Fenton Energy Ltd.
World of Smile Stadium
Whaddon Road
Cheltenham
GL52 5NA

01242 506150
info@fentonenergy.co.uk
www.fentonenergy.co.uk

your energy assessor

ENERGY STRATEGY

Compliance with BCS14

PROJECT NAME
74 Air Balloon Road

DATE
29th April 2021

ASSESSOR
Jordan Howlett

Energy Strategy

Project: 4102KJ - 2021.04. SS (74 Air Balloon - Matthew Deering Architects Ltd)

Contents

Executive Summary

This Energy Assessment has been compiled to demonstrate compliance with the Bristol City Council Policy BCS14 (from the Development Framework Core Strategy).

The proposal is for the conversion of a two bedroomed cottage into three dwellings, at 74 Air Balloon Road, Bristol.

Following the methodology outlined in the Climate Change and Sustainability – Practice Note, SAP calculations have been completed in stages to demonstrate a 20% reduction in regulated carbon emissions.

Firstly, SAP calculations achieving Part L compliance were modelled to provide 'baseline' energy demand and emissions. Then, additional measures were applied to provide 'residual' energy demand and emissions. Finally, appropriate decentralised renewables were included in the SAP calculations to provide the final energy demand and emissions figures for comparison. More detail is provided in the following sections.

To summarize the results, the total reduction in carbon emissions from on-site renewables is as follows:

Total CO_2 Savings on Residual Emissions

20.82%

Result

Pass

Design Principles to Reduce Energy Consumption and Carbon Emissions

Fabric

Low U-values and good detailing will help to limit heat losses through the fabric of the proposed dwelling.

All existing fabric elements will be thermally upgraded to at least the standards set out in Approved Document L1B to help limit heat losses associated with these areas and to complement the performance of the new build elements.

Fenestration and Solar Gain

Careful consideration will be given to the fenestration. Low U-values will need to be specified to limit heat losses through these areas. The glazing design allows for passive heating into the building. However, to minimise the risk of overheating within the dwellings, the glazing will be openable where practical and openings facing towards the south have been limited.

The positioning of the glazed openings will also maximise the available daylight into the building. This will not only improve comfort levels for the occupants but also reduce the energy consumption through artificial lighting.

The overheating risk, as assessed in the SAP calculations, is 'not significant' which is the lowest possible level of risk.

Mechanical Services

A well-designed building envelope must be supplemented by appropriate services within the building.

It is proposed that a highly efficient gas combi boiler will be installed to provide the heating and hot water to the dwellings.

Additionally, efficient mechanical extract fans will be fitted to the wet rooms.

Lighting

It is proposed that only energy efficient lighting is installed at the property. This means that all light fittings should have lamps with a luminous efficacy of greater than 45 lamp lumens per circuit-watt and a total output greater than 400 lamp lumens.

Renewables

Due to the small scale of the site most renewable technologies are not appropriate. Although an air source heat pump is technically feasible there is no suitable space for the external unit. However, photovoltaic panels are feasible and can be mounted on the proposed dormer roof so they will not be visible from street level. The size of array can be easily scaled to achieve the 20% carbon dioxide emissions reduction target, although this will have to be confirmed by a site survey prior to installation.

Overall performance

The following tables detail how the proposed building has been specified at this stage, incorporating the above principles. Also displayed is how the building performs in relation to the building regulations and the planning requirements for BCS14.

Proposed Fabric and Services Specification

Table 1 – Baseline Compliance

Showing the minimum specification required to achieve compliance with Part L. The specification is assumed at this stage as no specific build-ups are currently available.

