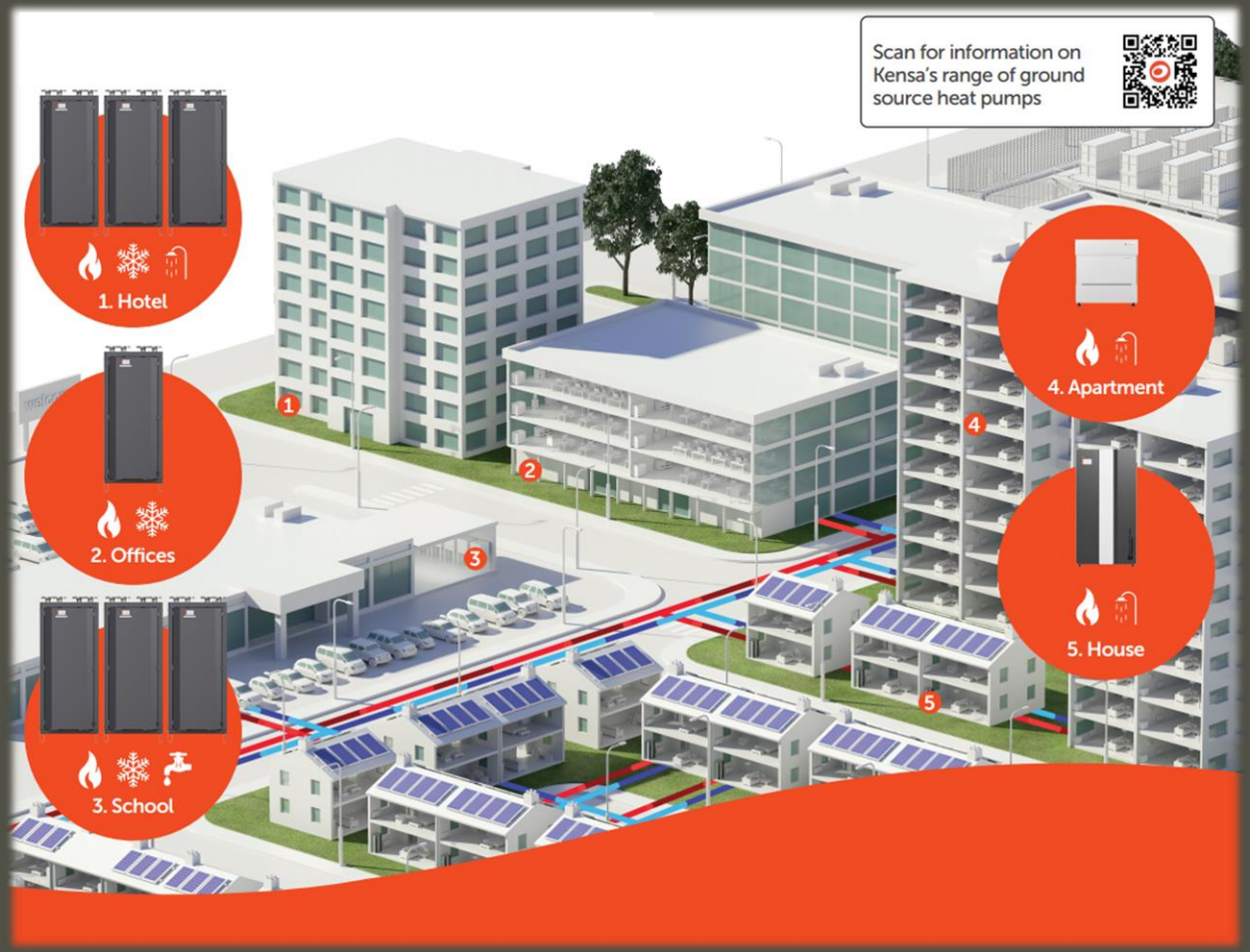
NETWORKED HEAT PUMPS IN NON-DOMESTIC BUILDINGS



Donna Rossetti
Non-Domestic Business Development Manager
October 2023

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- Who are Kensa?
- Ground array options
- Networked heat pumps and cooling
- Funded options
- Case studies and learning
- Questions

