A Client's Guide to Sustainable Private Housing

A draft for development

Gaia Research

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Every effort has been made to credit source material.

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" ……..there are limits to growth but there are no limits to development"
Amory Lovins 1991

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are needed to see this picture.

1 INTRODUCTION

1. This publication is one of a series of four client guides to sustainable buildings.[1] These guides resulted from a fast track and low budget process - a tiny fraction of the investment they seek to influence. As well as this one focussed on private housing, others have been written on offices, schools and social housing. While there is some commonality between the publications each has a sector focus, sector specific case studies and referencing to assist in delivering best practice.[2]

2. It has not been possible within the budget and time constraints to develop very far or to embrace the wealth of experience that exists in the client and design community. The guides are therefore produced as drafts for development with the knowledge that they require considerable adaptation before they are adequate to meet current needs. It is hoped that they will generate discussion and exchange of information and that the case study information can be expanded significantly and with critical appraisal. Anyone wishing to use this document as the basis of a consultation process with stakeholders, design teams, contractors or fellow professionals is invited to do so. It would be particularly useful to gather and share information on useful networks of expertise and best practice.

3. Buildings are designed to respond to social and/or business needs and they inevitably have social, economic and environmental impact. This series of guides is intended to assist clients to ensure that the influence at all three levels is as far as possible a positive one. The overall aim is to maximise the long term value of a building in meeting the needs, requirements and aspirations of users and the wider community and maximise the positive impact on the environment.

4. The current standard of private sector house building is highly variable but most pays little tribute to sustainable development objectives. There is a need to identify and embrace those elements and available guidance that can enable better houses to be delivered and to ensure that the benefits and opportunities are widely

[1] Available at www.gaiagroup.org
[2] Additional Case Studies available in Scottish House: A review of recent experience in Building Individual and small groups of house, available at http://www.scotland.gov.uk/cru/kd01/orange/shar-00.asp

disseminated.

5. The information here is based on the author's recent experience of writing an extensive training course in Sustainable Design for clients, architects, engineers and cost professionals. [3] The training course covers key themes of sustainable design on a modular basis and includes thorough referencing. Producing these *"sector based"* client guides provides an opportunity to integrate the issues around generic building typologies but does not seek to replicate the training programme which is far more extensive and provides more detailed technical guidance and background information.

Sustainability, as presently defined by government initiatives, challenges industry to produce higher levels of output, while enhancing the quality of life for employees and other stakeholders, using lower levels of input and generating less waste & pollution. This is intended to ensure *"non-declining human welfare over time"* and that a non-declining stock of capital assets, including environmental assets, exists to meet the needs of industry, individual consumers & society in the future. [4]

5. Key Issues faced by the client are:

Stewardship	Resource Effectiveness	Biodiversity
Pollution	Communities	Health

7. It is relatively easy to establish the key issues to address for a sustainable project and there is an abundance of existing guidance, but delivering on aspirations often proves to be extremely difficult. Success relies on a complex interaction of design, designed manageability, client commitment and user understanding. Importantly no client, architect or contractor can deliver a sustainable building without attention to the process from inception through to handover and subsequent management. Much of this guide deals with this aspect. It aims to inspire all involved to pursue the sustainable design of private housing, act as a

[3] Sustainable Construction – Modules 1-15 www.gaiagroup.org/Research/infotraining/sus_constr/cpd1.html
[4] Sustainable Construction CPD – Module 5 Environmental Legislation & Policy Gaia Research 2002

starting point for clients to develop a robust brief and assist them to establish the knowledge base and the process that will support real delivery. It also aims to encourage investigation of the extensive examples of innovative approaches to meeting housing need in Europe, and to encourage consideration of a wider range of options then currently available. Trends in layout, community involvement and application of beyond mandatory standards are encouraging.

8. The guides are produced at a time when there is a strong focus on sustainable construction in Scotland and a powerful political trend namely the commitment in 2002 to put sustainable development at the centre of policy.[5] The Scottish Executive's focus on community, citizenship, value, respect and quality are all vital aspects of sustainability. The Building Scotland Act (2003) made 'furthering sustainable development ' a requirement and this too will influence future policy.[6] The Scottish Executive also has a commitment to design quality through a policy on architecture.[7] Policies being developed now are likely to lead to substantial pressure on all involved in built development to improve their sustainability performance.

9. This document does not seek to repeat current arguments and policy objectives, but to support and compliment them with additional guidance to assist in delivery and to draw on these aspects to promote an integrated approach. The quality aspirations set out in current policies should be recognised as vital to successfully delivering a sustainable built environment.

10. Comments or suggestions of projects for inclusion please send to research@gaiagroup.org All named contributions will be acknowledged. We will also host a discussion forum and we invite your participation.[8]

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[5] Meeting the Needs www.Scotland.gov.uk/library5/rural/mtnsd.pdf
[6] Building Scotland Act 2003
www.scotland-legislation.hmso.gov.uk/legislation/scotland/acts2003/20030008.htm
[7] Scottish Executive A Policy for Architecture for Scotland
www.scotland.gov.uk/architecture/exec_summary.asp
[8] www.gaiagroup.org/Research/Forums

2 PRINCIPLES OF SUSTAINABLE PRIVATE HOUSING DESIGN

What is Sustainable Building Design?

1. Sustainable building design is applied good sense - an aspiration to build to the highest quality and functional standard, with maximum environmental and social benefit and with cost assessments that reflect the whole building life cycle such that investment can be properly maintained.

2. Achieving sustainability requires us to live within the limits of the earth's capacity to provide the materials for our activities and to absorb the waste and pollution that our activities generate.

3. Sustainable building design means applying of a set of design parameters which have often had insufficient attention in the past:- functional requirements - now and in the future, user needs and aspirations, resource consumption, material sourcing, location and access, impacts on stakeholders including building users and the local community, life cycle operation and costs, maintainability, building life and end-of-life, pollution, waste, biodiversity and health.

4. The process of procurement, design, tendering, construction and handover is a vitally important aspect of delivering buildings that can be sustained. Many projects suffer from a failure to think through design consequences in cost and management terms. There are many examples where this results in crucial aspects being edited, and undermining of project aspirations, late in the process. This is not inevitable but requires strong commitment, planning and considerable expertise if aspirations are to be achieved.[9]

5. The intended outcome is buildings that: -

    a. ….minimise adverse social, environmental and economic impacts by being efficient to operate, effective in their use of resources, minimizing waste & pollution and protecting occupant health and the wider environment during construction, operation, re-use and at the end of their useful life.

    b. ….enhance positive social and economic impacts by providing an environment that is fit for purpose, more responsive to individual, business and community needs and aspirations, more flexible and functional, maintainable and cheaper to run, and more respectful of the environment on which we all ultimately depend.

