THE ROYAL ACADEMY OF ENGINEERING

VISITING PROFESSORS IN ENGINEERING DESIGN FOR SUSTAINABLE DEVELOPMENT

Report on the Proceedings of the Annual Workshop at The Royal Academy of Engineering

26th – 27th June 2001

Report prepared by Bill Addis

The key objectives of the workshop were:

- To explore the relevance of social issues of sustainability in engineering education
- To identify the key issues about sustainability which most need addressing, for instance by means of research, and
- To address the needs of teaching Engineering Design for Sustainable Development as they affect the structuring of case studies.

The programme for the workshop is at Appendix 1.

Delegates were welcomed to this annual meeting of Visiting Professors in Engineering Design for Sustainable Development on behalf of the Royal Academy of Engineering by Jim McQuaid, Chairman of the Sustainable Development Education Working Group which oversees the Visiting Professors Scheme on behalf of the Council of the Academy. Having offered the welcome he changed his hat, becoming one of the Visiting Professors, at the University of Ulster, which would allow him to contribute more freely to the discussions.

Before proceeding to the first presentation, Jim McQuaid pointed out that the Academy had looked far and wide to find an external speaker on the theme of the social dimensions of sustainable development, but all, despite being willing, had been unable to fit this date into their busy diaries. He introduced the chairman for the evening, Roger Wootton, who had been his predecessor as Chairman of the Sustainable Development Education Working Group.

The Chairman welcomed all the VPs and their ‘minders’ from host universities and introduced Charles Ainger who would offer some introductory thoughts on the Social Dimensions of Sustainable Development to stimulate the discussion. He has been the Visiting Professor at Cambridge University Engineering Department since May 2001 and for some thirty years has worked in the water and environmental side of civil engineering with the firm Montgomery and Watson which was taken over by an American firm about three years ago. There he is Head of Business Development and the Head of Sustainable Development for the European side of that company. He was therefore ideally suited to provide the introduction to the subject.

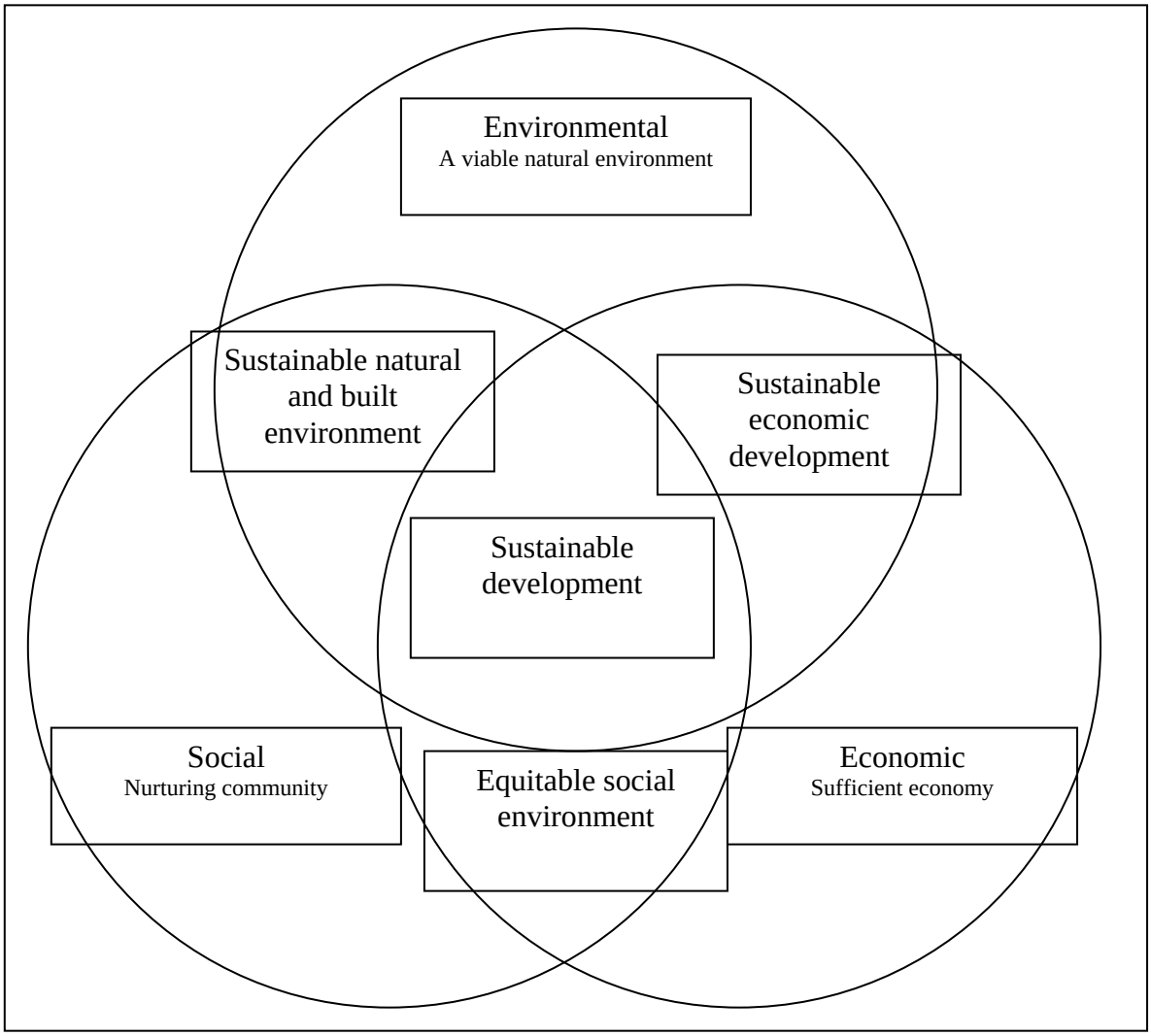
SYNDICATE DISCUSSION 1 (Tuesday eve)

Social Aspects of Sustainable Development

KEYNOTE PRESENTATION: **Charles Ainger (VP Cambridge)**

Charles Ainger began by admitting he felt a certain trepidation at being the new boy on the block talking to an audience who knew much about the subject.

He began by highlighting where the social dimension of Sustainable Development fits within the three principal models of Sustainable Development, firstly the Venn Diagram model, comprising:



- the economic dimension – still firmly in the driving seat for business, yet of the three it is the only one that is truly man-made, so it is interesting that we have now come to regard it as inevitable

- the environmental, which is now widely recognised as important, yet which we are tempted to believe we can manipulate without risk, even though it involves very complex natural eco-systems, and
- the social aspects, the 'Johnny-come-lately' that are still often squeezed out, perhaps because they are difficult to define.

There are some interesting phrases in the areas of overlap – *nurturing community, equitable social environment, well-being*. What does all this mean; how do we define them?

Charles Ainger then considered the Five Capitals model of Sustainable Development, as had been used, for instance, by Wessex Water:

- Financial capital – money, what we find in the balance sheet
- Human capital – inside our firms - our staff, skills, health, values, morale. This is creeping up the agenda as we move into the knowledge economy.
- Social capital – external to our firms, the community – security, culture, support. A firm in Oldham may suddenly find its social capital is not as large as a month ago after the recent riots. And under the heading 'Social responsibility' this now features highly in many corporate reports as different departments compete with one another to get to the top of this list in this section. It can be an effective way of attracting the chairman's attention.
- Natural capital – the environment, landscape, species, diversity, and
- Man-made capital – our buildings and infrastructure.

Finally, there were the four System Conditions for sustainable development proposed by the Natural Step which are used as objectives to create a vision of the activity in a sustainable society:

In the sustainable society, nature is not subject to systematically increasing:
1 … concentrations of substances extracted from the Earth's crust,
2 … concentrations of substances produced by society,
3 … degradation by physical means,
and in that society
4 … human needs are met worldwide.

This last condition means using all our resources efficiently and responsibly so that the needs of all our stakeholders – customers, staff, neighbours, people in other parts of the world, and people who are not yet born – stand the best chance of being met (although it is not clear who defines these needs).

An illustration of the difficulty of addressing social issues was a current CIRIA research project in which various indicators, including social ones, are being trialled by a number of firms. Within the Key Theme 'working with local communities' four principal issues are addressed:

- Minimising local nuisance and disruption
- Building effective channels of communication
- Contributing to the local economy, and
- Delivering structures and buildings that enhance the local environment.

So far it has proved hard to suggest indicators for the last two of this list – the very ones that refer to actual 'development'.

Charles Ainger then introduced the four questions for discussion in the 'social dimension' debate:

1. **Does including 'social ' components help deliver sustainable engineering solutions – and how?**

   For example:

   - *Changing public behaviour*: avoiding the use of certain washing powders can be a practical solution to phosphorus pollution in the rural sewage treatment.
   - *Changing planning regulations*: small communities should be able to use septic tanks rather than install sewers
   - *Considering ownership:* objections to wind farms in Denmark are low because they are often owned by local co-operatives. (a Danish proverb is: Your own pigs don't smell)

2. **What defines a socially sustainable product? (however sustainably it is produced?)**

   - Is being *manufactured sustainably* (based on life cycle analysis) enough, whatever the product's social impact?
   - Should engineers push for socially sustainable features in products …
     - Affordability and accessibility for the 'excluded' – the poorest 10%?
     - Helping cement rather than fragment communities?
     - Increasing people's power over their own lives?

3. **How do we train and support engineers to lead in changing their organisations?**

   - Can many engineering organisations be expected to change to sustainability only *from the top down*?
   - If not, then will change have to be initiated and led *from the bottom up*?
   - How, therefore, can we train and support graduate engineers to be *bottom-up revolutionaries*?

4. **What social objectives should infrastructure projects take account of in choosing the sustainable option?**

   - Should projects just stick to the easier 'side issues' like
     - Good local public relations
     - School visits and education spin-off
     - Some improved facilities …
   - Or should we take seriously the harder issues such as:
     - Real local job generation
     - Using (and training?) local suppliers and contractors, in order to help keep money in the local economy

    - Structuring projects to increase local community power, control and income.
- … and how do we consult properly with local people?

Charles Ainger concluded his preliminary remarks with a final caution reminding us why including the social dimension is hard:

- it requires *defining and measuring* 'soft' qualities that we have not defined and measured in the past – which may be why we are losing them.
- it will often demand *decentralisation* – challenging the (inevitable?) economic trends towards globalisation. This raises issues of inequality, power, ownership, scale and even growth.
- It challenges our engineers' training and preference for *large, complex, interesting* and *new* engineering projects. This will be hard to change or give up.

The speaker said he was clear about his feelings: we would have to make many of these changes otherwise the engineer would end up becoming the mere technician, but that was not the purpose of this introduction to the group discussions.