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Kensa Group Structure

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Ground Array Options

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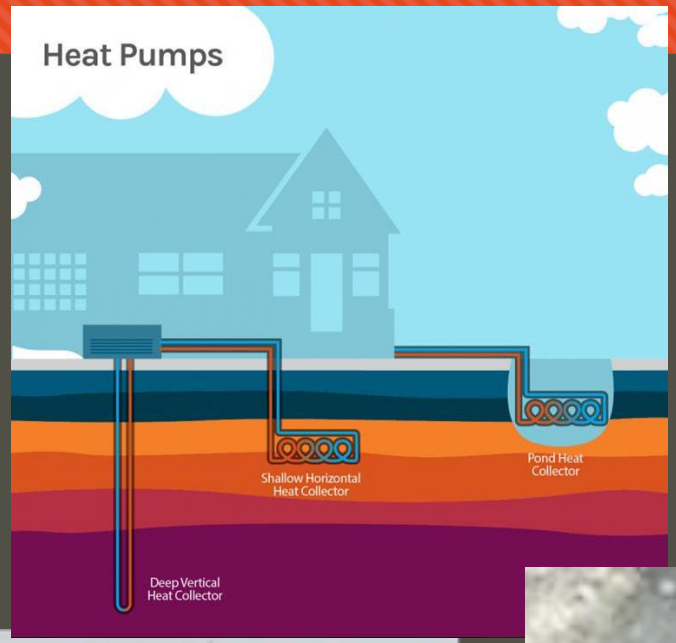
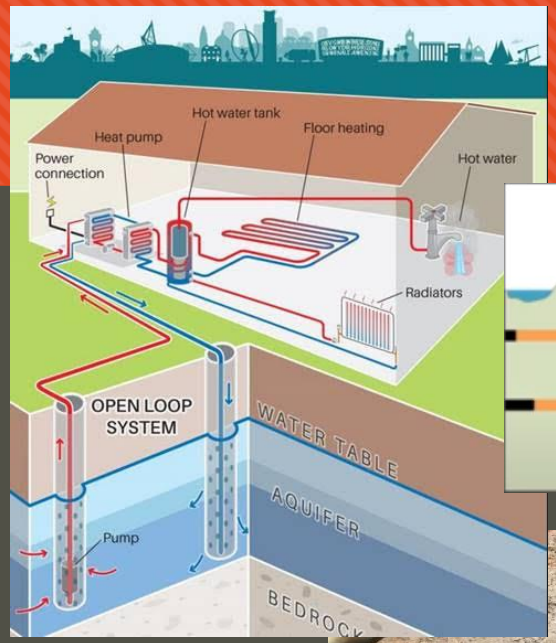
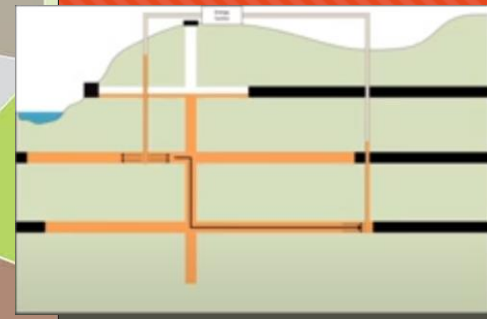
Ground array options

- Horizontal closed loop
- Closed loop water source
- Open loop
- Deep well
- **Closed loop boreholes**







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Closed loop vertical boreholes

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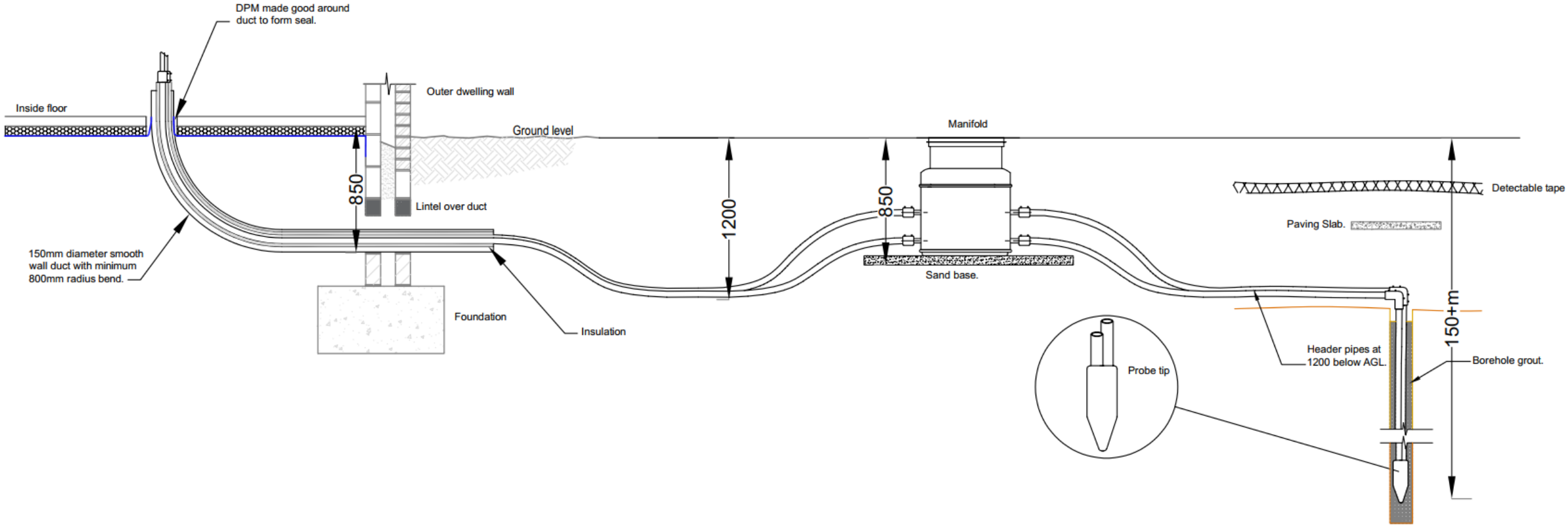
Shared Ground Arrays – How they look underground



