

Results of the Ground Source Heat Pump trial at Copt Hewick, Harrogate, North Yorkshire.

1.0 Executive Summary

The purpose of this briefing is to advise of the results of the heat pump trial in eight Council owned elderly peoples' bungalows at Vale View, Copt Hewick. The systems were installed in July 2005 and these results were compiled after one year's operation, in July 2006. The original aim to remove tenants from fuel poverty (in the context of ever increasing fuel prices) in a manner that was cost effective to the Council by introducing renewable technology, can be shown to have been achieved in addition, at least a 53% - 71% reduction in CO₂ emissions and 52% - 78% reduction in energy consumption has been shown to have been made.

Harrogate Borough Council is currently preparing a funding bid to install further ground source heat pump units along with other renewable technology systems.

2.0 Introduction

This pilot project is part of an ongoing improvement programme in thermal comfort for Council properties, under the Decent Homes standard.

Eight elderly persons' detached bungalows in a village (Copt Hewick) near Harrogate in North Yorkshire were chosen for this pilot scheme for ground source heat pumps as a solution to tackling fuel poverty in a cost effective manner whilst addressing environmental issues.

The properties were off the gas network and the standard improvement option would have been electric storage heaters but this would have required a larger electrical sub-station to be built and the replacement of a supply cable.

This option would have resulted in costs which were comparable with the provision of the ground source heat pumps but had the added benefits of lower running costs to the tenants and significant reduction in CO₂ emissions (one of the Council's top corporate priorities is caring for the environment').

The units were installed in the summer of 2005. Originally five of the properties had solid fuel heating and three had electric storage heaters.

The Council's heating contractor Help-Link UK installed the "IVT Greenline" units, manufactured in Sweden, supplied by Ice Energy.

The properties chosen were originally constructed in 1979 with empty cavities and low levels of loft insulation. The properties have been upgraded with additional cavity wall insulation and loft insulation levels up to 250mm. The windows had been replaced with double glazed units. Doors are composite and thermally efficient. High levels of insulation were deemed necessary as a pre-requisite for installation of a heat pump system. No improvements in performance have been included, for insulation measures, in the calculations and results. More detailed figures can be provided to an appendix to this briefing if required.

3.0 Tackling Fuel Poverty

The properties were occupied by elderly (or in some cases vulnerable) residents. On average, over 70% of the council's housing tenants are in receipt of income or disability related benefit, and this is frequently higher in older persons' accommodation.

The original aim to remove tenants from fuel poverty (when more than 10% of income is spent on heating and hot water bills), can be shown to have been achieved, by introducing renewable technology.

Taking account of the minimum achievable benefit levels from 1 April 2005, and existing fuel bills for the year ending July 2005, tenants on the minimum income would have been spending in excess of 12% on their income on heating bills (£700 per annum on a £5,691 minimum pensioner income for 2005/6).

After installing ground source heat pumps the percentage of income that tenants spent on heating and hot water was reduced to 3.8% (or £215 per annum). The heating bill costs are calculated using 7p per kWh (based on approximate prices for July 2005, when the heat pumps were installed) and the electricity consumption is calculated for a room temperature heating requirement of 21^oC. The income used to calculate the percentage of income spent on heat and hot water is the minimum benefit for a pensioner as above. This means that, at 2005 fuel prices and benefit levels, fuel prices would have to nearly triple before the tenant returned to fuel poverty (at 2005 benefit levels). Therefore these properties are "fuel poverty-proofed" for the foreseeable future.

4.0 Fuel Bill and Carbon Dioxide Savings

The post installation average annual heating and hot water bill of £215 can be calculated for homes with the heating level set at 21^oC. A price of 7p per unit of electricity (kWh) has been used throughout this analysis. This was the average price of electricity for the majority of the period at the time the heat pumps systems were installed. This compares with pre installation bills for the period July 2004 to July 2005, which showed a range of costs of £450 to £700 for hot water and heating. In the year leading up to the installation of heat pumps, tenants were using a range of electricity and coal to heat the bungalows and provide hot water.

As the tenants have become used to the availability of constant heat, several have decided that a lower temperature is preferable and this may result in them reducing their heating costs further at a later date.

