BedZED

Chris Twinn

1. BedZED virtually completed.

Introduction

In early 1999 the UK's Peabody Trust appointed Arup as part of the design team for the Beddington Zero (fossil) Energy Development (BedZED). Peabody, one of the largest housing associations in London, is a long-established and forward-thinking social housing provider. It manages almost 20 000 homes, and with a history spanning some 150 years, is constantly re-examining the challenges in providing urban homes.

The design appointment was the culmination of many years of ideas testing between Arup and the architect Bill Dunster, who before starting his practice had been a unit leader specialising in environmental design at the Architectural Association architecture school in London. Many of the debates and discussions in this forum revolved around fully harnessing renewable natural resources, achieving closed-loop material use, site resource autonomy, social involvement, and how all of these could respond to ever-increasing lifestyle expectations. At that time he also worked for Michael Hopkins & Partners on several Arup projects, included Bracken House[1], Inland Revenue Centre Nottingham[2], Portcullis House, and Nottingham University's Jubilee Campus[3].

Most of them had high environmental aspirations.

2.
BedZED sustainability 'triple bottom line'.

(1) Social amenity

- mixed tenure, home type, and occupiers
- living and working community activity
- urban density community critical mass
- proximity to wider community facilities
- private open space for homes
- sunlight and daylight amenity
- air quality and comfort
- reduced need for car
- local car pool
- community-led management
- community internet
- individual choice for carbon-free lifestyle

(2) Financial effectiveness

- housing association build costs
- affordable / key worker accommodation
- high demand for private sale elements
- commands margin over market value
- planning gain to add development value
- live / work to assist business start-ups
- links improve public transport viability
- addresses fuel poverty
- low energy running bills
- Internet links: community / local businesses / service

(3) Reduced environmental impact

- zero fossil fuel
- 100% renewable energy use
- zero heating homes
- passive solar heating
- PV power for 40 electric vehicles
- 50% reduced potable water
- on-site ecological water treatment
- wind-powered ventilation systems
- low embodied energy materials
- recycled timber
- reused structural steel
- urban tree waste bio-fuelled CHP
- improved site ecological value
- land as a finite resource
- bike facilities
- recycling facilities

3. Ecological footprint for UK lifestyle in ha/person, based on a four-person household (data source: BioRegional).

		Car mileage	Car ownership manufacture maintenance road infrastructure	Public transport	Air travel	Electricity and gas	Water	Domestic waste	Office footprint energy and paper	Food including transport but not packaging	Overall eco-footprint
Typical UK lifestyle	Owns car Yearly holidays by plane Recycles 11% Eats out of season, highly packaged, imported food	0.90 10 000 km/yr	0.41	0.00	0.30	0.45 22 500kWh/yr electric and gas	0.002 140 litres/day	1.70	0.80 Brown energy and virgin paper	1.63	6.19
BedZED Conventional lifestyle	Owns car and commutes to work by public transport Yearly holidays by plane Recycles 60% Moderate meat eater and some imported food	0.45 5000 km/yr	0.32	0.30 4000 km/yr	0.30	0.10 Waste wood CHP inc landfill diversion credit	0.001 91 litres/day	1.02	0.80 Brown energy and virgin paper	1.06	4.36
BedZED Ideal	Lives and works at BedZED Recycles office paper No car - ZED car member Two-yearly holidays by plane Recycles 80% at home Low meat diet with local fresh food	0.09 1000 km/yr	0.04 20 people per club car	0.30 4000 km/yr	0.15	0.10 Waste wood CHP inc landfill diversion credit	0.001 91 litres/day	0.34	0.16 Closed-loop office paper scheme	0.72	1.90
Global Average											2.40
Global Available	Leaving 18% of bio productive land for wildlife										1.90

Exploring the design ideas underpinning BedZED began some five years before any potential client, site, design fees, or development capital was available. Bill Dunster had previously built his own house to investigate some of the ideas, and the close collaboration between him and the Arup team enabled the ideas to be developed and tested, seeking to address the social and financial aspects of future sustainability alongside ecological impact and resource consumption. BioRegional Development, a charity dedicated to bringing sustainable business into the commercial market, recognized the project's potential. They secured funding from the World Wildlife Fund (WWF) for marketing the concept, located the potential site in Beddington, southwest London, and introduced the Peabody Trust, an innovative housing association, as funder/developer.

