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1. What we do / Accreditation
2. How it Works…
    - 2.1 Air Source
    - 2.2 Ground Source (Horizontal / Borehole)
    - 2.3 Water Source
3. Advantages
4. Practical requirements (Plant room, External unit, Ground collector)
5. Heat emitters (Radiators / UFH)
6. Restrictions (Permitted Developments, Power supply)
7. Q&A
8. Boiler Upgrade Scheme / EPC / MCS Performance Estimate
9. Quotation Process / Installation / Aftersales
10. Install / Project management / Scope of Works
11. Post Install (Warranty, servicing, maintenance)
12. Coverage area
13. Q&A
14. Case Studies

WDS Green Energy Ltd.

- WDS Green Energy specialise in design, supply & install of heat pump systems as well as heat emitter systems such as Underfloor heating and Radiators.
- Installed approximately 1000 ground and air source heat pumps ranging from 5kW domestic units to a 160kW system for a school & 200kW National Trust Property.
- Been operating for 12+ years throughout Wales, the Midlands, the South West & Southern England
- **Accredited By NAPIT as an Microgeneration Certification Scheme (MCS) installer**
- **Member of the Renewable Energy Consumer Code (RECC)** which sets out the code to protect consumers rights

APPROVED INSTALLER

MCS

NAPIT

RECC
RENEWABLE ENERGY CONSUMER CODE

Main Suppliers:

- Vaillant
- Mitsubishi
- Ecoforest
- Daikin Key Installer
- NIBE VIP
- CTC

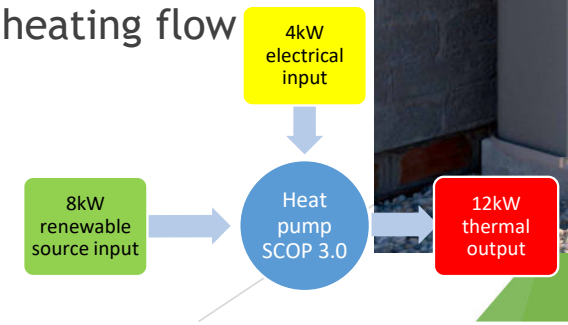
How it Works…

VIDEO

https://www.vaillant.co.uk/homeowners/advice-and-knowledge/how-does-a-heat-pump-work-2211666.html

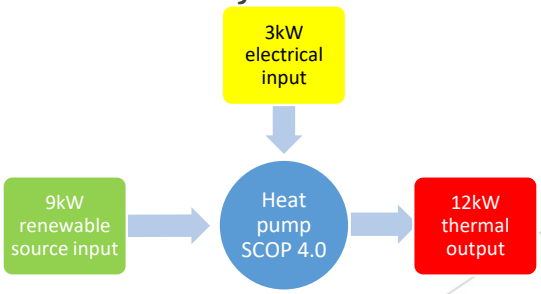
Air Source Heat Pump (ASHP)

- Thermal energy is extracted from the surrounding air.
- Environmental Operating Temperature Limits: -20˚C to +35˚C
- Monobloc system - Includes a single outdoor unit with pipes leading to the DHW Cylinder, Buffer & Ancillaries.
- Split System – Includes an outdoor unit as well as a indoor Hydrobox which are connected with pipes filled with refrigerant. Less common.
- Reduced install cost & less civil works required (no excavation) compared to GSHP (£11-16k single unit up to 14kW, Larger/twin unit systems £18-25k)
- Smaller internal plant area requirement compared to GSHP
- SCOP ranging from 2.8 to 4.5 (up to 5 in some cases) depending on operating conditions (external design temperature, heating flow temperature).



Ground Source Heat Pump (GSHP)

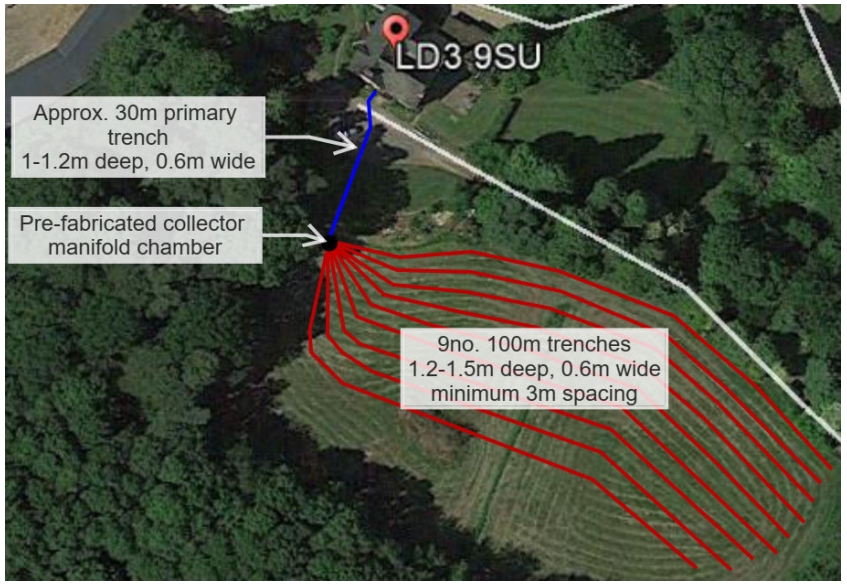
- Ground Source systems extract the heat from the ground using a number of buried pipes known as ***collectors***.
- The number and length/depth of pipes varies depending on the heat demand of the property – typically a 12kW system requires 300m of trench or 200m of borehole (or half that for a 6kW system)
- Ground Source is usually more efficient than Air Source due to the ambient temperature of the source being more consistent and usually warmer than the air temperature during winter.
- Seasonal Coefficient of Performance (SCOP) 3.5 – 5.3.
- Higher installation cost and civil works compared to ASHP (typically £19-27 + ground works, boreholes £30k+)



Ground Source

- ***Horizontal trenches*** - between 1.2-1.5m below ground, 3m spacing, 0.6m wide which usually range in lengths of 50, 75 or 100m.
- ***Boreholes*** – Vertical collectors typically 75-120m deep, 8m away from properties and 6m spacing.

  - Smaller area required but more expensive.



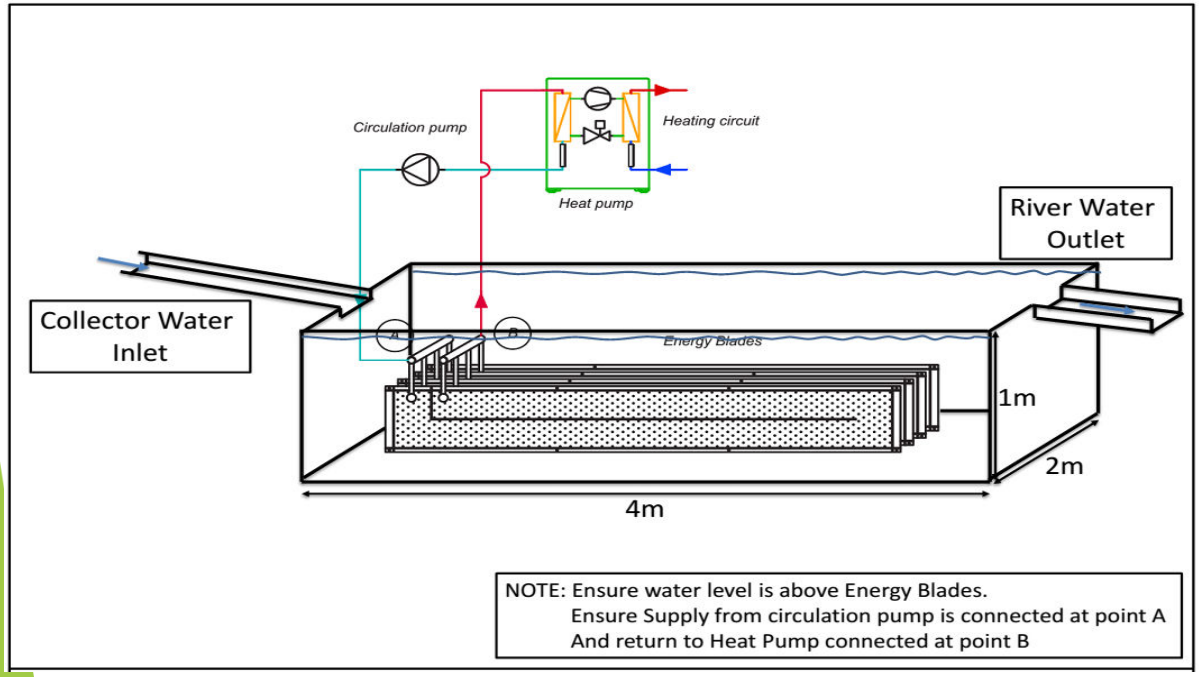
Water Source (1)

Ground source heat pumps can also use water as a heat source. This can be a lake/pond or a stream/river should sufficient flow be present.

