



Specialist Engineering Alliance

*Sustainable buildings  
need integrated teams*

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*March 2009*



## Specialist Engineering Alliance

### *About the Specialist Engineering Alliance*

The Specialist Engineering Alliance (SEA) was established in 2002 to provide an opportunity for the leading professional and trade bodies within the specialist engineering sector to work together to achieve greater integration of the specialist engineering delivery process. The Alliance, therefore, represents all those involved in the delivery of specialist engineering construction - consultants, engineering contractors, manufacturers and suppliers. The members of the Alliance are as follows:

- The Chartered Institution of Building Services Engineers (CIBSE)
- The Association for the British Electrotechnical Industry (BEAMA)
- Association of Consultancy and Engineering (ACE)
- Building Services Research and Information Association (BSRIA)
- Specialist Engineering Contractors' (SEC) Group
- The Federation of Environmental Trade Associations (FETA)

This report is intended to contribute to strengthening the work of the Government, the Strategic Forum and the Specialist Engineering Alliance in bringing about a more integrated and a more sustainable industry.

Its aim is to examine the potential for improving the sustainability of the built environment through an integrated approach to procurement and delivery, in which the role of the specialist engineering sector is recognised for its vital ability to improve building performance. Based on wide ranging knowledge and expertise across the construction sector, it puts forward a vision for sustainable buildings and sets out the actions needed from Government, clients, consultants, contractors and manufacturers to ensure the vision is realised. The report complements the Strategy for Sustainable Construction published by the Department for Business, Enterprise and Regulatory Reform (June 2008).

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## *Abbreviations used in the report*

BCSA	British Constructional Steelwork Association
BERR	Department for Business, Enterprise and Regulatory Reform
BMS	Building Management System
BSRIA	Building Services Research and Information Association
CABE	Commission for Architecture and the Built Environment
CIBSE	Chartered Institution of Building Services Engineers
DCLG	Department for Communities and Local Government
DCMS	Department for Culture, Media and Sport
DEFRA	Department for Environment, Food and Rural Affairs
ECA	Electrical Contractors' Association
HEVAC	Heating, Ventilating & Air Conditioning Manufacturers' Association
HVCA	Heating and Ventilating Contractors' Association
NAO	National Audit Office
OGC	Office of Government Commerce
PSCCF	Public Sector Construction Clients' Forum
SEA	Specialist Engineering Alliance
SEC	Specialist Engineering Contractors' Group
VFM	Value For Money
WLV	Whole Life Value



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# Foreword

by Peter Woolliscroft, Chairman, Construction Clients Group



The Construction Clients' Group welcomes this Report as it includes many of the critical ingredients that enable clients to get better value from their construction procurement. This can be achieved through better integration of the supply chain earlier in the project decision making process combined with the use of collaborative working principles.

The sustainability agenda is rapidly influencing the sector and decisions clients are making regarding their project portfolios. The recommendations from this report should enable the client to deliver more sustainable solutions in an environment where the sustainability challenge will only get tougher.

We hope that this report inspires the reader to take a different approach to their respective roles within the construction supply chain and enable them to proactively contribute to our industry by meeting the future environmental challenge.



**Peter Woolliscroft**

Chairman, Construction Clients Group

## Integration & Sustainability Working Group Members

- Lord O'Neill, *Specialist Engineering Contractors' Group*
- Rudi Klein, *Specialist Engineering Contractors' Group*
- John Nelson, *Specialist Engineering Contractors' Group*
- Gary Clark, *Bennetts Associates, Edinburgh*
- Philip Dingle, *Eaton Electrical Limited*
- Andrew Eastwell, *BSRIA*
- Martin Forster, *Hilti (Great Britain) Ltd*
- David Frise, *HVCA*
- David Leatherbarrow, *Trox UK Ltd*
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- Bob Lewis, *Taylor Woodrow*
- Geoff Lockwood, *Ebm-papst UK Ltd*
- Graham Manly, *HVCA*
- David MacRae, *TOSHIBA*
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- Victor Parkin, *Power Link Electrical Services*
- Paul Reeve, *ECA*
- Ian Sams, *TROX UK Ltd*
- Cedric Sloan, *FETA*
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- Paul Wenden, *Flakt Woods Ltd*
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Report editor: Sebastian Macmillan

# Introduction

by Lord O'Neill of Clackmannan, Chairman of the SEA Integration & Sustainability Working Group

In December 2006 the Specialist Engineering Alliance (SEA) agreed to establish an *Integration & Sustainability Working Group* with the following terms of reference:

1. To examine the impact of traditional construction procurement on the delivery of sustainable outcomes and the scope for ensuring such outcomes through an integrated approach to procurement and delivery.
2. The study to include the consideration of case examples covering delivery of best value, reductions in carbon emissions and progressive steps towards reduction of waste and energy consumption.
3. To produce a report with recommendations that should be addressed to both public and private sector clients (including both central and local government clients) and the specialist engineering sector of the construction industry.



The Working Group was established with a membership representing a wide cross-section of key roles in the delivery of construction projects.

Having examined the evidence, we are keenly aware of the barriers to sustainable construction arising from traditional procurement. These include a large number of interfaces between parties, high transaction costs, lack of communication, the probability of duplication and re-work, lump-sum tendering that ignores whole life costs, and the risk of lack of buy-in from all parties.

We have also investigated the evidence about integrated and collaborative working practices in which specialists who have in-depth knowledge about the functional performance of their materials, components or systems bring their knowledge to the project at the earliest possible stages. As a result of our



investigations, we are convinced that an integrated delivery team appointed at the outset of the procurement process will achieve a variety of benefits linked to the sustainability agenda, and has produced this report to share its findings and conclusions more widely.

The aim of the report therefore is to provide a roadmap for public and private sector clients, as well as contractors and consultants to highlight how integrated delivery processes lead to sustainable outcomes, and how value to the client is improved by an integrated design team that designs-in sustainable solutions and designs-out waste and inefficiency.

Although some of the report's conclusions and in particular its overriding message that sustainable construction demands genuinely integrated collaborative working will come as little surprise to many, our experience is that the essential changes recommended initially in the *'Rethinking Construction'* agenda have yet to be fully implemented. As the National Audit Office identified in its report *Improving public services through better construction* in 2005<sup>1</sup>, the annual savings that could be achieved by government clients adopting best practice in procurement amount to £2.6bn per year. We believe that progress since then towards implementation has been woefully inadequate, a view shared by the Public Accounts Committee.<sup>2</sup> We therefore offer this report as a contribution towards the pressing need for improving the sustainability of our building stock.



**Lord O'Neill of Clackmannan**

*Chairman of the SEA Integration & Sustainability Working Group*

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<sup>1</sup> Improving public services through better construction, National Audit Office, 2005. [www.nao.org.uk/publications/nao\\_reports/04-05/0405364es.pdf](http://www.nao.org.uk/publications/nao_reports/04-05/0405364es.pdf)

<sup>2</sup> Building for the future: sustainable construction and refurbishment on the government estate, Third report of session 2007-2008, HC 174, The Stationery Office, 15 January 2008.

## Executive summary and recommendations

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Sustainability - which at its simplest means improving social and economic outcomes while reducing environmental impact - is the most pressing issue we face in the built environment. We urgently need to be providing facilities that minimise resource use in their construction, that require only low levels of energy and water use for their operation, and that protect or enhance biodiversity and the natural environment.

This wide-ranging report is from the Integration & Sustainability Working Group of the Specialist Engineering Alliance (SEA). It draws on evidence from a number of recent publications from BERR, DCLG, DCMS, DEFRA, the OGC and the NAO, more than a dozen case studies, and the views of a number of leading industry figures. The evidence overwhelmingly shows that the procurement process is the major determinant for the sustainability of a facility or construction project.

Delivery processes that are fragmented, hierarchical and adversarial, stand in the way of sustainability. Instead more integrated and collaborative approaches are required in which specialists with detailed knowledge of the installation, operation and performance of essential components and systems are brought in at the early stages as part of an integrated delivery team. To bring this about requires actions by a number of key players including Government in its role as regulator, as well as key players in the delivery process particularly public and private sector clients, consultants and lead contractors.

### *The report highlights that:*

#### GOVERNMENT SHOULD:

- appoint a high profile 'Integration & Sustainability' champion;
- demonstrate leadership and commitment by commissioning sustainable buildings with performance radically better than current norms; and
- make funding for major projects conditional on the early appointment of an integrated team.

#### PUBLIC AND PRIVATE SECTOR CLIENTS FOR EACH MAJOR PROJECT SHOULD:

- create a Sustainability Working Group made up of key individuals with appropriate knowledge and expertise;
- insist upon and commission integrated delivery teams that include specialists from the supply side and those who will be responsible for operating the facility; and
- set a realistic budget and use whole life costing methods in preference to seeking to minimise capital cost.

#### THE SIX HALLMARKS OF INTEGRATED TEAMS

- Early involvement of key members of the project team.
- Selection by value, not lowest price
- Common processes, such as shared IT
- A commitment to measurement of performance as the basis for continuous improvement
- Long-term relationships in the supply chains
- Modern commercial arrangements based on target cost or target price with shared pain/gain incentivisation.

*The integrated project team: teamwork and partnering, Achieving Excellence in Construction Procurement Guide 5, Office of Government Commerce, 2007.*



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#### **INTEGRATED TEAMS SHOULD:**

- be able to demonstrate their technical proficiency, their commitment to training and health & safety, and the adequacy of the resources available;
- maintain records of the performance of past projects for which they have been responsible as proof of their capability, and use these to inform the design of new projects;
- respond to an overall budget by an integrated solution that demonstrably represents the optimum balance between capital cost and performance in use over an agreed life for the facility.

#### **DESIGNERS AND CONSULTANTS SHOULD:**

- focus on ensuring that stringent targets for operation and use are emphasized throughout the design process;
- involve specialists early - as this is when their expertise can have the greatest impact in meeting operating and performance targets;
- use best practice advice, and specify only approved products whose performance has been officially certified.

We believe that if there is a focus on these issues by public and private sector procurers and the industry, this would send out a powerful message that sustainability is at the forefront of the procurement process. The SEA is ready to work with public and private bodies to develop and implement these recommendations.

## Sustainability in the built environment

The built environment is a major contributor to our quality of life and economic success, and delivers enormous value to society. Everyone gains when our buildings and facilities provide efficiently constructed environments that promote health and well-being; schools that raise educational attainment, hospitals where patients recover more quickly, offices that promote productivity, housing that supports neighbourly behaviour, public open space that encourages recreation, community facilities that contribute to social inclusion, and urban design that supports local distinctiveness and generates civic pride.<sup>3</sup>

At best, buildings and facilities contribute to these social and economic outcomes while minimising their environmental impact. Optimum use is made of daylight and natural ventilation, artificial lighting and other services operate only to the extent needed by occupants, renewable energy technologies are fully integrated and exploited; and construction materials have the minimum embodied energy content.



*Kingsmead: Kingsmead Primary School is Cheshire is one of the best performing primary schools built in the last four years. Architect White Design led a well integrated project team with strong and enthusiastic support from Cheshire Country Council. Carbon emissions are relatively low, at 48 kgCO<sub>2</sub>/m<sup>2</sup> per annum, and occupant satisfaction is one of the highest recorded for a primary school. Some sustainability features have proved problematic, such as the biomass boilers, but the building is intrinsically very efficient.*

Photo credit: White Design

These are among the ideals at the heart of the sustainability agenda. Facilities meeting these aspirations represent sustainable construction; in turn they contribute towards a more sustainable built environment and, ultimately, support sustainable communities. The ambitions are easy to identify and have the support of numerous government initiatives.