Category	Item	Value/Details	Part L Minimum Standard
Building Fabric (W/m^2K)	Ground Floor (Existing)	0.25	0.70
	Ground Floor (New)	0.22	0.70
	Exposed Floor (above stairwell)	0.25	0.70
	External Wall (Existing)	0.30	0.70
	External Wall (New)	0.28	0.70
	Partition Wall (Existing)	0.28	0.70
	Partition Wall (New)	0.30	0.70
	Pitched Roof, Sloping Ceiling	0.18	0.35
	Pitched Roof, Flat Ceiling	0.16	0.35
	Flat Roof	0.18	0.35
	Flat Ceiling to Stairwell	0.18	0.35
Fenestration (W/m^2K)	Solid Door	1.40	2.00
	Fully Glazed Door	1.60	2.00
	Window	1.60	2.00
Ventilation	Mechanical Ventilation	Natural Ventilation (Extract fans fitted to wet rooms)	Natural Ventilation
Heating	Primary Heating System	Gas combi boiler (88% efficient)	Gas combi boiler, minimum 88% efficient
	Controls	Programmer, room thermostats and TRVs	Programmer, room thermostat and TRVs
	Heat Distribution	Radiators	Radiators
	Water Heating	Combi	Combi
	Secondary Heating System	None	None
Additional Features	Low Energy Lighting	75%	75%
	SAP Appendix Q	None	None
	Renewables	None	None
	Regulation 36 Compliance	125 litres/person/day	125 litres/person/day

Table 2 – Additional Energy Efficiency Measures

Showing updates to the baseline specification to reduce energy demand.

Category	Item	Value/Details	Part L Minimum Standard
Heating	Controls	Time and temperature zone controls with delayed start thermostat	Programmer, room thermostat and TRVs
Additional Features	Low Energy Lighting	100%	75%

Selecting Renewables

Table 3 – Feasibility Matrix of Appropriate Renewables

Showing the considerations in choosing a renewable technology for this site.

Technology	Requirements	Requirements Met?	Appropriate?
Photovoltaic panels	Roof facing east to west (through south)	Yes	Yes
	Little/no or modest overshading	Yes*	
	Flat roof or pitched roof not greater than 45°	Yes	
	Any size development	Yes	
Solar thermal	All requirements as for photovoltaic panels	Yes	No
	Hot water tank (not compatible with combi boilers)	No	
Air source heat pumps	Suitable external wall or other location on-site for equipment	No	No
	Aesthetic considerations	No	
	Noise impact	Yes	
	Any size development	Yes	
Ground source heat pumps	External space for horizontal trench or vertical borehole	No	No
	Medium to large sized development	No	
	Archaeology	Unknown	
	Best suited to underfloor heating	No	
Biomass	Space needed for plant, fuel storage and deliveries	No	No
	Medium to large sized development	No	
	Minimal impact on residents (air quality, deliveries)	No	
Combined heat and power	Space need for plant, access and servicing	No	No
	Large sized development (large heat demand)	No	
District heating	Available network	No	No
	Very large sized development (substantial heat demand)	No	

**See the following aerial image demonstrating that the overshading risk is low for the likely location of any solar panels.*

Please refer to Appendices D through J for more in-depth information on these technologies.

Fig. 1 – Aerial Image of the Site – Overshading Risk

Note: the blue arrow shows the location of 74 Air Balloon Road, Bristol. As can be seen, there are no obstructions that are likely to create overshading to any potential solar panels.

