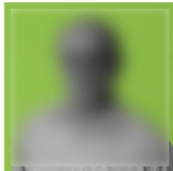




ZERO CARBON HOMES

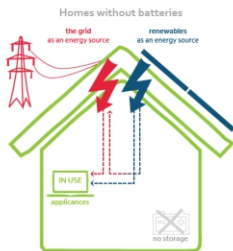
energy production and storage



Living in a Zero Carbon Home

"I am a professor of Electrical Engineering at the University of Sheffield. Some of the things I'm working on are using batteries recycled from electric vehicles for energy storage in homes, testing large scale centralised electricity storage, improving battery reliability in electric vehicles."

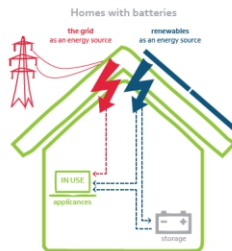
Even when you produce your own electricity you still import some energy from the **grid**, because you can't always use the energy you produce all the time.



≈ 30%

grid independence

Energy is **exported** and **imported** from the grid depending on the demand and the rate of production. Therefore homes are more dependent on the grid.



≈ 70%

grid independence

No energy is **exported** to the grid. Energy is only **imported** from the grid when the battery is empty. Therefore homes are less dependent on the grid.

Why is Energy Storage Important?

Over a year, a home PV installation could generate more electricity than is needed. Energy storage does two things. Firstly it allows the home to use more of its own renewable generated electricity. Secondly, it prevents the risk of the grid getting overloaded at times of peak renewable generation.

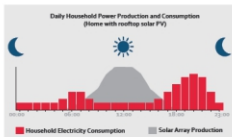
Smart Housing

The house could be "smart" enough to store or not electricity depending on whether grid electricity is more or less expensive relative to what is generated by the house. Individual homes could automatically buy and sell electricity to suit their needs.

Energy Storage in the future

For Stocksbridge and the rest of the UK, electricity storage will not be a disruptive addition to the infrastructural fabric of the country. It will be underdone and hands off but could change the ways we use electricity.

It will be more than just using as much as possible of the energy that we generate but it will help us to keep heating the electricity distribution network that provided electricity to all of us when there is nothing else left.



The future of Stocksbridge in 2024?

How to finance Energy Storage?

At the moment, in the UK there are no financial incentives for battery storage. For a home, the price of batteries can significantly add to the cost of a PV system and their lifetime is much shorter than the PV panels on the roof (based on typical energy use, a 10 year warranty). Researchers are working hard to reduce the cost and increase the lifetime of battery storage.

+ 20-40%

cost to install a battery storage system
in combination with PV



Electric Car

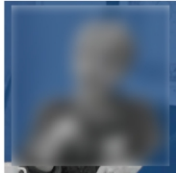
Battery Bank

A house can store electricity that is not consumed inside an electric car or battery bank