Advanced detailed design work was needed to prove the cost viability sufficiently for Peabody to feel confident enough with the innovation to put in a competitive tender for the site. Their bid, although not the highest, was judged with its sustainability proposals as offering best value by Sutton Borough Council. This was one of the first occasions that a UK local authority had accepted sustainability benefits as adding value. This needed the approval of central government because prior to this the local authority's obligation to sell public assets for the best value had been assumed to mean the best price.

4.Typical live/work studio.

A planning submission was submitted in February 1999, with outline approval given in July and full approval gained in November 1999. The planning approval included many sustainability issues in its Section 106 Agreement.

Construction started on site in May 2000 with the phased occupancy during 2002. Peabody Trust is overseeing an extensive programme of post-occupancy monitoring.

The context

Realization is dawning that to attain a more harmonious equilibrium with our planet, our consumption of virgin natural resources, with its waste and effluent, needs to reduce by 80-90% over the next 100 or so years. Much of the built environment we are creating will within its lifetime be expected to adapt to this agenda. Incorporating the ability to respond may well be incremental for many projects, with them successively taking larger steps toward sustainability. BedZED, by contrast, sets out to demonstrate what is possible by taking big steps now.

Buildings are key to generating social advancement and prosperity, yet are one of the largest consumers of natural resources and generators of pollution and waste. It is often quoted that about 50% of atmospheric carbon emissions is from buildings - a considerable underestimate if you include the need to travel to and from them. This emphasizes the challenge ahead: the built environment is the largest consumer of natural raw materials and the largest single generator of landfill waste.

Addressing environmental impact requires a whole-life approach, involving for any one material its sourcing from nature, its processing, transport, in-use by-products, recycling and reuse ability, and avoiding its final waste disposal. For fossil fuels, the current dominant issue is in-use by-product or waste, ie global carbon emissions. Stabilising the increasing atmospheric CO_2 levels is expected to need around 60% emissions reduction by 2050 - well within the life of many buildings we are constructing now. This is but the first part of the scenario. With the world population expected almost to double by 2100 before stabilising at about 10bn, that same consumption level spread more thinly means a reduction of almost 90% by the developed world by 2100!

For many areas of natural resources similar effects and scale of reductions are anticipated. This suggests that we should build with only 10% of the virgin materials we currently use; and intriguingly, on closer inspection this is not as difficult as it first seems. The 20% of materials delivered to site that end up as waste could be eradicated, and there is probably a similar level of waste in the materials sourcing and component manufacturing processes.

And if we design buildings for double the useful life, at a stroke we begin to halve the amount of material needed in whole life terms for the social benefit gained from that site. Added to this, there is much material already taken from nature in circulation and in our buildings.

If we could develop processes for recycling this as high quality 'secondary materials', then it appears quite possible to reduce our overall demand for new natural raw material by 90% in almost all fields of human activity. This sets our future agenda for designing the built environment.

Why BedZED?

BedZED's new-build development of 83 mixed tenure homes (social, key worker, and for sale), plus some 3000m^2 of live/work, workspaces, retail, and leisure uses, occupies an urban brownfield site in South London. Its chosen high build-density reflects the importance of using limited land resources to the full, being based on the density needed for accommodating all the UK's projected new homes needs entirely on available brownfield sites, to avoid sacrificing any more limited greenfield amenity. Such high density helps build coherent communities and provides critical mass for facilities like public transport, but still allows the massing and orientation needed for good passive solar and daylight access. Making the roof areas 'green' helps increase the site's ecological value and its carbon absorbing ability, as well as giving the occupants private gardens.

BedZED was conceived to show that in large-scale construction a high level of sustainability can be practical and cost-effective. If the sustainability concept is to have any sort of meaningful overall effect on the environment, it must move into the volume mainstream, satisfy economic and social objectives, and benefit all stakeholders.

A fundamental shift in financial approach was needed. Normally, sustainability and its technologies are seen as 'add-ons', ie additional cost unwelcome to most building funders. Often, heat recovery will be added to conventional mechanical plant to save energy, yet with diminishing carbon-emission returns and more capital cost. Likewise, simply adding solar thermal collectors still requires a full conventional boiler back-up.