Before breaking into discussion groups the Chairman invited any clarification of the questions.

Ed Gallagher asked to what extent political and social-political issues should be addressed since they clearly affect change, at international, national and local levels.

Charles Ainger felt they were important and probably came into all of the questions. He had not mentioned it specifically because it would be all to easy to end up saying "When THEY change things, at whatever level, then we will respond". That is a common response. He had wanted the questions to focus on what engineers can do.

Paul Jowitt felt that there was a potential circularity in Question C (see p.8) since the academic institutions would themselves need to change. He recalled a recent meeting with Forum for the Future where someone said they wanted engineering graduates who would burn their boats but we would only get that if academics were prepared to burn their books.

Charles Ainger agreed that, from his brief experience, academic organisations were probably among the hardest of all to change, and felt he should leave his comments at that for the moment.

The audience then split up into the four discussion groups.

SYNDICATE GROUP DISCUSSION (1) Chair: Roger Wootton

Following the Keynote presentation four groups discussed the questions above. The conclusions of the syndicate group discussions were as follows:

Group A Presented by Richard Dodds (Unilever / VP Liverpool)
Does including 'social ' components help deliver sustainable engineering solutions – and how?
The general conclusion was 'yes, it can help', but there was not agreement to all the detail. Key issues are:

- Getting the balance between economic, social and political drivers right – the size of the three circles.
- Distinguishing carefully between social and community. The examples given had related to small communities rather than the broader idea of 'social'. It was felt it is easier to deal with community issues in a rural context than an urban one.
- Interaction with the community on social issues is more likely to get you to an implemented solution, but not an engineering *optimal* solution
- To what extent should we as an engineering profession get involved – should it be 'real' rather than cosmetic or 'pretend'?

Group B Presented by Richard Darton (Oxford)
What defines a socially sustainable product? (however sustainably it is produced?)

- It was agreed that it was not possible to produce an artefact having zero environmental impact and so Sustainable Development must mean more than just the production process. It must include the creation of wealth, improvement in quality of life and how society is affected by introduction of a product, including employment and social issues.
- Social impact is not addressed within the conventional approach to Life Cycle Analysis.
- The social impact on *all* stakeholders should be addressed, though it is not clear how this might be measured
- It is important where you draw the boundary when looking at sustainable development. It was important to agree boundaries with regard to standards, policies and ethics.
- What is sustainable consumption? Is it sustainable to produce ever more products? Is growth in GDP an indicator of success? New indicators of Sustainable Development are going to be needed for firms beyond the Profit and Loss account.

Group C Presented by Ken Snowden (Nortel Network / VP Loughborough)
How do we train and support engineers to lead in changing their organisations?

- Will depend on whether change comes from top down or from bottom up.
- University courses in Sustainable Development will need to be made compulsory; and the Engineering Institutions will need to be involved in this through the process of accreditation.
- It is important to consider how SMEs will be influenced.

- There is great potential for using Sustainable Development as a means of 'selling' the profession to schools and potential undergraduates. Case studies have an important role here. Role playing exercises were felt to be especially valuable.

Group D Presented by Barrie Mould (WS Atkins / VP Brighton)
What social objectives should infrastructure projects take account of in choosing the sustainable option?

- It is important to articulate clearly the quality-of-life issues related to a project.
- Community ownership and responsibility are important and have to be addressed. The engineer's job is to help introduce the sustainable approach to the community.
- The size of the community is a key issue – local, national, global. This affects the capacity for the community to be involved and to engage in debate.
- It is difficult to compare local and global communities, and the benefits they gain. It can be comparing apples and oranges – CO_2 emissions vs. local jobs.
- In this group we generally found it easier to deal with specific examples. The examples of Slapton Sands and Heathrow Terminal 5 were cited.

General discussion chaired by Roger Wootton
Professor McQuaid felt it is always important to deal with the unique contexts of different projects. The need for some sort of social or community inclusion often results from a situation when the decision-maker is not trusted. If engineers' decisions are trusted, then 'inclusion' or involving the community may well not be needed. He felt that the engineering community was usually rather better trusted that the scientific community. Various reactions from other members of the audience suggested this view might not be unanimous.

Ed Gallagher commented that the sizes of the three circles in the Venn diagram model of sustainable development were not equal across all sizes of community. At the international level, economic issues tend to prevail; at a national level, social issues are more prominent whereas at a local level, it is probably the environmental issues that dominate. He also questioned the degree to which engineers stand up for the principles, for instance when that might mean losing a job.

In reply Paul Jowitt felt it was always important to educate the client about matters of sustainable development. He also reminded us that there are parallels in sustainable development to the situation we can find with food where, as a consumer, we may sometimes end up paying three times over – once over the counter, once by way of agricultural subsidies and (in the case of BSE and foot and mouth disease) once more by way of clearing a problem up.

Richard Darton saw parallels between sustainable development now and the case of safety some years ago. He doubted whether many engineers would be taking a clear lead, though it could be a stimulus and generator for new business.

Barrie Mould returned to the top down / bottom up issue. In construction we are lucky that one of the main clients – the Government is becoming educated but this doesn't mean that those lower down should not do anything. The key debate is who is going

to change the client. We are finding now that some clients are being changed by pressure from the City. Carillion for example is a good model in the construction industry for how a contractor can lead the way.

Roger Sainsbury wondered how firms should be evaluated? He felt it would always be using financial criteria. Ultimately this was a reflection of what the customer will buy.

Roger Wootton, in the Chair, commented that there is growing evidence for a strong correlation between the good sustainability performance of firms and their financial performance. This is especially true among many domestic products.

Peter Gardiner (Brighton) felt we will need to wait for a global catastrophe before environmental and sustainability issues are taken sufficiently seriously. By then we are going to have to have trained engineers across the whole spectrum of sustainability issues. An essential part of this is to match the sustainability outcome of business and project decisions with economic outcomes. He gave the example of the ***Green Angels*** scheme they had started in Brighton. Final year students visit local firms and explain to them the issues in sustainable development and discuss how this may impact on the firm (especially SMEs) about materials, energy, waste and so on, as well as their bottom line.

Jeff Hulse (Newcastle) wanted to return to Jim McQuaid's point about trust. He believed that engineers are generally not good communicators and, often, not good listeners either. When dealing with the public you are dealing with their perceptions – their perception is their reality. We must not baffle them with highly technical language – that threatens our trust and credibility. Once public trust has been lost, it is very difficult to regain. They had seen this many times in the chemical industry. This demands better communication by engineers and means bringing behavioural science into engineering – something the best students grasp very quickly because they see how useful it will be for them to progress through their career.

Rex Harris (Birmingham) reported that at Birmingham they are finding far fewer students applying to do engineering. He felt there was a need to train more engineers to address social issues and that this could be a way of attracting good student and more of them.

Roger Wootton brought the discussion to a close observing that some of the key people for bringing about many of the changes discussed were in that very room and thanked Professor Ainger for the stimulating introduction to the discussion.

The discussion was followed by dinner in the Academy.

SYNDICATE DISCUSSION 2 (Wednesday am)

EPSRC's Infrastructure and Environment Programme

The morning session was chaired by Roger Sainsbury. He introduced the speaker, Peter Hedges, who manages the Infrastructure and Environment Programme run by the Engineering and Physical Sciences Research Council (EPSRC). Peter's background was in biochemistry and he has been with the EPSRC for some eleven years, making him now a career civil servant. He has a particular interest in sustainability concepts in projects that are for non-industrial end-users. We are, indeed, all aware that sustainability issues have a significant political dimension, both at national and local level. Peter is also a district councillor and so he sees the issues from both sides of the fence.

KEYNOTE PRESENTATION – **Peter Hedges (EPSRC)**

Dr Hedges began by giving an overview of the government's funding of research and where the EPSRC fits into this scheme.

The mission of the EPSRC is

- To promote and support high-quality basic, strategic and applied research and related postgraduate training in engineering and the physical sciences
- To advance knowledge and technology and provide trained engineers and scientists to meet the needs of users, thereby contributing to the quality of life and economic competitiveness of the UK
- To provide advice, disseminate knowledge and promote public understanding in the fields of engineering and the physical sciences.

During the year 1997-98 Government funded a total of £6,267 million Research and Development projects, broken down as follows:

Civil departments	£1,282 m	
Defence	£2,311 m	
Funding councils	£1,033 m	
Contribution to EU R&D	£362 m	
Science	£1,279 m	(of which EPSRC approx. 30%)

During the year 1999-2000, the EPSRC programme allocations for training, research grants and facilities was broken down as follows:

General engineering	£47 m
Engineering for manufacturing	£35 m
Engineering for infrastructure, the environment and healthcare	£27 m
Maths	£13 m
Physics	£41 m
Chemistry	£48 m

Life sciences	£10 m
Materials	£49 m
Information technology and computer sciences	£62 m

In a slide showing the R&D spend of the top 25 companies, it was clear that the largest spending was in pharmaceuticals, oil, aerospace and communications. Construction did not feature in the list.

EPSRC funding generally falls into two modes – *responsive mode* research projects – those suggested to the EPSRC, and a number of subject-based, multidisciplinary *managed* activities, for example in computational engineering mathematics and materials processing for engineering applications. In addition there a number of Platform Grants, fast track grants for young academics, Visiting Fellowships and feasibility studies. (Full details are given on the EPSRC web site - www.epsrc.ac.uk).

The *Engineering Programme* includes within its scope the main engineering fields, including building, civil and environmental engineering, electrical, mechanical and process engineering, as well as design and manufacturing, systems, control and instrumentation. It also includes medical engineering. This scheme is funded mainly through the responsive mode.

The *Innovative Manufacturing Programme* comprises wholly managed research initiatives and is focused through Manufacturing Centres, most of which are either 'self-selected', based on existing support, or invited to fill gaps in the overall strategy to meet Sector needs. Some smaller awards are made to smaller research centres to fill identified gaps in the portfolio.

The *Infrastructure and Environment Programme* is a wholly managed and strategic programme supporting research that:

- Targets key quality of life indicators (e.g. water and air quality, waste, climate change)
- Supports research aimed at meeting the Brundtland definition of sustainable development as that 'which meets the needs of present without compromising the ability of future generations to meet their own needs'.
- Meets the need of users of the research in industry, commerce, the service sector, the public sector, local and national government.

The support is focused through Research Consortia, LINK Programmes and Calls for Proposals within the overall area of:

- Sustainable technology
- Urban and rural environment
- 'Inclusive' and medical engineering
- Transport, and
- Energy

The Research Consortia are identified and supported in three ways:

- Calls for expressions of interest and Scoping Workshops, such as the 'Towards a Sustainable Urban Environment' call issued on 1st June 2001.
- Development of existing Centres of Excellence or Research Collaborations, and
- Development of funding Partnerships with other Research Councils and other Funding Agencies.