ELECTRICITY FROM WIND POWER

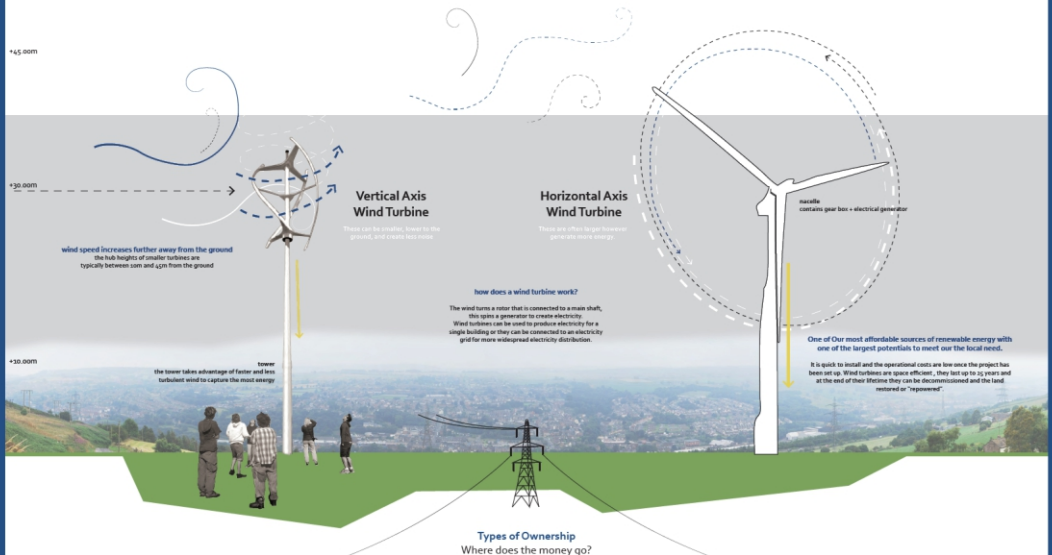
what is the wind potential in Stocksbridge?



Wind power in Stocksbridge

"The wind is free and we have a lot of it in our valley. It makes all the sense in the world to harness it, it has been done for a thousand years. Future energy generation needs to be a mixture from many sources. Every time I pass through West Yorkshire, I see more and more domestic wind turbines in our valleys encouraging."

Whether to erect commercial wind turbines in our valley seems to me to be a separate matter. The question is "who has the right to alter our skyline (countrywide) greenbelt for their own profit?" No contentious reply would be that if the turbine was supported and owned by the community (for example to pay for the energy needs of our Sports Centre or perhaps to generate electricity for its residents), then it should go ahead."



farmers?

Farmers sign a land rental agreement, a wind power company takes care of the installation and the land owners earn land rental income.



the community?

The community can purchase land to develop a shared ownership wind farm that would generate electricity to be used locally. This could significantly contribute to the demands of buildings such as the Leisure Centre.



individual homes

Micro wind turbines can help to reduce your energy demand from the grid. This can either be sold back to the grid or stored onsite in batteries.

CASE STUDY

Baywind Energy Co-operative Cumbria

www.baywind.co.uk/baywind_home.asp

1996 - 1997 £1.5 million raised to buy two 1.5 MW turbines at Herkess Hill wind farm near Silloth.

1998 - 1999 £450,000 raised to buy one 660kW turbine at the Harrold Hill wind farm near Silloth.

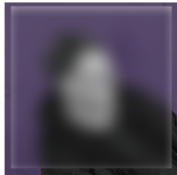
The co-op was formed in 1996 for 2 directions, it has now grown to 3, you shareholders in the UK and abroad. Preference is given to local people 35% of existing Baywind shareholders live either in Cumbria or Lancashire with a wider number from the Northwest Region. Every member receives a yearly share interest based on the profits earned from electricity generation during the year.





STOCKSBRIDGE BY TRAIN

What options does Stocksbridge have for more sustainable transport?



**Stocksbridge to Sheffield in eleven minutes.
That's the plan.**

"Using the existing track linking Stocksbridge with Sheffield Victoria Station, just one vehicle could provide passengers with a regular, half hourly train service.

Despite research suggesting that there is substantial local demand for one, there hasn't been a regular passenger service along the Don Valley line since the late 1990s. The Don Valley Railway is a local campaign group committed to seeing the reinstatement of a regular, reliable and convenient commuter rail service along this underused line."

**A Light rail or light rail transit (LRT) between
Stocksbridge and Sheffield**



In association with:



A SITE FOR THE FUTURE STATION

Chris Bell has identified the potential location for a station within Stocksbridge. He suggests the St Matthew Church on Manchester Road a good location and land to the rear of the church has previously been allocated for a station.

The church is a large, Victorian building which needs more maintenance. The congregation has declined over the last 10 years and now the church is struggling to reach our financial requirements.

