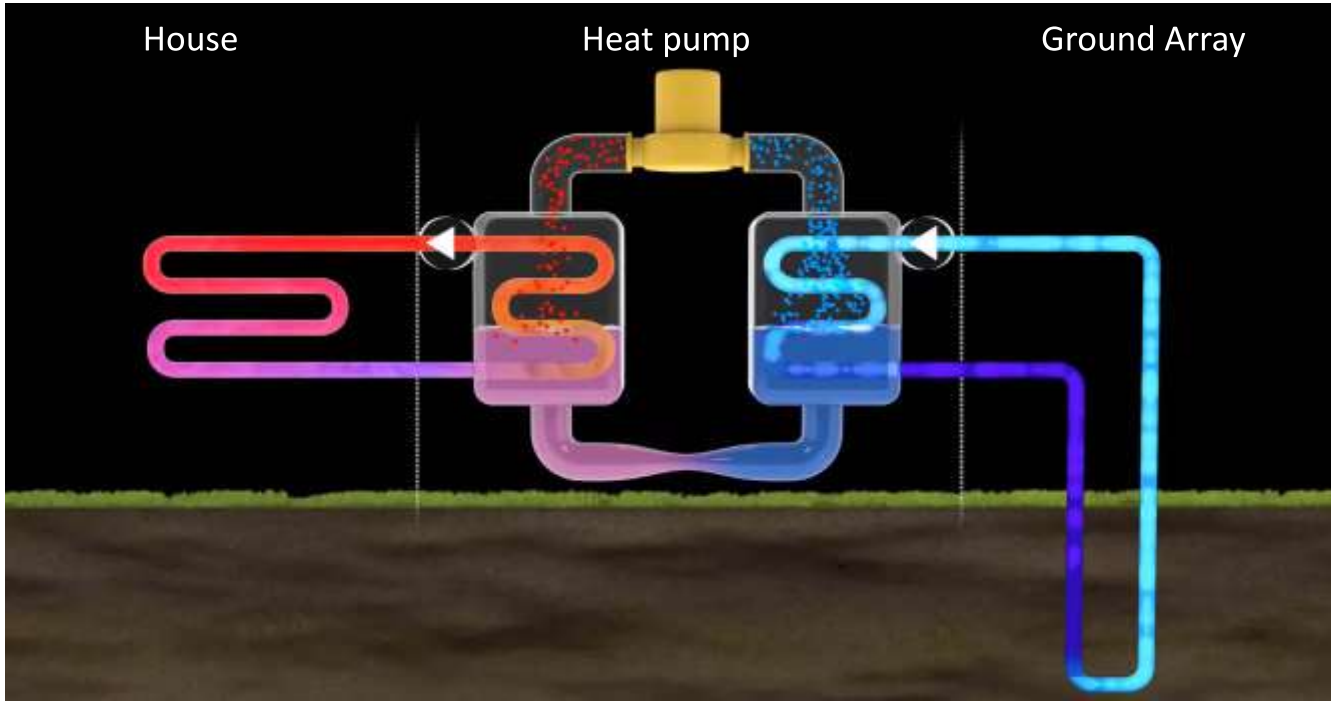
GROUP STRUCTURE

HOW A GSHP WORKS

The basics:

