

GROUND SOURCE HEAT PUMPS AND SHARED GROUND LOOP ARRAYS



The UK's leading ground source heat pump manufacturer and installation contractor

Our aims

- Decarbonise heat across all sectors
 - Scottish Energy Strategy 2017: The equivalent of 50% of the energy for Scotland's heat, transport and electricity consumption to be supplied from renewable sources by 2030
 - Building standards: will be tightened to ensure that new homes use renewable heat from 2024, with standards for non-domestic buildings also tightened. A new Zero Carbon Standard for public sector buildings will be consulted on later this year.
 - Scotland's electricity grid 74% decarbonised due to the huge growth of onshore wind in the last 10 years offering considerable potential for heat and transport decarbonisation through electrification.
- Reduce fuel poverty in rural and urban communities
 - Currently 25% of Scottish household are in fuel poverty
 - 7% of Scottish households are in extreme fuel poverty
- Provide a simple, effective and low maintenance solution to achieve the first two aims

INTRODUCING KENSA



The UK's leading ground source heat pump manufacturer and installation contractor



Kensa Contracting has an award-winning heritage with thousands of successful installations in both retrofit and new build properties.

- Delivery of larger scale GSHP projects
- Turnkey project management solution
- Full or shared project management options
- Equipment supplied by Kensa Heat Pumps



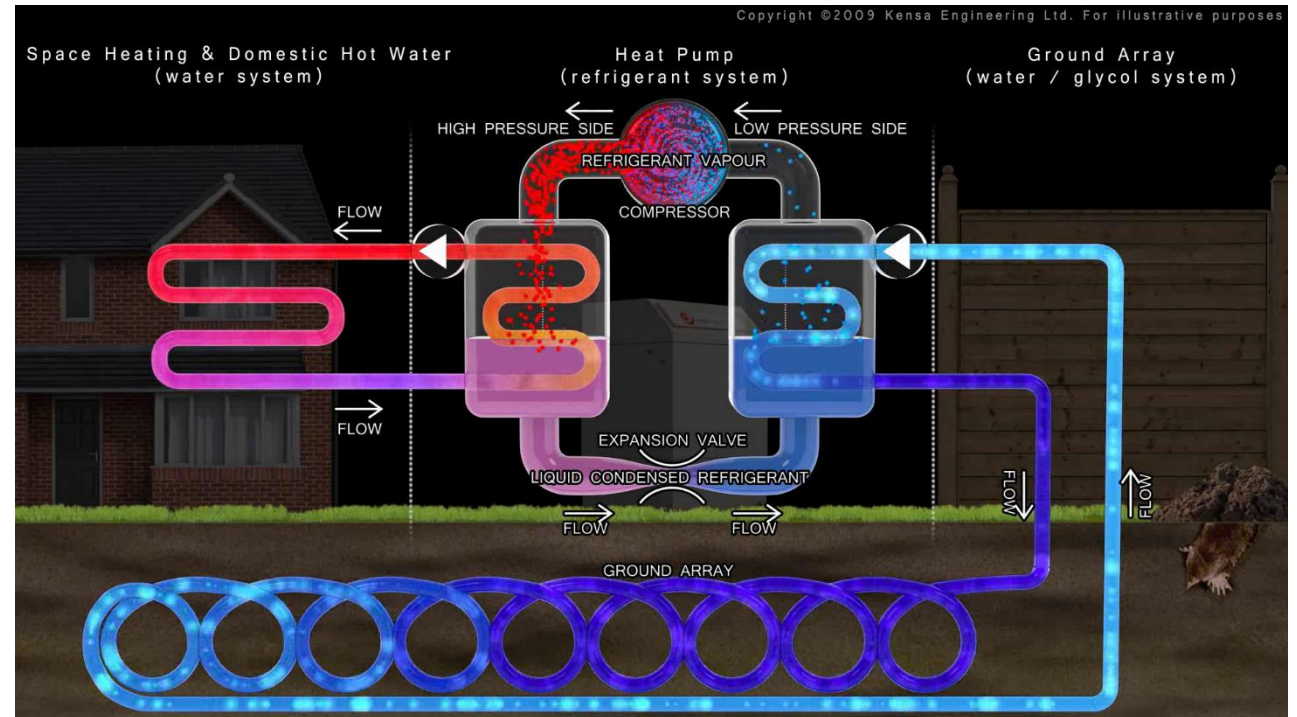
GROUND SOURCE HEAT PUMP TECHNOLOGY



The UK's leading ground source heat pump manufacturer and installation contractor