"Faced with the increasing costs of owning such a large, historic building, the Parochial Church Council has been looking at options as to how the building can be used both by the church and the community."

- A Diocese of Sheffield spokesman

Chris suggests the combination of the Church and a Station should be explored. Further review could be part by looking into setting up a station shop.



St Matthew Church, Stocksbridge

COST ESTIMATION

The cost is estimated at £4.3 million pounds – a staggering reduction on previous estimates. This reduction was achieved because a track inspection identified the good condition of the existing track.

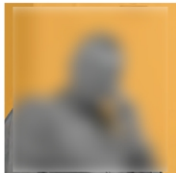
It may be possible to reduce the cost below the £4.3 million price tag – not least because savings include approved bus (as part of the train is added by off-art cost risks involved in development).





ELECTRICITY FROM THE SUN

Photovoltaic panels on your home

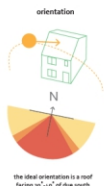


Living with PV Panels in Stocksbridge

Some people with PV panels adjust their lifestyle to ensure they use as much of the energy they generate as possible. For example using their washing machines in the middle of the day when the PV panels are at the highest energy generation rate. Once installed there are a "fit and forget" technology. Although the initial costs can be high, they are low maintenance and some can last for over 25 years!

The requirements of PV panels

Even if your roof is not the perfect orientation or pitch you can still generate a stable amount of energy



pitch



Effect of orientation + pitch on array performance - South Yorkshire

energy per year (kWh) (10% peak)	South-East	South	South-West
10°	1000	1000	1000
20°	1000	1000	1000
30°	1000	1000	1000
40°	1000	1000	1000
50°	1000	1000	1000
60°	1000	1000	1000
70°	1000	1000	1000
80°	1000	1000	1000
90°	1000	1000	1000
100°	1000	1000	1000
110°	1000	1000	1000
120°	1000	1000	1000
130°	1000	1000	1000
140°	1000	1000	1000
150°	1000	1000	1000
160°	1000	1000	1000
170°	1000	1000	1000
180°	1000	1000	1000

ref: www.microgen-database.org.uk

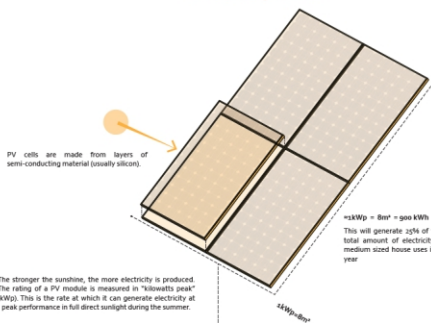
exposure



Any shade, such as from trees or neighbouring buildings, can have a large impact on the performance of a PV system



How does a solar panel work?



PV cells are made from layers of semi-conducting material (usually silicon).

The stronger the sunshine, the more electricity is produced. The rating of a PV module is measured in "kilowatts peak" (kWp). This is the rate at which it can generate electricity at peak performance in full direct sunlight during the summer.

$4kWp \times 8hr = 32kWh$
This will generate 20% of the total amount of electricity a medium sized house uses in a year

A 4kWp PV array will generate the same amount of electricity as medium sized house consumes in a year

Under the Government's "Feed-in-Tariff" you can get paid for all the units that you generate (even if these are used onsite)

Groups of cells are mounted together in panels or modules that can be mounted on your roof. Most PV systems are made up of panels that fit on top of an existing roof, but you can also fit solar tiles instead of standard roof tiles.

The size of a 4kWp array



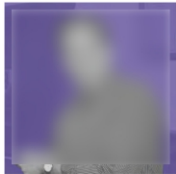
Installation of a PV panel

Check the orientation, exposure and pitch of your roof, this will affect the payback time. Any roof should be structurally surveyed to ensure PV panels can be fitted. The cost of installation is increased for slate/tile roofs rather than concrete tiles because more tiles need to be removed to lay the stainless-steel roof hooks and re-flash it.