- ***Pond Mats/Slinky*** – pipe attached to corrosion resistant stainless steel frames or weighted down with blocks which are sunk to the bottom of the pond/lake or secured underneath a floating pontoon.

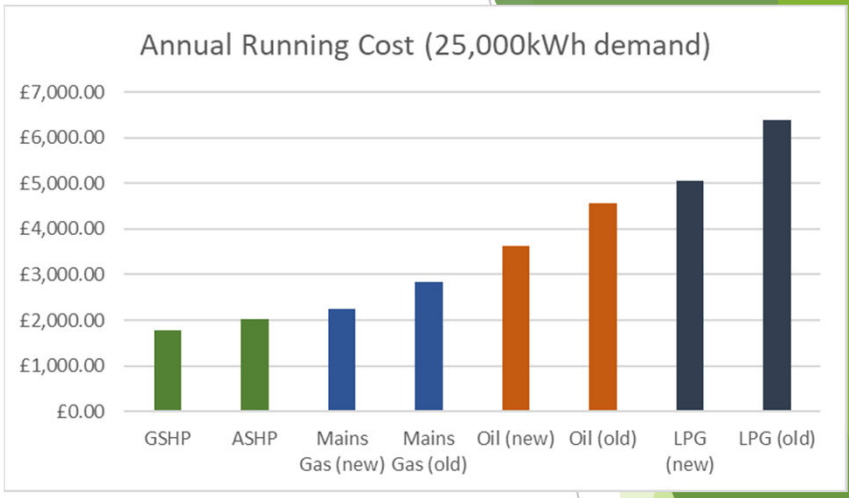
Water Source (2)

- ***Energy Blades*** – Stainless steel, water-immersible heat exchanger specifically intended for use in closed-loop ground-source heat pumps systems.
- Used for transferring energy from water source to the heat transfer fluid (glycol, anti-freeze)
- Capable of transferring up to 20kW of Heat to the glycol mixture in a fast flowing water (10-12kW standing)

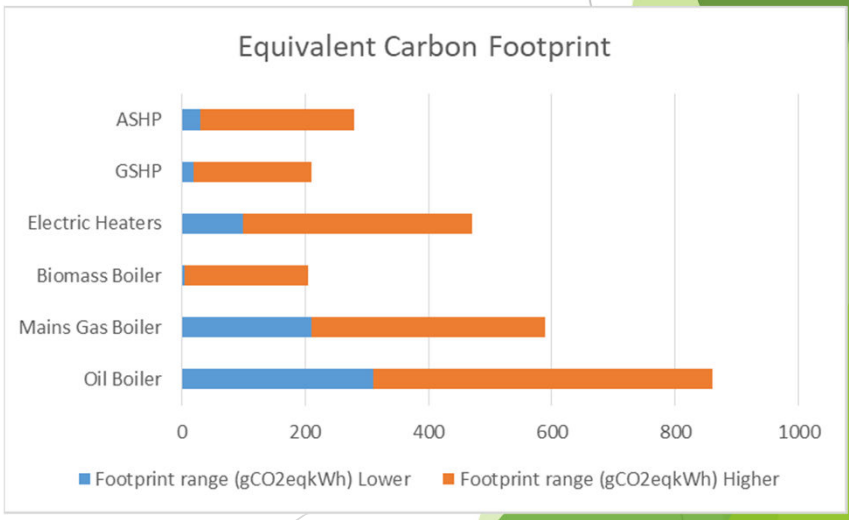


Heat Pump Advantages

- Lower carbon footprint than fossil fuel and direct electric heating systems (storage heaters/flow boilers)
- Reduced running costs compared to fossil fuels
- Reduces dependency on fossil fuels / deliveries
- More constant heat delivery
- Equivalent lifetime to boilers 15-20 years
- Future proofing – ahead of fossil fuel legistlation
- Boiler Upgrade Scheme (BUS) grant funding



Energy/fuel costs based on https://energysavingtrust.org.uk/about-us/our-data/



Houses of Parliament: Office of Science & Technology
Carbon footprint of Heat Generation, May 2016

Practical Requirements

Plant Room Requirement

Required Equipment & Ancillaries:

Air Source	Ground Source
Internal Unit (Split Systems only)	Heat Pump
DHW Cylinder	DHW Cylinder
Buffer Tank	Buffer Tank
DHW & Heating Expansion Vessels	DHW & Heating Expansion Vessels
Control Unit	Brine Expansion Vessel
Pipework & Ancillaries	Control Unit
	Pipework & Ancillaries

Plant Room Requirement - ASHP

Plant Room Requirement - ASHP

- Typically 1.5 x 0.9m or similar
- More compact options available

Air Source – External Unit

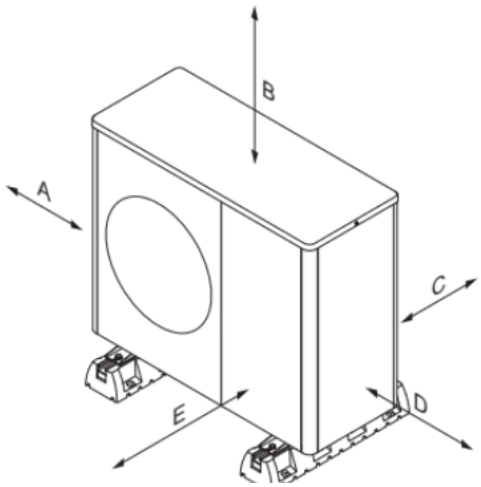
- Units sit on a solid base with suitable drainage – often soakaway below unit
- Approx HP dimensions W1100 x H1100-1600 x D500mm
- Away from noise sensitive areas and neighbouring properties