In addition to fuel bill savings, the work undertaken to replace heating and hot water systems has improved CO₂ emissions from each property by between 50% and 70% reduction. The eight properties have reduced their total CO₂ emissions by 25.6 tonnes per annum, an average 64% reduction in CO₂ emissions.

5.0 Impact on Council Running costs

The systems are expected to have a longer life than gas systems, partly because significantly lower running temperatures will not cause deterioration of components in the same way. This is true for both the radiators and distribution pipework and the heat pump itself. The expected life of a heat pump of this type is 25 years (40 to 50 estimated for the ground loop) whereas a gas boiler's life expectancy is around 15 years. Therefore, over the longer term, should significant numbers of heat pumps be installed, the pressure on housing improvement budgets should be relieved because systems would be renewed less often.

Lower maintenance costs are also anticipated, when compared with the mandatory annual gas fired system inspections but a longer term or larger study will be needed to prove this point.

6.0 Tenant Satisfaction

The tenants have used phrases such as "we are entirely satisfied with the heating systems" and "we are happy using these heat pumps".

Further tenants' surveys and distribution of summary information to tenants is currently being undertaken, but initial discussions with tenants have led to an expectation that the feedback will be positive.

A change of tariff types from economy seven to normal metering has also occurred in the properties previously on electric storage heaters. In a total cost calculation a tenant's household costs in addition to heating and hot water include appliances, lights and cooking costs.

7.0 System Faults and their Eradication

Once the ground source heat pumps were installed the tenants were advised to leave the heating systems running for 24 hours in order to increase the efficiency of the system and achieve greater levels of thermal comfort.

The lower output water temperature of 55^oC, provided by the system was initially thought by tenants to be a problem. This was discussed as the systems were installed but, since then, has not been raised. The tenants know to run the hot tap only as the temperature it is supplied at is usually satisfactory to use. The Tenants

understand, for example when running a bath or bowl of water, adding no cold water makes a saving for them as they are not now cooling down water that they have paid to heat.

Re-routing pipes along a shorter path, direct from the new installation to the taps has been arranged with Help-Link, to combat the tenants' concerns about having to run the tap for a period before hot water arrives.

A lack of understanding of the installation process which would accommodate ground settlement resulted in leakage to four of the eight the ground loop systems installation which have now been rectified by Help-Link but temporarily caused higher than normal electricity bills. It should be noted that Help-Link reimbursed the tenants for the total cost of additional electricity usage resulting from the leak (and also covered the costs of rectifying the problem).

The heat pumps introduce constant heat into the properties resulting in some tenants finding this too warm at night, and therefore tenants are currently being offered thermostatic radiator valves in bedrooms when they have approached the council about this matter. The option offered of thermostatic radiators in tenants' bedrooms needs to be included as standard. Further consultation with tenants is planned, together with the circulation of summary findings of this trial.

The staff involved in the pilot project have considered the problems experienced carefully and the lessons learnt have allowed the Council and Help-Link to develop the techniques used, in order to avoid such problems in the future. These improved techniques will be applied to any future installations by specifying them in contract documents and ensuring that the contractor is coached in the techniques in the early stages of future installations.

8.0 Further Development of the Technology

The Council has agreed to pilot a trial roof panel that links into the ground loop. The panel makes use of more rapid high temperature fluctuations from direct sunshine and an excess of heat that can be stored in the ground, to be utilised later, further reducing bills. The trial roof panel will be fitted to number 13 Vale View Copt Hewick where a ground sourced heating system is already in operation and will allow comparative data. This may allow a smaller ground installation to be considered in a similar installation or provide a further 15% saving on energy bills for a low cost investment of about £300.

9.0 Conclusions

The modelling of the outputs understated the benefits that were obtained from the heat pumps installed at Copt Hewick.

These systems offer a number of benefits including:

- Fuel poverty proofing of the property whilst reducing CO₂ emission
- Reductions of at least 50% CO₂ can be obtained for heating and hot water..

- The systems provide a continuously stable thermal environment for the tenants.
- Reduction in running costs to approx £215 per tenant previously £450 -£700 was found. (Average running costs for tenant's bills can be reduced by two thirds by converting from coal to a heat pump system and by approx 40% from electric storage heaters to heat pump.)
- Anticipated reduction in maintenance costs.
- Anticipated increase in tenant satisfaction (to be determined by survey).

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