SUSTAINABLE LEISURE CENTRE

how can the leisure centre be more environmentally + economically sustainable

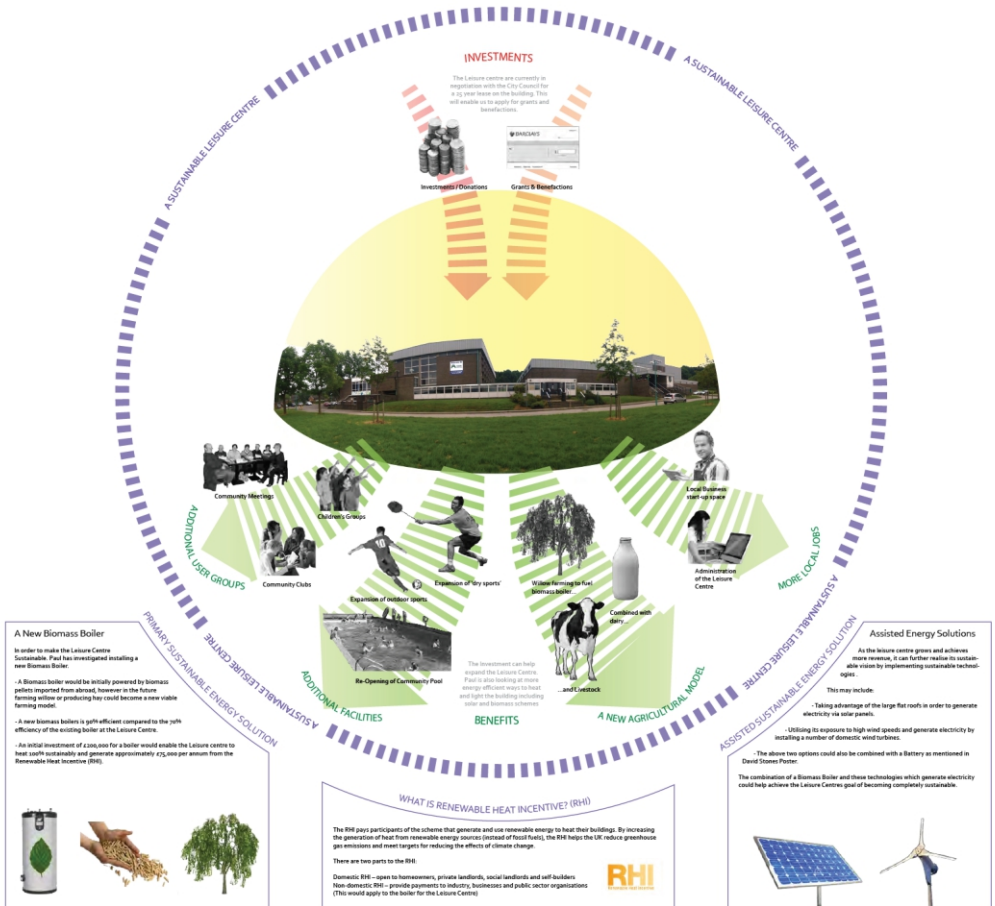


How to power the Leisure Centre

In January 2013 Sheffield City Council announced that, due to budget cuts, it intended to close Stocksbridge Leisure Centre and Swimming Bath. The centre was closed for around three months during the summer of 2013 during which over a huge group of volunteers set about refurbishing the centre. Money was raised by the council and raised in the community, local firms donated supplies and individuals undertook over 2000 hours of voluntary work.

The dry sports facilities were open to groups from September 2013 with a full public opening in January 2014. The pool remains closed until sufficient funds can be raised to carry out the necessary repairs and refurbishment.

The long term goal for the Leisure Centre to be fully operational and powered sustainably.