Air Source – External Unit

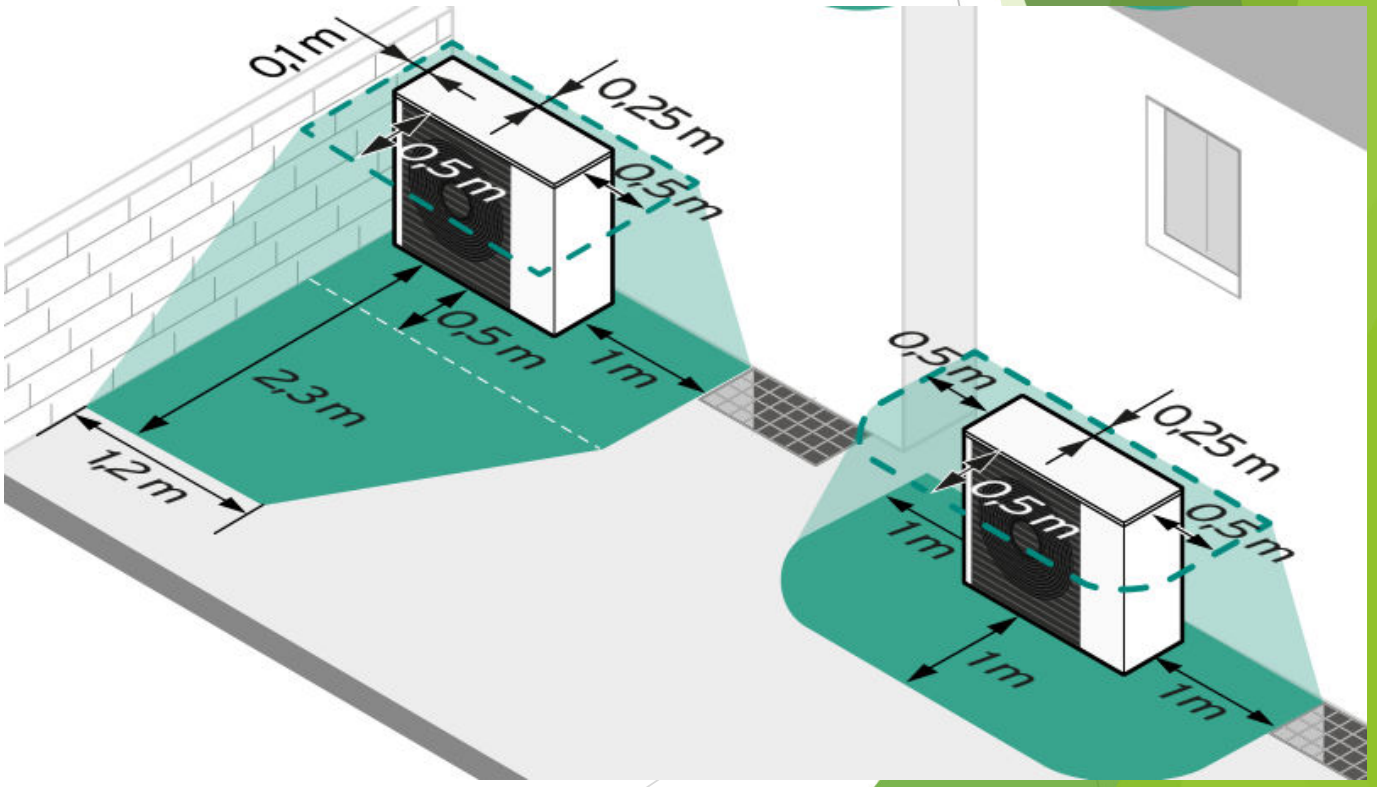
- Units sit on a solid base with suitable drainage – often soakaway below unit
- Manufacturer specific clearances – normally about 1800 x 1800mm clear area required

Air Source – Location Requirements

Ensuring the correct spacing between the heat pump and all surrounding bodies

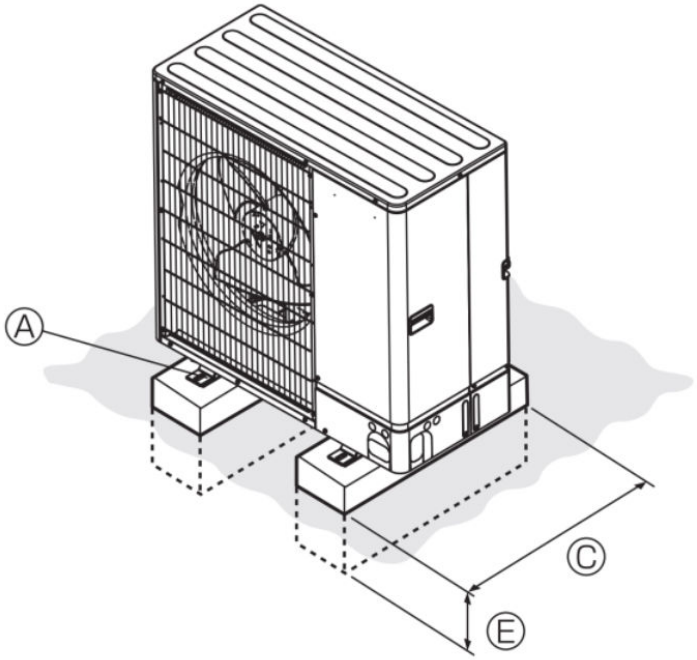


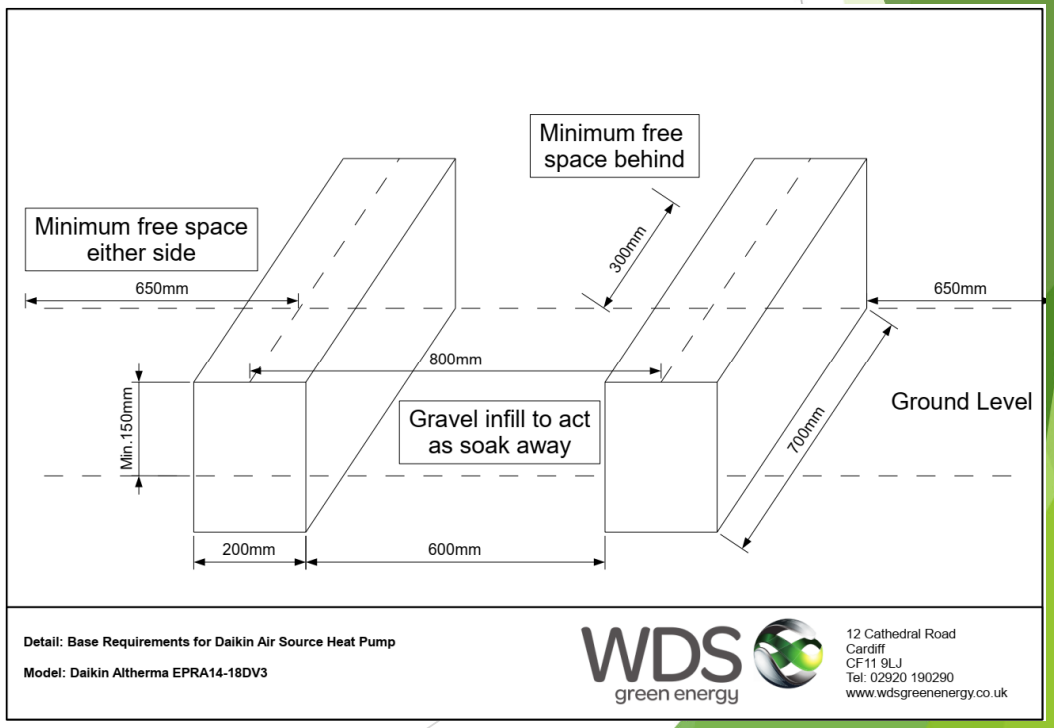
Minimum clearance	Heating mode
A	100 mm
B	1000 mm
C	200 mm
D	500 mm
E	600 mm



