Decarbonisation options for the UHD hospital estate.

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This paper focuses on the energy options for Bournemouth hospital but will also inform a similar strategy for the Poole hospital site with options for Christchurch hospital and Alderney sterilisation unit.

Background

The government has set a target for all the NHS estate to be net carbon zero by 2040. The carbon footprint of a hospital is made up of many factors and these can be seen in the UHD green plan.

Energy usage is one of the primary contributors to the trust carbon footprint and UHD use two main types, these are power in the form of electricity and gas to provide the heating and hot water. The power supply to site is being decarbonized by the introduction of renewable and low carbon generation across the national grid and locally by PV installations. The gas supply being a fossil fuel is not reducing and will be required to be replaced with a low carbon alternative.

The Bournemouth hospital site used a total 37 million kilowatt hours of energy in 2024-5 supplied from power, gas and heat from the on-site waste incinerator. The incinerator is operated by SRCL and provides 80°C water to the main heating circuit. When this is decommissioned, the heat supplied will revert to the site gas supply. This will increase the overall site heat requirement 22 million kWh of gas. The planned site developments once occupied will only increase these figures as 25% occupied area is added to the site load.

This mix of energy has a significant cost, and the total spend on energy in the 2024-25 period was £4.5m. The differential in the energy prices with electricity being 3-4 times the price of gas has naturally led to gas being the preferred fuel of choice. With electricity accounting for 75% of the spend of energy.

There is no current option to utilise district heating services to provide energy as this does not exist in the hospital location and BCP has no current plan in place to deliver this.

The trust has primarily a choice of two solutions moving forward towards becoming net zero,

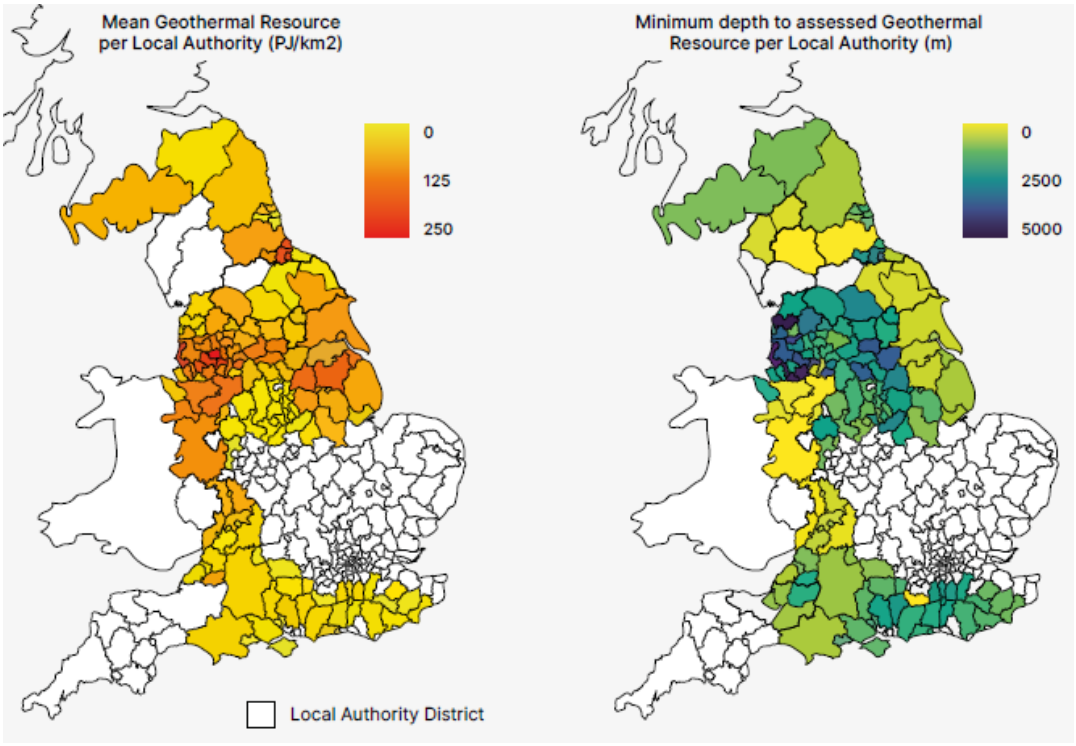
- To adopt an all-electric solution using heat pump technology that will derive the useful energy from either an air-source, ground-source, or water-source. This will have a significant revenue cost due to the higher price of power. Heat pump technology is developing rapidly in the current market but the requirement for relatively high supply temperatures in the healthcare setting means that the performance of these heat pump units is typically at a ratio of 2.5 :1. That is for every unit of power you supply you will provide 2.5 units of useful heat. Given the expected heating demand of 22 million kWh this will require in the region of 10 million kWh of power. The power for this has been factored into the new supply that is being routed from Kings Park to the new Wessex Field sub-station. This capacity can be released if not required in the future.