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Networked Heat Pumps and Cooling

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Networked Ground Source Heat Pumps

- A form of ultra-low temperature heat network connecting ground source heat pumps inside individual buildings.
- Mimics traditional gas framework and allows private equity investment
- Link as few as 2 properties
- Infinitely scalable for large developments
- Suitable for combining domestic and commercial properties
- Communal ground array pipework
- Individual heat pump in each property delivering heating and or cooling

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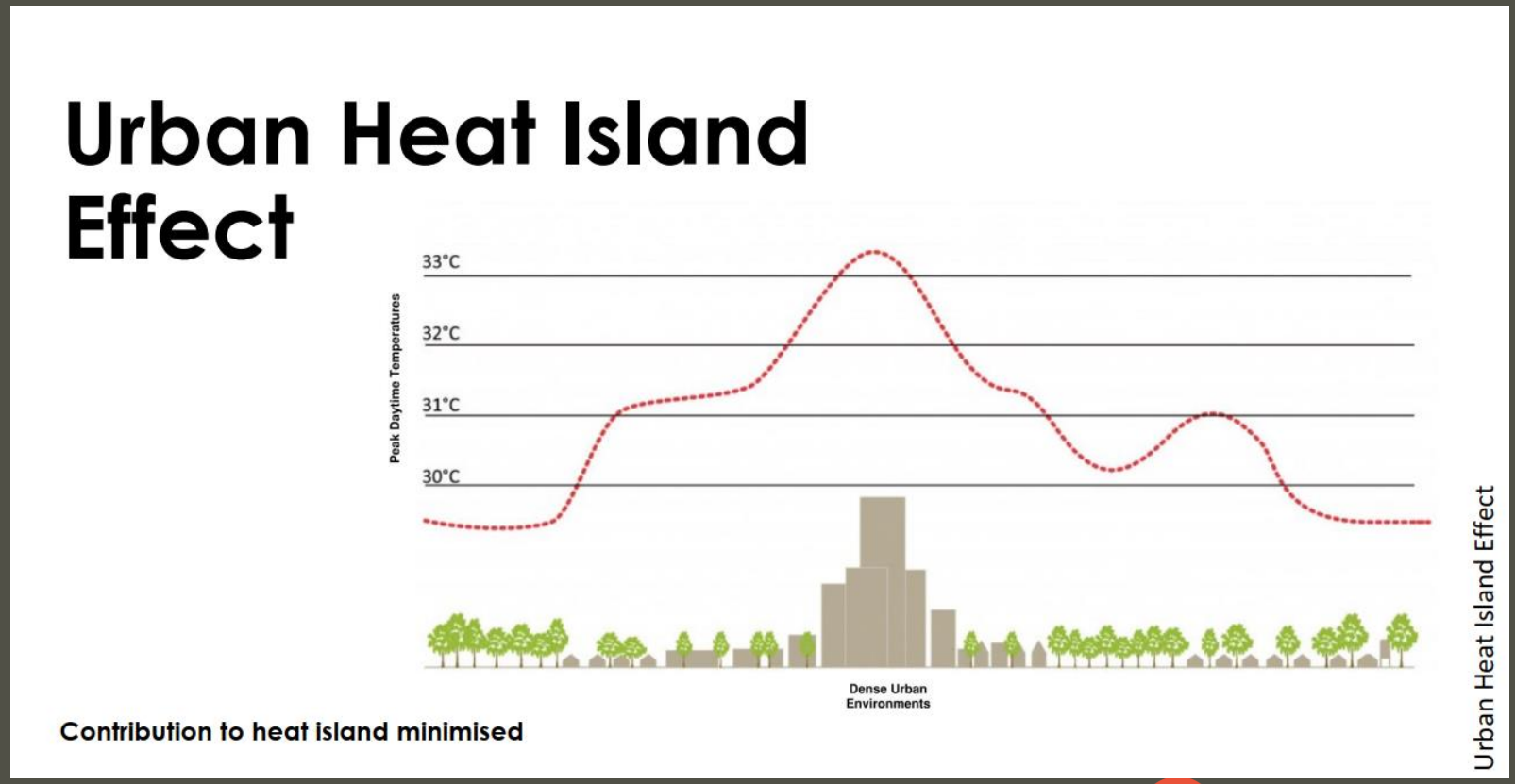
Cooling with Ground Source

