



PROJECT SUMMARY:



CLIENT

Goram Homes & Bristol City Council

PROJECT

Castle Park

PROJECT OVERVIEW

In 2018 Bristol City Council declared a climate emergency and set targets of reaching carbon neutrality by 2030.

One of the schemes which will make a strong contribution to this is the Castle Park Heat Pump Project which will pump

water from the nearby floating harbour, use a state-of-the-art heat pump system to increase the temperature to 70-80°C, and distribute it to homes and businesses via the Bristol Heat Network.

VITAL SOLUTION

The award-winning Castle Park Heat Pump project consists of three main elements:

The abstraction platform sits slightly above the water in the nearby floating harbour and supports the pipework which is submerged. This takes water from the harbour, filters it and pumps it into the main energy centre.

The main energy centre is a custom-built structure which houses the 3MW water source heat pump and associated plant and equipment. Vital Energi's in-house architectural team worked with the Council's structural engineers to create a steel frame and block building which was later clad in cedar. A large thermal store is attached to the energy centre and heat from the heat pump charges this thermal store and is then released as necessary.

The third main component of the project is the prefabricated plant room which houses back up gas-fired boilers which are used during times of maintenance or peak demand.

This project is a fantastic demonstration of how new, renewable energy sources can be used by "plugging" them into

an existing heat network to lower the overall carbon factor. The project was conceived by Bristol City Council and Gorman Homes and made deliverable by the assembly of a multi-disciplinary team which included Star Refrigeration, Sustainable Energy Ltd and DQS Consulting Ltd.

Developing the Design

Vital Energi received the RIBA stage 3 design and worked with the client's professional team to evolve it into a solution which would fit onto an extremely constrained site, whilst delivering optimal performance and eligibility for the Renewable Heat Initiative.

Making the Site Fit For A 21st Century Energy Centre

One of the biggest constraints on the Castle Park project was the tight site which also had limited access. This meant there was limited room for deliveries and no possibilities for storage. This resulted in waste material from groundworks, such as shrubs and topsoil, needing to be removed from the site immediately and deliveries being done on the day the items were needed.

THE BENEFITS:

- > Winner of the 2022 European Heat Pump Association Awards
- > 3MW Heat Pump - Largest single heat pump project delivered in England to date.
- > Created an innovative solution to allow the abstraction platform to hang above the water without damaging the 100-year old harbour wall.
- > Helping to heat 1,000 homes connected to the Bristol Heat Network

▶ (Right) The Castle Park site during the construction phase of the project. (Below) A 3D model created by Vital Energi's CAD Department.



‘ *The Bristol Heat Network is an integral part of our strategy for decarbonising the city and ensuring that Bristol continues to play its part in addressing the climate crisis.* ’

CLLR. NICOLA BEECH, CABINET MEMBER FOR CLIMATE, ECOLOGY, WASTE AND ENERGY - BRISTOL CITY COUNCIL

We oversaw all piling and created an innovative concrete slab foundation which anchored the steel beams that supported the abstraction platform

Creating A Construction Programme to Overcome Space Restraints

Because of the congested nature of the site, we were forced to build the project “from left to right”. This was due to the fact that the energy centre filled a considerable proportion of the building footprint.

This called for works to be scheduled so that they wouldn't block access to parts of the project scheduled later. We therefore delivered the abstraction platform, followed by the main energy centre and finally, took delivery of the containerised plantroom. As each aspect was delivered, we lost significant access to that part of the site, making deliveries of large plant, or use of construction vehicles difficult.

Overcoming Structural Issues to Deliver the Abstraction Platform

The Castle Park project takes water from the nearby floating harbour, pumping it from the river into the energy centre. To achieve this we needed to create an abstraction platform to support the equipment. The original design had the platform attached to the harbour wall in a cantilevered solution, but structural surveys of the 100-year-old wall identified that it would not be able to take the weight.

To achieve a viable solution we had to work closely with multiple external bodies (MMO, Environmental Authority, Harbour Master, Bristol City Council Bridges & Highways Structure department) to create a design which met the needs of the project without impacting on the surrounding structures. To solve this our designers ran a steel beam from the foundations of the energy centre over the harbour wall.

As the installation of the platform was over water, it became a major logistical operation involving multiple crane lifts, a barge platform and several working boats. The final result was an optimised solution which could safely support the weight of the equipment without putting a strain on the harbour wall.

Delivering A Sensitive Construction Project

The Castle Park location brought with it the need for a considerate construction programme and we were able to reach out to our nationwide network of experts to assist with specialist areas. By bringing this team together we were able to use the experience of marine specialists, ecologists, tree surgeons, asbestos consultants, experts in Japanese Knotweed and many more to ensure all aspects of the project were delivered to the highest standards.

One clear example of this was found when groundworks uncovered the original walls of Bristol Castle and our archaeologist was on hand to stop works and explore the site, ensuring nothing of historical interest was damaged.

Working Within Strict Conditions

Due to the number of agencies involved with the harbour, and the sensitive nature of the project this scheme came with some of the most stringent planning conditions we had encountered. In all, there were 26 separate conditions attached, all of which needed to be discharged through the construction phase.

Protecting the Ecology of The Harbour

Ensuring the heat pump project does not damage the ecology of the harbour was paramount to both Vital Energi and the client. To achieve this, we worked with environmental specialists to ensure the harbour was unharmed.

Our solution sees water taken from , and returned into the harbour, without coming into contact with any chemicals. The system will also only take 3°C of heat from the water so there is no adverse effect on wildlife. Additionally, we have calibrated pump speeds so that fish and eels will not be caught in the abstraction flow.

How The Heat Pump Works

Water is taken from the river via the abstraction pipework which is submerged below the waterline. The water is filtered at this stage to prevent debris from entering the system. From here it is pumped through a second filter which removes smaller particles which include mussel eggs which can

hatch and grow in the pipework.

Once the water is filtered it passes through the water source heat pump where the ambient heat reacts with ammonia and creates low pressure vapour which can be compressed to a high-pressure vapour of around 110°C. This is an extremely efficient system of generating heat and the system has a COP of 3.18.

Heat from the water source heat pump is directed into a thermal store which then feeds into the Bristol Heat Network where it contributes to heating 1,000 homes and businesses.

Creating A Prefabricated Plantroom

To ensure continuity of supply, and that peak demand could be met efficiently, the design incorporates back up gas boilers. The heat pump will deliver approximately 80% of all heat from the energy centre and the gas boilers will be used during routine maintenance and times of exceptionally high demand.

The decision to make the 32-tonne plant room off-site enabled us to have fewer people, and fewer construction works on the crowded site. The finished pre-fabricated energy centre was then craned into position and connected. This part of the project was completed last as the plantroom significantly restricts access to the rest of the site once in situ.

Connecting to the Larger Network

The existing Bristol Heat Network runs next to the border of the Castle Park construction site and it had been installed with a valve, which enabled easier connection. Vital Energi installed a district heating from the energy centre, to the main network where it reaches 1,000 homes and businesses.

Creating A Role Model For The Heat Pump Industry

Since we began constructing the Castle Park heat pump project it has been on of the UK's most high-profile renewable energy projects, attracting visits from the likes of Shadow Secretary of State for Climate Change and Net Zero, Ed Miliband and, most recently, it won the European Heat Pump Association's “Heat Pump City of the Year” award.