

Planning for Climate Change Case Study



Ground Source Heat Pump at Castle Howard

- **Local authority area:** Ryedale District Council
- **Stakeholders:** Castle Howard Estate Ltd, Ecovision Systems Ltd

Summary

The project involved the installation of a Ground Source Heat Pump (GSHP) to provide a replacement for oil-fired heating at Castle Howard.

Background

- A change of heating system at Castle Howard from oil fired to another system was required to help reduce overall expenditure as part of a larger program to release funds for the much needed conservation of the buildings and landscape as laid out in the Castle Howard Conservation Management Plan.
- The project also aimed for an improved carbon footprint as well as affording an opportunity for educational purposes.

Method

- A feasibility study of all alternatives to oil resulted in a recommendation for a wood burning system.
- However the high expenditure required for a refurbished and enlarged boiler house, as well as some concerns over the running costs of the system resulted in the project being abandoned.
- In the meantime discussions with those in the ground source heat industry led to experimentation with the existing oil fired system.
- Ground source heat systems run at between 50 degrees and 65 degrees. The existing oil-fired system was running at 75-85 degrees and on time clocks. The whole system was also governed by thermostatic controls throughout the house.
- The ground source heat technicians were of the opinion that because the pipe work in the house was of a large diameter, the heat pump technology would work successfully.
- To prove whether or not a ground source heating system would work in Castle Howard, the oil fired boiler temperatures were reduced to 55 degrees and all the time clocks removed so that the system would run 24/7.



The results were as follows:

- Fuel consumption was reduced from 85,000 to 55,000 litres in 2006. In 2007 and 2008 the consumption was around 65,000 litres each year as the winters were colder.
 - The temperature in the house was comfortable, even during the colder periods.
 - For several years monitoring and recording of temperature and humidity throughout the house has taken place on a daily basis. As a result of the operating change the humidity and temperature recordings both showed a more stable environment, resulting in better conditions for the contents. This was important as the majority of the contents are conditionally exempt, with further items being subject to an 'in lieu in situ' status, and as such English Heritage has the duty to check that their condition does not deteriorate.
 - The boilers worked more efficiently, resulting in fewer problems and therefore less maintenance.
- The conclusion reached was that a Ground Source Heat system would work at Castle Howard and at the same time drastically reduce the estate's overall consumption of oil with all the resulting benefits that would entail.
 - English Heritage was supportive of the project, subject to it being carried out properly. This included ensuring there was sufficient detail on reinstatement, and an archaeological watching brief on the excavation of the trench.
 - The project involved placing 60 coils, each 100m in length, into the pond immediately to the north of the main house. These were then connected via a manifold chamber constructed by the lake, to two pipes that were then run at 1m depth from the chamber to the house, approximately 250m away.
 - As a Grade 1 Listed Park and Garden, planning consent was required to dig the trench and this was granted subject to an Archaeological Watching Brief. These two pipes were then connected to two heat pumps in the basement of the house.
 - The heat pumps were then coupled to the existing heating system. The house was already supplied by 3 phase electricity, and the supply only needed a fuse upgrade.
 - The Castle Howard Building Services and Gardens teams undertook the digging and relaying of the trench for the pipes. A local contractor carried out the electrical work for the installation of the heat exchangers in conjunction with Ecovision's engineers. A local self-employed plumber was responsible for the installation of the pipe work under the supervision of Ecovision's engineers.
 - The project took seven months from conception to completion, with the actual ground work taking just under three months.

Result - Key outcomes and impact

- Heat pumps in general and ground source heat pumps (GSHP) are effectively reverse air conditioning systems. They use low

temperature heat and convert it into a much higher and hence more useful temperature that can be used for water heating and general domestic heating.

- Using initial energy from the lake, together with the high efficiency of the heat pump will save a large amount of carbon dioxide emissions that would otherwise be expelled into the atmosphere under traditional heating systems.
- Although the technology is well used around the world, the UK market is lagging behind, with low level of awareness. This is likely to change, as a quality system offers excellent performance and significantly reduce carbon dioxide emissions and provide space heating.
- The high efficiency of the ground source heat pumps is minimising the electricity demand, and the respective CO2 emissions that goes with it.

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References / Links

<http://www.castlehoward.co.uk/The-Estate/About-the-Estate/Ground-Source-Heating.html>