- Dense urban environments are hotter naturally due to concrete and little vegetation
- Increases the need for cooling
- Traditional cooling with ASHP/Air Con contributes to this increase
- No air temp rise to contribute to urban heat islanding
- Opportunity to sell waste heat to Networked heat pumps



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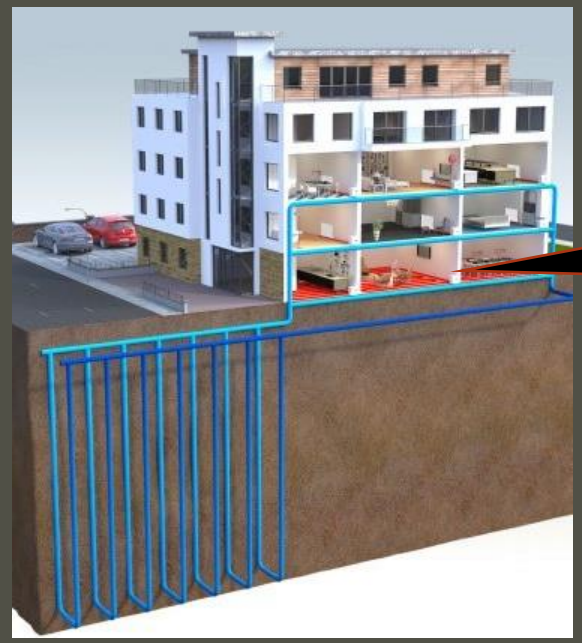
Cooling with Ground Source Heat Pumps

Passive Cooling

'Free cooling' – just the circulation pump



1) Fan coil
2) AHU
3) Passive Beams
4) MVHR

Cardiff Trial: Last summer during the 30C+ heatwave, passive cooled rooms at 21C all day vs non-cooled rooms at 28C, at an effective cost of £20 per year to run

Active Cooling

Running the heat pump in reverse

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GSHP Active Cooling - Benefits

- Cooling with no external plant required
- Higher SEER with combined passive than most split unit cooling systems
- No issues with external plant location or noise for planning
- No contribution to urban heat islanding
- Lowest carbon option for cooling
- Lowest running cost

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Funded Networked Heat Pumps

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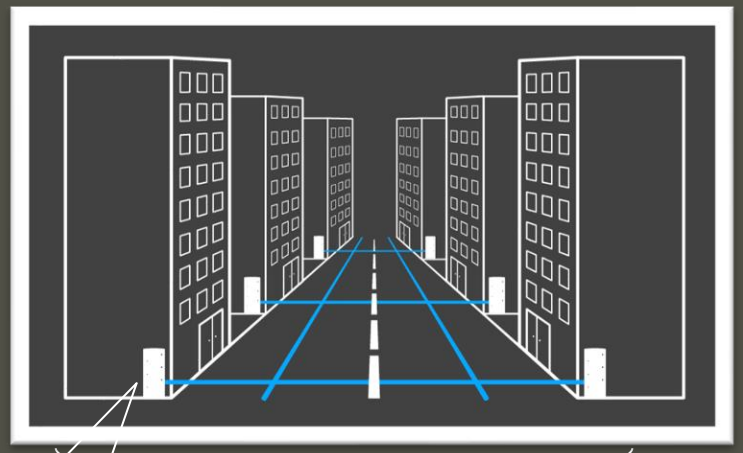
Think back to the gas network today, you pay a standing charge to access the infrastructure outside the building. We emulate this.

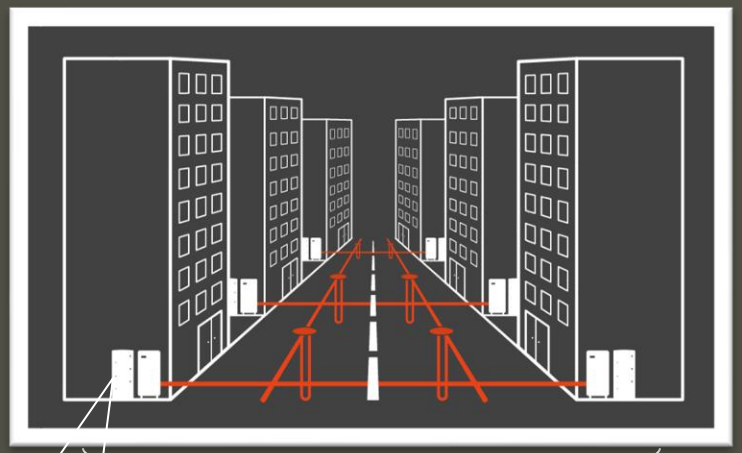
Gas



You are responsible for the internal equipment (boilers)

Gas network

Ground-Source Heat Pumps



You are responsible for the internal equipment (GS heat pumps)

