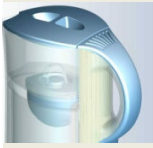


▶ **ANALYSIS & DESIGN**
ASSESSMENT OF PRODUCT PERFORMANCE & DESIGN DEVELOPMENT



▶ **RESEARCH & DEVELOPMENT**
FEASIBILITY OF NEW CONCEPTS & UNDERSTANDING CORE PHYSICS



▶ **PRODUCT DEVELOPMENT**
WORKING AS PART OF YOUR MULTIDISCIPLINARY TEAM - FROM CONCEPT TO MARKET

- Ground Source Heat & Power
- Thermo-hydraulic Analysis
- Design Study

Intelligent

Fluid Solutions

SPECIALISTS IN THE APPLICATION OF FLUIDS ENGINEERING & CFD FOR ENGINEERING & DESIGN

Design & Analysis of a Ground Source Heat and Power System

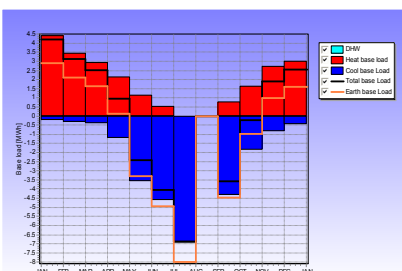
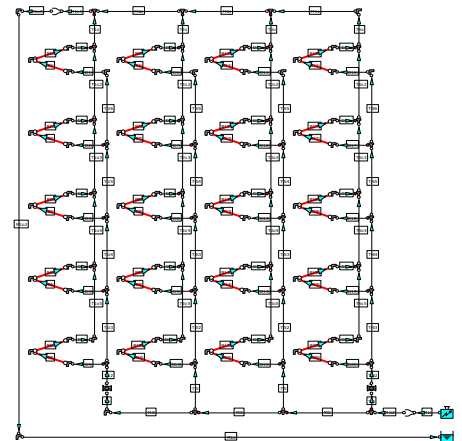
A Ground Source Heat & Power System (GSHP) aims to harness the thermal energy stored in the ground to provide heat and power. In essence, the system relies on the fact that metres below the earth's surface the temperature remains relatively constant throughout the year (due mainly to either solar radiation or heating from the earth's core).

When extracting heat, a GSHP system pumps a working fluid through boreholes to extract heat and hence increase in fluid temperature. A heat pump is used to extract the heat from the fluid and to use it as useful energy. When designed correctly, these systems have the capability to extract four

units of heat energy for every unit of electrical energy required to drive the GSHP system. Thus GSHP should be an essential component of a modern low carbon building heat and power system.

The work programme aimed to develop an optimised GSHP system design for a new school development in South London. The local geological characteristics of the location and the heating/cooling demand were used as inputs to the design exercise.

The output was a hydraulic borehole network design capable of providing heat and power over a 40 year cycle.

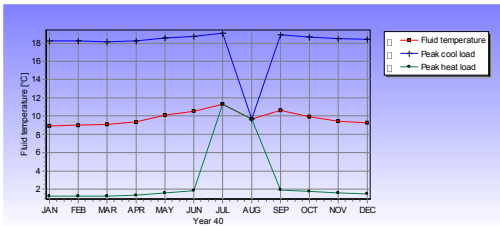


Project Summary

In the UK GSHP systems have the potential to make a significant impact reducing the carbon footprint of domestic, commercial and public buildings. The current project aimed to develop an optimised GSHP design for a school development in South London. Local geological characteristics and the heating/cooling demand of the building were the inputs to the design exercise. A closed-loop borehole system was specified. The output from the exercise was an optimised hydraulic network design consisting of 20 boreholes that was capable of meeting transient peak load as well as long-term sustainability over a 40 year loading cycle.

Getting the Most From Engineering Analysis

Using advanced engineering analysis to predict and develop device performance and hence gain confidence and reduce technical risk



Information on the local geological formation and rock type are critical inputs to the design of a GSHP system. A test borehole was used therefore to obtain a detailed understanding of the geology of the site and hence the thermal properties of the ground. In particular the test bore indicated a ground temperature of approximately 13.5°C at a depth of 100m.

The design monthly thermal load of the system was provided in the form of a base load energy requirement in conjunction with a peak load. The loading indicated that a simultaneous heating/cooling demand will exist throughout the year.

The geological information and the design loading were then used to select an appropriate heat pump for the GSHP system. The specification of the heat pump provides the remaining input parameters required for the development of an optimised borehole network or Ground Source Heat Exchanger (GSHE).

The GSHE has to provide sufficient energy for the specified base and peak load requirements as well as minimising the effect of ground temperature changes due to heating/cooling load imbalance. Thus the system must be robust enough to accommodate a slowly changing ground temperature.

Commercially available GSHP software was used to calculate the required size of the GSHE and the thermal response of the ground to the design heat load over a 40 year cycle.

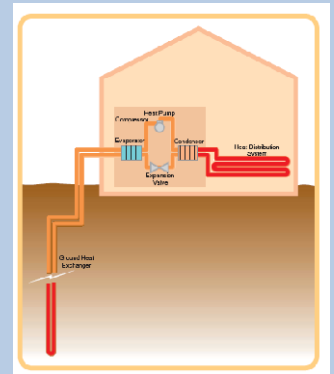
An iterative design process was then used to develop an optimised hydraulic network design. The objective of this stage of the exercise was to ensure that the flow in the boreholes is uniform, fully turbulent and with the minimum resistance.

The final output from the programme of work was the developed borehole network design and a Bill of Materials to be passed on to the installation company.

INTELLIGENT ENGINEERING Experience & Technology



The advent of inexpensive computer power and commercially available analysis software has made possible the full virtual modeling of product performance. However, the technology is still developing in terms of accuracy and reliability. Thus CFD is not a substitute for traditional engineering methods, but rather compliments the existing processes



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