- To develop a geothermal solution that pulls energy from the geology below the Bournemouth site. This will involve drilling to depth of between 1.5 – 2.5 km and pumping the hot water allow the energy to be transferred into the current heating distribution system. The deep drill solution should be able to provide a 70 – 80-degree Celsius delivery temperature. Any reduced temperature from a shallow drill would deliver temperatures in the 50 – 60-degree range that will require raising through secondary heat pumps to the higher delivery temp by supplementary heating. The Department for Energy Security & Net Zero have produced a deep geothermal energy white paper in association with the NE enterprise and Net zero hub, this white paper aims to provide an evidence-based assessment and ‘case making’ document to help accelerate the development and deployment of deep geothermal energy projects in the UK.

Geothermal solution

From the information available we have opportunity both in terms of available energy and accessibility to develop a geothermal solution for the Bournemouth site.

Map of geothermal opportunities in the UK

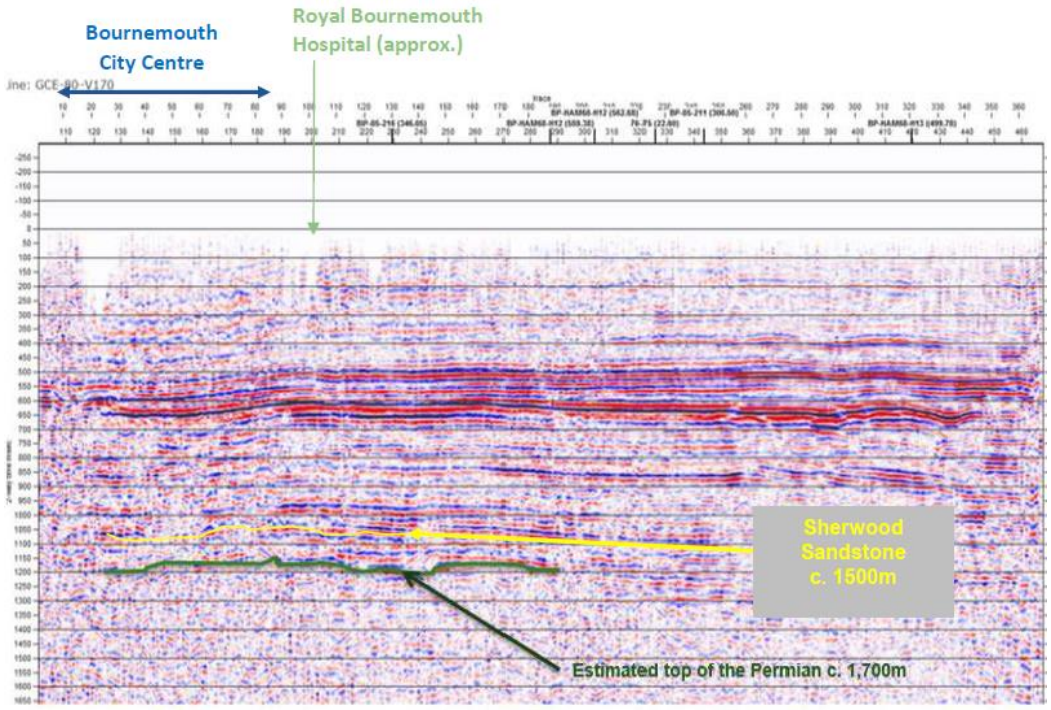


Subsurface information in Bournemouth

Local investigation by a drilling specialist, GT Energy, shows how the historic record data that was generated for the oil and gas exploration in the area can be used to inform our opportunity for a geothermal solution. There is extensive data from the production and exploration wells that covers 175Km of line data east and west southwest of Bournemouth and Pool as shown.