THE INMAN INITIATIVE

a brighter future for a beloved building



Progressing the Inman Centre

"Since the 60's the Inman Pavilion has been a much loved community hall and it still is, but it's showing its age a little now. It is structurally sound but leaks energy. It has plenty of space but it needs a little reorganisation to make it more useful for the different groups. Now it has a committee of people representing all the groups using it and the aim is to make the Pavilion a flexible, energy-efficient building sustainable for the next 30 years or so!"



we have
poor lighting
(artificial + natural)

we have
a lack of storage
facilities

we have
a lack of storage
external space

we want
a more efficient
heating strategy

we want
to modernise the
kitchen + toilets

Timeline of the Inman Pavilion



The future sustainable vision -
their is more to come!

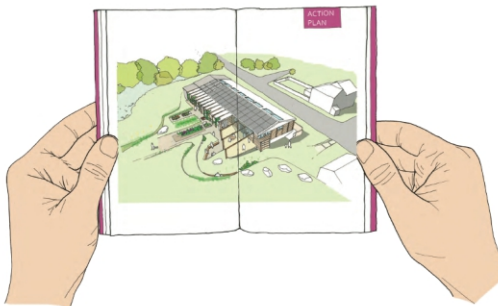
It's a big job. But in October and November 2013, the Inman had ideas help from a Sheffield University Student Live Project. Architecture students worked in consultation with different Inman users to vision the future of the Pavilion.

The Inman committee has been given a comprehensive document with suggestions for optimising space, improving insulation, for alternative sources of heating, community gardens and more. The document can be viewed at the Library.

Now the Inman committee is recruiting volunteers to assist with the most practical.

Now is the time to add your ideas!

Are you knowledgeable in building surveying, cladding or planning policy?
We would love for you to join our team





RECOVERING HEAT FROM TATA STEEL

From waste to a resource: What to do with the waste heat from the steelworks?



Can Tata's waste heat be harnessed?

If the waste heat is going to be released into the environment, why not use this as a resource instead?

"Imagine converting something that is considered waste by the steel industry into a resource that could be used by the town of Stocksbridge. Laying down the heat (through a water distribution network) would not be cheap and may be disruptive during the time of construction but Stocksbridge would not be the first town to do it. Combined heat generation (district heating) is widely deployed in some continental European cities as well as in the city centre in Sheffield. If this scheme is feasible, the first users to be connected would be those buildings with the highest demand for heating such as public buildings, community centres and schools."

The steelworks generate a great deal of waste heat from its industrial process:

Who are the potential users?

The first users would be the biggest consumers of energy for heating within the community such as community areas, commercial establishments and public buildings. The network could later be extended for all interested residents. Extra heat could later be sent towards Sheffield and other communities.

A potential first user district heating pipe is shown on the Stocksbridge Valley model.

Heat from overground pipes

District heating is distributed via underground pipes

Heat from industrial ducts

By harnessing wasted heat from Steel works, Stocksbridge will be significantly lowering its carbon footprint

Where are nearby examples of distributed heating networks?

Sheffield has a well developed heating network that connects major buildings in the city centre area fed by a source that generates heat and electricity by burning refuse. However, there are other local areas where the heating network is developed to an extent that it provided heat to commercial and public buildings as well as over 50,000 residential properties of the city total.

The amount of waste heat that the steel works generates could cover the heating needs of:



x 125

the heating demand of 2000 local homes within Stocksbridge

OR



the equivalent demand of 10 Stocksbridge Leisure Centres combined

OR



around half the domestic gas demand of Stocksbridge

for 1/2 of Stocksbridge

POSSIBLE BENEFICIARIES:

- Leisure Centre
- Stocksbridge High School
- St Anne's Catholic Primary School
- Stocksbridge Junior School
- The Co-Operative Food
- Stocksbridge Town Council
- Stocksbridge Library
- and more....

