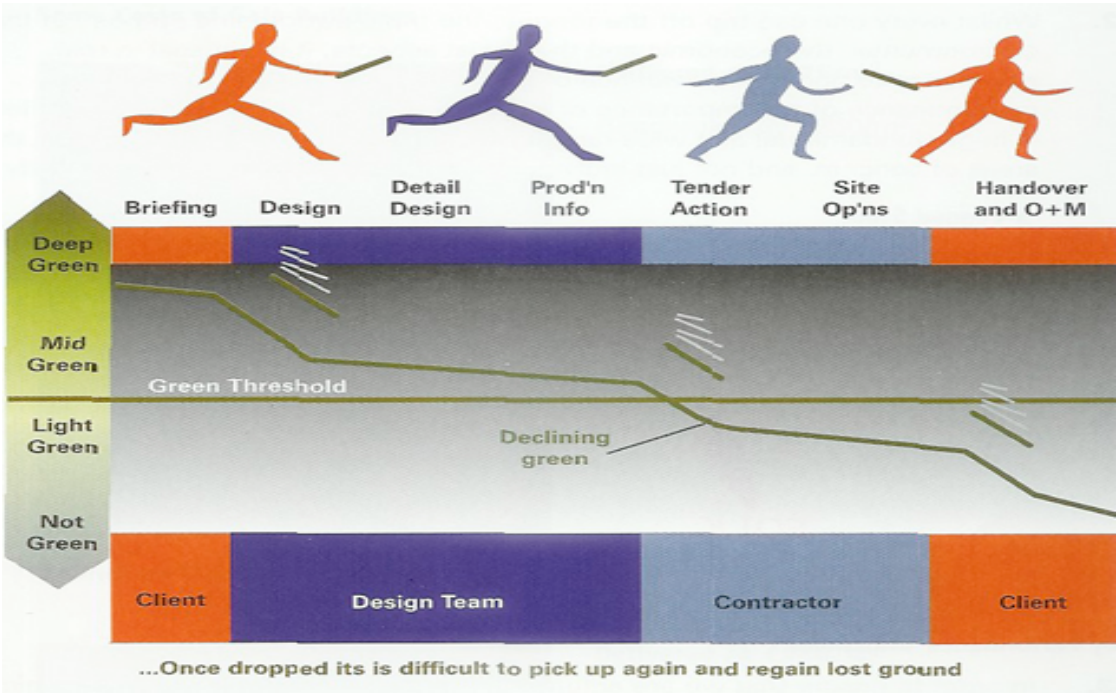
Project Management Guide for A Sustainable Campus v.3

University of Strathclyde



"Estates Services will pursue Sustainable Development in all its investments and create a world class Sustainable Learning Environment"

University of Strathclyde Glasgow

gaia group

"The process of procuring sustainable buildings puts an onus on all involved to go beyond practices that have been standardized over the last few decades and to challenge processes that people have become comfortable with"

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INTRODUCTION

The University of Strathclyde recognises the development of sustainable buildings and places as fundamental to its reputation, viability and performance. There is a strong commitment to putting sustainable development at the centre of national policy and Estates Services (ES) wishes to participate fully in this aspiration and to gain the benefits.

The University of Strathclyde Estates Services (ES) role is to aid and facilitate procurement and refurbishment of buildings within the context of overall university strategy and policy. Estates Services perceives sustainable building design as a process that requires continual attention from inception to handover and beyond, rather than a set of add-ons that are a cost and maintenance burden.

The Estates Service Sustainable Development Policy clarifies the aim, objectives and benefits of sustainable development of the University stock and campus.[1] Alongside the policy ES has developed Sustainable Design Quality Standards (SDQS)[2] in the form of minimum ***performance targets*** that ES is seeking to deliver in new and refurbishment buildings from 2010 onwards. It is intended to assist ES to procure new buildings and upgrade the current stock to meet the needs, requirements and aspirations of users and the wider community, and deliver best value in the short and long term.

ES is aware that sustainable buildings cannot be delivered through business as usual. It requires the widespread deployment of new skills, a change in approach, and more commitment to genuine sustainability than has been evident in much recent procurement. It was felt that the delivery of sustainable buildings was much more likely if clients and project managers were aware of the ES approach in the form of a practical guide. Therefore in addition to the Sustainable Development Policy and the **Sustainable Design Quality Standards** Estates Service have produced the **Project Management Guide to a Sustainable Campus** It is intended to assist in delivering buildings that: -

a. Minimise adverse social, environmental and economic impacts by: - meeting and exceeding user and management aspirations for fit for purpose facilities, protecting occupant health & well-being; minimizing generation of waste & pollution; being flexible and functional, manageable, maintainable and affordable to build and to run; minimising future legal and economic liability by avoiding potentially harmful products and materials that may prove difficult and or expensive to dispose of at a future date; and protecting the wider environment during construction, operation, re-use and at the end of their useful life;

[1] The University of Strathclyde Estate – Sustainable Construction Policy
[2] Sustainable Design Quality Standards

b. Enhance positive environmental, social and economic impacts by: - being healthy, resource efficient and affordable, providing facilities that that enhance teaching, learning and research, are responsive to individual, University and community needs and aspirations, and are respectful of the environment on which we all ultimately depend.

It is a vital part of the ES response to the current demands for more sustainable buildings and places. The contents of this guide aim to communicate from ES to project managers, design teams and users the essential components in the process of delivering, well performing, sustainable buildings and places. This guide supplements existing guidance on procurement. [3] It should be read in conjunction with the policy and standards and other procurement information.

The guide is relevant to new and refurbishment projects. For the latter, the section What Next is a useful starting point prior to beginning the procurement process at Stage A.

This guide also aims to counteract the widespread misunderstanding that current building design and refurbishment procurement approaches are optimized. They are not. The context for building procurement for the last 40 years has largely been on the basis of time and cost. However over the same period economic, environmental and social policy have been changing, and continue to change, to reflect improved understanding of the impacts of built development. Contemporary procurement needs to recognise and respond to these changes if they are to represent responsible practice and best value in the short and long term. Some new skills are required.

This guide cannot provide all the answers in the design and refurbishment of all current and future university buildings, but it should communicate ES's seriousness in addressing the issues seriously and in seeking commitment from its supply chain and consultants. It also should provide an underpinning strategy, and act as a 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. Ignoring or inadequately addressing the issues raised here will lead to a less than satisfactory result.

[3] The requirements are captured in existing policy and EM procurement guidance that can be found at www.strath.ac.uk/estates/

2 SUSTAINABLE BUILDING DESIGN - PRINCIPLES

2.1 What is Sustainable Building Design?

Buildings are designed to respond to social and/or business needs and they inevitably have social, economic and environmental impact. Sustainable Building Design is intended to ensure that the influence at all three levels is as far as possible a positive one and to deliver the best possible outcomes in the short and long term. Sustainable buildings should represent best value in the short term and also buffer clients from predictable future risks such as climate change, future liability and resource depletion.

Sustainable Building Design is advanced class contemporary procurement – not only responding to time and cost constraints but also to environmental, social and economic issues.

Sustainable building design requires building or refurbishing to the highest quality and functional standard, within cost yardsticks that reflect the whole building life cycle such that investment can be properly maintained, and with maximum environmental and social benefit. Upgrading will help the University to meet its commitments.

Sustainable building design and refurbishment means applying of a set of design parameters which have often had insufficient attention in the past: - future flexibility, resource consumption, material sourcing, impacts of materials on health, indoor environmental health, pollution, waste avoidance, biodiversity, transportation, impacts on a local community, maintainability, life cycle operation and associated life cycle costs.

The spaces between buildings are also vitally important in making places that are functional, safe and enjoyable and they can play an important part in offsetting adverse effects of construction through appropriate planting, finishes and place making.

Features of a Sustainable Campus

- Has a well-understood and University-wide commitment to sustainable development and a management policy to implement that commitment.
- Meets the functional needs of the University and integrates with the wider community.
- Has attractive design.
- Recognizes people and buildings as vital assets of the University.
- Enhances the work environment through stimulating internal conditions including good natural light, good ventilation and personal control.
- Has a high quality external environment that facilitates outdoor activities.
- Does 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.
- Is responsive to local community needs, requirements and aspirations.
- Enhances biodiversity locally and globally and does not use materials that threaten species or environments.
- Does not cause unnecessary waste of energy, water or materials due to short life, poor design, inefficiency or poor quality construction procedures.
- Uses materials that are environmentally benign in manufacture, use and disposal.
- Is well understood so as to be affordable to run, manageable and maintainable.
- Does not consume a disproportionate amount of resources, including land during construction, use or disposal.
- Uses renewable and non-toxic recycled resources wherever possible.
- Creates minimum dependence on polluting forms of transport and encourages access to safe, non-polluting and sustainable transport.
- Is flexible to facilitate changes in policy and technology and which allows expansion or contraction in the future, where appropriate.

2 SUSTAINABLE BUILDING DESIGN- PRINCIPLES

2.2 Why is Sustainable Building Design important?

A defining aspect of construction activity in the 21st century is the move from the need to undertake construction within time and cost constraints to a realisation that construction activity must also acknowledge its significant social and environmental impacts and the need to embrace social and environmental constraints.