Instead, the approach for BedZED was to identify materials and engineering systems whose need was often marginal, and design them out. Advanced analytical techniques explored how passive systems could be enhanced enough to allow active systems to be completely omitted. This yields direct cost and resource reductions at several levels: in capital costs for engineering systems, in control complexity to likewise reduce capital costs, in plant maintenance costs, and in energy cost.

The H&V Awards 2002:
Building Services Engineer of the Year:
Chris Twinn

Energy grading

For BedZED, Arup developed a technique to evaluate and match renewable energies to energy demands.

Until all energy sources have their full environmental cost factored into their retail price, making renewable energies cost-effective is quite a challenge. The technique is 'energy grading': ranking the full range of possible renewable sources against end-use energy needs, to generate a checklist of building design priorities. The key issue is to match the lowest possible grade of source against the grade of the end demand. This process also involves mapping demand and availability, given that most renewable energies tend to be more finite and need coupling via energy storage to allow this demand/availability match.

Designing the building concept around these principles allows the most cost-effective use of renewables. Covering a building in photovoltaic (PV) solar electric collectors may show environmental awareness and highlight new energy technologies, but in energy grading terms, PV's modest output and current high cost suggest there may be more pragmatic ways to provide renewable energy.

Energy grading highlights interesting issues, like the inherent inefficiency of many conventional systems that consume high-grade energy and deliver only low-grade energy to building users. Should we be using so much high-grade electricity to drive pumps and fans for what is in effect low-grade energy for room comfort needs?

Likewise, are the high-grade electrical energy needs of heat-pumps appropriate for delivering heating and cooling? It emphasizes the significant cost benefits of passive solar heating and passive cooling for room comfort, and the cost-effectiveness of designing buildings for reduced energy demand in the first place.

Zero-heating homes

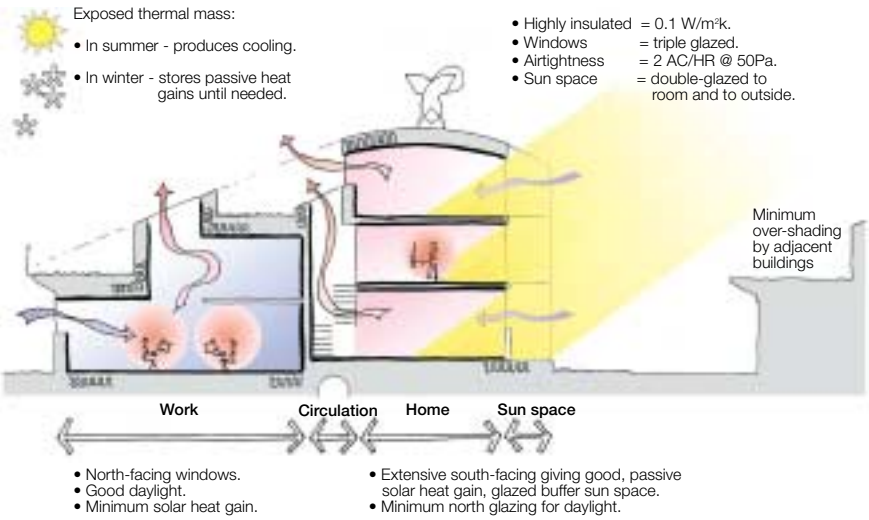
One result of applying energy grading at BedZED was to question the need for conventional room space heating, in which a system is simply sized to provide comfort, with regulation minimum thermal insulation. Yet many buildings have internal heat gains from people and their activities. So why not size the insulation, with thermal mass heat storage, so that this heat is sufficient to provide space heating through day and night, thus avoiding the need for any conventional heating? As the UK Building Regulations have increased thermal insulation minimum standards, so the proportion of the year when heating is needed has shortened. Yet the system cost does not reduce in proportion. So - what level of insulation will completely eliminate the heating system and hence reap a capital cost dividend?

Building physics

The design aim was to reap these cost and energy dividends by fully exploiting the building envelope and fabric as primary modifiers of the indoor climate, to the point where complete mechanical systems could be omitted.

For UK mainstream housing this early design analysis time is rare because the industry tends to work to rigid perceptions of market expectations. At BedZED the project team was committed to demonstrate the viability of the principles even before land purchase. As is often the case, much complex analysis was needed to demonstrate that such a simple solution is achievable.