There are certainly examples where the construction industry has successfully delivered facilities in which the ambitions for high design quality and low environmental impact have been achieved. But there are many, many more where performance is far from exemplary. If we are serious about reducing the carbon footprint of the built environment to meet our international commitments, we need more than a handful of demonstration projects. We urgently need to improve the performance of every building we erect.

Sustainability encompasses our efficient generation and use of energy, the reduction of our dependence on fossil fuels and minimising waste in all its manifestations. It requires us all to plan our developments in socially sensitive ways and to look at the impact on local economies of our work. Ultimately it also means that what we do should be much more efficiently managed to be less wasteful and far less expensive.

David Frise,  
*Founder Chairman of the M & E Sustainability Issues Group<sup>4</sup>*

  
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<sup>3</sup> Commission for Architecture and the Built Environment, The Value Handbook, CABE, 2006.

<sup>4</sup> 'Responding to the tales and challenges of sustainable design', David Frise, Modern Building Services, vol 3, issue 10, February 2007, page 37.

About half of the UK's energy use and carbon dioxide emissions are associated with heating and lighting our building stock. And construction projects consume enormous volumes of concrete, glass, timber and a wide range of other raw materials that are sourced, transported, processed, and then transported again to site to be assembled into buildings, infrastructure and other facilities. The negative impacts of these activities include loss of biodiversity and climate change, in turn affecting weather patterns, sea levels, storms, rainfall and flooding. In the medium and long term, present rates of consumption of raw materials, production of waste to landfill and consumption of gas and electricity with their associated carbon emissions appear to be unsustainable. This is the background to the current government-led drive towards greater sustainability.

This report from the SEA identifies that the way in which buildings are typically procured is not helpful to sustainable delivery. Specifically, it finds that the conventional approach to building procurement often prevents the skills and expertise of the supply chain from being fully applied in practice.

Particularly in view of the rapid pace of innovation in products and services, only specialist manufacturers and suppliers know their full performance characteristics. Responsible for continuous research and development, only these specialists fully understand installation and performance in use issues, and which of the many available options will provide the best whole life value in any given situation. Sustainable construction can only come about if this knowledge is fully understood and used from the very start of each project.

These arguments are not entirely new. They can be traced back a decade to the report of the Construction Task Force<sup>5</sup> which recognised that the separation of design from construction was detrimental to the industry's efficiency and effectiveness, and had a harmful impact on value for money for the industry's customers. The report called for the industry to adopt integration as one of the most important elements of the *Rethinking Construction* agenda. The message was reinforced when the report was updated and re-issued by the Strategic Forum as *Accelerating Change*<sup>6</sup> in 2002.

But how wide does integration go? Who needs to be part of the integrated team? This report shows how specialist engineering contractors with their detailed knowledge and understanding of new and improved products are essential players in integrated teams and should be involved from the early stages.

It is critical, for example, for consultants to talk to manufacturers from the beginning to set sustainability criteria not just so that a checklist box can be ticked but, crucially, to ensure the design and delivery process achieves these criteria in the ultimate operation of the building in use. Only by this means will a fully integrated approach to design, procurement and delivery be achieved, with sustainability considered from the start rather than - as is often the case - bolted on as an afterthought at the end.

Nowhere is this more urgent than in the case of energy use with its associated emissions of carbon dioxide. The link between carbon dioxide emissions and global climate change do not need repeating here. For every one building where energy is well-controlled, there are hundreds, perhaps thousands, where inefficient systems and poor controls result in avoidable waste.

<sup>5</sup> Rethinking Construction, Construction Task Force, DETR, 1998.

<sup>6</sup> Accelerating Change, Strategic Forum for Construction, 2002.

<sup>7</sup> Introductory Address, The Building Services Summit, 2007

<sup>8</sup> 'The practical aspects of whole-life costing', John Langmaid, Modern Building Services, vol 2, issue 1, May 2005.

<sup>9</sup> Building for the future: sustainable construction and refurbishment on the government estate, NAO, April 2007, page 7.

Only by insisting on the early involvement of the entire supply chain can you get everyone to take collective ownership of the design, cost and risk. Too often, the design is left to consultants, with no input from the M&E contractor. They're a critical part of the team, especially when you consider almost half of the budget of any building relates to building services installations. Every government client should have to demonstrate a clear commitment to engaging the supply chain before work commences. Funding should be withheld until teamwork is in place.

Rudi Klein, SEC Group<sup>7</sup>

Whole life value (WLV) is more important than value for money for one simple reason. WLV represents the long-term value for the money invested, value for money (VFM) tends to represent the immediate spend against the functions provided by the technical solution.

John Langmaid, BSRIA<sup>8</sup>

#### ENVIRONMENTAL FEATURES OF SUSTAINABLE BUILDINGS<sup>9</sup>

Sustainable buildings can include measures to:

- reduce energy consumption and associated emissions of carbon dioxide;
- minimise the use of resources such as water and construction materials;
- reduce the release of pollutants;
- maximise the use of sustainably sourced and recycled materials (e.g. timber);
- promote sustainable travel choices through public transport and cycling provision;
- conserve, or enhance, biodiversity; and
- using materials that can be continually recycled without loss of properties (e.g. steel).

# The national vision for sustainable construction

The SEA welcomes the commitment by Government to sustainable construction, and shares the ambitions set out in the Strategy for Sustainable Construction<sup>10</sup>, a cross-departmental publication signed by BERR, DCLG, DCMS, DEFRA, DIUS, HM Treasury, and the Strategic Forum for Construction.

The Strategy identifies a series of 'means' and 'ends'. The ends are a set of outputs that relate directly to sustainability, the means are the processes required to achieve the ends. Overarching targets are set together with a delivery plan of specific actions and deliverables contributing to the overall targets. The means and ends are:

## MEANS:

- **Procurement:** improved whole life value achieved through best practice construction procurement and supply side integration
- **Design quality:** greater uptake of design quality assessment tools
- **Innovation:** enhanced capacity for innovation
- **People:** increased commitment to training and health & safety
- **Regulation:** reductions in administrative burdens affecting public and private sectors

## ENDS:

- **Climate change mitigation:** carbon dioxide emissions reduced by 60% on 1990 levels by 2050\*, and by at least 26% by 2020.
- **Climate change adaptation:** a robust approach to adaptation
- **Water:** Reductions in water consumption per capita to 130 litres per person per day or less by 2030
- **Biodiversity:** surveys for all construction projects over £1m, and necessary actions instigated
- **Waste:** by 2012 a 50% reduction in construction, demolition and excavation waste to landfill compared to 2008
- **Materials:** responsible sourcing of 25% of products by value by 2012

The Strategy notes that:

*More widespread adoption of integrated working practices within the industry is most likely to deliver a more sustainable end product.*

Under procurement and integration, the Strategy sets out a range of commitments to improved procurement and integration that include:

*Procurement decisions will be transparent, made on best value rather than lower cost, use evaluation criteria and where appropriate, specialist advisors, whilst encouraging the contribution of smaller organisations.*

*All members of the construction team will be identified and involved at an early stage, particularly during the design process, and encouraged to work collaboratively.*

*Supply chain partners will be required to demonstrate their competency, their commitment to integrated working, innovation, sustainability and to a culture of trust and transparency*

*The duties of each project team member will be identified and shared at the outset of the project and appropriate insurance policies, such as project insurance, put in place.*

<sup>10</sup>The 2050 target was increased from 60% to 80% by the Climate Change Secretary in October 2008.

<sup>10</sup> Strategy for Sustainable Construction, BERR, June 2008.

## KEY PRINCIPLES OF SUSTAINABLE ENERGY USE IN BUILDINGS

- lighting, heating, fresh air, water and power are provided to occupants when, where and to the extent they are needed to provide comfortable and attractive conditions and to support the tasks being undertaken;
- orientation and the sizing, positioning and design of openings makes maximum use of natural forces such as daylight and wind, and minimise the need for applied energy; the building fabric is highly insulated and well-sealed;
- building services are provided using intrinsically efficient lighting, heating and ventilation technologies, complete with control systems that encourage and support efficient energy and environmental management practices and minimise avoidable waste of fuel, power and water;
- components, materials and systems are chosen to minimise environmental impact and protect biodiversity;
- energy and environmental management regimes are established with achievable targets for cost, consumption and waste, regular monitoring, and corrective actions as appropriate.



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The Strategy also emphasizes client leadership including client commitment to best practice guidelines and co-operation with all organisations involved in the project. Under the heading of sustainability, the Strategy includes the following commitments:

*An overarching Sustainable Development Strategy will be developed with relevant stakeholders using a 'one planet' approach.*

*Each project will develop a specific Sustainability Action Plan which will address environmental, social and economic aspects, and aim to exceed the highest levels within relevant standards and include all aspects of the supply chain*

*Targets, including the business case, will be set within all contracts, and performance will be monitored and appraised regularly.*

*Projects will incorporate best practice approaches to resource use, waste minimisation, low-carbon performance, employment, training and community engagement*

The Government Strategy is the latest in a line of Government publications that have identified integrated teams as essential to the delivery of sustainability. The 2004 Energy White Paper stated:

*It is very important ... to capitalise on the opportunities presented by new build and major refurbishment, since the effects on CO<sub>2</sub> emissions are both long-lived and difficult to design out at a later date. Early action that tackles planning, design, construction, commissioning and operation in an integrated manner can ensure that building stock in 2050 does not create carbon emissions which could have been avoided - and which would require disproportionately costly action to address in the future.<sup>11</sup>*

The Office of Government Commerce has set Common Minimum Standards that emphasise integrated supply teams:

*Achieving Excellence calls for the use of integrated supply teams, the development of long-term relationships with suppliers, the reduction of financial and decision-making approval chains, improved skills development and empowerment, the adoption of performance measurement indicators and the use of tools such as value and risk management and whole life costing in order to support and deliver innovative solutions to meet business needs. ...*

*Procurement routes should be limited to those which support integrated team working (the 3 recommended procurement routes are PPP/PFI, Design & Build and the Prime-type Contracting approach). Traditional, non-integrated procurement approaches should not be used unless it can be clearly shown that they offer best value for money - this means, in practice they will seldom be used.<sup>12</sup>*

The OGC Achieving Excellence Procurement Guide 5 on the Integrated Project Team: teamworking and partnering<sup>13</sup> contains advice about assembling the Integrated Project Team (IPT) as follows:

*The aim is to identify the most appropriate specialists and involve them at key points throughout the project where their expertise can contribute to the design process as well as the construction process. This enables the team to integrate design, fabrication and construction progressively. On most projects substantial design is carried out by specialists concerned with the structure and systems. These specialists should be part of the IPT. Key manufacturers should also be involved. An integrated team creates the best environment for all who contribute to the design process - consultants, specialists and manufacturers - to generate the design solutions that optimise value for money for the client.*

#### WHY ARE SO FEW BUILDINGS GENUINELY SUSTAINABLE?

*"The basic principles are very straightforward; minimise artificial lighting, heating and mechanical ventilation, avoid air-conditioning, conserve water, use the site and materials wisely and recycle where possible. And yet, poor design too often results in buildings having an unnecessarily high environmental impact.*

*A fundamental requirement for success is establishing a clear client brief that rates sustainability targets as important as style, image and aesthetics. Putting sustainability at the core of the design brief helps to ensure that the building will be more economical, comfortable, productive, humane and better looking than a conventional building.*

*Delivering sustainable buildings requires a new design vocabulary. Climate responsible buildings, which are based on the principles of bio-climatic design, require the architect and engineers to work as an inter-disciplinary team. This will deliver intelligent buildings that work with natural systems to provide (for free) much of the requirements for lighting, heating, cooling and ventilation...*

*Integrated design places the engineer (and ideally the contractor and facilities manager) alongside the architect as equal partners in the design process."*

**Professor David Strong,**  
*formerly of the Building Research Establishment<sup>14</sup>*

<sup>11</sup> Energy efficiency: the government's plan for action, (Energy White Paper) DEFRA, April 2004, para 119.

