

## SERVICES FOR HOUSING HOCKERTON HOUSING SCHEME

A technically and socially innovative housing project at Hockerton in Nottinghamshire has set out to implement the Agenda 21 principles on a local scale. With a radical approach, impeccable design credentials and committed occupant-owners, the scheme is a striking way forward. It might work for them, but will it work for the rest of us?

BY JOHN FIELD



# Open agenda

**M**ore aptly described as a lifestyle project, the Hockerton housing scheme has gained local celebrity status and considerable media attention.

This rural experiment in sustainable living certainly has radical objectives: zero net energy consumption, no external fresh water or fossil fuel supplies and the encouragement of local lifestyles.

The houses have been designed by architects Brenda and Robert Vale, responsible for Britain's first truly autonomous house<sup>1</sup>. They have designed the five earth-sheltered terraced houses for a 25-acre site outside Newark. The site is owned by the project instigator, Nick Martin, who built the Vales' autonomous house.

Each of the five houses in the project is owned by a family, avoiding the problems of over-idealised communal living attempted in the 1960s and 1970s. However, owners share an attitude to life which helps forge joint responsibilities and commitments.

Such common attitudes include a commitment to local working and a consequent re-

duction in transport requirements – shared car ownership is already being tried, and there are plans for a communal electric vehicle. The working arrangements affect the whole project and have pushed the members towards finding ways to get paid work, including consultancy resulting from their own project.

Making the BT advertisement work – “Daddy, do you have to go into work?” – is an Agenda 21 option. At Hockerton this means a mixture of hands-on involvement on the site and letting the electrons do the travelling.

The five houses are arranged on one level in a south-facing linear terrace with full-width conservatories. The north wall has an earth berm which extends over the roof to a depth of around 400 mm. To promote standardisation of construction components, each house comprises six, 3 m-wide bays, five of which have a window into the conservatory (figure 1).

These bays may be through living rooms or divided to provide a front bedroom and a rear bathroom, utility room or store. The sixth bay extends as a porch into the conservatory, providing an entrance way.

The earth-covered roof, bermed walls and the floor all boast 300 mm of expanded polystyrene insulation which, on its own, would provide a U-value of 0.12 W/m<sup>2</sup>K. The south wall is in brick and block with a 150 mm, fully-filled cavity with separated lintels. This achieves a U-value of around 0.2 W/m<sup>2</sup>K, excluding the conservatory.

Five panes of glass separate the living areas from the outside world, the glazing being triple-glazed, argon-filled panes with one low emissivity surface. The conservatories have clear double-glazing.

High insulation levels and the south-facing aspect mean that the houses are expected to have no auxiliary space heating requirement. They have neither conventional space heating nor wood-burning stoves, which were seen as providing too much heat for much of the time. Domestic hot water is provided by a 700 W heat pump serving an 11 m<sup>3</sup> insulated store in each house. Water is heated in a heat exchanger as it passes through this store.

The heat pump evaporator is located in the conservatory. This improves the crucial win-

**WHAT IS AGENDA 21?**

In the late 1980s, it was finally realised that reckless consumption of the Earth's finite resources was threatening the eco-systems on which all life depends.

When a World Commission on Environment and Development was held in 1987, it introduced the useful idea of sustainable development – the concept which states that the needs of the present are met without compromising the ability of future generations to meet their own needs.

This concept struck a chord, as much with business and Government as it did with the green movement. At the Rio Earth Summit in 1992, nations signed up to a new environmental agenda for the next century: Agenda 21.

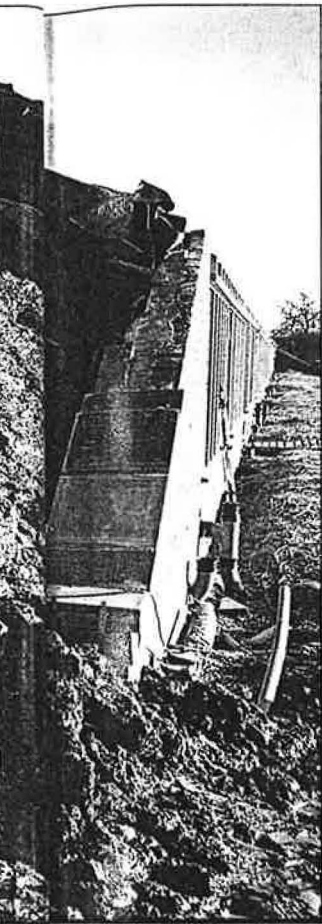
Much of Agenda 21 depends on local action. Every council is now required to prepare its own strategy, Local Agenda 21, to achieve sustainable development and the partnerships to do this.

