Ten years ago Countryside Properties and Taylor Wimpey (formerly Taylor Woodrow) began work on an innovative new housing project. This joint venture won a Homes and Communities Agency (formerly English Partnerships) competition to design and build a mixed-use, residential development of around 1,400 dwellings on the Greenwich Peninsula in South East London, with environmental sustainability at its heart. As a result of the higher densities that have been achieved by good design in the earlier phases the village is expected to increase to a total of around 2,900 units.

The ambitious goals of the Greenwich Millennium Village development was to build homes using materials that reduce environmental impact where possible (see Ingenia, issue 8, 2001). Construction waste was to be kept to a minimum and recycled where possible. The homes themselves would be designed to minimise energy and water consumption; they would be sheltered from the wind and make the most of available sunlight, especially during winter.

To help reduce car dependency, car parking would be restricted and sited away from individual properties. Secure places to store bicycles would be provided. The site would incorporate an ecology park and landscaped public spaces.

Building a community was another important goal of the project. There would be a village-wide IT network, then a novel idea, with a community website offering local up-to-date information. The 20% affordable housing required within the development was to be integrated with private housing and the development would also include commercial and retail space.

The first homes were occupied in 2000 and the project became the first major scheme to achieve an EcoHomes ‘Excellent’ rating in August 2001. Since then, around 1,100 dwellings have been built and work continues to implement the final goals of the development.

BUILDING MATERIALS

The first challenge for the project was presented by the choice of building materials. A major portion of the energy consumption associated with buildings comes from the construction, manufacture...
SEGREGATED WASTE STREAMS have been maintained for products to be recovered for recycling collection from the site. The recycled products included timber, metals and plasterboard. On later phases, Laing O’Rourke, the contractor, used a specialist waste contractor, ICWM, to deal with all waste and the majority of the segregation of waste was carried out off-site, with the exception of plasterboard waste and metals. An average of 23 m³ of waste was generated per dwelling. This was a very significant improvement over the 1999 base benchmark of 50 m³ and exceeded the final target figure of 25 m³.

**SAVINGS IN THE HOME**

Savings have been a constant goal of the village development. In addition to embodied energy, the development aimed to reduce the energy used during occupation, and its associated carbon dioxide emissions.

Good insulation was key to saving energy and was largely responsible for a 44% improvement in energy efficiency compared with the 1999 Building Regulations standards. Large-scale fabric improvements were made with additional insulation to the metal stud wall constructions, roof and ground floors. High-performance aluminium composite and timber windows were imported from Scandinavia.

Energy demand reduction has been addressed in other aspects of building design too. The buildings’ design ensures daylight for kitchens and living rooms; natural ventilation is used in the car park; and low-energy lighting and appliances that are A-rated for energy are installed in the dwellings. Indoor retractable airing units with a humidistat-controlled ventilation system are provided in each bathroom to help reduce usage of tumble dryers. Energy saving advice is also provided to home owners when they move in. In addition, there are services and space for a home office in every unit, which could potentially reduce the number of journeys to work and their consequent carbon dioxide emissions.

Greenwich Millennium Village also uses a combined heat and power (CHP) engine. Electricity generated during the operation of the CHP is used for powering the car park and common area lighting, with any surplus being sold back into the grid. The CO₂ reduction compared with the initial benchmark based on an all-electric system is estimated at 67%.

Despite this impressive improvement, important lessons have been learned over the eight years the system has been running. Two different CHP solutions were incorporated for the first two phases. The Phase 2 energy centre was large enough to meet the total energy demand for all the 556 dwellings in that particular phase. For the 560 dwellings in Phase 1, three smaller energy centres were built to serve each of the three main blocks.