The recently launched research theme 'Towards a Sustainable Urban Environment' (the first) will aim to fund projects in:

- Urban design
- Sustainable construction and whole life costing of buildings
- Waste, pollution and land management
- Urban transport systems and urban design
- Social inclusion

Future themes are likely to address other multidisciplinary fields such as the sustainable generation of energy and flooding.

The Research Consortia are required to demonstrate certain characteristic features:

- Multidisciplinary teams or partnerships
- Active and effective collaboration with users
- Defined output and deliverable against key quality-of-life and/or sustainability indicators
- Outreach activities to providers and users outside the Research Consortia, and
- Collaboration with key international researchers in the field.

Peter Hedges concluded his presentation by identifying a number of questions the EPSRC is seeking to explore in order to overcome various barriers to achieving their goals:

Communications and language	As a life scientist working with engineers, Peter Hedges was aware of the different approaches of different disciplines. The Scoping Workshops are intended to help break such barriers down – but will they help?
Multidisciplinary research teams	Is the funding sufficiently attractive, and will the funding mechanism assist team building?
User interaction	Is the funding sufficient and will the mechanism help?
Critical mass	In the past if was felt that the funding was spread too widely – for instance six different groups were funded to research the use of old tyres – but there was little collaboration across this group. Will the offer of funding Research Chairs help?
Research quality	Does the subject area offer sufficient academic interest to attract high calibre staff, especially

	given their multi-disciplinary nature?

Dr Hedges reinforced the EPSRC's intention that sustainability was intended to underpin a wide range of funded research and he was particularly keen to explore how the social issues might be better integrated. He hoped very much that the new schemes would be better able to address the social science agenda and attract the right social scientists to get involved.

By way of illustrating the importance of the social and political issues, he gave an example from Cricklade, where there was a planning application being considered for a large biomass power station. However, this scheme is being opposed by the local community to a man and woman. This is despite letters from Friends of the Earth in the local newspaper, explaining how it is an environmentally responsible and good thing to be doing. All the local people are interested in is the pollution they think they are going to get from this incinerator. This is despite the fact that it is a very high-tech plant with very low emissions indeed. When you become involved in local politics, you realise the importance of the NIMBY principle. People really don't trust the decision-makers. The same seems to be true in waste disposal. Everyone is agreed that we ought to be burning more waste than we do, as long as it is not done near where they live.

Before proceeding to discussion, the Chairman asked for some clarification of one of the terms Dr Hedges had used under the heading of 'inclusive and medical engineering'. What, he wondered, is 'inclusive engineering'?

Dr Hedges accepted that it was a broad term and explained that they had been thinking about it in terms of the extended quality-of-life agenda. It related to the social inclusion aspects of sustainability that had been discussed yesterday evening. In the past the EPSRC had funded research, for instance, in how houses might be designed to allow old people to live in them for longer. It was now proposed to extend this aspect of social inclusion to include other excluded groups such as the disabled.

SYNDICATE GROUP DISCUSSION (2) Chair: Roger Sainsbury

Following the Keynote Presentation the delegates split into four syndicate groups for discussion.

David Foxley reminded delegates that it had previously been a common perception that much university research was characterised as solutions in search of problems to solve. It was now very much the aim of the EPSRC to turn this around and ensure that research was undertaken to meet the needs of society and industry. It was, therefore, the purpose of the discussion groups to identify the areas they felt most needed research to be undertaken. The groups reflect four broad areas of engineering:

1 Sustainable urban and rural environment

2 Products and the environment

3 Future energy generation and low carbon technology

4 Process and the environment

Each group was asked to consider the same four concerns over barriers to achieving sustainability:

- That a conventional practice, procedure or professional approach has an unfavourable impact on sustainable development (as defined in the Government's strategy and the various indicators)
- That there are uncertainties about effects or impacts, or there are cross-impacts that are difficult to unravel
- There are questions about the relative weighting of different impacts and indicators
- There are uncertainties about the effectiveness of different means – technological, social, economic, etc. - of achieving change in the right direction.

FEEDBACK FROM SYNDICATE GROUPS

The conclusions of the syndicate group discussions were as follows:

Group A Presented by Paul Jowitt (Heriot Watt)

Sustainable urban and rural environment

The group identified the following key issues that would benefit from better understanding and targeted research. The interesting thing was that very few of them were actually about making things:

- Transport
- Social dimensions, especially leisure
- Conflict resolution
- Agriculture
- Clients' needs and market forces
- Community response
- Urban complexity
- Quality of life
- Waste

They went on to identify the following main barriers to achieving sustainability that would also benefit from research. Again, very few were about hard technology:

- The bottom line
- Segmented responsibility
- The influence of Private Finance Initiatives (PFIs)
- The lack of joined-up thinking and taking a holistic view
- Conflict between market and environmental objectives
- The balance of policy and technology
- Lack of belief
- The concept of a finite vision
- Whether there was a human genetic predisposition to certain behaviour
- Non-communication of crises
- Media (mis-)representation

Paul Jowitt concluded his summary with a number of disparate but important issues that were of concern:

- The tendency for several crises to appear together (like the No.19 bus!)
- A tendency for wooliness – for instance some recently who had confused Factor 4 and Factor 10 and averaged them as Factor 7!
- The need to examine and/or change the role of the engineer
- Possible differences between the contribution of male and female engineers (yin / yang?) – in any case, more female engineers would be beneficial

- Better understanding of the idea of 'optimal' – this meant different things to engineers and others, especially considering the social issues of sustainability
- The importance of the idea of 'harmony'
- The potential understanding from 'bio-mimicry'

Group B Presented by Ken Snowden (Nortel / VP Loughborough)

Products (and green chemicals) and the environment

The group identified the following key issues that would benefit from better understanding and targeted research:

- How to change the behaviour of organisations – people at the top base their decisions on economics – how are we to get social and environmental issues onto their agenda
- Lack of "design for the environment" (DFE) tools and understanding the environmental dimension
- Short commercial / industrial time horizons, but long time horizon for sustainability – many products have a life of only 18 months or so.
- The public (often) already assumes products *are* green
- The need for quality-of-life indicators, and their link to individual products
- When delivering green processes and chemicals it is important to consider the whole life cycle – serious consequences if you are 'found out' later
- Better understanding of the consumer and community psychology
- Rapid technological (and market) change leads to unsustainable products. Recycling old products in some industries is simply not possible – they are too big and out of date
- Important to understand the different cultures and attitudes to sustainable development around the world
- The means and methods for teaching engineers (MSc, MEng). Especially the need to broaden courses and introduce the sustainability thread into other courses in the curriculum earlier in the degree.
- Lack of Life Cycle Analysis (LCA) data about chemicals, especially their biological / ecological impact assessments

Group C Presented by Gary Acres (VP Birmingham)

Energy generation and the low-carbon technologies

The group identified the following key issues that would benefit from better understanding and targeted research. As with other groups, there are no science or technology issues on our list:

- Planning constraints are one of the major issues – wind farms, hydropower and so on. – as they stand they are going to limit the UK's ability to meet its 2010 commitments
- End-user input – for example in Birmingham they are not well informed about the opportunities and examples from around the world

- Risk assessment should not be left to the engineering and scientific community. The public must be involved. They have a very different view of the hydrogen technologies, for example
- The Infrastructure is resistant to change. The emphasis now is on distributed energy generation systems, but there are problems for CHP and so on with connection charges. In Woking they have managed to overcome this problem.
- Important to involve the engineering community in deciding on new generation systems, especially so they can be made in this country rather than imported
- Learning from best practice
- The UK focus on R&D should move towards exploitation
- We should learn from experience abroad – e.g. wind generation in Denmark, nuclear energy in France – especially how you can involve and deal with the public
- Targets are needed to encourage uptake of new energy sources. There are in some areas – renewables and CHP for instance, but more are needed
- NETA and Government market forces tend to discourage the idea of distributed small power generation

Group D Presented by Jeff Hulse (VP Newcastle)

Processes and the environment

The group identified the following key issues that would benefit from better understanding and targeted research:

- Improvement in the design of processes that lead towards Sustainable Development. These have not changed much over the last thirty years.
- The social issues are important. It is fundamental to accepting responsibility for our non-sustainable actions
- Waste processes and community-based issues which point towards the 'small is beautiful' philosophy. Incineration of waste is a valuable teaching example that brings out all the issues.
- Centres of excellence needed – especially to look at the big vs. small processes. How / when will this actually lead to changes?
- Regulation issues

PLENARY DISCUSSION (2)

Barrie Mould asked Peter Hedges whether, and how, the EPSRC would deal with the 'big social issues' that had been identified in our different discussion groups
He had found it an interesting discussion and significant that the groups had identified a long list of non-technical issues. He felt the EPSRC would be able to respond to this challenge.

Peter Guthrie responded to this by pointing out that we do, of course, also need the engineering research that will develop the technologies needed to meet the social issues. He recalled the earlier example of the need for small locally available waste incineration processes. He had commented to Charles Ainger that such small plant would probably not be able to generate sufficiently high temperatures to remove the dioxins, and Charles responded that he had recently met someone who claimed he had developed a process that would achieve this. This highlights the point that we need to be developing the technology to answer the questions that this more holistic approach to defining the problems, throws up. We are not saying here that is irrelevant. What we are saying is that the engineering has gone past the wider thinking and the social, economic and political inclusion in the thinking and now needs to be brought into line. ***There is a need for more research that answers questions that people are asking rather than answering interesting questions that are proposed by researchers***.

Jim McQuaid drew attention to the frequent lack of information available when engineering and related decisions need to be made. He cited the example from a University where a new building is being commissioned to replace an existing one. He had asked the design team how the new building would compare with the existing one in sustainability terms, but he had not yet got an answer from them. In the mean time he had asked some students in that University to come up with an answer to the question.

Alan Strong (Ulster) believed strongly that engineers lie at the heart of the process and, while we need a broader understanding, we must not lose the depth of technical understanding and rigour in engineering education needed to carry out the engineers' task.

Jim McQuaid (VP Ulster) raised the important idea of 'sustainable enough'. It is not possible to categorise issues only as sustainable or non-sustainable. The key question was how to decide what is enough, including stakeholder participation? Any research into these issues would be helpful.

Charles Ainger (VP Cambridge) asked Peter Hedges whether the EPSRC was allowed to fund research involving a real 'mixed bag' of technologies as could often be the case with sustainable engineering solutions. Peter replied that it was, giving the example of the complex engineering and market issues associated with distributed energy generation.

The chairman brought the discussion to a close in order to proceed to the main lecture for the morning.