Agenda 21 recognises that environmental problems and solutions are linked to social and economic problems. Urban decay and neglected open spaces increase fear of crime and discourage investors in inner cities.

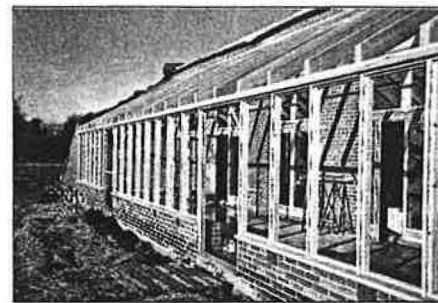
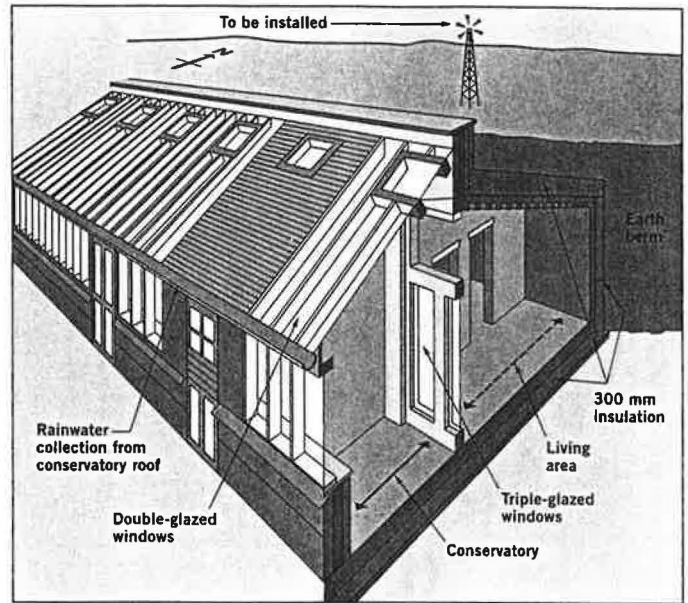
Hence local Agenda 21 emphasises the importance of involving people, especially in disadvantaged groups, in seeking solutions.

More information about Agenda 21 can be found on the World Wide Web.

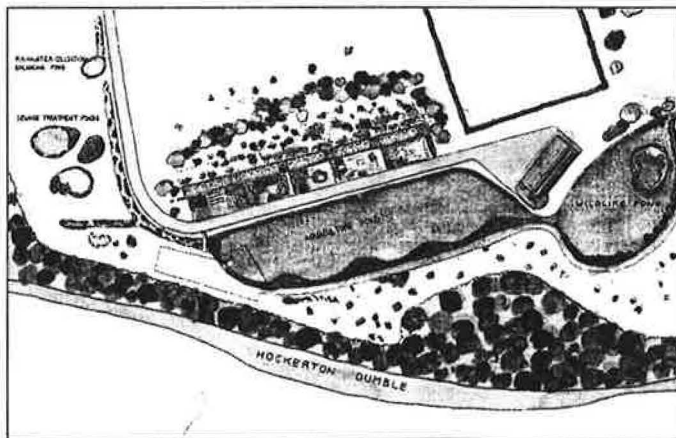
Take a look at both [www.detr.gov.UK](http://www.detr.gov.UK) and [www.hackney.gov.uk/agenda21](http://www.hackney.gov.uk/agenda21)



ABOVE: The black tunnel will be the communal pantry within the earth berm, which is also shown on the site map, RIGHT.



ABOVE, FIGURE 1: Isometric showing the construction details with, LEFT, the state of play in January 1998. The heat pump for each house will be located in the conservatories. This will improve heat pump winter performance, but raises questions about comfort conditions in the conservatories.



ter performance of the heat pump, but raises interesting questions about shortening the useful living season in the conservatories. It also provides the shock-horror tempting possibility of running the heat pumps in summer to provide cooling to the conservatories.

