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THE EUROPEAN
LOW-ENERGY
FORUM 1994

Derek Gregory



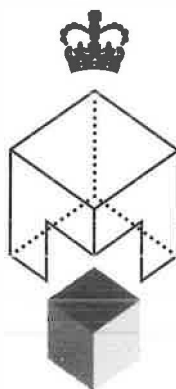
BSRIA

THE EUROPEAN LOW-ENERGY FORUM 1994

Results of a two-day workshop
to discuss why more low-energy
buildings are not being built today,
and to make recommendations
for the future.

Derek Gregory

ACKNOWLEDGEMENT



C O N S T R U C T I O N
S P O N S O R S H I P
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working with our industries

This forum was planned, organised and hosted by BSRIA with partial funding from the Department of the Environment under the DOE Partners in Technology Programme. The Architects Journal and BSRIA also made a contribution to the funding. It was timed to run in parallel with the CIBSE Technical Conference, and was held at a nearby location in Brighton so that delegates to each function could join together at appropriate periods.

The planning was carried out by a group consisting of Peter Jackman and Derek Gregory of BSRIA and Timothy Battle of Rybka Battle Ltd.

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SUMMARY

Sixty one representatives from all sectors of the construction industry accepted BSRIA's invitation to participate in a 2-day meeting to discuss:

1. **Why are not more "low-energy design" buildings being built today if the technology is currently available?**

and

2. **What should be done to promote more "low-energy buildings"?**

Delegates included client representatives (eg property developers) as well as architects, engineers and constructors.

Four separate syndicates concentrated on the market forces, structural design options, lighting issues, and comfort issues. Assembling together after their separate deliberations there was a good consensus on why so few low-energy buildings are now being built, but less so on the recommendations for future action.

The Forum confirmed what had been assumed at the start, that **Low Energy for its own sake is not a marketable commodity**. Energy costs are still a minor consideration in the overall economics of a building. Clients are more interested in low capital costs, flexibility for future changes in building use, and increasingly with occupant satisfaction with the quality of the working space.

Clients also fear that emerging technologies will increase the risk of failure. This concern partly arises because surveyors, project managers and other advisers have a poor understanding of innovative proposals and their lack of conviction leads clients to shy away from novel design solutions. When clients asked for performance guarantees from the designers nobody wanted to give them. The designers said that performance, particularly comfort, was influenced by many factors beyond the specialist designer's control, especially once the building was occupied.

It also became clear that **"Comfort" means more than just temperature and fresh air**. The concept of comfort was expanded into what was called "quality of the working space". This included not only conventional comfort criteria such as temperature, lighting levels and ventilation but covered the overall ambience and spaciousness of the interior itself. There was a feeling that occupants were happier if they could see outside, regardless of the actual view itself, if they had individual control of some of the environmental parameters, and if they perceived a positive attitude to comfort by their managers.

A key thought surfaced throughout the forum, that **measurable criteria of performance are needed for marketing**. Delegates said that they wanted measurable criteria with which to assess and label a building's performance. The application of BREEAM was endorsed, with a call for it to be enhanced to include "comfort" and other measures of performance to enable its use for marketing purposes.

There seemed to be no evidence that the marketplace demands air conditioning for its own sake, as long as comfort can be provided at equally low cost and freedom from risk of failure. Delegates thought that natural ventilation could in principle be adequate to keep a properly shaped and oriented building comfortable, but that there is a technology gap in providing free ingress of air without ingress of external noise and pollution.

The forum did not produce a clear answer to the question of what should be done to promote more low-energy buildings in the light of the fact that the marketplace does not rate "low-energy" very highly. Most "designers" present felt that society really needed low-energy features and they were keen to include them - some felt that this could be done at no extra cost over a conventional building. But the market need to respond to the clients' emphasis on low cost - low risk - occupant satisfaction meant that low energy characteristics would have to be introduced as part of an overall embodiment of quality and performance.

RECOMMENDATIONS

Over 40 recommendations emerged, each addressed to a sector of industry or to a specific body.