Kensa Utilities

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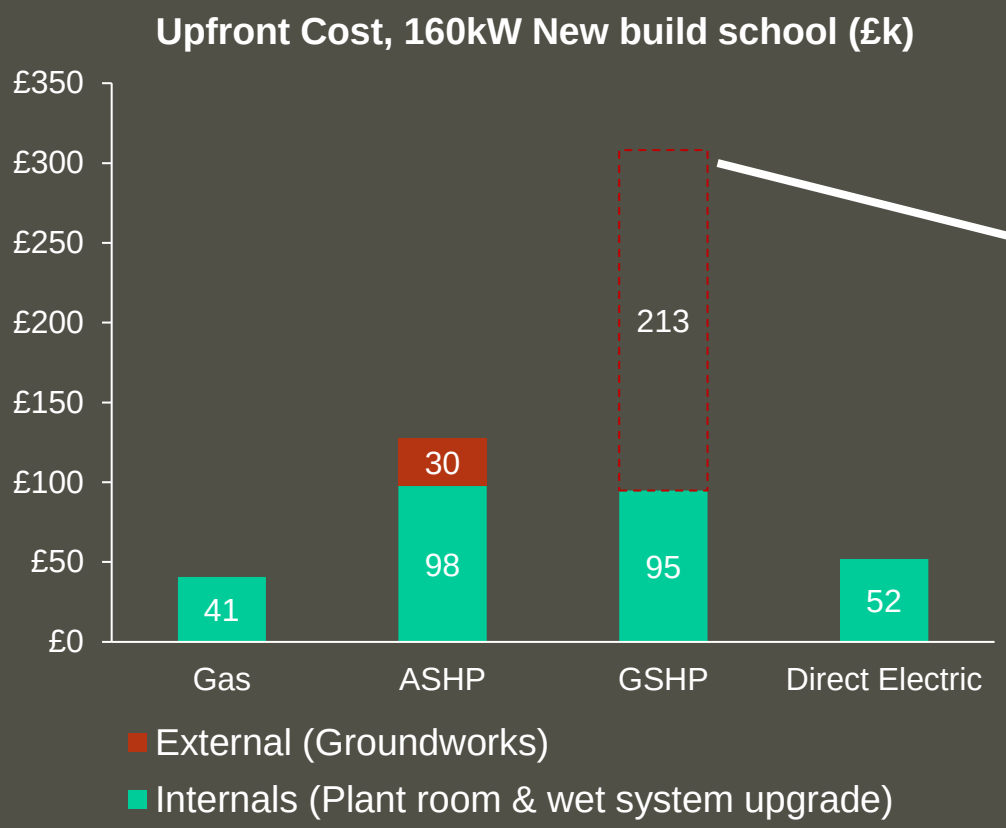
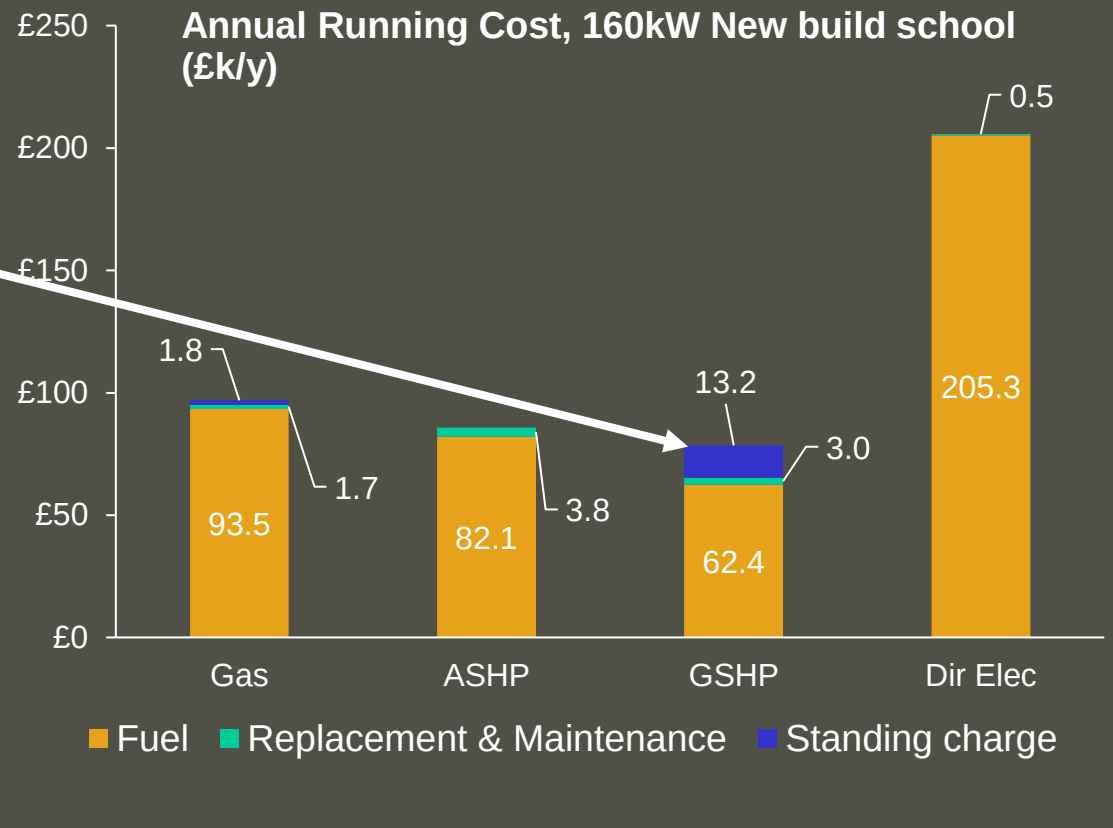
Lower upfront costs than air-source and cheaper running costs, for a better product





