design advice

towards greener buildings
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towards greener buildings

The first review of the Government’s Design Advice service
The Design Advice service has two principal aims:

- to improve the environmental performance of the UK's building stock and
- to assist construction professionals and their clients to create buildings that are economical to construct and maintain and have a healthy internal environment.

The service, which operates through a nationwide network of approved consultants (see Directory in back cover), is available to all new-build and refurbishment projects in all building sectors. The sole restriction is that the project must have a minimum floor area of 500 m².

Design Advice is managed and operated by the Building Research Establishment on behalf of the Government and is part of the Government's Energy Efficiency Best Practice programme.

What does Design Advice provide?

Initially a free one-day consultancy, resulting in a written report that identifies areas for environmental and energy efficiency improvements. Depending on the nature of the project and how far it has been developed, the report embraces such issues as:

- site layout and ecology
- building fabric and insulation
- efficient heating, lighting and ventilation strategies
- use of water
- use of sustainable and recycled materials
- energy management, metering and controls.

Subsequently, a valuable 30 per cent fee remission is available for approved longer-term consultancies on individual aspects of environmental design such as lighting controls, natural ventilation and thermal modelling.

introduction

towards greener buildings

Design Advice offers authoritative and independent advice on the energy-efficient and environmentally conscious design of buildings.
Who can use Design Advice?
Anyone involved in the construction process: building developers, fund providers, design teams, construction professionals, housing associations, local authorities and building owners or tenants.

Who are the Design Advice consultants?
Design Advice's approved consultants are architects, building services engineers and environmental specialists with significant expertise and professional experience in the energy and environmental aspects of building design. All Design Advice consultants undertake regular professional training and development.

Who benefits?
Building in harmony with the environment makes good commercial sense. Design Advice aims to ensure that both the construction business and the wider commercial community secure the greatest possible benefits from the high-quality advice it offers.

- The economic gains can come from reduced construction, maintenance and energy costs, especially when viewed in terms of the building's whole life.
- The employment gains come from providing a good-quality working environment. Employees usually work more productively in environmental buildings. Employees also expect their employers to be aware of - and take action on - environmental issues.
- The potential market-share gains come, not only from cost savings, but also from an improved corporate profile and image. The environment is no longer a passing fashion. Customers and the wider public expect companies and other organisations to take action to safeguard the environment and to take seriously their wider responsibilities, both to society and to the natural environment.
respecting the environment

Giles Worsley, architecture correspondent of the Daily Telegraph, reviews the growing importance of ecological design.
To be an architect today and not to be concerned about ecological design is almost a contradiction in terms. Everyone is at it, from grand international jetsetters such as Norman Foster and Richard Rogers to classical architects like Robert Adam. When Ken Yeang, the guru of the green skyscraper, flies in from Malaysia the lecture halls are packed with students eager to find out whether it really is possible to build environmentally sensitive tall buildings. The Queen has taken a stand, pumping water up from a deep borehole under Buckingham Palace to cool the new Queen's Gallery instead of relying on conventional electrically driven air-cooled convectors on the roof. Even the House of Commons is in on the act. The great chimneys sailing over the roffline of the New Parliamentary Building, just completed in Parliament Square, are both practical ventilation shafts that minimise the need for air-conditioning and symbols of the Government's determination to encourage green buildings.

The New Parliamentary Building was designed by Michael Hopkins and Partners, for whom, as for many successful architectural practices, ecological or green design has become a driving force in the creation of architectural form. Michael Hopkins was also responsible for the building which more than any other represents the recent sea-change in attitudes towards green design, the Inland Revenue Centre in Nottingham.

Below: The New Parliamentary Building (2000), Westminster, which provides office accommodation for 215 Members of Parliament. Fourteen chimneys exhaust stale air gathered from shafts connected to the offices below. They also draw in fresh air at their base through heat recovery units to supply fans housed in the roof space. Architect: Michael Hopkins & Partners

Opposite: Entrance hall of the Elizabeth Fry Building, University of East Anglia, Norwich (1990). The building was planned to demonstrate environmentally responsible, low-energy design principles without incurring additional costs. Its main features include orientation to reduce solar gain and maximise passive cooling; high levels of insulation and structural airtightness; use of hollow construction (twowells) for ventilation and cooling; and shallow floor plan to maximise use of daylight. Architect: John Miller and Partners.
This was a revelation. Since the 1960s Government offices had come to symbolise everything that was worst about modern architecture: buildings that not only looked ugly, but were wasteful in their use of energy and were disagreeable places to work in. Here was a building, a Government building, that was actually pleasant to work in and a stunning piece of architecture, and also kept the accountants happy. All three were the direct result of a commitment to good architecture.

In the 1960s and 1970s the common assumption was that the ideal office was a sealed environment. Man could disregard nature. Air-conditioning, central heating and artificial lighting would solve any problems. But they did not. Instead they created new problems. The fluorescent lights were exhausting; the air-conditioning dried the air and seemed to pass bugs at will; suspended ceilings made the rooms uncomfortably low and there was not even a chance to open a window. Sick Building Syndrome flourished. Staff morale plummeted and absenteeism soared.

In the end, what condemned these buildings was their wastefulness. Artificially controlled offices use far too much energy to be acceptable in an age of global climate change. The ground rules of architectural design had to change and the Inland Revenue Centre in Nottingham is the result. Air-conditioning has gone and instead the building relies on natural ventilation to remain cool. At the same time floor-widths have been kept narrow to allow as much daylight as possible, instead of having no control over their environments individual workers can alter the temperature if it gets too hot or cold, open and close the windows if it gets too stuffy or draughty and alter the sun-louvers to control the amount of sunlight.
Getting rid of the mass of pipes and ducts needed to run the air-conditioning also means that offices can be satisfyingly higher. The result is a pleasant place to work, but also a building that satisfies the accountants because the savings on mechanical and energy requirements make it cheaper to run and maintain. And, above all, by cutting the amount of energy required the building's impact on global warming is minimised.