In thermal analysis terms the availability of heat from occupants, appliances, cooking, washing, and solar heat is highly variable both in timing and quantity. There are other parameters, too, like the extent of glazing: at times it can contribute useful solar heat, yet be the largest heat loss component. Also, steady-state building energy flows do not necessarily represent reality. Low-grade heat will take time to pass through a thick wall during which external influencing conditions will change, often to the extent that the heat may not pass through at all, but instead reverse its flow. Adjusting the thermal capacity and thermal insulation characteristics of materials and energy transfer mechanisms can significantly affect what happens to the energy and whether it can then be reused. Many of the construction industry's usual materials, with their significant thermal inertia, can give significantly different results from steady-state theory.



5. Building physics.

'BedZED fully exploited the envelope and fabric of the building as the primary modifiers of the indoor climate, so that complete mechanical systems could be omitted.'

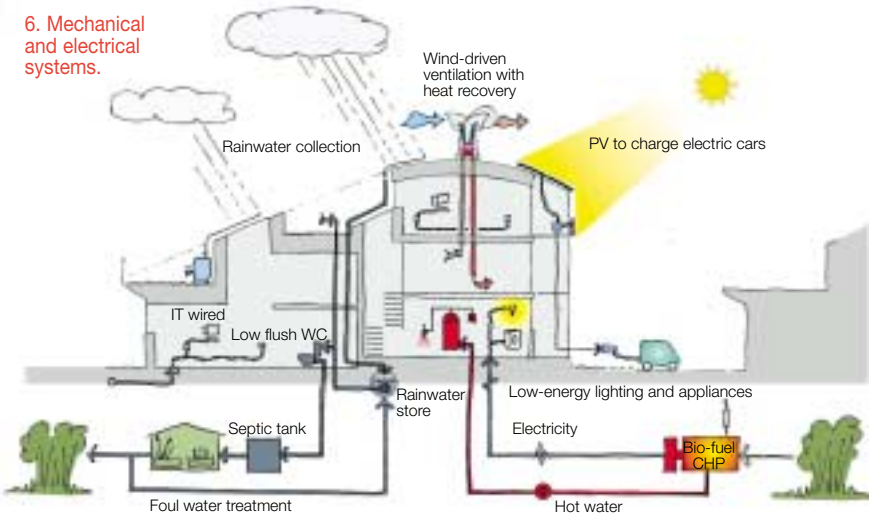
Dynamic thermal analytical and simulation tools, plus real weather data sequences, established the material performance and building massing needed for the zero-heating homes: the first time, it is believed, that such advanced computer tools - developed over the past 10 years for analysing passive cooling techniques in office buildings - have been used on a major housing project. For BedZED, these were the tools needed to show that normal home heating might be omitted. Super-insulated homes with extensive areas of exposed high thermal capacity materials could thus match heating needs against naturally occurring passive internal and solar heat gains.

The analyses revealed several different 'design worst' cases. The very coldest outdoor air temperatures usually relate to clear night skies, which in turn most often relate to daytime solar heat gain. Extended periods of overcast skies are critical, although they normally relate to higher outdoor air temperatures. Different occupant lifestyles are also factors; for example, how much top-up heating makes for the comfort of a new-born child? Then there is the prolonged absence of occupants from home, with their consequent lack of contribution to heat gains.

Ensuring room temperatures do not fall when this happens is another critical design case, given the absence of a large heating system to recover temperatures when the occupants return. Terraced blocks work well for reduced overall heat loss, as long as large temperature differences in adjacent homes are avoided. Building envelope airtightness is particularly critical. For the north-facing workspaces they could have lower machine heat gains than a typical office, ie if used as live-work studios, and thus need some supplementary background heating.

Computer analysis and simulation can explore solutions to all possible scenarios, allowing the design to pursue the simplicity of passive heating in a robust solution.

6. Mechanical and electrical systems.



7. Kitchen adjacent to sunspace.

Building massing and orientation

One analysis result was to recommend distinctly different orientations for the varying building uses of homes and workspaces. The latter have potentially high occupancy levels and office machine heat gains which, added to solar gain, can at times give too high a room temperature and prompt a need for summer supplementary mechanical cooling. These spaces are thus best orientated north; maximising natural daylight, reducing the need for daytime artificial lighting, and avoiding excess solar heat gain. The high thermal inertia room surfaces mean that workspaces can easily accept institutional standards of office equipment heat gain, and maintain peak summer comfort conditions using only passive cooling plus cool night natural ventilation. Homes, on the other hand, have less occupancy density and less internal heat gains, so by facing south, gain useful benefit from supplementary solar heat gain.

