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10741

Energy Efficiency Demonstration Scheme Expanded Project Profile 282

Potential users

Housing Associations and Local Authorities

Host organisation

CCHA Housing (formerly Coventry Churches Housing Association)
PO Box 160
Abbey Park
London Road
Coventry CV3 4HZ
Tel No: 0203 501014
Mr S Fergusson

Investment cost

Basic rehabilitation £16,490/house.
Energy efficient package: additional £1,495/house.

Savings achieved

£77/a on space and hot water heating (normalised to include higher room temperatures in test group).

Monitoring contractor

DATABUILD
Building Technologists
4 Venture Way
Aston Science Park
Birmingham B7 4AP
Tel No: 021 359 8505
Mr M Trollope

Main equipment suppliers

British Gypsum Ltd – (Insulated dry-lining)
Ruddington Hall Loughborough Road Ruddington
Nottingham NG11 6LX Tel No: 0602 844844

Higher Insulation Standards for small pre-1919 Terraced Houses

Schlegel Engineering – (Draught stripping)
Henlow Industrial Estate
Henlow Camp
Bedfordshire SG16 6DS
Tel No: 0462 815500

Myson Heating Ltd – (Water heating)
Eastern Avenue
Team Valley Trading Estate
Gateshead
Tyne & Wear NE11 0PG
Tel No: 091 487 2211

Aims of the project

CCHA Housing (formerly Coventry Churches Housing Association) rehabilitate about 50 houses each year, mainly the two-up, two-down type with a rear extension. The usual refurbishment package comprises improvements to the building envelope, the installation of a new boiler and central heating system, loft insulation and the dry lining of external walls on the rear extensions. However, the measures seldom improve the thermal comfort for the tenants who are generally on a low income. Even after refurbishment many homes may still suffer from condensation and mould growth.

To improve this situation and provide an affordable heating system, the CCHA developed an energy efficient rehabilitation package which was subsequently installed in a test sample of houses. The main aim of the project was to assess the economic, social and technical benefits of the improved refurbishment.



Typical housing owned by CCHA



How energy was saved by CCHA Housing

The normal refurbishment package undertaken by CCHA Housing in their pre-1919 houses comprised:

- new concrete floor with damp proof membrane throughout
- new damp proof course
- replastering throughout, including plasterboard ceilings
- re-roofing, including a flat roof which is replaced with a pitched roof
- new low pressure heating system with radiators in most rooms, gas-fired back boiler in the living room
- new single glazed window frames
- hot water heating system (hot water cylinder heated from back boiler or electric immersion heater)
- loft insulation (100mm)
- draught-stripping of external doors
- 12mm insulated plaster board fitted to external walls of rear extensions

After the rehabilitation the houses which are predominately pre-1919 and of solid wall construction ($U=2.0 \text{ W/m}^2\text{C}$) are still affected by low temperatures, and exhibit persistent condensation and mould growth. As a result the tenants suffer discomfort and have to endure high heating bills. The tenants are generally on a low income and cannot afford to heat all the rooms to adequate temperatures.

To improve the situation and to provide heating that the tenants can afford to use, CCHA Housing developed an energy efficient rehabilitation package. The package reduces the design heat loss of the building, improves the thermal comfort by eliminating some unwanted ventilation and can reduce maintenance costs. The latter is achieved through the elimination of condensation and associated mould growth, thereby increasing the planned internal maintenance interval.

The design of the energy efficient refurbishment ensures that cold bridges are avoided as far as possible. In addition the heating system is fairly simple and straightforward to operate. The energy efficient refurbishment included the following additional items:

- 25mm expanded polystyrene as edge insulation and under most of the ground floor slab
- 28mm polyurethane dry lining on all external walls and on some party wall returns including bathrooms
- insulation on window reveals (12mm polyurethane minimum)



Refurbishment measures – dry lining

- insulation of gaps at the end of first floor joists on external walls (50mm expanded polystyrene)
- loft insulation – two 100mm layers laid at right angles and the insulation of loft hatches
- draught stripping of all doors and opening windows
- trickle ventilators in bedrooms and living room
- gas-fired heating system including a low-output boiler with simple controls and a gas fire with back boiler in living room
- multipoint gas water heater
- condensation drain fitted to all fixed windows.

It was estimated that these measures would reduce the design heat loss of a small terraced house from 6.0 kW to 3.5 kW. The largest contribution being the improvement in fabric heat loss, from 4.8 kW to 2.2 kW.

The scheme was supported by the Energy Efficiency Office under its Demonstration Scheme, and CCHA Housing received a small grant towards the cost of the additional energy efficient measures to allow the homes to be independently monitored.

Monitoring

The main aims of the monitoring were to test the cost-effectiveness and buildability of the package of energy efficient measures. This required a programme of physical monitoring which was supported by social monitoring to determine, among other things, the tenants' view of their thermal comfort. The performance of the 16 test houses was compared with a closely matched group of control houses, refurbished to the normal standards.

The houses, located in Coventry, Nuneaton and Rugby, were end of terrace and mid-terrace. A reasonable match was obtained between the two groups of houses. However, the control group had not been rehabilitated at the same time or to exactly the same standard – some did not have dry-lining in their extensions. These factors were taken into consideration during the subsequent analysis of the monitored data. Both groups of houses were also subjected to pressure tests to determine their air leakage characteristics.

The programme of monitoring assessed the buildability of the package of energy measures, measured energy savings and internal temperatures, assessed future maintenance implications and estimated the cost-effectiveness of the package in relation to the standard rehabilitation. In addition



Refurbishment measures – boiler replacement

social monitoring determined the tenants' view of their accommodation and the heating system provided. A structured interview was carried out with each household to obtain this information. The tenants were not chosen on any pre-conceived basis, other than their willingness to participate in the monitoring programme.