[9] Sustainable Construction CPD – Module 9 Site Issues & Construction Processes Gaia Research 2002

The wide-ranging changes in attitudes towards the environmental and the social impact of construction, and consequential changes in policies and legislation, that have been taking place in society over recent years have been prompted by a range of factors, including:

- the disturbing results of research into global warming, climate change, depletion of the ozone layer, and widespread pollution of water, land and air;
- the increased awareness of these and other environmental issues and their increasing presence and importance on the political agenda – locally, nationally and internationally - especially since the UN Conference on Environment and Development in Rio, 1992 and its Agenda 21 declaration;
- increasing recognition that buildings and the natural environment are essential to the maintenance of our human life and to improving quality of life;
- increasing realisation that the built environment has a crucial impact on the physical and economic health and well-being of individuals, communities and organisations;
- increasing realisation that the construction, fit out, operation and ultimate demolition of buildings is a huge factor in human impact on the environment both directly; through material and energy consumption and the consequent pollution and waste, and also through the pressures on inefficient or avoidable infrastructure;
- increasing realisation that it is important to design in ways that best employ financial resources in the long term. This means looking at whole life costs and building functionality .as fundamental aspects of design;
- increasing concern about indoor air quality, personal environmental control and other adverse factors within buildings, highlighted in the specific aspect of increasing child asthma and allergy but also the number of incidences of non-specific ‘Sick Building Syndrome’;
- increasing concern that a sustainable construction industry cannot be seen in isolation from supply, construction processes and manufacturing or from the proper management and maintenance of buildings in use. Sustainable construction has to be seen as a process rather than a product delivered at handover;
- the action of individuals, professionals and communities in challenging imposition of inappropriate development projects on communities rather than development that meets the identified needs of communities;
- the increased understanding that achieving a sustainable built environment brings real quantifiable benefits.

Why is sustainable building design important?

The widespread political and social concern for the environment has been one of the most significant changes of recent years. Until recently environmentally responsible building and manufacturing was largely seen as a peripheral activity. To many in architectural circles it was seen as a style to be resisted. In economic terms it was perceived as being wasteful of capital. In social terms it was perceived as elitist. Changes in society and policy have made it evident that these perceptions were profoundly wrong.

Increasingly environmental concern has been identified as intertwined with social and financial consideration as vital components of sustainable development. It is not a style or wasteful or elitist but an approach that is intended to ensure development that results in increasing 'quality of life' for all. This is now fully acknowledged by national and international policy. Sustainable building design is not just an important aspiration it is a vital one and a legal, financial, social and environmental imperative. The alternatives *'unsustainable development'* or *'no development at all'* are manifestly less attractive.

The pressures on the industry to address the three strands of sustainability (economics, social equity and environmental protection & enhancement) have led and are continuing to lead to government and corporate policy changes, and to more-stringent legislation. The industry is developing practices that can lead to built development projects that are significantly more efficient and affordable, more fit for purpose, much more socially acceptable, and much less damaging to the environment than before.

An important consideration is concerned with change management. There is a need to ensure that investment made today is relevant to future needs and aspirations including social, technological and regulatory changes. International commitments to sustainable development, echoed by the Scottish Executive, mean that substantial changes are planned in respect of regulations, legislation and fiscal policy to assist in meeting policy objectives. These are intended to promote the right sort of development rather than development for its own sake.

Sustainable buildings provide a potentially promising way to help address a range of challenges facing Scotland including:

- the high cost of infrastructure and security of energy supply;
- increasing cost of waste disposal;
- continued European pressure to cut pollution;
- the rising incidence of allergies and asthma, especially in children and the elderly;
- continued European pressure to improve indoor air quality through regulation;
- growing concern over the cost of global warming;
- increasing expenses of maintaining and operating public building;
- pressures on biodiversity;
- pending increases in water charges;
- manufacturing of sustainable building products for import substitution and export;
- employment in long term healthy and productive industry.

Features of sustainable private housing

- Have interesting, mould-breaking and attractive design forms.
- Result from a well-understood and organization-wide proactive commitment to engage in sustainable construction as a positive social and economic driver.
- Integrate with existing communities and create possibilities for new communities to evolve through consideration of shared and communal facilities and mixed use development.
- Do not endanger the health of the occupants, or any other parties, through exposure to pollutants, the use of toxic materials or providing host environments to harmful organisms.
- Are responsive to the needs, requirements and aspirations of all members of the local community.
- Enhance biodiversity locally by landscaping based on best practice guidance and globally by not using materials from threatened species or environments
- Do not cause unnecessary waste of energy, water or materials due to short life, poor design, inefficiency or poor construction and manufacturing procedures.
- Incorporate best practice in energy efficiency, building health and longevity by excellent standards of insulation, proper detailing to minimise air infiltration, designed ventilation and good control.
- Use only those materials that are benign in manufacture, use and disposal.
- Are affordable to run and simple to manage and maintain in a benign manner.
- Do not consume a disproportionate amount of resources, including land during construction, use or disposal
- Use renewable and recycled and recyclable resources wherever possible.
- Have a green travel plan at inception to create minimum dependence on polluting forms of transport and encourage access to, and the development of, safe, non-polluting and sustainable forms of transport.
- Are flexible to facilitate changes in response to demographics and technology and which allow expansion or contraction in the future, where appropriate.

Why a sustainable design guide for private sector housing?

Buildings and the built environment have a crucial impact on the physical and economic health and well-being of individuals, communities and organisations. Where buildings contribute to disaffection, alienation and undermine community and where they create excessive financial liability, they are clearly not only undesirable but unsustainable. Delivering sustainable homes is crucial to the future of individuals and communities.

Individual houses represent a significant investment but in the majority of cases purchasers options are extremely limited. Amongst bulk providers there is largely a lack of interest and engagement in delivering best practice, quality environments, diversity and the integration that might contribute to sustainable design objectives. The nature of the market means that these qualities, which exist in abundance outside the bulk market, are rarely given an opportunity to be demonstrated beyond the one-off house.

There is little or no requirement on developers to address social or environmental need and little joined up thinking in planning and sustainability issues. There is a low regulatory threshold and little application of voluntary standards in excess of the mandatory ones that are visible and competitive market drivers throughout Europe. Standards may be improving but less than adequate private housing continues to be developed in abundance and with no cognisance on the part of regulators of the opportunities for significant improvement.

There are real financial, social and qualitative advantages to be gained from building in a more sustainable manner. Flexible, healthy, efficient, maintainable and manageable buildings can drastically reduce adverse environmental impact, deliver financial benefits from resource productivity and maintain long-term investment. If undertaken properly there is ample opportunity for providers to take advantage of resource economies and waste avoidance and to pass these benefits onto clients.

Clients looking to ensure that their housing provides ongoing benefit into the future rather than the unwelcome burden that much of our current stock represents need to recognise that much more is possible. Most house building falls far short of the standards of insulation, air quality and moisture management that are readily achievable. Many clients are looking beyond the current overriding obsession with first cost because evidence increasingly points to it imposing unacceptable burdens on health, energy consumption and quality of life.