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

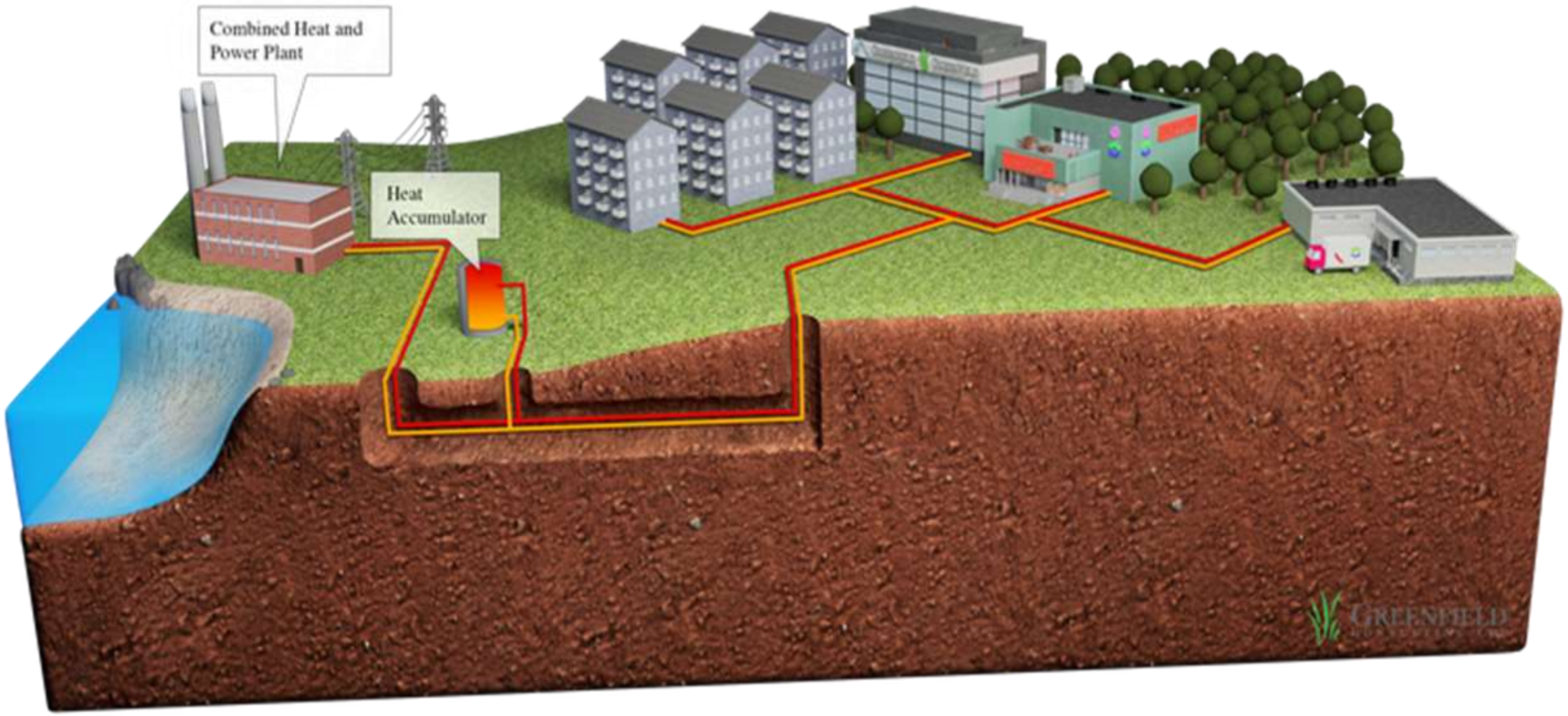


https://www.kensaheatpumps.com/how-a-ground-source-heat-pump-works/

TRADITIONAL DISTRICT HEATING

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

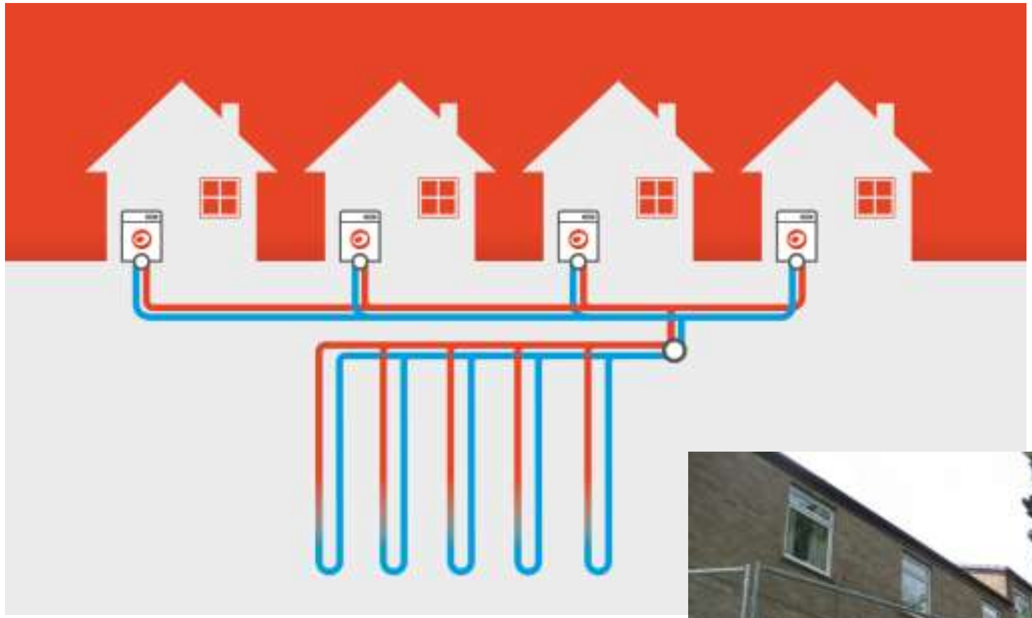


SHARED GROUND LOOP ARRAYS

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

- Ambient temperature distribution
- No district heat losses and no overheating
- Potential for free summer cooling
- 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