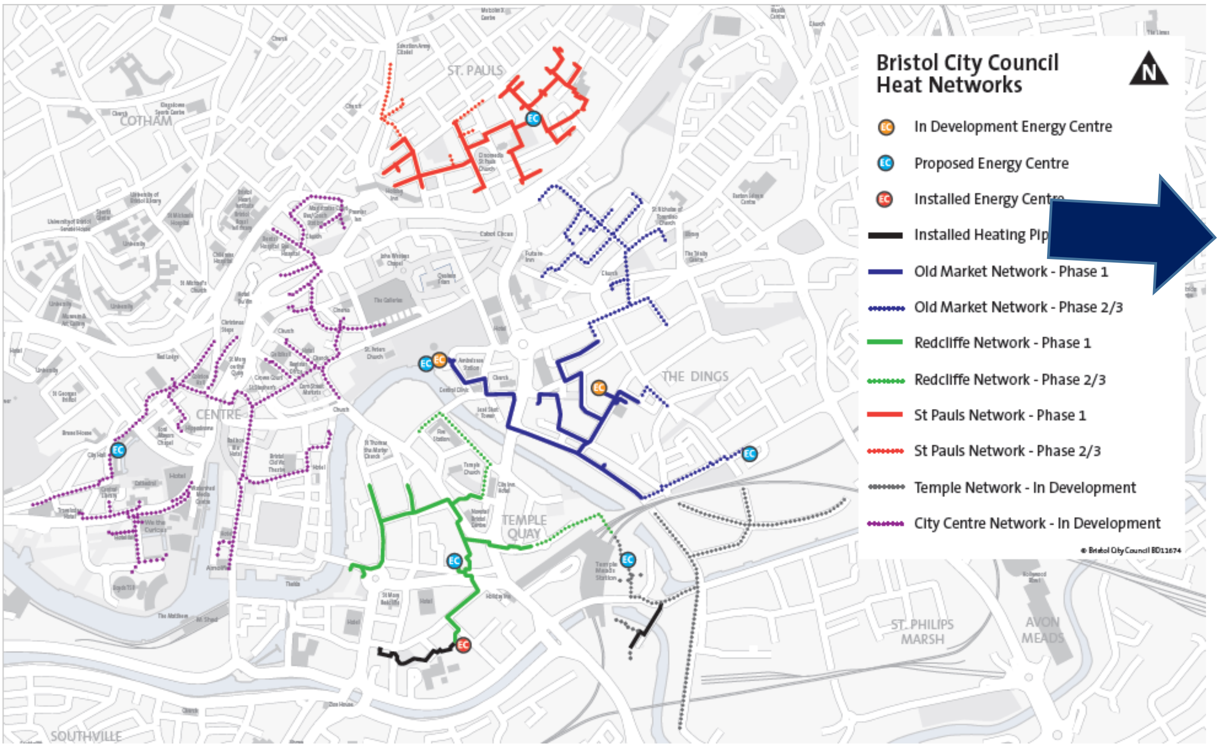
Heat Hierarchy

Table 4 – Following the Heat Hierarchy

Showing how the heat hierarchy, as outlined in BCS14 can be applied to this site.

Stage	Feasible	Notes
1. Connection to existing CHP/CCHP distribution networks	No	No network available
2. Site-wide renewable CHP/CCHP	No	Only a single unit proposed for the site
3. Site-wide gas-fired CHP/CCHP	No	Only a single unit proposed for the site
4. Site-wide renewable community heating/cooling	No	Only a single unit proposed for the site
5. Site-wide gas-fired community heating/cooling	No	Only a single unit proposed for the site
6. Individual building renewable heating	No	No suitable location for external unit

Fig. 2 – Bristol City Council Heat Networks Map



Note: the blue arrow shows the direction to 74 Air Balloon Road, Bristol. It is approximately 2 miles from the Old Market Network. Therefore, this is not within the scope of any existing or proposed heat network.

Feasibility of Appropriate Renewables - Conclusion

Due to the location, size and type of development most renewable technologies are not appropriate for this site.

In the future, if a district heating system were to be introduced to the area, the proposed site could be connected to this network. This could be facilitated as wet central heating systems are planned for this development. However, given that it is just a single building, made up of three flats, there may be additional technical barriers to making such a connection.

Although an air source heat pump per dwelling is technically feasible, there is no suitable location for the external units that would allow air to circulate freely around the unit whilst not impacting on the aesthetics of or access to the building.

However, photovoltaic panels do offer an immediate, appropriate solution. The number of panels can be scaled to achieve the 20% reduction in CO_2, as demonstrated in Table 7. This will need to be confirmed by survey before installation.

Appropriate Solution(s)

Photovoltaic Panels

Table 5 – Proposed Renewables

Showing renewables added to the specification to reduce carbon emissions.

Category	Item	Value/Details	Part L Minimum Standard
Additional Features	Renewables	2.1kWp PV Panels	-

Table 6 – Renewables Specification

Total Array Size	Direct/Landlord's Supply	Orientation	Inclination	Overshading
2.1kWp	Landlord's Supply	Horizontal	0° (nominal)*	None or very little

**The SAP calculation accepts 0°, 30°, 45°, 60° and 90°. The angle given is the nearest of these values to the true pitch of the PV.*

This size of array can be achieved with 6 × 350W panels or equivalent and take up an area of approximately 12m^2 of roof space.