Approaches to housing provision in place in other countries actively seek to create sustainable communities by consideration of space use, interaction, intra-generational equity, the natural environment, resource effectiveness and flexibility.[10] Those that place client involvement at the core of development strategies rather than leaving decisions to a few centralised and private organisations are proving extremely successful in building communities. Housing clients should seek to become familiar with these in order to expand on the limited range of options available.

[10] Sustainable Construction CPD – Module 15 Urban Ecology Gaia Research 2004

3 ACHIEVING SUSTAINABLE DESIGN

Client's role in sustainable procurement

There is a significant resource of information on setting objectives and aspirations for sustainable housing. The guidance is highlighted in the appendix and detailed references on particular aspects are provided in each of the Gaia CPD modules.

A lot of guidance also relates to the activity involved in the construction process to ensure that this is undertaken in an environmentally sound manner. Initiatives such as "considerate constructors" are helpful in promoting the requisite attitude and methods for undertaking the construction process in a manner that is attentive to neighbours rights and needs and provides good guidance on site management.[11]

Significantly less attention has been given to problems of tender strategies, cost cutting and handover which have the potential to undermine the project aspirations, and to which sustainability objectives are often particularly vulnerable.

This dearth of information on the delivery of sustainability objectives of projects is surprising, given the far reaching and long-term impact. Documents such as the Environmental Code of Practice, its Feedback Case Studies and the Green Guide to the Architects' Job Book are perhaps the most thoroughly developed to date in terms of dealing with sustainable construction as a process and not a product. Module 9 in Gaia's Sustainable Design Series also covers the process issues from tender through to handover, in a succinct manner.

Most importantly for a client setting out to procure a building is the need to determine how they want to live and how the building will meet their needs now and in the future.

[11] www.considerateconstructorsscheme.org.uk

Sustainable design is intended to deliver a number of specific benefits to clients

- A better managed construction process
- Improved integration between planning, construction and other policy objectives
- Improved build quality
- Smoother handover and operation
- Improved performance and work satisfaction
- Reduced building related ill- health
- Improved occupant comfort
- Future proofing against legislation
- Reduced long term legal and financial liability
- Improved access and reduced travel times
- Improved flexibility in building design to extend building life
- Improved effectiveness in use of financial resources
- Reduced costs in use
- Reduced capital cost
- Improved maintainability

In addition clients need to recognise their wider responsibilities to meeting government and social objectives: -

- Reduced construction waste
- More effective use of products and materials
- Reduced adverse impact on water, air and land resources
- Reduced infrastructure
- Improved community benefits
- Improved feedback
- Reduced pressures on biodiversity
- Recognition through a number of specific awards

Become an informed client

The first step in the process of achieving a successful project is for the client to be clear about their commitments and priorities. They need to assess their own needs, capacity and skills, and identify information networks on best practice.

Discussions with professional advisers at the earliest stage can assist in determining and defining design priorities and setting project objectives. Talk to specialists experienced in sustainable design, procurement construction. Remember that they are professionals, that this is how they earn their living, and they may expect to be paid for advice.

Sustainable design is a specialist skill. Clients should either appoint an advisor specializing in sustainable design or give serious consideration to appointing an independent advisor, to support the client and design team with appropriate advice.

Be aware of the legal and other responsibilities that might inform your approach. As a result of international and government policy, the regulatory framework is changing and there may be financial and legal issues that need consideration at the outset.

As the client you have the responsibility of communicating your needs, the nature of a sustainable design approach, and the benefits, responsibilities and issues involved. Identifying good advice is likely to be the most significant component of success.

Take time to build trust and confidence in the professional advisor(s). Clients need this trust to carry a project through to successful completion. Remember the advisor will sometimes have to report the unpalatable - particularly in connection with affordability. It will help clients and advisors to visit projects with similar objectives and to have a thorough and open discussion of achievements and failings.

A crucial issue in sustainable building design is to recognise that considerable attention is required throughout the procurement and design process if the project is to have a successful outcome. Yet further attention is needed to ensure that the investment is maintained in optimum condition after handover. Identify appropriate benchmarks, tools and techniques that define requirements to ensure that best practice is adhered to, in particular a good process guidance tool that identifies the appropriate questions to ask and the proper time to ask them.[12]

Clients should expect their advisors and design teams to have undergone training. The GAIA CPD is a good basis for all building professionals and clients of construction.. They should also have a documented commitment to sustainable design. It should contain a central vision that can be easily understood and communicated to all stakeholders and give confidence in a real understanding of the issues. The commitment should include adequate provision and structures in place to communicate the policy and to provide the appropriate training.

[12] Sustainable Construction CPD – Module 14 Appraisal Tools & Techniques Gaia Research 2004.

Gaia Research CPD series: Sustainable Construction CPD

Module 1: Materials Selection: … aims to give the reader a sound and broad grasp of the issues and priorities affecting materials selection in the design of places, buildings, services and objects and a realistic perspective on the range of issues which will affect decision making.
Module 2: Lighting and Daylighting: … is designed to enable the professional to be better able to make informed decisions about lighting & daylighting design. It directs the reader to contemporary tools and guidance which will assist in implementing best practice.
Module 3: Water and Sewage Management: … considers the flow of water through buildings. It looks at its efficient use, the appropriate treatment of the wastewater discharged and the potential for reuse. It also considers rain falling on and around buildings, the potential for reuse and appropriate discharge.
Module 4: Heating: …aims to enable the reader to deliver high quality buildings which have a low heating demand. It emphasises the role of minimising demand at the outset through passive measures.
Module 5: Environmental Policy and Legislation: … aims to highlight the key policy drivers for the creation of more-sustainable construction and the legislative requirements that need to be met.
Module 6: Cooling and Ventilation Strategies: …. seeks to highlight the principal issues and sources of guidance to ensure that buildings are as comfortable and healthy as they might be while minimising reliance on unnecessary energy for ventilation & cooling. The issue of healthy indoor environments is of increasing importance.
Module 7: Renewable Energy Technologies: ….give guidance on how to make best use of the available opportunities and how to go about designing and specifying appropriate renewables systems. They are increasingly part of the design pallet and have increasing support from government, but are still new to the majority of designers and clients.
Module 8: Sustainability Drivers: … provides a review of the principle milestones which have brought about the shift in attitudes towards sustainable design of the built environment.
Module 9: Construction Processes, Site Issues and Handover: …best practice guidance on tender evaluation, site practice, management and handover. A much neglected area which is fundamental to delivering client aspirations.
Module 10: Low Impact Construction: ….looks at recent innovative initiatives to design using very low impact materials such as straw, earth, hemp and timber.
Module 11: Electrical Installations
…. intended to help designers to develop strategies for low impact electrical services design and to implement them effectively. A subject that meets
Module 12: Post Occupancy Evaluation: …A thorough and concise review of methods of obtaining feedback from buildings in use and the history of development of the techniques with a series of case studies largely taken from the PROBE studies.
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Module 15: Urban Ecology: …considers the sustainable design of the built environment of our cities and countryside.
More information from Gaia Research, The Monastery, 2 Hart Street Lane, Edinburgh, Scotland, EH1 3RG Tel. (00 44) 131 558 7227 / Fax. (00 44) 131 557 9292 research@gaiagroup.org www.GaiaGroup.org

Identify the benefits of sustainable design

It is a good idea to draw up a list of specific opportunities and benefits that client are seeking. These may involve clients own needs and aspirations (cost-in-use, light quality and views, satisfaction, health or flexibility) and also extend to the community and the natural environment. Keep these at the forefront as a design develops.