LECTURE (Wednesday am second session)

Jonathan Porritt

The chairman, Roger Sainsbury, introduced the speaker, though felt he hardly needed to be introduced. Jonathan Porritt was one of the founders of Forum for the Future and is the newly-appointed chairman of the Sustainable Development Commission ,

Mr Porritt said he would address two main themes – the Sustainable Development Commission and the role of engineers in delivering sustainability, and implications this held for engineers' education.

The Sustainable Development Commission (SDC) was formed in Autumn 2000 and is the amalgamation of two former bodies – the Round Table for Sustainable Development and the Prime Minister's Panel on Sustainable Development, both of which were set up in the aftermath of the Earth Summit at Rio de Janeiro. The Government decided this in order to give the issues a higher position in Government terms, which means that it reports directly to the Prime Minister and to the first ministers of the devolved administrations and, most importantly, to ensure that it is a genuine sustainable development body – not an environmental body with a few social and economic issues added on.

It was highly significant that the government has come to realise that sustainability is more than environmental issues with a bit more; whether they have fully understood the implications of this is another matter entirely.

The SDC was meant to have fourteen people, but it has ended up with twenty-two – such is the way of these things. The members aim to represent the full cross-section of society and can speak on behalf of (they don't represent organisations) all its various constituencies – the conventional environmental issues, thematic issues to do with the whole question of regeneration, poverty, health, community development, as well as people who represent constituencies such as young people, trade unions, business, local government, the regions – it goes on and on. It is very difficult to define where the final boundary is – some one had once suggested that the boundary of sustainable development is, perhaps, life itself! Since the recent election, the administration for the SDC has been 'put into' the Department for the Environment, Food and Rural Affairs (DEFRA). Mr Porritt was concerned whether that might mean it became labelled again as an environmental group. He hoped not, because it very definitely is not.

The Sustainable Development Commission has six main tasks.

1. Climate change

The SDC will engage with climate-change issues for the UK and will both advise Government and audit the Government's performance in this area – a critical friend, so to speak. This involved setting and meeting a whole range of targets, for instance for energy. It is also seeking to develop models of how a low-carbon economy could actually work at every level – international, national, regional, city, town.

You cannot get away from climate change – it sits there lie a huge overarching, inter-connected set of concerns about the physical environment, about society, about the shape of our economy, about resource productivity. It really is the biggest thing that we have to wrestle with. A lot of other policy areas are derivative from that overarching set of concerns about climate change.

2. Farming and the rural economy

One thing that is widely agreed by everyone involved is that the last review of the UK agriculture, rural economy and the role of farming – undertaken more than fifty years ago (1945-47) – has come to the end of its useful life. The SDC will undertake a new, independent review, and recommend actions.

3. Regeneration programmes

The SDC will evaluate regeneration programmes (involving billions of pounds) using sustainability criteria. There are already a large number of excellent examples of how this can be done – site specific, location specific, project specific, programme specific which should be an inspiration to all, but there is a huge job to get the messages from best practice to influence normal practice.

4. Economic growth

The SDC will address the compatibility of, and possible conflict between economic growth and sustainable development, for instance in the context of regional development funds. It would also seek to identify or develop a *kind* of growth that would help development towards sustainability.

5. Communications

The SDC will work with communicators to improve our understanding of sustainable development. The phrase must be used both explicitly and consistently if people are to come to terms with what it means.

6. Sectoral activities

The SDC will focus especially on three sectors:

Government itself

For example the SDC is currently planning how to ensure the principles of sustainable Development are embedded in everything the Department of Health does. It is easy to imagine the huge task this is – the NHS impinges on all our lives, has an enormous budget, is currently proceeding with a massive building programme for new hospitals – and Mr Porritt suggested delegates were probably aware that many of these were not yet really embracing many aspects of sustainable development. It is easy to see the huge multiplier effect there would be if sustainability could be brought into every aspect of how a Government Department operates, far beyond government itself.

The regions (RDAs)

The SDC will be working with the Regional Development Agencies and assessing how their economic development strategies, not just their regeneration programmes, are helping regions to move towards sustainable futures. There are several interesting projects in the area of green technologies, renewable technologies, the built environment and infra-structural issues.

The business sector
A number of schemes are being jointly funded with the Department of Trade and Industry. These include sectoral sustainable strategies, business leadership about how businesses take up the challenge and turn themselves into wealth-creating organisations, which have truly understood how to do that on a sustainable basis.

Finally, the overall objective of the Sustainable Development Commission is to embed the thinking about the principles and practice of sustainable development in as many aspects of UK society that we can reach …

… and all this is to be achieved within an annual budget of £500k.

Before continuing to address the role of engineers, Mr Porritt wanted to return to definitions again. There is, he believed, an important difference between sustainability and sustainable development. Sustainability is a state, with boundary conditions. It has biophysical and social parameters that indicate whether a species is in a stable state and which is capable of being scientifically defined. Sustainability is the destination. Sustainable development, on the other hand, is the journey we need to take to get there – how much pain, so to speak, we must suffer before we get there. The idea of sustainability lies behind that of sustainable development.

He wished to take issue with a comment he had heard in the earlier discussion when someone mentioned the idea of 'sustainable enough' and he wanted to clarify this issue. As far as he was concerned, there is no such thing as 'sustainable enough' in the long term. We are either here in a stable state, or we are not. It is important for us to define this state in order that we can aim towards it.

We can only get there, Mr Porritt felt, if the key professionals who deliver things to people are fully engaged in what that journey involves. And, he has long argued, engineers are at the very centre of this process. They, not the politicians, are the ones who can ensure that:

- sustainable development is operational
- sustainable development is made to work for people
- sustainable development delivers new ways of investing in our infrastructure, new ways of generating energy and providing a built environment
- sustainable development delivers new ways of using consumer durables.

There is no point along the sustainable development journey at which an engineer will not be involved.

However, Mr Porritt said he had found it often massively frustrating dealing with the engineering profession as a whole. Yet, in his view this is precisely what engineering ought to be about.

One problem was that sustainable development came out of the environmental movement – 'weirdoes' who wanted to ***stop*** things happening. A lot of engineers see sustainable development as tainted with a green zealotry. Many engineers are also wont to challenge our capability of modelling the technical processes in order to

demonstrate that certain solutions are ‘more sustainable’. They challenge the whole idea because, they say, it has not been carefully thought though yet.

Mr Porritt felt it was not the engineering technology that was the barrier to progressing further. Rather, the main challenge was dealing with the infrastructure of our brains. He was now pleased that some institutions, including the Royal Academy Engineering and the Engineering Council, are embracing sustainable development as something more than environmental issues with some ‘add-ons’.

Forum for the Future was very involved in the recent Engineer of the 21st Century Inquiry. This was a detailed analysis of what could happen within the engineering profession to place sustainable development at the heart of the profession, not as an add-on bit. It was co-ordinated by the Forum but run entirely by young engineers from leading firms and practices in the UK - bringing together Government civil servants, the private sector, the professions - to devise a way forward for the engineering profession. The Institution of Electrical Engineers is now coming up with its own initiative in this area, and the Government is also interested in involving young engineers.

At this point Mr Porritt felt that he had said enough by way of an introduction and he would follow up other issues in the discussion.

QUESTIONS AND DISCUSSION

The Chairman, Roger Sainsbury thanked Mr Porritt for providing an excellent review of where we were and where we are trying to get to, as well as a suitable stimulus for discussion. He suggested that, in the discussion, some of the issues raised earlier about barriers and obstacles could also be brought in.

Question 1
Peter Gardiner began by suggesting that Mr Porritt had only caught part of the story earlier when the idea of ‘sustainable enough’ was being discussed. It had, in fact, been suggested as a pragmatic approach that engineers can adopt for the present. If we spent all our time trying to define sustainability now, we would be missing out on improvements we could already make. We were not going to get to the optimal sustainable solution in one step.

Mr Porritt accepted this point and agreed with the approach. Nevertheless, he felt frustrated that so many people did not take even those steps that were quite easy to take. There are, for instance, several headquarters buildings that have been completed in recent years that are doing just about all you could expect them to achieve in environmental terms. However, there are still so many more being built that are, frankly, environmental monstrosities. So, clearly, the step-by-step approach is better than doing nothing.

He did, however, have a reservation about the incremental approach. There is a danger of going off down sub-optimal routes. He was concerned that, although many are investing in solutions that reduce environmental impact, they are not always doing

it in ways that will serve them in the long term. And the main reason for that is that they understand what environmental impact is, they are not sure what the end point is; they do not understand what genuine sustainability is.

An example is the CFC story. When the refrigerant industry was advised of the damaging effect of CFCs, and their forthcoming prohibition under the Montreal Protocol, it went on to develop HCFCs as a replacement. In the short term this may have been satisfactory, but it was already known that these, too, were damaging to the Ozone layer and a date for their phasing out had been set under the same Montreal Protocol. So the industry had to invest a second large amount of research and development resources on finding a second replacement. A more enlightened attitude would have avoided this. The problem was that the real goal or true sustainable use of refrigerants had not been defined. These firms' shareholders have every right to feel aggrieved by this. Hundreds of millions of pounds was wasted.

Question 2

Peter Guthrie probably spoke for others in the room when he admitted sharing Mr Porritt's feelings (of frustration) about some fellow engineers. He also admitted that he and others in the room were not sure about the final goal. However, he and others in the room were entirely convinced that engineers are and will be at the very centre of the solution-finding process. Mr Guthrie wondered whether this was the case, or were engineers deluding themselves. And, bearing all this in mind, then, he wondered why there was not a single engineer on the SDC.

Mr Porritt replied first that he believed passionately in the centrality of engineers to the enterprise of persuading people to work towards sustainability. However, it was not the case that engineers were *automatically* at the centre. For example, the Government has just announced a review of UK energy policy and this would open up the debate again about certain routes that some thought were closed – in particular the role of nuclear power in a low-carbon world, and this is the right sort of thing for a Government to do. In that debate, engineers are not all lined up in the same place. Some will argue the case for nuclear, and do so for wholly valid reasons. Others are going to explore the possibility of increasing the use of renewables.

The second issue is how different bits of society perceive engineers. He was not sure that those in government shared the perception that engineers are at the centre. Have engineers done enough to persuade Government that they are really are central? Does Lord Sainsbury, for instance, really understand that some of these things can only be achieved by a much more thorough engagement of the engineering profession? Mr Porritt felt that Lord Sainsbury had thought about this more than most, but was not sure that even he was entirely convinced of the centrality of engineers. And it is certainly true that neither society at large, nor young people in particular, saw engineers as the key to providing sustainable solutions. He realised that this touched on the important matter of how the profession can attract the right sort of person into engineering, and keeping them there after their studies. But that was another discussion.