One shared feature is the pantry – a cellar which is above ground, but within the earth berm at the west end of the terrace. As the houses are one level and will be generally warm, there will be no natural cool area. A pantry is therefore provided to reduce the need for refrigerated storage.

While the windows have trickle ventilators which would provide background ventilation (albeit from the conservatories), a simple mechanical ventilation with heat recovery (mvhr) system has been installed using clay pipes.

This provides higher fresh air, particularly to the enclosed rooms to the north. The mvhr system also allows temporary higher air change rates, for example when cooking or drying clothes. The system has three operating speeds to provide 400 litres/h/house.

With suitable design and equipment selection, variable speed systems can have very low demand on low load. It will be interesting to see how important it is to avoid use at full speed, and whether there is a temptation to do this regularly in summer for comfort reasons.

The designers have made a feature of the clay supply and return air pipes which are suspended from the ceiling. Air is supplied to the front rooms (which have higher solar and living gains) and extracted from the kitchen and bathroom. A plate heat exchanger is lo-

cated in the porch area, and it is intended that the system should operate continuously on low speed.

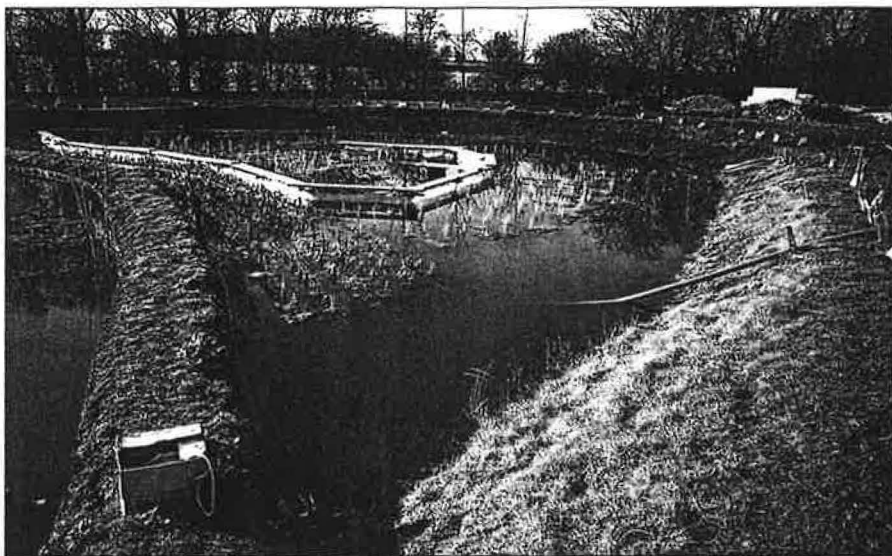
The project objective, to match costs of conventional housing, has required lateral thinking to offset the higher costs of environmentally sound construction materials. For example, standardising the bay width (which provides a significant constraint on internal layout) has allowed extremely simple and inexpensive construction of the roof which supports the earth berm. Further savings arise from not including any conventional heating system, and avoiding the need for a gas supply or oil storage on site.

The houses will not require an external fresh water supply. Instead, rainwater is collected from the conservatory roofs for storage and mineralisation prior to drinking. The requirements for water of less demanding quality will be met by collecting rain water from the earth berm roof and other parts of the site.

This non-potable water will require pumping to a small reservoir, from where it will be gravity-fed to the houses. Demand is reduced by the use of low-flush and dual-flush water closets, as well as spray taps and showers. Individual families are trying out further measures such as composting toilets and a domestic urinal suitable for both sexes, adapted from a conventional bidet.

A reed-bed system deals with the waste water, with a special section allotted for pre-treatment of human waste. The outflow from these systems will be of higher quality than

## SERVICES FOR HOUSING HOCKERTON HOUSING SCHEME



The water treatment ponds. A reed-bed will pre-treat human waste, raising the water quality above EU standards.

required for EU bathing standards. Passing through an aqua-culture pond to make use of nutrients, the water ends in a substantial wild-life pond which is also used by the members' families for summer recreation.

The radical approach of the project extends to materials selection, and has resulted in the almost complete eradication of pvc. Instead, clayware has been used for the ventilation pipes, and non-pvc wiring has been used for electrical and telephone services.