Changes in attitudes towards the environmental and social impact of construction have been taking place in recent years prompted by a range of factors. As a consequence there have been significant changes in policies and legislation and in expectations with regard to environmental and social responsibility of organisations. These changes mean that building in a more sustainable manner is recognised by ES as having real financial, social and qualitative advantages in the short and the longer term. Sustainable buildings i.e. those that are flexible, healthy, efficient, maintainable and manageable can reduce adverse environmental liability, deliver financial benefits from resource productivity and maintain long-term investment.

The benefits of giving attention to these aspects range from enhanced employee satisfaction, to financial advantages resulting from the shifts in taxation to reverse unsustainable trends in resource consumption and pollution.

2.2.1 Asset Management

" A number of studies document measurable benefits for enhanced daylighting, natural ventilation, and improved indoor air quality in buildings. Benefits ... include enhanced employee performance and student productivity, as well as reduced absenteeism and illness."[4]

Buildings and people are valuable assets. University buildings and the campus affect the health and well being of individuals. Where the buildings and spaces fail to fully contribute to teaching, learning and research or where they create excessive financial liability, they are clearly undesirable and unsustainable. Employers are increasingly attentive to the productivity benefits of improving the work environment through a range of approaches. Teaching and learning are known to be enhanced by good building design including daylight, indoor air quality, and the creation of a sense of community.

[4] A Report to California's Sustainable Building Task Force - The Costs and Financial Benefits of Green Buildings 2003

Contemporary Construction

Changes in attitudes towards the environmental and social impact of construction have been taking place in recent years 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 requirement to live within the limits of the earth's capacity to provide materials for our activities and to absorb the waste and pollution that our activities generate.
- Increased awareness of these and other environmental issues and their presence and importance on the political agenda – locally, nationally and internationally.
- Increasing recognition that the quality of buildings and the natural environment are essential to the maintenance of our human life and to improving quality of life.
- The realisation that the built environment has a crucial impact on the physical and economic health and well being of individuals, communities and organisations.
- Recognition that the construction, fit out, operation and demolition of buildings is a huge factor in human impact on the environment directly - through material and energy consumption, pollution and waste, - and indirectly through pressure on infrastructure.
- The desire to show evidence of best value in the long term. This means looking at whole life costs and building functionality .as fundamental aspects of design.
- 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 'Building Related Ill-health'.
- Recognition that sustainable construction has to be seen as a process rather than a product delivered at handover. The construction industry cannot be seen in isolation from supply, construction processes and manufacturing or from the proper management and maintenance of buildings in use.
- The action of individuals, professionals and communities in challenging imposition of inappropriate buildings rather than those that meet identified needs and contribute to genuine improvement.
- Understanding that a sustainable built environment brings real quantifiable benefits.

As a consequence there have been significant changes in policies and legislation.

2.2.2 Future Proofing

It is important to ES to ensure that buildings provide ongoing benefit into the future rather than the unwelcome burden that much of our current stock represents. It is clear that much recent built development is less efficient, less healthy and less attentive to organisational needs than it might otherwise be. Given the changing environment in respect of legislation and resource management there is imperative to act.

The increasingly widespread political and social concern for the environment has been one of the most significant changes of recent years. Increasingly environmental concern has been identified as linked to social and financial consideration as vital components of ***sustainable development***. This is now fully acknowledged by national and international policy that is intended to ensure development that results in increasing 'quality of life' for all. The alternatives '*unsustainable development*' or '*no development at all*' are manifestly less attractive.

There is a need to ensure that investment made today is relevant to future needs and aspirations including social, technological and regulatory changes. International commitment to sustainable development means 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.

Increased public awareness and understanding about long-term costs and impacts of buildings means that many clients are actively seeking resource efficient, non-polluting and healthy buildings. Clients must now consider a buildings' value in respect of the legacy that it bestows on a planet with diminishing resources and under pressure from a wide range of pollutants.

Sustainable buildings provide a promising way to help to address a range of long-term challenges facing ES such as:

- The high cost of infrastructure and security of energy supply;
- Increases in water charges;
- Increasing cost of waste disposal, especially toxic and special waste;
- Continued pressure (through taxation and legislation) to cut pollution;
- Continued pressure to improve indoor air quality through regulation;
- Growing concern over the cost of alleviating the consequences of global warming;
- Increasing expense of maintaining and operating buildings;
- Growing concern over pressures on biodiversity.

Maintaining the Investment

- All building design involves a balance between up-front expense, on going running costs and maintenance, eventual decommissioning and dismantling.
- Sustainable buildings are intended to provide social, financial and environmental benefits over their life that unsustainable buildings do not.
- This does not mean that they will necessarily be more expensive in capital terms. Option appraisals should provide sufficient information throughout the design process to enable decisions to be made about what represents best value.
- Design decisions should reflect the building lifecycle but we are currently at an early stage in our ability to do this. The life cycle benefits of maintenance, productivity and resource effectiveness should not be overlooked in favour of short-term capital cost savings.
- The running of a facility 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 individuals and organisations are in future likely to be much more pro-active in asserting their rights and making clients and designers accountable.
- 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 and 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.

2.2.3 Key issues

Emerging evidence suggests that poor environmental performance will be penalised in future and the benefits of good performance will be increasingly apparent as economic instruments begin to penalise, and reward, in order to reverse unsustainable trends. Designers of buildings will be required to satisfy a number of criteria to deliver best value. Some of the issues and e are provided as guidance.

Manage the Process – The design and delivery process is crucial to sustainable building design.

- Ensure a commitment to responsible procurement and purchasing in your sustainable development policy.
- Recognise sustainable design as part of a process, rather than simply a product at handover.
- Have in place process tools that extend from consultation, through design, site issues, commissioning, handover and post occupancy evaluation.
- All professional service providers should show evidence of experience and training of themselves and their subcontractors and of past performance.
- Ensure that project managers, the design team and contractors demonstrate commitment to compliance with sustainability objectives evidenced by method statements covering their role in ensuring its delivery.
- Employ specialist advice in undertaking appraisal of their commitment, aspirations and experience.
- 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 with measurable targets.

Create Healthy Environments - enhance living, leisure and work environments; do not endanger the health of the builders or users, or others, through exposure to pollutants or toxic materials or harmful organisms.

- Materials and products should present no health risk over their lifecycle.
- Consider the impact of the indoor environment on the well-being of users.
- Consider the layout, depth and accommodation on occupants' requirements for view and daylight.
- Avoid materials that contain VOC's or other pollutants.
- Put in place a cleaning regime that uses healthy materials.
- Locate noisy equipment away from sensitive areas.
- People like control of their environment.
- Centralised control can be acceptable if occupants are consulted.
- Make links to outside to encourage outdoor enjoyment and recreation.

Support Communities – identify and meet the real needs, requirements and aspirations of communities & stakeholders and involve them in key decisions.

- Consult stakeholders including users and future managers and ensure that they are engaged in the process.
- 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 these might impact on local communities.
- Avoid nuisance during construction or post completion.

Minimise Pollution - create minimum dependence on polluting materials, management practices, energy and transport;

- Materials and products should have minimal adverse environmental impact from sourcing to end of use.
- Materials should have minimum embodied toxicity and long maintainable life.
- Materials should facilitate safe and efficient recycling or ultimately disposal.
- Products should have minimum dependence on non-renewable resources over their lifecycle.
- Materials such as paints and finishes should be free of VOCs.
- Avoid treatment of timber through design detailing.
- Where there is a choice use materials as close to their natural state as possible.
- Locate building near to low-impact transport networks.
- Consider the availability of the public transport infrastructure and encourage use of public transport and cycle, pedestrian safe access and storage and facilities that will encourage such as shower provision.
- Consider joint uses between the project and the local community – such as café space or library facilities.
- Use landscape as an integral part of minimising adverse impacts of transport e.g., enhancing cycle ways.

Enhance Biodiversity - not use materials that threaten species or environments and improve natural habitats through appropriate planting and water use.

- Fully investigate the opportunities for enhancing biodiversity.
- Materials should be used with minimum adverse impact on biodiversity.
- Maximise habitat creation and minimise disruption.
- 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.
- Ensure choice of plant / seed varieties encourage a range of microhabitats & feeding opportunities.
- Investigate alternatives to hard landscape (porous paving / car block / gabions).

Use Resources Effectively – not consume a disproportionate amount of money, energy, water, materials or land during construction, use or disposal; not cause unnecessary waste due to short life, poor design, inefficiency or poor construction and manufacturing procedures; and be affordable, manageable and maintainable in use;

- Minimise energy and water consumption and sewage to reduce infrastructure and minimise costs in use.
- Investigate cost effective opportunities to improve energy and water utilisation.
- Conservation is generally the best value option. E.g., low water consumption and low flush fittings, energy efficient goods and good control.
- Avoid water collection and recycling that raises overall costs and introduces need for chemical treatment.
- A SUDS strategy offers excellent potential to improve landscape design quality and enhance biodiversity.
- Consider form, orientation and landscape and opt for passive solutions wherever possible.
- Adopt a strategy where mechanical systems support passive systems and do not substitute for them.
- Look for local sources of heating and cooling such as incineration or aquifer cooling
- Well-designed controls are vital.
- Involve management in briefing, design and handover.
- Avoid recycled materials with embodied toxicity, as this is a risk to health and a future financial liability.
- Design for dismantling, deconstruction and re-use.
- Include waste minimisation in design criteria including recovery of materials on site.
- Understand the cost of waste and the benefits of waste avoidance.
- Recognise the direction of policy in respect of special waste and the potential future burden of poor specification.
- Build on existing sites rather than on green fields.
- Design in waste management to the completed building.