The thermal inertia coupled with cool night ventilation also keep summer room temperatures low enough when otherwise well-insulated homes would need mechanical cooling to avoid overheating.

Bio-fuelled combined heat and power (CHP)

The earliest concepts for BedZED centred on the idea of home energy autonomy, with each dwelling operating solely on the ambient energy it could harvest from its own site. This led to the energy-consuming systems in the dwelling being reduced enough to match the energy harvested from solar via PV, thermal collectors, and a small wind turbine. However, in cost terms this was not viable within current cost yardsticks and so the thinking turned to wider local community autonomy, eventually identifying bio-fuelled CHP as a potential solution.

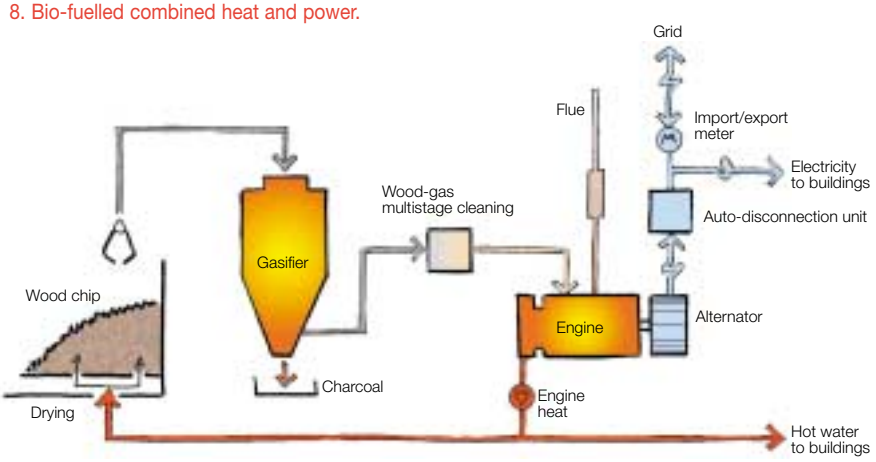
A key element of sustainability and its resource productivity is finding waste streams and using them as raw materials. An existing local community waste stream was identified in the form of urban tree waste. Tree prunings had previously been consigned to landfill by the local authority, but the increasing landfill tax made them an ideal alternative low cost energy source. Its origin from trees also gave renewable credentials to this waste, with the carbon emitted from combustion being re-absorbed by the continued tree growth. A proprietary gasifier system converts woodchip into a wood-gas suitable for fuelling the CHP's spark ignition engine.

Establishing capital cost viability for small-scale CHP is at best difficult, but for a prototype bio-fuelled version is even more challenging because the gasifier fuel treatment system all but doubles its cost until such time as it can be mass-produced. Consequently, the aim was to roughly halve the building's energy demand, so reducing the plant size needed and making bio-fuelled CHP viable. The mix of building uses with their diversified overall demand peaks also helped.

Likewise, the elimination of fans and pumps, and the use of EU 'A' rated domestic appliances, low-energy compact fluorescent luminaries, and meters visible to the consumers, were all aspects of reducing electrical energy demand.

The design identified other capital costs to help fund the CHP. As well the 100 or so gas-fired boilers normal for a project of this size, also omitted were radiator systems in the dwellings and the piped mains gas connections. Similarly the passive building design for non-domestic uses helped reduce mechanical and electrical fitout costs.

8. Bio-fuelled combined heat and power.



9. Harnessing renewable energy using subspaces, photovoltaics, and wind cowl ventilation.

'Demand for the BedZED homes has been exceptional. There is a long waiting list of people wanting a modern green lifestyle that has an innovative design approach.'

The need for the boilers normally provided alongside CHP to cope with peaks of winter heating demand was also eliminated by reducing these peaks enough for heat demand to match the CHP peak heat output.

The Grid electricity import/export connection is used as a cost-effective alternative to conventional standby boiler plant. Thus, the total heat and domestic hot water demand is met by a CHP unit sized to match the annual BedZED electricity demand.