The benefits include some factors that are relatively easy to quantify, such as power, energy and water savings and avoidance of waste (on average 25-30%, 25-40% and 50-75% respectively).

Many clients will also be seeking a better indoor environment through avoidance of off-gassing materials, better ventilation, personal control and good daylighting. Sustainable design extends to consideration of the natural environment also requiring attention to landscape, materials sourcing, waste and pollution in all forms.

The limited financial evidence available is mainly gathered from office and school environments. There is little UK data to provide a comprehensive analysis of the actual costs and financial benefits of sustainable housing. The financial benefits are still rarely adequately attractive to most investors but are likely to increase as the balance of taxation continues to reflect concerns for adverse social and environmental impacts. The direction of current policy makes it clear that looking for short-term gains is not good sense.

Market awareness, legislation and government & private sector policy have provided incentives to improve construction practice and to set in place procedures for continual improvement. This has resulted in development of a range of tools and methodologies to promote, assist and measure achievements in sustainable construction. They cover different professions and stages in the construction process as well as widely different elements. Most have a useful role to play at some level.

Clients should seek to ensure that they and their design team are fully aware of the benefits.

Remember that standard practice lags significantly behind what is possible and changes will reinforce this over the life of the project. Aim for the best possible standards. Every client procuring a new building should champion sustainable design and be open to innovative approaches that promote continual improvement.

Maintaining the Investment

There is a lot of evidence to suggest that sustainable buildings are more expensive then standard construction. Estimates based on American projects certified under LEED- a US based rating scheme similar in principal to the UK BREEAM - indicate 0-3%, for the lower and up to 10% for the higher ratings. Elements of this include increased design time, and the cost of higher performance products and benign materials. [13]

In truth all building design involves a balance between up-front expense, on going running costs and maintenance, eventual decommissioning and dismantling.

There is growing evidence that sustainable buildings provide significant social, financial and environmental benefits over their life that conventional buildings do not. Design decisions should reflect this lifecycle but we are currently at an early stage in our ability to do this.

Even in PPP projects there is evidence of an overemphasis on capital costs because we are culturally driven to seek short-term gains at the expense of the longer term. As a consequence life cycle benefits of maintenance, productivity and resource effectiveness are overlooked in favour of short-term capital cost savings or stock solutions.

The running of a building must be considered at the outset and hence the building operation strategy needs to be well documented throughout the design process.

We know that building presents certain risks to health and well-being and that simple measures can reduce these risks.

We know some of the principal causes of waste and hazard that are likely to impact on costs and these can be designed out.

Importantly, a large number of beneficial features have little or no additional capital cost e.g., site and window orientation and strategic approaches to the layout plan and form to reduce cable and pipe runs.

Passive solutions and design solutions aimed at low maintenance strategies are less likely to incur high costs then highly serviced environments. NB: Beware "no maintenance" strategies that invariably mean that something is unmaintainable!

Other sustainable options such as high levels of insulation or passive design may cost more in the design phase but can be offset by the reduced cost of a smaller mechanical system or by designing it out altogether.

[13] Sustainable Design CPD – Module 13 Cost Issues Gaia Research 2004

Set out the project aims

Make sure that all those involved in the final house have an opportunity to contribute and inform the process. Identify key requirements.

A client should get professional advice that addresses their aspirations but is a sensible approach to the budget. It is pointless to have expectations that cannot be delivered.

Clients should establish their views and aspirations, and their aims will become the reference point throughout the design and construction stages, and can be used to test the overall success of the project over the longer term. The client may wish to think radically about their current and future needs. Be prepared to rethink assumptions about the home and the home environment. The impact of social and demographic changes, in combination with new technology, are profound. The evolution of the new work environment also calls for radical rethinking and responses in how we deliver housing for home and part-time working. Needs will change over time and the client may wish to take this into account.

It may be useful to consider whether the client's current accommodation is being used effectively and whether there is opportunity to identify beneficial changes or integration with other users. With changes in technology and lifestyle attitudes there are new opportunities presenting themselves. This is being exhibited in more mixed use developments and more flexibility to suit part time and freelance working. Looking for multi-functional uses is increasingly the norm.

Commit to maintaining sustainable design on the agenda throughout the design and construction process and agree this with the professional advisor.

Remember that you are looking to develop a solution that enhances your life. This is more likely to be achieved if it is functional, efficient and healthy, internally and in its impact on the wider world.

The appropriate approach with an emphasis on sustainability should assist in providing a framework for:

- establishing, developing and communicating client priorities & value systems;
- setting the sustainable design strategy;
- communicating with stakeholders to define the functional needs, requirements and aspirations for all those affected;
- enabling user and management participation at an early stage in the design process;
- improving briefing procedures;
- preparing tender documentation such that sustainable design is tied down;
- establishing supply chain management where specifications involve real or perceived innovation;
- engaging bidders cogniscent of the issues and benefits of sustainable design;
- selecting the design team who understand sustainable design in practice;
- maintaining the sustainable design strategy throughout the project;
- setting appropriate fee structures;
- developing teamwork and robust communication;
- allowing adequate time for design development of engineered solutions involving passive design & good ergonomic control;
- implementing responsible site procedures;
- ensuring that commissioning and handover is undertaken properly;
- reducing waste;
- minimising pollution in all forms;
- avoiding use of toxic substances;
- maximising positive impacts on biodiversity;
- establishing formal feedback mechanisms including post-occupancy evaluation

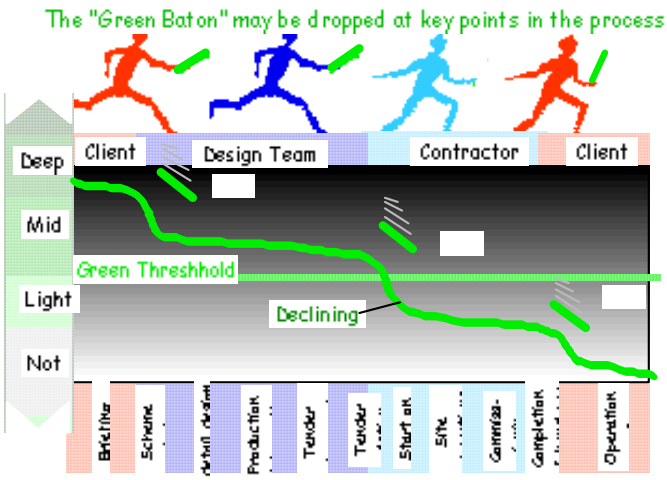
Develop the brief based on best practice

Clients should set out their sustainable design objectives clearly using an appropriate briefing guide. This will benefit from discussion of options. Clearly and thoroughly define and demand sustainable design or you will not get it.