2.3 How is Sustainable Building Design achieved?

A range of tools and methodologies promote, assist and measure achievements in sustainable construction. They cover different stages in the construction process as well as different elements. Many have a useful role to play at but should be used with caution to ensure that they respect the context, the client needs and best value.

However, the uncomfortable truth is that sustainable buildings are achieved much less often than clients aspire to them. The reasons are wide-ranging from lack of knowledge and experience of the issues to a contemporary obsession with add-on technology at the expense of build quality. Many aspects are tackled by ES standard specification.

It is relatively easy to establish the key issues to address but delivering on aspirations in practice often proves to be extremely difficult. The process of procurement, design, tendering, construction and handover is vitally important. Failure to be vigilant about sustainability issues during the procurement process is the most likely reason for failure. Simply put the process of procuring sustainable buildings puts an onus on all involved to go beyond practices that have been standardized over the last few decades and to challenge processes that people have become comfortable with. It is in the interests of many to guard the status quo.

Undoubtedly a lack of understanding, skills or commitment by design teams and project managers will undermine aspirations. Hence ensuring that the design team understand the significance of pursuing a sustainable development strategy, and are committed to it, is critical. Vigilance at all stages is vital and the project managers and whole team commit to maintaining sustainable design on the agenda throughout the design and construction process if the project is to have a successful outcome. Sustainability advisors are best equipped to provide support when reporting direct to the client

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 a project aspiration late in the process. This is often cost cutting paraded as value engineering a technique still in its infancy and a term increasingly derided. Value engineering is not a substitute for good design and a fully integrated process. Indeed it could be seen as failure as it often requires cutting of elements otherwise perceived as a need or a requirement.

3 ESTATES SERVICES STRATEGY FOR SUSTAINABLE PROCUREMENT

Building procurement generally starts from a commitment to a time and cost. Sustainable building procurement requires success on a number of additional counts. It should: -

- Meet or exceed the requirements of the client;
- Deliver, and show evidence of delivery, of the University commitments to sustainable development and sustainable construction;
- Demonstrate procurement of resource efficient, healthy and non-polluting buildings that support community, enhance biodiversity and can be managed in the long term.
- Be delivered on time;
- Represent best value.

This will only be achieved by constant vigilance. At the outset of the project there will be great aspirations in respect of sustainability objectives. Projects tend to find these aspirations are at risk and undermined as it progresses from first thoughts to completed building. Considerable attention is required throughout the procurement and design process if the appropriate outcome is to be achieved.

All those involved need to dedicate adequate resources, to the full period of design, tender, handover, seasonal commissioning and feedback. Project briefs should incorporate principles and targets that contribute to the process of continual improvement.

In order to avoid late changes the whole team should be engaged in the design process. Design targets should be reinforced with option appraisals based on cost and performance through all stages of the process and slippage between Fee Stages must be avoided. These provide clarity and control and vital time for reflection. Ensure that adequate time is allowed to develop a consolidated design. Attempting to speed up the design process will lead to short cuts and is unlikely to deliver the best result.

Yet further attention is needed to ensure that the investment is maintained in optimum condition after handover, which needs to be planned for throughout the project. Responsibilities for handover need to be will assigned early on.

3 ESTATES SERVICES STRATEGY FOR SUSTAINABLE PROCUREMENT

3.1 Communicate the requirements clearly & unequivocally

In order to achieve sustainable buildings and a sustainable campus ES should clearly, thoroughly and contractually define and demand sustainable design. It is also important to communicate the intended outcomes of an appropriate approach and to have a procurement system that can deliver.

ES has set out their sustainable design objectives clearly and has undertaken development work over a two-year period to set and agree a framework of standards for 2010 and proposed standards for 2012. This point forward provides the opportunity to ensure that **everyone** involved understands the nature of a sustainable approach, together with the benefits, responsibilities and issues.

The requirements need to be reinforced through all stages of the procurement and refurbishment 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 Contractor and back to the Client.

- **The ES sustainable construction policy and standards need to be communicated** internally in the first instance so that all involved are aware of the aim, objectives and principles and have the opportunity to comment on them. The policy and standards are a good starting point.

- **ES needs to highlight strategic sustainability issues of importance to all projects** such as attention to location, orientation, design and construction detail, resource conservation, manageability, usable controls, appropriate tender procedures, targeting and integration.

- **ES needs to assess its own capacity and skills base** and if necessary seek the appropriate in-house training in fundamentals of sustainable design. These factors will influence the various types of appointment, the associated roles and responsibilities and any specialist consultants and/or requirements.

- **ES needs to consider the supply chain and procurement process** and determine whether it is fully appropriate to meeting the sustainable development agenda. Many project managers, designers and constructors do not recognise the benefits to clients offered by sustainable construction. They too often pay only lip service to the requirement and as a consequence opportunities are missed.

- **ES may wish to consider introducing more stringent competition, rewards and penalties for delivery of design objectives**. It is not sufficient to assume that sustainable design will be delivered without a combination of experience, training, and commitment to principles and targets.

- **ES should expect project managers, design teams and constructors to have undergone appropriate and validated training** to address contemporary and relevant issues ranging from materials specification to air tightness detailing.

- **The client or client group should be introduced to the sustainable development policy as an aspect of the project brief.** An informed client is essential to success and they should be directed to policy and training and sustainable projects.

3 ESTATES SERVICES STRATEGY FOR SUSTAINABLE PROCUREMENT

3.2 Identify and communicate the benefits

In order to embark on a sustainable construction programme there is a need for all involved to understand the benefits that it will deliver for clients and users. It is important to secure the necessary commitment on the part of the client and/or those with the authority within the client group.

- **Draw up a list of specific opportunities and benefits to the university and ES and keep these at the forefront of your thinking as a design develops.**

- **Encourage other stakeholders to draw up a list of specific opportunities and benefits. Include the client group, users, community, designers, management and contractors.**

  - Include direct benefits such as cost-in-use that are relatively easy to quantify, such as power, energy and water savings and avoidance of waste. This may require internal discussions to clarify returns and appropriate 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 this looking for short term gains is not good sense.user satisfaction, community enhancement, enhanced teaching and learning, improved health and productivity and reduced liability.

  - Potentially more significant but harder to quantify are the estimates of productivity improvements and reduction in sickness and ill-health resulting from better indoor environments through avoidance of off-gassing materials, better ventilation, personal control and good daylighting.

  - Also consider inclusion of impacts on meeting legal obligations, public profile and corporate social responsibility.

- **Encourage stakeholders to take steps to make a positive impact in areas under their influence.**

Some Potential Benefits

Improved Process Management

- Selecting a team who have, or are prepared to attain, the appropriate skills.
- Selecting the design team who are committed to deliver sustainable design.
- Setting appropriate fee structures.
- Allowing adequate time for development of best value solutions.
- Preparing tender documentation such that sustainable design is tied down.
- Engaging bidders cogniscent of sustainable design as best value.
- Implementing responsible site procedures.
- Establishing supply chain management where specification involve innovation.
- Engaging user and management participation at an early stage.
- Improved build quality.
- Ensuring that commissioning and handover is undertaken properly.
- Facilitating interdisciplinary design.
- Smoother handover and operation.
- Establishing formal feedback including post-occupancy evaluation.

Improved Communication

- Determining the needs, requirements and aspirations with stakeholders.
- Demonstrate commitment to meeting govt and social objectives.
- Establishing and communicating priorities and value systems to advisors.
- Ensuring that consultants understand objectives and have adequate support.
- Developing teamwork.

Employee Satisfaction

- Improved performance and work satisfaction.

Improved Environmental Performance

- Reducing waste.
- Minimising pollution in all forms.
- Avoiding use of toxic substances.
- Positive impacts on biodiversity.
- Reduced travel related environmental impacts.

Future Proofing against Legislation and Financial Liability

- Improved flexibility to extend building life.
- Reduced liability for disposal of materials and products that represent special waste.
- Reduced building related ill- health.

Best Value

- Improved manageability and maintainability.
- Reduced capital cost.
- Reduced costs in use.

4 WORK STAGE ISSUES

Before Gateway ZERO- Strategic Assessment

There is a point at which strategic non project specific aspects of the sustainability agenda need to be actioned.

These are overarching requirements outwith any particular project such as setting timescales for actions identified in the sustainability design quality standards matrix including establishing the datum of University impacts in order to create the basis of continual improvement.

The Design and Contractor Frameworks need to be integrated with the sustainability policy and SDQS. Project managers and design teams should provide commentary on their role in all aspects of the SDQS and provide the required policy information and sign up to the required commitments.

Gateway ZERO- Strategic Assessment

At this point project specific aspects of the sustainability agenda need to be raised and demonstrably incorporated into the feasibility study.