This strategy has added significantly to costs, and the wiring used is much less flexible and hence harder to use than pvc equivalents. Other measures include sustainable softwood, solvent-free and lead-free paints.

Recycling of organic waste will be achieved by using on-site composting facilities. The use of non-recyclable materials and products will be minimised and arrangements will be made for recycling non-organic materials.

The planned renewable electricity supplies – a wind turbine and photovoltaic cells – are expected to be communal site facilities. This will require a single mains supply to the site with sub-meters to individual houses. The normal problems of managing and billing of sub-metered supplies will need to be addressed, as experience shows that a disciplined approach is required to avoid arguments and payment problems.

Use of the mains electricity supply for daily and seasonal top-up is a vital part of achieving the net-zero carbon target while allowing the benefits of modern amenities within reasonable cost limits. It solves the problem of how to allow significant use of electricity on demand without expensive electricity storage.

The members are certainly interested in green electricity supply contracts, but the site will have to wait until after the final stages of market liberalisation (April 1998 at the earliest) to look further than their local electricity supplier. One suspects that neither of the types currently on offer have great relevance to the project: some suppliers charge a premium for green supplies, and use the proceeds to fund green developments that would



Inside the houses. The mechanical ventilation uses clay pipes slung from the high-mass structure. The pipes extend for the full length of the housing development, with spigots supplying the front rooms, and extract from kitchens and bathrooms.

not otherwise have happened. Others take the green electron approach of allowing you to buy electricity earmarked as renewably generated.

The mechanism for this earmarking is unclear and the approach has attracted criticism from environmentalists as being little more than a marketing gimmick. Furthermore, an historical problem remains: it is difficult to find a supply contract which pays for generated electricity from renewables or chp to be sold back to the grid. For smaller generators the extra costs of this arrangement are less than the value of electricity, something which the electricity regulator should address.

The next stage of energy self sufficiency – avoiding the use of mains electricity altogether – seems to be out of reach for this project, but it may possibly remain a goal to minimise use of the mains. This would re-

quire the far harder problem of instantaneous demand management which, for a communal supply, is a rather difficult people-problem.

The planned renewable energy supplies have met with traditional problems, specifically the high cost of photovoltaics and local opposition to the planned 5.5 kW wind turbine. The project as a whole was held up while a massive case was prepared for Section 106 planning approval, but there was a shift in local authority attitude once the local authority had Agenda 21 objectives of its own.

Planning permission was granted subject to an agreement, ensuring that the houses could never be sold for speculative purposes, and that the project's sustainable aims be enshrined in a legal document.

With the fairly extensive use of electricity (hot water heat pump, cooking, low energy lighting, ventilation and fresh/grey water pumps) it seems quite a tall order for the project to achieve net-zero energy even if the 5.5 kW wind turbine and photovoltaics are installed.

It will be a fascinating to see the results of the monitoring exercise being carried out for the BRE. This will look at how the electricity and other energy and CO<sub>2</sub> balances work out, and what would have been required for net-zero energy if the objective is not met. The researchers should consider carbon emissions, cost and other balances of practical measures, and not delivered energy which has no practical relevance.

The battles over planning permission raise the issue of land use – this is a 25-acre site with a wonderful rural outlook. The terraced layout avoids the inherent waste of land used to separate detached housing, but the reed-bed and wildlife pond may not be accessible to more general housing.

This land-use issue should also be addressed to assess of how this type of housing might satisfy large-scale housing needs.

Overall, the Hockerton housing scheme shows a refreshing combination of boldness and realism in taking on the seemingly insurmountable Agenda 21 challenge of the next century. The occupants are certainly not achieving this without sacrifice, but one senses they will benefit greatly and may provide important lessons for UK housebuilding.

The owners happily volunteer that traditional career advancement comes second to their objectives for the project. But this lifestyle is not without sacrifices and pressures.

As the Hockerton houses were not completed last autumn, some owners have had to live with their children in nearby caravans over the winter. The level of media attention and its time demands on the occupants has also provided extra unwanted pressures, with little material reward.

John Field is director of energy management consultancy Target Energy Services. Contact them on the World Wide Web at: [www.targ@targ.demon.co.uk](http://www.targ@targ.demon.co.uk)

### Reference

<sup>1</sup>Bunn R, 'Living on auto', *Building Services Journal*, 7/94.