<sup>12</sup> Common Minimum Standards for the procurement of built environments in the public sector, OGC, 2006, page 2.

<sup>13</sup> Achieving Excellence in Construction Procurement Guide 5: The integrated project team: teamworking and partnering, OGC, 2003, page 8

<sup>14</sup> Constructing the Future, Issue 32, BRE, Summer 2007, page 9, [www.bre.co.uk/pdf/ctf/ctf\\_32.pdf](http://www.bre.co.uk/pdf/ctf/ctf_32.pdf)

And in its *Achieving Excellence Procurement Guide 11 on Sustainability*<sup>15</sup>, the OGC states:

*The supply team must see sustainability as a fundamental part of the project process. The team must include appropriately skilled and experienced suppliers, which have the relevant back-up and technical expertise to deliver the project.*

The National Audit Office meanwhile concluded in *Building for the future: sustainable construction and refurbishment on the government estate*<sup>16</sup> that the Government had failed to meet its own sustainability targets for the construction and refurbishment of buildings on the government estate. The NAO's investigations revealed the importance of integrated teamwork and recommended its adoption:

*Departments and agencies should improve the sustainability of new builds and refurbishments on the government estate by ... using integrated teams in all projects, so that all stakeholders are signed up to the need to deliver sustainability. (paragraph 5)*

Under the heading *Integrated teams increase the chances of benefits realisation*, the NAO report further states:

*We observed the benefits of bringing together all of the building project's stakeholders in an 'integrated team'...In particular, those with key design responsibility for sustainability need to be involved early in the process. Where all stakeholders were involved throughout the project, and where all stakeholders understood that sustainability was a key objective, we observed that:*

*"the building was built in accordance with its design. (i.e. that the contractor adhered to the design, rather than substituting cheaper alternatives);*

- *the finished building was managed and operated in accordance with the design... and*
- *greater consideration was given to the whole life cost implications of design options... (paragraph 4.11)*

Reinforcing its findings, the NAO report's Recommendation 2 states:

*Departments and agencies should employ integrated teams to deliver construction and major refurbishment projects. Integrated teams should:*

- *comprise department or agency clients, designers, building contractors, and specialist suppliers and consultants, all of which should be signed up to the need to deliver sustainability in the project;*
- *ensure that all of the aspects of sustainability included in the original design are delivered, i.e. that 'value engineering' does not result in less sustainable product substitutions or the removal of sustainable design criteria on grounds of cost; and*
- *engage, throughout the project, those responsible for running the building, in order that the building is sustainably managed and operated in accordance with the design. (page 29)*

It is not only in Britain that integration is recognised as essential to sustainability. In the 'Mitigation of Climate Change' volume of the fourth assessment report of the Intergovernmental Panel on Climate Change, the IPCC identifies buildings as having the highest potential for mitigation of green house gases among the key sectors it examines. In the commercial buildings sector, it calls for 'integrated design of commercial buildings' among key mitigation technologies and practices.<sup>17</sup>

This survey of key policy documents illustrates the degree of national and international concern that exists over environmental sustainability. What emerges from this evidence is a clear consensus about the necessity of integrated teams to the delivery of sustainable solutions. At the same time, the number of facilities that can claim to be genuinely sustainable is few.

<sup>15</sup> Achieving Excellence in Construction Procurement Guide 11: Sustainability, OGC, 2007, page 29.

<sup>16</sup> Building for the future: sustainable construction and refurbishment on the government estate, NAO, 2007.

<sup>17</sup> Summary for Policy Makers, Working Group III Report 'Mitigation of Climate Change', IPCC Fourth Assessment Report, 2007, table SPM.3.

<sup>18</sup> Improving Public Services through better construction, NAO, 2005, page 13.

<sup>19</sup> 2012 Construction Commitments, launched by Tessa Jowell, 5 July 2006.

*Where suppliers are involved at an early stage the quality of design is better, leading to efficient and higher quality construction that delivers lower whole life costs and the required service delivery outcomes. Departments should involve construction suppliers early on in the design process, where appropriate paying for their time on a fee basis.*

NAO<sup>18</sup>

*An integrated project team works together to achieve the best possible solution in terms of design, buildability, environmental performance and sustainability.*

2012 Construction Commitments<sup>19</sup>



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In terms of their energy requirements, there is an urgent need for every building project to be reviewed in terms of a hierarchy of energy provision:

1. Energy demand should be reduced to the lowest possible level.
2. Building services must be inherently efficient and well controlled.
3. On-site or locally generated power from renewable energy sources should be provided wherever it is feasible to do so.
4. Finally, the remaining power requirements will need to be provided by power generated conventionally.

The Working Group believes that all too often the first three steps in this hierarchy are skated over with little attention, with the result that conventional power - which should be used as a last resort - is relied on fully. Integrated teams that include appropriate specialists can ameliorate this situation. Through their expertise and experience, they can minimise demand, design efficient and well-controlled services, and incorporate renewable energy technologies.

Similarly those with expertise in minimising waste and selecting materials and components with the least environmental impact are essential to the production of sustainable facilities.

Government urgently needs to lead by example, particularly those parts of the public sector that are regular clients of the construction industry. Typically, repeat clients in central and local government know a great deal about the expected use of their facilities by occupants and can take a long term view in terms of design life, maintenance, energy costs, and whole life value. Indeed central government has a duty to do so under OGC rules. By adopting best practice and showing what is possible, public sector clients can drive forward innovation and help to promote widespread take up across the whole industry.

The Group further believes that the UK Government and the Devolved Administrations should each appoint a high profile 'champion' to propel the integration and sustainability agenda. Without these champions, the '*Rethinking Construction*' agenda will never be implemented.

Local authorities have a duty to deliver best value and to seek continuous improvement in the efficiency, effectiveness and economy of their service delivery. The Group believes that public sector auditing bodies should insist that evidence of integration and collaborative working be included as part of the best value review process in the public sector.

To support the activities of the integration champions and best value auditors, the Group believes there is a need for a network of construction advisors to able to guide and assist public sector clients on assembling and appointing integrated project teams. The members of the Working Group are fully committed to this plan and are prepared to offer their services to get the network started.

Our recommendations are also applicable to those parts of the private sector that regularly commission new buildings or major refurbishments, and are committed to sustainability. The Working Group welcomes the fact that some leading private sector corporations have already published their own sustainability guides, such as the John Lewis Partnership (see table 3 on page 24).

Among the many benefits that will follow are that such facilities will be future-proofed. Given the uncertainties that surround climate change, the security and cost of future energy supplies, and the likely demands of European and national legislation, buildings that are efficient today are likely to need far fewer adaptations and remedial works to bring them up to future standards. As well as offering benefits today, using an integrated team offers greatly reduced future risk.

#### RECOMMENDATION 1

*Funding for public sector projects should, progressively, be made conditional upon evidence that the procurer has put in place an inclusive and integrated design team comprising those parties - consultants, project managers, engineering contractors, manufacturers and facilities managers - that are key to delivering sustainable outcomes.*

#### RECOMMENDATION 2

*Government must take a lead in adopting best practices in sustainability by commissioning integrated teams to provide facilities that demonstrate the step change in sustainable performance that such teams can deliver and that is urgently needed to drive forward innovation and deliver sustainability. Greater incentives and penalties should be introduced to ensure the improved ways of delivering sustainable facilities are driven through.*

#### RECOMMENDATION 3

*Central Government and Devolved Administrations should each appoint a high profile 'champion' to propel the integration and collaboration agenda.*

#### RECOMMENDATION 4

*Evidence of integration and collaborative working should be part of the best value review process in the public sector.*

#### RECOMMENDATION 5

*There is a need for a network to advise the public sector about assembling integrated construction project teams, and members of the Working Group are willing to come together to get this started.*

## The specialist engineering sector and its expertise

The widespread endorsement of integration including early engagement of the specialist engineering sector - in the Energy White Paper, by BERR, DCLG, DCMS, DEFRA, the Strategic Forum, OGC and NAO - is greatly welcomed by the sector. At the same time, it comes as no surprise. Those in the sector are well aware of its skills and expertise - and concerned to see many projects going forward where that expertise remains under-utilised. The SEA believes that sustainable construction can be delivered only by a sustainable industry.

A sustainable construction industry is one that invests in training, regularly updates and upgrades its skills, invests in new technologies and places health and safety at the top of its priorities. All these factors are also crucial in delivering consistent quality and service that, ultimately, delivers best value for clients.

The specialist engineering sector has invested heavily in licensing, qualification and registration schemes which are concerned with matters such as levels of training, resourcing, quality of work, and health and safety. If Government is serious about sustainable construction, public sector procurers have a critical role to play in promoting it by only selecting competent firms as consultants or contractors on public sector works. At minimum, competence involves objective proof that the business:

- Is technically proficient and sufficiently resourced for the level and volume of work and/or services it provides;
- Is of sound financial standing; and
- Has procedures in place for improving health and safety performance.

Members of the SEA bodies meet these standards, and many firms in the sector are investing in training and technology to deliver sustainable outcomes. We welcome the establishment by DCLG of accreditation schemes for energy assessors in accordance with the European Energy Performance of Buildings Directive, and development of training and competence assessment introduced by CIBSE. To support these vital innovations in sustainability it is essential that their investment receives recognition from public sector procurers. As Sir Nicholas Stern explained in his 2007 report *The Economics of Climate Change*<sup>20</sup>, “Investing in new lower-carbon technologies carries risks....Companies may worry that they will not have a market for their new products...”

Specialists bring detailed technical and practical knowledge of the performance characteristics of the materials, components and systems which they manufacture and/or supply and/or install. They therefore know how their products can be selected and used in ways that optimise efficiency and reduce waste.

As an example, in the case of achieving energy efficient buildings, through their understanding of building services and how buildings react thermally, they have the ability to recommend the most energy efficient solutions. This is particularly vital when designing renewable energy systems as potential energy savings are only achieved if systems are correctly sized and properly controlled. Specialists also have in-depth understanding of how to integrate systems such as solar thermal technology and heat pumps, and their associated control systems.

Full commissioning of all the building systems and services is essential, but is so often the first casualty when projects fall behind schedule; the essential time needed is compressed and the results compromised.

### CIBSE LOW CARBON CONSULTANTS AND ENERGY ASSESSORS

CIBSE has introduced a register for professional building services engineers who are competent to minimize energy use and carbon emissions from buildings both in design and operation of new and existing buildings. Membership of the register follows an examination of competence.

