VITAL ENERGi

CASE STUDY

Easter Bush Trigeneration Energy Scheme Design

DISTRICT HEATING AND ENERGY CENTRE

PROJECT OVERVIEW

The University of Edinburgh was established in 1583 and is one of the oldest English-speaking universities in the world. It consists of six main sites with more than 41,000 students and more than 10,000 full-time equivalent members of staff. The Royal (Dick) School of Veterinary Studies is a one-of-a-kind centre of excellence in clinical activity, teaching and research. The School comprises the Roslin Institute, Global Academy of Agriculture and Food Security, Roslin Innovation Centre, Hospital for Small Animals, Equine Veterinary Services, Farm Animal Services, Easter Bush Pathology and Jeanne Marchig International Centre for Animal Welfare Education.

Following the successful delivery of the Holyrood low-carbon energy centre and subsequent expansion, Vital Energi were selected to design, build, install and operate a tri-generation scheme at Easter Bush. The scheme will provide electricity, heat, hot water and cooling to the Campus and is future-proofed to accommodate further connections when new buildings are complete.

VITAL SOLUTION

The design of the energy centre and 4km district energy network was a collaborative process between our client, their consultants and ourselves. Our client had a clear vision of what the expectations of the energy centre were and the design was developed to work within these spatial constraints.

The design contains a 1.5MW CHP engine, two 4MW boilers, a 0.6MWc absorption chiller, 1.6MWc vapour compression chiller and two 100m3 thermal stores, one for heating and one for cooling. Space has also been allowed for the inclusion of future plant equipment to accommodate additional connections. The infrastructure works included the new electrical point of connection, gas, water and hydrant network connections.

PROJECT SUMMARY:

CLIENT
University of Edinburgh

PROJECT
Easter Bush Campus

TIMESCALE:
April 2016 - October 2017

CONTRACT VALUE:
£9 million

THE BENEFITS:

- Reduced operating costs through design and system operation optimisation
- Optimised layout to allow ease of access for operation and maintenance, whilst maintaining the original building footprint constraint
- Reconfiguration of district cooling equipment to reduce the number of pumps required and lower the pressure of the circuit

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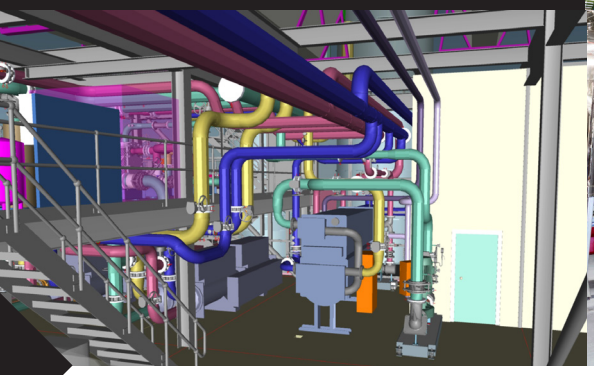

