We've estimated our emissions from cars at 1.6 $KtCO_2$, oil-fired boilers at 1.5 $KtCO_2$, electricity at 0.6 $KtCO_2$ and gas at 0.4 $KtCO_2$

2. The government is expected to decide whether to use hydrogen for domestic heating in 2026. However, all indications are that hydrogen will be in limited supply and reserved for industrial processes that require high heat (e.g., steel production). Electric heating is an option, but this is 3-4 times less efficient than heat pumps. Electric heating will remain an option for properties that aren't suitable for heat pumps.

3. Electricity demand is expected to double over the coming years to meet the UK's 2050 target. This means that nationally, the generation of sustainable electricity will need to quadruple from its current level. Local community generation is expected to contribute to meeting this increase in national demand. The increase in demand for electricity in our village will likely be 2.5x because of our current dependency on fuel oil and our use of private transport given our rural location.

4. The feasibility study will likely discount a central heat factory because of the high capital costs, energy loss from transporting water at high temperatures, the impact of laying hot water pipes through the village, and the disruption to households when retrofitting the hot water supply and heat exchangers.

5. There has been speculation about using hydrogen fuel cells in cars, but hydrogen is expected to be reserved for heavy goods vehicles.

6. Energy storage is critical to achieving a 100% zero-carbon energy supply. Excess sustainable energy production can be stored and used to meet demand when insufficient sustainable energy is generated. If a shortfall needs to be made up from the National Grid, it can be purchased and stored when electricity costs are at their lowest.

7. In the future, households will likely use their EVs to store energy when electricity prices are low and to supply the home when electricity prices are high or when there's an insufficient supply of sustainable electricity. It's estimated that an average EV could meet the electricity needs of an average UK household for about six days.

8. It could be argued that we should rely on the UK government to deliver 100% renewable electricity to the National Grid. However, the national demand for sustainable electricity is expected to increase by a factor of 4 over the coming years, and local community generation is needed to help meet this need. In addition, local generation will reduce the cost of electricity to the community, increase engagement in sustainability, and consequently accelerate the uptake of sustainable technologies (e.g., heat pumps and EVs).

Our Strategy

Subject to extensive community consultation.





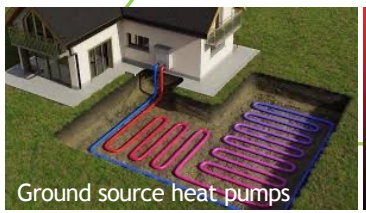


Zero-carbon electricity: Our strategy is enabled by the local generation of low-cost, sustainable electricity. Local energy storage or supply from the National Grid will be important when the sun isn't shining, or the wind isn't blowing.



Community support: Community engagement is essential to ensure support. We will achieve this through workshops, household energy efficiency surveys, and advice. Group purchase schemes of heat pumps and insulation will also be considered.