Concerning the makeup of the SDC, Mr Porritt said there had been many discussions about how to represent the business community – old economies, new economies, this sector that sector, how you get the balance between big companies and small companies, and so forth. He had to confess that, at that stage, the engineering professions did not come into the debate. Since then he had considerable representation from the construction industry to try to ensure that it was represented, and he had to reply that they had not had the debate in terms of different sectors. It was more a debate about trying to reflect different ways in which the economy works. In fact we have Chris Gibson-Smith, a senior manager from BP, and there is no doubt that they are a science and engineering-based company. While he is not a trained engineer, he is certainly involved in engineering and knows a lot about the engineering profession and he has certainly intervened a lot on the engineering issues that keep coming up.

There are two other business representatives on the SDC – one is from the retail sector – which is critical with all its product and consumption issues - and the other is from communications and the new economy. There have been many discussions about whether these were the right choices and there is no ultimate defence of the final choice, that is just how it turned out.

The construction industry has not been overlooked, however. It has been invited to second someone onto the Secretariat of the Commission to work with it in a more applied way. It would be wrong, Mr Porritt commented, to overrate the role of the Commissioners – they are just the people who talk about things. Someone then has to go away and do it and that is the Secretariat.

[Note: The current membership of the Sustainable Development Commission is reproduced in Appendix 2]

Question 3

Peter Guthrie went on to ask a second, unrelated question. Just before the recent election he had organised a visit to Britain for members of the Sustainable Development Unit from Hong Kong and was pleased that they had been able to go away with an impression of the then current situation where that the SDC would be responsible directly to the Prime Minister. Since the election it seemed that this had changed and there was now the possibility that the work of the SDC could get lost in the larger role of DEFRA. Was Mr Porritt concerned about this?

He replied that it was only the secretariat that was in the DEFRA. It had been a possibility that the Secretariat would have had a home in the Cabinet Office, but that did not come about. But Mr Porritt felt that that was not really the main issues. The reporting structure is the most important thing The SDC does have to account for its activities directly to the Prime Minister and his staff in Number 10.

He also admitted that he was not sure that the Prime Minister had yet bought into the centrality of sustainable development. There was no doubt that it did not yet have the presence of the main over-arching ideas such as social inclusion and modernisation. The reason for this is that sustainable development is really not yet in Tony Blair's brain. That is why Mr Porritt kept on coming back to the language of sustainability.

The concepts and epistemology of sustainable development are vital to getting political breakthroughs. It is important to be able to talk about it in straightforward terms, without losing any of the essence and the rigour, so that sustainable development can become ownable by very senior politicians. Mr Porritt admitted that they had not yet achieved this.

Question 4
Barrie Mould (VP Brighton) returned to the issue of the bottom line and how it is perceived by industry as a reason for not getting involved in sustainable development. He asked Mr Porritt to comment on how industry might measure economic progress and growth in new ways.

Mr Porritt was pleased that many of the very large companies had become engaged over the last ten years, since the Earth Summit, by defining the business case for sustainable development. Few people realise how much they have done; it really had been astonishing and had been a very powerful source of new energy and creative thinking. The business case has been articulated in a variety of ways. Some of them are very hard-edged, capable of monetary calculation – eco-efficiency benefits, design benefits, risk management benefits – all of which have a direct connection through to the bottom line. Some of them are more intangible – reputation, licence to operate in society, cost of compliance, cost of capital – the evidence is less firm, but it is strong and a lot of companies do not need persuading that the idea of sustainable development is working for them as a business priority.

Mr Porritt gave the example of a couple of companies with which Forum for the Future is working who do not believe the basic assumptions behind sustainable development – they do not think that the planet is collapsing and society is imploding. They think we will muddle through, like we have always done, and that the urgency that people like the speaker were trying to inject into the debate is inappropriate. Nevertheless, the firms are having no trouble in internalising sustainable development in their businesses, and they are not being cynical; they are just asking what is going to make them a better business, responding to where expectations are going and serving a changing market. They do not see it as their job to agree or disagree with the reasons why the market is changing.

The speaker said that the SDC was looking at the whole idea of economic and business growth. It was important to challenge the idea that the only thing for businesses to do was to aim automatically at double-digit growth as if it was the only thing to aim at. We need to look at what we might mean by sustainable growth. Clearly it cannot be to use exponentially increasing quantities of energy and materials to make things. We can, for instance, look at growth in terms of the economic value per unit of throughput. And we can go beyond that to look at the increase in human welfare that is generated by each tonne of material we use. This might give us a model of economic growth that is compatible with the idea of sustainability. Until we get some measure of economic input that encapsulates the environmental and social effect of our activities, it is difficult to see how anyone – businesses or politicians – can get the feed back they need in order to manage and control the process.

Roger Sainsbury added that he had been reminded of the story by Tom Stoppard about Niels Bohr who kept a horseshoe hanging over his front door. When challenged that he really should not believe in such superstitions he replied that he didn't, but apparently they worked even if you didn't believe in them.

Question 5

Roger Duffel (Hertfordshire), too, shared the speaker's frustration with many engineers. He also wanted to share the difficulty he was having filling places on a new course on "Sustainable Engineering and the Built Environment" he was involved in launching at Nottingham Trent University. It was difficult to persuade the majority of the centrality of sustainable development to engineering.

Mr Porritt felt it was a chicken and egg situation. He had found the business schools even more reluctant to embrace sustainable development than engineering departments in universities. They say there is no demand - businesses have not been receptive to the idea of such courses. Yet, when he had asked, Mr Porritt has found the companies disagree – they are short of the necessary skills and say they do want such courses. It may be there is a need to bang heads together.

He was interested in the Institution of Electrical Engineers recent launch of a Network for Sustainability that already had 1200 members and is being run by young engineers who see sustainability as a core issue for them. It really is demand led.

On the question of education for sustainable development – this is not covered by the SDC because it falls within the "Panel on education and sustainable development" co-ordinated within the Department of Education. Mr Porritt felt it was important to communicate the links between engineering and sustainable development, and this must be a better way of trying to recruit more and better students.

Question 6

George Howarth (VP Bournemouth) observed that it would be at least 10 years before we would see any results from bringing sustainable development into the education of engineers when they get into influential, decision-making management positions. He felt this was too long, and wondered how it might it be possible to get there quicker. Should we be putting our education efforts into the business-to-business areas or towards the general public.

Mr Porritt felt the construction industry was a good example here. There is an opportunity to pass the idea of sustainable development along the supply chain from client through the design team to the sub-contracting firms. The government was responsible for a great deal of procurement of construction and is already leading by example by incorporating issues of sustainability into the process. It was important to bring whole life costing into the decision process – capital and running expenditure are still usually treated entirely separately. There are examples too from other countries, such as Germany and Sweden, where their governments are prepared to pay a premium to get demonstrable sustainable development and get higher standards of building and level of performance.

Question 7
Gary Acres (Birmingham) was not sure that sustainable development was perceived as an exciting option for students. He reported a survey in Birmingham schools which had found that any title of an engineering course which also contained the words *media*, *sport* or *law* got a high rating, whereas those with *sustainable* in the title came bottom.

Mr Porritt was not sure if sustainable development was the sort of subject to sell in such an 'in-your-face' way. Maybe it was necessary to convey the idea of 'saving the planet' into the course titles. He could not believe that people would turn away from courses aiming to achieve that. He felt that many courses could benefit from the rigour of sustainable development underlying them.

Peter Guthrie commented that they had found the opposite at Cambridge. To a large extent it depends on how you ask the question. Among undergraduates there had been a huge demand for his Module called 'Engineering Design for Sustainable Development'. The students really do see how their input can actually make a difference. We do need to attract more students and we will need to change the courses and, to a large extent, the academics themselves to attract more students.

Question 8
Bernard Hon (Liverpool) remarked that globalisation was now prevalent in both economic and other ways, and the Internet too had broadened our horizons. He wondered whether the Sustainable Development Commission would really be able to have an impact, given this international dimension.

Mr Porritt replied that the SDC did not have an international or global remit. He acknowledged that the UK was a very small country and the world would hardly notice if Britain failed to engage with sustainable development or if it succeeded in creating economic growth based on a low-carbon economy – it would have an insignificant effect compared to whatever happens in the USA or China. Nor is it very clear that we are leading the world in many areas of sustainable development. The reason why the UK will be able to meet its Kyoto targets has nothing to do with what we or the Government are doing now. It is because Mrs Thatcher had a pathological hatred of coal miners. It has nothing to do with a systematic approach to a low-carbon economy.

Nevertheless, Mr Porritt felt that the UK was demonstrating how it could have a considerable role in showing how sustainable development could be done and helping to show those in other parts of the word how they might get there more quickly and without going along the same route as we have had to do. He hard recently learnt about the Clean Development Mechanism that would be part of the Kyoto agreement, if we ever get there. This is already leading to some fascinating exchanges between UK companies and UK academics about ways in which other countries can make technology leaps that would not previously be available to them, and move from where they are now on their own energy curve to where they are going to need to be in the future without going through all of these tortuous and hopelessly inefficient stages.

In the case of China, for example, we were already having significant technology exchange with them. They are already engaged in a huge climate change programme and it is already having an effect.

Question 9
Charles Ainger (VP Cambridge) said he was particularly interested in the means of changing organisations to meet the challenges of sustainable development. This involved people from all backgrounds and he felt it was important to make sure courses on sustainable development should be available to all students. He believed we have between 10 and 20 years to change and wondered how that might come about. How much would be achieved by top-down processes? Maybe 5%. And what critical mass of organisations needs to change to make a difference? Maybe 25%. That raises the question how much change are we going to get from bottom up? He wondered where Mr Porritt thought the change would come from.

Mr Porritt replied, slightly tongue-in-cheek, that he would begin with the compulsory re-education of all economists since they seem to have no connection to the real world that he lived in. He agreed that the issue was one of change management and felt that many large organisations were achieving significant results, and he mentioned that he had brought into the SDC Secretariat a secondee from BAA to look at business leadership issues, but agreed that that was only one aspect of organisational change, and that was a pragmatic choice.

There are, Mr Porritt suggested, some examples where top-down approach to introducing sustainable development had really worked and have been sustained not because of the person at the top, but because the baton has been taken up lower down and throughout the company. He cited the example of John Browne at BP. Once employees had been given permission, so to speak, to address the sustainability issues, they have said, thank you very much, we like that, and they have found it helpful in building up a better idea of the sort of firm they work for and useful when talking to their friends who have not always held BP in high regard. It has benefited the firm a lot in helping create the sort of firm that people want to work for.