Table 7 – Summary Table

Showing how energy demand and carbon emissions can be reduced by implementing the measures detailed in the preceding steps.

	Energy demand (kWh pa)	Energy saving achieved (%)	Regulated CO_2 emissions (kg pa)	Saving achieved on residual CO_2 emissions (%)
Building Regulations Part L compliance ("Baseline" energy demand and emissions)	**17,801.81**		**4,194.75**	
Proposed scheme after energy efficiency measures and CHP ("Residual" energy demand and emissions)	**17,071.98**	**4.10**	**3,980.83**	
Proposed scheme after on-site renewables	**15,474.94**	**9.35**	**3,151.97**	**20.82**
Proposed scheme offset for financial contribution or other "allowable solution"			**N/A**	**N/A**
Total savings on residual emissions				**20.82**

For further details please refer to the SAP Reports and the appendices.

Appendix A – Plot Detail

Plot	Baseline Energy Demand (kWh pa)	Baseline CO_2 (kg pa)	Additional Measures Energy Demand (kWh pa)	Additional Measures CO_2 (kg pa)	Renewables Demand (kWh pa)	Renewables CO_2 (kg pa)
Ground Floor Flat	6,845.67	1,592.90	6,548.20	1,510.34	5,996.84	1,224.19
First Floor Flat	5,521.97	1,316.92	5,317.53	1,252.47	4,744.12	954.87
Second Floor Flat	5,434.17	1,284.93	5,206.25	1,218.02	4,733.98	972.91

Appendix B – PV Share, Apportioned By Flat Area

Plot	Area (m^2)	Total Area (m^2)	Weighting	PV Share (kWp)	Total Array Size (kWp)
Ground Floor Flat	51.10	148.02	0.345	0.725	**2.10**
First Floor Flat	53.12		0.359	0.754	
Second Floor Flat	43.80		0.296	0.621	

Appendix C – Possible Solar Panel

FuturaSun
anticipate tomorrow

NEW
5 BUSBAR

FU 340 / 350 / 360 / 370 / 375 / 380 M

Monocrystalline Photovoltaic Module - 72 Cells

Engineered in Italy

TÜVRheinland CERTIFIED
IEC 61215
IEC 61730
Regular Production Surveillance
www.tuv.com
ID 1111213361

PV CYCLE

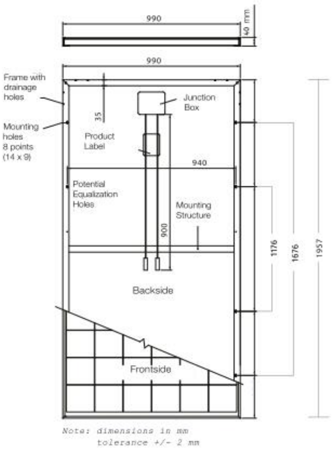
CE

GENERAL FEATURES

- **15-year product warranty**
- **High-efficiency cells** decrease ohmic losses and increase the yield
- **Tempered 3.2 mm safety glass** for optimal mechanical stability and transparency
- **High temperature resistance** (tested at 105° C for 200 hours)
- For installations **up to an altitude of 7000 m**
- Maximum **resistance against hail** (83 km/h)
- Quality controll with **electroluminescence (EL) tests** on each module

CERTIFICATIONS

- **IEC 61215:2016 - IEC 61730:2016 & Factory Inspection** NEW
- **Fire Resistance - Class 1**
- **Salt Corrosion Resistance**
  IEC 61701
- **Ammonia Corrosion**
  IEC 62716
- **Dust and Sand Resistance**
  IEC 60068-2-68