Industry

Should set up a group to develop an "MOT" type performance test for buildings, both new and in use; develop and validate more design software for the conceptual design stage; research acoustic attenuation problems through natural ventilation openings; reduce reflected glare from VDUs.

Designers

Should apply comfort standards at a conceptual stage; consider assessment and manageability of performance throughout the life of buildings; develop adaptable design solutions.

Clients

Should apply greater realism to their expectations and avoid compromising important criteria; recognise that the achievement of comfort is more than just a design issue and involves proper operation and management of buildings and the people in them; and make use of field data from existing buildings when specifying new ones.

Standards-makers

Should be more flexible towards accommodating individual building applications; provide space and proximity norms for guidance; encourage designers to achieve higher than standard performance; and avoid over-prescriptive standards.

Government

Should include low energy targets and air tightness standards in regulations; sponsor a UK clear sky test facility; stimulate the market for dimmable low energy lighting; adopt a more holistic approach to research in building energy reduction.

BSRIA and/or BRE

Should monitor low energy building comfort levels and performance in the field, and produce and disseminate a database of low energy building performance in use; produce guidance for commissioning and testing of low energy buildings; issue a bulletin that identifies current sources of design data; produce simple performance prediction models.

BRE

Should extend BREEAM to include "quality of space" aspects; publish a Digest on low energy lighting.

CIBSE

Should promote CPD material, require "low energy" design content in university/college courses, and instigate a technology review group on low energy design; re-examine standard lighting level norms.

BCO (The British Council of Offices)

Should prepare a realistic and consistent model brief for low energy designs; include daylighting in their guide for urban offices; add a "MOT" type testing scheme for buildings, both new and in use.

ACE (The Association of Consulting Engineers)

Should set a fee structure to reflect increased design input in low-energy buildings; develop guidelines on professional indemnity

1 INTRODUCTION

There is a consensus within the construction industry that, in principle, low-energy buildings are "a good thing". They should help to preserve the long-term global environment, be cheaper to operate, and be equally or more pleasant for the occupants, than conventional buildings.

Why, then are low-energy buildings not currently recognised in the UK marketplace?

The European Low Energy Design Forum, chaired by Timothy Battle, was organised in order to address this question and to make recommendations for the future. Sixty one delegates were invited by BSRIA to attend a two-day meeting held in parallel with and in close proximity to the CIBSE Technical Conference in Brighton on 2-4 October 1994. The delegates were selected to provide a cross section of opinion and experience from the construction industry, not just the services sector. In particular, architects, construction companies and developers were included together with consulting engineers, manufacturers and contractors from within BSRIA's membership.

This BSRIA Technical Note contains the most important points raised by the syndicates and a full list of the recommendations for future action.

A detailed "Proceedings" volume, containing a full account of the discussions, conclusions and recommendations of each of the four syndicates, together with notes of the four keynote speeches has been prepared and is available at BSRIA for consultation.

2 CHAIRMAN'S COMMENTS

"This is the third in a series of workshops, the previous ones being held in 1984/5 and in 1990/1, where invited delegates have gathered together to try and identify some key issues and resulting initiatives facing our industry that will impact in the years ahead.

Whilst we all know from personal experience that Future Gazing is not exactly a precise science, we are also aware that it is possible to identify emerging trends that are likely to influence future events. The broader the cross section of an informed group invited to take part in the exercise, the greater the probability of some success in identifying these emerging trends.

On this occasion we brought together those involved in the procurement of the building envelope for the commercial marketplace and asked individual workshops to look at service design aspects of that procurement process. What comes out from the deliberations is that the standard criteria by which the performance of commercial buildings has been evaluated over the past decade are no longer relevant for the next decade. Indeed, the British Council of Offices (BCO) has recognised this by its revised Specification for Offices which places an emphasis on a diversity factor for services criteria rather than a single standard of performance.

This greater degree of objectivity in deciding how buildings are serviced opens the door to establishing a performance yardstick for building design that moves beyond the BREEAM assessment scheme to evaluating the buildings for their annual consumption of energy, which in turn reflects on the use of natural light and emerging technologies such as the use of coolth and mass in building services design. Our work at Brighton confirmed the key role of the services engineer in creating, with other members of the design team, buildings that respond in a positive way to the environmental and political issues that are now facing us in the run up to the new Millennium.