CIBSE also maintains a register of accredited Low Carbon Energy Assessors (LCEAs) who have demonstrable competence to provide Energy Performance Certificates introduced in April 2008 under the European Energy Performance of Buildings Directive.<sup>21</sup>

*Research and development plays a key role in the quest for sustainability and the development of new products. Manufacturers need to be bold and indeed many are already channelling their energies into better product design and componentry - hence gas-fired humidifiers, energy-efficient fans and pumps, air-handling units fitted with recuperators or thermal wheels to increase their efficiency. The air-distribution sector has focused on improving the design of grilles, louvers and diffusers, with smooth surfaces on units to minimise frictional losses in the airstream.*

Gerry Stapley,  
President, HEVAC Association

<sup>20</sup> *The Economics of Climate Change*, Nicholas Stern, Cambridge University Press, 2007.  
<sup>21</sup> [www.cibse.org/index.cfm?go=page.view&item=818](http://www.cibse.org/index.cfm?go=page.view&item=818)

Often overlooked also is the importance of efficient and effective operation of a facility. In order for the potential benefits of efficient systems to be realised in practice, there is a need for the crucial knowledge that only specialist suppliers, manufacturers and installers have to feed forward into facilities management. Some progress has been made by the University of Cambridge to pioneer the equivalent of sea trials for complex buildings under the heading 'soft landings'<sup>22</sup> (see box on page 17), but far more needs to be done to implement more effective hand-over procedures that include training in operation and management for both facilities managers and potentially, occupants. These need to be defined within the procurement process and provided as part of the overall package to the client. In this way, the latent knowledge of specialists will be transferred to those responsible for operation. The SEA is happy to make recommendations about those who have demonstrable competence in managing systems effectively.

Specialist knowledge in the sector ranges from conceptual knowledge about the physics of buildings and how applied energy can be minimised by the design of the fabric and glazing, through to detailed product knowledge about product performance, characteristics and installation, and on to effective operation and maintenance requirements. These capabilities are summarised in table 1.

The British Constructional Steelwork Association has already introduced its own Sustainability Charter which encourages member firms to be more sustainable within their own operations. The Charter, reproduced on page 16, is implemented through audit and inspections.

The sustainability benefits from early engagement of specialists are summarised in table 2.

*Table 1 Conceptual skills and product knowledge contained within the specialist engineering sector*

CONCEPTUAL SKILLS	PRODUCT KNOWLEDGE
Knowledge of building physics	Product performance and operational characteristics under a variety of operating circumstances
Knowledge of thermal and lighting characteristics	Supply chains: manufacturing and transport of products, and where waste can be avoided
Performance of building fabric and interaction between fabric and services	Site installation and maintenance access requirements for engineering plant and services
Control systems, occupant behaviour, and training needs to ensure components and systems are fully effective in use	Investigation of best practice and how to prepare a performance specification prior to tendering

#### RECOMMENDATION 6

Preference in public sector selection procedures should be given to firms that can - whether individually or through membership of reputable qualification schemes - demonstrate their technical proficiency, commitment to training and health & safety, and availability of adequate resources.

#### RECOMMENDATION 7

Public sector selection procedures should incorporate weightings that favour firms that have invested in sustainable and renewable technologies and can show evidence of waste reduction within their businesses.

The Baxi commercial heating training academy in the West Midlands is fully equipped with a range of boilers and water heaters. All are live, enabling training to be provided on installation, commissioning, servicing and fault finding. The academy specialises in integrated boiler house solutions, especially those using renewable and sustainable technologies. Acting as a knowledge hub, it is widely available to consultants, contractors, installers and merchants.<sup>23</sup>

<sup>22</sup> [www.tandf.co.uk/journals/press/rbri.pdf](http://www.tandf.co.uk/journals/press/rbri.pdf)

<sup>23</sup> [www.baxi.co.uk/information/courses.htm](http://www.baxi.co.uk/information/courses.htm)

<i>Table 2 Sustainability benefits from early engagement of specialists</i>		ENVIRON- MENTAL BENEFITS	SOCIAL BENEFITS	ECONOMIC BENEFITS
OBJECTIVE	OUTCOME			
Comfortable environments	Environments that are comfortable for occupants and achieve specified comfort criteria contribute to productivity, health and welfare.	✓	✓	✓
Healthy, productive and satisfied occupants	Buildings that provide opportunities for occupants to exercise greater control over their local environment, e.g. by opening windows or lowering blinds, lead to more satisfied occupants, with productivity and health and safety benefits.	✓	✓	✓
Avoidance of excessive plant and equipment	Reductions in excessive solar gain through good design rather than by installing mechanical cooling plant - potentially saving in capital costs.	✓		✓
Maintenance savings	Reliable low maintenance plant and equipment leads to reduced maintenance and visits, reducing transport costs and associated environmental impact.	✓		✓
Lower energy costs and reduced carbon emissions	More energy efficient solutions lead to lower energy costs and reduced emissions of carbon.	✓		✓
Better value for money	Lower operational costs over the lifetime of the facility.	✓		✓
Government targets and future legislation	Buildings that are more sustainable will be more robust against emerging targets and benchmarks, and will more easily meet rising standards and expectations.		✓	✓
Environmental management standards	Procuring sustainable buildings will help occupying organisations more easily gain certification through ISO 14001 and similar Environmental Management Systems.			✓
Minimise non-value added activities	Duplication, re-design and re-work are minimised or eliminated.		✓	✓
Pre-integrated modular and factory based solutions	Plant and equipment developed within the supply chain, and constructed and tested off-site increase reliability, require less material, and generate less waste.	✓	✓	✓
Quicker statutory approvals	More sustainable buildings are likely to meet local and regional criteria more easily and to obtain planning permission quicker.			✓

*Integrated teams are essential if we are going to make the most of energy efficient and no or low carbon technologies such as new and intelligent building controls, effective monitoring, optimal lighting regimes and renewable energy sources.*

**Alan Littler,**  
*President, ECA (2008-2009)*

*Construction will continue to waste huge amounts of materials if we continue with current procurement practices. We need an integrated delivery process in which design teams comprising consultants, contractors and manufacturers, all buy into more efficient designs and methods of construction. By reducing waste, we will also significantly reduce energy use and increase profitability right through the supply chain.*

**Cal Bailey,**  
*NG Bailey: contribution to the House of Lords inquiry on construction waste, on behalf of SEC Group 2008.*



**Specialist Engineering Alliance**

## Steel Construction Sustainability Charter

The objective of the Steel Construction Sustainability Charter is: *To develop steel as a sustainable form of construction in terms of economic viability, social progress and environmental responsibility.*

The BCSA requires that Sustainability Charter Members shall make a formal declaration to:

- Operate their businesses in efficient and financially sustainable ways in order to undertake contracts that satisfy clients and add value for stakeholders
- Work to optimise the impact of manufacturing and construction activities on the eco-efficiency of steel construction through its life cycle.
- Work towards increasing the efficiency of use of resources and energy in steel construction by promoting the recovery, reuse and recycling of steel.
- Foster the health and safety of employees and others in the steel construction industry, and operate generally in a healthy, safe and environmentally sound manner.
- Demonstrate its social responsibility by promoting values and initiatives that show respect for people and communities associated with steel construction.
- Conduct business with high ethical standards in dealings with employees, clients, suppliers and the community.
- Engage stakeholders and independent third parties in constructive dialogue to help implement sustainable development.
- Build on their knowledge of sustainability and willingly share this with others, by being open and active in communications and by helping steel and construction companies and other organisations in the supply chain to implement sustainable policies.

The BCSA will develop and publish key performance indicators that benchmark the development of sustainable steel construction generally and that permit individual Sustainability Charter Members to measure their own progress.

The BCSA will promote the advantages of sustainable steel construction generally and will give special public recognition to Sustainability Charter Members.

*Partnering* is the process of working together as a team to improve performance through agreeing mutual objectives, devising a way to resolve any disputes, collaborating to achieve continuous improvement, and sharing risks and rewards equitably.

*Strategic partnering* involves the integrated supply team and the client organisation working together on a series of construction projects in which knowledge and expertise can be transferred from one project to the next.

*Project partnering* on one-off projects can still offer many of the benefits.

### THE SUPPLY SIDE SHOULD COMMIT TO:

- Inform clients of the options for meeting their needs.
- Shorten and competently manage the design and construction supply chain.
- Keep clients informed of project progress, including delays and cost over-runs.
- Design projects that can be built on time and to a quality that meets the client's needs.
- Help to find solutions to problems that are fair to all parties.
- Solve interface problems in the supply side.

## The integrated team and sustainability

Sustainable construction requires a step change in the culture of the industry that can be achieved only by clients procuring and specifying sustainable construction projects, products and services. Clients, particularly those in the public sector, have to accept their environmental and social responsibilities when commissioning projects since, ultimately, they will have to take responsibility for the environmental performance of the complete facility, and a sustainable project will enable them to do this with the least environmental impact.

The 'Rethinking Construction' agenda places considerable emphasis on client leadership and vision. Nevertheless, the supply side should not automatically rely on clients to lead in building an integrated team, and may have to support them in doing so. Indeed, integrated teams can bring a substantial range of expertise to support clients. They should start by helping clients to understand what value means for them; the creation of whole life value should be a clear objective. Once clients have a clear appreciation of what they expect from a project, the integrated team should put to them a value proposition and an integrated solution.

The facility must, of course, meet client requirements and be fit for purpose, but this is only a minimum. The team should provide the client with evidence about environmental performance, operating costs and whole life value rather than simply capital cost information, on the grounds that the benefits and the costs of a building are in its occupation. 'How much will it cost?' is not the only issue that has to be addressed. The team should test client expressed needs and requested features against cost and value criteria and encourage engineering choices to be made on the basis of best value not lowest price.

The ability of an integrated team to see a project through from start to finish is a prerequisite to 'designing in' sustainability. Sustainable processes and products cannot be added on to the end; they are achievable only if well integrated from the very beginning. Projects must be pre-planned for ease of construction, make maximum use of standard components and processes, minimise waste, conserve scarce resources, and protect wildlife habitat and bio-diversity.

Integration provides a number of additional benefits for clients. By using project participants who have long-term supply chain relationships and common processes such as information systems and a common IT platform, the integrated team solves interface problems and avoids duplication, re-design and re-work. Improved supplier relationships reduce transaction costs, improve trust, and at best encourage the measurement of performance and a commitment to continuous improvement.

Where the team is encouraged to manage cost collaboratively, for example through a modern commercial arrangement based on target cost or target price, all parties will be incentivised by sharing in efficiency gains. Integrated teams with long term relationships that have built up trust and expertise also offer greater competence in managing the process.

At every stage, members of the integrated team should harness the expertise of their supply chains to analyse every aspect of the supply chain process - acquisition, delivery and transport, storage, and the flow of materials and components to their point of use. Careful planning of these activities by every member of the team will help to minimise waste, reduce the likelihood of products and components being lost in transit or damaged on site, and prevent defective work.

Life cycle cost data is notoriously difficult to ascertain, but an integrated team that works together regularly will build up a database of robust information about operating and maintenance costs. For clients, greater confidence can be placed in data collected in this way by an integrated team with a long term relationship.

### SOFT LANDINGS

Although 'right first time' is a laudable aim, many complex buildings need a period of 'sea trials' where systems are fine-tuned so that they operate in accordance with the design intent. Soft landings is a term used to describe the process whereby members of the integrated team remain on site after hand-over to coach the facilities management team in the optimum use of the building.