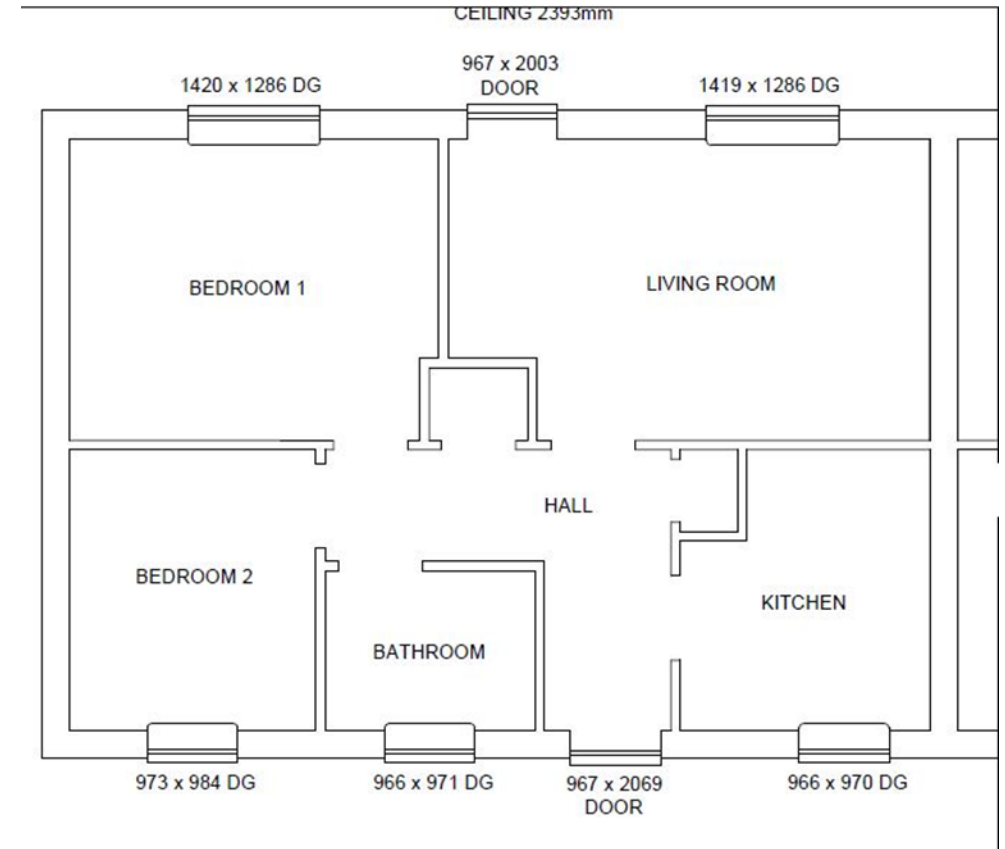
The basics:

- Non combustion heating system
- Produces up to three times more energy than it consumes
- Ground provides a highly efficient source of heat
- Unaffected by air temperature
- Recharged by solar energy and rainfall
- Ground type (thermal conductivity) needs to be factored into sizing calculations
- Correct sizing is important to avoid over extract



<https://www.kensaheatpumps.com/how-a-ground-source-heat-pump-works/>

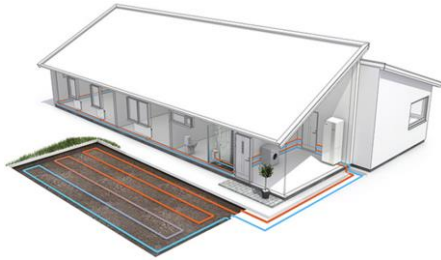
- Elemental heat loss calculation to BS EN 12831
- Heat loss carried out room-by-room
- Peak heat load sized to 99.6% external air temperature
- Size to 100% of peak load
- No backup required
- Size hot water cylinder depending on need
- Choose heat pump depending on high output or high temperature
- Borehole sizing based on peak load and annual load



OTHER METHODS OF HEAT EXTRACTION

GSHP TECHNOLOGY

Straight pipe



- Collector pipework laid horizontally
- Requires large land area
- Not that sensitive to ground type
- Can be oversized easily
- Cost effective
- Quick to install