Sadly, the reader of this Technical Note is unlikely to capture the sense of excitement and possibility that was generated in the workshops and plenary sessions."

3 STRUCTURE AND ORGANISATION OF THE FORUM

The main discussions were held in four parallel syndicates covering different subjects during four sessions of 90 minutes each. At the beginning there was a plenary session in which the Forum Chairman introduced the syndicate leaders who each made an introductory presentation related to their topic. The results of the syndicate discussions were presented by the leaders in a final plenary session.

There were also four keynote sessions at which invited speakers made presentations. Two of these were shared with the delegates of the CIBSE conference as were evening social functions thus encouraging inter-mixing and discussion.

The syndicate leaders were invited by BSRIA and were briefed in advance by the planning group. Briefing papers, prepared jointly by each leader and BSRIA, were sent to all the delegates prior to the meeting. A "Rapporteur" from BSRIA was appointed to each syndicate to assist the leader and to produce notes for the later production of proceedings.

The four syndicates addressed the following topics:

Evaluation and Marketing of Low-Energy Buildings with Good Environmental Performance

Leader - initially Graham Love, substituted due to illness by Ken Dytor and Tim Battle

Design of Low-Energy Buildings - Environmental Control by Structure

Leader - Guy Battle

Design of Low-Energy Buildings - Artificial and Natural Lighting

Leader - Rab Bennetts

Comfort in Low-Energy Buildings

Leaders - Bill Bordass and Adrian Leaman

4 RESULTS OF SYNDICATE 1 - EVALUATION AND MARKETING OF LOW-ENERGY BUILDINGS WITH GOOD ENVIRONMENTAL PERFORMANCE

The syndicate examined the problem of encouraging the client or ultimate customer of a building to give more attention to "lower-energy" designs. Very rapidly the syndicate established that it was always the client who states what the market needs, and, to promote low-energy design, there is a need to educate the client as to what is available now.

Breaking into three groups to discuss these issues, each group independently came to the same conclusions, that "low-energy" per se is not a marketable commodity; that designers are not comfortable with a low-energy concept; that proponents of low-energy should look for other requirements that might help to piggy-back their concepts; that cost is the predominant concern of the conventional decision makers; that quality of the working space is the predominant concern of the building's occupants; and finally that flexibility and functionality are more important to the client than energy consumption.

The syndicate sent a "challenge" to the other three syndicates, telling them that the clients' needs included:

- low cost (capital, maintenance, operating);
- flexibility (capability of changing office modules);
- specified and guaranteed performance criteria;
- a means of labelling the performance of buildings for marketing purposes.

Two of the three groups responded with comments. One expressed concern that words like "value" and "quality" were missing, and stated that performance guarantees, certainly in relation to comfort, were not feasible.

The syndicate tried to project client's needs into the future (10 years) but felt unqualified to do this. However, they felt that environmental awareness now prevalent in the young will have reached the decision-makers by then but energy reduction for its own sake still will have not become sought after by anybody other than "consumers" or building occupants as energy costs will still remain relatively low. Concern over time and cost of travel to work will have an influence over distribution of offices, assets will be worked harder and most income will be derived from service industries employing staff who are more demanding in their wish to enjoy their working environment.

After spending more time fleshing out the requirements of a building performance labelling scheme, which they said should be continued, like an MOT test, throughout the life of a building, the syndicate's recommendations for action were concentrated on:

1. setting up a study group to define such a scheme;

2. encouraging BCO to add elements of such a scheme to its specification;
3. asking BRE in the meantime to extend BREEAM to include "quality of space" aspects.

5 RESULTS OF SYNDICATE 2 - DESIGN OF LOW-ENERGY BUILDINGS - ENVIRONMENTAL CONTROL BY STRUCTURE

The syndicate attempted to define what was meant by a "low-energy building". They suggested that it was a building which:

- limits the use of air conditioning
- optimises the interaction with the fabric to attenuate thermal swings
- minimises life cycle energy costs
- meets low energy consumption targets
- minimises energy consumption related to human needs
- results in responsible waste minimisation
- maximises the use of natural resources
- results in a productive internal environment with the lowest CO₂ output
- optimises the use of resources
- meets the client's brief in terms of cost, standards, energy and maintenance costs
- makes efficient use of energy consistent with occupant comfort/productivity
- and uses fabric and structure to moderate the external environment to create an optimum internal environment with minimum energy use.