Passive ventilation systems, good insulation and an emphasis on natural lighting are the keys to green design, coupled with a commitment to the use of ecologically responsible building materials. Explaining how this works in a large building such as the Inland Revenue offices is complex, but a single, smaller building can encapsulate the fundamental principles of green design. The solar house, a small country house near Wakeham in Sussex, is just such a building. This has recently been completed as a deliberate exercise in solar house design by the innovative classical architect Robert Adam working with Ray Maw, an expert in solar heating, for Harold Carter.

Orientation is critical. Green design means working with the sun, not against it, taking advantage of the heat. It gives off to minimise the need for artificial heating, but ensuring that in the height of summer the building does not over-heat. Thus the solar house is orientated north-south. The north or entrance front presents a massive elevation to the visitor with thick, heavily insulated walls and small windows, so that as little heat as possible is lost. By contrast the south front is 60% glass, allowing the sun to heat the central, two-storey hall which has a massive, solid floor to retain heat and acts as a radiator warming the whole house. Air is drawn into the hall at ground level, warmed and then pulled up through the house by the tall chimneys. At the same time the portico shelters the hall from direct sunlight in summer, so preventing overheating, but in winter when the sun is low it does not prevent the hall being bathed in sun. All the windows are triple-glazed to reduce heat loss through the glass.

Left: The solar house D2000 at Wakeham, Sussex, combines the disciplines of classical architecture with technical innovation and the latest developments in passive solar heating. The result is a small country house that is at once classical, progressive and highly energy efficient. Architect: Robert Adam Architects.
Above: The Web of Life building (1998) at London Zoo, with its large oversailing roof resting on regularly spaced columns, makes extensive use of renewable materials. Sophisticated natural ventilation techniques are designed to make the building thermally independent of the external environment. Architect: Quarmby Kendon Architects.

Left: Translucent solar protection screens on the south side of the Elizabeth Fry Building, University of East Anglia (see page 4).

Below: The Docklands Campus (1998) of the University of East London, developed on a contaminated brownfield site alongside Royal Albert Dock. The new campus is spearheading commercial investment and employment in this long-neglected area. The design incorporates good practice across a range of sustainable issues: substantial amounts of recycled materials were used, and the integrated fabric energy storage system should produce low levels of CO₂ emissions and energy consumption. Architect: Edward Cullinan Architects.
Right: The dramatic pitched roofs and ventilation stacks of the Queens Building at De Montfort University, Leicester. The building, which houses the School of Engineering and Manufacture, is almost completely naturally lit and ventilated and is of traditional masonry construction with a wide insulation-filled cavity. Architect: Short Ford & Associates

Below: Westminster Lodge (1997) at Hook Park, Dorset, is constructed from locally sourced roundwood timbers, which are a by-product of good silvicultural practice. The Lodge provides accommodation for students studying ecological design, manufacturing and construction. Four pairs of rooms are grouped around a central living- and seminar-room and kitchen, all underneath a great, grass-topped curving roof canopy. Although timbers represent half the annual crop of British timber, they have traditionally been disregarded as a structural material. Architect: Edward Cullinan Architects

Bottom: Glenn Murcutt’s Artists’ House in North Sydney (1983) was designed to create the minimum interference with nature and the existing site. The house, a long, low, single-storey column and beam platform, is constructed entirely of steel with a corrugated curved roof and timber terraces. Architect: Glenn Murcutt

Many of the ideas behind the solar house and other green buildings were familiar to our Victorian forebears. Visit any Victorian school and you will find high rooms with large windows and ventilation turrets. But the Victorians were let down by primitive technology and a weak understanding of the dynamic of air flows – to put it crudely, single-glazed windows let out too much heat, walls were insufficiently insulated and nobody realised how large the pipes had to be to ventilate a building properly.

Today these problems have been resolved. Triple glazing means that heat no longer seeps out through windows, effective insulation seals walls and roofs, and we now know quite how large the pipes have to be to draw enough air through a building. A glimpse at the great vents of Short Ford & Associates’ Queens Building at De Montfort University, Leicester, gives an idea of the scale required – and how dramatic these can be when incorporated into the design of the building.

There are very few buildings for which green design is inappropriate. It is as critical in tropical countries as in more temperate climes, which is why Ken Yeang has designed what he calls the Bio-climatic Skyscraper and why the houses designed by highly influential Australian architect Glenn Murcutt make no use of air-conditioning, despite being built in some of the hottest places in the world. In countries such as Germany, Austria and the Netherlands green design is so firmly established that it has become the norm, not the exception. In France it defined the form of the new law courts in Bordeaux designed by Richard Rogers, who has taken the ideas developed there even further with his new Welsh Assembly building in Cardiff.
Green design is essential for low-cost housing where minimal energy demands result in low fuel bills for those who need to husband every penny they have. Thus the principles of green design underlie the experimental pair of semi-detached houses which the rising young architectural practice Sergison Bates has just completed for the William Sutton Housing Trust in Stevenage. Orientation is carefully considered, the timber structure is made out of recycled or waste materials, and an innovative breathing construction means that despite the heavy insulation the building remains at a constant humidity, minimising problems such as mould, parasites and asthma which might otherwise flourish.