Having identified the key issues, investigate the appropriate benchmarks so as to make explicit the sustainable development objectives and make them visible, quantifiable, life cycle and evidence based.[14] Getting the right balance between flexibility and pinning down the deliverables will need experience. Ensure that time is allowed to develop an appropriate design based on a single system.

Setting targets against current norms is not adequate and will not deliver the best possible life cycle benefits.[15] Innovation should be encouraged.

The requirements should be reinforced through all subsequent stages of the process. There is a high risk of the "sustainability baton" being dropped throughout the process and particularly as responsibilities are transferred from the Client to the Design Team to the Builder and back to the Client.



..Once dropped it is difficult to pick up again and regain lost ground. In some circumstances, with the right experience, aspirations can be exceeded.

The effect of compromises will inevitably depend on the aspirations at the start-out. A project with low expectations will be lucky to have green credentials at all by the time it gets to its delivery point.

Careful handover is central to efficient building operation. The commissioning, servicing, cleaning, maintaining and operations strategies should be described in a user manual. The contract should contain clauses relating to appropriate levels of staff training and there should be a clear plan to indicate how this information will be communicated at handover. Make feedback a fundamental requirement against established and firm targets.

[14] Sustainable Construction CPD – Module 14 Appraisal Tools & Techniques Gaia Research 2004.
[15] Action Energy www.actionenergy.org.uk

Key sustainable design issues

You will have your own view on the issues and their relative importance to you. These are provided as guidance.

Management of the Process

The design and delivery process is crucial to proper implementation of sustainable building design.
Implement a management system or adopt a process guide.
Have in place process tools that extend from consultation, through outline design, site issues, commissioning, handover and post occupancy evaluation. Take advice on your legal responsibilities e.g., duty of care for waste during construction and building life.
Become familiar with recent prosecutions so that you are aware of the scope of issues to be addressed.
Ensure that your advisors show commitment to legal compliance evidenced by method statements
Ensure a commitment to responsible procurement and purchasing.
Ensure that those engaged understand the sustainable design strategy and their role in ensuring its delivery
All professional service providers should show evidence of their approach and of past performance.
Take a rigorous approach to exploring the commitment of the design team and contractors.
Employ specialist advice in undertaking appraisal of their commitment, aspirations and experience.
Commitment to training of themselves and their subcontractors should be evidenced
Make sure that you understand the design and that alternative approaches have been properly considered.
Ask questions and demand straightforward answers – nothing should be too complicated to understand.
The brief should be fully understood by the design team and the results must be measurable.

Creating healthy environments

Consider the impact of the indoor environment on the well-being of the occupants.
Occupants appreciate a view and daylight especially if they have limited mobility. Consider at the outset the impact on the layout, building depth and schedule of accommodation.
Avoid materials that contain VOC's or other pollutants.
Put in place a cleaning regime that uses non polluting materials
Locate noisy equipment away from sensitive areas
Extract any pollutants or heat locally.
Controls – People like to have control of their environment.
Make links to outside to encourage outdoor enjoyment and recreation.

Promoting biodiversity

Materials should be used with minimum adverse impact on biodiversity
A full investigation should appraise the opportunities for enhancing biodiversity
Maximise habitat creation and minimise disruption - Bird and bat boxes
Creation of zones: wildlife / human / traffic and wildlife corridors and create self-sustaining habitats
Use SUDS to create variety of habitats (seasonal, wet / dry / semi-dry)
Maintain a low maintenance regime
Treat pollutants locally
Choice of plant / seed varieties for range of microhabitats & feeding opportunities
Use native species for main structure planting shelterbelts, to form new local woodland
Alternatives to hard landscape (porous paving / car block / gabions)

Supporting communities

Consult all those affected
The project should enhance the local environment by quality design and provision of improved facilities.
The local community/ communities should be consulted and their concerns respected.
Consider the throughputs from the building and how it might impact on local communities
Avoid nuisance during construction or post completion.
Look to sourcing materials and skills locally

Minimise Pollution
All materials and products should have minimal adverse environmental impact at all levels from sourcing to end of use. The answers to this are rarely simple but some principles are possible.
Products should be fit for their purpose and present no health risk over their lifecycle.
They should be controllable, maintainable for long efficient use and facilitate safe recycling in all or part and ultimately safe disposal.
They should have minimum dependence on non-renewable resources over their lifecycle.
Systems should be validated in there own right in respect of their value and cost-effectiveness.
Materials should have minimum embodied toxicity and have long maintainable life with ultimately safe and efficient recycling or disposal.
Materials such as paints and finishes should be free of chemicals.
Avoid treatment of timber through design to prevent water retention.
Use local materials if possible and as close to their natural state as possible.
Consider the availability of the public transport infrastructure and the availability of public transport, cycle, pedestrian access
Mixed use and high density development can reduce the need to travel and bring lifestyle advantages - you may wish to consider the available options or investigate generating an initiative with a new client group. This opens up all sorts of opportunities for mixed use and shared facilities but whilst common in Europe they are largely unknown in the UK.
Consider joint uses between the project and the local community – such as café space or library facilities
Discourage through traffic or commuter parking
Use landscape design as an integral part of minimising the adverse impacts of transport. Using space around the house for delight not car standing.

Resource Effectiveness
Energy & Water
It makes environmental and economic sense to minimise energy and water consumption and sewage outfall to reduce infrastructure and minimise costs in use associated with energy, water and sewage charges.
There are many opportunities to improve energy and water utilisation and to offset demand.
Considerations should be based on usability and whole life costs.
Conservation is always the best first option. Negawatts and negalitres are invariably the low hanging fruit. E.g., site treatment and re-use of water, low consumption fittings, low flush and waterless fittings.
Toilet effluent is manageable
Avoid forms of water recycling that raise the overall costs and introduce need for chemical treatment.
SUDS offer excellent potential to improve landscape design quality and enhance biodiversity
Rainwater harvesting can be used to offset demand and contribute as part of an enhanced SUDS strategy
All proper precautions re- legionella are now well documented.
Consider form, orientation and landscape and opt for passive solutions wherever possible. Mechanical systems should support passive systems not substitute for them.
Look for local sources of heating and cooling such as incineration or aquifer cooling
Controls, management are also vital
Waste
Recycled materials should be considered but embodied toxicity may be an issue
Design for dismantling
Recover materials on site
Use pre fabrication if appropriate
Understand your legal responsibilities with respect to waste.
Understand the cost of waste and the benefits of waste avoidance.
Build on existing sites rather than on green fields
Recycle as much as possible
Include waste minimisation in design criteria
Design in waste management to the completed building

Seek evidence that the tendering bodies are aware of the benefits of sustainable design

It is critically important to ensure that the design team members understand the significance of pursuing a sustainable development strategy, and are committed to it.