The principal barriers affecting the implementation of low-energy design techniques in buildings were identified thus:

- cost of energy
- fear of financial failure
- perceived risk of "new technology"
- mystification of some techniques
- uncertain perception of comfort
- noise and air pollution problems in the use of natural ventilation
- poor design tools
- unrealistic clients' briefs
- need for flexibility of use
- uncontrolled behaviour of occupants
- perception of high cost
- lack of consideration at early design stage
- inappropriate fee structures
- concerns about professional indemnity
- shortage of engineers with relevant design knowledge
- shortfalls in technology and equipment
- problems in commissioning over several seasons
- inadequate air tightness standards.

Some energy saving techniques were discussed. They included - use of thermal mass; natural ventilation by windows, vents and solar/wind towers; thermal storage; and preheating or cooling of entering air from the ground. No conclusions were drawn from this discussion.

The syndicate split into three groups to carry out a conceptual design of three

different types of buildings, a developer's managed and let-on office, a corporate headquarters, and a zero energy building.

The first design was an atrium building using thermal mass storage, low-energy lighting, and natural ventilation. The designers believed that mechanical ventilation and fan coil units would also be required as a back-up against failure.

The second design was also an atrium building using mechanical displacement ventilation from ground-cooled air. The structure used a heavy thermal mass and had a double skin on the south, with occupant controlled sunshade louvres.

The third design depended on deep cuts in the building to maximise natural light, and was carefully orientated with respect to solar gain. Mechanical ventilation was used and energy was to be provided by a combination of photovoltaic panels, wind turbines on the roof and a solar steam generator. The panel thought that these would still be unable to provide all of the building's energy needs.

Finally the syndicate proposed thirteen actions to encourage the use of low-energy design in the future. They were:

- 1) DOE (Building Regulations) to include low-energy targets and air tightness in Regulations.
- 2) BSRIA and BRE to carry out impartial monitoring and assessment of low-energy buildings.
- 3) BSRIA and BRE to develop a database of low-energy buildings and disseminate case study material.
- 4) Designers and planning officers to give greater consideration to low-energy techniques at the conceptual stage of building design, using an enhanced version of BREEAM.
- 5) CIBSE to promote CPD material to improve the education of building professionals in the concepts of low-energy design/considerations.
- 6) CIBSE to require greater emphasis concerning low-energy design on relevant university/college courses.
- 7) ACE to adapt fee structures to accommodate increased design input for low-energy buildings.
- 8) BCO to prepare a realistic and consistent model brief.
- 9) CIBSE to instigate a group to review low-energy R&D and information/guidance requirements.

- 10) BSRIA should prepare and disseminate a bulletin which identifies current information sources on low-energy design.
- 11) BEPAC and Industry to develop and validate more design software, particularly those suitable for use at the conceptual design stage.
- 12) BSRIA to produce guidance for commissioning and testing of low-energy systems.
- 13) RIBA/CIBSE/ACE to develop guidelines concerning professional indemnity issues.

6 RESULTS OF SYNDICATE 3 - DESIGN OF LOW-ENERGY BUILDINGS - ARTIFICIAL AND NATURAL LIGHTING

The Syndicate, composed predominantly of architects and design engineers, felt that low-energy for its own sake was not a marketable commodity and should not be pursued in isolation. What the clients need are low cost-in-use buildings in which the occupants will be comfortable and satisfied and will thus be more productive. Provision of these attributes would automatically result in a low energy consumption and need not add more than 5% to the capital cost of a building.

The delegates also felt that comfort means more than just temperature, fresh air and lighting levels but should also include the overall ambience and spaciousness of the interior as contributors to the "quality of the working space". In addition, there are other factors important for occupant satisfaction which are relevant to the topic of "lighting". These include the ability to see outside the building (not necessarily a beautiful view) and the provision of some level of individual control over lighting as well as temperature and air movement.