*Mark Way and Bill Bordass, 'Making feedback and post-occupancy evaluation routine: Soft Landings - involving design and building teams in improving performance', Building Research and Information, volume 33, number 4, pages 353 - 360.*

### ADVANTAGES OF INTEGRATED TEAMS

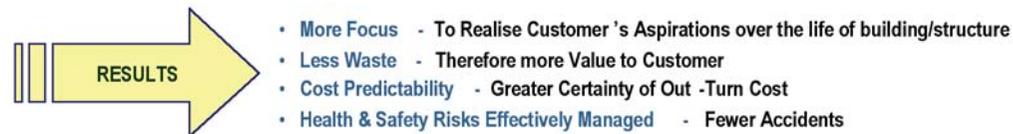
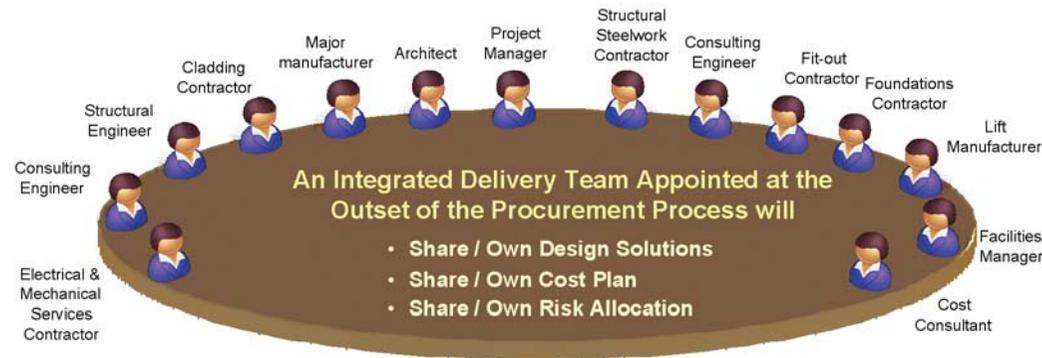
Integrated working not only improves value for the client, but also allows time for firms in the supply chain to develop business relationships with each other, creating an environment that encourages investment in capacity and innovation.

*House of Commons Business and Enterprise Committee. Construction Matters. Ninth report of session 2007-2008, Volume 1.*



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Figure 1 The Integrated Delivery Team



**Overall Result ... A Sustainable Outcome!**

**RECOMMENDATION 8**

Integrated teams should manage cost collaboratively to ensure all members of the team are incentivised by efficiency gains.

**RECOMMENDATION 9**

Integrated teams should collaborate with their supply chains to pre-plan projects, raise efficiency and minimise waste.

**RECOMMENDATION 10**

Integrated teams should collect information about operating and maintenance costs and use this evidence as the basis of their assurances to clients about performance and cost in use of the facility.

**RECOMMENDATION 11**

Integrated teams must exploit the research and development capabilities of specialists to offer clients innovative and reliable solutions with enhanced long term performance that meet sustainability criteria.

**RECOMMENDATION 12**

The integrated team must stand by its products and provide training and support to ensure end users gain the maximum operational benefits and performance improvements from them.

In terms of delivery, the integrated team is well placed to advise on the availability of new products and innovative solutions that meet sustainability criteria. Pre-planning, standardisation, pre-assembly and pre-fabrication lead to efficiency gains, improved quality and long term value in the finished product. The solution is itself integrated. In turn this will help to ensure that the completed facility meets best practice targets for energy and water consumption, helping to reduce environmental pollution and tackling the causes of climate change. Each integrated project enhances the built environment in a sustainable way and improves the quality of life.

Many in the supply chain have the research and development expertise to develop innovative solutions that improve quality and reliability and increase sustainability. If these benefits are to be gained by the industry, manufacturers must take every opportunity to advise teams on the availability of new products and innovative solutions, and to promote the advantages of increased standardisation, pre-assembly and pre-fabrication to clients and designers. There are enormous opportunities to reduce waste, add value and enhance the finished product.

The sector must therefore play its full part in providing products and processes that meet sustainability criteria and enhance long term performance and functionality of the completed project. The sector must be prepared to stand by its products, and assist end users to gain the maximum benefit from them. Case studies illustrating the achievements of integrated teams are given below. Figure 2, on page 20, shows how people, process and product are related.

Case studies illustrating the achievements of integrated teams are given below.

#### CASE STUDY - Team members chosen for sustainable expertise and experience

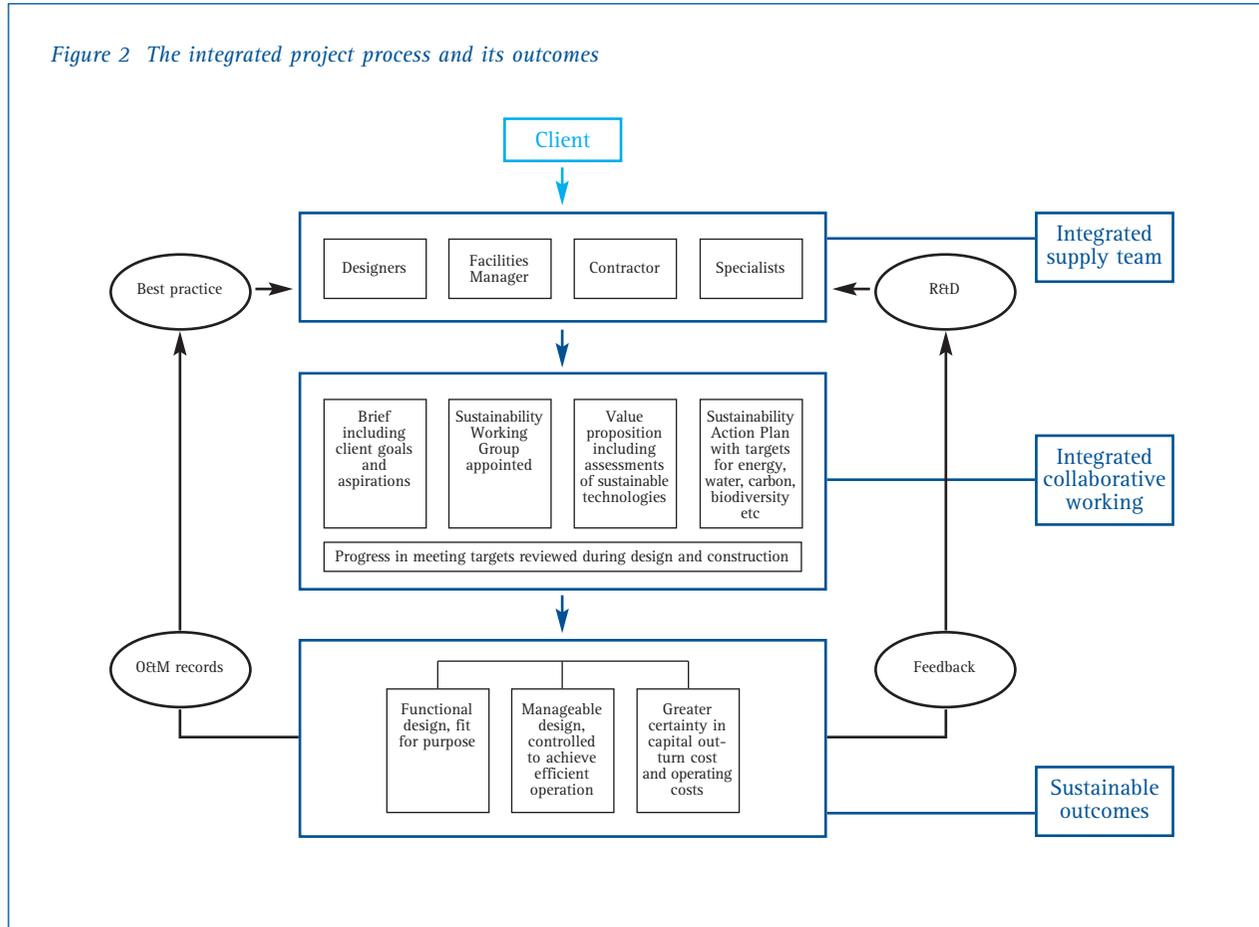
When Wessex Water commissioned architects Bennetts Associates to design a new 10,600 sqm headquarters, sustainability was a fundamental part of the client's brief. The Construction Manager from Mace was chosen for his experience of sustainable construction, and trade contractors were selected similarly for their experience of sustainable buildings. All trade contractors attended sustainability induction workshops organized by the construction manager, and their performance was reviewed against environmental indicators during the contract. The resulting achievements include excellent waste management practices and high levels of recycling - including concrete that used recycled aggregate. Environmentally, the building uses natural ventilation with BMS control, exposed concrete thermal mass, and energy efficient lighting. A post occupancy evaluation exercise highlighted some airtightness issues but these were resolved, and the building is performing well in terms of heating. Increased IT use has raised electrical demand. Extensive monitoring in the first year followed by implementation of an energy management strategy in conjunction with the controls supplier Honeywell, brought total annual energy consumption down to a target of 100 kWh/sqm, about one-third of a typical office of this type. The building is regarded as one of the finest examples of energy efficiency in the UK.

#### CASE STUDY - Building services at the top table

At the new £64m 100-bed Royal Alexandra Children's Hospital in Brighton, building-services company SES exploited off-site construction and pre-fabrication to achieve financial and time savings. SES worked closely with the architects BDP, main contractor Kajima and the client team throughout the planning process. Prefabrication relies heavily on pre-planning, and SES were involved in high level discussions throughout the project to ensure the maximum benefits in both on-site installation and end use were achieved. Close relationships in the supply chain also allowed a systematic stock management system and just-in-time delivery.



Figure 2 The integrated project process and its outcomes



The [Environment] Agency considers it obtained a better engineering solution [through early involvement of specialist engineering contractors] that will last up to 20 years longer than the initial design, which also has significant environmental benefits at a saving of £1,120,000 (12%) on the construction cost of the original solution. The contractors and consultants considered that without the early joint working approach the solution and savings would otherwise not have been identified. NAO Case Study 17<sup>24</sup>

Thames Water houses in one location the integrated project team... designers, the contractors and specialist suppliers... Consequently, projects are easier to implement, costs are lower and ideas are exchanged openly during the initial design phase when they have the best opportunity to make the greatest impact. NAO Case Study 10<sup>25</sup>

24 Case study 17, Improving Public Services through better construction, NAO' 2005

25 Case study 10, Improving Public Services through better construction, NAO. 2005

## Clients: team selection and the procurement process

The major driver for achieving sustainable outcomes for construction projects is the **procurement** process. Sustainable solutions must, primarily, come through the design process but this can only be possible when design teams are inclusive - embracing consultants, project managers, specialist contractors, facilities managers and key manufacturers. SEC Group's own research in 2005 revealed that the vast majority of engineering contractors have little involvement in design teams on Government works.<sup>26</sup>

If we are to achieve sustainable outcomes - especially reductions in energy use and waste - clients have to adopt a more integrated and collaborative approach to procurement, especially at the design stage. Traditional, fragmented and hierarchical delivery damages sustainability as well as being a source of waste and inefficiency.

The Specialist Engineering Alliance believes that there are three major contributions that the client needs to make through the procurement process to ensure a successful and sustainable project.

**FIRST, INTEGRATED TEAMS.** The client must insist upon and commission an integrated team to take responsibility for the design and delivery of the project. Team members need to be selected on the basis of their competence and expertise, and the team must include those with specialist knowledge such as product manufacturers and suppliers. Specialists are essential to the design and development of jointly devised solutions that involve increased standardisation, pre-assembly and pre-fabrication, which take work off the site, reduce health and safety risks, and improve quality and reliability. Specialists, with their research and development expertise, can advise on new products and innovative solutions which, when linked closely to design and installation, can bring real sustainability benefits in the finished product and improve the delivery of whole life value.

**SECOND, COLLABORATIVE WORKING PRACTICES.** Clients need to recognise that it takes time for the team to be put together if it is to do the job properly. Clients should support integrated working, promote co-operation and non-adversarial attitudes, and encourage effective teamworking practices including a focus on jointly devised innovative solutions and a blame-free culture. An equitable system of risk and reward that incentivises the whole team will encourage innovation, improve product quality, and increase value for money. Payment practices should be established that facilitate and enhance collaborative working. The use of performance specifications for the design gives specialists the opportunity to exploit their skills and knowledge of products and systems so as to deliver the most effective solution.