Slinkies



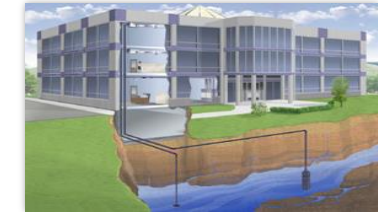
- Pre coiled pipework laid in trenches 1-2m below ground
- Requires large land area, but less digging
- Not that sensitive to ground type
- Can be oversized easily
- Cost effective
- Even quicker to install

Surface water (closed loop)



- Ideal solution where surface water (e.g. lake) is available
- Uses pond mats featuring slinky pipe on steel frames
- Extremely efficient
- Cost effective
- Reduced maintenance compared to open loop

Aquifer or mine water (open loop)



- Extracts ground water from an underground aquifer or mine
- Efficient
- Costly to maintain
- Considerations need to be taken regarding corrosion issues, filtration and extraction

In brief:

- Extremely low CO₂ emissions enabling easy carbon and building regulations compliance
- No point of use NO_x or SO_x emissions
- Lowest energy bills; slightly lower than air source heat pumps, LPG & oil
- Ultra-efficient and reliable
- Minimal service and maintenance costs
- 20 – 25 year heat pump unit life expectancy
- >100 year ground array life expectancy
- Ideally suited for time of use tariffs
- Completely unobtrusive – no visual impact



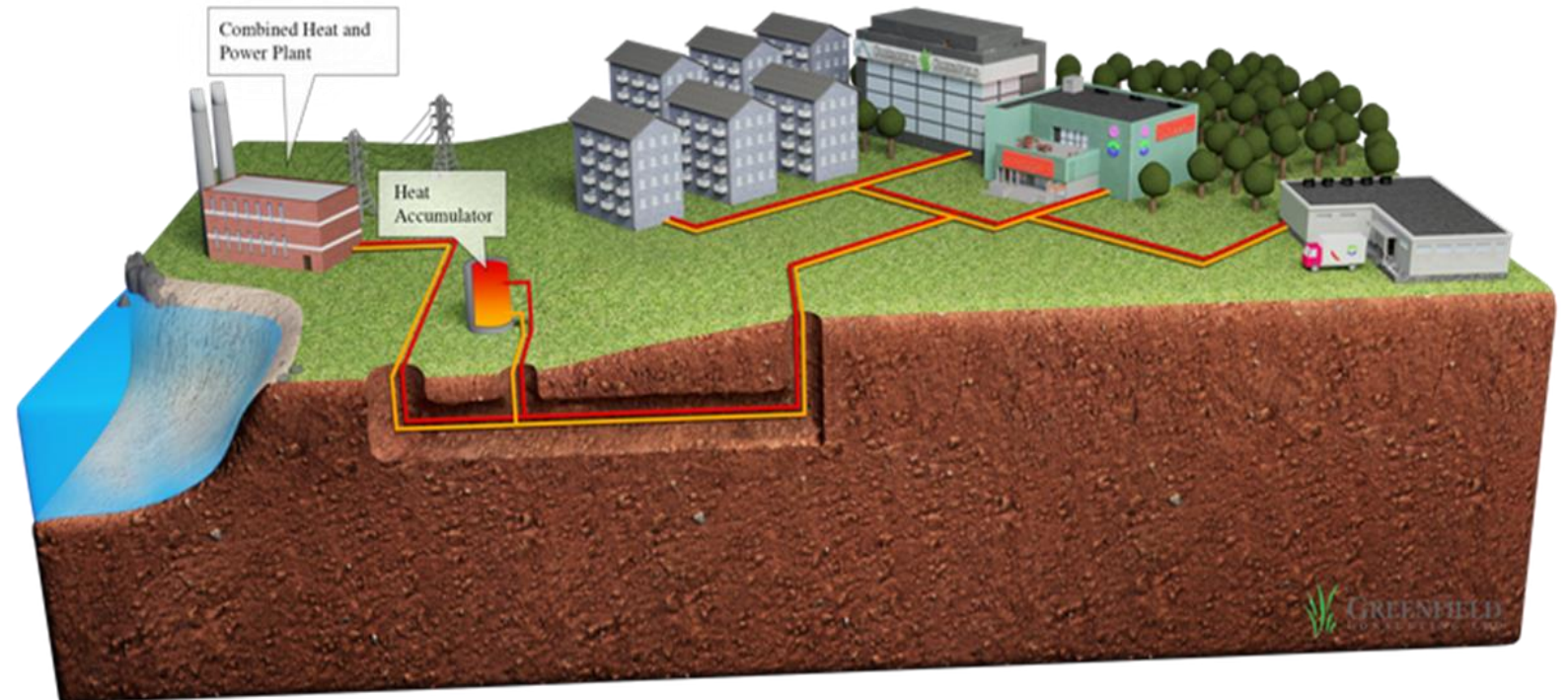
DISTRICT HEATING VS SHARED GROUND LOOP ARRAYS