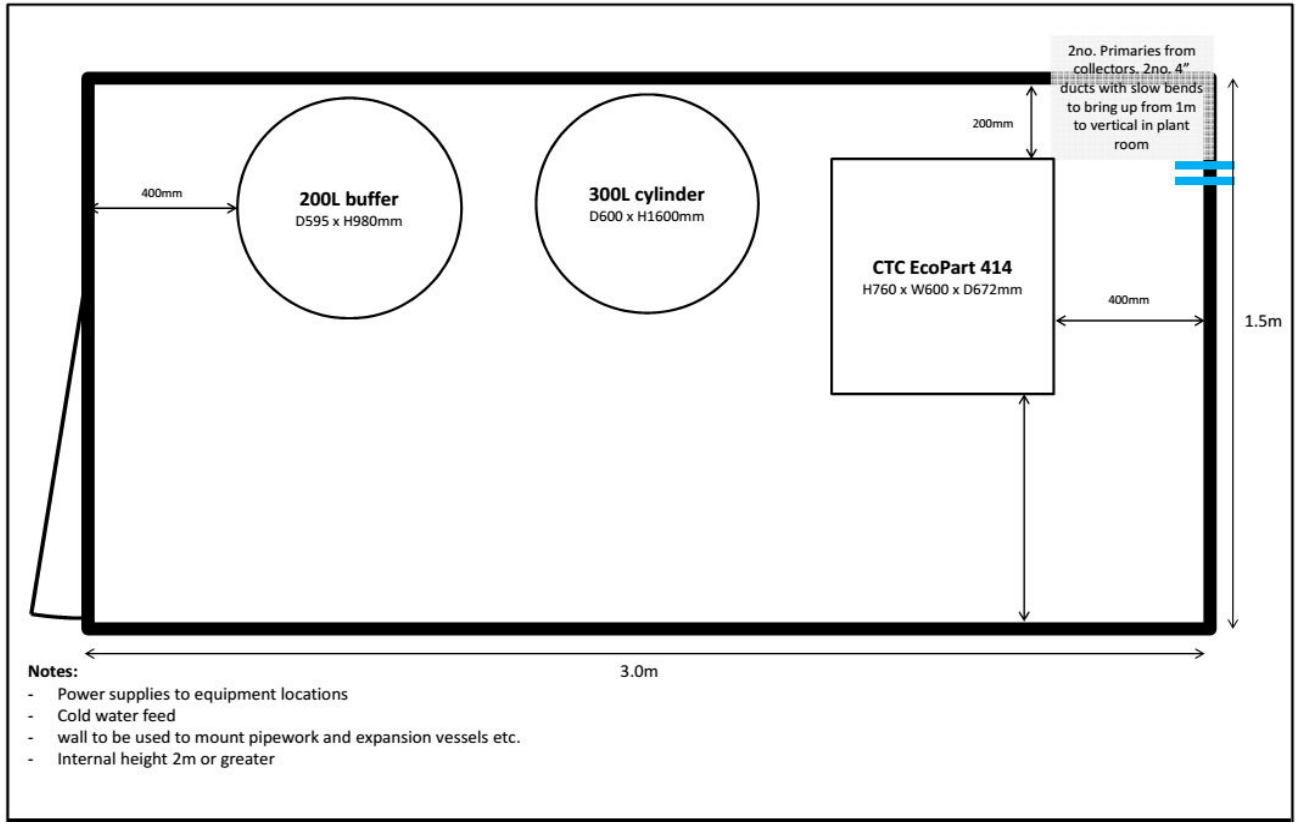
Air Source – Base Requirements

- Pump is situated at the correct height above ground level with required clearances
- Soakaway for defrost run off, if no drain is present





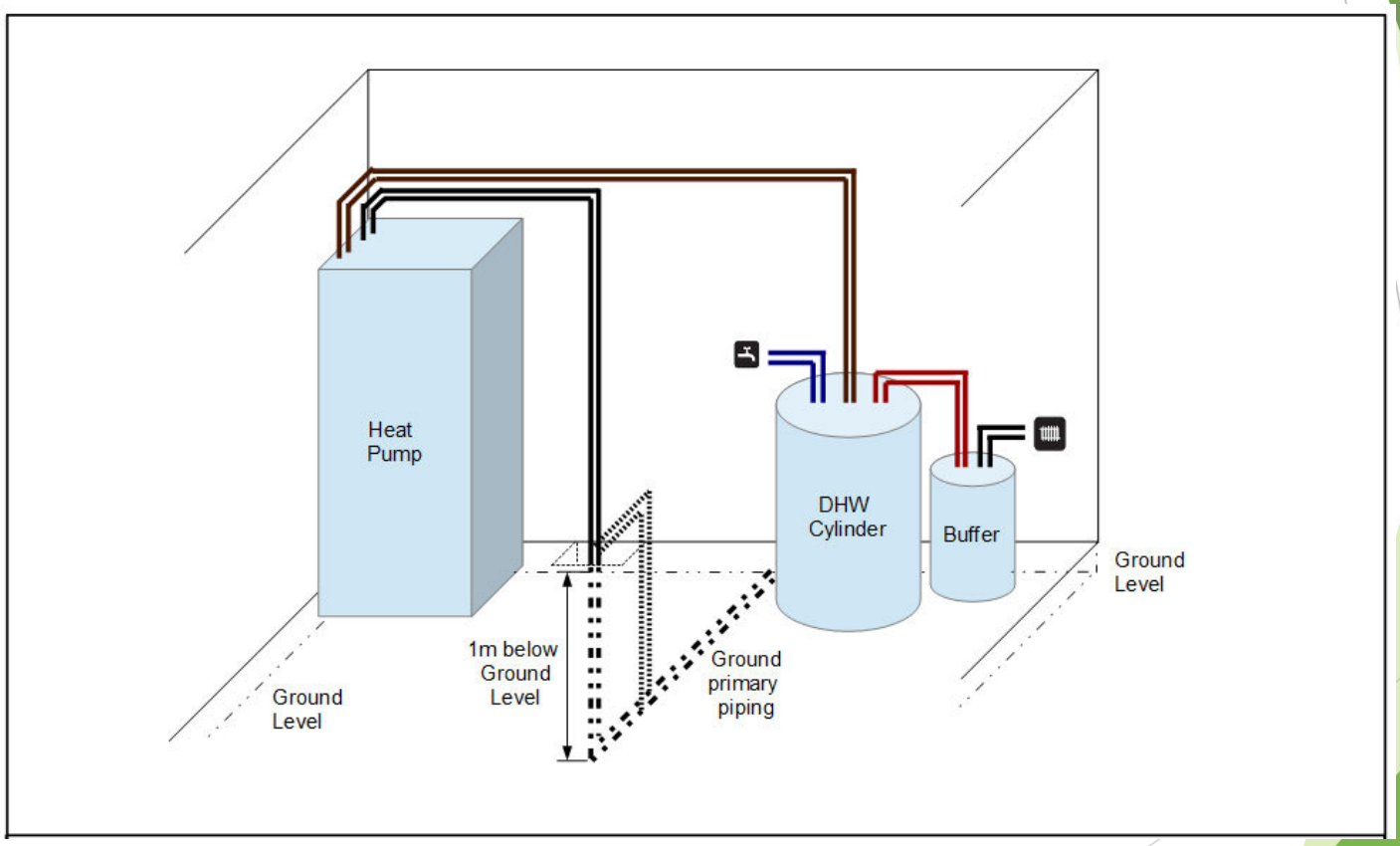
Plant Room Layout – GSHP Example 1



Notes:

- Power supplies to equipment locations
- Cold water feed
- wall to be used to mount pipework and expansion vessels etc.
- Internal height 2m or greater

Plant Room Layout



Plant Room Layout

Ground Loop Layout PT1

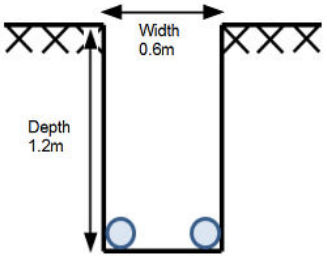
- Part of the quotation / install service we provide is a detailed Ground Loop Layout Plan (For GSHP)
- This is designed in accordance to MCS Standards

Boreholes

Ground Collector:
3no. 93m boreholes with minimum 6m spaces from structures and each other

Required Trenches:
Trenches between boreholes and manifold for 40mm collector pipework 1.2m deep x 0.6m wide

1 pair of 63mm pre-insulated flow and return to pre-cast manifold from plant room as per layout



Manifold pit depth at height of manifold

Trench length measured from manifold pit

Manifold Ports	Diameter (mm)	Height (mm)
2 – 4	400	600
5 – 12	600	800

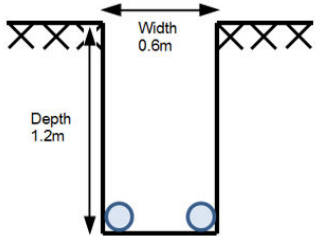
Ground Loop Layout PT2

Horizontal Collectors

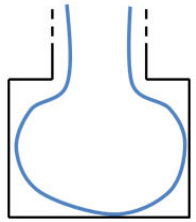
Ground Collector:
6no. 100m trenches with approx. 6m spaces.