GUARANTEES

Performance guarantee

Max power decrease **0.5%**/year

97% at the end of first year

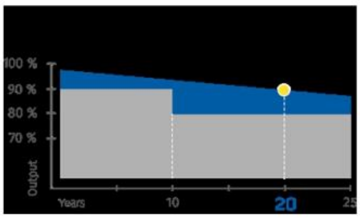
90% at the end of 20th year NEW

87% at the end of 25th year

Product guarantee

15 YEARS NEW

Market standard performances
FuturaSun performances



ELECTRICAL DATA							
MODULE		FU 340 M	FU 350 M	FU 360 M	FU 370 M	FU 375 M	FU 380 M*
Standard Test Conditions STC: 1000 W/sqm - AM 1.5 - 25 °C - tolerance: Pmax (±3%), Voc (±4%), Isc (±5%)							
Module power (Pmax)	W	340	350	360	370	375	380
Open circuit voltage (Voc)	V	46.97	47.65	48.34	48.96	49.26	49.38
Short circuit current (Isc)	A	9.07	9.2	9.41	9.66	9.81	9.91
Maximum power voltage (Vmpp)	V	38.73	39.3	39.86	40.33	40.55	40.82
Maximum power current (Impp)	A	8.78	8.91	9.04	9.18	9.25	9.31
Module efficiency	%	17.54	18.06	18.58	19.09	19.35	19.61
Nominal Module Operating Temperature NMOT: 800 W/mq - T=45 °C - AM 1.5							
Module power (Pmax)	W	249.74	257.08	264.4	271.8	275.4	279.1
Open circuit voltage (Voc)	V	43.32	43.95	44.59	45.16	45.43	45.55
Short circuit voltage (Isc)	A	7.46	7.56	7.74	7.94	8.07	8.15
Maximum power voltage (Vmpp)	V	35.05	35.57	36.07	36.5	36.7	36.94
Maximum power current (Impp)	A	7.12	7.23	7.33	7.45	7.5	7.55

TEMPERATURE RATINGS		
Short circuit voltage (Isc)	%/°C	0.0344
Open circuit voltage (Voc)	%/°C	-0.273
Module power (Pmax)	%/°C	-0.389
NMOT **	°C	45
Operating temprature	°C	from -40 to +85

** Certification on going*

*** Nominal Module Operating Temperature*

MECHANICAL SPECIFICATIONS	
Dimensions	1957 x 990 x 40 mm
Weight	22.5 kg
Glass	Tempered, transparent, 3.2 mm
Cell encapsulation	EVA (Ethylene Vinyl Acetate)
Cells	72 monocrystalline cells 156.75x156.75 mm
Backsheet	Composite multilayer film
Frame	Anodized aluminium frame with mounting and drainage holes
Junction box	Certified according to IEC 62790, IP 68 approved
Cables	Solar cable, length 900 mm (1500 mm upon request) assembled with MC4-combinable plugs
Maximum reverse current (Ir)	20 A
Maximum system voltage	1000 V *(1500 V on request)*
Maximum load (wind/snow)	5400 Pa (including safety factor 1.5)
Protection Class	II - accordance to IEC 61730

Authorized Dealer

2019_72m_340-380_en

FuturaSun® anticipate tomorrow

FuturaSun srl
Riva del Pasubio, 14 - 35013 Cittadella - Italy
Tel + 39 049 5979802 Fax + 39 049 0963081
www.futurasun.com - info@futurasun.it

Appendix D – Photovoltaic Panels

What are Photovoltaic Panels?

Photovoltaic Panels (PV) panels convert the energy in light received from the Sun into electricity. There are two types of system – grid connected systems are the most common and allow electricity to be drawn from the national grid during times when the panels are not generating enough electricity to provide all the power needs. This setup also allows any surplus electricity to be sold back to the grid. Conversely, standalone systems are not connected to the grid and so require supplementing with other power generating systems or batteries to ensure that the supply of electricity is not interrupted.

Space Requirements

PV Panels are composed of a series of small solar cells that are connected together. They come in a variety of shapes, sizes and outputs and ideally will be installed on an inclined south-facing roof to maximise the power generated. Larger arrays will result in more power being generated, up to the limits of available roof space. If space is limited, solar tiles can be installed as these can fit more capacity into the same area. However, these are more expensive than traditional panel installations.