The UK's leading ground source heat pump manufacturer and installation contractor

Drawbacks:

- Heat loss through network
- Overheating in risers & corridors
- Networked heat metering
- Requires split-billing
- Single heat energy provider
- Complex funding claims
- Large & unsightly central plant
- ESCO purchases energy
- Highly specialised servicing
- Back up system required

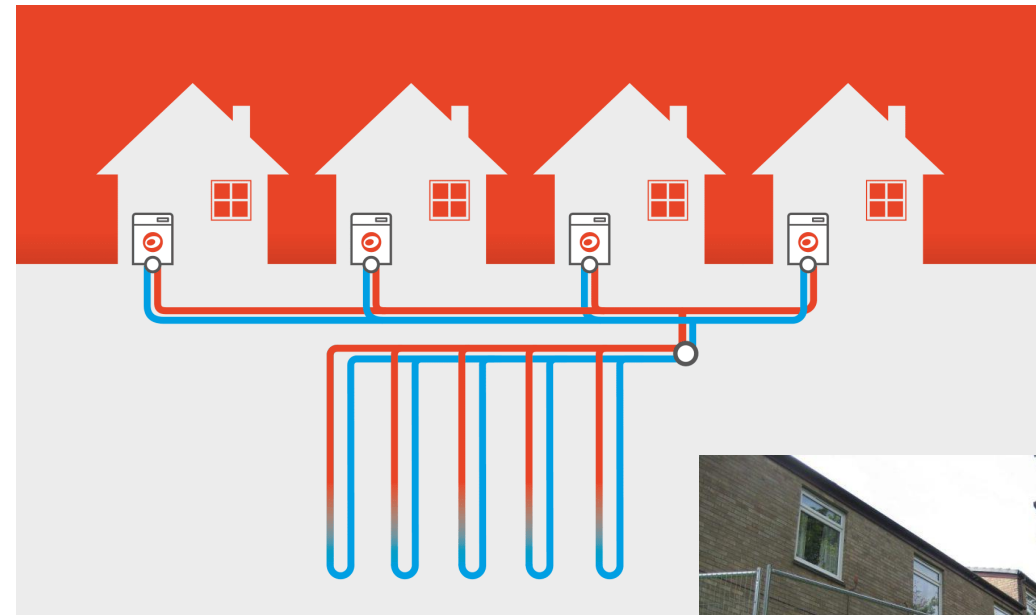


SHARED GROUND LOOP ARRAYS

Shared ground loop arrays are a form of ultra-low temperature heat network connecting Kensa ground source heat pumps inside individual dwellings.

A different approach:

- Link as few as two properties
- Infinitely scalable for large developments
- Suitable for single and multiple occupancy dwellings
- Communal ground array pipework
- Individual heat pump in each dwelling
- Mimics a traditional gas framework