Required Trenches:
Trenches between boreholes and manifold for 40mm collector pipework

1 pair of flow and return to pre-cast manifold from plant room



Bulb trench end to allow loop bend



Manifold pit depth at height of manifold

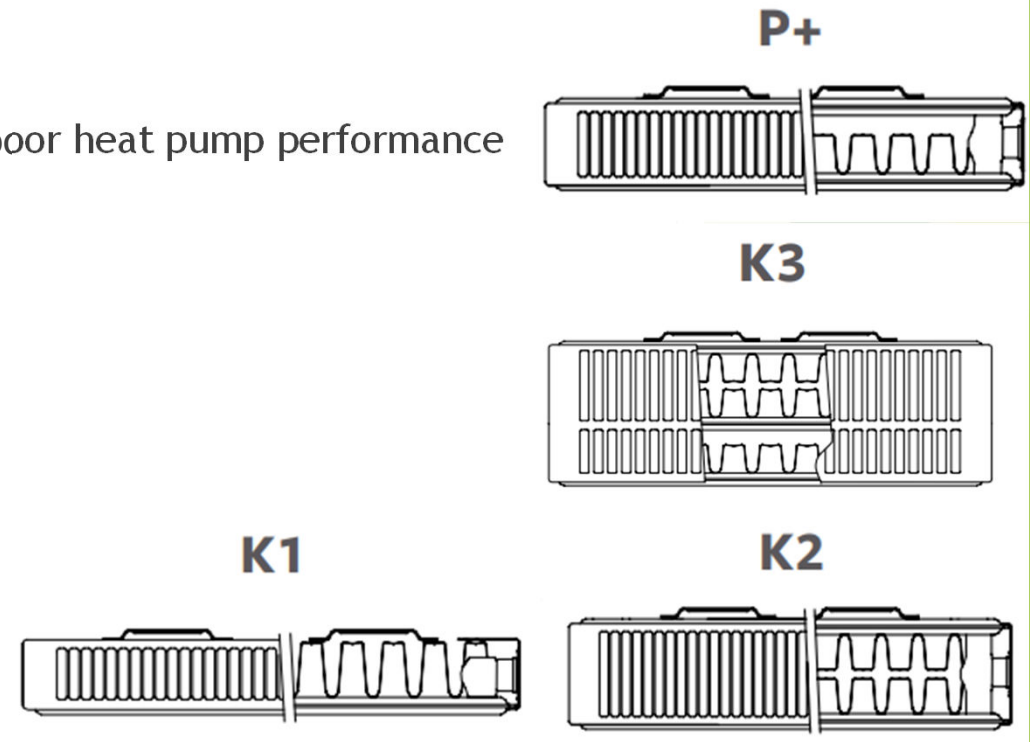
Trench length measured from manifold pit

Manifold Ports	Diameter (mm)	Height (mm)
2 – 4	400	600
5 – 12	600	800

Heat Emitters

Heat Emitters

- Heat pumps are designed to run at lower temperatures and are most efficient when combined with a UFH system, though radiators with sufficient output can be used and at low flow temperatures
- Undersized radiators are one the most common cause of poor heat pump performance and room temperatures not being satisfied



Heat Emitters - UFH

- UFH installation methods vary dependant on the floor construction and type of project (retrofit/renovation/new build).
- Floor covering critical to potential output Tile > vinyl > wood/laminate > carpet

HEAT EMITTERS

	GROUNDS FLOORS	FIRST FLOORS	Totals
UFH INSTALLATION:	Screed Based	EPS Overfloor	
TOTAL HEATED AREA (m^2):	205.5	70.2	275.8
APPROX. UFH PIPE (m):	1,644	562	2,206

MATERIALS INCLUDED:	- 16mm PE-RT/Al/PE-RT pipe at 150mm spacings	- Staples for UFH pipe
	- UFH manifold(s)	- Primaries from heat source to manifold(s)
	- Mixing valves	- Manifold connectors
	- Actuated valves	- Thermostats
	- EPS 400 aluminium coated overfloor boards	
ALSO INCLUDED:	- Installation, Travel & Subsistence	- Design

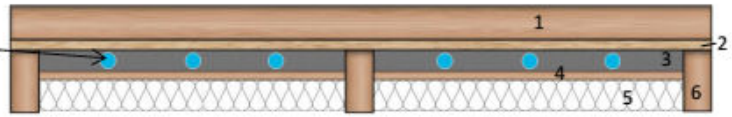
GROUNDS FLOORS	Screed Based			
ROOMS	**AREA m^2**	**HEATING CIRCUITS**	**THERMOSTATS**	**MANIFOLDS**
Bedroom 1	16.4	2	1	7 way manifold
Bath	5.2	1	1	
Living/Kitchen	28.1	2	1	
Communal Conservatory	28.0	2	1	
Living/Kitchen	54.2	4	2	4 way manifold
Living/Kitchen	22.3	2	1	3 way manifold
Bedroom 1/Shower	14.5	1	1	
Hall/WC	8.8	1	1	4 way manifold
Kitchen	10.6	1	1	
Utility	8.1	1	1	
Store	9.3	1	1	
FIRST FLOORS	**EPS Overfloor**			
Landing	7.0	1	1	3 way manifold
Bedroom 1/En-suite	12.1	1	1	
Bedroom 2/En-suite	14.6	1	1	
Staff Room/Shower	23.3	2	1	3 way manifold
Bedroom 1	13.2	1	1	

UFH – Other Screed (Options 1-3)

Option 1 – Suspended Floor screed - Insulation below, pipe affix to board

Supplied by WDS

- 16mm Pert/Al/Pert pipe
- Optional pipe-fixing cliptrack/staples



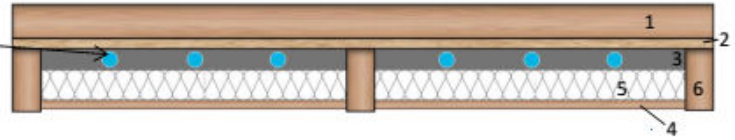
Supplied by others

1. Flooring
2. Structural deck
3. Biscuit screed
4. Plywood board
5. Insulation
6. Timber joists

Option 2 – Suspended Floor screed - insulation above, pipe affix to insulation

Supplied by WDS

- 16mm Pert/Al/Pert pipe
- Optional pipe-fixing cliptrack/staples



Supplied by others

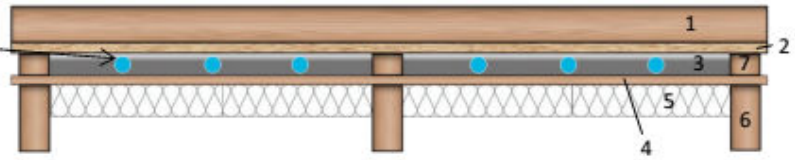
1. Flooring
2. Structural deck
3. Biscuit screed
4. Plywood board
5. Insulation
6. Timber joists

UFH – Other Screed (Options 1-3)

Option 3 - Suspended Floor screed - Supporting deck with battens, pipe affix to deck

Supplied by WDS

- 16mm Pert/Al/Pert pipe
- Optional cliptrack/ staples



Supplied by others

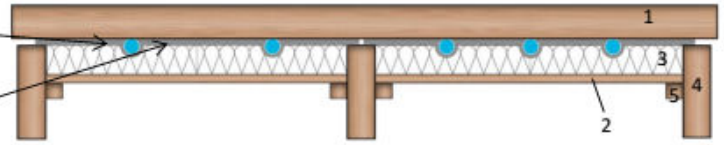
1. Flooring
2. Structural deck
3. Biscuit screed
4. Plywood board
5. Insulation
6. Timber joists
7. Timber battens

UFH – Joist EPS / Spreader (Options 4a & 4b)

4a - Suspended Floor - Supporting deck with battens, mineral wool insulation with pipe in spreader plates secured to joists.

Supplied by WDS

- 16mm Pert/Al/Pert pipe
- Aluminium spreader plates

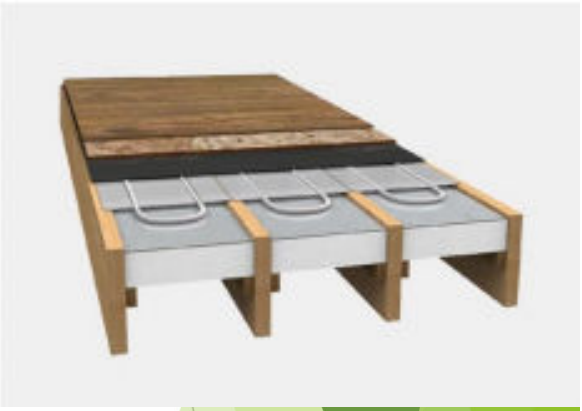


Double
400mm joist centres
(pipe centres at 150mm or 200mm)

Triple
600mm joist centres

Supplied by others

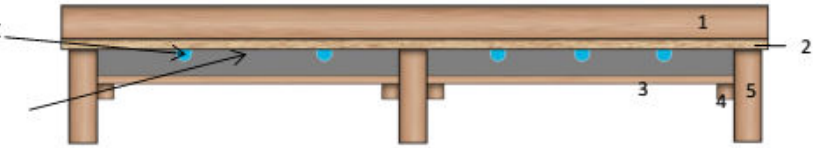
1. Flooring*
2. Plywood support
3. Insulation
4. Timber joists
5. Timber battens