Heat recovery wind cowls

The wind cowl ventilation system illustrates the application of energy-grading. Conventionally, much high-grade fan and pump electricity is consumed to deliver low-grade energy for room comfort temperature control and ventilation. This tends to be significant because these systems run for extended operating periods. Nonetheless, as building envelopes become more airtight to reduce uncontrolled heat-loss, then provision of controlled minimum ventilation becomes particularly important. Fresh air provision is needed plus removal of condensation moisture from kitchens and bathrooms, toilet smells, and kitchen fumes.

The UK Building Regulations permit ventilation fans to be eliminated if trickle ventilators and passive stack extract vents are provided. However, introducing unheated winter fresh air via window trickle vents would require heating to be reinstated in each room. At BedZED the wind cowl system was developed to deliver preheated fresh air to each home and extract its vitiated air, complete with heat recovery from the extracted ventilation air.

The BedZED wind cowls crown some 10 years of Arup development work on harnessing low velocity wind, and are the first to introduce heat recovery using wind power, with both positive and negative wind pressure used to deliver supply air and extract vitiated air. They also generate enough pressure for the air to be ducted down into the building, delivering their preheated air to each living room and bedroom, and extracting air from each kitchen, bathroom, and toilet. The cowl was designed from first principles, tested, and then refined in a wind tunnel at full scale. A specialist test method was developed to permit the ventilation airflow and pressure characteristics to be quantified. This allowed the cowl to achieve a certifiable ventilation and heat recovery performance, and hence the omission of all ventilation fans, trickle vents, electrics, controls, and fresh air heating in the homes, thus providing a system using only renewable energy.

Photovoltaics

PV for powering the buildings was originally discarded because its capital cost is too high to recover through savings in relatively cheap mains electricity. Nonetheless, the buildings were still future-proofed to accept solar collectors on their southern façades in anticipation of when PV costs reduce. Subsequently the opportunity of EU demonstration grants arose. Given that the buildings were already carbon neutral with the bio-fuelled CHP, this prompted detailed study of BedZED occupants' likely lifestyle eco-footprint, and from that the significant carbon emissions due to transport fossil fuel. Further investigations confirmed the significant higher cost per kWh of UK petrol compared to grid electricity, together with the inherent higher efficiency of electric vehicles, giving clear running cost benefits from electric cars. With 95% of all urban journeys less than 40km - well within the range of electric cars - this presented the opportunity for building-mounted PV to power electric zero carbon emissions urban-use cars. Whereas PV providing electrical power to buildings had a payback of around 75 years, using it instead of the high-taxed petrol reduced this to approximately 13 years. With EU/UK grants equating to 50% of capital cost, the theoretical payback period went down to just 6.5 years. 107kWp of PV has been integrated into the south-facing BedZED façades, sufficient for 40 electric cars. Charging points have been installed and occupants can have free parking and charging if they use electric cars. Now BedZED is occupied, environmental consultant BioRegional Developments has started a car hire scheme, with plans to expand with electric cars (which also are exempt from the new central London Congestion Charge). The use of solar power for electric cars effectively changes BedZED from being just carbon-neutral into a net exporter of renewable energy. Perhaps this is the future for our buildings.

Water

Clean water is increasingly seen as a finite natural resource even in the UK climate. Increasing demand highlights the large resource needed to deliver clean water without waste and then transport and treat the resulting discharges.

BedZED seeks to reduce treated potable water demand by more than 50% and then treat the effluent on site - with less resources used and the water available for recycling.

Various good practice measures have been incorporated, including restrictors to prevent excess flows, mains pressure showers to avoid power-showers, meters visible to consumers, EU 'A' grade water-consuming appliances, and very low/dual flush toilets. Rainwater is collected from roof surfaces and stored in underground tanks for irrigation and toilet flushing. An ecological on-site foul water treatment system was added to the development after a statutory

water authority agreed that it would adopt and operate the completed system. This uses vegetation as a cleaning agent in the secondary and tertiary treatment stages, partly because of its low energy consumption. The system treats the water to a high enough standard for it to feed recycled 'green water' as a supplementary feed into the rainwater storage tanks.