* calculations based on the equivalent of 6 tonnes of steam were produced every hour



COMMUNITY HYDRO POWER

harnessing electricity from the weirs in the Upper Don



Hydro power on the Upper Don

"I'm looking at the potential to obtain wider support from the community for schemes to generate electricity from local weirs and reservoirs (using turbines or Archimedes screws). Also, ideally the electricity generated would be mainly used by nearby houses and businesses."



Hydropower helped to power the industrial past of the region.

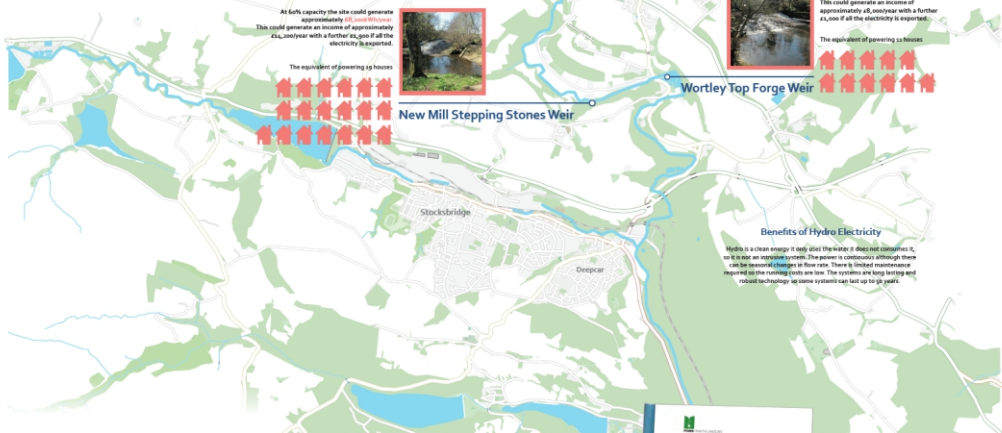
Can it still contribute as an energy source for the future and what is the electricity generation potential of the local streams and rivers?

How does Hydro Electricity Work?

Electricity is produced when a flow of water is channelled through a turbine connected to an electricity generator. Two factors are important: the head (vertical drop) of water, and the flow. These will determine the amount of energy which can be produced. Hydroelectric schemes can be divided into two broad categories: large scale - more than 5 MW and small scale - less than 5 MW. In the steep sided valleys of the South Pennine catchment area, most of the streams are high head, low flow - below 100 kW. A system producing 1 kW consistently over a year, would generate 8,760 kWh a year.

Hydro systems can be connected to the main electricity grid or as stand alone 'off-grid' power systems. In a grid connected system, any electricity generated but not used can be sold to electricity companies. In an off-grid system, the electricity generated but not used can be sold to electricity companies. Close to where the power will be used, or to a suitable grid connection.

www.gov.uk/government/uploads/system/uploads/attachment_data/file/304006/Small-scale-hydro-power.pdf



SADDLEWORTH GREATER MANCHESTER
England's first high head community owned hydroelectric plant

CASE STUDY

Dove Stone Reservoir Saddleworth Greater Manchester

By harnessing the 90 foot dam on the Dove Stone Reservoir, the 30kW crossflow turbine will generate some 170,000 kWh/year of electricity.

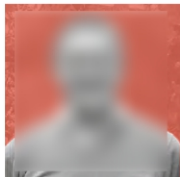
This could generate an annual income of £35,700.

Running costs are approximately £3,000, but it is estimated the scheme will save about 1,000 tonnes of CO₂ per year.

Saddleworth Community Hydro has been supported by hope (Water Power Enterprises), a social enterprise that removes the risk from community energy projects by funding upfront costs such as legal fees, environmental consultants and design work. In Saddleworth's case, this has already amounted to almost £30,000.



Heating your home from the mines



"The huge amounts of water now held in the shafts and tunnels beneath Stockholm can be tapped into. Heat pumps which work in much the same way as fridges, can be used to 'upgrade' heat energy from lower temperature waters in the mines to make water hot enough to heat buildings."