At Litschutz Davidson’s new headquarters for CAE Electronics in Sussex the problems are not those of low-income families but of a high-tech company with large numbers of computers. Usually it is assumed that the heat they generate can only be countered by air-conditioning. But the architects have shown that by integrating the architecture, structure and services to create a low-energy building utilising passive cooling and high levels of natural ventilation and daylight even the most demanding IT company can be accommodated in a green building.

Green design is a virtuous circle. The buildings it creates are more attractive places in which to live or work. They are cheaper to run in the long term and they are environmentally responsible. So why is green design still seen as problematic? The difficulty does not lie with the architects. When I was asked to write this article I thought I would have to cast around for examples until I realised that virtually every architect I had talked to in the past two months had automatically discussed issues of green design, not because it was unusual but because it was central to their thinking. Nor does the problem lie with the technology. Inevitably there is more to learn, but the principles are established and the materials proven. No, the problem is much more insidious. It lies with the blinkered attitudes of the big financial corporations who ultimately fund most new building.

Below: These experimental semi-detached homes (1999) at Stevenage, Hertfordshire, are designed to provide a stable and healthy internal environment. Structure, claddings and brings allow moisture to escape slowly through the roof without creating condensation; if the internal climate is too dry, moisture can migrate into the building. Architect: Sergison Bates Architects

Bottom: The high internal heat gains in the new headquarters (1999) of CAE Electronics, Burgess Hill, Sussex, are dispelled by passive cooling. During the day the reinforced concrete cools the air, while at night any warming of the structure is dissipated by the ventilation system using the lower-temperature night air. Mechanical cooling is restricted to isolated high-load areas. External shading reduces overheating and thus cooling loads. Architect: Litschutz Davidson
It is no coincidence that all the examples cited above are by architects working directly for the client who intends to use the building, whether it is a Government department, a private individual, a housing association or a high-tech company. But these are the exceptions. Most buildings are built speculatively by developers relying on institutional funding and most institutional funders still demand fully serviced, air-conditioned buildings for offices or are only worried about the immediate construction costs of private houses, not their long-term running costs.

That is beginning to change, as Peter Walicknowski of the Australia-based property developers Lendlease, who were responsible for the massive retail development at Bluewater in north Kent, showed when he declared that ‘we don’t believe that society will tolerate inefficient buildings in the future.’ For good architects green design is now fundamental to the way they think, as integral as drains and wiring. It is no longer an optional extra. Intelligent clients have come to realise that too. It is time the financial corporations caught up with reality.

Left: The sports hall at John Cabot City Technology College, Bristol (1993). The building form - a street running between two large communal spaces - achieves good levels of natural lighting. Overheating is avoided by fixed shading and retractable blinds and by the provision of cross-ventilation. Architect: Feilden Clegg Architects

Left: The Solar Office (1998) at Duxford International Business Park, Suntelard, is the first commercial office designed to run on building-integrated solar power. The building is designed to minimise the use of energy, while the envelope generates energy by a 73 kWe photovoltaic array integrated into the south-facing façade. Architect: Studio E Architects

Opposite: The distinctive façade of Alexander Graham Bell House (see page 6), a red cube within a silver cylinder.
Good practice case studies

A selection of Design Advice consultancies during the past year.
preserving royal treasures

State-of-the-art environmental controls will preserve precious works from the Royal Collections in the best possible condition.
The Queen's Gallery at Buckingham Palace is renowned for the range and originality of its exhibitions, which draw on the diverse Royal Collections. In a major redevelopment, due for completion in 2002 to mark Her Majesty's Golden Jubilee, the exhibition space is being remodelled and extended so that paintings, miniatures and enamels, drawings and watercolours, furniture and porcelain can all be displayed to maximum effect and in the best possible environmental conditions.

Klimaat, the project's M & E Design Consultant, invited Design Advice consultant Francis Vaughan to join the design team. Francis specialises in the computer-aided environmental analysis of buildings, and his brief was to help to achieve, as cost-effectively as possible, the different environmental conditions specified for each exhibition space.

Dynamic thermal modelling
Sophisticated thermal analysis provided an accurate prediction of temperatures, relative humidities and room loads throughout the Gallery for typical summer, mid-season and winter days. This process led to a number of design changes to the roof glazing and insulation levels.

Modelling the HVAC system
Modelling the proposed HVAC systems against the room loads enabled Klimaat to check the suitability of each HVAC system and select the most appropriate cooling, heating, humidification, de-humidification and fan components. The results of this exercise led to several important modifications. These included changing controls to avoid exceeding upper relative humidity levels and optimising a number of air-conditioning systems to use the minimum air supply and energy.

Modelling the air movement
One important element of the design brief was to ensure satisfactory environmental conditions throughout the Gallery's full hanging height. Computational fluid dynamic models – which combine the predicted surface temperatures from the dynamic thermal modelling and air supply requirements from the HVAC models – showed a variation of only 3° Centigrade: an excellent result.

'We were able to achieve excellent temperature and humidity profiles in the gallery spaces with smaller plant and duct sizes that reduced alterations to this heritage building and fulfilled the Palace's requirements at the lowest possible cost.'

Roger Brecken, Klimaat
world-class performances

Design Advice input is helping audiences appreciate international musicians in comfort.
The people of Edinburgh regard the Usher Hall as a major cultural asset and as a cornerstone of their city's national and international standing. As well as hosting the principal concerts of the annual Edinburgh International Festival, the Hall is the home of two major orchestras, and its unique reputation attracts top-class national and international performers.

The Hall, which opened in 1914, is an opulent reflection of civic pride and self-confidence. However, in recent years it has begun to show its age, and in September 1999 closed its doors for ten months at the start of an £8 million redevelopment programme funded by City of Edinburgh Council.