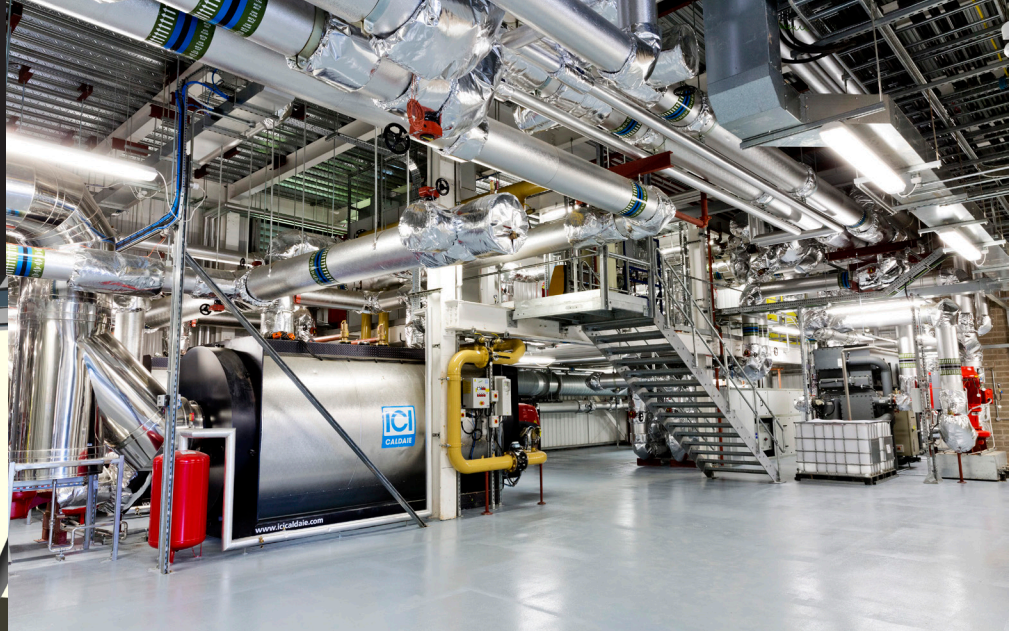

Flexible design to accommodate spatial restrictions

We considered the feasibility of operating and maintaining the energy centre and made changes to the layout to ensure the equipment was accessible. Planning permission had been granted for the energy centre so to maximise the potential of the space, we incorporated a mezzanine structure to the design to accommodate the progressive obligations of the project stakeholders. We have future proofed the energy centre design by leaving one elevation free of any obstructions to enable future expansion.

Optimising operations to reduce running costs

Our designers developed the design to minimise pumping costs by fully utilising the capabilities of the other required system pumps. In the district heating circuit, we changed the configuration of the circuit and equipment and ensured the CHP and thermal store were hydraulically balanced. This approach reduces re-occurring costs associated with water treatment, system pumping and standing thermal losses.

As part of optimising the design lifecycle of the equipment we reconfigured the cooling circuit to lower the operating pressures. When the 4.75bar district cooling pumps were on the return line of the cooling circuit, the thermal store, free cooling heat exchanger and chillers would need to be rated at 10bar. We moved the pumps onto the flow line so the plant was only subject to a static pressure of 3.5bar and reduced the pressure needed from the plant equipment to 6bar. These changes lead to lower pumping and pressure requirements which reduces system operating costs.

Adaptations to design to increase life cycle and reduce costs

Our designers implemented enhancements to the design which increased the life cycle of the plant and reduced both the upfront and running costs. These included acoustic enclosures around the vapour chillers so noise restrictions could be adhered to, and additional valves on the thermal store header so the connection point of the absorption chiller can be changed in the future. The client wanted to utilise free cooling when outside temperatures dropped below 10oC so the absorption and vapour chillers can be turned off. Water is then cooled by using fans installed above the chillers which circulate the outside air and cool the water in the pipes to a flow temperature of 14oC.

We carried out in depth analysis of how the district heating and cooling system network performs, which meant we amended the insulation series of the pre-insulated underground pipework to increase the overall efficiency of the system and re-occurring annual carbon savings. Originally, the district heating and cooling networks used series 2 pre-insulated pipework however, to improve efficiency whilst minimising capital costs, we reduced the insulation on the cooling network to series 1 as the temperature of the ground was at a similar temperature to the return chilled water at 12oC. We also upgraded the district heating pipework to series 3 to produce greater long-term financial savings and a further reduction of over 12,000kg of CO2 per annum.

Building client relationship to ensure successful design

The complete energy centre, on full build out, will provide 7.8MW of heating, 3.5MW of cooling and has built in resilience to ensure it can meet the needs of the campus year round. We identified several substantial areas in the original design that will maximise long term savings and minimise operational losses and we successfully worked with the client's professional team to integrate these enhancements into the final design.

By developing a close, working partnership we took on-board all of their restrictions and requests to deliver an optimised tri-generation solution which will meet the client's specific heating and cooling requirements.