Sustainable design is now perceived as a business edge and inexperienced, ill-informed and unscrupulous designers and contractors will read this document and offer a variation on the content. Beware those just talking the talk they will not be able to deliver.

Seek supportable evidence of achievements through professional practice, built development, benchmark standards achieved, professional recognition or other means. Ensure that they have adequate commitment, skills and experience to deliver including expertise in sustainable design.

All members of the team (designer, contractor) should:-

- show a genuine commitment to sustainability
- provide evidence of appropriate training
- show real experience of delivering sustainable design
- show a working knowledge of best practice nationally and internationally, and a commitment to raising standards through networking.

Determine any additional training needs that tendering bodies might need. Few of them will have adequate knowledge or training to really deliver best practice.

Each client is unique and the design responses should reflect this. Look for an integrated design team approach with an emphasis on a single design response rather then disparate elements, especially expensive 'sustainability add-ons' that simply increase cost and servicing needs.

Look for straightforward simple solutions that work well rather than add ons especially where they add capital cost and have high or unknown maintenance implications.[16]

Reinforce targets through all stages of the process using appropriate tools and techniques.

Make sustainable design a fundamental criteria for selection of successful bidders.

Ensure that the tender documentation makes explicit the need for process management throughout the design and construction period and that bidders will sign up to the Considerate Constructors Scheme.

Specify all the testing regimes such as air infiltration testing and ensure they are costed out. Ensure that time is allowed for commissioning and handover and that appropriate information is gathered.

[16] Eco-minimalism – Getting the Priorities Right by Liddell H.L. & Grant N. www.gaiagroup.org/Architects/eco-min.pdf

Maintain a watching brief through to handover

If the project is well established with suitable targets and agreements then this should form the basis of a constructive agenda.

Design changes are inevitable and should be assessed in terms of their impact on sustainable design to ensure that they are neutral or beneficial.

Establishing controls within the routine of the site operations will be beneficial

- Unique or unusual elements, materials, products or services systems should by this stage have been fully explained - but it may be useful to reinforce principals if mistakes and substitutions are to be avoided.
- Environmental issues regarding construction-related activities on site, should be a permanent consideration.
- Within reason all relevant sub-contractors should have explanations of key environmental elements, and have the key aspects highlighted.
- Monitoring, checking & testing routines should be established at the outset.
- The design team should be informed and present at all key checkpoints.

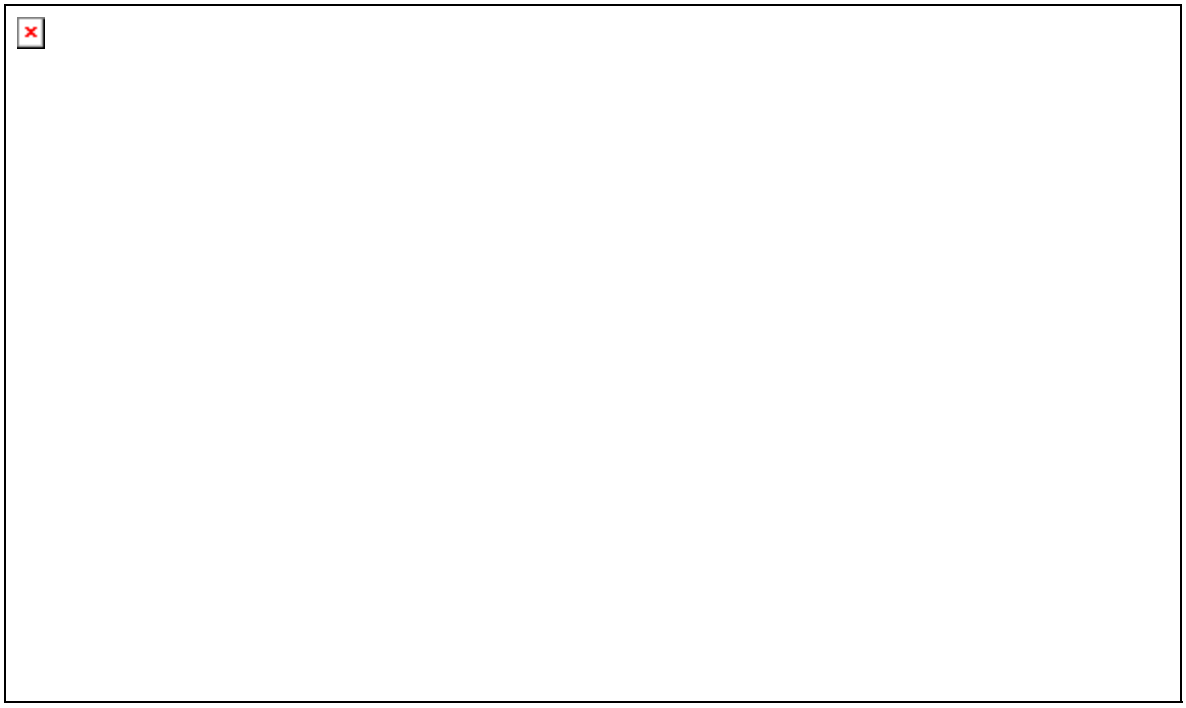
It is good practice for a handbook & operational manuals, to be maintained through the site operations.

Particular attention should be paid to the commissioning operations - not just of innovative technology - but also of the routine ones, as they can also undermine a system. It will become clear at this point how important it was to specify all the testing regimes at the tender period and for these to have been costed out and accounted for.

The interface between completion of a project on site, handover and ongoing operation & maintenance is a key point in the procurement process. If Client, Design Team and Contractor have been attentive to the issues and requirements then the building will be delivered as intended. However, the first period of occupation involves a learning curve as well. A lack of understanding of controls, regimes or design parameters can reduce their efficiency or undermine them altogether. This is where sustainability as a process and not a product is really demonstrated.

As the client you need to understand how the building is intended to operate especially any innovative aspects. It is particularly important to be attentive to build quality and attention should be paid to the commissioning operations - not just of innovative technology - but also of the routine ones, as they can also undermine a system. It will become clear at this point how important it was to specify all the testing regimes at the tender period and for these to have been costed out and accounted for.

The critical point in the cycle of procurement is when the building becomes the full responsibility of the operators. Monitor key aspects of a buildings' resource usage (energy, water, waste materials, etc.) as part of the sustainable development policy. This will help to identify problems at an early stage.



4 EXAMPLES

Andersen House, Stavanger

Gaia Lista

The Andersen House in Stavanger, Norway, 1984, was constructed in keeping with the Gaia architectural philosophy, avoiding the use of materials known to contain toxic substances.
This beautiful 210m^2 wood and stone pentagonal building was a final year graduate thesis and the first example of the breathing wall, a construction technique that is now popular.

The breathing wall was achieved with the use of a porous perimeter wall constructed from panels of wood wool bonded with cement, and a wooden outer skin. Between the two walls is an air cavity which stops the wind and creates a temperate intermediate area. A greenhouse on one side of the house also functions as a skin protecting it from the wind, warms it with solar heat, and enables it to breathe temperate air. The wooden skin is broken by gaps that admit light to the windows. On the southwest aspect a double height, central room with a glazed external wall transmits the light and heat of the sun to the adjoining rooms through internal windows.