David Banks, a geology consultant from Derbyshire stated that whilst Britain's use of ground heat technology still lagged behind Germany and Sweden, interest is growing. There are now around 10,000 heat pumps installed in the UK compared with only nine in 1999.

This sort of technology relies on awareness being raised and this is precisely what we want to do in Stocksbridge.

For this type of technology to be successful in Stockbridge it will also rely on government backing through strict planning measures to force house builders to include such a system in their plans (rather than a cheaper solution).



Glenalmond Street Housing
Glasgow

<http://www.sust.org/pdf/glenalmond.pdf>

In Glenalmond Street, the heat from the mines below is used to heat a thermal store which provides hot water for all the houses in the street. This new source of energy could help Glasgow to meet government targets to ensure 25 per cent of heat demand comes from renewable sources by 2020. On top of the system's sustainability, it also considerably reduced the residents' heating bill.

"Seventeen flats in Glenalmond Street, in the east end of Glasgow, have been using thermal power for the past 30 years, cutting heating bills from around £800 for a three-bedroom flat to just £180 a year"



In Blue:

Small communal mine shaft.

2004

In Red:
Large mine void under
the valley



HOW CAN STOCKSBRIDGE BECOME MORE ENERGY INDEPENDENT FROM THE GRID

a comparison of different local strategies for the future



Energy independence in Stocksbridge

"I am an PhD student in the Physics department at the University of Sheffield, researching energy independence and sustainability. Combining different sources of energy, particularly solar and wind, can give an energy supply that more accurately meets the needs of people in their homes. What kind of energy mix would best supply the community, and what difference can energy storage make to these options?"

It is very difficult to get full energy independence from the grid, but the more energy Stocksbridge can produce and store for itself the closer it will get.

OPTION 1

how can Stocksbridge generate its own electricity?

what is the percentage of Stocksbridge's electricity use that is met locally?

energy payback time?

Based on a 280m² PV array
+ 50% homes have a PV roof

27%
electricity use is met locally

3.7 years
payback time

OPTION 2

+ 25000m² PV farm
approximately 3.5 football
pitches

Based on a 280m² PV array
50% homes have a PV roof
+ 2 community solar fields
a community wind farm

+ 100 kW wind
turbines
x 3

34%
electricity use is met locally
+ 10 kWh
30 kWh battery
storage in every
home
47%
electricity use is met
locally

3.8 years
payback time
+ 10 kWh
30 kWh battery
storage in every
home
4.6 years
payback time

OPTION 3

25000m² PV farm
approximately 3.5 football
pitches

Based on a 280m² PV array
50% homes have a PV roof
2 community solar fields
+ a LARGE community wind farm

500 kW wind turbines
x 10

59%
electricity use is met locally
+ 10 kWh
30 kWh battery
storage in every
home
75%
electricity use is met
locally

2.8 years
payback time
+ 10 kWh
30 kWh battery
storage in every
home
3.4 years
payback time

OPTION 4

25000m² PV farm
approximately 3.5 football
pitches

+ 150 MWh pumped
hydro storage capacity
+ pumped hydro-electric storage

Based on a 280m² PV array
50% homes have a PV roof
2 community solar fields
a LARGE community wind farm
+ pumped hydro-electric storage

500 kW wind turbines
x 10

79%
electricity use is met locally
+ 10 kWh
30 kWh battery
storage in every
home
81%
electricity use is met
locally

2.2 years
payback time
+ 10 kWh
30 kWh battery
storage in every
home
3.3 years
payback time



WHAT IS BIOMASS?