Finally Mr Porritt expressed his concern for how the media were dealing with the sort of leadership that is necessary when firms try to deal with the sustainability agenda. As soon as there is the slightest transgression, the media really hammers people and it makes it very difficult for firms to be open about what they are trying to achieve, while admitting that they do not always manage to do so. He had been working with ICI and they are really trying throughout the firm to do things, and they are succeeding. And yet you will never see a good word about ICI in the press. That is because the media is still dealing with ICI where it was ten years ago when they did, indeed, have a lot of environmental problems. Although the firm got rid of many of its environmental problems by selling off those parts of the company, it really has changed now, and yet the media still treats them as a load of profiteering planet-bashers. The staff is really concerned about this because they cannot understand why the media still presents them as if they have made no changes at all.

The Chairman brought the discussion to a close, thanking Mr Jonathan Porritt for the stimulating presentation and his lively responses to the discussion.

Delegates then made their way to lunch.

SYNDICATE GROUP DISCUSSION (3) (Wednesday PM)

Pedagogy

Chair: George Howarth

Jim McQuaid, Chair of the Sustainable Development Education Working Group at the RAEng, introduced the theme of the afternoon session. He reminded delegates of the main lecture at last year's conference on the use of case studies in MBA courses and management courses. He had not found it very useful. Likewise he had discovered a report, published in 1992 on Best Practice in University Teaching that offered little or no help or guidance. He had contacted both the Higher Education Staff Development Agency (HESDA) and the staff training department at Sheffield University that also yielded nothing of great use.

His conclusion was that very little work had been done on the pedagogical role of case studies.

He reminded delegates of the need to focus on *learning outcomes*, and observed that these had recently gained greater prominence with the Teaching Quality Assessment process that required courses, modules and even individual lectures to have explicit learning outcomes. He felt that the process of accreditation by the engineering institutions should follow this practice and become output-based.

The purpose of the syndicate discussion session was set out in the printed note on Pedagogy. This referred delegates back to the ROAMEF statement that sets the aims for the VP Scheme.

Following this short introduction the delegates split into four syndicate groups to discuss the following questions:

A What are the characteristics of case studies that are most useful / least useful in teaching the principles of sustainability?

B How should case studies be structured to assist the integration of sustainability into conventional syllabus subjects?

C How can (non-RAEng) teachers be encouraged to use the case study materials in their own teaching?

D What are the strengths and weaknesses of particular technology aids in presenting case study materials for teaching and learning?

FEEDBACK FROM SYNDICATE GROUPS

The conclusions of the syndicate group discussions were as follows:

Group A Presented by Allen Clegg (Loughborough)

What are the characteristics of case studies that are most useful / least useful in teaching the principles of sustainability?

The group identified the following as the most beneficial aspects of case studies – they can be:

- inclusive
- liberalising
- enjoyable
- motivating
- good for introducing transferable skills – communicating; role play

Problems with case studies include:

- they are resource intensive
- they are time intensive, maybe more than is officially allocated
- they need considerable organisation

Guidance for the use of case studies is:

- don't provide all the information
- don't concentrate only on engineering issues – engineering is a vehicle for achieving something for society
- don't let individuals dominate

Group B Presented by Alan Strong (Ulster)

How should case studies be structured to assist the integration of sustainability into conventional syllabus subjects?

The group identified the following key issues about the structure of case studies:

Integration

- different modules
- avoid sanitisation
- across universities
- VPs can act as a catalyst
- Achieved via students
- subject and staff driven
- need to buy in staff support
- resources needed
- assessment
- educational and stimulating

Structure

- pre-supposes 'underpinning'
- has Learning Outcome
- has a real-life context
- involves lateral thinking
- embraces environment, society and economics
- include site visit (virtual or real)
- considers policy
- includes teamwork

Types of model

The group identified four different models for case studies

- Model A – very small – 20 minutes; repeatable
- Model B – Large – open ended; design-related – resource intensive
- Model C – 'shambolic' (i.e. high level of spontaneity) approach, very interactive, fed irrelevant information – high learning
- Model D – more formal analysis of a problem - in between A and B. More transferable skills than A and B.

Group C Presented by Charles Ainger (VP Cambridge)

How can (non-RAEng) teachers be encouraged to use the case study materials in their own teaching?

The group first of all looked at the barriers that need to be overcome and then at the possible means of overcoming them:

Barriers

The following is a 'worst-case stereotype':

- Promotion criteria reward selfish specialisation
- Skill sets required for teaching and research reflect this
- 'no time in timetable to add case studies'
- no time / energy to prepare new material
- more demanding in time and preparation
- scared to go off-script and out of control of answers

Solutions

How to break down the barriers:

Issue / method	Stick	Carrot
External funding	Make it a condition that any funding must use case studies	Reward sharing

Accreditation	Make case studies a condition of accreditation	N/a
Publish information on teaching methods, and compare with other universities	Expose a course or module as out of date	Positive student response
Incentives for individual lecturers	Reason for demotion Expect the Head of Department to do them (group felt that some lecturers 'could not do' case studies)	performance related pay / promotion VPs offer help to existing lecturers VPs provide and communicate 'good practice' examples Offer prizes for best case studies
Targeting lecturers who can do case studies (perhaps only about 15% can handle this type of teaching)	Insist on personality tests	More fun for those who can

Specific change actions

- Do off-line experiments with lecturers and students – take them off to a master class / away-day
- Invite guest lectures from other departments in the same university
- Most teachers have too little experience outside the university environment and, hence no case studies, hence encourage rotation – teaching to external practice and back
- Involve Institution of Learning and Teaching – train in 'facilitated learning' via case studies as well as how to lecture

Remember – it is also a question of how you do the case study – it is important to unpack the second level of learning

Also as reported at the Engineering Professor's Council conference - If you only lecture facts as knowledge, you'll become obsolete

Group D Presented by George Drahun (Aston)

What are the strengths and weaknesses of particular technology aids in presenting case study materials for teaching and learning?

Dr Drahun began by recalling one message from last year's talk about using case studies in management schools and that was the difference between a *case study* and a *case history*. A case study involves interaction between the presenter and the audience. It is about decision making and participation In a case history there is one answer. In a case study there can be many answers.

The looked at how various technologies can be used in the context of case-study work and found most had several benefits:

Technology	Positive	Negative
Intranet / Internet	Lots of information An intranet can be used to define / limit the information that is 'important' or relevant. The material can be easy to update Good students can extend themselves	Too much information
OHP / PowerPoint	Can learn to present complex information	Can get lost in the technology of PPT
Video	Good for presenting information Feedback on presentations and interaction Present a site visit	
CD-ROMs	Interactive	
Chalk	Interactive	
Knowledge-based systems	Good for LCA	
Books / handouts	Can control data	Handouts can become very big – can worry some students
e-mail	Not really a teaching aid, but offers fast communication with students	

SYNDICATE GROUP DISCUSSION (3)

Chaired by George Haworth

Barrie Mould (WS Atkins), referring to the results form Group B on integration, felt he had not understood how the use of case studies had achieved the integration of sustainability into the main syllabus.

Jim McQuaid replied on behalf of Group B. Rather than asking resident staff how they would be able to use case study material, and then taking a hammer to knock the case study material into shape as teaching material to suit the needs of the teachers, we use a technique that is equivalent to the "expressed preference" method of eliciting people's views - instead of asking people, you deduce their views by observing their behaviour. The relevant action that teachers take nowadays is to state the relevant outcome that the students must achieve. So we look at the stated learning outcomes and where they mention sustainability. We were quite surprised – we found that a large number of existing modules contain such mentions and so we are able to structure a case study that suits the declared learning outcomes

Mark Hadfield (Bournemouth) felt that if we are looking at learning outcomes, we should also be looking at assessment. If we are to integrate sustainability into the curriculum the methods of assessment are also important. We should address in more detail what assessment methods are relevant to case studies.

Roger Sainsbury expressed his concern that one of the speakers had suggested that only a small number – perhaps 15% - of lecturers had the skills to deal with case studies in the curriculum. He wondered how many others in the room agreed with this proposition, especially in view of the fact that lecturers already needed certain talents to become lecturers. He also wondered whether the same might be true of Visiting Professors, because they are not given any special training for their role, nor were they tested for relevant skills before being appointed as a VP.

Only one person in the room reacted, saying that he too was surprised at the statement, and felt that many of the skills needed to be a course tutor were probably relevant to dealing with case studies.

Peter Guthrie returned to the matter of learning outcomes for courses and expressed concern that many merely paid lip service to sustainability. Similarly with the many applications for EPSRC funding that claimed that the results of research would make a contribution towards sustainable development: in nine cases out of ten, such a statement was utterly meaningless. In his view VPs were not contributing to universities by means of serving the learning outcome needs of courses. He felt that VPs are influencing what is taught in the other courses in engineering undergraduate syllabuses and he thought there was a need to find other ways of measuring how successful this was. He supported the idea of the VP as Trojan Horse who helped change attitudes in academic departments, but he felt that all the VPs agreed that the students were a pushover when it came to changing attitudes: academic staff, on the other hand, are a high mountain to climb.

Jim McQuaid replied that many of the courses he had looked at were just ordinary subjects that, on the face of it, had nothing to do with sustainable development. Many lecturers' reaction was "what has their subject got to do with sustainable development" and by looking at the declared learning outcomes he (Jim) had been able to make the link and educate the lecturers a little to see what their subject had to do with sustainable development.

Alan Strong returned to the question as to whether all academic staff were capable of delivering their courses using case study material. In fact, most staff use case studies and probably have done for many years. The point is that very few are doing so in the area of sustainable development, which, because of its holistic approach, ranges across many disciplines. This, he felt, had perhaps been a misunderstanding earlier. Many lecturers, more among the older generation, perhaps, might indeed not be so comfortable with this sort of approach. He felt that VPs surely have the skills in advocacy to negotiate, to assist and to provoke, to encourage, to advise and to facilitate, and to persuade and encourage many academic staff to move into this area.

Returning to the matter of assessment, he reminded the group that, while every learning outcome might need to be assessed, it was not necessary to do this in a formal way nor to assess all case study work. It was often sufficient to get feedback from the students to verify the high degree of engagement with good case study work and it was important to reward the good students with good marks.

Charles Ainger said he had taken his figure of 15% from his experience in engineering in general, where he had found it to be the case. It may be that those in academia have a different balance of skills. He wanted to emphasise the difference between the deep and focused view of traditional engineering teaching material, and the breadth of the view and the holistic approach needed to deal with sustainable development, as well as being able to deal with the spontaneity and open-endedness of the kind of case study we are talking about in this area. It was important not to underestimate the need for experience and training with that different kind of learning.