These are requirements of any project such as setting timescales for actions identified in the SDQS and establishing that the project can meet the requirements in relation to transport policy and IT. Estates Services also needs to set reduction targets against the current datum

4 WORK STAGE ISSUES

STRATEGIC BRIEFING
Stage A: Appraisal - Clearly set out the project aim and the sustainability objectives

It is important at the outset of a project to consult on the needs, requirements and aspirations of the client body and to determine the impacts on others who may be affected. This should ensure that it is a building or refurbishment that is needed, and that ES can achieve the right building, in the right place. The appraisal needs to embrace the widest range of options and define the project clearly and comprehensively. For refurbishment projects read the Section 5 and then return to this Stage.

- ES to engage with the client group. Establish who will be crucial to the success of the building in the long term and adopt an approach that encourages their involvement - include students, teaching, research and administrative staff building operators and management.

- ES to identify if current premises are being used effectively and whether there is opportunity to identify beneficial changes or integration with other users.

- Clients will want to improve their ability to carry out core responsibilities, which should be clearly identified by ES and developed as a strategic aim of the project.

- ES to assist the client to identify business, technical, resource and environmental requirements.

- In sustainable terms the appraisal needs to consider contemporary influences that may include: -
  - University/ES Policy
  - Change management
  - Technology Choice
  - New ways of working
  - Health and Productivity
  - Sustainable travel
  - Alternatives to a building in achieving the same result

- ES to communicate the sustainability aspirations to the client group and assist them to determine their priorities in the form of a brief. The SDQS will be a good starting point.

- ES to provide the stakeholders with good quality information on the direction of economic, social and environmental policy that will impact on them and assist them to draw up a list of specific opportunities and benefits (see p. 23) that sustainable design will deliver.

- ES to draw the client attention to their legal and other responsibilities. As a result of international and government policy, the regulatory framework is changing and there are

implications for building operators to be considered.

- ES to encourage radical thinking about current and future needs. Rethink assumptions about teaching, learning and research needs. The impact of social and demographic changes, in combination with new technology, is profound.

- ES to consult with affected communities to inform the process. The consultation should not raise expectations that cannot be delivered.

- ES to determine the most vital constituents of the core procurement management team and establish robust lines of communication. Identify procedures to be used in the event of a need for clarification by the procurement management team.

- ES to establish criteria for selection of the project management and design team. Including track record, commitment to interdisciplinary working and environmentally responsible design.

Note for Clients & Building Users

- Embarking on procurement or refurbishment of a building is a daunting task that will become more so as it progresses. Only after handover will many clients be aware of the enormity and complexity of the task. It makes sense to be well prepared.
- A successful built development project requires commitment on the part of the Client or Client Group particularly in the early stages to inform strategic thinking.
- Become an informed client - An informed client is essential to the success of a project. You will be more likely to achieve benefits if you have knowledge of the issues, the appropriate questions to ask and, importantly, the proper time to ask them i.e., before it is too late.
- Understand the direction of economic, social and environmental policy that will impact on your project in the short and long term.
- Identify any sector or project specific funding opportunities and conditions that apply and bring these to the attention of ES.
- Visit best practice projects and become involved in discussion networks on sustainable procurement, design and construction.
- Identify and firmly agree responsibilities at an early stage.
- Recognise the importance of vigilance at all stages and maintaining sustainable design on the agenda throughout the design and construction process is in your best interest.
- Identify someone early on who will be responsible for taking control of the finished building.

Note on Appointing Interdisciplinary Design Team

- Appoint members of the design team as soon as they can usefully contribute, to an interdisciplinary approach. This will enable a more creative and efficient use of form and fabric and better functionality and manageability than is likely to be achieved by individuals working in isolation.
- ES should ask for evidence of experience and training and achievements from design teams to discriminate between those claiming knowledge of the issues and those who have made real, even small, contributions to sustainable design. [5] (see below)
- The commitment of the project management team to delivering the benefits of sustainable design to the client is critical. They must demonstrate full knowledge of the benefits and be prepared to take on board new tools and methodologies if appropriate.
- Fee structures should reflect the pursuit of a naturally serviced environment based on project or life-cycle cost, the potential for capital and, if appropriate, running cost savings and the levels of As each design team member is considered, it may be useful to recognise that the scope of professional services agreed should acknowledge that sometimes additional, and difficult to define, inputs are required to design in an interdisciplinary manner without leaving areas of uncertainty.

What to look for in a design team

- Optimise passive solutions in preference to mechanical solutions;
- Avoid gimmicks and oversizing;
- Commitment to design in an interdisciplinary manner;
- Low mechanical services percentage of overall capital costs;
- Prepared to innovate;
- Develop, early on, a handover strategy;
- Waste minimisation throughout procurement and life of the building;
- Experience of delivering to stringent targets for energy and water consumption;
- Use of healthy and benign materials with minimum embodied pollution;
- Whole-life costing in preference to simple capital cost regimes;
- Optimized use of solar gain, passive cooling and passive moisture management to deliver a comfortable indoor environment;
- Optimised use of natural light and air to meet user needs;
- Minimisation of dependence on polluting forms of transport;
- Engagement with the user and management /maintenance;
- Control, usability and manageability as crucial design aspects;
- Commit to specific sustainable design progress reviews with Estates Services at each stage;
- Commitment to meet regularly during the defects liability period.

[5] The Architecture profession has been most pro-active in this regard RIAS Sustainability Accreditation scheme provides 3rd party recognition of skills in project delivery at different scales and complexity of project.

4 WORK STAGE ISSUES

STRATEGIC BRIEFING
Stage B: Design Brief - Investigate the options and develop a best practice brief

This is the opportunity to establish whether the client's requirements are functionally, economically, socially and environmentally sustainable. This will involve a feasibility study that assesses affordability, the relationship of activities to users and the relationship between building type, activity and site. The options should be thoroughly explored.

- In addition to the usual briefing issues ES will wish to consider items that may be unfamiliar to members of the IDT such as new development controls, environmental controls, tools and benchmarking, reporting procedures and process aspects.
- Responsibilities for ensuring the delivery of each of the SDQS should be clearly assigned.
- The relative merits of a number of sites and/or buildings should be appraised to determine which best suit the requirements. This should be an iterative process with consideration of options between new build, refurbishment and acquisition demonstrated.
- The IDT should identify the 'base load' of the project in the form of an estimate of water, energy, power requirements, traffic flows, emissions, noise etc. They should pay particular attention to special processes or needs and to access and neighbours.
- Development or major refurbishment is an appropriate time to investigate potential for strategic resource conservation through a strategic approach to a site such as sharing fuel sources, micro-climate, local transport, topography, potential for land forming and so on.
- This is the right time to consider how the building usage may change over time such as possible extensions, alterations and flexibility of use.
- Consultation at this stage with local, statutory and utility authorities and others is necessary to highlight potential problems, provide information for integration and avoid abortive work. The consultation should meet the requirements of the SDQS and BREEAM.
- Insist on environmentally engineered strategies from services engineers for ventilation, daylighting, cooling and heating.

- The feasibility study should be completed by the IDT to thoroughly appraise the ability to achieve the ES requirements set out its in it SDQS for developments and refurbishments from 2010 and ensure that these are embedded in the brief.

4 WORK STAGE ISSUES

Tasks to be evidenced prior to sign off of Stage B

The completion of the following items must be agreed by the University of Strathclyde internal project manager prior to Stage B sign off.

- All design team members to provide outline commentary on their role in all aspects of the SDQS and demonstrate how the targets will be achieved in this building.
- Design consultants to provide comprehensive sustainability policy, overview of practices, procedures and approach.
- Estates Services to Initiate BREEAM process. Appoint BREEAM assessor.
- The IDT should appoint one of the team to maintain a BREEAM file and record credits achieved.
- Design team to confirm target of BREEAM "excellent" as a contract requirement for new build. And BREEAM "very good" for refurbishment. Design team to provide pre-BREEAM assessment of how sufficient credits will be achieved.
- Design team to provide a policy statement on careful selection of healthy materials.
- Design team to agree to provide EPC label.
- Design team to provide an appraisal of the ability of site to meet or surpass masterplan objectives.
- Design team to agree to schedule of post-completion meetings.
- IDT to initiate site ecology review process. Estates services to appoint project ecologist.
- IDT to demonstrate the "client consultation" strategy to the ES project manager in line with SDQS and BREEAM requirements including regular attendees, meeting schedule, and evidencing and reporting strategy.

A sustainable development progress review must be completed prior to the sign off of Stage B.

This marks the entrance to **Gateway One: Outline Business Case**

4 WORK STAGE ISSUES

OUTLINE PROPOSALS
Stage C: Look for creative comprehensive outline proposals

The location, a schedule of accommodation and the long-term objectives for the building will all have been determined with sustainability aspirations figuring large in the feasibility study. This is the opportunity for a design concept to be presented that is capable of fully meeting all the key requirements and that demonstrates that it is based on a thorough exploration of available options.