Surface water runoff is handled using SuDS (sustainable drainage system) principles for surfaces where there may be slight contamination by cars, animals, or garden treatments. Use of permeable hard surfaces, foundation filter media for cleaning any contamination, and site water holding features avoids draining surface water into the local sewers. Instead the rainwater slowly soaks into the ground and local water-courses, as would be the case had there been no buildings on the site.

Materials

Sourcing materials is where the construction industry still has most progress to make to reduce its environmental impact, requiring co-operation and working practice changes right along the supply and procurement chain. This is the area most difficult for designers to influence, as they are expected to take and use the products already available on the market. Locating reused and 'secondary' material sources, establishing their provenance, and guaranteeing their performance is currently difficult, requiring significant manpower resources. On previous projects with Dunster, almost 80% use of secondary materials had been achieved, but limited time and cost meant more modest levels at BedZED.

Nonetheless, there was considerable success. Most existing site material was retained there, whilst much of the heavier building materials was sourced within a 55km radius to reduce transport impact and allow source checking. Reused structural steel was used in the workspace framing structure, and reclaimed timber for internal partition studwork.

Materials with a recognized environmental standard, like Forest Stewardship Council (FSC) certified wood, was used extensively. Kitchens units are of plywood from a checked source, instead of the normal chipboard. Waste was addressed both at construction and for the buildings in-use. Building waste was segregated on site and sent for recycling. For the homes, a domestic segregation strategy was agreed with the local authority, with segregation bins provided in all kitchens and around the site for local authority collection. There is on-site processing of green waste.

Identifying and recording the full extent of the building materials' environmental impact and the amount of consumer waste recycled forms part of an on-going research programme.

10. Use of materials: triple-glazing + locally-sourced untreated oak cladding + local brick.

Information and communications technology (ICT)

BedZED was designed to take full advantage of ICT. The ability to access knowledge and communicate it will define future successful communities, with the Internet starting to become the primary means to identify services, and gain community information. Access to Broadband is available to all BedZED occupants, giving them the potential of almost instantaneous Internet access as well as the option of being permanently on-line. This complements BedZED's live/work objectives, as well as allowing the growth of community-related services providers. The ICT cable routes are intended to be fully rewireable so they can respond to future changing requirements.

A clear distinction has been made between ICT for occupants' use and for the general operation of the buildings. ICT by its nature is rapidly developing, and equipment procured today can be expected to be obsolete within five years. This is completely at odds with buildings, which are intended to function and last with minimum maintenance and renewal for many decades. In addition, occupants tend to prefer buildings that are simple and easy to operate, without needing to understand computer protocols or requiring sophisticated technical backup. Thus in almost all day-to-day use of their buildings, occupants are in manual control, ie opening windows, without any computerized automatic controls. Not only does this complement the passive building design, but also it is highly cost-effective. For selected site central management functions, however, a computer-based system allows such functions as remote reading and billing of electricity, heat, and water meters, etc.

Feedback

A demonstration project should be a source of useful feedback and BedZED is already providing much, a good deal of it to be published. Peabody is overseeing more than 20 BedZED-related research projects, so a significant amount of information is expected over the next few years. Much of this is related to lifestyles, and monitoring how the occupants settle in, use and develop the facilities provided. The first period of monitoring has already shown that compared with current UK benchmarks:

- Hot water heating is about 45% less.
- Electricity for lighting, cooking, and all appliances is 55% less.
- Water consumption is about 60% less.

During construction a constant challenge was to achieve a consistently high build quality. The results are considerably better than current UK benchmarks, and demonstrate that general industry improvement is achievable. They highlighted that specific effort is needed in certain areas, notably site supervision and training for the many smaller sub-contractors upon which the industry depends. The nature and structure of the industry means that explaining the thinking behind innovation is difficult to pass down the supply chain.

The need to achieve high levels of building envelope airtightness is a particularly important example of this. The implications of potential remedial works costs and supplementary energy use far exceed the small effort needed to get it right at the appropriate stage of the construction process.

It is interesting that since BedZED, the UK Building Regulations have been revised in an attempt to start to address this airtightness issue for first time.

The availability of skilled site staff for construction, and particularly housing, is another wider issue for the UK industry. There has been low take-up of local labour training initiatives; perceptions of construction are at odds with the aspirations of our younger generations. Much of this points towards a future of off-site manufacturing where skills and training, materials and waste handling, and efficiency can be better provided.