**Building simulation**

One important element of the upgrading, designed to increase the comfort of both audience and performers, is the installation of a sophisticated, energy-efficient displacement ventilation system. The new system reflects the keen interest of the design team, drawn from Council officers and external consultants, in environmental low-energy design.

Patrick Brown of the Architectural Services Department of City of Edinburgh Council brought in Design Advice consultant Derek McDonald to use building simulation technologies to evaluate the environmental strategy for the Hall. By modelling the Hall at different seasons and with varying audience sizes, Derek was able to confirm its overall effectiveness, and also to assess design alternatives for specific parts of the Hall.

**Ventilation control**

Each member of the audience receives a constant, low-velocity, tempered air supply directly at their seat. This reverses the previous inefficient high-level system, which pushed cool air down from the ceiling to meet hotter air rising from the audience.

Where the seating is raked, i.e. in the two circles and at the back of the stalls, the supply direction from the floor is horizontal; in the main part of the stalls it is vertical. The air enters the Hall at 19° Centigrade, and gains only 2° to 3° before being extracted through high-level vents. The system can be controlled to suit varying occupancy levels and uses, such as promenade concerts when the stall seats are removed, and varying external temperatures.

**Protecting the fabric**

Poor ventilation (and the passage of time) have caused considerable damage to the Hall's ornate ceilings and plasterwork. The new ventilation system is designed to minimise the build-up of moisture generated by the audience. For this reason, the system continues to run after occupancy to protect the fabric of the Hall and ensure it is fully ventilated.

"The modelling commissioned under the Design Advice service provided important support for the design solution we had already developed and confirmed our own assessment of its viability. It proved an essential part of the design process."

Patrick Brown, Chief Mechanical Services Engineer,
Architectural Services, City of Edinburgh Council
commitment
to quality

A Design Advice consultancy assisted Volkswagen to achieve high environmental standards for its showrooms.
The Volkswagen Group UK commissioned Design Advice consultant John Doggart to advise on environmental issues surrounding future developments of car showrooms and workshops. Volkswagen is re-branding its dealership network of some 260 outlets, and this programme involves developing a relatively standardised specification.

**Leading the way on environmental issues**

Environmental issues are increasingly taking centre stage in the automotive industry, and Volkswagen is committed to leading the way. This commitment reflects both the inherent importance of the issues themselves and the company's responsiveness to increasing customer concerns. There are also significant pragmatic reasons, for an energy-efficient building with good thermal control provides a pleasant environment for both staff and customers.

**Implementing low-energy design**

John Doggart's report examined a range of areas in which low-energy design techniques and materials would make a substantial impact on development. One significant recommendation was to optimise U-values in order to reduce heat loss. Natural ventilation was proposed as a viable alternative to air-conditioning. This would have the added benefit of releasing valuable floor space, as less plant would be required, and also reduce running costs. More detailed work may be considered to evaluate the thermal, cost and comfort performance of improving insulation standards and of providing natural ventilation instead of air-conditioning. This would be available under Design Advice's extended scheme, which subsidises consultancy work by 30 per cent.

Other measures discussed included:
- using energy-efficient services for lighting, heating and hot water
- provision of user-friendly occupant controls and monitoring of equipment
- selecting materials with reduced environmental impact
- using the BREEAM 5/93 Environmental Assessment Method to benchmark and achieve a high building environmental standard.

As well as reducing energy demand and environmental impact, the measures suggested would result in additional benefits for Volkswagen, including:
- reduced running costs for energy and water
- a healthy and pleasant working environment
- reduced risk from future environmental legislation by exceeding minimum requirements
- improved company image with customers and staff.

These measures would also help to meet the UK's commitment at the Kyoto Summit to reduce, by the year 2010, greenhouse gas emissions by 12.5 per cent of 1990 levels.
friendly healthcare

Design Advice achieved major energy efficiency gains and cost savings in this unusual refurbishment and new-build project.
The four doctors of Clevedon's Sunnyside Practice work from a 1950s chalet bungalow, much extended and adapted over the years. They - and their patients too - are convinced that the relaxed informality of their surgery, once a family home, makes a positive impact on the health care they offer. So when the opportunity came to expand into the next-door property and build a new reception and waiting area between the two houses, the partners, and their clinical and administrative staff, were eager to ensure that the expanded and modernised facilities would retain their friendly atmosphere.

The energy efficiency challenge
Design Advice consultant Stephen Kinsella was brought in by architects Palmer Associates early in the design stage. As Stephen recalls, 'The challenge was to maximise energy efficiency in buildings constructed at a time when there was little or no environmental awareness. Another important factor was to plan for the unusually high number of people who work from the surgery on an occasional basis, running specialist clinics and so on.'

Stephen's recommendations focused on lighting and energy conservation, and cost-effective heating.

Lighting and energy conservation
The unusual building form makes it difficult to utilise daylight. Stephen proposed rooflights for the new reception/waiting area and light-coloured decoration throughout. According to architect Carole Hockaday, 'It was difficult to prevent the area between the two houses becoming rather gloomy. Stephen's input was valuable in finding ways of using daylight to reduce the level of artificial lighting.'

Several surgeries and clinics are used only intermittently, and for these Stephen suggested presence sensors so as to reduce energy use and costs. These particularly appealed to the client. 'We hadn't heard of them before, but we all thought them a good idea,' comments Dr Phil White, the partner responsible for the expansion project. Dr White and his colleagues also welcomed Stephen's proposals to maximise lighting where it is needed, rather than throughout the building.

Stephen also recommended double glazing throughout and wall and roof insulation above Building Regulations minima.