**THIRD, PROPER UNDERSTANDING OF VALUE.** Clients must be aware of the trade-off between cost and quality and therefore be clear about what they want from a project: about their requirements, their needs and wants, and about what represents value to them. Once they have developed this awareness, they should set a realistic budget for capital and revenue to achieve it. Since the benefits of a building arise from its occupation, early contact between Facilities Managers and Designers is important to ensure designers understand operational needs and capabilities. These links also help to ensure that once handed over with a package of training in how to manage the systems, the facility can be operated effectively and in accordance with the design intent. On-going costs in areas like energy and maintenance are not trivial and can easily be doubled by poor design. Clients should therefore take a whole life value approach in which on-going costs are given priority over initial capital costs. This includes preventing the main contractor from changing the specification or substituting cheaper but inferior alternative products at the last minute.

### BENEFITS TO CLIENTS FROM INTEGRATION

- Greater efficiency in project execution saving time, resources and associated costs.
- Project delivered on time and to budget as specified
- More appropriate completed design, fit for purpose and closer to client's aspirations and requirements.
- Reduced likelihood of need for early replacement of inadequate equipment
- Reduced likelihood of over-specified products being run at less than optimum performance.
- Greater overall efficiency of operation of the end product (building or facility) and associated cost savings throughout the life-cycle of the end product.
- Reduced whole life cost of the building.
- Productivity and health and safety benefits.

### RECOMMENDATION 13

Many larger projects would benefit from the setting up, during the early stages, of a Project Sustainability Working Group. Made up of specialists, this would provide advice on all aspects of sustainability to the client and others in the design team. The Integration & Sustainability Working Group of the SEA contains such expertise, and is prepared to form an advisory group or body that can offer consultancy services.



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<sup>26</sup> Central Government Construction Procurement: survey of Specialist Engineering Contractors' satisfaction, October 2005. ([www.secgroup.co.uk](http://www.secgroup.co.uk))



*A 400 kW biomass boiler: Biomass boilers work best for community-wide schemes, where they can operate with a largely constant load. Where they are used within a building, they benefit from being procured by a fully integrated project team, with client and specialist supplier on board early, that fully considers the post-occupancy operation and management issues not just theoretical technical performance.*

Photo credit: Walter Poetsch/BSRIA

maintenance). Sustainable buildings have many long-term benefits including reduced operating costs, but the emerging evidence is that their capital costs are higher than those of less sustainable alternatives.<sup>27</sup> Owing to the strict budgetary separation, many public sector organisations are constrained in their ability to spend more capital in order to reduce revenue expenditure.

Government expenditure must meet the requirements of HM Treasury's Green Book Appraisal and Evaluation in Central Government.<sup>28</sup> Simple guidance on value for money and sustainability was issued in 2007 and uses the example of energy efficiency to illustrate the importance of whole life value:

*Many such products cost more initially but have significantly lower running costs, making them cheaper over their lifetime than less efficient products. When the respective environmental costs are also taken into account, the value for money case for the more energy efficient product becomes even stronger. In these circumstances, and provided that the product is otherwise fit for purpose - eg it provides heat or light to the standard required - the more energy efficient product should be procured as it has the best whole life net cost-benefit.<sup>29</sup>*

<sup>27</sup> The market for sustainable homes., Savills, 2007.

<sup>28</sup> [www.hm-treasury.gov.uk/media/3/F/green\\_book\\_260907.pdf](http://www.hm-treasury.gov.uk/media/3/F/green_book_260907.pdf)

<sup>29</sup> [www.hm-treasury.gov.uk/economic\\_data\\_and\\_tools/greenbook/data\\_greenbook\\_money\\_sustainability.cfm](http://www.hm-treasury.gov.uk/economic_data_and_tools/greenbook/data_greenbook_money_sustainability.cfm)

<sup>30</sup> Selecting the Team, Construction Industry Council, 2005.

The Working Group heard evidence of cases where a planned sustainable design had to be revised because, on being developed and implemented by the engineering contractor, it was found to have exceeded the budget. This is frequently the case on public sector projects. The Group considers that the error here has been not to bring the contractor into the design process sufficiently early. Were this done effectively, the integrated team could ensure that the design outcomes would match the cost plan.

The Working Group believes that clients should be clear about their total capital and revenue budget. Knowing this, the integrated team can then take responsibility for providing the client with the optimum solution to match the client's overall figure. This avoids the risk of an inefficient building with wasteful operation, unexpectedly high running costs, and a poor Energy Performance Certificate rating.

The strict separation in the public sector of capital versus revenue expenditure is a recognised barrier to sustainability. The difficulty arises because separate budgets are set for capital expenditure (used for the acquisition of a tangible asset such as a building or which adds to the capital value of an existing asset) as against revenue expenditure (defined as that incurred on day to day operation including utility costs and building

#### EARLY INVOLVEMENT

Overall, government is not doing enough as client to engage with the supply chain early on - a key feature of integrated working. As a result, the public sector is missing out on efficiencies that would deliver a cheaper and better quality end product.

*House of Commons Business and Enterprise Committee. Construction Matters. Ninth report of session 2007-2008, Volume 1.*

Selection is where team building begins. The CIC's publication *Selecting the Team*<sup>30</sup> gives practical advice on convening a selection panel, setting appropriate criteria and evaluating potential candidates. In the foreword Peter Rogers, then chairman of the Strategic Forum for Construction, says: Using a carefully selected integrated team will enhance a project in many ways. A key factor to the success of any project is getting the brief right and a well chosen team is better able to develop a brief that meets the client's needs. A good team will adopt a coordinated approach that means problems can be anticipated and planned for allowing the client to more effectively manage the level of risk. The project objectives are more likely to be understood by everyone involved in the construction process (the project stakeholders) and health and safety, environmental and sustainability issues are all considered throughout the construction phase not in an 'ad hoc' way.

#### ENERGY PERFORMANCE CERTIFICATES

Energy Performance Certificates denote the energy efficiency rating of buildings on a scale from 'G' the least efficient to 'A' the most efficient. New homes and those being sold require them. Public buildings over 1000 square metres must exhibit a Display Energy Certificate (DEC) showing their Operational Rating, which is based on utility meter readings.

Further supplementary guidance has been prepared by Working Group 2 of the Public Sector Construction Clients' Forum (PSCCF). This gives support to allowing trade-off between capital and revenue expenditure in new public sector projects, taking into account anticipated operational expenditure over a ten year period. The key proposal, endorsed also by a series of national workshops undertaken under the Urban Buzz initiative, is that the Green Book should include the following additional statement:

*Those commissioning public sector construction/refurbishment projects must show evidence of carrying out an option appraisal that includes both the running costs out to 10 years, or another period if demonstrably appropriate, and also the notional costs of carbon dioxide and other emissions at costs advised by DEFRA (currently the cost of CO<sub>2</sub> emissions is £75 per tonne per year); these costs should all be discounted back to NPV in the normal manner.<sup>31</sup>*

The Integration & Sustainability Working Group endorses this proposal, and believes it will encourage improved long term thinking and more sustainable buildings.

In taking a 'cradle to grave' approach to building operation, clients should also adopt a 'cradle to grave' procurement strategy. It is wasteful of resources to procure design, construction/installation, FM or maintenance separately. Such an approach fragments the delivery process and works against participation of the full team in whole life considerations.

Comparisons between the products and outcomes of traditional procurement against those of integrated collaborative working are given in table 3, page 24. Case studies on the use of sustainability frameworks and charters are provided on pages 25 and 26.

#### CLIENT SURVEY RESULTS - RISING DEMAND FOR SUSTAINABLE OFFICES

International property advisers GVA Grimley have conducted several surveys of office occupiers to determine their attitudes and intentions towards 'green' issues. From their own surveys and the findings of other similarly situated organisations, they report an increasing demand for more sustainable offices. Surveys show occupiers recognise the benefits and are prepared to pay to achieve them. Their research also shows that the premium in build costs for sustainable offices more than pays for itself over time, while the asset performance is stronger than that of offices built to minimum standards. According to GVA Grimley: Such buildings should carry a lower risk premium and experience reduced obsolescence, translating into higher rents, stronger rental growth and higher capital values.<sup>32</sup>

#### RECOMMENDATION 14

Greater flexibility in the treatment of capital and revenue budgets is required in the public sector, to encourage long-term thinking and capital investment in more sustainable facilities.

#### RECOMMENDATION 15

Clients should be clear about their overall budget and should entrust this to the integrated design team. Through its understanding of costs and performance, the team can make a value proposition that represents the optimum balance between capital and operating costs within the client's budget.

<sup>31</sup> Implementation of emerging government and other urban regeneration sustainability policies, David Adamson and Peter Morris, Urban Buzz Project Report, April 2008, <http://128.16.14.67/scommunities/getUBFile.do?id=74>

<sup>32</sup> RESEARCH: Sustainability - towards sustainable offices, GVA Newsletter, Spring 2007



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*Table 3 A comparison between traditional procurement and integrated collaborative working*

TRADITIONAL PROCUREMENT	INTEGRATED COLLABORATIVE WORKING
<b>Process</b>	<b>Process</b>
Main focus is on minimising initial capital cost.	Main focus is on identifying customer requirements and value criteria.
Lump sum, lowest price tendering ignores whole life costs, such as energy, water and maintenance over the lifetime of the building.	Working to a client budget that combines capital and revenue expenditure, the integrated team can take decisions to provide the optimum balance between initial capital cost and on-going costs over an agreed period.
Lack of dialogue and poor communication between engineering consultants, contractors, suppliers and manufacturers result in initial design concepts that have to be converted into practical and co-ordinated design solutions. Specialist expertise is introduced after key decisions have been made without it. Duplication at the different levels of delivery result in re-design and re-work and are a source of inefficiency as well as waste.	Key members of the project team are involved early in the process so that options and ideas from those who are expert in providing built environment solutions are made available to clients when they are defining their business needs and choosing possible solutions.
Brought together as a group of lowest tenderers, the parties have little incentive for delivering customer value, and focus on improving their own profitability.	Selection of collaborators on the basis of value not lowest price.
Hierarchical and sequential appointments generate many interfaces, and needless transaction costs are incurred through extensive tendering and contractual processes potentially leading to adversarial relationships.	Transaction costs are reduced through early collaboration.
Collaboration is limited to a need to know sharing of information, and when things go wrong, seeking to blame others.	Working together as a team to agree mutual objectives, and devising ways to resolve any disputes.
There are no incentives for adopting common processes.	Adopting common processes such as shared IT.
Lack of long term relationships among the supply team or with the customer, limit any incentive in delivering a well-integrated product. Concern is limited to each party's separate element.	Using participants who have long-term supply chain relationships.
	<i>continued over</i>

*Table 3 A comparison between traditional procurement and integrated collaborative working (continued)*

TRADITIONAL PROCUREMENT	INTEGRATED COLLABORATIVE WORKING
<b>Process</b>	<b>Process</b>
Each party tries to minimise its own exposure to risk by passing it to others, and there are no incentives to make efficiency gains.	Dealing with risks and rewards equitably by using a modern commercial arrangement based on target cost or target price with all parties being incentivised by sharing in efficiency gains.
Performance is measured only on a company by company basis, not the whole team.	Agreeing to measure performance and to seek continuous improvement.
<b>Outcomes</b>	<b>Outcomes</b>
Out turn costs higher than the original bid, and projects frequently late in hand-over.	Improved predictability of cost and time arising from realistic assessments of both made by the whole team.
Fragmented delivery process makes sustainable design and construction difficult to achieve. Not everyone buys into the most sustainable solutions and value engineering can result in the late substitution of cheaper but less sustainable options. Sub-optimal solutions and lack of integration in the final product are often the result.	A more integrated product with improved whole life costs.