- The ES Project manager should ensure that design team members introduced to the project show experience and commitment to interdisciplinary and sustainable design.
- The IDT should review the brief based on the explorations undertaken at Stage B to see if any new opportunities emerge and to ensure that the issues are being addressed timeously.
- The IDT should revisit the performance targets in the SDQS and BREEAM such that standards aspired to fully exploit the experience of the team.
- The IDT should compare and contrast options with respect to structural design, thermal mass, air-tightness and insulation, materials, daylighting, heating and cooling.
- The IDT should undertake option appraisals that fully investigate rainwater harvesting and on-site renewables to determine best value using data based on best practice achievable levels of conservation and life cycle costing. "Just in case sizing" should be avoided.
- The IDT should make bioclimatic design of building and landscape a consideration at this stage. The landscape, building orientation, form and structure should be the principal climate moderators and take account of options with regard to the uses of the building and space planning.
- The ES project manager should look for evidence of an integrated approach to the development of structure and form not isolated or sequential activities.
- The IDT should undertake a review of all passive opportunities for environmental design prior to making assumptions about mechanical servicing. The review should cover pros and cons such as the dilemma between useful solar gain and overheating and glare.
- Identify the functions and demands of each of the spaces and those areas with specialist requirements (heating, cooling, ventilation, acoustic, lighting may all be relevant). Deal with

them separately rather than raise the standard of all the building.

- The ES Project manager should look for evidence of design assessments and system decisions to be accompanied by qualitative as well as quantitative analysis. Include factors related to infrastructure upgrading, maintainability of the structure and fabric.

- Any cooling requirement must be demonstrated as a necessity taking account of best practice knowledge of adaptation. Cooling loads must be modeled and reviewed with the head of building services, with full exploration of alternative management strategies.

- Appointment of an acoustician at this stage should be a consideration as it may influence and assist with selection of materials.

- The IDT should assess the SDQS and confirm any areas where they require specialist input.

4 WORK STAGE ISSUES

Tasks to be evidenced prior to sign off of Stage C

The completion of the following items must be agreed by the University of Strathclyde internal project manager prior to Stage C sign off.

Performance Targets -
- IDT to include a report on progress against all sustainability targets and policies.
- The IDT to provide feedback on all SDQS actions
- The IDT to indicate how all mandatory BREEAM items will be achieved and confirming the BREEAM score is on target.

Climate Strategy – IDT to demonstrate bio-climatic approach to sun and shelter and preliminary modeling to establish availability of solar energy and demonstrate how to optimize thermal gains and shade in relation to layout, uses, views, comfort requirements and glare.

Option Appraisal - IDT to demonstrate appraisals of a range of structural, energy and water management options and proactive pursuit of best value approaches

Lighting/Daylighting - IDT to demonstrate preliminary modeling to establish availability of daylight and how this relates to optimizing building layout and any shading requirements.

Controls - IDT to demonstrate proposed zones and control strategies for discussion with users and managers.

Thermal Design – IDT to demonstrate attention to optimising internal and external gains and eliminating mechanical cooling based on orientation, form, fabric, layout, thermal mass, solar shading, and passive well controlled daylighting and ventilation strategies.

Ventilation - IDT to demonstrate consideration of natural ventilation and awareness of the need to integrate with fire, noise and thermal control.

Landscape - IDT to
- Demonstrate ecological appraisal of site and prevailing climate to help determine orientation and landscape.
- Consider shelter and microclimate in relation to external space and location of entrances protected from prevailing wind and rain.
- Demonstrate how plants and trees may form part of a wider ecological strategy including solar shading, water processing and retention.
- Demonstrate a range of options for management and creative use of rainwater.

Energy Requirements /Power – IDT to
- Demonstrate consideration of minimising load requirements to save on infrastructure.
- Demonstrate consideration of heat recovery options.
- Identify any potential local energy sources.
- Demonstrate consideration of using the least polluting energy source.
- Provide outline EPC calculations and confirm that the required standard is achievable. Demonstrate likely EPC rating and key areas of sensitivity in the design.
- Prepare an integrated LZC technology feasibility study to inform options appraisal.
- Identify that the energy targets are adequate to achieve BREEAM Excellent, evidencing likely and potential credit achievement.

Fire - IDT to demonstrate use of proactive fire engineering at an early stage to generate innovative design possibilities and save money.

Conveying - IDT to demonstrate avoidance except for essential use and disabled access. Encourage use of stairs through appropriate layouts and design.

Waste - IDT to

- Demonstrate consideration of recycling opportunities including design for deconstruction.
- Review contribution to recycling and reuse targets and demonstrate integration with the University Waste Management policy.

Noise - IDT to demonstrate consideration of position of plant that may cause disturbance away from sensitive areas or management of the consequences.

BREEAM - ES Project manager to confirm that all information has been made available to the BREEAM Assessor and is on target.

Water Provision & Treatment - IDT to demonstrate consideration of early strategic decisions about collection, usage, conservation and treatment or rainwater and the implications for building form, infrastructure and land requirements. An audit of water supply and demand is essential.

Materials - IDT to

- Demonstrate avoiding unhealthy materials in the indoor environment.
- Demonstrate avoiding materials with long term-liability for disposal such as PVC based materials.
- Demonstrate how embodied energy issues may influence decisions.
- Confirm available accreditation schemes applicable to key materials.

Secured by Design - IDT to report on any issues that may be relevant to secured by design.

A sustainable development progress review must be completed prior to the sign off of Stage C.

4 WORK STAGE ISSUES

DETAIL PROPOSALS
Stage D: A clear approach to guarantee benchmarks

The Concept design stage should have established the strategic approach. This is the time to take the project to planning permission with a cost plan, signed off by the client.

- The ES Project manager should ensure that design team members introduced to the project show experience and commitment to interdisciplinary and sustainable design.
- The IDT should review the brief to ensure that issues are being addressed and targets met.
- The Targets and handover documentation issues need to be on the agenda of all design team and progress meetings and a person identified who will manage the handover.
- The IDT should demonstrate that strategies for structural design, thermal mass, air-tightness and insulation, materials, daylighting, heating, ventilation and cooling are all now clarified and ensure these are integrated.
- The IDT Project manager should timetable specific design co-ordination meetings to ensure an interdisciplinary approach and avoid the need for downstream changes.
- The IDT should confirm the predicted energy and power requirements to achieve best practice and confirm the energy strategy
- The IDT should confirm the predicted water consumption and any water storage requirements to achieve best practice and confirm the water strategy.
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- The IDT should confirm the waste storage and management requirements to achieve best practice and confirm the waste strategy.
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- The IDT should periodically review the mechanical services specification and ensure that passive and environmentally engineered options have been considered and that oversizing and over-specification is minimized.
- The IDT should ensure that dilemmas between light and daylight, solar gain, overheating and glare are adequately resolved with manageable and well-understood controls.
- The IDT should pay particular attention to controls to provide for user responsibility and flexibility without waste.

- The IDT should take account of time scales and availability of products, materials or systems in establishing the lead in period and be prepared to offer alternatives.

- The IDT should be explicit about controls. All systems should be efficient and controllable to reduce internal gains and waste.

- The IDT and project management team should have a system of recording and auditable file of all major design decisions and implications approved or instructed by the University. This is of key importance as we move to stage D. This ensures that the IDT, UoS, and client departments and clear on the design approach and anticipated outcomes.

4 WORK STAGE ISSUES

Tasks to be evidenced prior to sign off of Stage D

The completion of the following items must be agreed by the University of Strathclyde internal project manager prior to Stage D sign off.

Performance Targets -
- IDT to include a report on progress against all sustainability targets and policies.
- IDT to provide feedback on all SDQS actions
- The IDT to confirm that the BREEAM target can be achieved on budget.

Climate Strategy – IDT to demonstrate detailed modeling to identify sun paths and quantify solar gains, glare and shade and how this influences an optimised layout in relation to uses.

Option Appraisal - IDT to clarify preferred options for structural, energy and water management and demonstrate best value.

Lighting/Daylighting - IDT
- To demonstrate naturally lit internal spaces wherever possible evidenced by daylight calculations and integrated with well controlled and low energy lighting.
- To provide operational statement for exterior lighting. Lights optically set to distribute light to required area only and minimise occurrence of obtrusive light
- Quantify lighting related energy needs.

Controls - IDT to demonstrate
- Appropriate zoning.
- Controls - manual on and manual/auto off.
- Separate management from personal control
- Systems are fail-safe and fail-efficient.
- Energy/water monitoring with exception reporting and diagnostics to simplify fault finding.

Thermal Design – IDT to
- Quantify modeled heating needs and appropriate controls to demonstrate at least 50% reduction on heating from published benchmarks
- Consider implications of any infrastructural upgrading and alternative strategies offered by form and fabric. upgrade with option appraisal for existing properties
- Incorporate air tightness to a maximum of 5 $m^3/m^2/hr$ @ 50 Pa.
- Include passive management of internal humidity as part of design development.
- Quantify modelled cooling needs and identify approach to be taken.

Ventilation - IDT to
- Include modelling and option appraisal to ensure optimised, well-controlled low energy ventilation strategy on a room by room basis
- Demonstrate integration with heating /cooling systems
- Quantify energy implications with properly controlled fan power.
- On polluted sites demonstrate intermediate climatic zones to pre-condition incoming air.