Heating
Stephen's proposals for thermal improvements included additional insulation and zoned heating, so that heating is available only when and where it is required. As a result a new boiler was not required, so saving, including additional works, some £10,000 capital costs. Part of Stephen's work on the heating system was carried out as an extended Design Advice consultancy.
environmental

showcase

The winning design team for the proposed National Assembly for Wales has set itself some formidable energy-saving targets.
The innovative building proposed for the National Assembly for Wales will be a landmark of leading-edge environmental design. Through the use of advanced simulation tools, and support from Design Advice, pioneering techniques are being explored and integrated into the Assembly's design as it evolves.

Design Advice consultant BDSP Partnership is part of the design consortium, led by architect Richard Rogers, that won the architectural competition for the Assembly. BDSP has been involved in the design development since its conception.

**Reducing energy use**

The design team is turning the proposed location for the Assembly, at the Waterside in the heart of Cardiff Bay, to its advantage to develop some radical energy-saving techniques. A thorough understanding of the structure's form and the ambient climate is being gained through the use of simulation techniques to allow the team to produce a climatic responsive design. This philosophy encompasses the desire to maximise the implementation of natural ventilation, renewable energy sources and embodied energy within building materials.

The proposed 100-year life span of this building presents the opportunity to evaluate ideas that would otherwise not be considered. The longevity associated with the project means that a number of energy-saving measures become economically viable, such as wind power and solar energy.

**Achieving transparency**

Transparency – in both the literal and the metaphorical sense – is one of the guiding principles of Rogers' design concept for the Assembly. The roof canopy is elevated to increase the catchment of direct and diffuse sunlight and is cantilevered around the edges to provide shading from the highest summer solar altitudes, while the undulating curved shape is used to reflect light into the lower levels. Workspaces in the lower levels will include lighting control systems compensating for available daylight.

**Passive structure**

Carefully designed passive and active engineering systems are being considered, including design implementation of heating/cooling water pipe circuits connected to bay water and ground water heat sinks. For some areas hollow core slabs are being considered, which provide radiant and convective heating and cooling inertia.

Air distribution concepts include using underground builders' work ducts to pre-cool the incoming air and passive roof ventilators to enhance air circulation.

**Water, water everywhere**

The relatively large roof area provides an ideal opportunity to harvest rainwater for use by the building's main toilet facilities. Landscape irrigation and external façade washing are also being considered.
Two Design Advice consultancies highlight the importance of pursuing a proactive energy strategy.
The high energy demands of chilled and cold storage and packing facilities all repay careful monitoring and control. Design Advice consultant Ed Horgan of Brier Associates identified substantial potential cost savings for two companies handling large quantities of fresh produce. Macleod McCombe (Produce) of Sittingbourne, Kent, distributes imported fruit and vegetables to major retailers, while Geest Foods in Milton Keynes manufactures ready-made meals for a major supermarket chain.

Localised energy controls
At each site Ed Horgan highlighted a range of relatively low-cost energy controls that would significantly reduce energy consumption as part of ongoing refurbishment. For Macleod McCombe he proposed:

- local control for the blast chiller to prevent unnecessary operation
- improved controls in the pack house to reduce energy used for air-conditioning
- use of free cooling and waste heat recovery from air compressors for the pack house
- load-shedding strategy for high-tariff winter peak hours.

For Geest, the recommendations focused on:

- the central steam boilerhouse and steam/condensate system, where major savings through improved insulation and controls can be achieved
- improved operation and time control of refrigeration and general electrical services
- improvements to air compressor control
- water audit to identify excessive consumption and establish re-use and recycling systems.

Billing
The two surveys also highlighted the importance of monitoring gas and electricity costs. Tender exercises can ensure that supplies are contracted at the most competitive tariffs, while bills should always be checked to ensure that the correct tariffs have been applied. In addition, water, effluent and sewerage billing can often be reduced by taking advantage of non-return rebates.

'The Design Advice survey showed that there was considerable scope for improving the way we manage our energy consumption. As a small concern, we do not have in-house specialist energy-saving expertise. Our Design Advice consultant produced useful, practical suggestions, many of which we have already implemented as part of our refurbishment programme.'

Ben Clayton, Geest Foods
holidays

for people with disabilities

A Design Advice consultancy created a strategy for efficient energy use in two holiday centres for people with disabilities.
The Winged Fellowship Trust operates five well-equipped holiday centres for people with severe physical disabilities and their carers. The planned refurbishment of two centres – Netley Waterside House, which overlooks Southampton Water, and Sandpipers, near the seafront in Southport – brought an unusual opportunity to introduce a range of energy-saving techniques.

**Raising awareness**

As in all holiday establishments, systems at Netley Waterside and Sandpipers have to be sufficiently flexible to meet the needs of guests and to adjust to varying occupancy rates. Guests are paying customers, and so cannot be required to follow energy-saving measures.

However, much more can be expected of the staff and of the volunteers who assist the disabled guests to make the most of their stay. Trevor Floyd recommended producing a short manual explaining how to implement energy-saving measures. He estimated that simple ‘housekeeping’ – eg turning off the kitchen extractor fans when the cookers are not in use, ensuring that open windows and doors do not compete against air-conditioning or central heating – would reduce annual energy costs in each centre by 10 per cent, an overall total of £6,000.

**Improving energy consumption**

Trevor Floyd signposted energy-saving equipment and controls to be installed during the refurbishment. These included:

- thermostatic controls on all radiators to regulate heating in individual rooms
- cascading controls on the new boilers to ensure that boilers operate in line with occupancy patterns
- zoned hot water supplies to meet different usage patterns by guests, staff and volunteers while ensuring that guests continue to enjoy constant hot water
- compact fluorescent lighting units and the most efficient light fittings – these two changes alone would reduce light energy costs by almost 60 per cent
- automatic doors to minimise draughts.

