VITAL ENERGi

CASE STUDY

King's Cross Cooling

CHILLERS & DISTRICT COOLING NETWORK

OVERVIEW

We have been involved in developing the King's Cross energy strategy since 2009, creating an energy generation and distribution solution which evolved alongside the development, ensuring optimum performance at each stage.

One of the planning stipulations attached to the 67-acre London site was that the energy infrastructure would produce low carbon cooling, in addition to heat and power, making it a tri-generation scheme. We were commissioned to perform a feasibility study and designed a solution which took waste heat from the CHPs in the existing energy centre, during the warmer summer months when it wasn't being used, and converted it into cooling for the surrounding buildings via an absorption chiller.

The project was made challenging in several respects, with one being the unusual shape and size of the footprint the new "cooling pod" would be situated on and the second was the proximity to the HS1 train line which brings strict restrictions which are backed up by severe financial penalties.

THE SOLUTION

The initial concept for the development would have seen traditional, individual cooling solutions set up in each building, but we were asked to develop a proposal for a central cooling pod, which would fulfil the tri-generation requirement for the project. The site of the Cooling Pod was the last area to be designated in the plans and makes use of a crescent shaped piece of land situated between the HS1 Channel Tunnel Rail Link and an office development.

This irregular, curved 120m long space varied from 6-8 metres wide. Our designers created a two-story solution with an optimal plant layout which not only accommodated all the necessary equipment, but allowed for safe operation and maintenance going forward.

Overcoming Restrictions to Deliver the Optimum Energy Solution

Proximity to the HS1 train line brought many challenges to the project. This included routine issues such as working with Network Rail to ensure all nearby crane works were acceptable to more in depth concerns which needed design-led solutions. There was a concern from Network Rail, for example, that pluming from the plant could drift across the rail tracks and impair drivers' sight lines. The concern was so great that it was agreed that substantial financial penalties would

PROJECT SUMMARY:

CLIENT
Metropolitan King's Cross Limited

PROJECT
Chillers & Cooling Network

TIMESCALE:
2013-2017

CONTRACT VALUE:
£4.5 Million

THE BENEFITS:

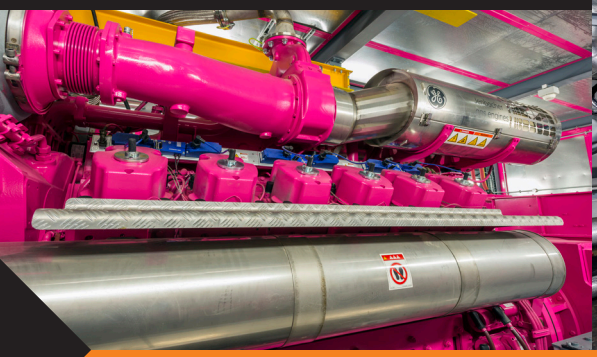
> Reduced footprint resulting in valuable space being saved on the development

> All work designed and installed within restrictions imposed by vicinity to HS1 & meeting planning conditions

> Innovative plant room layout to meet unusual shaped footprint

> Improved efficiency for overall site wide energy system

Heat generated by the CHP in the T1 Energy Centre is pumped to the cooling pod where it is converted into chilled water for cooling.



The scheme not only makes use of the waste heat generated, but also allows the CHP engine to run more hours and closer to full capacity, which makes it more efficient and commercially beneficial. The electricity generated from the CHP also feeds the plant in the cooling pod which has an overall cooling capacity in excess of the peak load and can fully meet the anticipated peak cooling of the buildings it serves.

be imposed if trains were disrupted by pluming.

The design of the energy centre includes three different types of chillers; absorption, water cooled and air cooled, which each produce chilled water. The absorption chiller, which converts waste heat from the T1 energy centre into cooling, only initiates when the external temperature reaches 17°C or above which eliminates the possibility of pluming. These three types of cooling are controlled by a sophisticated Building Management System which ensures the correct combination of cooling is in use at any time.

Where possible, the system utilises the excess heat from the T1 energy centre. If this heat is not available, as it is being used for heating in the colder winter months then the system will switch to the water source chillers as they are more efficient than the air chillers (during these colder environment conditions). When the temperature creates the possibility of pluming the system switches to the air chillers. All three of these types of cooling are extremely efficient and as the grid decarbonises, the air and water chillers result in lower carbon emissions.

The Cooling Pod is capable of producing 12.4MW of cooling but as standard will deliver 9MW. The Cooling Pod plant comprises a 1.4MW absorption chiller, three 3MW water-cooled electric chillers, two 1MW dry air-cooled chillers and two 30m³ thermal stores. Crucially, the solution also has two 2.5MVA transformers which gives added resilience, allowing cooling to be maintained should one fail.

Energy Efficient District Cooling

The hot water is produced by the CHP in the T1 energy centre and pumped through 80m of buried, pre-insulate, twin series pipework. Once the heat has been converted into cooling through the absorption chiller it is distributed through a district cooling network which is currently made up of 680m of Series 1 pre-insulated pipework.

This network currently connects two buildings, but this will expand to four commercial and three residential, with the Cooling Pod able to deliver 9MW of cooling overall. Whilst the installation of district cooling is the same process as district heating, it still encountered some substantial technical hurdles which required a 38m thrust bored tunnel which allowed it to avoid the HV electric cables and gas mains in its path.

Meeting Noise Restrictions

One of the biggest restrictions for the project was noise, which severely limited the acoustic emissions from the plant and this called for the design of a specialist, bespoke solution. We very closely with the project acoustic specialist to create a range of internal acoustic insulation to ensure noise emissions were acceptable to the planning condition noise criteria. The most innovative part of this solution saw the creation of an acoustic green roof to attenuate the noise of the cooling towers and air cooled chillers. This ensured acoustic emissions fell within acceptable parameters, but also provided an attractive architectural feature for the structure.

Employing Innovation & Flexibility to Commission the Project

The commissioning process is an essential step to ensuring the energy installation will perform as designed. Vital Energi consider this to be one of the most important steps in designing an efficient and reliable energy solution and the Cooling Pod project presented several interesting challenges.

Firstly, the project was commissioned before the heat loads were connected to the network. This resulted in our Prefabrication department creating a custom made Heat Load Bank which enabled us to run the system as normal, thoroughly test every aspect and ensure it was performing optimally.

Our solution met all legislation and planning conditions and restrictions while satisfying the client's brief and resulted in a cost effective, energy efficient cooling solution which will benefit the surrounding development for years to come.