KENSA'S SHOEBOX HEAT PUMP

A perfect fit for Shared Ground Loop Arrays:

WINNER GREEN ENERGY AWARDS · AWARDS 2013 · H&V News AWARDS 2013 FINALIST · FINALIST 10th

- 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/

ENFIELD PROJECT – STEP BY STEP

In brief:

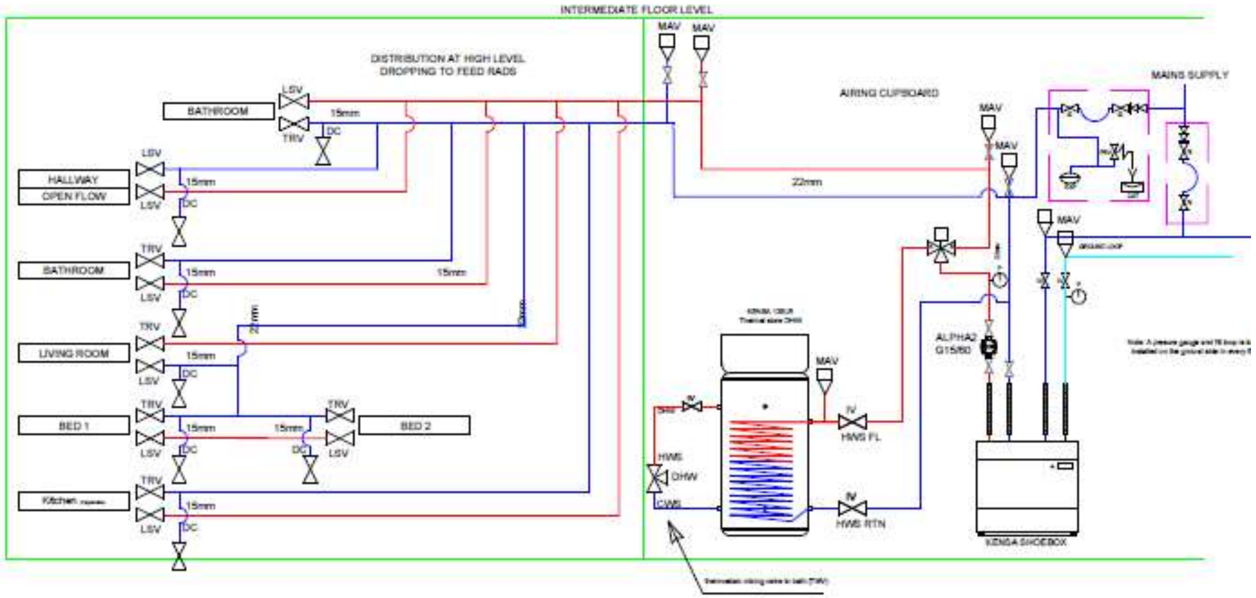
- Client: Enfield Council
- Principal Contractor: **ENGIE**
- Specialist subcontractor: **Kensa**
- England's largest shared loop district GHSP system
- Eight tower blocks – up to 402 individual flats
- Expected 50%+ savings on residents' heating bills
- Significant CO_2 emissions reductions
- Generates 20 year RHI income for Enfield
- Enfield Council benefits from ECO funding
- Commenced: **November 2017**
- Completed: **October 2018**
- Total contract value: **£7.3m**