**CASE STUDY - FRAMEWORK FOR SUSTAINABLE CONSTRUCTION**

The John Lewis Partnership has established a comprehensive framework for delivering sustainable construction in the retail sector. JLP recognises that its ambitious programme for the next ten years presents a tremendous opportunity for the development and implementation of new standards to minimise its impact on the environment and the communities it serves. Running to 34 pages, the framework was developed in conjunction with Forum for the Future. It starts with a vision that emphasises comfort and efficiency but commits the organisation to taking practical steps with clear sustainability objectives. Every project will have a Sustainability Action Plan and the appointment of a senior sustainability champion. In selecting members of the construction team, sustainable development will be a key consideration in the selection criteria and carry a high weighting.



#### CASE STUDY - SUSTAINABLE OFFICES IN DURHAM

The Rivergreen Business Centre just outside Durham is a naturally ventilated speculative office building owned and occupied by Rivergreen Developments, with parts of it let to a variety of organisations from sole traders to Durham County Council. Rivergreen is committed to developing stable and long-standing relationships with the supply side, and as a repeat client, provides strong client leadership. Cruciform in plan the building relies wholly on natural ventilation, even in the conference centre where a limit on occupation density has been accepted rather than installing air-conditioning. Sustainable technologies include biomass boilers, solar thermal panels for domestic hot water, rainwater recycling, and a south-facing rammed earth wall that absorbs solar radiation. Not only did the building achieve a BREEAM 'excellent' rating, but a study of it in use by Arup R&D show it to be performing well. BSRIA have featured it as model project.<sup>33</sup>

#### CASE STUDY - HIGHEST BREEAM 'EXCELLENT' RATING

The 4,500 sqm Innovate Green Building in Leeds went through many design development stages before becoming what is now a very low carbon footprint building. Yorkshire Forward worked with Innovate Properties to fund part of the cost of prototyping sustainable construction methods. The design team examined each element from first principles to assess its benefits to the overall building performance. Consisting of two flexible office blocks linked with a feature street, the project features Termodeck hollow pre-cast floor planks through which ventilation passes before being supplied to occupants through diffusers. The fabric is highly insulated and works as a thermal store. Air handling units have thermal wheels that recover heat from the extract air. Other innovative technologies include combined heat and power, an absorption chiller, and underfloor heating to the 'street', as well as low energy lights, a vacuum toilet system, waterless urinals and rainwater and grey water harvesting. Services are controlled by a BMS. The project was awarded an 'excellent' BREEAM rating scoring 87.55%, the highest ever rating at the time.

#### CASE STUDY - A 'SUSTAINABILITY CHARTER'

For Land Securities' shell and core office development at New Street Square, the architects Bennetts Associates developed the sustainability brief and specification with the client. Before tender, there was high degree of coordination that included 3D clash detection modelling. As part of the tendering procedure, there was in-depth questioning of potential contractors, and the successful contractor was required to sign up to a 'sustainability charter' as part of his appointment. 93% of demolition waste was recycled, and site waste was tracked. 100% of plasterboard was recycled. Cladding uses a high performance system with low embodied energy and external FSC-certified timber louvres. The main structure uses post-tensioned concrete slabs with blast furnace slag aggregate. Plant rooms and WC cores are prefabricated, and risers are modular. The client and the design team were both closely involved in the supply chain, and Land Securities have long term agreements with first and second tier suppliers. The contract was design-and-build with novation.

<sup>33</sup> 'Tales from the Rivergreen', BSRIA Delta t, October 2007, pages 12-16.

## How designers and consultants can support integration

According to Mike McCloskey, HVCA President 2006-07, designers are well intentioned and have the correct approach, but there is an implementation gap:

*In most cases, the initial design of a building-services system contains the right aspirations and many of the right techniques, but on too many occasions something goes badly wrong between that point and implementation. This is why consulting engineers need to work hand in glove with contractors as early as possible in the process to ensure the systems they design can be properly and accurately implemented - especially now as the drive for sustainable buildings gathers pace.<sup>34</sup>*

Key professional institutions have for several years recognised the benefits of early involvement of specialist suppliers, specialist contractors and specialist manufacturers, and have promoted integration to their members. For example, the CIBSE recommends embracing a radically new role for specialist suppliers:

*Harnessing the skills and experience of specialist suppliers from the outset can bring commercial benefit to every firm in the design and construction supply chain. It can end rework, maximise standardisation of components, material and processes, maximise the effective use of labour on site, reduce risk (including cost of ownership risk), and boost the morale of each individual throughout the supply chain. These benefits will enable the unnecessary costs due to inefficiency and waste to be converted into higher margins, salaries and wages, better training and lower prices to customers.<sup>35</sup>*

The Institution of Civil Engineers has taken a similar line:

*Designers must involve the contractors, specialist sub-contractors and key manufacturers as soon as possible. In order to interpret and develop a functional brief it is essential that designers (including specialist subcontractors and key manufacturers) are able to get close to clients. Many contractors do not allow this to happen and this needs to change. Once the project is designed the advantages that can be offered by these specialists are missed.<sup>36</sup>*

The Integration & Sustainability Working Group believes these recommendations need to be implemented as a matter of urgency, with consultants involving key members of the supply chain early on. Consultants should support and participate in a cross-disciplinary Sustainability Working Group for each project, to inform the development of the design; and specialist engineering sector representatives should be essential members of it.

The Integration & Sustainability Working Group further recommends that designers and consultants should:

- Use best practice advice about environmental sustainability from the Carbon Trust, professional institutions (such as CIBSE and IMechE) best practice programmes (such as Constructing Excellence and the Waste & Resources Action Programme, WRAP) research organisations (such as BSRIA) and trade bodies (such as HVCA, ECA, BCSA and SELECT).
- Use products whose performance has been certified by organisations such as Eurovent, AMCA, or HMSA.
- Use government approved schemes to select products, e.g. Microgeneration Certification.

### Benefits of integration for designers

- Better design with a building fit for purpose.
- More satisfied clients leading to repeat business.
- Improved reputation for achieved performance, higher profile in the market place and PR opportunities.
- Savings in design costs and better margins associated with redesign and re-work by speaking to the right person at the right time.

The recently published CIC *Consultant's Appointment* contract for consultancy services promotes a new approach for integration of design responsibilities between consultants and specialist contractors, and its use is endorsed by the SEA.

<sup>34</sup> 'Don't get lost in a sustainability blitz' Mike McCloskey, *Modern Building Services*, vol 3, issue 11, March 2007, page 11.

<sup>35</sup> Supply chain integration in building services, CIBSE Briefing, 2002.

<sup>36</sup> Institution of Civil Engineers, quoted in *Accelerating Change*.



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Consultants should focus on ensuring operation and use in the completed project are discussed at an appropriately early stage in the design process and, once the design is agreed among the integrated team, avoid compromising it. Stringent sustainability targets should be set, particularly for energy use, carbon footprint, and water consumption; and checked periodically during the design process to ensure they are met in the completed project. A wide range of tools is available for assessing environmental impact.

Costs should be managed collaboratively and by negotiation with the integrated supply team, to ensure engineering choices are made on the basis of best value against clients' real needs rather than lowest price.

The specialist engineering sector further believes that consultants should develop better links to manufacturers and distributors, for example via common Continuing Professional Development seminars and courses.

Case studies where designers have led integration are given below.

#### CASE STUDY - FABRIC AND SERVICES WORKING TOGETHER

At the PowerGen headquarters building in Coventry, sustainability was a fundamental part of the clients brief, and natural ventilation rather than air conditioning was particularly emphasized, together with daylight. The design team used computational fluid dynamic (CFD) modelling early in the process, as well as sophisticated daylight modelling methods. All heating and cooling is provided by a series of heat pumps. A night cooling control algorithm was devised for high level BMS-controlled window vents by Nigel Griffiths and developed by Kinross Control Systems. Exposed thermal mass in the soffits reduces the risk of overheating, and the form and finish of these soffits, as well as the post-tensioning and GRP formwork, were developed by the design team in collaboration with the main contractor. A full bay mock-up helped to refine the process. Pre-fabricated brick cladding was also developed in conjunction with the contractor. The form of contract was design-and-build with novation.

#### CASE STUDY - BUILDING FABRIC USED FOR ENERGY STORAGE

At Brighton Library, sustainability was a fundamental part of the client's brief. The architect - Bennetts Associates - was the sustainability champion. The environmental strategy for the building is based around Fabric Energy Storage (FES). The whole building was designed as an integrated ventilation and thermal storage system using in-situ concrete together with Termodeck hollow-core concrete planks. Ventilation air is delivered to occupants via the hollow cores of these planks; in doing so, the air either heats them in winter or cools them in summer, helping to maintain comfort conditions. In addition, the BMS controls vents and also high level wind cowls supplied by Vision. To make this design happen, required integrative working with a number of specialist contractors. The integrated nature of the building fabric and ventilation supply system was a key element of the design, and was recognized as such and held intact during value engineering exercises. The contract type was PFI design-and-build.

#### RECOMMENDATION 16

Consultants and designers should, as a matter of course, use best practice advice, appropriate assessment tools, and government certification schemes.

#### RECOMMENDATION 17

Consultants should focus on ensuring operation and use are discussed at an appropriately early stage, set stringent targets in association with specialist members of the integrated team, and work with the supply team to ensure they are achieved in the completed project.

#### RECOMMENDATION 18

Consultants should develop better links to manufacturers and distributors, with common CDP seminars and courses.

Through M & E sustainability the Heating and Ventilating Contractors' Association (HVCA) and the Electrical Contractors' Association (ECA) have published a series of green guides to good practice and/or specification leaflets for sustainable systems and equipment for members. ([www.mech-elec.org.uk](http://www.mech-elec.org.uk))

#### CASE STUDY - INTEGRATED LIGHTING AND RADIANT HEATING SYSTEM

Horbury High School in Wakefield has been designed to achieve a 'very good' BREEAM rating. The goal of a comfortable and productive working environment in the classrooms has been achieved using an exposed concrete soffit with suspended rafts incorporating lighting, radiant-heating and acoustic absorption. The rafts were made by SAS and sister company HCP. M&E Consultants were Silcock Leedham. The project services engineer said: 'SAS was chosen as we had complete confidence that the company would be able to work with us on the design and manufacture of this bespoke solution. Combining the heating into the acoustic lighting rafts ensures a comfortable teaching environment is achieved, whilst allowing us to utilise the thermal properties of the concrete floors.' No wall space is required for radiators and the radiant panels have a low water content, reducing plant size and energy consumption.

#### CASE STUDY - PRE-FABRICATED CLADDING DESIGNED COLLABORATIVELY

At Potterrow, Edinburgh, sustainability and BREEAM targets were written into the specification and contract. For the pre-fabricated concrete façade, three trade contractors were invited to design in discussions with the architects at RIBA Stage C, and a performance specification was developed with their suggestions. Once the main contractor was appointed, Lovell was appointed to supply and fix the cladding. Detailed design of the cladding was undertaken by the architects in conjunction with both main contractor and supplier, and resulted in considerable savings in time and money as well as improvements in quality. A mock-up was created for quality inspection and testing of interfaces with the glazing supplier. As a result of this, build quality is high with many issues being resolved at the mock-up stage. The building also features an integrated mixed mode ventilation strategy and it represents the first building in Scotland to achieve the Construction BREEAM standard.



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## Lead contractors and specialists

Clients will eventually take responsibility for the environmental sustainability of the complete facility as provided to them. In contractor-led procurement routes, contractors must therefore help clients to appreciate, and to meet, their environmental and social responsibilities.