4b - Suspended Floor - Supporting battens, aluminium coated EPS panel between 400mm centre joists

Supplied by WDS

- 16mm Pert/Al/Pert pipe
- Aluminium coated Joist EPS boards



Double
400mm joist centres
200mm pipe centres

Triple
400mm joist centres
150mm pipe centres

Supplied by others

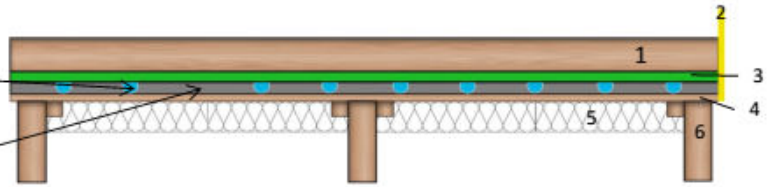
1. Flooring*
2. Structural deck (optional)
3. Plywood support
4. Timber battens
5. Timber joists

UFH – EPS Panels (Options 5a & 5b)

5a – **Suspended Floor - Supporting deck with battens, pipe lay in overfloor panels with spreader plates**

Supplied by WDS

- 16mm Pert/Al/Pert pipe
- Aluminium coated overfloor panel (EPS)



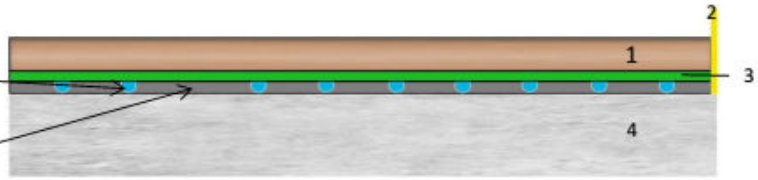
Supplied by others

1. Flooring, max 25mm
2. Perimeter strip
3. Underlay/primer/ intermediate layer
4. Structural deck (on top of joists)
5. Insulation
6. Timber joists

Option 5b – Existing solid floor, pipe lay in overfloor panels with spreader plates

Supplied by WDS

- 16mm Pert/Al/Pert pipe
- Aluminium coated overfloor panel (EPS)



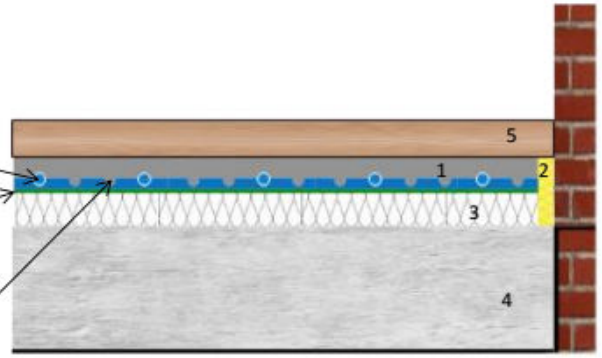
Supplied by others

1. Flooring, max 25mm
2. Perimeter strip
3. Underlay/primer/ intermediate layer
4. Existing floor (clean and level)

UFH – Screed (Option 6)

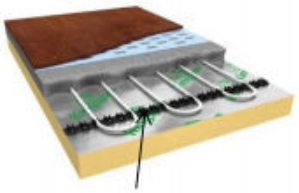
Supplied by WDS

- 16mm Pert/Al/Pert pipe
- Vapour barrier
- Clip track/Plastic pipe tray



Supplied by others

1. Screed
2. Edge insulation
3. Floor Insulation
4. Concrete slab
5. Flooring*



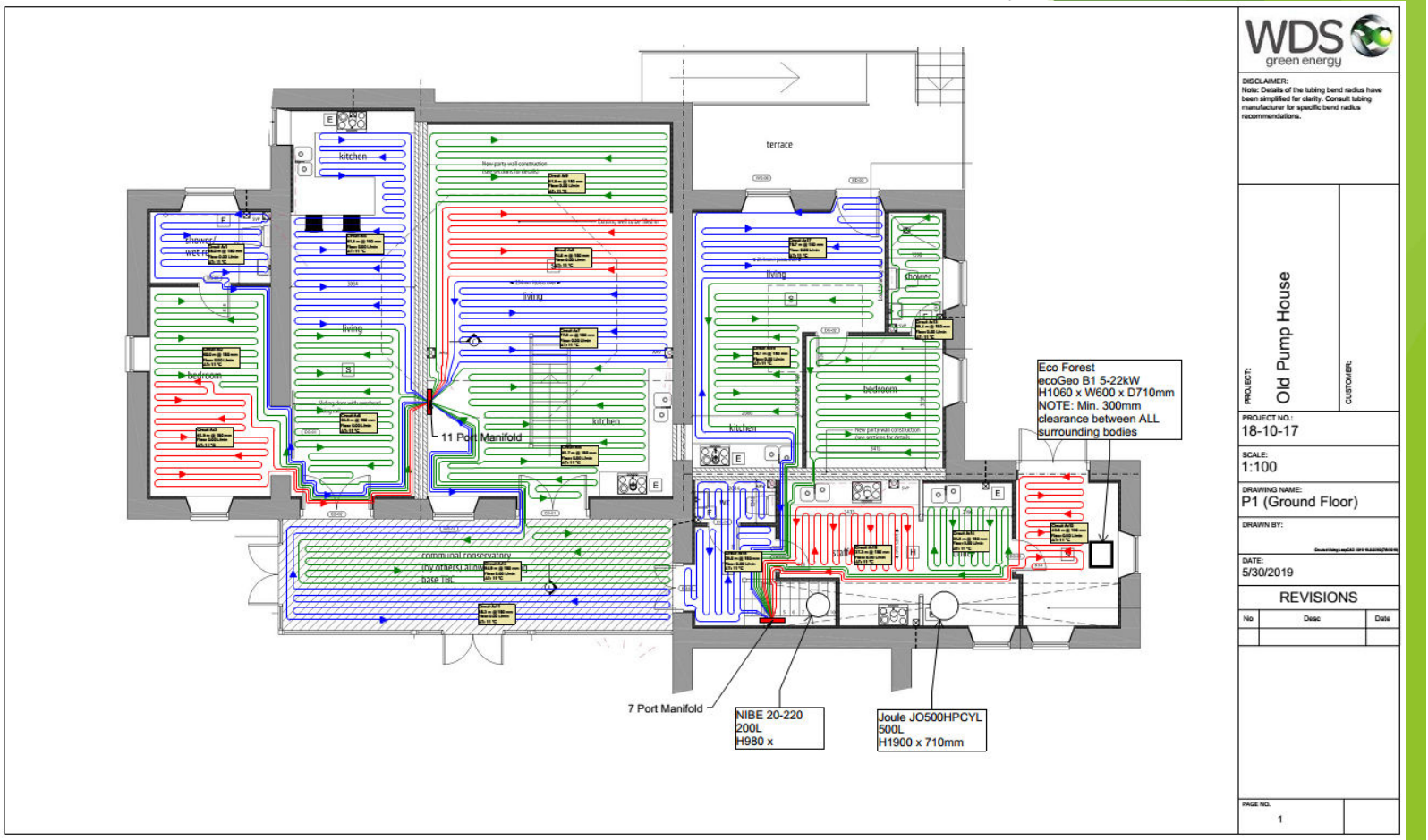
Clip track

Plastic pipe tray

*Limiting floor surface temperature to a maximum of 27°C. by using floor probes, is essential when using wooden floor finishes. Specialist timber floor suppliers should be contacted to obtain expert advice on your chosen floor finish. The addition of carpet and rugs on wooden floors can increase the temperature between floor and carpet. Make sure the combined tog value of carpet & underlay does not exceed 2.5 tog. Total thickness of floorboards and any wooden or laminate floor finish should not exceed 25mm.

Heat Emitters - UFH

- Prior to installation a UFH Layout will be created ensuring that all areas while including the proposed locations for all manifolds and thermostats to be confirmed with the customer.