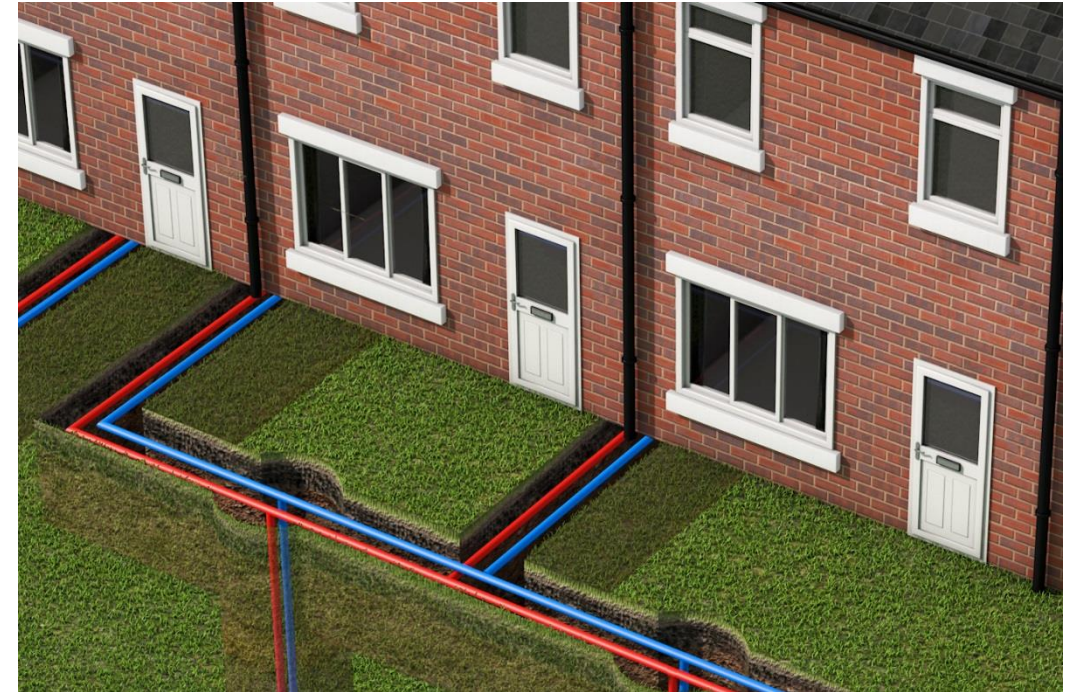


<https://www.kensaheatpumps.com/the-technology/heat-sources-collectors/shared-ground-loop-arrays/>

SGLA BENEFITS

- Scalable and flexible solution
- Ambient temperature distribution
- No district heat losses and no overheating
- Potential for free summer cooling
- Individual heat pump in each dwelling
- Powered from occupants own electricity supply
- Householders able to switch energy suppliers
- Lowest running costs
- Independent billing and independent heat
- Eligible for 20 years payback from the Non Domestic RHI
- Split ownership permitted
- Ground arrays 100+ year lifetime
- Planning exempt

DISTRICT HEATING vs SGLAs



A perfect fit for Shared Ground Loop Arrays:



- 3kW and 6kW models
- Quiet operation: 47 dBA and 52 dBA
- Compact design: 530mm x 475mm x 370mm
- or 560mm x 605mm x 565mm (H x W x D)
- Integrated ground side circulation pump
- Heating and hot water (above 60°C)
- Fits in a cupboard or under a sink
- Compatible with all control systems



<https://www.kensaheatpumps.com/ground-source-heat-pump-products-services/shoebox-ground-source-heat-pump/>

For developments with multiple properties, vertical boreholes are typically used to extract heat energy and are linked together to form the shared ground array.

- Closed loop pipework in vertical hole
- Dependant on site geology
- Requires specialist installation
- Typically 100-150m deep
- Gives 30-60 Watts per metre
- Space efficient and quick
- More expensive than slinkies or water
- Economies of scale can be realised
- >100 year borehole life expectancy



<https://www.kensaheatpumps.com/district-ground-source-heat-pumps-installation-in-tower-blocks>

Kensa Contracting offers flexible service delivery options depending on the level of project management required.

This can include:

- feasibility studies, geological surveys & financial modelling
- ground array sizing, design & installation
- heat pump selection, installation & commissioning handover
- integration with existing or upgraded heat emitters
- integration with existing or upgraded heating controls
- sub-contractor management
- tenant liaison and householder education
- support with RHI & ECO grant funding applications
- warranty & after sales support



<https://www.kensaheatpumps.com/the-technology/installation-fullfilment/kensa-contracting-ltd/>

DISTRIBUTION SYSTEM & CONTROLS

- Distribution system sized to 45°C flow temperature
- Radiators oversized
- Timeclock
- Central thermostat
- TRV on radiators
- Hot water priority
- 60°C stored hot water
- Local hot water cylinder

