

THERMAL SOLAR ENERGY

Pilot installation

BELFAST

United Kingdom

In order to replace fossil fuels and to reduce CO₂-emissions, the use of thermal solar energy with common long-term storage of the heat is one of the most promising possibilities. These installations require a common storage tank that is able to provide warm water for a long period into the local district heating network. They may, depending on their dimension, provide as much as 50 to 70 % of the annual heating needs of a residential quarter. In addition to this, these systems can use innovative techniques, for example concerning their connection or feeding into a heat network and offer large energy saving potentials in comparison with single installations.

THE CITY

Belfast, the largest city in Northern Ireland, is a major seaport located on the east coast of the Province. The City is a major industrial and commercial center as well as a bustling seaport. In the 17th century development of industries like linen, rope-making and shipbuilding doubled the size of the Belfast as a village every ten years achieving today's status of the robust northern metropolis with around 260 000 inhabitants. In the late 19th century Belfast became the center of a vigorous political movement over the union with Great Britain and the city was the engine-room that drove the whirring wheels of the industrial revolution in Ulster.

Today the city of Belfast is highly pedestrianized, with benches where you can sit and listen to the street musicians.



CONTEXT

Belfast Energy Agency was established in April 1999. It aims to co-ordinate energy activities across the city with priorities in five main areas: renewables, community energy planning, SMEs, green transport and energy education.

By the end of October 2001 Belfast Energy Agency had produced the city's energy balance with the aim of identifying energy use patterns within the greater Belfast area. One of the results was that there is a significant potential for renewable energy especially solar and landfill gas projects. In order to raise public awareness about renewable energy an information pack has been designed comprising different RES. A competition has also been promoted to local schools with the opportunity to win a renewable technology for use within the school.

Since November 2001 the Belfast Energy Agency has been co-ordinating a new carbon reduction pilot. It involves a feasibility study to determine whether staff from several organisations would be interested in buying energy measures at discount prices as part of an Energy Shareholders Club.

EXPERIENCE OF BELFAST

Belfast Energy Agency in partnership with Energy Action (Dublin) were successful in securing funding from Energy Challenge to assess the feasibility of implementing solar water heating in social housing in both Northern Ireland and the Republic of Ireland. This bid was supported by Northern Ireland Electricity (NIE), Northern Ireland Housing Executive and Donegal County Council.

Solar water heating is a well-developed, reliable technology. It has been widely used throughout Europe in both private and public sector housing. However in Ireland its application has been limited to the private sector, where householders have initiated the installations themselves. Consequently there has been no objective, co-ordinated assessment of its performance. This project took the innovative step of introducing solar water heating into three socially owned houses in Northern Ireland and three local authority houses in the Republic of Ireland, with the aim of assessing performance.

Suitable households were identified by assessing their compliance with a number of criteria::

- > was the property south facing
- > was the heating system oil or natural gas
- > was there adequate roof space to allow installation work to be carried out
- > was the heating system suitably controlled to allow hot water and central heating to be independently controlled

In Northern Ireland there was an initial resistance from tenants, who were suspicious of the technology and doubted whether it would work. However following an information campaign by Belfast Energy Agency suitable houses were located close to Belfast. In the Republic of Ireland three houses were selected in Inishowen, Co. Donegal.

The type of solar water heating system chosen was the evacuated tube system. This system is manufactured locally by Themomax in their production factory in Bangor. The evacuated tube system utilises both heat and light from the sun to produce hot water and so can operate in a wide variety of weather conditions. They are effective not only on hot sunny days, but also in cold, windy and even cloudy conditions.

The systems were fitted together with a super insulated hot water storage tank, which ensures that any hot water created by the solar collector is kept at a high temperature for a long time. These systems were also fitted with monitoring equipment as standard. This enabled tenants to keep records of the systems performance on a daily basis.

There has been no objective assessment of the performance of solar water heating in Ireland. This project aimed to assess the feasibility of implementing this system in social housing, to use the information gathered to inform discussion and to raise the profile of solar and renewable energy in Ireland. To these ends it was necessary to accurately record the performance of the systems over the course of a full year.

Prior to installation householders were briefed on the principles of solar water heating and on how to use the systems to the maximum effect. Monitoring sheets were developed, which enabled the tenants to record the temperature of water in both the solar collector in the roof and in the hot water cylinder itself. These temperatures were recorded three times a day by the householders, usually once in the morning, afternoon and evening. The corresponding weather conditions were also recorded on the monitoring sheet. In addition to this, householders were also required to keep a record of the hot water used during the day as well as if they required any additional back-up water heating.