Assumptions: 388,000kWh/yr heating only, 80% boiler efficiency, 2.5 ASHP COP, 3.3 GSHP COP B0/W55 @ -3 external air temp, 52.9p/kWh elec, 18.9p/kWh gas, market test figures Oct 2022, annual GSHP, ASHP & Gas maintenance, 15 year gas lifetime, 15 year ASHP, 20 year GSHP

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GSHP for less Capex and lower Opex

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Case Studies and Learning

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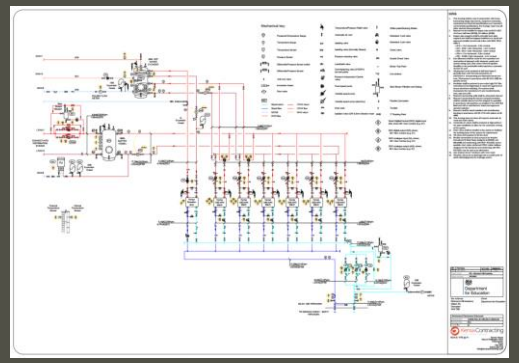
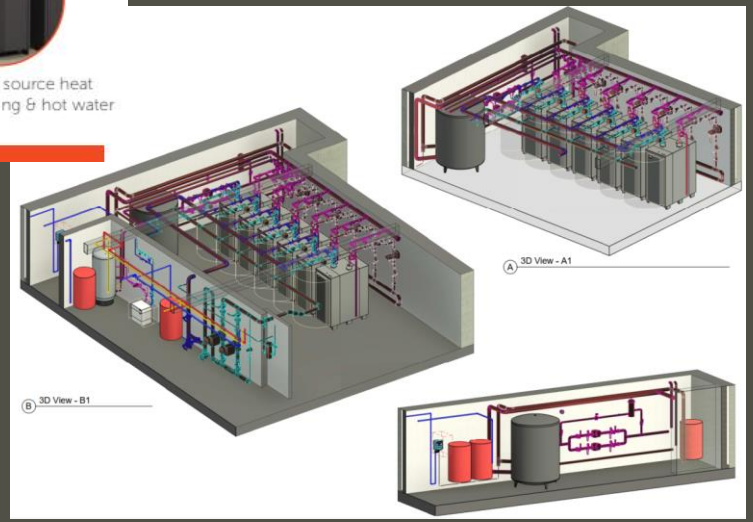
Richmond Hill Primary Academy

Department for Education pilot GSHP decarbonisation programme

- 400kW
- 33 x 230m Boreholes
- New heating distribution system
- Fabric improvement works
- Annual carbon savings of 74 tCO_2e





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Richmond Hill Primary Academy

Richmond Hill Primary Academy

- Site setup and welfare
- Track mat leading to drill site
- Main pitch untouched
- Turf cut and removed prior to any works
- RIPTA approved method statement and Sport England approval