Installation Costs, Funding, Maintenance and Payback

The average cost for a solar panel installation for a small-scale building is approximately £5,000-£9,000, although this is highly dependent on the size of array being installed. Planning permission is not usually required unless the panels are to be installed on a listed building or the property is situated in a conservation area.

The photovoltaic array can be expected to last for up to 25 years, depending on the manufacturer.

On January 1st 2020, a new government incentive scheme was introduced, known as the Smart Export Guarantee (SEG). For those installing small scale renewable technologies, with a maximum capacity of 5MW, the SEG will pay for each unit of electricity fed into the National Grid. It is anticipated that payback for a PV system could be achieved in approximately 12 years.

Advantages of Photovoltaic Panels

- Electricity bills reduced
- Source of renewable energy
- Reduced carbon footprint
- Low maintenance

Disadvantages of Photovoltaic Panels

- Relatively high upfront cost
- Energy generation varies with the average annual amount of radiation received
- Power output highly weather dependent
- No electricity produced at night
- Requires a lot of roof space for an effective array.

Appendix E – Solar Thermal Panels

What is Solar Thermal Energy?

A solar thermal system uses energy from the Sun to heat water which is then stored in a hot water cylinder.

Space Requirements

For a small scale solar thermal setup, it is suggested that approximately five square meters of south facing space will be required, to ensure that as much solar energy as possible can be collected. A sloping roof is not required as the panels can be fitted to a frame mounted on a flat roof or even hung from a wall.

Before installing a solar thermal system, it is important to check if your current setup is suitable – solar thermal systems require a hot water cylinder to store the heated water and are therefore not compatible with combination boilers or direct acting water heaters. If the cylinder present prior to the installation of the solar thermal system is not a solar cylinder, it will be necessary to either replace the cylinder with one which has a solar heating coil fitted or to add an extra cylinder with a solar coil to ensure that the system works correctly.

Installation Costs, Funding, Maintenance and Payback

The initial cost of installing a typical small scale solar thermal system is generally between £5,000 and £9,000. There are currently no financial schemes available for solar thermal panels.

Very little maintenance is usually required after the system is installed, although it is important to have the system inspected every three to seven years by a qualified solar panel expert.

The payback costs for solar panels depend greatly on the installation costs. For example, a system costing between £5,000 and £7,000 to install has a typical payback time between 13 and 17 years.

Planning Requirements

Planning permission is generally not required for the installation of a solar thermal system. However, restrictions may apply if the building is listed or sited within a conservation area – it is advisable to check with the local council prior to installation.

Advantages

- Clean and efficient water heating
- Easy to maintain
- Quiet
- Low carbon footprint

Disadvantages

- High initial cost
- Effectiveness depends on the number of hours of sunshine your area gets during the day
- The system is limited to only heating water – no electricity is produced
- Only useful if there is meaningful hot water demand

Appendix F – Air Source Heat Pumps

What are Air Source Heat Pumps?

Air source heat pumps (ASHPs) extract thermal energy from outside air (using the principles of vapour compression refrigeration), which can then be used to heat the building as well as to provide hot water. Heat pumps can also be run in reverse, cooling the building and transferring the excess heat to the outside.

There are two types of air source heat pump systems:

1. **Air to air** systems transfer the warmed air throughout the building using fans
2. **Air to water** systems transfer heat to water, which is then distributed via plumbing similar to that used in a conventional heating system with a boiler

Air source heat pumps operate at lower temperatures than traditional gas boilers. This means that these systems can be utilised more effectively with an underfloor heating setup compared to using radiators, as with underfloor heating the warmth is distributed more evenly and thus more efficiently. It is vital that the building fabric be well insulated if the benefits of an air source heat pump are to be fully utilised.

Space Requirements

An area on the exterior of the building, such as on a wall or roof, will be required for the external unit. This ideally should be in a warmer location which not only has enough space for the unit but is also clear of obstructions to allow air to flow freely.

Additionally, space will be required for the internal unit. Typically, these are no larger than a standard hot water cylinder or boiler unit, depending on the exact setup used. However, with many setups a separate hot water cylinder, along with the space for this, is also required.