Databuild was appointed by BRECSU to undertake the monitoring of the project.

Although some extra supervision was necessary in the early stages of the building work, monitoring during the construction process showed that the installation of a range of energy efficient fabric and ventilation measures could be successfully undertaken. The majority of problems encountered were not serious and could be overcome with comparatively minor modifications to the specification and working sequences. During the drying out period some complaints were received of excessive condensation on windows. The problem persisted in four test houses, eventually leading to mould growth on the window frames. However, a survey indicated that this problem was even more acute in the control group of houses. The pressure tests indicated that there was little reduction in air leakage, even after extensive draught-stripping. However, there were fewer complaints relating to draughts in the test houses. The heating system controls comprised an on/off switch, a zone valve for adjusting the first floor heating and a boiler output control valve. Some of the tenants in the test houses complained of inadequate control of their heating systems. Other complaints related to a lack of instructions on using the heating controls, the reliability of the heating systems, blocked condensation channels on window sills etc.

Energy savings and other benefits

If a direct comparison is made between the test and control houses as monitored, the average energy saving by the test group is 1,346 kWh per year, or about 10%. This is based on the external temperature averaged over 30 years, and should be qualified. A detailed analysis of the data showed that on average the test houses were maintained at a temperature of 19.6°C, and the control houses at 18.8°C, a difference of 0.8°C. If the two groups of houses had been maintained at similar temperatures, the saving on space heating in the test houses would have been nearer 27%.



Part of the monitoring package – ventilation investigation

A lack of understanding of the heating system caused the tenants to use additional space heating energy in the test houses. Furthermore, these houses were drying out during the monitoring period and required higher levels of ventilation and heating.

The test group used almost 25% less fuel for water heating – suggesting that the multipoint water heater is a highly successful measure for this type of housing.

When allowance is made for similar room temperatures in both groups of houses, the average saving on space heating is 3,550 kWh (27%), which is worth £56 at the 1989 fuel prices. The saving on hot water heating in the test group was equivalent to 1,408 kWh (25%), worth £21 per year. The total saving on heating and hot water averaged £77 per year, during the monitoring period.

The additional cost of the energy efficient measures was £1,495 – a 9% increase to the cost of the standard refurbishment. The prevention of condensation and mould is expected to prolong the normal maintenance interval which would produce worthwhile long term savings for the building owner. Other factors such as the need to provide affordable heating to prevent possible litigation against the landlord make this investment worth considering.

Replication potential

The package of energy efficient measures can be applied with equal success to most small, solid walled homes. This and a similar Demonstration undertaken on Merseyside (Expanded Project Profile 209), have shown that energy efficient refurbishment is a viable option that can be undertaken in most regions of the country.

It is estimated that there are nearly 5 million homes throughout the UK built before 1919. Currently about 200,000 are refurbished each year. At this rate of progress it will take a long time to bring this housing stock up to modern standards and expectations. There is a great deal of scope for saving energy in these dwellings. The Demonstration has shown that energy efficient refurbishment is effective and a potential investment option that other landlords should consider when improving older housing.



Part of the monitoring package – temperature measurement

CCHA Housing

CCHA Housing has long experience of carrying out rehabilitation programmes on late 19th and early 20th century housing. CCHA Housing now manage over 6,000 homes throughout the Midlands of which 2,500 are mainly two-up and two-down inner city terraced houses.

CCHA Housing – our experience

Older housing, even after improvement, can continue to have major condensation problems. This is not only costly, but generates the fractious debate with residents as to whether, or not, the problem is condensation – the resident's responsibility. If we could evolve a long term, cost-effective solution to this problem, then it would solve a number of contentious issues. Firstly, it would reduce the long term repair and maintenance costs; secondly it would reduce the heating costs for the tenants, and finally it would improve our amenity relationship with residents who are fed up with continually complaining about recurring condensation which CCHA Housing could do little to rectify.

The solution had to be cost-effective both in terms of capital cost and maintenance costs. In common with most Associations we are working within very tight grant levels and it is pointless installing equipment which requires continual repair or servicing. The solution also had to be compatible with the social habits of the occupants. It is pointless trying to introduce an approach which requires the residents to modify their normal patterns of life.

The results of this exercise have been highly satisfactory. Notwithstanding some of the problems encountered during the monitoring exercise, detailed in the Expanded Project Profile, we have achieved potential heating cost savings of £77 per year for a typical resident, for a modest additional capital investment of £1,495. Since the majority of residents are on low incomes this saving is important and significant.

On a wider front, the ability to evolve an approach to refurbishment that can achieve such energy efficiency is of crucial importance in the long term. A substantial proportion of the UK housing stock was constructed before 1919.

CCHA Housing is now incorporating the findings of this project in all future refurbishment schemes. In addition the standard of existing refurbishment is gradually being improved. Although it is a slow process given the limitation on grants, but even small steps are better than nothing.

Our thanks to the Energy Efficiency Office and BRECSU for their support with this project. It has helped CCHA reduce costs and improve the quality of life for the residents.



Stewart Fergusson

Stewart Fergusson
Director of Organisation and Management Development

Best Practice programme

The work described here was carried out under the Energy Efficiency Demonstration Scheme. The Energy Efficiency Office has replaced the Demonstration Scheme by the Best Practice programme which is aimed at advancing and disseminating impartial information to help improve energy efficiency. Results from the Demonstration Scheme will continue to be promoted. However, new projects can only be considered for support under the Best Practice programme.

For copies of reports and further information on this or other

projects, please contact the Enquiries Bureau at the:
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Information on participation in the Best Practice programme and on energy efficiency generally is also available from your Regional Energy Efficiency Office.