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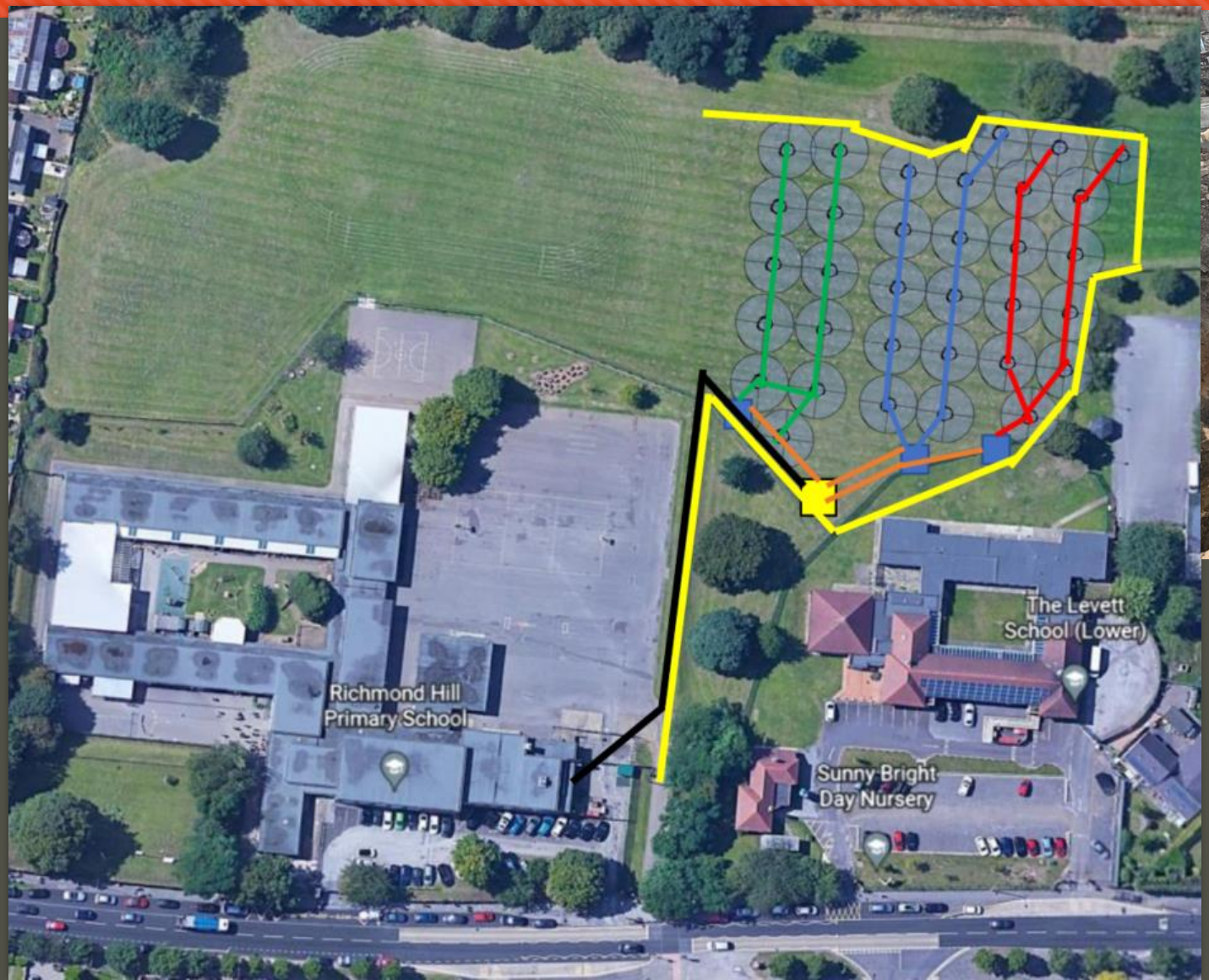
Richmond Hill Primary Academy



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Project Learning – Richmond Hill Primary Academy

- Early investigation of electricity supply capacity available, and any upgrade requirements, as long lead times for DNO work
- Design phases for a project of this scale will take around 3 months
- Projects of this scale will require planning applications to be submitted, so its better to put in an anticipated system application and amend after the approval if necessary.
- For sports pitches that are going to be used for boreholes, it is generally required to produce full RIPTA agronomy reports, for planning, methodology and reinstatement
- Projects of this size cannot be undertaken in the 6 week holiday period, so we have developed safe methodology for working on live school sites

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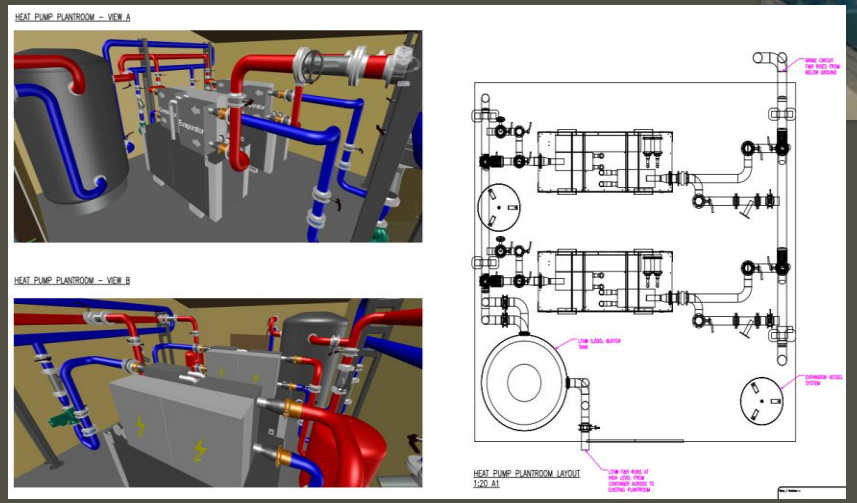
Willowburn Leisure Centre, Alnwick