Installation Costs, Funding, Maintenance and Payback

The cost of purchasing and installing an air source heat pump system is generally between £3,000 and £11,000, depending on the size and complexity of the setup. Additional costs may be incurred if your property is particularly large. However, it may be possible to obtain payments from the Government's Renewable Heat Incentive (RHI), which will offset some of the costs incurred with installing the heat pump.

Air source heat pumps can be expected to last for up to 20 years as long as they are inspected every three to five years by a qualified technician. A typical payback period for ASHPs is around 12 years, once RHI is taken into account.

Planning

It is advisable to consult your local planning authority prior to purchasing the heat pump to establish whether there are any restrictions as to the positioning of the external unit.

Advantages

- Lower fuel bills
- Can provide heating in winter and cooling in the summer as well as hot water year-round
- Low maintenance
- Low carbon footprint

Disadvantages

- Works more efficiently with underfloor heating, or larger radiators
- The outdoor unit produces noise so careful siting is required
- Less efficient in winter due to the need to extract heat from colder air, resulting in lower Coefficient of Performance (COP) values.

Appendix G – Ground Source Heat Pumps

What are Ground Source Heat Pumps?

Ground source heat pumps (GSHPs) use pipes, buried in available land close to the building, to extract heat from the ground. Water and antifreeze are circulated around the pipes absorbing heat, which is the transferred through a heat exchanger in the heat pump into the building. From this point, the heat can be used to provide space or hot water heating, or the system can be run in reverse to provide cooling.

Ground source heat pumps operate at lower temperatures than traditional gas boilers. This means that these systems can be utilised more efficiently with an underfloor heating setup than with radiators. It is particularly vital that the building be well insulated to fully take advantage of the benefits of a ground source heat pump.

Space Requirements

There are two types of ground source heat pump systems:

1. **Horizontal** systems, which require an area of approximately 700m^2
2. **Vertical** systems, which have a borehole approximately a quarter of a metre across and up to 100m deep.

Larger sites will require either a larger area or more boreholes. Whichever system is chosen, suitable access must be available for the machinery required to install the pipework, especially in the case of the drill rig required for the vertical systems.

Space must also be available for the internal unit. These are typically larger than a standard gas boiler, approximately the size of a domestic hot water cylinder.

Installation Costs, Funding, Maintenance and Payback

Installing ground source heat pumps can cost between £10,000 and £18,000. The horizontal system is often cheaper as the expensive drill rig required to drill the borehole is unnecessary.

It may be possible to obtain payments from the Government's Renewable Heat Incentive (RHI), which will help to offset some of the costs involved with installing the heat pump. Additionally, the heat pump, if inspected regularly by a qualified servicer, can be expected to last for up to twenty years.

With low running costs and possible income from the RHI, the payback period can typically be between 8 and 12 years.

Planning Requirements

Ground source heat pumps are generally permitted, but some restrictions apply, such as with listed buildings. Consulting your local authority prior to installation is recommended.

Advantages

- Lower fuel bills, especially if used to replace direct electric heating
- Can provide both space and hot water heating
- Can provide heating in winter and cooling in summer as well as hot water year-round
- Lower carbon footprint
- Low maintenance
- More efficient in winter than air source heat pumps due to ground temperatures remaining more constant throughout the year

Disadvantages

- More expensive to install than air source heat pumps
- Suitable land must be available for the pipework or boreholes
- The building must be very well insulated
- Works most efficiently with underfloor heating or warm air distribution

Appendix H – Biomass

What is Biomass?

Biomass is any fuel obtained from natural or organic material, such as manure, forest debris or agricultural or horticultural waste. The most common biomass energy source is wood in the form of pellets, wood chips or logs. Biomass boilers can be used as a replacement for a fossil fuel-based heat source, and are best suited to medium to large scale sites.

Space Requirements

Typically, biomass boilers are contained in a single plant room serving the whole site. This room needs to be big enough for the boiler or boilers themselves, along with water tanks and space for fuel storage.