Lead contractors are responsible for co-ordinating the operations that encompass design, manufacture, construction and delivery. There are substantial opportunities for them to eliminate non-value-added activities. One of their key tasks is to ensure that the right expertise is available at the right time in the process. Ideally in this form of procurement, they should convene and lead the Sustainability Working Group for the project.

The contractor should involve appropriate members of the supply chain early in the process by supporting an integrated supply team. Good working relationships with specialists, product manufacturers and suppliers are essential, since their input to product design can offer the potential for considerable savings through identification of standard products and detailed design solutions that are practical to implement and reliable in operation. Such relationships will be enhanced by payment practices that facilitate and enhance collaborative working.

Groups made up of established suppliers who stay together from one project to the next take experience and a culture of continuous improvement with them, and offer a number of demonstrable business, efficiency and safety benefits. Collaboration of this kind provides opportunities to drive out waste at all stages of the project, to raise productivity and to reduce project times, to reduce costs by 'getting it right first time' and to 'design-in' sustainability.

In particular, contractors should ensure designers are able to get close to clients so as to contribute to the brief, and encourage designers to involve specialist contractors and key manufacturers as soon as possible. Once the project is designed the advantages that can be offered by these specialists are missed.

Contractors should ensure specifications and targets are passed along the supply chain, and above all avoid substitute inferior products in the hope of saving capital costs. All too often these prove to have inferior performance and to require higher maintenance and running costs. It is vital for sustainability that the whole life value of the project as a whole is considered, not just its initial capital cost.

Some examples of contractor-led integration are given below.

### CASE STUDY - STRATEGIC ALLIANCE IN THE SUPPLY SIDE

Taylor Woodrow formed a Strategic Alliance Partnership (SAP) in 1999 as an open-book alliance between its building services division and three key suppliers. Preferred supply partners offering specialist engineering services and products were added to the partnership. They benefit from continuity of work, while claims and variations have fallen sharply. Radical improvements in tendering, planning, organising and delivering projects followed. Successful delivery of the Welsh Assembly Building on time and to budget is the most prominent of many projects to have benefited from the collaborative approach, which Taylor Woodrow says is essential to the successful delivery of major schemes.<sup>37</sup>

### Benefits of integration for lead contractors

- Build right first time to a fully co-ordinated design.
- Knowing they have provided a building fit for purpose with known maintenance costs.
- Greater certainty about costs and quantity of work
- Satisfied clients.
- Brand advantage.
- Reputation for delivering sustainable projects.
- Margins which are compatible with risk.

### RECOMMENDATION 19

Lead contractors should promote contact between designers and client, and between designers and specialist contractors and key manufacturers early in the process.

### RECOMMENDATION 20

Lead contractors should ensure the whole integrated supply team is aware of specifications and targets, and must avoid substituting inferior products that jeopardise long term performance.

<sup>37</sup> [www.strategicalliancepartnership.com](http://www.strategicalliancepartnership.com)

#### CASE STUDY - SUSTAINABLE SCHOOL IN NOTTINGHAM

Redlands Primary School in Nottingham was extended in 2003-2005 with the addition of a 7-class junior teaching block and a table tennis centre. The total contract value was £3.1m but owing to funding issues was managed as a phased programme. Nottinghamshire County Council used the project to advance a strategy for sustainable development and the school includes a wind turbine, rainwater harvesting and passive ventilation. Willmot Dixon were the construction partner, being selected through a 70/30 price/quality tendering exercise. As the main contractor, they already had a supply chain in place. At the time of the partnership formation, funding was in place only for the first phase, but the team agreed to work together at risk before the second phase funding was obtained. During construction, a fire at a local school resulted in pupils being temporarily relocated to Redlands which halted construction. Despite this, the teamwork approach resulted in the project being completed on time and to budget. The partnering and sustainable construction elements of the project led to it being featured as a Constructing Excellence LGTF Demonstration Project.<sup>38</sup>

#### CASE STUDY - A MONUMENT TO INTEGRATED COLLABORATIVE WORKING

The striking St Pancras station re-development is a monument to integrated collaborative working. The £800m four-and-a-half year project was completed on time and to budget. The contract was commissioned by London & Continental Railways and was carried out as a fully integrated joint venture, with open book accounting, between Costain, Laing O'Rourke, Bachy, and including Emtor Rail as the mechanical and electrical contractor. The project is a triumph of logistics, with a site staff of over 2000 working on the Grade 2 listed building while railway services were maintained throughout. Commercial teams successfully managed and resolved issues without letting costs escalate.

#### CASE STUDY - BMS INSTALLER INVOLVED FROM DESIGN STAGE

The Winchester Discovery Centre is a £5m flagship refurbishment and new build project to transform the former town library into a cultural centre including performance space and an exhibition gallery. All HVAC plant is controlled by a BMS, enabling remote management and monitoring. The controls were installed by WES, who were involved in the controls project for a year from design and planning right through to commissioning.

## Insurers and investors as stakeholders

The Integration & Sustainability Working Group has identified that other parties also need to change their standard practices and take action to bring about more sustainable projects through integrated collaborative working and the early involvement of specialist engineering contractors.

Existing systems of individual Professional Indemnity insurance reinforce the existing fragmentation in the team and encourage adversarial relationships. Responsibilities are clearly divided, discipline by discipline. Each party focuses on its own individual part of the project and protects its own territory, leaving no-one to view the project as a whole. Innovation is discouraged by risk-averse attitudes.



*Cambridge Centre for Mathematical Sciences: The Cambridge Centre for Mathematical Sciences was a successful early adopter of the Soft Landings approach, where the design team stayed involved after occupation to hand-hold the occupants and fine-tune the systems in the light of operational experience. Soft Landings works best where it is a no-blame, no-liability process running alongside the traditional defects warranty period, ensuring that the project team and the key specialist contractors work together to ensure the building performs as intended.*

Photo credit: Roderic Bunn/BSRIA

Even simple measures such as natural ventilation are seen as representing a higher risk than mechanical systems, resulting frequently in over-design and the installation of unnecessary plant and services, with all their associated running and maintenance costs. New project-based forms of insurance are gradually being introduced, but progress is slow and sustainability is the casualty.

Some investors are clearly interested only in short term returns and unwilling to consider whole life value. While this is understandable, other investors such as pension funds, despite the apparently long-term nature of their interest, can be equally risk averse, which is a further barrier to progress and innovation. Neither of these limitations, however, apply to local or central government which have long-term needs and are in a position to take a long term view and benefit from facilities that are fit for purpose over their expected life-times.

### Benefits of integration for associated stakeholders

- Better return on capital from long term sustainability
- Adaptable and flexible buildings contribute to sustainability by being longer life and looser fit, requiring fewer unplanned upgrades and refurbishments. They are more likely to meet future environmental legislation and to improve their Energy Performance Certificate rating without costly upgrades.

### RECOMMENDATION 21

Integrated teams should explore project bank accounts and single project insurance both to reassure clients but also as a way of supporting integrated collaborative working.

### RECOMMENDATION 22

Financiers who are investing for the longer term themselves need to take a long term perspective towards the facilities in which they are investing.

## List of recommendations

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- Funding for public sector projects should, progressively, be made conditional upon evidence that the procurer has put in place an inclusive and integrated design team comprising those parties - consultants, project managers, engineering contractors, manufacturers and facilities managers - that are key to delivering sustainable outcomes. [\(Recommendation 1, page 12\)](#)
- Government must take a lead in adopting best practices in sustainability by commissioning integrated teams to provide facilities that demonstrate the step change in sustainable performance that such teams can deliver and that is urgently needed to drive forward innovation and deliver sustainability. Greater incentives and penalties should be introduced to ensure the improved ways of delivering sustainable facilities are driven through. [\(Recommendation 2, page 12\)](#)
- Central Government and Devolved Administrations should each appoint a high profile 'champion' to drive forward the integration and collaboration agenda. [\(Recommendation 3, page 12\)](#)
- Evidence of integration and collaborative working should be part of the best value review process in the public sector. [\(Recommendation 4, page 12\)](#)
- There is a need for a network to advise the public sector about assembling integrated construction project teams, and members of the Working Group are willing to come together to get this started. [\(Recommendation 5, page 12\)](#)
- Preference in public sector selection procedures should be given to firms that can - whether individually or through membership of reputable qualification schemes - demonstrate their technical proficiency, commitment to training and health & safety, and availability of adequate resources. [\(Recommendation 6, page 14\)](#)
- Public sector selection procedures should incorporate weightings that favour firms that have invested in sustainable and renewable technologies and that can show evidence of waste reduction within their businesses. [\(Recommendation 7, page 14\)](#)
- Integrated teams should manage cost collaboratively to ensure all members of the team are incentivised by efficiency gains. [\(Recommendation 8, page 18\)](#)
- Integrated teams should collaborate with their supply chains to pre-plan projects, raise efficiency and minimise waste. [\(Recommendation 9, page 18\)](#)
- Integrated teams should collect information about operating and maintenance costs and use this evidence as the basis of their assurances to clients about performance and cost in use of the facility. [\(Recommendation 10, page 18\)](#)
- Integrated teams must exploit the research and development capabilities of specialists to offer clients innovative and reliable solutions with enhanced long term performance that meet sustainability criteria. [\(Recommendation 11, page 18\)](#)
- The integrated team must stand by its products and provide training and support to ensure end users gain the maximum operational benefits and performance improvements from them. [\(Recommendation 12, page 18\)](#)
- Many larger projects would benefit from the setting up, during the early stages, of a Project Sustainability Working Group. Made up of specialists, this would provide advice on all aspects of sustainability to the client and others in the design team. The Integration & Sustainability Working Group of the SEA contains such expertise, and is prepared to form an advisory group or body that can offer consultancy services. [\(Recommendation 13, page 21\)](#)
- Greater flexibility in the treatment of capital and revenue budgets is required in the public sector, to encourage long-term thinking and capital investment in more sustainable facilities. [\(Recommendation 14, page 23\)](#)
- Clients should be clear about their overall budget and should entrust this to the integrated design team. Through its understanding of costs and performance, the team can make a value proposition that represents the optimum balance between capital and operating costs within the client's budget. [\(Recommendation 15, page 23\)](#)
- Consultants should, as a matter of course, use best practice advice, appropriate assessment tools, and government certification schemes. [\(Recommendation 16, page 28\)](#)
- Consultants should focus on ensuring operation and use are discussed at an appropriately early stage, set stringent targets in association with specialist members of the integrated team, and work with the supply team to ensure they are achieved in the completed project. [\(Recommendation 17, page 28\)](#)
- Consultants should develop better links to manufacturers and distributors, with common CDP seminars and courses. [\(Recommendation 18, page 28\)](#)
- Lead contractors should promote contact between designers and client, and between designers and specialist contractors and key manufacturers early in the process. [\(Recommendation 19, page 30\)](#)
- Lead contractors should ensure the whole integrated supply team is aware of specifications and targets, and must avoid substituting inferior products that jeopardise long term performance. [\(Recommendation 20, page 30\)](#)
- Integrated teams should explore project bank accounts and single project insurance both to reassure clients but also as a way of supporting integrated collaborative working. [\(Recommendation 21, page 32\)](#)
- Financiers who are investing for the longer term themselves need to take a long term perspective towards the facilities in which they are investing. [\(Recommendation 22, page 32\)](#)



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The logo for Specialist Engineering Alliance (SEA) features the lowercase letters 'sea' in a white, elegant serif font. The letters are closely spaced, with the 's' and 'e' overlapping slightly. The logo is centered horizontally and is flanked by two thin white horizontal lines, one above and one below the text.

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