The chairman drew a close to the discussion of the syndicate sessions and made a suggestion for a future meeting to look at two or three of the case studies in use and really explore these issues in detail, because they are crucial. He would also like to hear how people have done a case study and overcome the problems that had been raised. He felt that this would be especially useful for the new VPs and would be an opportunity to learn from the experience of others. Developing and proving case studies was meant to be the key activity of the VPs and it was important to do this as well as possible.

Jim McQuaid suggested a variation. One of the key purposes of the case studies is that it should be able to be used by people who had no direct connection with its preparation. It might therefore be better if a case study were assessed by someone who had not been involved in its preparation – testing a case study in the way it is intended to be used. Paul Jowitt suggested this might be rather like a master class.

PLENARY DISCUSSION (3)

Chaired by George Haworth

The chairman introduced the final plenary session at which a number of more general issues were discussed, and began with one topic that several people had mentioned – the VP website. David Foxley provided delegates with an update.

The website had progressed rather more slowly than had been hoped. He reminded everyone to return the proformas that had been sent out to collect information for the website database. The purpose of the website had been intended to be a communication medium, for instance for work in progress. One problem was the issue of intellectual property and copyright. But they were now fairly close to providing on-line access to everyone. A query was raised about the Hertfordshire website which seemed to have disappeared – in fact it is still there, but is currently under reconstruction.

Copyright is an issue and all published material had to be either the university's copyright or permission of the holder had to be obtained.

Jim McQuaid asked whether any university in the UK had restrictions on placing teaching materials on the website (no-one knew). MIT had recently gained considerable publicity by saying it was going to do this and that it was going to be a world first. Peter Guthrie thought the difference with MIT is that they are proposing to put all their teaching material on the web.

The lesson seemed to be that simply placing the lecture material on the web did not give away very much.

The key issue was using other people's material. You can make occasional copies but cannot use others' material in 'organised publishing mode' such as bound course notes or a web site. David Foxley reported that Liverpool University was using a watermark on copyright photographs published on their web site

Peter Gardener introduced Neil Carrett who was making a study of the use of case studies in education. He has looked for hard evidence of the effectiveness of using case studies and has found very little. Neil would welcome any information people might give him about their experiences – both hard data and anecdotal information.

The chairman returned to the subject of the social aspects of sustainable development. He had enjoyed the presentation and discussion but they were all realising the issues, not providing answers to the questions. The RAEng had difficulties in finding an expert speaker on the subject. He wondered whether the group should return to the subject at a later date. His fear was that each of the 15 VPs would go off and do the social aspect in different ways and he felt there ought to be some consistency. Alternatively maybe some of the VPs ought to come together to try to work things through.

Jeff Hulse mentioned one of the better known gurus from the USA – Vince Covello – and his fee two years ago was $7000. However he filled a large room with chemical

engineers at £100 a head, and it was a profitable day all round. Sandman who is the other guru from the USA, and he charges about £10,000 a day. Neither of them has written books.

Several people felt that the social issues should be pursued further, and a speaker sought, and maybe some discussion on the website when it got going.

Barrie Mould reported that the CIRIA Construction Industry Indicators Project included some social indicators at sector, company and project levels. Considerable research was undertaken to identify appropriate indicators for social aspects in the construction industry. These were about to be tried out by a number of firms that had volunteered to be 'pioneers'.

The discussion turned to the matter of publicising the work of the RAEng and the VPs. The chairman thought much had already been accomplished and it might be appropriate for the RAEng to organise a conference to tell people about it. Several people agreed the achievements had not been publicised widely enough. Various suggestions were made about appropriate conferences and periodicals.

David Foxley mentioned a United Nations Environment Programme and their UK offshoot runs an annual conference on sustainable development education. He had attended the last two and had been the token representative of the engineering industry in an audience of between 50 and 100.

Harry Eccles informed the group there was a conference on sustainability and the chemical industry on 18th July.

Alan Strong suggested that an excellent use of the forthcoming website could be to pool papers all the VPs had written about their work. That way everyone could learn from each other. Alan also mentioned that he had hosted a European conference at Ulster in November 2000 entitled Engineering Design and Application for Sustainable Development, but it had not been well attended and only one VP attended.

Alan finally informed the delegates that this coming November, the University of Ulster together with Bryson House Charity, the Northern Ireland Government and Belfast City Council are hosting the entire Sustainable Development Commission. All the key decision makers are being targeted and numbers are to be limited to 200. Alan Strong invited applications to attend, though it was not in his power to offer places. He hoped some VPs would be able to attend.

Roger Duffell (Hertfordshire) said he used every opportunity to publicise the RAEng work, especially when abroad. He asked how many VPs there are now, and how many were planned. He also asked what plans there were to prepare tangible evidence of the results of the first three years of the scheme and the possibility of making material available to other universities not involved in the VP scheme.

David Foxley replied that there are currently 15 VPs. The Academy agreed not to increase the number this year, however, but to consolidate the work of the current ones. Five of the current universities involved have been invited to apply to extend the original three year scheme to five, in recognition of the fact that it is more than a

three-year task. One condition of this extension is that the VP should walk way at the end of year 5 and leave what he has prepared to carry on without him.

Further funding for the scheme has been secured and it is planned to add five more universities next year and five more the year after making a total of 25 in all. The total duration of the scheme will be 9 years.

Jim McQuaid reported that he was doing his bit to publicise the scheme – for instance he had recently talked to 200 people in the Houses of Parliament – and the scheme had been publicised in at least one education conference. There was also the need to report and monitor progress in the original ROAMEF agreement under which the scheme was launched. This required a report after the first three years and appraisal as to achievement of objectives, progress towards outcomes, feedback from stakeholders, wider benefit to the RAEng reputation, and the lessons learned. A further aim was 'feedback' which meant the feeding of case study material to other universities.

David Foxley reminded everyone that it was also part of the contract that each VP had to report back to the RAEng annually before the following year's funding was released.

Charles Ainger thanked the other delegates for making his first VP workshop a useful one. He wondered, though, whether one group was not being ignored in the proceedings – the students who have benefited from the VP's contributions. While some students would find themselves working in a firm that fully embraced sustainability issues, many would not. He wondered whether there might be a case for forming a graduate club to keep in touch and encourage the sharing of experiences and ideas with each other and with VPs too, perhaps.

The chairman thought it was a good idea and should be discussed further. He thanked David Foxley and Jim McQuaid for their parts in preparing for and organising the whole event successfully, and brought the workshop to a close.

Appendix 1

Visiting Professors in Engineering Design for Sustainable Development

Annual Workshop 26/27th June 2001

Programme

26th June:

17:30	Tea
18:00	Start of workshop: Chairman's welcome and administrative arrangements
18:15	Introduction to debate on Social Aspects of Sustainable Development.
18:30	Break into 4 sub groups
19:00	Return to Conference Room for plenary debate
19:30	Reception
20:00-21:30	Dinner

27th June:

09:00	Coffee
09:15	EPSRC's Infrastructure and Environment Programme (Peter Hedges)
09:45	Syndicate discussions
10:45	Report back
11:30	Lecture by Jonathon Porritt
12:15-13:00	Open Discussion
13:00-14:00	Lunch
14:00-14:15	Introduction to Syndicate Groups (Jim McQuaid)
14:15-15:15	Syndicate discussions (Pedagogy)
15:15-16:00	Report back on syndicate discussions
16:00-16:15	Tea
16:15-17:00	Plenary discussion

dmf/08/06/2001

Appendix 2

Members of the Sustainable Development Commission
(http://www.sd-commission.gov.uk/)

Chairman: Jonathon Porritt CBE

Biographical details
Jonathon Porritt, Director of Forum for the Future, is one of the best known and most influential advocates for the environment. His numerous appearances on television and radio, countless public lectures and many hard-hitting articles in newspapers and magazines have made him probably the best-known environmentalist in Britain today. In 1996 he founded Forum for the Future, a charity campaigning for solutions to today's environmental problems working closely with business. He leads the Forum Business Programme, working with 15 of the UK's leading companies, and chairs the Advisory Board of the Forum's bi-monthly flagship magazine Green Futures.
In April 1999, he became chairman of the South West Round Table for Sustainable Development and was appointed to the Board of the South West Regional Development Agency in December 1999. He is a Trustee of WWF UK, Vice-President of the Socialist Environment Resources Association (SERA), Chairman of the Agricultural Reform Group and the Gloucestershire Environmental Trust. He is an advisor on environmental issues to many bodies and is a member of Robin Cook's Green Globe Task Force. He was formerly Director of Friends of the Earth (1984-90); co-chair of the Green Party (1980-83) and chairman of UNED-UK (1993-96). Jonathon was appointed CBE in January 2000 for services to environmental protection. He was born in London in 1950.

The Members:

- Maria Adebowale

Is the founding Director of the new non-governmental organisation, Capacity, working on community participation, poverty, environment and human right issues at local, national and international levels. She is a Commissioner of the new UK Sustainable Development Commission and a member of the Advisory Committee on Consumer Products and the Environment. Maria has Masters in Public International Law and has a worked on UK, European and International environment and community programmes. She a senior consultant at the Centre for Strategy and Communication, a trustee of the Black Environment Network, and a Visiting Fellow of South Bank University. Maria is the former Director of the Environmental Law Foundation and is the author of numerous articles on environment law, sustainable development issues and human rights.

- Rod Aspinwall

Is Deputy Chairman of the Enviros Group and Professor of Environmental Management in the Department of City and Regional Planning, Cardiff University. His early career was in geological exploration for minerals, followed by experience in water resource development and conservation work. From 1972 Rod built Aspinwall and Company into a multi-disciplinary, international environmental consultancy, now part of the Enviros Group. He now concentrates, through consulting and teaching, on

raising capacity and literacy levels around sustainability issues with senior business executives. In 1995, Rod was awarded the OBE for services to environmental management.

- Helen Browning

Runs Eastbrook Farm, a 1,350 acre organic livestock and arable farm in Wiltshire. As part of her degree course, Helen took up an industrial placement with MAFF, undertaking comparative research on organic/conventional farming systems. On taking over the tenancy of Eastbrook Farm in 1986, Helen began conversion to organic methods, and gradually converted all the land and livestock enterprises. Helen founded EFOM in the late eighties which now supplies the major multiple and independent retailers; and its own home delivery service. Helen is Chairman of the Soil Association and a Meat and Livestock Commissioner. She sits on a number of committees, including the Agriculture and Environment Biotechnology Commission and Food Ethics Council. Helen was also a member of the British Government Panel on Sustainable Development. She was awarded an OBE in 1998 for services to organic agriculture.

- Maureen Child

Was elected to Edinburgh Council in 1995, and is now Executive Member for Finance under the new democratic arrangements in the City. She is committed to bringing community participation and environmentalism into the mainstream through the Local Agenda 21 process in Scotland's capital city. She has given political impetus to the sustainable development agenda in the Council and worked in partnership with other agencies as Chair of the Edinburgh Environment Partnership and member of the Lord Provost's Commission on Sustainable Development. She has also made a contribution in a Scottish wide context as Vice Chair of the Convention of Scottish Local Authorities (CoSLA) Sustainability Group.