These measures would produce substantial additional savings of approximately £7,000 per year overall.

**Collecting usage data**

Sub-metering electricity, gas and water consumption would allow usage patterns in different areas of the centres, and for different purposes, to be monitored and matched to occupancy patterns. Ultimately, energy consumption in all the Trust’s centres could be compared, and could also be set against standard national benchmarks.

'Design Advice allowed a relatively small charity to benefit from advice on how to save energy and reduce our impact on the environment. This is extremely good for our profile, as well as saving us vital funds that can now be used for what we do best, provide holidays for people with disabilities and breaks for carers. Our consultant managed to instigate energy and environmental awareness within our organisation at senior level and generate the commitment from people at the grass roots to implement the necessary measures.'

Ian Fothersgill, Operations Director, The Winged Fellowship Trust
renovating

a listed building

University College Chichester is creating flexible teaching spaces and also achieving significant energy efficiency.
St Michael's House is one of a crescent of handsome late 18th-century mansions that form the local-point of the Bognor Regis campus of University College Chichester. The passage of time, plus some unsympathetic 1960s extensions, have left this Grade II listed building somewhat battered. A major renovation programme currently underway is creating a multi-purpose teaching building, including state-of-the-art lecture theatres and classrooms – and at the same time is recapturing much of the building's original grandeur.

Design Advice consultant Roy Jordan of Briar Associates was asked to assess the energy efficiency of the renovation. The main part of his report focused on the proposed heating system.

**Energy-efficient heating**

Roy Jordan recommended incorporating a range of controls into the heating system in order to minimise waste and prevent overheating of unused areas. His main proposal – to establish six independent heating zones – was welcomed enthusiastically by Mike Sellers, Head of Estates and Premises at the College. 'Zoning is critical in these days of cost constraints. We have planned the renovation to allow many different uses throughout the day and evening, but it would be uneconomic, and highly wasteful of energy, to heat the entire building when only one or two rooms are being used.'

Other recommendations included optimum start control (to vary the heating start time in accordance with prevailing temperatures) and local temperature controls in order to fine-tune the heat in individual rooms.

**Further energy-saving measures**

In order to benefit from seasonal efficiencies, Roy Jordan proposed that hot water should be produced independently, thus allowing the heating boilers to be switched off during the summer. He also suggested high-frequency fluorescent lighting, which achieves a 25 per cent reduction in energy usage, and automatic lighting and ventilation controls.

‘St Michael's House isn’t entirely green, but Design Advice helped us to achieve a significant degree of energy efficiency. Our consultant's report will be useful evidence for audit purposes in demonstrating that we have spent public money wisely, and the energy efficiency gains we have made will ensure that we continue to do so.’

Mike Sellers, Head of Estates and Premises,
University College Chichester
freshness
and quality

A new Food Hall offers customers high-quality produce in attractive and environmentally conscious surroundings.
Co overwritten.

Environmental awareness
According to Raymond Linch, Managing Director of The Food Company, which is developing the new outlet, 'the aim is to create a pleasant and relaxed environment where customers will return regularly -- and willingly.'

Good environmental practice has been at the forefront from the start. Timber products will be sourced from sustainable forests; refrigerants will be non-ozone-depleting, ie CFC- and HCFC-free; customers will be supplied with recyclable and recycled packaging; and staff will be encouraged to cycle to work, storing their bikes in specially provided racks.

Raymond Linch points out that food-retailing makes some unusual environmental demands. Artificial lighting is essential -- natural light can distort the appearance of fresh produce -- and so too is air-conditioning in order to ensure controlled and consistent temperatures.

Design Advice input
Reviewing the plans for the Food Hall, Design Advice consultant Marian Kempson from Oscar Feber made a number of valuable recommendations that have been implemented in the final design. These included:

- reducing lighting costs through timed sensors in storage areas and a separate night-time circuit on the shop floor
- installing an opaque canopy on the south elevation and venetian blinds in the café in order to reduce solar gains and hence cooling loads
- fitting compact fluorescent lamps or tubes and using reflectors rather than diffusers
- producing hot water from local instantaneous units to avoid heat loss
- collecting rainwater for landscape watering
- heat recovery from exhaust air.

Raymond Linch was very satisfied with the proposals put forward in the Design Advice report. 'We pride ourselves on taking the environment seriously in our work. The consultancy assisted our thinking and produced useful additional ideas.'
bright futures

A community centre at the heart of an inner-city regeneration programme is being designed along environment-friendly lines.
Bright Futures is the justifiably optimistic title of a far-reaching £60 million plus regeneration programme designed to revitalise 2,500 estate and street properties in Stockwell in inner south London during the next five years.

Community involvement
As well as improving individual homes, the programme, which has strong and genuine involvement from local residents, will replace the haphazard estate layouts with a series of sustainable, individual neighbourhoods. Extensive environmental improvements will also make the area safer and more attractive.

The key to the regeneration strategy is the construction of a new community centre. This will provide a much-needed focus for neighbourhood activities – meetings, social events and so on – as well as a base for training initiatives designed to reduce unemployment and re-skill local people.

Green commitment
Both Hyde Southbank Homes, which is managing the project, and architects BPTW are strongly committed to good practice in environmental design. All the key public rooms (and some service rooms as well) in the new community centre will be lit and ventilated naturally, and wherever possible recycled materials will be employed. To increase thermal comfort and reduce energy costs, the U-values of the walls and roof exceed those laid down in Building Regulations.