To provide a high level of natural lighting means must be provided to control or reduce the level near windows and to throw light deep into the building. Both active and passive techniques are already available. Window design becomes very important and dividing the window into two areas, upper for light collection and lower for view, is a good approach. Window shades, preferably external, are vital to prevent glare, but should not completely shut out the outside. Sunlight should be kept out and skylight should be gathered from above the highest angle of the sun. Contrast between a brilliant perimeter and a dark background is to be avoided and ceilings should be kept unobstructed and light-coloured to assist penetration of light.

For maximum depth penetration of natural light high ceilings are desirable. A floor depth-to-ceiling height ratio of about 4.5 is suggested. For conventional ceiling heights this restricts floor plate depths to 12 metres and not 18 metres as recommended in the new BCO guide to urban offices.

Artificial light will always be required to compensate for variations in natural illumination. However, it may not be possible to provide individual control of background lighting. On the other hand individual control of task lighting levels is important for user satisfaction. Current lighting level standards seem to be too high. Dimmable fluorescent lighting is currently expensive because of a small market. Market size could be stimulated by a Government initiative similar to that for condensing boilers.

The following actions were proposed.

1. CIBSE to re-examine lighting level standards in the context of natural lighting.
2. Government should stimulate the market for dimmable fluorescent lighting.

3. VDU manufacturers should tackle reflected glare problems from low-angle natural light.
4. BCO should include daylighting in their guide and modify their floorplate depth recommendations.
5. BRE should produce a simple BRE Digest on natural lighting, using the detailed EU document already available.
6. Government should sponsor a clear-sky test facility in the UK.
7. BRE should develop BREEAM further.
8. Industry should research possibilities of acoustic attenuation through natural ventilation openings.

7 RESULTS OF SYNDICATE 4 - COMFORT IN LOW-ENERGY BUILDINGS

Thirteen delegates met to discuss the comfort-related issues which determine the requirements for the achievement and maintenance of satisfactory conditions in low-energy buildings.

The Syndicate first answered the questions posed in the briefing paper. They concluded that concerns about the global environment are real, that both comfort and low energy use are compatible, and that to achieve low energy use, comfort expectations need to be altered, not necessarily lowered. Since comfort and acceptability cannot be measured precisely it will always be impossible to define targets absolutely. Health and safety criteria are not the same as comfort issues, though they are strongly related. User friendly buildings are more productive than others, subject to good management practices, and finally low-energy buildings are not recognised in the marketplace because "low-energy" is not relevant when considered in isolation.

The syndicate then attempted to identify current knowledge about comfort. Two points of view were either that existing comfort standards are universally applicable, or that comfort criteria must be changed for different applications. Members felt that comfort conditions should be individually controlled, but there is a lack of understanding of behavioural patterns. Occupant comfort is also dependent on the speed of response both of the system and of management. One must not compare the best of good naturally ventilated buildings with bad air conditioned ones. Finally, a plea was made for better communication of the existing knowledge on comfort to the practitioners in industry.

A response to Syndicate 1's message of clients' needs was given. There was deep concern that the message did not mention either quality or value, and that a better description of "flexibility" was "adaptability", implying the possibility of more radical changes to the building being possible. The syndicate said that no performance guarantee of comfort could ever be given because the provision of comfort depends on many design and operational factors not under the control of the building services designer. The enhancement of BREEAM was accepted, with the suggestion that performance assessments were made at completion and during the life of a building.

The Syndicate finally stated its actions for the future, but made no suggestions as to whom they were specifically addressed. In summary:

Research is needed to validate models with real field data; to develop uncomplicated prediction models; and to study influence of physical changes on perceived comfort. Research on productivity was thought to be difficult. Research policy should apply a more holistic approach to ensure all relevant aspects of comfort are considered together.

Designers should be stimulated to apply comfort standards in the context of the individual building; to consider assessment of performance factors throughout the

construction and life of a building; to provide upgradable designs; and to design for manageability of comfort conditions.