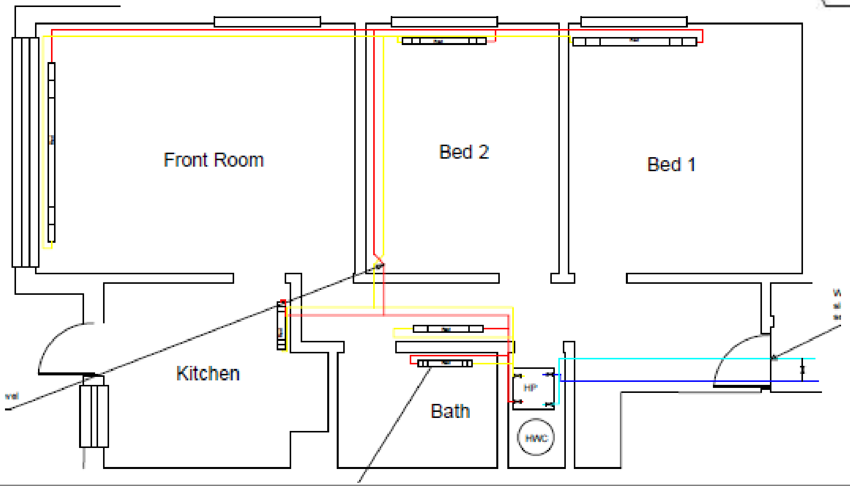
1. Tenant liaison

- Resident remained in occupation throughout the works
- Resident Liaison Officers consulted each family before, during and after works
- Communal meetings held for each block prior to works
- Individual plans agreed to ensure safe delivery of works
- Access to respite area for residents
- Ability to view mock-up for typical flat installation
- Opportunity to ask technical/general questions

2. Survey and Design

- Detailed property surveys to establish heat loads for accurate heat pump sizing and radiator sizing
- Borehole design was a combination of desktop analysis and on-site Thermal Response Test
- Risers designed to ensure no requirement for central circulation pumps
- Surveys carried out to locate all buried services – both externally and internally





3. Borehole drilling

- Specialist pre-drilling at BH locations to rule out UXO
- 96 boreholes; 20,700 metres; 32 arrays
- Each array serves half a tower block

4. Trenching and headering

- Trenches are dug from each BH
- Pipework installed in trench
- Manifolds group the boreholes together
- Two pairs of pipes run into each basement
- All ground reinstated at the end

PROJECT OVERVIEW

5. Riser installation

- Risers installed in stairwells from basement to top floor
- Core drilling on each floor
- Four pipes from basement to 6th floor
- Two pipes from 7th to 13th floor
- Branches taken off at each floor to serve the four flats
- Pipework insulated to prevent condensation
- All boxed in once completed
- All work approved by Enfield Council’s fire safety team

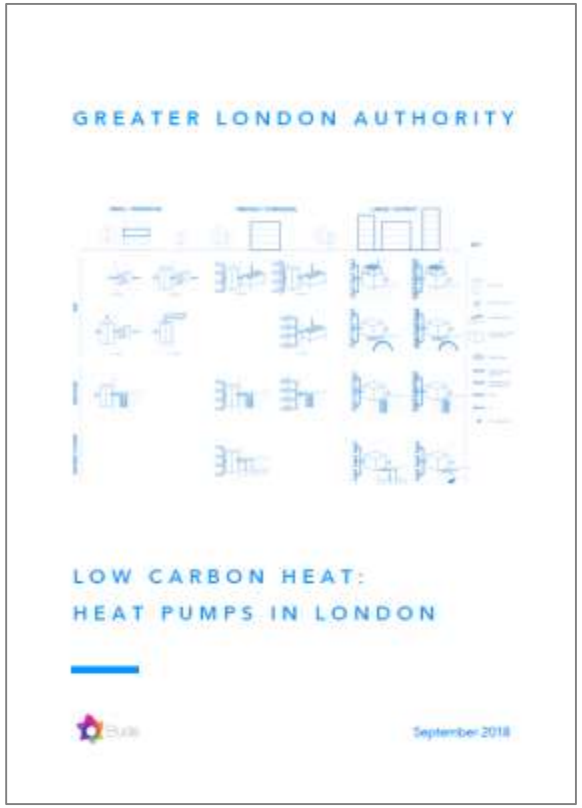
6. Flat installation

- Existing hot water cylinder and storage heaters removed (where fitted)
- New radiators and distribution pipework installed
- Heat pump installed in airing cupboard
- Shelf fitted and hot water tank installed above heat pump
- New controls – dial thermostat and twin channel programmer
- Ground array flushed and filled with anti-freeze
- Heat pump system switched on
- Existing electric UFH system de-commissioned
- Making good and pipework painted
- System handed over to resident

7. Key outcomes

- £4.3 million RHI return
- ECO funding obtained for client
- 773 tCO_2 saving/yr
- Running costs for residents reduced from £900/yr to £350/yr
- Significant reduction in maintenance costs for Enfield Council