**TABLE 1** - **CO₂ EMISSION TARGETS AND REDUCTIONS**

<table>
<thead>
<tr>
<th></th>
<th>1997 Practice Benchmark</th>
<th>Achieved at Greenwich Millennium Village</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂ emissions associated with embodied energy in construction</td>
<td>647 kgCO₂ per m²</td>
<td>460 kgCO₂ per m²</td>
</tr>
<tr>
<td>Annual CO₂ emissions associated with total energy used in occupation</td>
<td>42 kgCO₂ per m²</td>
<td>14 kgCO₂ per m²</td>
</tr>
</tbody>
</table>

**BRE GREEN GUIDE**

The Green Guide to Housing Specification provides developers with easy to use guidance on how to make the best environmental choices when selecting construction materials and components. The Green Guide, material and components are assessed in terms of their environmental impacts.

Materials and components are arranged on a building element basis so that they can be compared and selected from comparable systems or materials. The elements covered are external walls, internal walls and partitions, roof, ground floors, upper floors, floor finishes, windows, insulation and landscaping. – See www.thegreenguide.org.uk

The interior of each home is designed to maximise the use of space and natural light © Countryside Properties

and delivery of materials. This is known as the embodied energy (see Table 1 for a comparison of the associated carbon dioxide emissions and the annual emissions during occupation).

Significant efforts went into specifying locally sourced materials and certified manufacturing systems. In general, lightweight building methods have lower embodied energy than heavier ones, although this approach does conflict with the requirement to achieve higher thermal mass for energy efficiency within the dwellings. Particular emphasis was placed on the cladding and roofing materials. Together with the structure, these usually account for over 80% of the total embodied energy of a typical residential building.

Materials rated ‘A’ by the BRE (formerly the Building Research Establishment Ltd) were used in external walls, windows, roofs, internal walls and ceilings, as well as in elements of the hard and soft landscaping. All insulation materials used in the construction had zero ozone depleting potential and the timber was from accredited Forestry Stewardship Council sources.

To create the high residential density for Greenwich Millennium Village, concrete framed construction was used for the high rise apartments. These buildings had a relatively high embodied energy when compared with low-rise housing, so alternative approaches including cement replacement materials were carefully considered. Although the partial use of cement replacement concrete was adopted, its wide-scale use for the high-rise frames proved unviable due to the practical constraints of early age strength gain. Early attempts were made to build as much as possible of the work off-site although it was challenging to reach the targeted standards in a way that was cost-effective. Quality measurements were made of bathrooms constructed on-site and compared with complete modular off-site units without significant difference in build quality. Some reductions in construction waste were available with off-site manufacture, although it proved very difficult to precisely quantify the separate waste streams. The cost of off-site produced components, however, was approximately 15% greater than the typical on-site built unit. This experience reflects the use of current technology for residential projects.

**WASTE AND RECYCLING**

One of the targets the project set out to achieve was to reduce construction waste. This has had a positive impact in both reducing the levels of waste and in identifying specific issues to be addressed.
It is important that operational arrangements are put in place to ensure that energy costs to residents are competitive with more conventional domestic solutions.

### TABLE 2 – PERFORMANCE IMPROVEMENTS ACHIEVED

<table>
<thead>
<tr>
<th>Innovation Target</th>
<th>Initial 1999 Benchmark</th>
<th>Improvement target</th>
<th>Current achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Primary energy consumption for typical dwelling</td>
<td>28.520 kWh/m²</td>
<td>70%</td>
<td>66% with CHP and Biomass</td>
</tr>
<tr>
<td>2 Embodied energy for typical dwelling</td>
<td>55.1 CO₂/kg/m²</td>
<td>50%</td>
<td>37%</td>
</tr>
<tr>
<td>3 Water consumption</td>
<td>161L/person/day</td>
<td>30%</td>
<td>33%</td>
</tr>
<tr>
<td>4 Construction cost (excluding infrastructure and land)</td>
<td>£1,499/m²</td>
<td>25%</td>
<td>37%</td>
</tr>
<tr>
<td>5 Construction duration</td>
<td>Phase 1 adjusted</td>
<td>20%</td>
<td>18%</td>
</tr>
<tr>
<td>6 Construction defects at practical completion</td>
<td>n/a</td>
<td>100%</td>
<td>94%</td>
</tr>
<tr>
<td>7 Reduce the amount of construction waste</td>
<td>n/a</td>
<td>50%</td>
<td>65%</td>
</tr>
<tr>
<td>8 Integration of tenures</td>
<td>Include 20% affordable homes in the GMV development</td>
<td>20%</td>
<td>35% for Phase 1</td>
</tr>
<tr>
<td>9 Promotion of mixed use</td>
<td>Provide 4,000 m³ of mixed use space in GMV</td>
<td>n/a</td>
<td>1.88 m³</td>
</tr>
<tr>
<td>10 Positive encouragement of sustainability</td>
<td>Achieve EcoHomes ‘Excellent’ rating for all homes</td>
<td>n/a</td>
<td>Excellent’ achieved for all homes</td>
</tr>
</tbody>
</table>

