

MINEWATER PROJECT: OLD MINES – NEW ENERGY

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SUMMARY

Abandoned and flooded mines are a good potential source of geothermal energy; they also offer space for storage of hot and cold water. Crucially, the minewater can provide a focus for sustainable regeneration of former mining areas, improving self-image, health and economy for local communities.

The Minewater project examines all of the issues that must be addressed in order to successfully harness this resource for heating and cooling buildings, thereby demonstrating a new renewable energy resource that can help deliver sustainable communities and restore local pride.

The project includes a live pilot at Heerlen (Netherlands) together with feasibility work in Germany, France and the UK. Early drilling results from the Heerlen pilot have revealed promising temperatures and capacity, so the notion of this concept as an effective new renewable energy resource for former mining areas remains on track.

INTRODUCTION

Abandoned and flooded mines are a good potential source of geothermal energy; they also offer space for storage of hot and cold water. Crucially, the minewater can provide a focus for sustainable regeneration of former mining areas, improving self-image, health and economy for local communities.

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The project, funded by the EC Interreg IIIb programme, is being carried out by an international consortium of partners from the Netherlands, UK, France and Germany, and is led by the Municipality of Heerlen. This project secured the Interreg funding in 2003, and was then revised in 2006.

This presentation provides an outline of the project activities being carried out, together with the progress so far and current indications of likely success.

The current principal focus for the progress of the project is the Heerlen pilot: drilling has proceeded at two sites and the emerging results are encouraging. Work at other locations mostly comprises pre-investment studies. The work in France (Lorraine region) and Germany (Aachen) has commenced during the last few months but this in itself is also a reflection of project success hitherto: the successful

progress at Heerlen encouraged new partners to join the project in 2006.

METHODS

The Minewater project comprises a spectrum of studies at different stages that are unified by the possibility of extracting useful energy from mines that are now closed.

Activities being carried out within the project focus on:

- the live pilot scheme (Heerlen, Netherlands) that will use water from the local mines to heat and cool local communities
- pre-investment studies that range from the detailed specific (Aachen, Germany), to a regional assessment (Lorraine, France) and a scoping study for a country (UK).

The scheme in Heerlen involves the regeneration of a former mining area that includes a large new-build development. The ambition is to heat this development by means of district energy infrastructure supplied by water from disused mines. Both heating and cooling networks are being investigated, using water from different levels of the mines.

Innovative technical concepts are being developed, including a design strategy for the buildings to satisfy heating and cooling demands by the direct use of the mine water supply temperatures. This mode of heating, using very low temperatures (between 32C and 37C) is known as a 'low exergy' system.

The progress with the Heerlen pilot is the result of several years of preliminary work. Initial studies were carried out to deduce the viability of this concept. This included:

- an examination of the local geology
- obtaining knowledge of the mining galleries and shafts
- evaluating the likely water temperatures, volumes and quality
- liaising with the local people, most importantly with former miners
- assembling a team of interested partners that includes the developer Weller.

Following the results of the preliminary work it was then necessary to undertake legal studies and obtain permits for drilling. Drilling was necessary because the closed mines has been filled in. Results of the drilling were subsequently used to inform the decision of whether it would be practically possible for the minewater to be used for supplying useful energy to the local community. A great

deal of work has also been carried out on environmental issues, and complex financial (ESCO) models to deliver the project.

These investigations were carried out in tandem with another proposed pilot at Midlothian in Scotland. The shafts of the now-closed Monktonhall colliery lie within the boundary of a proposed new town, Shawfair, situated close to the existing town of Dalkeith a few miles south of Edinburgh.

Similar initial investigations were carried out in order to establish whether the minewater could potentially be used for meeting the heating requirements of the planned new community. The shaft at Monktonhall was not filled, so no drilling would be involved. A pump is installed to remove water from the mine; this therefore provided a ready source of water at 13°C, an ideal temperature for supplying a heat pump. Potentially, this could be part of an integrated system also including combined heat and power, feeding a district heating network – an option appraisal exercise to assess this and other technical solutions, and then a finance advisor was consulted to establish the viability of the scheme.

As well as the pilot work, a number of pre-investment studies are being carried out. These largely involve new partners, from France and Germany, who have joined the project team in late 2006.