The Solar Collectors' Performance

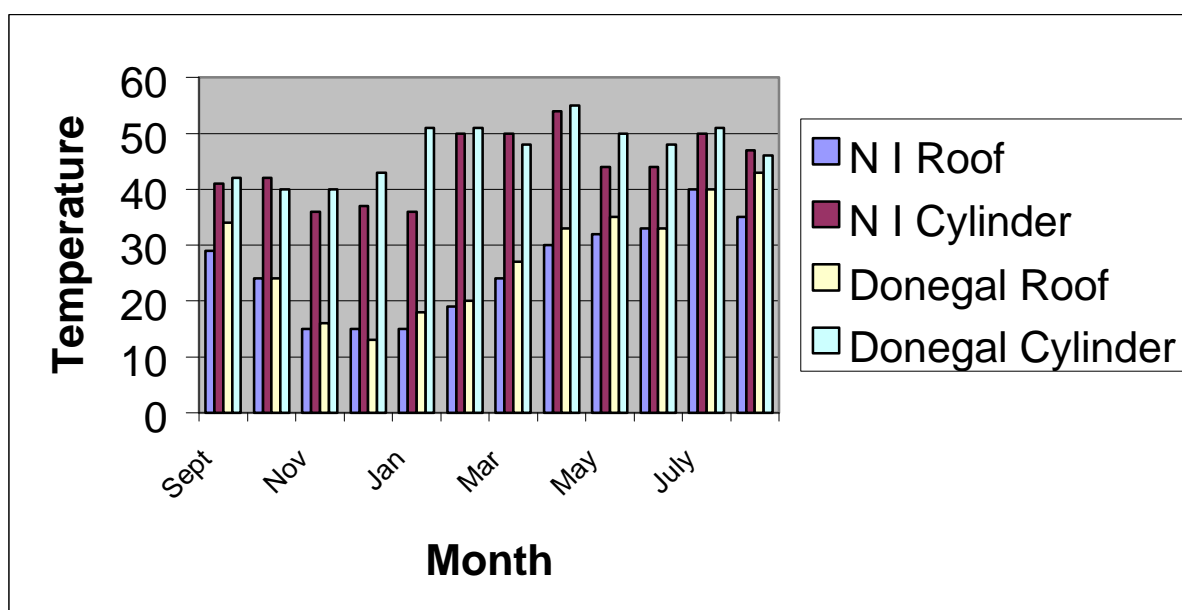
Systems were installed in mid August 2000 in Bangor and Holywood and at the beginning of September in Donegal. From the outset results appeared to be very promising.

During August the solar collectors provided over 95% of the households' hot water needs. In fact only one household required additional heating and that was only for one hour in the whole month.

As winter approached and weather conditions deteriorated progressively more back-up heating was required. However even in December and January, when back-up heating was required on almost every day, it was still only required for an average of one hour per day. With regard to this it is worth noting that even when the solar collector is not meeting the full hot water needs it is still providing a background heating. By taking the chill off the water, it means that back-up heating is required for shorter periods than would be normal.

As spring advanced less back-up heating was required. By May the solar collectors were meeting 92% of household needs. Despite relatively poor weather in June, July and August this continued to be the case with the solar collectors providing 95% of hot water requirements.

Broadly speaking the performance of the systems in Bangor and Holywood has been very similar to the performance of the Donegal systems. There have been some differences in performance but these can be attributed to local weather conditions. The graph below compares the temperatures in the solar collector and hot water cylinders in both areas over the course of the year.



Feedback from householders has been very positive. They reported no serious inconvenience during the installation of systems, which in all cases was completed within two days. Instruction on how to operate the systems had been easy to understand. All the householders reported that they had been satisfied with the performance of the systems. The systems had saved them money and provided hot water. The hot water provided in the summer was seen as a particular advantage. Oil consumption had been significantly reduced on average by 1000 litres per annum. The panels themselves were unobtrusive.

EVALUATION AND OUTLOOK

The monitoring data collected and householder feedback demonstrate there are real benefits from solar water heating in an Irish context. The technology is clean and sustainable. The systems' performance has been effective in the Irish climate.

The average cost of the systems fully installed was 1,880 Euro¹. Based on information from householders, who recorded oil savings of 1000 litres of oil per annum, this would equate to a direct saving on annual fuel bills of 120 Euro – taking the average price of oil as 0.12 Euro per litre. This gives a payback period of 15.9 years on the systems.

However the cost of 1,880 Euro is not truly representative of the cost of this technology. The figure includes marketing costs and sophisticated monitoring equipment necessary for the project, but which normally would not be required. This would bring the cost of systems down to 1,750 Euro. In addition Thermomax systems are top of the range, solar water heating systems can be installed for as little as 940 Euro. Payback periods, therefore, could be significantly shorter. Shortly before this project commenced VAT on solar panels in the UK was reduced from 17.5% to 5%. This combined with greater promotion and the real savings that can be made, can have an impact in the uptake of solar panels and therefore a reduction in their costs.

Furthermore solar water heating systems are not subject to rising fuel prices. The price of oil is constantly fluctuating – at one point during the project it actually rose to a high of 0.17 Euro per litre. Solar water heating affords a sense of security and peace of mind.

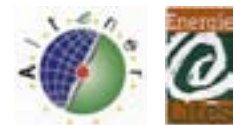
This project has benefited the six households involved financially. It has contributed to carbon reduction, and it has raised awareness of the potential for solar water heating in Ireland.



FOR FURTHER INFORMATION

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¹ Exchange rate is 1£=1.59785 Euros