°Case Study

Decentralised Energy
Mansfield District Council

°Climate east midlands

Rebecca Adlington Swimming Centre

Rebecca Adlington, Olympic Gold Medal winning swimmer from Mansfield, at the opening of the pool renamed in her honour. (image from Mansfield District Council)

This case study describes how a former coal-heated public swimming pool in Mansfield was refurbished and retrofitted with low carbon energy sources (two biomass boilers and a Ground Source Heat Pump) by Mansfield District Council in light of its climate change commitments.

Mansfield is located in the Maun Valley in Nottinghamshire and is the largest town in the county, with a population of around 100,000. Mansfield District Council (MDC) is a signatory to the Nottingham Declaration on Climate Change, making public the Council's commitment towards actively addressing climate change. In 2010 Mansfield District Council worked with the Carbon Trust to produce a Carbon Management Plan, setting out how it would reduce its carbon footprint by 35% by 2014.

The refurbishment of the Rebecca Adlington Swimming Centre through exemplary energy efficient design and renewable energy technologies is just one measure the Council has taken to achieve its climate goals. Replacing an existing coal-fired boiler with a Ground Source Heat Pump and Biomass Boiler will achieve a CO^2 saving of 2,821 tonnes over 10 years, compared to replacing with gas. The greater carbon saving over gas motivated the decision to use renewable heat. As the previous system was coal-fired it has also improved local air quality.

Mansfield District Council

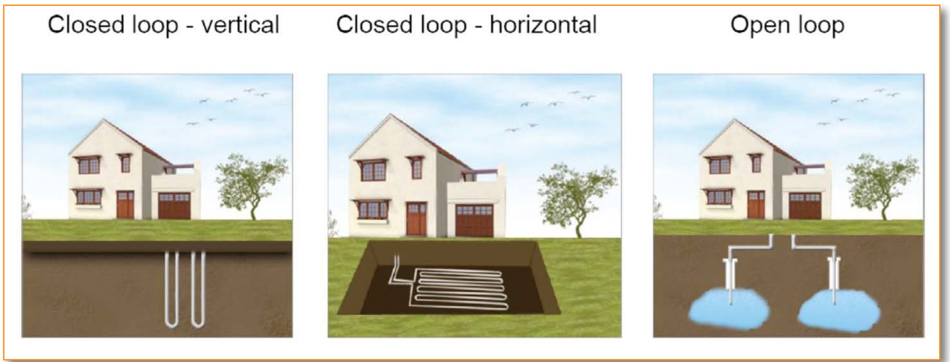
Introduction to the technologies installed at the Swimming Centre

Ground Source Heat Pumps

Heat Pumps use the same technology as refrigerators. They can capture heat stored in the air, ground or water and deliver it into a building and can also be used to remove heat from a building. There are three types of heat pump:

- Air Source Heat Pumps
- Water Source Heat Pumps (lake or river)
- Ground Source Heat Pumps

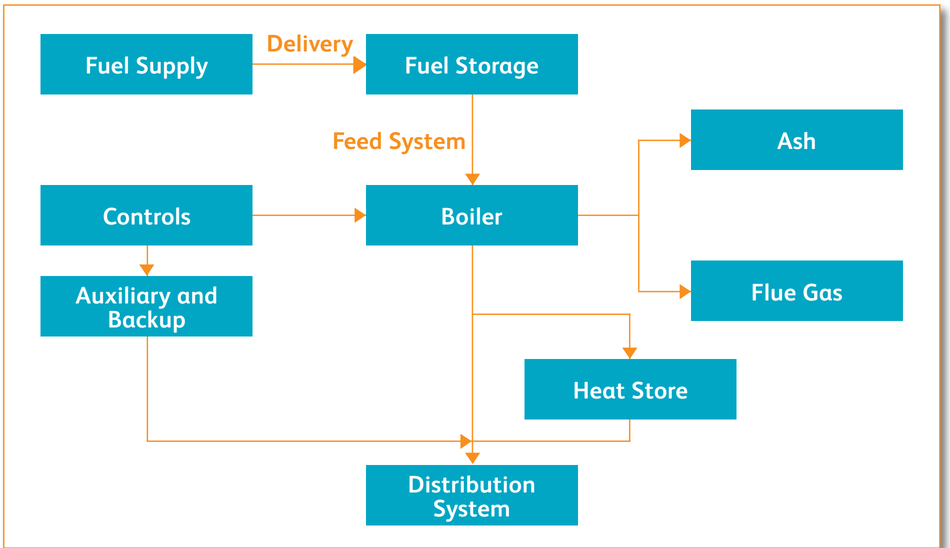
Ground Source Heat Pumps can consist of an open or closed loop. Closed loop systems typically take up more space, but do not have to be sunk as deep into the ground. Open loop systems take up less space but have to be far deeper, which has cost implications. For either system a minimum depth is necessary to achieve minimum efficiencies. A 100m bore with a 40mm diameter will typically generate around 5kW per bore or around 40,000kWh per annum. For coils, a 10m slinky trench generates around 1kW, or 8000kWh per annum.