Against this background it was natural for the architects to seek to reinforce the scheme's green credentials. BPTW approached Design Advice consultant Mark Anderson of Ove Arup & Partners. He proposed a welcoming, green entrance, including a pergola-like structure. BPTW is now planting trees and reconsidering the designs of solar shading at the front of the building. For the crèche and function rooms, Mark Anderson recommended passive stack ventilation and underfloor heating supplied by a condensing boiler with zone controls to shut off heat from unoccupied areas: especially important in a multi-functional building in use throughout the day and evening.
landmark
office

Advanced simulation techniques established environmental performance and improved occupant comfort.
Unusually, the design of this major office development in Glasgow incorporates both traditional and contemporary elements. The stone north elevation provides continuity with neighbouring buildings. In contrast, the extensive glazing on the roof and 100-metre-long south elevation, together with a three-storey atrium in the heart of the building, achieve a dynamic, modern impact.

Wallace Whittle & Partners, the project’s Consulting Engineers, commissioned an initial one-day Design Advice consultancy from Derek McDonald. His report confirmed a number of important design issues. These included the building’s potential high heat loss in winter and high solar gain in summer, and its overall energy balance, which is partly affected by the glazing specification and the use of shading devices and blind systems.

**Predicting performance**

Subsequently, in an extended Design Advice consultancy, Derek McDonald used advanced simulation techniques to predict the building’s performance on three ‘design days’, selected to represent winter, a ‘typical’ summer’s day, and a ‘peak’ summer’s day with unusually high temperatures. The results, which were generated for these three days with up to six different glazing systems on the south façade, showed the varying effects that the extensive fenestration would have on the internal environmental performance. Ultimately, the design was refined to introduce air on the south side of the building to counteract the effects of the glazing.

Derek McDonald also used computational fluid dynamics to simulate detailed air flow and temperatures across the building. This analysis gave a more meaningful prediction of the interaction between the building envelope and environmental systems contributing to occupant comfort.

> ‘The dynamic simulation performed under the Design Advice service proved highly significant in validating both the concept and the detailing of the original design and in convincing the client of its practicability and energy efficiency.’

Douglas McNicol, Associate Partner,
Wallace Whittle & Partners
By identifying the optimum heating system, a Design Advice consultancy enhanced the appearance of a Georgian town house.
Soon after moving into their new home in the centre of Edinburgh, the owners started major renovations. Almost immediately they hit a major problem. How could the two spacious living-rooms, on the ground and first floors, be heated most effectively?

**Underfloor heating**

The solution, identified by Design Advice consultant David Palmer, was underfloor heating. The comfortable, consistent temperature it provides, notably in large rooms, suits the owners' lifestyle perfectly. The additional installation cost was very small, since most of the floors were being lifted as part of the renovation work, and was more than repaid by substantial savings in running costs.

For both aesthetic and practical reasons, the owners were also delighted to dispense with the existing traditional cast-iron radiators. As David Palmer explains, "Most heat from radiators rises to the ceiling as hot air. More than 2 to 3 metres away from the radiators the floor remains cold. A high-ceilinged room can produce significant temperature stratification, which requires excessive heat to achieve comfortable temperatures across the room. Underfloor heating does not cause stratification, and as well as being more fuel-efficient also provides a more comfortable environment." Digital programmable thermostats in each room enable temperatures profiles to be set room-by-room, so achieving optimum control and energy efficiency.

Removing the radiators ('a real eyesore' according to Helen Lucas of Erdal Architects) also restored the elegant proportions of the two rooms, which sweep through the house from front to back.

**Boilers**

David Palmer specified two wall-mounted room sealed-flue condensing domestic boilers, each serving two floors. These represented a huge reduction of 62 kW from the 106 kW originally proposed, and again met the owners’ particular requirements. They were reluctant to install a large boiler within the house itself; these, each fitting unobtrusively into a bathroom, are proving the ideal solution – and are significantly cheaper as well. A separate boiler provides hot water.

‘We needed a fresh eye on the problem, but timing was critical. David Palmer, the Design Advice consultant, reacted promptly and his innovative ideas really excited the owners.’

Helen Lucas, Erdal Architects
proactive environmental policy

High environmental standards were the aim from the start when UNISON renovated its newly acquired print works.
UNISON (the largest public-sector trade union) acquired its new print facility, a light industrial unit in Charlton, south-east London, as a shell and embarked on a complete refurbishment. Mike Malina, the Union officer responsible for environmental issues, was determined to combine operating efficiency with the use of appropriate technologies. He topped up the refurbishment budget with an additional 10 per cent environmental budget designed to meet extra capital costs. This ‘top-up’ budget had an average payback period of seven years.

**Energy-efficient features**

The specification for the refurbishment included a variety of energy-efficient features designed to provide the constant temperatures and humidity necessary for paper storage and high-quality full-colour printing. Heating is provided by a gas-fired hot-air system with four diffusers at different points within the unit. Destratification fans push hot air down into the warehouse space, thus reducing the overall heating level necessary. Although gas-fired radiant heating was potentially more efficient, it was ruled out because of likely humidity problems. Heat-exchanging ventilation bricks recover some of the energy lost through the extraction ventilation, and a plastic air curtain on the main warehouse door reduces air leakage. Infrared switching was fitted to the lighting in the office area, and infrared water controls to the toilet facilities.

**The challenge to Design Advice**

Design Advice consultants Dave Hampton and Sonny Masero undertook a one-day consultancy. In their words, ‘Mike Malina had been extremely thorough, and it was a real challenge to discover whether he had missed anything.’ Their main recommendation was to modify the high-frequency lighting to the ‘daylight linking selected off’ system. This turns a set number of tubes off when natural light reaches a given level, so providing energy savings without the need to install costly control systems.