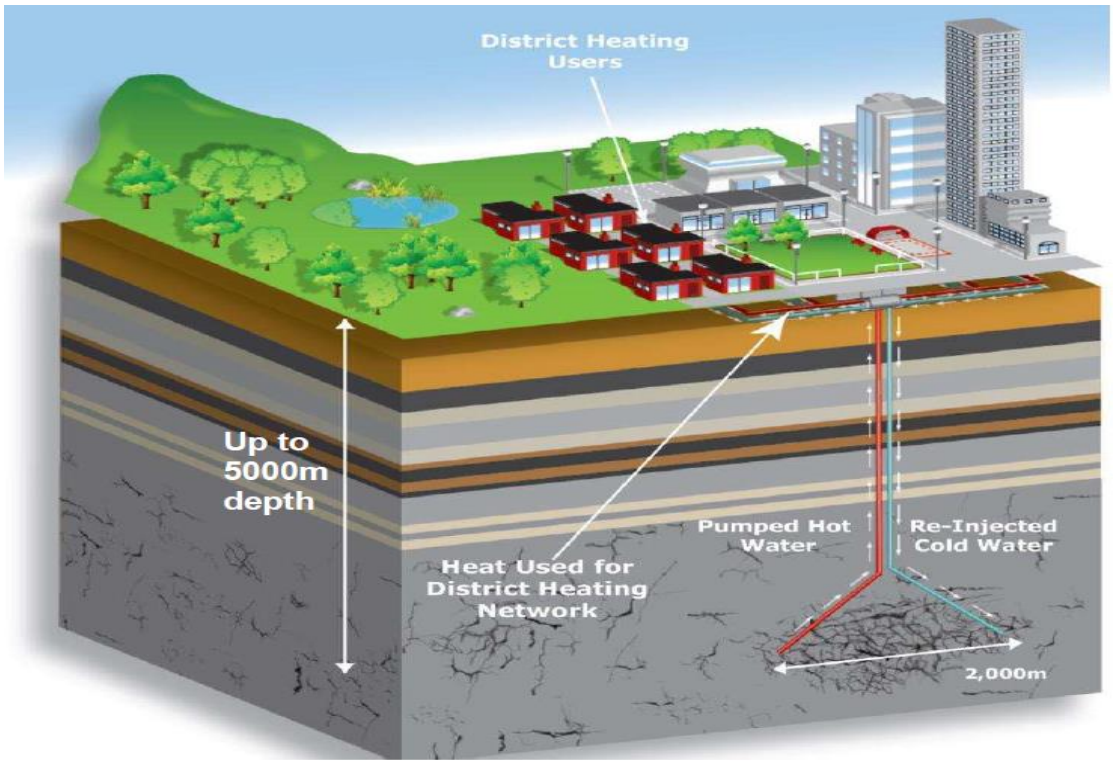
Looking deeper

Survey line GCE-80-V170 runs adjacent to the A338 and passes close to the Bournemouth site.