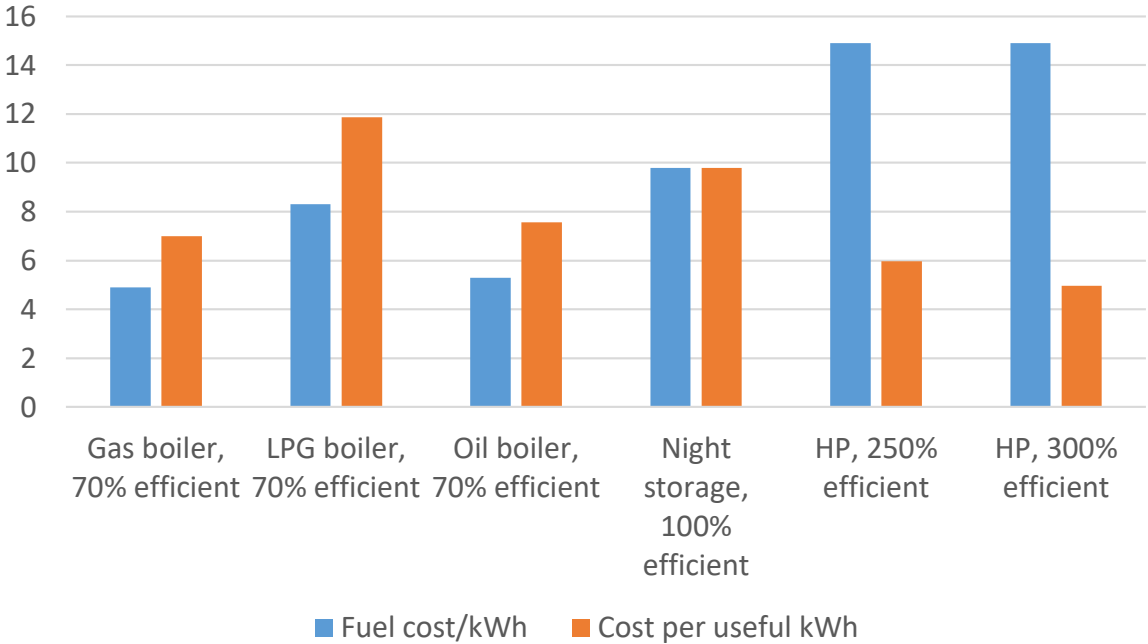


DISTRICT HEATING vs SGLAs



Annual cost

Heating System Running Cost/kWh



Unit cost

Comparison of predicted heating costs for the resident(s) of a 2-bed energy efficient apartment



Source: Etude, 'Low Carbon Heat: Heat Pumps In London', September 2018.

TENANT TESTIMONIALS

GSHPs & HOUSEHOLDERS



"We were spending £70 per week before on electric, we have now knocked that down by just over half, so it's a big difference and the house is really warm now."

"The system is very easy to use, simple, it's not hard at all, anyone could do it."



"Night storage heating was extremely dear, especially given that you didn't get any heat after tea time."

"I've been writing down how much money I've been putting in since the heat pump installation, I reckon I'm saving between 35-40% to what I was putting in before."



"I've lived with many heating systems, coal, oil, gas, storage heaters, but ground source has to be my favourite, it provides a nice, gentle, constant heat that keep my home really comfortable."