Energy is provided to all homes from combined heat and power facilities. These are contained within sound-proofed enclosures in the energy centres at Country Properties.

At the start of the project, one of the visions was for an IT and telecoms hub connecting all the homes in the village and a partnership was established with BT to implement this. Unfortunately, it became difficult to coordinate this part of the project with the many different business visions. At the start of the project, one of the visions was for an IT and telecoms hub connecting all the homes in the village and a partnership was established with BT to implement this. Unfortunately, it became difficult to coordinate this part of the project with the many different business visions. At the start of the project, one of the visions was for an IT and telecoms hub connecting all the homes in the village and a partnership was established with BT to implement this. Unfortunately, it became difficult to coordinate this part of the project with the many different business visions.
The original plan gave careful consideration to integrating affordable housing for rent with private housing for sale. Approximately 20% of the dwellings in the first two phases are designated as affordable housing. This proportion is expected to rise to about 30% of the total number of dwellings with future phases. All the housing has the same external appearance, although the dwellings differ internally to reflect the different specifications required for affordable and private housing. Affordable homes are generally clustered in groups of around six dwellings spread throughout the village. Attempts to bring commercial life to what is predominantly a residential area proved an important challenge for the project. Commercial space for shops and restaurants was included in the buildings around the village square. These offer neighbourhood shops and a village centre which is used by the Residents’ Association (and the management company until delivery of the community centre on the next phases). The development now has nine commercial units; five of these are in active use and occupation of the remaining units is likely to follow shortly.

A part-time community development manager was appointed to the project about six months before the first residents moved in. This role helped establish close links between the Greenwich Millennium Village residents, the onsite school, and health centre. A play strategy for children of all ages was prepared in consultation with the residents and is now being implemented. Grant funding has been secured to fund works to improve the outdoor football pitch at the Millennium School and the school’s facilities are also used for a popular parent and toddler group.

As more residents have moved in, the role of the community development manager has given way to more formal resident involvement in running the village. There is a thriving residents’ association and a number of residents are now board members of the management company. An active residents’ internet forum works well in encouraging residents to organise community events and manage car sharing and child care, for example.

Research into their attitudes and expectations has shown consistently that residents support the concept and the ethos of the village. Many residents appreciate the development’s sustainable design features. They enjoy being a part of what they consider to be a special community. The innovative masterplan design, based on the concept of a pedestrian street running through the village, helps in this respect. It is also clear that many residents do not use their cars during the week and enjoy having the options of cycling, walking, or public transport.

**WHAT NEXT?**

The original plan was to produce 1,377 dwellings over four phases. Phases 1 and 2 are now complete, with 1,100 properties – more than was originally planned. Phases 3 and 4, which are expected to contain about 1,800 units, are on hold until issues about noise from the adjacent wharf can be resolved. Once work continues, the lessons learned from the first 10 years should help to guide these later phases where even higher standards are expected to be achieved.

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**BIOGRAPHIES –**

Alan Cherry and Richard Hodkinson

Alan H Cherry CBE FRICS Hon MRTPI is Chairman of Countryside Properties plc, one of the UK’s leading housing and property development companies. Countryside Properties is a developer specialising in the creation of sustainable communities and urban regenerations.

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