Landscape – IDT to
- Clarify options for management and creative use of rainwater and demonstrate best value.
- Show microclimate design strategy
- Quantify the benefits of a bio-climatic approach to sun and shelter
- Demonstrate use of plants and trees as part of strategy including solar shading and water management.
- Show evidence that project complies with policy on enrichment of public space.

- Create meeting spaces/ zones that link buildings and places. Consider exposure of public space to wind, sun & rain - creating space for shelter as well as sun
- Ensure landscape can be low maintenance and chemical and irrigation free.
- Demonstrate protection of existing ecological features and evidence of adherence to local biodiversity plan and University Biodiversity Policy.to ensure overall biodiversity improvement.

Energy Requirements/ Power - IDT to
- Specify efficient systems and good control.
- Identify fuel sources and any future supply issues over the building lifespan. .
- Confirm energy use in relation to specific targets. i.e., minimum of 30% reduction on building regulations CO_2 targets for new build or 30% reduction on use in existing buildings.
- Demonstrate load/consumption evaluation as per CIBSE TM39, and UoS Metering Policy.
- Provide detailed EPC calculations.
- Clearly identify that the energy targets are adequate to achieve BREEAM Excellent.
- Quantify fan power requirements.

Fire - IDT to demonstrate a fire strategy integrated with noise and ventilation issues.

Conveying - IDT to confirm specification of efficient systems and demonstrate location in relation to requirements are optimized.

Waste- IDT to demonstrate design for separation of wastes and suitable, easy-to-use collection systems for large schemes.

Noise - IDT to programme timing of tests to ensure requirements can be achieved.

Water Provision & Treatment - IDT to
- clarify preferred options for management and use of rainwater and demonstrate best value.
- provide a validated water consumption target based on spray taps and low flush WCs
- provide rainwater collection option appraisal.

Materials - IDT to
- Demonstrate proactive pursuit of healthy and low polluting materials
- Demonstrate how embodied energy issues have influenced decisions.
- Update information on accreditation schemes applicable to key materials.

Secured by Design - IDT to clarify preferred options in line with the brief.

Space Planning - IDT report to demonstrate adaptability in open plan versus cellular spaces

Urban Design - IDT to
- Demonstrate how the project integrates with the campus travel plan, and development aspirations

Consultation – IDT to demonstrate ongoing consultation with client and others affected.

Climate Change Strategy -IDT to confirm SuDs strategy

BREEAM - - ES Project manager to confirm that all information has been made available to the BREEAM Assessor and is on target.

Building User Guide –IDT to confirm input to the BUG with the ES PM, in line with Estates Services Building User Guide documentation.

Travel - IDT to confirm design development of links to public transport, cycling infrastructure in line with the University Travel Plan targets and actions.

ICT - IDT to update the ICT strategy and demonstrate how it meets client needs.

Co-ordination – IDT to include a review covering steps to confirm co-ordination of spatial, structural, constructional, indoor climate and services requirements.

A sustainable development progress review must be completed prior to the sign off of Stage D.

This marks the entrance to **Gateway Two: Full Business Case**

4 WORK STAGE ISSUES

TECHNICAL INFORMATION
Stage E: Clear co-ordinated proposals

This is the point at which integration of structure, services, materials and site is essential, and robust means of consolidation and review are required between members of the design team.

- New team members may be appointed or there may be changes in responsibility. The ES Project manager should ensure that everyone involved understands the issues to date and is adequately trained to implement the requirements.

- This would be a good time for the IDT to revisit the brief and the sustainable design policy, intentions and commitments to ensure that the issues are being addressed and targets met.

- The IDT also needs to plan ahead for specification and buildability if environmental targets are to be achieved.

- The IDT should identify specific aspects of the construction where performance to a defined standard will require post-construction testing and validation, including airtightness. Ensure that these are highlighted as a matter for tender documentation and that adequate information is provided for inclusion.

- The IDT should prepare a pre-qualification statement for materials and products. This may exclude specific materials and nominate others. It should encompass information on verification of sources to meet the BREEAM requirements.

- The IDT should identify where there may be lead times for materials, products or systems and ensure that these are highlighted when going forward to tender documentation.

- The IDT should ensure that stakeholders are aware of the project progress and timescales;

- The IDT should ensure that only the most efficient and resource-conserving systems (conveying, heating, cooling, water, lighting) have been specified and without oversizing.

- The IDT should demonstrate that handover and commissioning of systems have been adequately considered and that there is a nominated individual responsible.

- The ES project manager should confirm that assessments of predicted energy and water consumption in use are used as the basis of selection between systems.

- IDT to confirm that targets can still be achieved develop these into life-cycle cost studies for presentation to the client to inform decision-making.

- The ES project manager should revisit the issue of building management and user control for efficiency and comfort to ensure that the person(s) responsible for managing the completed building are fully in agreement with the requirements and the strategy.

- The ES project manager should involve client/users/operators in discussions on issues concerning maintenance and operation in order to ensure that procedures are fully planned, are affordable and adequate, with minimum adverse environmental impact.

- The IDT should create a list/schedule of reductions to be used in the event of the project cost being over budget. Identify those aspects where cost reductions would seriously undermine sustainability objectives and exclude them from the list.

- The ES project manager should verify that controls and operational aspects intended to assist in meeting targets are not prey to cost cutting.

- The IDT should ensure that the Production Information includes all the information relevant to the performance of the construction process and the completed building.

- The ES project manager should ensure that time is allowed for commissioning and handover and that appropriate information is gathered. Careful handover is vital to efficient operation.

Tasks to be evidenced prior to sign off of Stage E

The completion of the following items must be agreed by the University of Strathclyde internal project manager prior to Stage E Sign off.

Performance Targets
- IDT to include a report on progress against all sustainability targets and policies.
- IDT to provide feedback on all SDQS actions
- The IDT to confirm that the BREEAM target can be achieved on budget.

Design Progression- The Stage E report to show clear progression on all of the issues identified at the end of Stage D and to confirm that the SDQS can be achieved.

Design Protection – IDT to prepare risk report on changes that would adversely affect the sustainability strategy and targets.

Consultation – IDT to demonstrate ongoing consultation with client and those affected

BREEAM - - ES Project manager to confirm that all information has been made available to the BREEAM Assessor and is on target.

Co-ordination – Stage E report to include a review covering steps to confirm co-ordination of spatial, structural, constructional, indoor climate and services requirements.

A sustainable development progress review must be completed prior to the sign off of Stage E.

4 WORK STAGE ISSUES

PRODUCTION INFORMATION
Stage F/G: Clear, quantifiable and evidence-based requirements

The tendering process is vital in establishing the appropriate procedures to ensure that specific objectives can be achieved so as to avoid conflicting priorities giving rise to tensions that may undermine the sustainability strategy. The tender documentation should clarify that sustainability is perceived as an aspect of build quality, not excessive cost. Construction to handover then becomes a process of reinforcing the objectives alongside other constraints.

- The IDT to prepare the Tender Documentation in such a way that the bidding contractors recognise sustainable design as a fundamental criteria for selection of successful bidders.
- The ES Project manager should arrange a pre-tender meeting with all the contractors to reinforce the sustainability requirements as fundamental good practice rather than expensive add-ons.
- The ES Project manager should establish a system for checking the environmental commitments of contractors and on-site validation procedures.
- Where performance targets are to be achieved, e.g. air tightness, thermal integrity, monitoring procedures, alarm/fault detection systems, they should be made an explicit contractual obligation to ensure adequate resources are allowed by prospective contractors.
- The IDT to ensure that the tender documentation makes explicit the need for process management including that Log Books are to be established and maintained throughout the design and construction period and that bidders will sign up to the Considerate Constructors Scheme
- Documentation and interviews which relate to the creation of shortlists for tenderers should explicitly refer to site environmental policy and practice and set performance targets for issues arising from the construction process such as noise creation, emissions, discharges and landfill and integrate these into the contractors' method statements.
- The IDT to prepare the Tender Documentation such that feedback a fundamental requirement against established and firm targets.

- The IDT to prepare the Tender Documentation so that commissioning, servicing, cleaning, maintaining and operations strategies are described in a user manual along with a clear plan to indicate how this information will be communicated at handover.

- Where specific materials or products are nominated or excluded the Tender documentation must make this explicit and indicate where any lead times are likely to be an issue.

- The ES Project manager should set up a specific meeting with the building operator to discuss all the relevant issues and then put this on the agenda for site meetings at appropriate intervals.

- The IDT should make clear that issues impacting on environmental performance will be managed through to handover and operation.

- The IDT to prepare the Tender Documentation such that contractors must provide evidence that the required performance targets can be validated and include method statements and costs of seasonal commissioning.

- Where there are specific environmental considerations to be made in selection of materials and products the contractor must be required to provide evidence that these are understood.

- The IDT to prepare the Tender Documentation so as to provide a point of reference to which the contractor may address requirements for validation of changes that may have an environmental implication.

- The IDT to prepare the Tender Documentation so as to identify appropriate reporting procedures for failures or outstanding enquiries that specifically refer to environmental issues during routine snagging and clear roles and responsibilities on both sides.

- If the Tender Documentation is written so as to ensure that the successful contractor takes responsibility for building maintenance issues during the construction and defect liability periods this will probably aid a smooth handover.