- London aims to be a zero-carbon city by 2050
- GLA commissioned major report on viability of heat pumps for London: Enfield project featured
- The report concludes that efficient heat pumps offer a cost competitive form of low carbon heating
- Heat pumps are very likely to play a growing role for the delivery of low carbon heat in the capital
- Staging seminars to support the roll-out of heat pumps in new builds



> “**Heat pump systems** provide the lowest carbon heat for all case studies, though significant differences exist between the various types of heat pump. The lowest carbon heat is achieved by the residential block using ground source heat pumps coupled to a communal ground loop. This system benefits from very small distribution losses due to the ambient flow temperature and relatively high efficiencies of 380% for space heating at 35°C and 290% for DHW at 60°C offered by ground source heat pumps.”

- The carbon intensity of electricity generation has fallen significantly with further major reductions forecast for the next few decades.

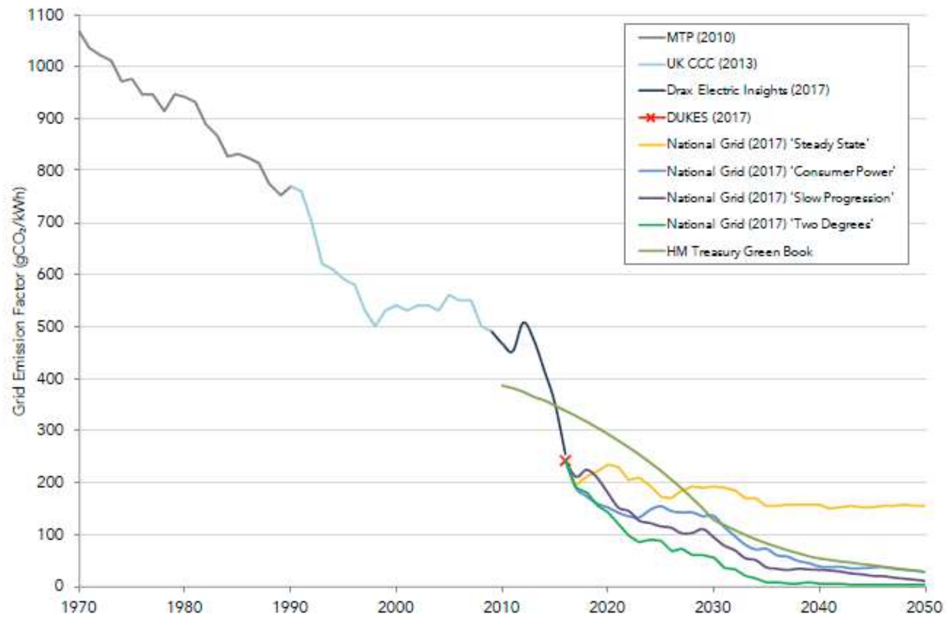


Figure 3.01 – Historic and projected carbon content of electricity

Source: Etude, *Low Carbon Heat: Heat Pumps In London* (September 2018)

- The much-reduced carbon intensity of electricity generation will be reflected in the next edition of SAP.

		Current SAP		Next Generation SAP (SAP 10)		Projected 2030	
Heat Source	Efficiency of Heat Source	Carbon Intensity (kg CO_2 per kWh)	Carbon Emissions (kg CO_2 per kWh)	Carbon Intensity (kg CO_2 per kWh)	Carbon Emissions (kg CO_2 per kWh)	Carbon Intensity (kg CO_2 per kWh)	Carbon Emissions (kg CO_2 per kWh)
Gas Boiler	85%	0.216	0.227	0.208	0.219	0.208	0.219
GSHP	300%	0.519	0.173	0.233	0.078	0.15	0.050
Direct Electric	100%	0.519	0.519	0.233	0.233	0.15	0.150
GSHP Carbon Savings against Gas Combi Boiler			24%		65%		77%

*"The Government recognises that **GSHPs are likely to be a strategically important technology for decarbonising heat**, and anticipates potential for significant growth in deployment of this technology through the period to 2050.*

Conclusions

- The technology is well developed and has been deployed at scale
- Government funding for shared ground loop heat pumps is in place to stimulate significant growth
- Investment returns on shared ground loops are attractive both in return rates and potential volumes
- Kensa has the knowledge and expertise to deploy this technology at significantly increased scale
- GSHP are a sustainable heating solution for both new build and retrofit projects
- **GSHP offer a solution to the Climate Emergency we are facing**