- Rita Clifton

Is Chief Executive of Interbrand. On graduating from Cambridge, Rita began her career in advertising, and joined Saatchi & Saatchi in 1986. There, she worked with a wide range of high profile clients - including Procter & Gamble, British Airways and Visa International - and set up the Agency's groundbreaking 'Green Unit' and Futures Group. She became Vice-Chairman & Executive Planning Director in 1995. Rita writes and lectures widely on subjects such as innovation, retail and corporate branding, and global brand futures; she conceived and edited Interbrand's latest book 'The Future of Brands'. In 1998 she was voted one of the Women of Achievement in marketing, advertising and media.

- Lindsey Colbourne

Is Director of Projects in Partnership, a national organisation specialising in creating sustainable solutions through participation and partnership. She is internationally recognised for her pioneering work in developing and applying techniques for involving a wide range of individuals and organisations in sustainable development - often in situations of conflict. In 1993, at the age of 25, Lindsey established Vision 21 in Gloucestershire, the first community-based Local Agenda 21, a network of 1,500 volunteers working on 60 projects, in partnership with the county council and 6 district councils. She is also Co-ordinator of InterAct, an alliance of experienced practitioners, researchers, writers and policy makers committed to using

these techniques to support democratic renewal, social inclusion, sustainable development and a vibrant civil society.

- Anna Coote

Is Director of the Public Health Programme at the King's Fund, London. She leads the Fund's work on health improvement, regeneration and tackling health inequalities. She was formerly Deputy Director of the Institute for Public Policy Research, the London-based, centre-left think tank (1993-7), where she led the Institute's groundbreaking work on health and social policy, on citizens' juries and deliberative public involvement, and on media and communications. She has been adviser to the Minister for Women (1997-8); a Senior Lecturer in Media and Communications at Goldsmiths College, London University (1991-3); a producer and editor of current affairs and documentaries for Channel Four TV (1982-9); Deputy Editor of the New Statesman (1978-82), and a journalist and broadcaster. She is a member of the London Health Commission, the Department of Health's Task Force on Inequalities and Public Health, the Foyer Federation Council, and a Trustee of the charity Help the Aged. She is an honorary member of the Faculty of Public Health Medicine.

- Ed Crooks

Awaiting biography

- Nicky Gavron

Is Deputy Mayor of London and the Mayor's Adviser on Spatial Development and on planning matters. She is the Greater London Assembly member for Enfield/Haringey. She was chair of the London Planning Advisory Committee from 1994 until March 2000 when it was absorbed into the GLA. She remains a Haringey Councillor. Nationally, Nicky is Vice-Chair of the Local Government Association Planning Committee, and leads the LGA sponsored working group on Reforming Local Planning (part of the Futureswork programme). She is also a member of the Commission for Integrated Transport and an Adviser to the Urban Task Force. Nicky has a long track record, formulating policies and developing initiatives, which integrate transport and land use to deliver sustainable communities and cities.

- Chris Gibson-Smith

Is Group Managing Director of BP, responsible for Policies and Technology. On joining BP, he worked as an exploration and production geologist in many countries before being appointed Chief Geologist in 1983. He attended the Stanford Graduate School of Business as a Sloan Fellow, and received an MS in Management Science in 1985, and then held a range of senior positions within BP before being promoted to MD in 1997. Chris is also a non-executive director of Lloyds TSB and a director of Arts & Business. He has served on government advisory committees on aviation, and oil and gas. He also served two terms on the Sloan Advisory Board of the Stanford Business School, is a past Chairman of Business in the Arts Scotland, past Chairman of the California Marine Mammal Centre, and past Council member of the CBI Scotland.

- Brian Hanna

Is Chief Executive and Town Clerk of Belfast City Council, Northern Ireland's largest district council. In his position as Chief Executive he attempts to play a

positive and constructive role in the sustainable development of his native city believing that equal weight needs to be given to economic, social and environmental factors if the sustainable development of Belfast is to be achieved. Before taking up his current position Brian was the City Council's Director of Health & Environmental Services and he continues to take a close interest in environmental matters particularly those directly related to cities. He is a fellow of the Chartered Institute of Environmental Health and a Member of both the Society of Local Authority Chief Executives and the National Society for Clean Air. Brian is a member of the UK Sustainable Development Commission. He was awarded a CBE in the 2000 New Year's Honours List and an honorary degree by The Queen's University of Belfast in 2001.

- Deirdre Hutton

Is Chairman of the National Consumer Council, previously having been Chairman of the Scottish Consumer Council. She has been engaged in the consumer sector for some twelve years. Her experience in this area has led her into a number of other fields and her appointments include non-executive director of the Financial Services Authority, membership of the Better Regulation Task Force, Chairman of the DTI's Foresight Panel on the Food Chain and Industrial Crops, as well as Vice-Chairman of the Scottish Environment Protection Agency.

- Alan Knight

Was appointed as Environmental Specialist to B&Q, Britain's largest DIY and Garden Centre chain, in October 1990. Since then, Alan has played an instrumental role developing and co-ordinating B&Q's environmental policy and advising the company on future issues. In 1998 he received an OBE for 'services to environment audit and business'. In 1999 he became Chairman of the Kingfisher Environment Forum responsible for developing and co-ordinating policy across the whole Kingfisher group. In 1995 he won the 'Environmental Leader Award' from the Tomorrow Magazine. Alan is Chair of the Government Advisory Panel of Consumer Products and the Environment and is an ambassador to WWF UK.

- Walter Menzies

Is Chief Executive of Sustainability Northwest (SNW). A Scot by birth, his early career was as an architect and urban designer in London before spending six years at the sharp end of housing and urban regeneration on Merseyside, with Riverside Housing Association. In 1983, he joined Groundwork as the second Executive Director in the network and played a leading role in its development into a major force for environmental regeneration. His final post in Groundwork was as the first Regional Director for Northwest England. In 1997, he was appointed Chief Executive of Sustainability Northwest (SNW), Europe's first business-led partnership for sustainable regional development. SNW is focused on Northwest England. It champions a challenging - but positive - solutions driven approach to sustainable regional development in all sectors of the economy and society.

- Tim O'Riordan

Is Professor of Environmental Sciences at the University of East Anglia and Associate Director of the Centre for Social and Economic Research on the Global Environment. He has promoted the cause of interdisciplinary research for sustainable development along with colleagues in the School of Environmental Sciences and

elsewhere in Europe and North America. He has conducted extensive research on the implications for government generally of the transition to sustainability. He is a Deputy Lieutenant for the County of Norfolk and a Fellow of the British Academy. He has also served on advisory committees to Dow Chemical and TXU-Europe, and is a core faculty member of the Business and Environment programme.

- Derek Osborn

Is a senior environmentalist advising on long-term strategic issues for governments, international bodies, business and the voluntary sector. In the public sector he was Chairman of the UK Round Table on Sustainable Development from April 1999 until it was wound up in July 2000. He was on the Board of the Environment Agency for England and Wales from its inception in 1996 until 1998. From 1990 to 1995 he was Director General of Environment Protection in the Department of the Environment. In the business sector Derek Osborn is a non-Executive Director of Severn Trent plc, and chairs the Board's Environment Committee. He also provides environmental advice to Tarmac, ERM CVS, Innovest and Jupiter Asset Management Green Funds. In the voluntary sector Derek Osborn is Chairman of UNED Forum. In addition, he is a visiting professor at the School of Public Policy, UCL.

- Anne Power

Is Professor of Social Policy at the London School of Economics and Deputy Director of the Centre for Analysis of Social Exclusion. Since 1965 she has been involved in European and American housing and urban problems. In 1966 she worked with Martin Luther King's 'End Slums' campaign in Chicago, and on her return to Britain organised community-based projects in Islington. From 1979 to1989 she worked for the Department of the Environment, setting up Priority Estates Projects to rescue run-down estates all over the country. In 1991 she became founding Director of the National Tenants Resource Centre at Trafford Hall in Chester, which provides residential training for people living and working in low-income communities. She was awarded a MBE in 1983 for work in Brixton, and a CBE in June 2000 for services to regeneration and promotion of resident participation. Anne Power is a member of the Urban Task Force and the Government's Housing Sounding Board.

- Charles Secrett

Is Director of Friends of the Earth (FOE). He frequently appears on national TV and radio news and current affairs programmes, and has written extensively on a wide range of environmental topics. He was a Member of UK Round Table on Sustainable Development and Chair of its Transport sub-group, which was responsible for its influential report 'Defining a Sustainable Transport Sector' (1996). Charles sits on the Advisory Council of the Environmental Law Foundation, and on the Advisory Board of 'The Ecologist' magazine. He has recently joined the Board of the Carolina Environment Programme, at the University of North Carolina. He regularly speaks at public meetings organised by local environmental campaigners around the country, and enjoys working with community groups.

- Richard Wakeford

Has been Chief Executive of the Countryside Agency since its formation in April 1999, having been Chief Executive of the Countryside Commission from 1996. Prior to this he was in the Economic and Domestic Affairs Secretariat at the Cabinet

Office where he dealt with cross-departmental issues relating to economic and environmental affairs. Before that he was Head of Development Plans and Policies in the Department of the Environment, implementing the plan-led system and developing a range of planning policies. He edited the land use and transport chapters of the UK Sustainable Development Strategy, building on his earlier work on the team which prepared the country's first Environment White Paper 'This Common Inheritance'. As a citizen volunteer, he played a leading role in developing the London Borough of Richmond's LA21 strategy work.

- Graham Wynne

Is Chief Executive of the RSPB. He joined the RSPB in 1987, became Director of Conservation in 1989 and was appointed Chief Executive in 1998. He had previously spent 15 years as a town planner in London, principally concerned with inner city regeneration. Graham is a Council member of BirdLife International, a global partnership of conservation organisations, and chairs their policy committee. He is a member of the UK Biodiversity Steering Group and of the Green Globe Task Force, and was a member of the UK Round Table on Sustainable Development.

- Raymond Young

Is a board member of Forward Scotland; a member of the Scottish Advisory Task Force on the New Deal and Chair of the Environmental Task Force in Scotland. An architect by training, and, having worked with community based housing associations, for the Housing Corporation and Scottish Homes, he now runs a part time housing and regeneration consultancy from a sustainable straw bale office. He is an Honorary Senior Research Fellow at the Department of Urban Studies at the University of Glasgow, with particular interest in community regeneration and partnership. Raymond was awarded the OBE in 1989.