This is an area where Arup is now deeply involved with Peabody, with the development of factory prefabrication, volumetric housing, and the manufacture of completed building sections ready for simple finally assembly on site[4].

Awards

Building Energy Globe Award for Sustainable Energy:
First Prize for Buildings & Houses

The H&V Awards 2002:
Air Movement Product of the Year (for the heat recovery wind cowls)

The Building Services Awards 2002:
Environmental Initiative of the Year

European Association for Renewable Energies (EUROSOLAR) Awards 2002:
Solar Construction Award

The BedZED tendered build costs were based on Peabody's budget for good quality social housing on brownfield sites in London. On top of the basic build price there were costs related to extra project staff training, management, supervision, and quality control. There were also one-off innovation costs related to design research, materials sourcing and establishing their environmental impact, establishing quality control methods for recycled materials and non-standard components, obtaining the associated statutory approvals, and the added programming time this needed. On site, particular care and effort were needed to ensure that the complete construction sequence was fully thought through in advance.

All the sub-contractors needed proper briefing on the work methods needed to avoid substandard workmanship, thereby attracting high remedial costs.

Demand for the BedZED homes has been exceptional. The level of early enquiries was so high that Peabody felt confident enough to hold back until purchasers could see the finished buildings, instead of selling from the drawings. This interest has continued to increase so that the homes command a significant premium above market rates. There is a long waiting list for people wanting a BedZED-type home with supply being largely constrained by the difficulty of securing new sites. The most frequent reason given for wanting to live at BedZED is the modern green lifestyle (63% of occupant survey respondees), with innovative design coming a close second (61%). Popular design features include the sunspace, the gardens, and the sense of space in the homes.

The wider interest and response to BedZED to date has been very positive with:

- weekly organized guided site tours over-subscribed, reflecting high interest from other building professionals and building procurers
- extensive media coverage
- growing demand from building clients and building procurers to explore the potential of sustainability for them
- local authority planners seeking help in understanding what practical sustainability benchmarks they can request more widely as part of the building planning permission process. Planners already have a Local Agenda 21 obligation to progress sustainability on behalf of the local community.
- key developers beginning to recognize the edge that offering sustainability gives them when purchasing land to build on and in assisting with planning approvals.

Conclusion

BedZED seeks to offer its occupants the opportunity to live and work with a completely carbon-neutral lifestyle, making this choice attractive, cost-effective, and appropriate to modern living. It offers solutions to many sustainability lifestyle issues in a practical and replicable way.

One key reason for embarking on the BedZED project was to demonstrate to a sceptical industry how sustainability is possible and can be cost-effective, and how we can really make a difference for society and its future. There is inherently considerable industry inertia to change and improvement. It is through delivering successfully examples like BedZED and proving there is market demand for this kind of product that mainstream developers and construction participants will feel they can seriously take steps towards a more sustainable world. It requires innovation, a strong belief, considerable time input, and the dedication of the complete project team to show how this can be achieved.

The meeting of like-minded people across different disciplines sets in motion ideas for raising the limits of what is possible, instead of what is expected. Relatively rarely do the full range of parties come together to deliver a complete example project without compromise. BedZED is one of these.

The result has exceeded all expectations.

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(4) THE HOUSING FORUM. Homing in on excellence: A commentary on the use of offsite fabrication methods for the UK housebuilding industry. Arup, for The Housing Forum, nd [2002].

Credits

Client:
Peabody Trust

Architect:
Bill Dunster Architects

Engineer: building physics, energy, M&E systems:
Arup Enzo di Enno, Phillip Ellis, Lesley Graham, Gaurav Jain, Jacob Knight, Andy Mace, Frank McLaughlin, Colin Rapley, Ray Sciortino, Les Stokes, Mike Summers, Chris Twinn

Environmental consultant:
BioRegional Developments

Structural & civil engineer:
Ellis & Moore

Cost/site management:
Gardiner & Theobald

CHP supplier:
B9 Energy Biomass

PV supplier:
BP Solar

Wind cowl supplier:
Vision

Specialist water utility:
Albion Water

Illustrations:
2, 3, 5, 6, 8: Penny Rees
4, 7, 10 -12:
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1, 9:
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11. Live / work space. 12 right: '... a modern green lifestyle with an innovative approach'.