Dave Hampton and Sonny Masero were also concerned that uncontrolled air filtration could result in heat loss. The BREFAN Air Leakage Audit they commissioned under the Design Advice special consultancy scheme confirmed some of the suspected weaknesses in the building’s fabric.

**Good practice in action**

Otherwise Dave Hampton and Sonny Masero were delighted to affirm UNISON’s commitment to high environmental standards: ‘Cost-effective, environmentally aware refurbishment is making this a quality best practice building.’

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**FACTFILE**

Design Advice Consultants
Dave Hampton and Sonny Masero, ARBS consulting

Client
UNISON
Building sector
Industrial

Estimated floor area
830 m²

Total value of project
£1.9 million

Running cost savings identified
Approx £7,800 per year
Local authorities are keen to be energy-efficient – and can make a real impact in social housing.
Many local authorities are enthusiastic advocates of sustainable design. In social housing projects they are well placed to ensure that theory translates into significant cost-saving benefits for local residents. For two recent projects Design Advice consultants provided practical energy and environmental advice.

Minimising energy bills

In Lincoln, the City Council is upgrading Kipling Court, a run-down three-storey 1960s block of flats, to provide high-quality, secure homes for elderly and disabled tenants. Energy efficiency was a high priority from the start of the design process – with target weekly bills of no more 10 per cent of the average weekly state pension.

The recommendations made by Design Advice consultant Jim Newton included double glazing the windows, external and cavity insulation for walls, fitting spray taps and showers to reduce water consumption, and installing an energy-efficient heating and hot water system. Here Jim Newton proposed two alternatives: individual combi boilers in each flat or a small-scale gas-fired CHP plant for Kipling Court and seven nearby bungalows. The total savings identified are estimated at £8,400 per year – which will make a real difference to residents on low incomes.

Terry Bentley, Lincoln City Council’s Energy Efficiency Officer, recalls that Jim Newton’s report provided useful confirmation of ideas he had been advocating, ‘Our in-house technical staff are aware of available technologies, but are sometimes nervous of taking a leap into the unknown by employing too many of them.’

Overall design efficiency

In Spen Valley, in the West Yorkshire Pennines, Design Advice consultant Matthew Hill reviewed the plans for the Sackville Street development. 30 houses being built for Kirklees Metropolitan Council. The houses, which will be let through Kirklees Community Association, are part of a larger mixed housing development. Both the architect, Julian Wade of The Plan Shop, and the Council are strongly committed to environment-friendly design; the Council has produced a ‘Housing Design Guide for Sustainable Development’.

According to Simon Holmesmith of Kirklees Council, Matthew Hill’s report was useful in ‘fine-tuning some aspects of the design’. As well as proposing a range of measures – such as water conservation techniques and using collected and filtered rainwater in toilets and washing machines – Matthew also suggested ways of making the scheme as environmentally effective as possible, for instance by modifying the proposed insulation and glazing materials.

Matthew Hill points out that the Kirklees project exemplifies the way in which Design Advice can bring together the environmental engineering and architectural design of a project. The Council itself has incorporated all Matthew’s recommendations into the design and build tender, and is using his consultancy to develop its design guidelines for windows and heating systems.

FACTFILE

Kipling Court, Lincoln
Design Advice Consultant
Jim Newton, Symonds Power & Energy
Client
Lincoln City Council
Building sector
Housing
Estimated floor area
720 m²
Total value of project
£300,000
Running cost savings identified
£8,370
Capital cost savings identified
£1500
Sackville Street Development, Spen Valley
Design Advice Consultant
Matthew Hill, Leeds Environmental Design Associates
Client
Kirklees Metropolitan Council
Building sector
Housing
Estimated floor area
2,350 m²
Total value of project
£1.6 million
heritage

of St Patrick

A Design Advice consultancy supported the environmental approach of an innovative heritage centre.
St Patrick's Heritage Centre promises to be an evocative introduction to the early days of Christianity in Ireland, and in particular to St Patrick himself, the missionary who became Ireland's patron saint. The Centre's architects, Consarc Design Group of Belfast, have created an innovative design that makes sympathetic use of local materials, notably limestone for the front elevation, and of the natural topography of the site itself.

**Environmental evaluation**

Design Advice consultant James Campbell was asked to carry out an environmental evaluation of the conceptual design at a relatively advanced stage in the design process. As Claude Maguire of Consarc Design explains, 'We are very committed to environmental design, and were looking for someone to bring a fresh perspective. James Campbell enabled us to make a number of useful alterations to the design details at this stage when we were working to a very tight budget.'

The modifications identified by James Campbell included the replacement of some north-facing glazing with timber-insulated infill panels, and the addition of louvres to the striking south-facing entrance rotunda, the local point of the Centre, to moderate solar gain. In addition, recalls Maguire, 'We also took on board some useful ideas on cross-ventilation, a topic that a lot of designers profess to know about but few properly understand.'

**Benefitting from Design Advice**

Both Claude Maguire and James Campbell agree that timing is crucial. According to Campbell, 'Design Advice provides an invaluable opportunity for an outsider to take an environmentally holistic view of a project. But involvement needs to be at the right stage after an initial concept has been evolved but before final specifications and budgets are agreed, since at that stage changes may become more difficult to implement.' Claude Maguire of Consarc echoes these sentiments: he would certainly use this scheme again, but would involve the consultant earlier.

Sympathetic design and use of appropriate local materials can enhance the appearance of heritage centres and similar environmental buildings.
Acknowledgments

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