- 52Nr 282m Deep Boreholes all in the car park and land surrounding the building
- Heating the adult and learner pools, 6 air handling units and the DHW for showers
- 700kW of low temperature heat delivered by 2 x 350kW heat pumps in an energy centre
- 100kW high temperature unit, delivering the DHW top up to 65c
- Kensa contracting completed the full design and build of the entire project
- Annual carbon savings of 323 tCO_2e



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Project Learning – Willowburn Leisure Centre

- Borehole locations meant using every part of the perimeter car parks, this involved critical staging of the ground array and its installation, to ensure that 50% of the parking was always accessible and available for patrons
- DNO's across the Country can work to different timescales, it is best to get early engagement and notification started for any project
- Artesian conditions were only expected to be low to moderate on this site, but one section was high, and meant we had large volumes of pressurized water to deal with as part of the drilling process, this slowed us down
- As part of the DNO upgrade, this has involved a 24hr period of shutdown to the facility, so careful planning is required for this phase.

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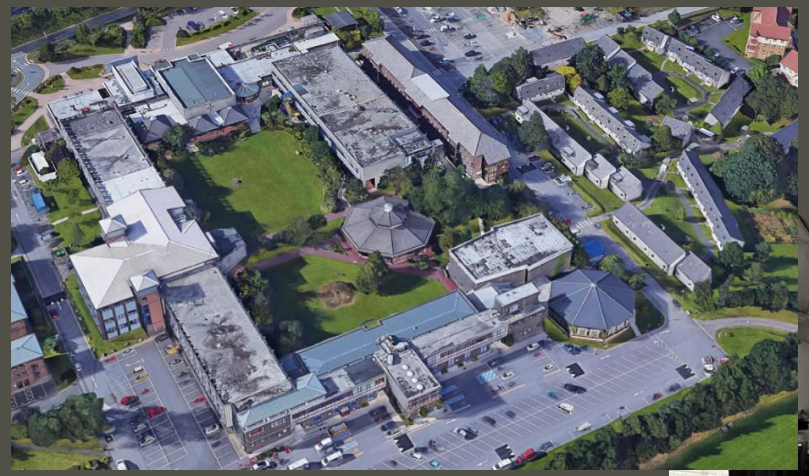
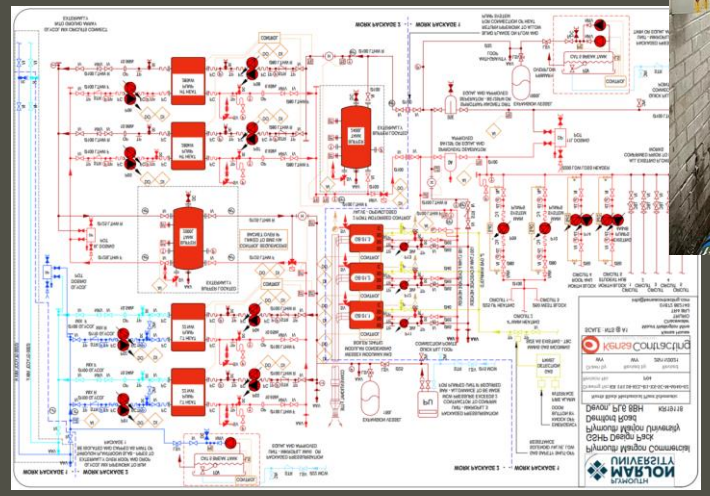
Marjon University, Plymouth

- North, South and West Academic blocks of the Quad, 46 staff and student accommodation blocks
- Total heating load of 950kW for the entire site
- 84Nr Boreholes at varying depths across the campus
- Installed two centralised plant options with two stage higher temperature and 46 decentralised shared ground array units
- Annual carbon savings of 440 tCO_2e
- Reduced the overall carbon output of the site by 80%





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Project learning Marjon University

- Early investigation of electricity supply capacity available, and any upgrade requirements, as long lead times for DNO work
- Design phases for a project of this scale will take around 6 months
- Dealing with live sites of any nature are tricky, but we delivered this project with a live campus, and minimal disruption to the students and faculty, over the 12 month installation period
- Large scale projects would benefit from upfront TRT's and ground investigation works, to provide cost certainty in the project
- Projects of this scale will require planning applications to be submitted, so its better to put in an anticipated system application, and amend after the approval if necessary

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BGS Research Centre, Glasgow

- Open loop 8 individual Wells, spread across site, 4 extraction and 4 injection all fully reversible for the monitoring of the boreholes to the aquifer resting within old mine workings at different depths.
- Total heating load of 220kW heating and cooling, for load extraction and temperature discharge and ranging across the aquifer
- Installed a centralised HEX heat exchanger cabin, with multiple options for research purposes
- Completed all of the above ground well heads, connections, HEX energy centre, controls and full commissioning.

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Thank you

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