HOMES FOR THE FUTURE Lanark Street, Glasgow

Roan Rutherford

The Lanark Street site is extremely narrow, only 7.5m in depth. The southern end of this strip was designed to provide the developer Mactaggart and Mickel with two houses, one large, one small, suitable for city centre living in the next century. The houses are stacked one on top of the other and are accessed from a hard paved southerly courtyard which can accommodate two parking spaces, alternatively it can serve as town garden space. To give security and privacy, the courtyard space can be closed off from the street by sliding screens.

Each house is accessed from the court through south facing conservatories which act as buffer zones to the highly insulated house shells. In addition to providing efficient condensing boilers, chimneys with open fire flues have been provided to cater for burning a variety of fuels or waste material. For experimental reasons, photovoltaic tiles are included within the roof tiling system to generate electricity from solar power.

The two houses illustrate two forms of housing for which there is likely to be increasing demand in the next century. The small one bedroom house has been designed suitable for occupation by a wheelchair user with recharging facilities for a powered wheelchair in the conservatory and covered access to its car space. This house design reflects the needs of the increasing proportion of older citizens and also the importance of having city centre ground floor accessible housing to cater for all types of disability for young and old.The larger house also has access from a ground floor conservatory allowing a close relationship with external space. It has three bedrooms at first floor level and a living/kitchen space above with clear views over the city. At the top level, provided as mezzanine floors over the living space is two studios or office spaces to cater for the increasing number of households with at least one member working from home. The studio spaces have panoramic views over the city.

Lebensgarten, Steyerberg, Germany[17]

Architects:

The 60 house eco-village of Lebensgarten at Steyerberg in North Germany has a fully integrated energy policy which includes a Combined Heat and power plant for on-site electricity and district heating. It is supplemented by both thermal and photovoltaic solar energy systems.

The photovoltaic array is set at the highest point of the highest roof in the village (the community building) to ensure minimum overshadowing. The default output setting of the PV array is for charging the batteries in the village's shared electric car, which is the only vehicle allowed into the otherwise fully pedestrianised precinct.

[17] Photo courtesy of www.lebensgarten.de

Withy Cottage, Herefordshire

Builder: Nick Grant

Withy Cottage is a low energy self-built house. As an experiment the occupants lived without mains electricity for 7 years during the build, which forced ultra-efficient use of electricity. Where possible these efficiency lessons have been transferred to the main building.

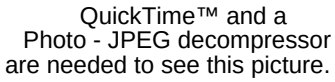
The owners are committed to an eco-minimalist approach with emphasis on efficiency and design.[18] On the equipment side this means careful choice of computer, to the minimisation of phantom loads. On the design side the need for lighting has been minimised by careful choice and placement of fixtures. Warm paint colours create a pleasant night time ambience with little light despite the large open-plan living space. Switched 5A sockets allow task and standard lamps to be turned off with a single switch when leaving a room. Low voltage halogen spotlights are banned.

Domestic solar hot water compliments the wood stove for hot water, and uses a PV powered pump. The washing machine is A-rated for energy and a switched spur above the worktop allows it to be switched off completely when not in use. The cooker is dual fuel and the cowl is a simple passive stack with manually controlled damper. Most cables are LSF but some flex and earthing are PVC as these were stock items. The bathroom extract fan is a through-wall Baxi heat recovery model. It runs on 2 W standby and 20 W boost. The boost is switched by a thermostat on the hot water pipe to the shower. The design gives several minutes run-on, which can be adjusted by altering the amount of insulation around the thermostat. Electricity use for the first 2 months' occupancy (December and January) has averaged 3.9 kWh/day.

18

Hockerton Housing, Notts[19]

Architects: Robert & Brenda Vale



This terraced development comprises 5 earth sheltered single storey houses, each 122 m^2, plus a conservatory area of 47 m^2. For much of the year, the conservatory is a habitable space. It is proportioned to maximise solar gains and high levels of insulation and thermal mass -including the earth shelter - reduce heat loss and to store heat gains to insulate the houses from annual exterior temperature swings. Space heating was not provided and no energy, other than solar and casual gains, is used to provide thermal comfort.

Each house is 6 m deep with a 19 m long façade facing south. The rooms have 3 m high French windows, which are triple glazed with low-e glass and argon filling. All rooms open to the conservatory, which is glazed with double low-e glazing.

The thermal performance of the houses was monitored in year one of occupancy.[20] Under normal occupancy the internal temperature has not dropped below 17°C with typical temperatures during winter 18-20°C. There are minimal draughts and fabric temperatures are similar to that of air. Typical summer temperatures are 22–23°C and the houses are kept relatively cool by the thermal mass and glazing, self-shading and use of passive ventilation in conservatories.

[19] Hocketon Housing Project, http://www.hockerton.demon.co.uk/
[20] Energy Efficiency New Practice Profile 119

Prisma Nuremburg

Joachim Eble Architects

This 9 storey, mixed use development in the centre of Nuremburg has a shopping precinct on the ground floor, the next three floors are offices and the top floors are private residential.

It offers a secure environment for a kindergarten, which serves the on-site housing as well as access to a range of useful facilities.

Attention was given to specification of environmentally sound materials - notably the finishes. Concrete is only used where absolutely necessary. Timber finishes are used throughout and the paint and other surface treatments are all low or zero emission.

Passive solar and natural ventilation strategies utilise waterflows and planting in atrium spaces.

The water strategy is based on catching, conserving and recycling on site.

BedZED – Beddington Zero Energy Development, Sutton

Architect: Bill Dunster

Beddington Zero Energy Development is designed as an environmentally friendly, energy-efficient mix of housing and workspace in Beddington, Sutton.

The development aims to use only energy generated on site, from renewable sources. It claims to be the first large-scale carbon neutral community and Britains largest eco-friendly residential property development.

A combined heat and power (CHP) unit produces 110 kW, to meet all of the heat and electricity requirements of the developments, from tree waste sourced from a local tree surgery. Hot water is circulated around the site via insulated pipes. These pipes deliver heat to centrally located domestic hot water cylinders in each home. The cylinders serve a dual purpose as hot water storage units and heat emitters. The cylinders are insulated but have a low output finned tube radiator attached to a thermostat that trickles heat into a home as required.

Solar power is used at the site for three purposes: solar shading control, electricity generation and as the skin of the building that also offers weather protection. The 109kW installation from BP Solarex charges the batteries of the scheme's pool of 20 electric cars.

The Bourne House

Architects: Gaia Architects

An environmentally friendly house built near Aberfeldy by Gaia Architects. Constructed in 1992 and consisting of 2 storeys with a large passive solar conservatory, timber frame and breathing walls. It won the House of the Year in 1992.

Natural daylight is allowed to flood into the interior through the double height conservatory, which doubles as part of the living area and the stairwell. Large windows elsewhere in the house, especially the full height gable windows in the bedroom, combine to give a bright and welcoming interior.