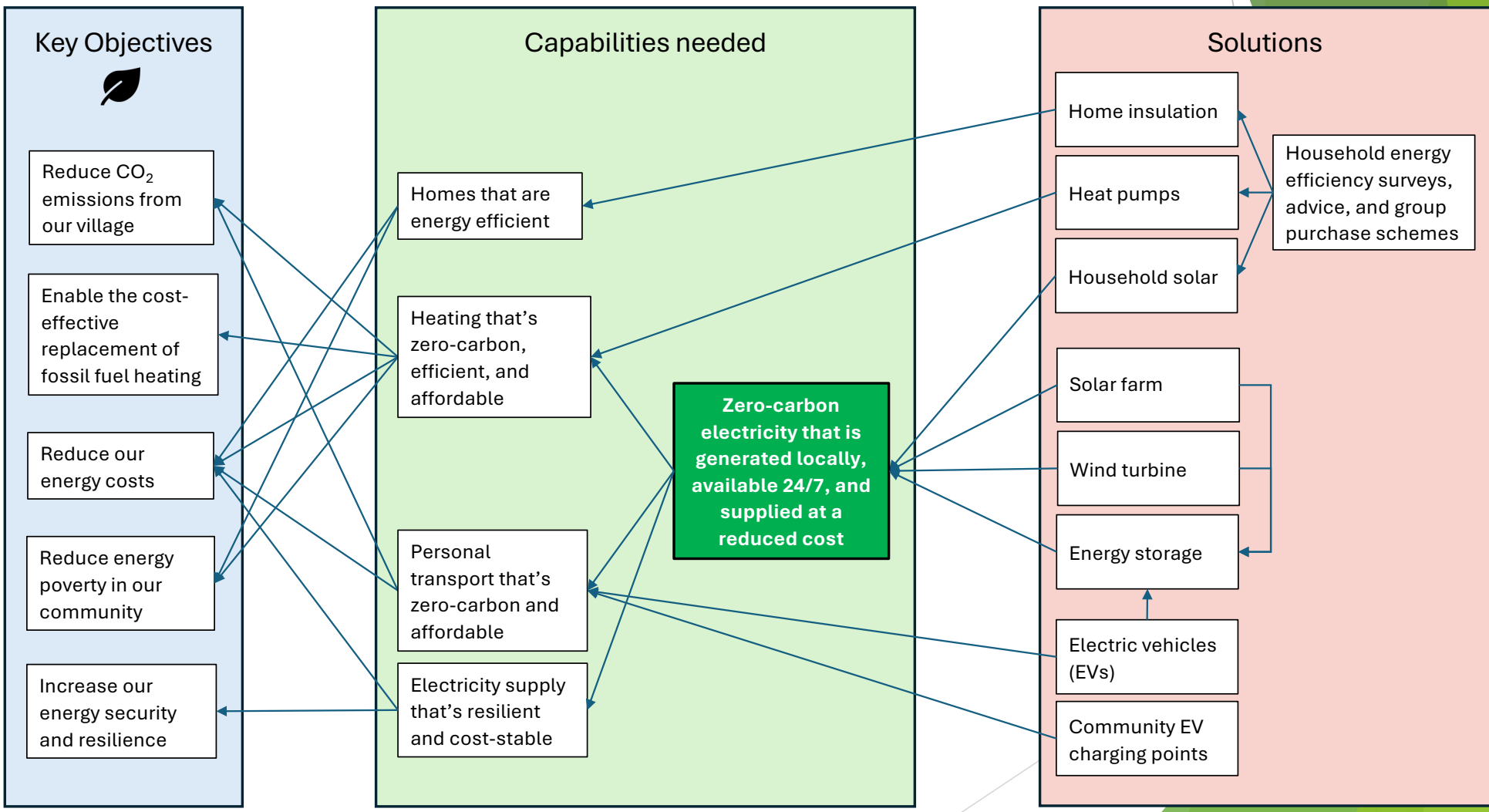


Heat pumps and storage heaters: Heat pumps are the most efficient alternative to fossil fuel heating systems. Low-cost electricity will encourage their adoption. Existing electric storage heaters will be sustainable when supplied with zero-carbon electricity.



Electric vehicles: We will support the transition to EVs through low-cost electricity and with community EV charging points to ensure equity.

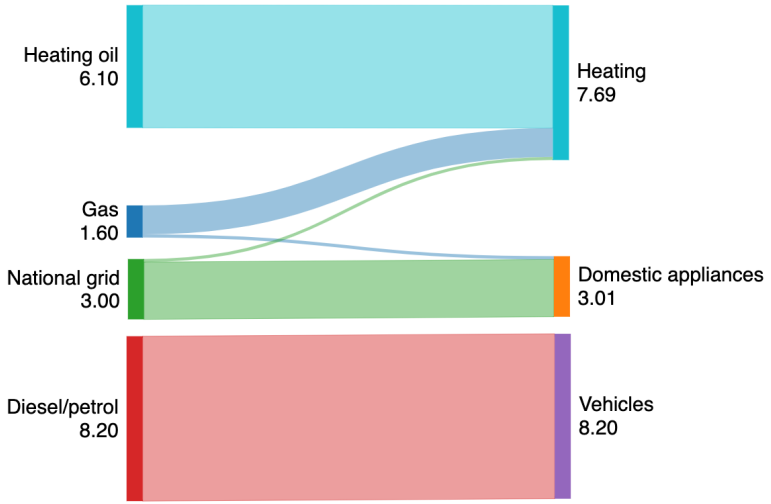
Our objectives will be achieved through new sustainable capabilities and the solutions needed to achieve them