- Establish a communication system between bidding contractors and relevant public and private authorities that can advise and assist recycling schemes.

- ES to establish criteria for selection of the project management and design team. Include track record, commitment to interdisciplinary working and environmentally responsible design.

Note on Appointing a Contractor

- ES should ask for evidence of experience and training and achievements from contractors.
- The contractor to demonstrate how he/she will meet requirements of CCS. SDQS and BREEAM.
- The contractor to demonstrate previous experience in sustainable construction.
- The contractor to provide sustainability policy.
- The contractor to demonstrate how he/she will minimise travel by site staff and visitors and integrate with public transport.Constructor to agree to introduce a building inventory to catalogues the materials used in the construction complies with the SDQS.
- ES to invite bidding contractors to contribute ideas to the project that will improve the sustainability without adversely affecting time or cost.

What to look for in a contractor

- Develop, early on, a handover strategy;
- Waste minimisation throughout procurement and life of the building;
- Experience of delivering to stringent targets for energy and water consumption;
- Use of healthy and benign materials with minimum embodied pollution
- Minimisation of dependence on polluting forms of transport;
- Engagement with the user and management /maintenance
- Commit to specific sustainable design progress reviews with Estates Services
- Commitment to meet regularly during the defects liability period.

4 WORK STAGE ISSUES

TENDER ACTION
Stage H: Seek Clear agreement to the objectives

The tendering process should produce viable tenders from all parties from an environmental perspective. The process of evaluation can proceed with all bidders being on an equal footing in regard to quality and cost.

- Make sustainability credentials an issue in selection of potential tenderers. At pre-tender the contractors should provide evidence of experience, environmental policy and methodology, and they should explain their understanding of any unique aspects of a project.
- The information should include provision for training of permanent and sub-contract staff.
- Clarify that the site will need to be registered with the Considerate Constructor scheme,
- Establish a system for checking the environmental commitments of sub-contractors and establishing on-site validation procedures.
- Designers and sustainability advisor to ensure adverse and positive implications can be captured should oversee contractor inputs to the building process.
- Prepare a handover report and keep it up to date. This should include all relevant environmental issues specifically related to building materials and building operation. Put documentation of handover information on the agenda of site progress meetings.
- Establish processes for cataloguing changes in particular for assessing the environmental impact of material and product substitutions and amendments. Periodically check that they are fully used and integrated into the construction processes.
- Plan adequate resources of time & money for seasonal commissioning during the first year. Ensure that account is taken of any potential variations in the occupation and use that might have an impact on the commissioning.
- Verify that all involved are aware of and use Good Practice Guidance on commissioning and handover so that all commissioning and testing is completed satisfactorily without purging and dumping of environmentally harmful emissions to air, ground or water.
- ES to consider procedures for post-occupancy evaluation. ES and the design team would be well advised to establish good lines of communication in preparation for the defects liability period.

This marks the entrance to Gateway Four: Pre-Construction Approval

4 WORK STAGE ISSUES

CONSTRUCTION
Stage J/K: Maintain a watching brief as the project develops on site

The successful contractor should understand the priorities and reporting procedures. They should have demonstrated that they recognise the benefits to all involved of good site practice reinforced by an environmental policy and a site method statement. Nonetheless, it will be necessary to be vigilant and proactive if aims and objectives are not to be diluted.

- The ES project management team should provide a report on the successful contractors approach to CCS strategy, EMS implementation, review of environmental aspects, BREEAM and SDQS
- The ES project manager should ensure that protocols for on-site validation of thermal integrity, air tightness and materials specification are in place and agreed.
- Design changes are often inevitable and the ES project manager should have a protocol to enable him/her to assess changes in terms of their impact on sustainable design to ensure that they are neutral or beneficial.
- Unique or unusual elements, materials, products or services systems should by this stage have been fully explained - however a site has a large and ever increasing workforce and key issues should be part of the induction process for new site staff (this is required for Health & Safety and could be included with it).
- Design Team and ES to monitor the Contractor's ability to manage the site and its activities in an efficient and safe manner.
- Environmental issues regarding the building being delivered and the construction-related activities on site should be a permanent agenda item.
- Within reason all relevant sub-contractors should have explanations of key environmental elements, and have the important installation aspects highlighted.
- Monitoring, checking & testing routines should be established at the outset.
- Appropriate design team members should ensure that they are informed and present at key checks.

- It is good practice for a handbook & operational manuals, to be maintained through the site operations in a manner that allows it to be presented in a manner that the client can navigate.

- 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.

- Identify an individual responsible for monitoring the environmental performance of the contractors. The Clerk of Works may be well suited to the task if appropriately trained and briefed.

- Where procedures have not been put in place to ensure that the environmental objectives of the construction plan are being monitored it would be worthwhile arranging for the following to be considered for integration with site procedures, documentation and site meetings:

    - Orderliness;
    - Protection of existing ecology in so far as it is affected by the works;
    - Avoidance of any on-site treatment which might adversely affect health of workers or others;
    - Good neighbourliness (safe access, minimum noise, vibration, litter and dust, sociable working hours, minimum discharges to air, ground and water courses).
    - Maintenance of materials and components in their highest value state to maximise opportunities for resale, reuse and recycling;
    - Separation of recyclable elements;
    - Safe disposal of remaining materials.

4 WORK STAGE ISSUES

PRACTICAL COMPLETION
Stage L: Ensure that handover is undertaken properly

The interface between completion of a project, handover and ongoing operation & maintenance is a key point in the procurement process. There should be a process in place to assist in the smooth transition to an optimally functioning building. This is where sustainability as a process and not a product is really demonstrated, or not.

- The occupation of a building involves a learning curve. Lack of understanding of controls, regimes or design parameters can reduce their efficiency or undermine them altogether.
- Clients typically expect buildings to work optimally from day one, but some form of tuning and induction process will generally be necessary. This should be seen by all involved as a vital part of the design process and not as an add-on extra or as a symptom of failure.
- All the design team should be aware of their responsibilities for ensuring the adequate operation of a building and committed to fulfilling these responsibilities.
- Training is needed for all who can contribute to the smooth, efficient and effective running including users and O&M staff. It should have been written into the original contract.
- In the last minute rush to handover training can be rudimentary. It is not adequate for a representative of an aspect of a building to talk to a representative of the users. Training should involve as many operational staff as possible. Refresher inputs can also be effective.
- Checking that products work as specified and operate according to the manufacturer's recommendations is essential.
- The occupants need to understand the difference between routine O&M and contractual issues relating to snagging and defects.
- ES require to plan all the relevant activities in relation to handover and occupancy in good time and to monitor these in terms of the sustainability targets for the project. E.g.- choice of furniture, fittings, removal operations and tutorials/ acclimatisation for Users.
- Once the building is in operation the design team should maintain a two way dialogue. They gain the benefit of feedback as to how the building is performing and the users have direct assistance in understanding how the building is intended to operate and in troubleshooting. It should be properly resourced in terms of time and finance.

This marks the entrance to Gateway Five: Post Occupancy Evaluation

5 WHAT NEXT

FEEDBACK
Feedback should be formalized and thorough

Feedback can take many forms and involves widely varying levels of involvement and commitment on the part of the design team. It is generally under-resourced, rarely forming part of any paid agreement. It is also fraught with practical problems of unresolved responsibility and potential liability, particularly in the early stages of a building operation. To make it a constructive, useful and fair process, is a challenge. Most will be gained if the partners enter into feedback discussions with an intention to share responsibility and learn lessons. More pragmatically, a constructive approach is most likely to deliver repeat work.

- All design team members should demonstrate a commitment to constructive feedback, and if appropriate this should be spelled out in their contractual responsibilities.

- Partnering and goodwill is more likely to deliver an optimally functioning building in the short term than adversarial relationships.

- This is the time to put in place the feedback mechanisms agreed at the outset of the project. The client and the design team should be clear about the purpose of feedback and clarify their responsibilities and liabilities at an early stage.

- Effective feedback on how a building is operating technically, in terms of human mechanics, spatial organisation, ease of management and communication, has a large potential for resource saving.

- A feedback session may take the form of one of the types below, or a combination of them, and should be inclusive of all who have influenced the project as a positive input to future work.

Types of feedback

Information gathering and debriefing.

This process is appropriate to the development of client experience, processes and professional practice that may inform future work to benefit other projects. It could be carried out by the project manager and extend to all members of the design team. A programme of issues to be addressed – or SWOT analysis (strengths, weaknesses, opportunities and threats) – might be the best framework to identify achievements and missed opportunities. In particular, the process by which any sustainability aspirations have been achieved or missed, as the project progressed,

Optimising Performance

This process is appropriate to ensuring that the building users and operators are adequately provided with information on the building's systems and their functions, and that the operating staff have processes in place to identify and remedy faults. A temporary or ongoing working relationship with the building's operating staff will encourage optimally efficient use of systems, minimisation of wastage, effective environmental performance and occupant satisfaction. It may involve ongoing provision of advice, and /or revisiting building user guides and operating manuals on the building operation, cleaning regimes, controls and management issues. The dialogue may also provide useful information on how successful the project was.