Clients and users should apply greater realism to their expectations; should realise that comfort requires operational and management strategies as well as design; should consider maximum use of space when specifying the design brief; and should use field data from completed buildings to specify new ones.

Standards-makers should promote flexible standards to permit consideration of specific building applications; should provide space norms and perimeter proximity standards; and should encourage designers to achieve higher performance levels than in the standards.

8 PARTICIPANTS

SYNDICATE 1 EVALUATION AND MARKETING

Syndicate Leaders Ken Dytor - British Land Corporation Ltd
Tim Battle - Rybka Battle Ltd

Rapporteur Anne King - BSRIA

Nigel Howard	Davis, Langdon & Everest
Robyn Thorogood	Department of the Environment
Ron German	Stanhope Properties
Catherine Ho	Building Simulation Ltd
Graham Wright	MEPK Architects
Chris Monson	Caradon Trend Ltd
David Lloyd Jones	David Lloyd-Jones Associates
Mike Packham	Bernard Williams Associates
Neil Burns	Oscar Faber Consulting Engineers
Andrew Field	EEO
Kevin Monaghan	MEPC UK Ltd
Neal Pennell	Land Securities (Properties) Ltd
Roderic Bunn	Building Services Journal
Les Brown	Prudential

The original syndicate leader, Graham Love, was unwell and his task was taken over by Ken Dytor. He too fell ill after the first half day and the syndicate was led through the rest of the Forum by Tim Battle, with a final report from Kevin Monaghan and Les Brown.

SYNDICATE 2 - ENVIRONMENTAL CONTROL BY STRUCTURE

Syndicate Leader Guy Battle - Battle McCarthy

Rapporteur Kevin Pennycook - BSRIA

Alan Baker	YRM Partnership
Bernard Johnson	Cundall Johnston & Partners
Andrew Scott	Massachusetts Institute of Technology
Jim Wild	Grove Projects Ltd
Richard Butterworth	MACE
John Bailey	Zisman Bowyer & Partners
Mark Lovell	Oscar Faber Consulting Engineers Ltd

Teresa Martinez	Benoy Ltd
Crispin Matson	Rybka Battle Ltd
Malachy Neeson	HL Technik AG
Ian Ward	Sheffield University
Patrick Bellew	Atelier Ten

Sinisa Stankovic	J Roger Preston & Partners
Richard Parnaby	RIBA
Steve Willis	BRE
Andrew Wright	MEPK Architects

SYNDICATE 3 - NATURAL AND ARTIFICIAL LIGHTING

Syndicate Leader Rab Bennetts - Bennetts Associates

Rapporteur Derek Gregory - BSRIA

Graham Marshall	Colt International Ltd
Rick Wilberforce	Pilkington Glass Ltd
Randall Thomas	Max Fordham & Partners
Martin Shaw	BRE
Bill Dickson	Sheppard Robson
Klaus Bode	J Roger Preston & Partners
Peter Clegg	Fielden Glegg Design
David Emond	R H Partnership
Brian Ford	Short, Ford & Associates
Chris Twinn	Ove Arup & Partners

SYNDICATE 4 - COMFORT IN LOW ENERGY BUILDINGS

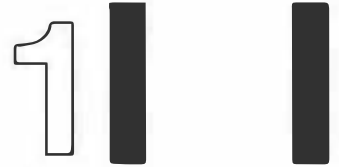
Syndicate Leaders Bill Bordass - William Bordass Associates
Adrian Leaman - University of York and Building Use Studies

Rapporteur Peter Jackman - BSRIA

Barrie Evans	Architects Journal
Paul Gillibrand	British Gas Properties
Alison Greenwood	FPM (Chesterton)
Peter Grigg	BRE
Rod Hughes	Nichol Armstrong Lowe
Fergus Nichol	Oxford Brookes University

Bjarne Olesen	D F Liedelt "Velta" GmbH
Paul Ruysevelt	Halcrow Gilbert Associates
Gabriel Somorjay	Low Somorjay Tallis
Terry Wyatt	Hoare Lea and Partners
Mario Costantino	Intertecno (for part of the time)

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