Restrictions

Permitted Development (PD)

GSHP

Generally classed as PD excluding listed buildings, conservation areas, world heritage sites.

ASHP

The Installation of an ASHP is considered to be permitted development, not needing planning permission, provided ALL of the conditions are met.

Main Criteria:

- ASHP located at least 3m (Wales) or 1m (England) away from property boundary
- Property is not classed as a listed building
- ASHP must not be located on a pitched roof
- Wales - ASHP must not be facing any Highway (in England if installed above ground level)
- England – ASHP must not be installed on a wall if that wall fronts a highway and any part of that wall is above the level of the ground storey. This does not apply in a conservation area or world heritage site etc.
- Installation complies with MCS 020
- 1st ASHP installation

Commercial

Generally planning required

https://www.planningportal.co.uk/info/200130/common_projects/27/heat_pumps/2

Distribution Network Operators (DNO)– Energy Network Association (ENA)

- As part of any heat pump installation, the DNO must be notified and for some units permission must be received prior to installation.
- There are numerous reasons why DNOs may need contacting before the installation of a Low Carbon Technology can take place; these include supply overload, damage to supply equipment, power quality issues or adequacy of earthing.
- The choice of pump is also dependent on the number of phases of the incoming supply. 3 Phase supplies can accommodate larger capacity pumps while running at a lower current.
- GSHP / ASHP 1ph = 0 - 30kW
- Option for multiple 1ph heat pumps instead of 3ph

Questions?

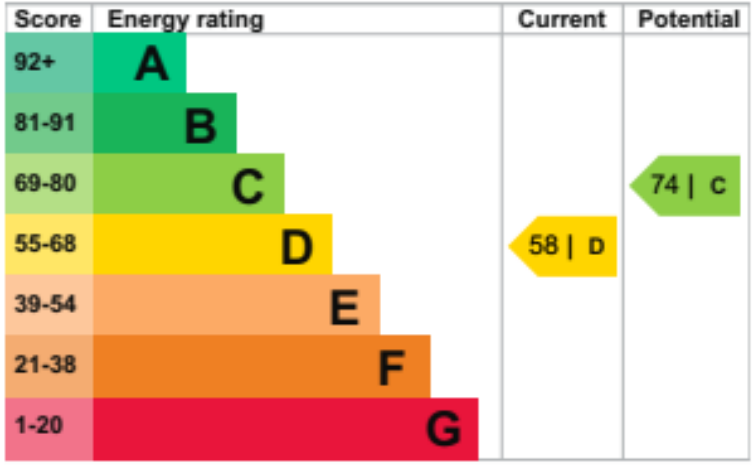
Boiler Upgrade Scheme, Energy Performance Certificates & MCS Performance

Boiler Upgrade Scheme (BUS)

- £5000 grant for ASHP / £6000 for GSHP
- Applied for and paid to installer – customer pays total minus grant (unless eligibility issues to be resolved prior to redeeming the grant monies)
- HP system must provide all heating and hot water demand of property, no fossil fuel backup (except for direct electrical)
- Existing Properties:
  - Must have EPC
  - No recommendation to improve Loft insulation
  - No recommendation for cavity wall insulation
  - Exemptions are available for certain properties such as listed buildings / exposed / conservation area
- New Builds:
  - Privately owned by individual – no developers (build to sell)
- Small Commercial also eligible
- Simpler than previous RHI scheme, flat grant payment for system whether a small bungalow or mansion house

Energy Performance Certificate (EPC)

- Space / Water Heating demand for performance estimates
- Insulation improvements for eligibility – Cavity Wall & Loft insulation only (exemptions apply)
- Less than 10 years old
- No minimum energy rating



Step	Typical installation cost	Typical yearly saving
1. Cavity wall insulation	£500 - £1,500	£38
2. Internal or external wall insulation	£4,000 - £14,000	£128
3. Solar water heating	£4,000 - £6,000	£39
4. Wind turbine	£15,000 - £25,000	£695

MCS Performance Estimate

Summary:

- Total demand of property
- Comparable running costs
- Performance Graph
- Total Benefits

Energy Performance Certificate (EPC) Information

Does this estimate relate to a new build or proposal for extension or reduction in size of an existing building? No

From EPC dated 04-06-21

EPC No. 4839-4826-3000-0257-6206

Energy required to heat property *from EPC* 20,114 kWh

Energy required for hot water *from EPC* 2,768 kWh

Fuel Information
(where possible from customer bills inc. VAT)

Date on which prices found: Energy Saving Trust, April 2022

Fuel	*Cost*
Oil	122.13 p/L
Electricity	28.30 p/kWh

New Renewable System Information

Type of System	Air Source Heat Pump	**This calculator is not designed to be used for Solar Assisted Heat Pumps*
Manufacturer Name	Vaillant	
Manufacturer Model	aroTHERM plus 12kW	
MCS Certificate No.	KIWA 00016/020 HP	
Flow Temperature	50°C	** Determined by the temp. of the water leaving the HP when supplying space heating at the external design temp.*
MCS SCOP Heating	3.92	** SCoP - Seasonal Coefficient of Performance. This value is based on the MCS HP SCoP Table*
MCS SCOP Hot Water	1.75	** If providing space heating and DHW then default value from SAP2012. If DHW only see methodology in MIS3005.*
Renewable System Provides	Heating & Hot Water	
Hot Water Immersion Use	once per week	** based on 50C up to 60C, 3kW*
Size of Hot Water Cylinder	250 L	

Existing Heating System

Existing heating system fuel	Oil boiler (condensing)	
Hot Water heated by	Oil boiler (condensing)	**If a different source of fuel is chosen for heating & hot water system, it is always assumed the hot water system is generated via direct electricity despite there appearing to be a choice*
Age of existing system	Post-2007	
Efficiency of existing system	92 %	

Estimated System Perfrormance / Comparison

Energy Requirement for the building

	Heating	Hot Water	Total
Energy required to heat property	20,114	2,768	22,882 kWh
Existing/Comparable System Consumption	21,863	3,343	25,206 kWh

New HP System Estimated Consumption

HP System Electricity Consumed	5,131	1,582	6,713 kWh

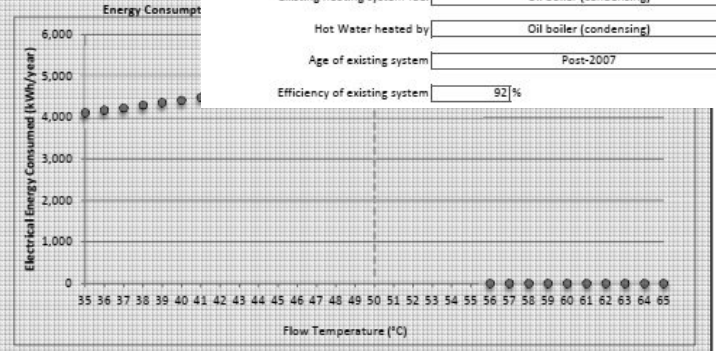
Running Costs

Please view all estimates with caution, these cannot be treated as a guaruntee of performance

Existing system annual running cost	£3,100	
HP System annual running cost	£1,943	**includes immersion*
Fossil Fuel Cost in new system	£0	
Annual fuel saving	£1,157	
Fuel Saving Over 7 Years	£8,099	
Approximate CO_2 saving	50%	

Capital Cost for Installation

Cost for installation of new system	£15,310 inc.VAT	**Refer to quotation document for more detail*



Quotation Process

Preliminary Quotation

- Able to give the customer a cost estimate based upon the EPC and/or any other information on hand i.e. Sketched/estate agent floor plans etc.

Full Quotation

- Provides an accurate heat loss assessment based upon full detailed plans including floorplans, elevations and section views or following a site survey
- For a quote of greater accuracy, U-Values must be provided. If this is not possible to provide, we can estimate the values based upon the material construction or the building regulations at the time of build.
- Assessment of existing heat emitter sizing with recommended improvements

Installing with WDS

1. DNO approval
2. Signed order and 20% deposit (of total minus BUS grant if eligible)
3. Handover from Sales to Project team – allocated Project Manager and second visit if required
4. Equipment orders placed, lead times notified, installation date
5. Preparation works complete
6. WDS Installation & Commissioning – typically 3-5 days
7. Handover
8. Manuals & MCS certificate

Project Management / Contractor Interfaces

- Communication is provided between WDS, customer, architect as well as any third party contactors.
- Contractual scope of works, layout drawings, base specifications, electrical requirements, hydraulic schematics provided
- Additional site visits prior to installation to ensure that the job goes as smoothly as possible.
- Provide the customer with all the necessary instruction manuals as well as a specific handover session where any queries and questions regarding the operation of the equipment may be addressed.