Installation Costs, Funding, Maintenance and Payback

The cost of a biomass boiler depends on a number of factors, including the type of boiler used, the fuel type and storage size. For example, the cost, including installation, of an automatically-fed pellet boiler can be as much as £20,000. It is important to note that biomass boilers are also eligible for the Government Renewable Heat Incentive (RHI) scheme, which provides payments to those using renewable heating systems. Therefore, despite the high initial cost, biomass boilers can have relatively short payback times of around 5-7 years.

Biomass boilers should be serviced every 12 months to ensure continued efficiency and to prevent any breakdowns.

Planning

There may be restrictions on the installation of biomass systems, due to concerns over local pollution and disruption to residents caused by deliveries.

Advantages

- Sustainable energy source
- Reduces dependence on fossil fuels
- Carbon-neutral – the carbon produced is absorbed by plants which can then be used as future biomass fuel
- Reduces waste sent to landfill
- Abundant availability of fuel

Disadvantages

- The burning of biomass fuels produces various gases that can contribute to local air pollution
- Space is required on-site for a plant room and fuel storage, as well as a designated fuel delivery area
- Constructing and operating biomass energy plants are often more expensive than more traditional power plants

Appendix I – Combined Heat and Power

What is Combine Heat and Power?

Combined Heat and Power (CHP), sometimes referred to as cogeneration, is a setup in which heat and power are generated simultaneously.

Energy which is lost at various steps in producing electricity in a conventional power plant can be captured and used to provide warmth. For example, water which has condensed from the steam used to turn the generating turbine is typically cooled in large cooling towers, with all the energy lost to the air. In a CHP plant, this 'waste' heat is instead used to produce hot water, hot air or steam, which can then be distributed to heat local buildings.

Space Requirements

Significant space is required for the power plant itself, as well as the additional space required for the recovery of the otherwise wasted heat. Additionally, to use this energy effectively, a large pipe network is needed to distribute the heat around the local area.

Installation Costs, Funding, Maintenance and Payback

The costs involved with setting up a CHP system, especially if the power plant is being constructed along with it rather than converted, are relatively high. As a result of this, these schemes tend to be large-scale long-term projects.

The network must be kept well maintained to avoid loss of service and to ensure continued operation. However, a large-scale network can heat a wide area more efficiently than with individual building heating systems, providing good long-term return on investments.

Advantages

- The CHP process can be applied to power plants that use either renewable or fossil fuels as well as those which use a combination of the two
- Emissions are generally lower than other electricity and heat producing systems
- A variety of energy consumers can benefit from the installation of a CHP plant, including hospitals, schools and industrial sites

Disadvantages

- CHP plants need to be local to their users to ensure as little energy is lost in the transmission as possible.
- The technology needed is expensive and more complex. Maintenance costs can also be greater
- Considerable amount of space is required for a full-size CHP setup, making it suitable only for larger sites

Appendix J – District Heating

What is District Heating?

Instead of relying on one boiler for each unit on site, district heating utilises hot water or steam from a single communal heat source and distributes that energy to a variety of consumers through a network of insulated pipes. This network can be as large as desired, allowing entire communities to benefit, as well as reducing the need for additional energy to be produced specifically for heating buildings in the local area.

In the individual property or building, a heat interface unit (HIU) gives the consumer control over the hot water they use in a similar manner to that provided by a traditional boiler.

Space Requirements

An energy centre or large plant room would be required for this type of system. Depending on the scale of the heat network, pipework may need to be laid underground to distribute the hot water across the site or to the local area.

Installation Costs, Funding, Maintenance and Payback

The initial cost of setting up district heating, including the plant and infrastructure needed to deliver the heat, is relatively high and so these large-scale schemes tend to be a long-term investment.

Regular maintenance is essential to ensure continued efficiency and to prevent any breakdowns.

Advantages

- More energy efficient as energy which is otherwise wasted can be used
- Lower carbon emissions
- Has the potential to reduce heating costs

Disadvantages

- If the main fuel source experiences problems, whole areas could potentially be without heating or hot water
- Can in some cases be more expensive than traditional heating
- A large network is required to gain full benefit – it is only suitable for use on very large sites or where there is a network already present