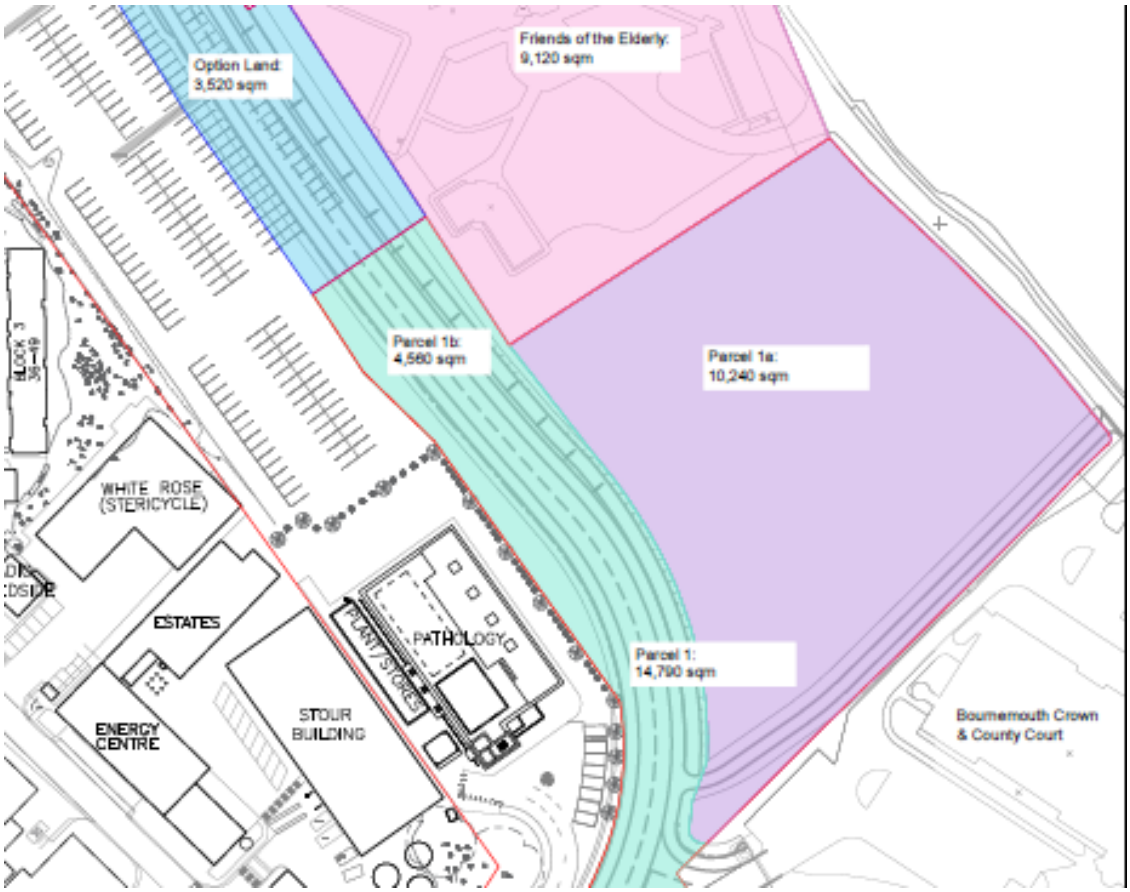
This data suggests that if suitable water reservoir formations can be identified below the Permian layer shown to be approximately 2,000m at the site, temperatures of 80 degrees or greater could be possible.

Representation of Geothermal installation below ground



Location

The planned purchase of land adjacent to the hospital on Wessex fields provides UHD the opportunity for the development of a deep geothermal well without disruption to the hospital site activity.



Whilst the initial drill stages take up a significant footprint e.g. Parcel 1a,and may take a year to construct. Once developed a geothermal installation has a limited footprint that can be incorporated into the Wessex field site developments adjacent to the site primary energy centre and possibly neighbouring customers.

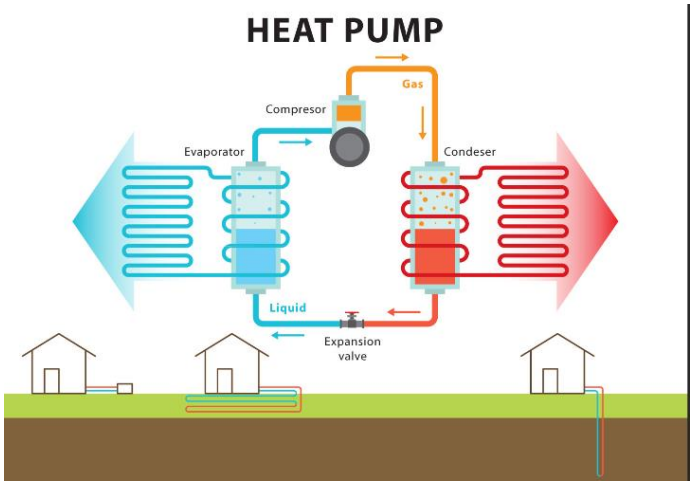
Impression of underground geothermal facility

Heat pump solution.

Heat pump technology is widely used in all sectors to provide heating and sometimes cooling. The equipment is relatively inexpensive and reliable, however the higher revenue cost of power over gas has made this an expensive alternative in many cases.

New build installations can favour heat pump technology as only one prime energy source is required to site and the building system can be specifically designed to operate at 40-50 °C to get the optimum performance out of the heat pumps with a performance expected at 3.5:1 to 4:1. Applying heat pumps to existing systems that are designed to work at higher temperatures, 70 – 80 °C, reduces the efficiency of the units to typically 2.5:1 and so drives up the revenue cost of operation.

A basic heat pump operates on a refrigeration cycle by taking heat from a chosen available external source, Air, Ground, or Water by cooling it and then passing the heat into the building system.



UHD Target

As the national supply grid decarbonizes this will become the major low carbon solution where alternatives are not available. UHD has an alternative available and selecting the right decarbonisation option utilizing either heat pumps or geothermal heat will achieve the NHS target reduction for energy.