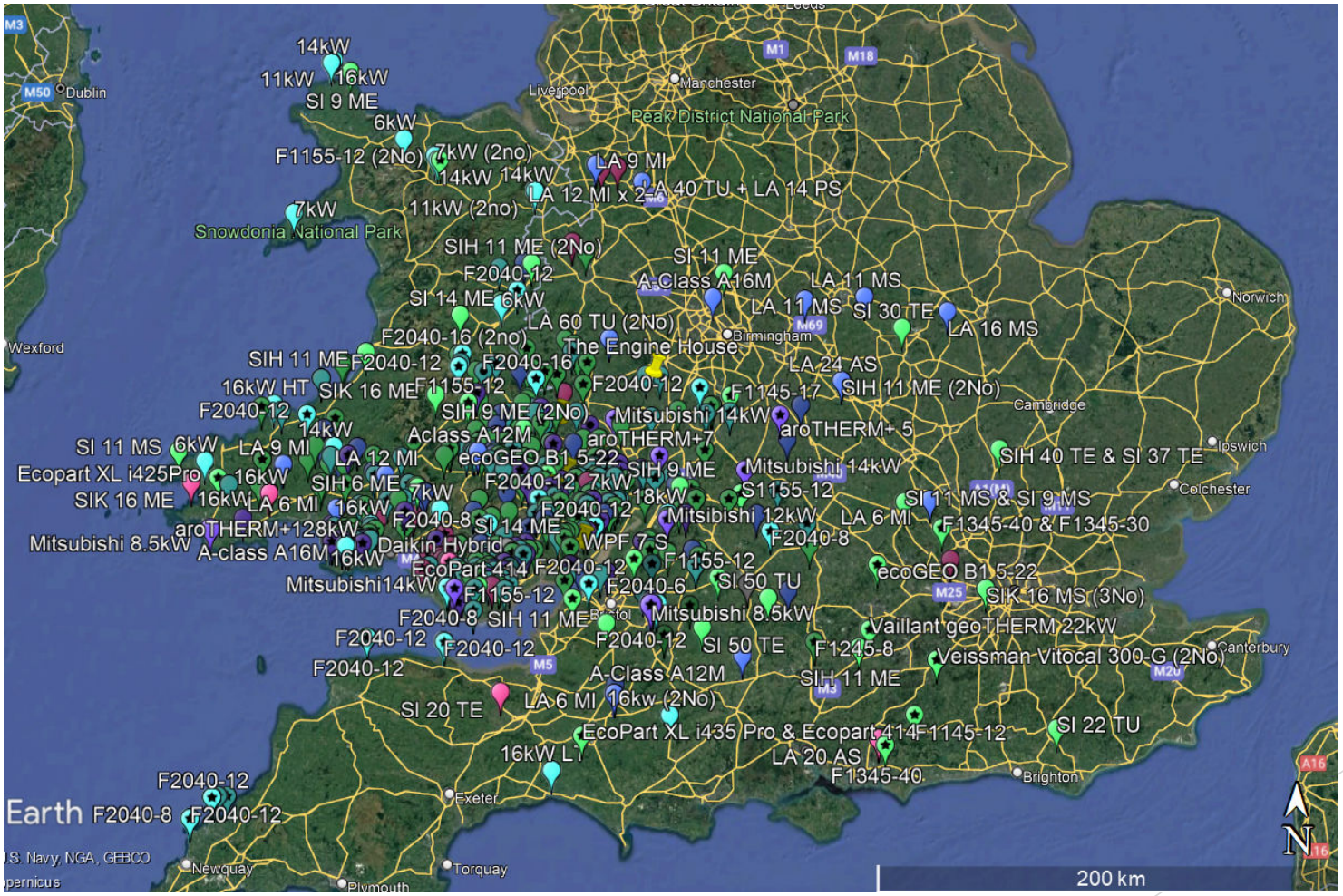
Post Installation

- ***Manufacturers Warranty*** varies from manufacturer to manufacturer with support being offered for up to 7 years.

- In addition to the manufacturers warranty, WDS include a 24 months ***Workmanship Warranty*** within the quotation which is insurance backed as a required by MCS.

- WDS offer a annual ***Service Agreement*** which covers all MCS and Manufacturer warranty servicing requirements at a cost of £200-£300 for domestic properties

Coverage Area



Questions?

Case Studies

Sunnyside, Rhossili ASHP

- NIBE F2040-12kW Retrofitted onto a Georgian property with poor insulation.
- Renewed Radiators
- Holiday Cottage
- 38% saving on running costs compared to existing oil boiler
- Annual RHI returns of £1,558 for 7 years = £11,446
- Combined benefits over 7 year period: £15,471

Spring Cottage, Stroud ASHP

- Mitsubish Ecodan 11kW ASHP fitted into old stone cottage as part of renovation, no insulation in walls.
- New radiator circuit throughout (originally electric storage heaters and coal fired rayburn)
- Estimated 67% reduction in running costs vs electric storage heaters
- *Customer testimony*
  "We are completely delighted with our air source heat pump! It has transformed our old stone cottage into the cosy home we've wanted. It has replaced a coal fired Rayburn so we're really pleased to now have a green energy source. Throughout the conversations with WDS about what system would best suit us we felt confident they were being objective and committed to us getting the right system for our home. Their attention to detail was impressive and their ability to adapt around the quirks of an old building. The team that came to install and commission our system were great. We've had a lot of trades through our home as we complete a renovation. The WDS guys were definitely top of the list in terms of politeness, competence and in keeping the disruption to a minimum."

Whitchurch, Cardiff suburb, ASHP

- Nibe 8kW ASHP retrofitted to 1980s property with insulated cavity walls & double glazing
- Some renewed radiators, not all
- *Customer testimony*
  "WDS Green Energy responded promptly and professionally to my enquiry. A price was provided shortly after the design process was completed by competent designers. The installation team were first class. Highly skilled and qualified and experienced. Lovely people to talk to. Since installation my heat pump has been faultless. I needed to tune the heat loss curve and the radiator valves initially and since then we have a warm house and loads of hot water. Combined with my solar PV system it means my house is almost energy neutral. Fantastic result."

Station House, Creigiau ASHP

- Mitsubish 14kW ASHP fitted onto Victorian terraced property as part of renovation/extension works, mix of new build extension and original uninsulated solid brick walls
- Renewed Radiators & small area of underfloor heating
- *Customer testimony*
  "Both the ASHP and UFH installations were immaculate, and we now have a very warm home with reduced running costs compared to our previous oil boiler – even more impressive given the house is now bigger than when the oil boiler provided heating."

Marsh Farm, West Sussex GSHP

- NIBE F1345 40kW
- NIBE 500L DHW Cylinder
- NIBE UKV220 & UKV300 Buffer
- 10no. 200m Ground loops designed for heating & DHW inc. heating of pool
- Heating & DHW Demand: 15.51kW
- Pool Heating Demand: 22kW

Doyden House, National Trust

- ASHP System, heating & DHW for 4 appartments
- Heating & DHW Demand: 27.7kW
- 3no. NIBE F2040-12kW
- 2no. NIBE 300L DHW Cylinder
- NIBE UKV500 Buffer

Croome Court – National Trust

- 48no. 200m Ground loops designed for heating only
- Heating Demand: 200kW
- 2no. Dimplex SI 100 TE – 100kW
- Dimplex 1000L Buffer

https://www.nationaltrust.org.uk/croome/features/ground-source-heating-at-croome

Bere Mill, Hampshire

- Closed Loop Water Source
- 2no. Energy Blades
- Total Demand: 32.4kW

- CTC EcoPart XL i430Pro
- Joule 400L Cylinder
- Joule 300L Solar Buffer