Ground Source Heat Pumps can be difficult to install, particularly when retrofitted, and system failures can be difficult to rectify, but if correctly installed they are low-maintenance and should have a long life. As electrical energy is required to run the pump, heat pumps produce renewable heat but are not carbon neutral, unless powered by renewable sources.

Biomass

Biomass generally refers to organic matter derived from plants. The most commonly used biomass is solid wood, as logs, woodchips or pellets, used to generate heat through combustion. Biomass combustion is a well-established commercial technology, ranging from small domestic stoves to power and Combined Heat and Power (CHP) plants of up to 4MW. Biomass is renewable but different fuels have varying environmental implications. Fuel is a major consideration in using biomass due to access and storage requirements. Issues arising can include difficulty in securing long-term price guarantees and varying calorific values of fuel. The sustainability and land use implications of the biomass may also be a consideration.



Scheme details

The Rebecca Adlington Swimming Centre was completed in 2010 and was a rebuild of the former Sherwood Baths. The building was previously coal-powered and the cheapest option would have been to continue using coal. However, the Council's commitment to reduce its CO_2 emissions influenced the decision to move to renewable heat in the form of a Ground Source Heat Pump and two biomass boilers. The project was funded directly by Mansfield District Council. The Ground Source Heat Pump is used to provide under-floor heating and keeps the pools up to temperature. The biomass boilers are used to provide air heating and hot water and run continually, with no conventional boiler as back-up.

Key facts:

- 180kW Ground Source Heat Pump
- Two 400kW biomass boilers
- No conventional back-up boilers
- Retrofit project replacing an existing coal-fired system
- Investment of £750,000 required on top of costs for redevelopment of the site
- CO_2 saving over 10 years compared to gas: 2,821 tonnes

Biomass Boilers

The two 400kW biomass boilers are fuelled with woodchips, sourced on a short-term contract from a local supplier close to the Centre. Following a tendering process Mansfield District Council found that a local supplier that didn't need to charge for delivery was the most competitive option. Apart from an early issue with the quantity of dust in the woodchip, immediately resolved by the supplier, the supply has been reliable and there have been no issues with fluctuating calorific values.

As existing coal bunkers were converted to store the biomass there was limited design necessary. The limited size necessitates weekly deliveries over winter but, by using a local supplier who doesn't charge for delivery, it has been possible to keep both the capital investment for the fuel store and the operational costs low. It does still mean that deliveries have to be carefully planned and there is very little margin for error, especially in winter months.

Ground Source Heat Pumps

The 180 kW Ground Source Heat Pump is a closed-loop system. The bore hole is 125m deep and water pressure is 1.2 bars. It was initially intended as a back-up system but is actually being used continually to keep the pool up to temperature. Apart from an initial problem of wiring not having a sufficiently high voltage, there have been no major technical issues. Maintenance is carried out every six months and on-site staff have learnt how to carry out routine maintenance, such as rectifying pressure drops in the Ground Source Heat Pump and repairing or replacing belts in the biomass fuel feed. No incentives have yet been claimed, since accurate heat monitors were not fitted. These will be installed to make it possible to access Government incentives such as the Renewable Heat Incentive, and the costs of retrofitting heat monitors should be recovered relatively quickly.

Lessons learnt

During the initial period of operation the biomass consumption was far higher than predicted. However, this was down to human error; establishing correct temperatures and increasing temperature gradually brought the consumption down to the level predicted before operation began.

There was a general issue at the beginning of operation as the staff who needed to operate and carry out day-to-day maintenance of the new plant lacked experience.

There were also some design issues that have had an impact on operation and maintenance:

- A chimney stack close to intake vents occasionally causes a smell of burning wood inside the building; this could have been avoided through increasing the height of the stack.
- A flue designed with a 90 degree elbow has necessitated more frequent cleaning as dust collects in the elbow. This has been resolved by putting permanent access scaffolding in place.
- There are only three light sensors in the fuel store (full, half-full and empty) and a more accurate system – preferably based on weight rather than volume, would allow better planning of deliveries.
- The lack of accurate heat monitors has prevented the scheme from claiming any Government incentives. Additionally, industrial heat monitors have proved difficult to source.

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These Decentralised Energy Case Studies are one of the outputs from a climate change training programme for local authority planners that ran in 2011/12. Other case studies can be viewed at the web address below. The programme was commissioned by Climate East Midlands, funded by East Midlands Improvement and Efficiency Partnership and delivered by the Carbon Trust in association with Aecom.

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