Kirk Park, Dalguise

Architect: Gaia Architects, Aberfeldy

A low budget house built in 2001with a Rural Home Ownership Grant provided by Communities Scotland for local people whose income does not enable them to raise a sufficient mortgage to enter the housing market. The site was a greenfield site resulting from the council extending the village boundary in the local plan.

Kirk Park is a small three bedroom house - 76m^2 built to Scottish Homes space standards. It feels spacious because of the full height living space with a gallery. Originally this was accessed by a loft ladder but later a timber staircase was built and the gallery has become a sitting room.

The superstructure is constructed entirely in timber with horizontal timber cladding. It is a very economical construction requiring only a single leaf of substructure blockwork. The exposed rafters and natural slate roof are in keeping with the local vernacular.

The house is well insulated with 200mm cellulose insulation in the roof & 150mm in the walls & the suspended timber floor. The larger south facing openings utilise any available sunlight through high performance double glazing. Most of the heating is provided by a small centrally located wood-burning stove. A condensing LPG combi boiler provides hot water and radiators for extreme weather. The family report that all of the energy costs average less than £10 a week.

The contract price of £70,000 included the installation of a septic tank and a private water supply.

Blaabaerstien Housing Association, Nesodden

Architect: Rosland (late 1970's).

The project consists of approximately 200 houses of various sizes and occupied by people of average income. It is terraced housing of moderate to low-density on a rocky hillside that backs onto a forest. The development is integrated excellently in natural terrain. Schools and shops are a 5 min walk . Cars are relegated to perimeter (you can drive in to deliver fridges, children and granny but the understanding is that cars are not left). The car parking is in communal underground garages - an easy option on a hillside. The housing is subdivided into groups of about 20 units around courtyards/playgrounds. It is very social.

An exemplar for private or social housing anywhere.

5 FURTHER INFORMATION

Policy Background

- A Better Quality of Life: A Strategy for Sustainable Development for the UK, The Stationery Office 1999, www.sustainable-development.gov.uk/uk_strategy
- Building a Better Quality of Life: A Strategy for More Sustainable Construction the UK, The Stationery Office, April 2000 – DETR www.dti.gov.uk/construction/sustain/
- *A Policy on Architecture for Scotland* Scottish Executive, 2001 www.scotland.gov.uk/library3/construction/apoa-00.asp
- *Client Pack, Construction Works Procurement Guidance* Scottish Executive www.scotland.gov.uk/building/client.asp

Guidance on Housing Design

- Howard N, Anderson J, The Green Guide to Housing Specification, 2002
- Rao S, et al EcoHomes – The environmental rating for homes, 2003
- Berge, B The Ecology of Building Materials Architectural Press, 2000.
- Pearson D., The Natural House Book Gaia Books 1989
- Hall K., & Warm P., Greener Building Products and Services Directory AECB 2002 (www.newbuilder.co.uk)
- Stevenson F., **Sustainable Housing Guide** Scottish Homes 2000
- Borer & Harris The Whole House Book 1998
- The Scottish Office, Siting and Design of New Housing in the Countryside, Planning Advice, Note 36, 1991
- Halliday S.P & Pemberton G., Scottish House: A Review of Recent Experience in Building Individual and Small Groups of Houses with a View to Sustainability, the Use of Traditional & New Materials and Innovative Design, Scottish Executive 2001 Scottish Executive CRU
- Fitting New Housing Development into the Landscape, Planning Advice Note, Pan 44, The Scottish Office, Environment Department, March 1994
- Fields of Vision – New Ideas in Rural House Design, Royal Incorporation of Architects in Scotland, 1993
- Roaf S, Fuentes M, Thomas S, Ecohouse – A Design Guide, 2002
- Smerdon T, Wagget R, Grey R, Sustainable Housing – options for independent energy, water supply and sewerage, BSRIA, 1997
- The Real Green Building Book 2000, Association for Environment Conscious Building

Case Studies

- Halliday SP *Feedback Case Studies* BSRIA 1996
- Halliday S.P., Sustainable Design CPD Series Gaia Research
- Vale R&B *Towards a Green Architecture 6 Practical Case Studies* 1991 RIBA.
- EEBPP, Report 38: Review of ultra-low-energy homes- A series of UK and overseas profiles 1996
- Halliday S.P & Pemberton G., Scottish House:as above
- Stevenson F., **Sustainable Housing Guide** Scottish Homes 2000
- Sustainable Housing Schemes in the UK, A guide with details of access, Hockerton Housing Project, 2002
- The BedZED files, Building for a Future, Volume 13, No 3, Winter 2003/04
- GIR 46 **Energy Efficiency in Scottish Housing Association refurbishment projects** 1999
- **10 Overcoats - Fascade renovations** Danish Ministry of Housing & Building

Construction Process and Methods

- Halliday S.P.,Sustainable Design CPD Series Gaia Research
- Halliday SP The Green Guide to the Architects' Job Book RIBA Publications 2000

Organisations

- **AECB** (Association for Environment Conscious Building) covers a wide range of expertise from architecture to specialist subcontractors. They produce a publication listing the range of services available from members. www.aecb.net
- **SEDA (Scottish Ecological Design Association)** covers primarily design concerns but does also have builders in its membership and is heavily buildings oriented. www.seda2.org
- **Centre for Alternative Technology** Fact Sheets and demonstration projects www.cat.org.uk
- **The Gaia Group** - sustainable design and on other modules in this series. www.gaiagroup.org
- ***Considerate Constructors Scheme Information Pack*** considerate.constructors@dial.pipex.co.uk
- ***Conservation Architects Scheme Information Pack*** www.rias.org.uk
- **Construction Resources** www.ecoconstruct.com
- **National Recycling Forum** www.nrf.org.uk/buy-recycled
- **RIAS (Royal Incorporation of Architects in Scotland)** www.rias.org.uk
- **Salvo** www.salvo.co.uk
- **Sustrans** www.sustrans.org.uk
- **Wlater Segal Trust www.segalselfbuild.co.uk**
- **UK** trust helping people to build their own homes using the Segal method with an emphasis on low impact healthy materials.
- www.iea.org/standby Lebot B., **Reducing Standy Power Waste to Less than 1 Watt: A relevant Global Strategy that Delivers**
- Greenpeace have a website 'PVC Alternatives Database' the website explains issues about PVC. It lists PVC products and alternatives, by country or by product http://archive.greenpeace.org/~toxics/pvcdatabase/
- The Energy Saving Trust- government funded and provides a wealth of information to householders, in particular. The Trust's website is well written and useful for both the commercial sector and individual households. 0207 222 0101, www.est.org.uk
- **The Friends of the Earth Campaign** at: www.foe.org.uk/campaigns/climate
- www.greenelectricitynetwork.org/
- www.unit-e.co.uk
- www.npower.com
- www.greenelectricity.co.uk
- www.greenelectricity.dial.pipex
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