SGLA COSTED EXAMPLES

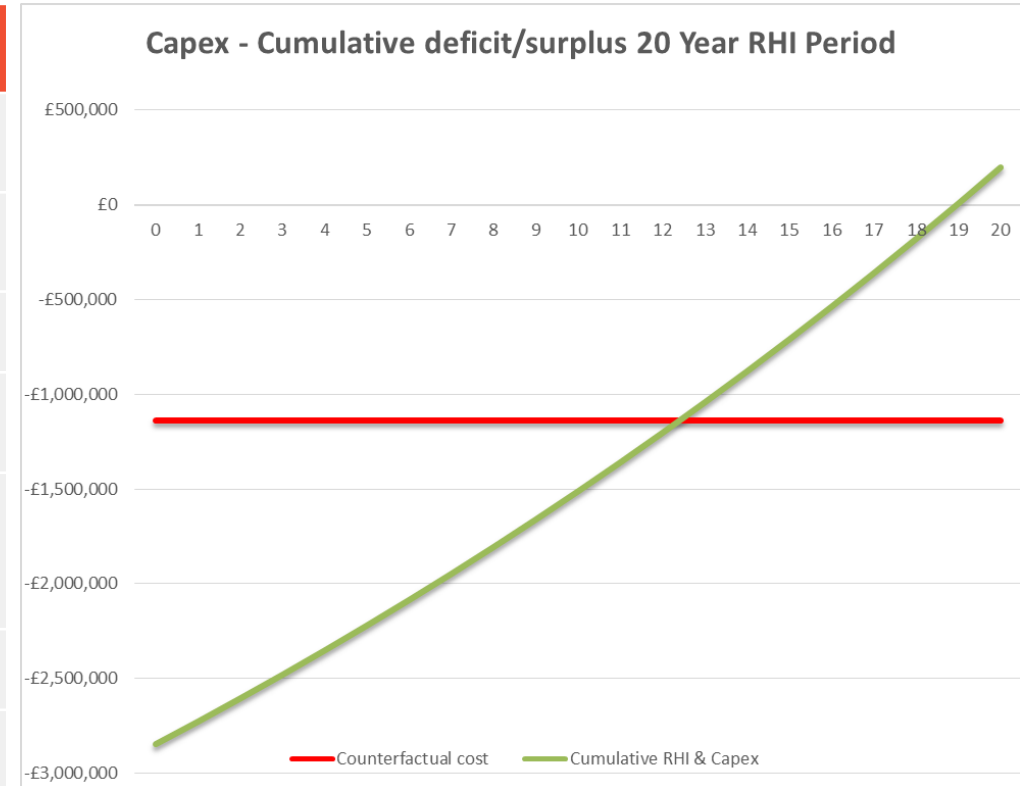


The UK's leading ground source heat pump manufacturer and installation contractor

NEW BUILD EXAMPLE

COSTED EXAMPLES

Number of properties	350	Per property average
Gross price excluding VAT	£2,846,367	£8,132
Counterfactual cost***	£1,137,545	£3,250
Marginal cost	£1,708,821	£4,882
Estimated RHI income over 20 years **	£3,041,774	£8,691
Residual benefit (RHI income less gross price):	£1,332,952	£3,808
IRR	5.7%	
Payback period	12.4 years	



In brief:

- Small new development of 8 houses
- Off the mains gas network
- 3 x communal borehole arrays
- Kensa carried out all works up to the heat pump location
- The developer's M&E contractor carried out all internal works
- Kensa provided MCS accreditation
- Properties averaged a running cost of £33 per month
- 20%-30% lower than a fossil fuel alternative
- SRHA claimed £2,836 in RHI income over the first two quarters of heat pump operation
- Over the 20 year income stream, the cost of installation will be fully recovered



“The delivery of affordable warmth is important to Shropshire Rural. Given that the majority of our housing stock doesn't have access to mains gas, Kensa's GSHP solution is proving to be very helpful.

We now have more than a third of our homes now getting their heat and domestic hot water in this way; whether through retrofitting or by incorporating the ground source heat pump into new homes.”

- Ian Richardson, SRHA

In brief:

- New build, phased installation
- 27 flats, 9 houses
- Each dwelling has its own Kensa Shoebox heat pump
- Heat pump and cylinder fit in airing cupboards
- 4 shared ground loop arrays
- 17 boreholes, 95-130m deep
- £146,000 ground array cost
- £368,000 RHI return
- 13.7 tCO₂ saving/yr
- Running costs for residents reduced from £900/yr to £350/yr



Shared Ground Loop Array System Based on average property for completed scheme	
Lifetime CO ₂ savings	83 tonnes
Typical annual running cost saving vs NSH	£352
Total capital cost (exc. VAT)	£13,540
Heat pump, cylinder, metering and ancillaries	£4,530
Boreholes and ground collector system	£4,820
New radiator system supply and install	£3,900
Design and project management	£290
Existing system replacement costs (fuel switch)	£8,000
ECO funding contribution	£1,356
Total additional cost	£4,184
Total RHI contribution	£14,077
Payback period	7 years



In brief:

22 flats and 1 site office

Previously heated by electric NSH

Hanover Housing Association

In brief:

- Retrofit project
- 402 flats
- 8 tower blocks, 13 storey
- 96 boreholes
- 212m typical borehole depth
- £4.6 million project
- £4.3 million RHI return
- 773 tCO₂ saving/yr
- Running costs for residents reduced from £900/yr to £350/yr



In brief:

- Northumberland County Council – Stakeford Depot
- Offices, vehicle servicing, signwriting
- Replace existing gas boiler
- Trend BMS Control
- 5 x 75kW Kensa Plantroom Heat Pump
- 1 x 6kW Kensa Shoebox for hot water
- 42 boreholes to 157m
- £650k retrofit all-in price
- £841k RHI income over 20 years
- £175k Running cost savings over 20 years



CONTACT DETAILS

Matthew Black

Business Development Manager, Scotland

Kensa Contracting Ltd

matthew.black@thekensagroup.com

Tel: 0345 222 4328 | Mob: 07984 274164

<https://www.kensacontracting.com/>

Accreditations