Aachen is situated in a mining district adjacent to Heerlen; both Dutch and German mining districts are hydraulically connected by galleries and mining fields. The Aachen team, Wfg, will investigate the effects of the Heerlen project on the mine water in the Aachen mines. As a result of the project they will also carry out pre-investment work that is likely to lead to future investment.

Also in Germany the partner Bonen are investigating the feasibility of a mine water system; here the coal deposit sits alone, unconnected to any other.

The French partner BRGM will examine the potential for mine water exploitation over the whole of the Lorraine coal field. This encompasses seventy municipalities, with a wide range of population density and industrial development. Here, the project work will examine the optimum size for a mine water scheme, identifying supply options ranging from a single built-up area to a large regional project.

As part of the revised project the UK partner BRE, involved from the start of the Mineawter project, will carry out an overview study of potential for using mine water in the UK. The UK has until recently had an extensive mining industry, and it is anticipated that this will include mining areas suitable for mine water exploitation; the work carried out in Midlothian already demonstrates there is considerable potential for once again harnessing energy from the mines.



RESULTS

The pilot study in Heerlen is the most advanced aspect of the project. The drilling has been successfully accomplished at the Heerlerheide site and commences soon at a second site.

When it became clear that there was indeed, in theory at least, potential in using the minewater the practical aspects were investigated. First, the legal aspects relating to ownership of the minewater and how to obtain the necessary concessions, were investigated. When these were successfully concluded, drilling commenced in order to establish was carried out.

At the first site the drilling was carried out between March and August 2006 with pump tests in July. Results were then reported to the council. These results were generally positive, and decisions were taken to proceed with a second investment with drilling commencing imminently.

The positive attitude not only of the council but also the developer – ‘think in terms of opportunities instead of problems’ - has been vital to the progress of this project. Redevelopment of the Heerlerheide centre is well under way and the prospects remain good for this community to be served once again with energy from its mines.

The energy supply from the minewater is likely, however, to be confined to heating – delivery of cooling is at the moment not being provided for. Solutions must also be found, if the ‘low exergy’ route is pursued, to the provision of domestic hot water, for which supplementary heating must be used in order to avoid potential problems with legionella.

A great deal of work was carried out in Midlothian. It was established that there was no technical barrier to the preferred engineering solution, using the minewater in an integrated system including a heat pump, combined heat and power, and a district heating network. Negotiations with the Coal Authority also progressed well. The reason for this pilot project not proceeding followed the conclusions of the business case; this had a strong focus on the high risk elements of the project. Furthermore, the developer decided to change the location for the first part of Shawfair to an area remote from minewater access.

The work concerning the other sites is still at an early stage and there are consequently no results to report as yet.

INTEGRATED DESIGN APPROACH

For the development of highly energy efficient buildings an integral design approach is necessary. An integrated approach has to achieve an overall optimization, taking into account all disciplines and their interactions. Basis is a set of unambiguous well defined performance criteria. The design

strategy applied is the so called Trias Energetica¹, a three step approach that establishes priorities for realising an optimal sustainable energy solution. In a first step the energy demand is limited to a minimum level. Step two is to tap renewable energy sources to a maximum share and step three is to use the remaining fossil fuels as efficient as possible. An overall goal is to limit the necessary temperature levels needed for conditioning the buildings.

In general, the heating and cooling of buildings can be realized with very low valued energy, with medium temperatures very close to the required room temperatures. The better the building properties the closer the temperatures of heat and cold supply can be to the room temperatures. In order to achieve this very good thermal insulation and suitable emission systems are a must.

DISCUSSION

The key finding so far has been that, through the Heerlen pilot, the project appears so far to support the notion that the water in disused mines can be harnessed usefully so that the mines become once more a source of energy – this time low rather than high carbon!

The project has also, of course, revealed difficulties but despite this there is clear replication potential across the many mining areas in the NWE region and beyond. The presence of new partners joining the project in 2006 with the intention of learning from the Heerlen experience and carrying out their own pre-investment studies is testament to this.

ACKNOWLEDGEMENT

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REFERENCES

Further information about the Minewater project can be found at the website:

www.minewaterproject.org

¹ The approach was introduced in 1996 by Novem in the Netherlands and has been further worked out by the Technical University of Delft.