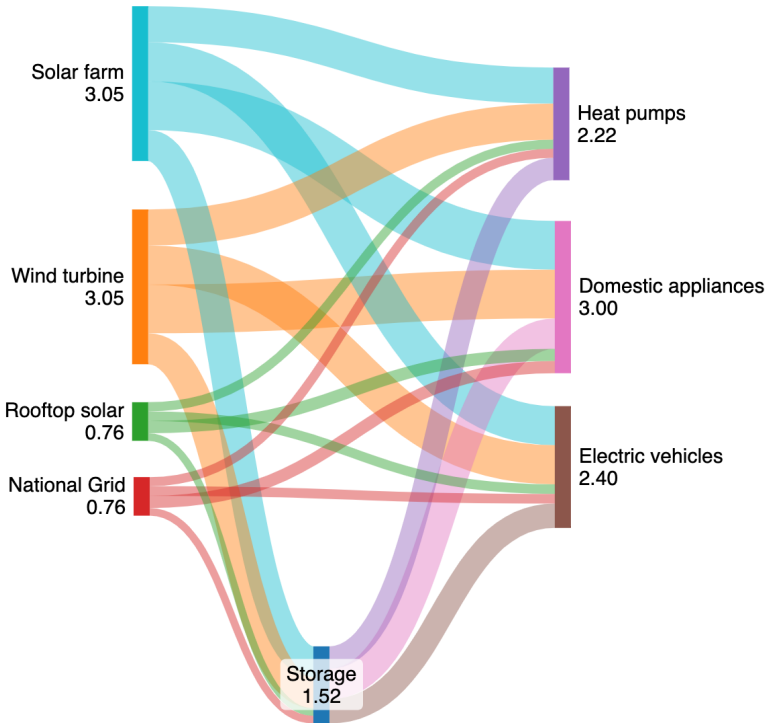
The transition from fossil fuels to zero-carbon electricity

Our vision is for our village to be powered and heated entirely by sustainable, secure, zero-carbon electricity.

Today (19 GWh)



Future (8 GWh)



Indicative only

- The efficiency of heat pumps and EVs reduces the input energy required by over 50%, from 19 GWh to 8 GWh.
- The demand for electricity increases by over 150%, from 3 GWh to 8 GWh.

Our initial focus: a community solar farm and wind turbine

- We've estimated our long-term electricity requirement at **7.3 GWh per annum.**
- This is 2.5x (or a 145% increase) on our current consumption of 3 GWh.
- Solar farms typically generate 0.24 GWh/acre/year after accounting for efficiency.
- An area of 12 acres would meet our current need, rising to **30 acres** in future.
- Peak power output is typically 0.25 MWp per acre, so a 31-acre installation would have a peak power output of **7.5 MWp.**
- The addition of a wind turbine would significantly reduce our land requirement, which would be further reduced with the widespread adoption of domestic rooftop solar.
- An onshore wind turbine in the south of the UK can be expected to generate at least **4 GWh per annum**, which is more than 50% of our future energy needs.
- A mixture of solar and wind is ideal because solar output is significantly lower in winter and non-existent at night, but the wind can always blow.

Key outstanding questions

- Does the community support our strategy?
- What are the best (and acceptable) locations for the solar farm and wind turbine?
- What is the viability, cost and likely timescale of connecting these generation plants to the national grid?
- What are viable up-front capital funding and ongoing operational models?
- Is local energy storage cost-effective, or should we rely on the national grid to meet any demand vs. supply shortfalls?
- What local electricity tariff cost per kWh can we achieve to encourage the transition to heat pumps and EVs?
- Is ambient ground source heating viable for certain high-density housing in our village, and should we include this in our long-term plan?

Our initial focus is Electricity Generation because it enables the other strategic pillars. Future projects will address the remaining pillars.