heating your home with wood

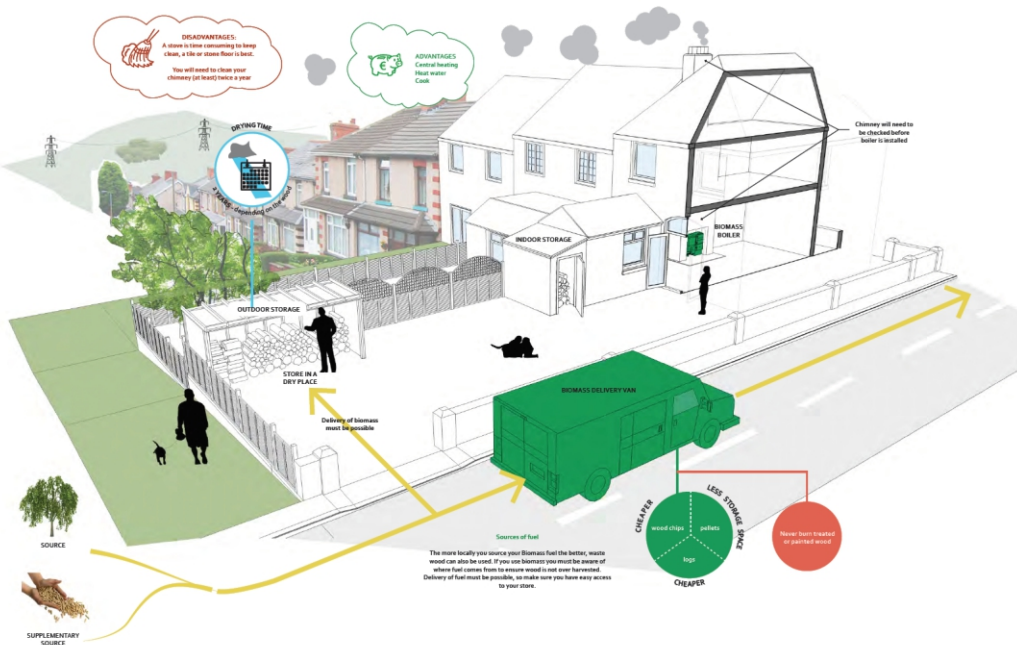


Biomass in Stocksbridge

It is a hedge type, so we are lucky to have a supply of waste wood that doesn't cost as anything. We do have to get it from a lot of different places and sort it out and using the resources that it is. We also have access to the wood. For this reason it is an economic option for us. For someone without this option it would be the same cost as buying any other fuel.

David understands the amount of effort that is involved in processing your own wood for fuel. It is very hard work and there is a smaller profit to be made. If you are at all of the way you will come home to a pile of wood for the heating, well, it is not. It is a lot more a couple of hours for the house to get warm in cold days, so you will have the long time, we did not want any back up heating. With the existing water and hot back up electricity radiators in a room. In the summer we also heat the water using a wood-burning water heating panel.

For example, not utility bills per annum were around £100 for electricity and gas for gas.*



What is biomass?

Biomass is renewable fuel that can be used for heating. Some boiler units can also produce electricity. The application of biomass boilers can be from large scale heating (down to an individual domestic boiler). Common fuels are sourced from wood, in the form of pellets, chips and logs. Some boilers can have a combination of biomass fuels including wood types, cereals and agricultural by-products. It is all dependent on the type of boiler required.

The Renewable Heat Incentive (RHI) is now available for domestic projects. It is a government financial incentive to promote the use of renewable heat, including biomass boilers.

Installing a biomass boiler

The first step would be to get your chimney checked (it may need to be fitted with a lined flue), you need to find a suitable burner for your home and ensure you have access to a fuel supplier.

You will also need to check that your plumbing is compatible, you may need a specialist plumber to install your biomass boiler but your supplier may suggest one.

Storage of fuel

Ensure there you have adequate dry storage space for fuel, in a year you can burn 10 tonnes of biomass! The store needs to be close to an access road but also not too far away from your house. It is safer to store biomass fuel rather than oil.

The type of wood matters

Pine wood means cleaning your chimney more often (due to its resin). Fruit woods like Hawthorn burn hot. Oak burns long.