Optimising design and procurement

This process is appropriate to adding to the wealth of knowledge about best practice approaches to design and procurement and to aid continual improvement in practice and in optimising building operation. Full feedback studies, such as the Probe Studies, have been used to highlight specific issues of relevance to an individual building but they also raise issues of generic interest to design and to the construction procurement cycle. These studies have highlighted invaluable information such as the real in-use performance of buildings and how this compares with predictions. These are among the best possible sources of guidance on building performance.

5 WHAT NEXT?

REFURBISHMENT – Make Refurbishment a creative opportunity

Refurbishment provides an opportunity to enhance aesthetics and environmental performance through upgrading fabric, structure, systems and components and attending to local ecology and landscape. Refurbishment has particular challenges and constraints but it represents an enormous creative opportunity. The instructions described in previous chapters provide general guidelines. Old buildings often represent a hazard to health that must be managed. This reinforces the need to utilise benign materials and processes in new construction.

- The ES project manager and the IDT should allow adequate time and fees for redesign to recommissioning. It may be that some elements may involve a balance between time and cost especially if there is opportunity for income generation or for avoidance of cost.

- The IDT and Project manager should discuss the standards for resource conservation, materials avoidance, user engagement, enhancing biodiversity set out in the ES policy at the outset, and provide a them seriously

- Tax and legal penalties for waste disposal activities has encouraged commercial and design interest in refurbishment and recycling. Methods are developing to facilitate flexibility and long life such as flexible design and design for deconstruction. The ES project manager and the IDT should make sure that they look at contemporary examples to ensure implementation of best practice

- Different parts of a building: fittings, services, fabric and structure, have different timescales for refurbishment. The IDT should undertake an audit of:
  - The existing site and buildings;
  - The existing plant, fabric and structure based on cost-in-use (maintenance and operating costs), and
  - Environmental impact (pollutants generated and environmental performance).

- The ES project manager and the IDT should prepare an asset register of buildings, contents and components as starting point for future works and identification of environmental opportunities.

- The ES project manager and the IDT should identify any hazardous materials or structure.

- If the project involves cultural and heritage aspects it may be pertinent to require commitment to care and enhancement of the existing structure. ES may consult the Conservation Architect Scheme run by the Royal Incorporation of Architects in Scotland (RIAS).

- Keep neighbours and authorities informed and updated where necessary of plans, timescales and other relevant issues.

- If demolition works are required then consult the **Optimise value during Demolition** part of this guide to identify opportunities for reuse and recycling.

- Identify the potential for reuse and recycling of structures, elements, materials and systems on the site.

- Aim to use mechanical systems as supports for natural systems, not as substitutes for them. Consider a move from active to passive solutions (optimum use of sunshine, natural light and air). Resist pressures to increase the servicing requirement from its current level and instead look to upgrade to the fabric to reduce the size of the mechanical systems replaced. Consider
    - Improved draught proofing
    - Reduce solar ingress – through brise soleil, window improvement, solar film
    - Insulation and window replacement

- Where installed systems are to be replaced investigate the contemporary mechanical services design to reduce the power loads and the size of the replacement systems.
    - Free cooling
    - Variable speed drives
    - High efficiency components

- Use modeling of the internal environment conditions to determine the temperature profile and better understand what the mechanical services are achieving and to consider flexibility

- Where systems are determined fit for ongoing uses consider the installation of additional good controls for lighting, water and heating/cooling. Much can be achieved by consideration of different zones and the use of thermostats, time switches, etc.

- The appointed ES representative should pay particular attention to:
    - Pre-qualification of suppliers and contractors;
    - Quality of stripping out and preservation of fabric and components;
    - Surprises that the building may hold (structurally or with respect to contaminants;
    - Complexity of services installation and access inside an existing shell;

- The appointed ES representative should prepare a handover report and keep it up to date throughout the works.

5 WHAT NEXT?

DEMOLITION
Optimise value during Demolition

A presumption in favour of retention and refurbishment of existing buildings should be the norm. There are excellent examples of resource efficient and healthy refurbishment, re-use, change of use and extensions that can add value to otherwise redundant buildings.

However, refurbishment may not always be the right option. Poorly designed buildings can inflict unnecessarily high demands on owners and operators by way of excessive running and maintenance costs, and on occupiers by way of poor working conditions. Where demolition is deemed the most appropriate solution then it will often highlight the benefits of designing out hazards in future buildings and encourage design for deconstruction in future buildings. If undertaken responsibly, it can be a positive contribution to the enhancement of the University Estate, University community and wider environment. Demolition generates high quantities of materials that is only waste if it is not used properly.

This section does not seek to add anything to the guidance already available on health and safety in the demolition of existing buildings.

- Before opting for demolition, the appointed ES representative should thoroughly investigate the opportunities in relation to new build versus refurbishment and or extension. This may well be an iterative process in respect of: long-term strategic plans for the University. Be as imaginative and wide-ranging as possible in your thinking.

- If demolition is the preferred option then following a few simple guidelines should
  - Minimise costs associated with waste
  - Maximize the value of residual components
  - Minimise disruption

- The demolition process incorporates three specific phases:
  - Decommissioning (to make a building or site inert– perhaps temporarily)
  - Dismantling
  - Disposal.

- The appointed ES representative should prepare a decommissioning plan that takes account of environmental matters, costs benefits and potential hazards. This should explicitly

encourage:

- Protection of local ecology;
- Maintenance of materials and components in their highest value state to maximise opportunities for resale, reuse and recycling.
- Safe disposal of remaining materials.
- Good neighbourliness (adequate information to local communities, safe access, non-obtrusive lighting and security, minimum noise, vibration, litter and dust, sociable working hours, minimum discharges to drains, ground and water courses); A requirement for the contractor to register the site with the considerate constructors scheme and to achieve a minimum number of points (36) should address this issue.

- The appointed ES representative should undertake a thorough audit and decommissioning exercise as well as thinking through the history of the building and its neighbours to minimise the risk and cost associated with surprises.

- The appointed ES representative should begin the preparation of a handover report at the outset of the works to cover all matters and keep it up to date throughout the works.

- The appointed ES representative should produce a cost benefit analysis of reclaim versus disposal of materials. Be aware of a pay off between cost and time. Achieving high reclaim may take time but have financial benefits

- The appointed ES representative should undertake a full audit of the building components and contents and:
  - Fully investigate re-use, recycling and reclaim opportunities.
  - Identify the potential reuse and recycling of structures, elements, materials and systems on the site.
  - Create a list of products and materials that could be recycled externally.
  - Publish the list through appropriate bodies and allow time for responses.

- The appointed ES representative should oversee preparation of Tender Documentation so that the contractors are aware of both their legal responsibilities and the University requirement to fulfill its responsibilities and commitments with respect to sustainable development. It should recognize the importance of cost, waste, pollution and toxicity issues. It should require:
  - An environmental statement for the work and explicit contract documentation based on a decommissioning plan
  - Method statements for particularly environmentally hazardous aspects of the demolition. These should be validated at tender evaluation;
  - A communication system between bidding contractors and relevant public and private authorities who can advise and assist recycling schemes;
  - A system for checking the environmental commitments of contractors and on-site validation procedures.

- The appointed ES representative should ensure that the building is decommissioned (to an inert state) before demolition begins.

Bibliography

Liddell, H.L., Gilbert J., & Halliday S.P., (2008) **Design for toxic chemical reduction in buildings** Scottish Executive. www.seda2.org/dfcrb/

Liddell H.L., (2008) **Eco—Minimalism – the Anti-dote to eco-bling** RIBA Publications. www.ribabookshops.com/site/viewtitle.asp?sid=&pid=9059&HID

MacKay D.J.C., (2008) **Sustainable Energy - Without the Hot Air** UIT Cambridge Ltd.

Halliday S.P., (2007) **Sustainable Construction** Butterworth Heinemann. www.elsevier.com/wps/find/bookdescription.cws_home/703833/description#description

Halliday S.P., (2007) **The Green Guide to the Architects Job Book, 2nd Edition** RIBA Publications. http://www.ribabookshops.com/site/viewtitle.asp?pid=7837

Stevenson F., (2005) **Design & Detailing for Deconstruction** Scottish Executive. www.seda2.org/dfd/

Morgan C., (2005) **Design & Detailing for Airtightness** Scottish Executive. www.seda2.org/dfa/

Berge B., (2000) **Ecology of Building Materials** Architectural Press.

GPG272 (1999) **Lighting for People, energy efficiency and architecture** BRE.

Von Weizacher E., (1997) **Factor Four, Doubling Wealth, Halving Resource Use** Earthscan.

Bell J. and Burt W., (1995) **Designing Buildings for Daylight** BRE.

Halliday S.P., (1994) **The Environmental Code of Practice for Buildings & their Services** BSRIA.

Grant N. and Moodie M., (1996) **Sewage Solutions** CAT Publications.

Liddell H. and Mackie A., (1996) **Energy, Conservation and Planning** Scottish Office.

BRECSU, (1995) **Avoiding or Minimising the Use of Air-Conditioning** BRE.

ECON 19 (1991) **Energy Efficiency in Offices** EEO.

PROBE Studies www.usablebuilding.co.uk

BRE **Building Research Establishment's Environmental Assessment Methods (BREEAM)** www.breeam.co.uk

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