

**Scottish Energy Systems Group**

*Evaluating the  
the project:  
‘Transferring  
Integrated  
Modelling Systems  
to Energy Sector  
SMEs’*

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## Executive Summary

Eclipse Research Consultants have carried out a review of the operation of the project 'Transferring Integrated Modelling Systems to Energy Sector SMEs', which is run by the Scottish Energy Systems Group (SESG), part of the Energy Systems Research Unit of the University of Strathclyde. The project runs from 1 Jan 2002 to 31 Dec 2004. The main funders are Strathclyde European Partnership (an ERDF) and Scottish Enterprise, together with its industry club members. The Scottish Executive through the Scottish Energy Efficiency Office paid for Newsletter production. The Scottish Energy Environment Foundation contributed in return for access to SESG members, and the University of Strathclyde provides premises and non-chargeable academic staff time as their in kind contribution.

SESG is an industry club for SMEs. Its primary aim is to transfer advanced energy/environment modelling systems from academia into practice, but it has several secondary aims which include developing the competitiveness of the region's SMEs involved in the design of the built environment, facilitating two-way knowledge transfer between research and industry, investing in the Scottish knowledge-base, and enhancing the relationship between SMEs and higher education establishments. Through application of modelling systems, SESG offers the potential for improving the performance of the Scottish building stock by raising comfort levels, reducing fuel poverty, and lowering environmental impact including carbon dioxide emissions – leading to improved health, well-being and productivity for occupants and making buildings more environmentally sustainable.

The SESG is overseen by Professor Joe Clarke of the University of Strathclyde. There are four members staff – the Director, the Administrator and two technical staff members. Three more university staff also contribute on an ad hoc basis. At the time of the Review, the Director had recently accepted a post with the Scottish Office, and one of the two technical staff members had been appointed as the new Director. The Group enjoys attractive accommodation in the University's Department of Mechanical Engineering where it has a CPD suite complete with computers for training, a breakout area, a large meeting room and high quality staff offices. The Group's main activities are the formation of the club; a programme of seminars, workshops and training events; and 'supported technology deployments' in which a member of SESG staff spends 2-3 days in a member organisation's offices assisting on a live project using IT tools.

The Review was undertaken by means of a visit to the Group on 13-14 September 2004, which provided an opportunity for a formal presentation to be made by Professor Clarke, discussions to be held with the four SESG staff, the Group's documentation and publications to be inspected, and a round table focus group discussion to be conducted with four SME members of the club.

The Group has operated precisely in the way anticipated in the original funding bid and generally achieved its targets with a few minor shortfalls. 47 seminars, workshops and training events have been run, based around a programme of monthly themes, and which have attracted a total of 641 delegates (exceeding the original target of 30 events and 600 delegates). Feedback from the events collected by means of questionnaires is overwhelmingly positive. 30 organisations are members of the club, down from a one-time maximum of 35, and generating an income projected to be £40,000 (compared with a target income of £45,000). 125 'supported technology deployments' have been undertaken (compared with a target of 78) in 28 different organisations, all but three or four of which are SMEs. Computers and software on short-term licences have been lent to club members from a loan pool.

SESG has an attractive web-site and has emailed notification of its events to a mailing list reported to be over 500. Two copies of the newsletter, 'Hot News', have been published – these are glossy and attractively illustrated and contain a leading article, case studies reports of past events, membership news and contact details. 7 conference papers have been presented at major conferences - 4 at the International Building Performance Simulation Association (IBPSA) 2003 international conference and 3 at the joint CIBSE/ASHRAE 2003 conference. Significantly 6 of these had industry

practitioners as joint authors, reporting their practical experiences of using simulation modelling to industry and to the research community.

Discussion with the former SESG Director and the focus group with members of the network showed that the Group has been successful in creating jobs and placing graduate students into their companies. According to figures collated by the former Director, 26 jobs have been created (target 30) of which 11 are women (target 9) and 2 are from ethnic minorities (target 3). 18 are for people under 25 (target 15) and 25 relate to environmental activities (target 30). The focus group discussion confirmed that the additional expertise gained by the participants had led to them offering new services, winning new commissions and increasing their sales. They are also now investing more in R&D. Focus group participants confirmed that none of these advances would have been possible without the existence of SESG. Unfortunately, they said it was virtually impossible to estimate the investments made in acquiring the new capabilities or the impact on turnover with any accuracy, rendering comparisons with the original targets for increased investment and sales impractical.

From descriptions of the take up of simulation modelling provided by the new SESG Director and the focus group discussion, it is apparent that SESG has been highly successful in stimulating technology transfer from academia to practice – simulation tools developed in academia are now in regular use by just over half the members of the network. SESG also, as projected, facilitates knowledge transfer in the reverse direction - for example during ‘supported technology deployments’ when simulation tools are being used on live projects, issues that need to be addressed by the research community are identified and fed back to academia and to software vendors. The TCS scheme, the University’s Collaborative Training Accounts, and the Student Project Day at the University are also occasions when feedback from industry is gained.

SESG is having a positive impact on buildings in Scotland. Focus group members reported examples where simulation modelling was used to enable better exploitation of natural lighting, improved visualisation of sunlight and shading, and incorporation of renewable energy technologies. In a case study in one of the conference papers, an example is reported of capital cost savings of £150,000 and annual running cost savings worth £36,000 arising from successful diagnosis of an overheating problem in a large factory building. An estimate made by the former SESG Director indicates overall carbon dioxide emissions savings at 26,500 tonnes (target 24,000 tonnes) arising from SESG’s activities.

The focus group members reported that in their view SESG was contributing to economic development and promoting R&D arising from increased demand for innovative products such as smart controls and advanced coatings. They believe that the greater accuracy of simulation modelling over conventional estimation methods helps to reduce over-design and also encourages take up of products like smart glass because the benefits can be more accurately assessed. Take up of renewable energy technologies has been encouraged through SESG seminars and the staff have also been involved in events promoting renewables organised by other organisations. Professor Clarke is negotiating with a number of product manufacturers and intends to work with them more closely to develop ways for simulating product performance.

Finally, as projected, SESG has successfully participated in strategic alliances with international organisations. It acts as the Scottish representative body on IBPSA, and as the Scottish facilitator for REASURE concerned with promoting renewable energy technologies. Professor Clarke participated in the EU network ENERBUILD, and the former Director is a member of the European network USOBUILD. SESG encouraged companies to participate in the EU Sixth Framework, though none of the bids was successful. The former SESG Director is the chair of CIBSE Scotland, and the Group has collaborated with the Scottish Energy Environment Foundation. Continuing Professional Development events have been run with the Scottish Environmental Design Association and with GAIA Architects. The Group also participates in an EPSRC-funded network concerned with comfort in buildings.

## **1 Overview**

Eclipse Research Consultants were asked to review and evaluate the operation of the project 'Transferring Integrated Modelling Systems to Energy Sector SMEs'. The project is run by the Scottish Energy Systems Group (SESG), part of the Energy Systems Research Unit of the University of Strathclyde. SESG is an industry club for SMEs, whose overall aim has been to transfer advanced energy/environment modelling systems from academia into practice. The current phase of the SESG commenced on 1 Jan 2002 and is scheduled to run for three years, concluding on 31 Dec 2004.

## **2 Suitability of Eclipse Research Consultants**

Eclipse Research Consultants is a small consultancy based in Cambridge which specialises in research management and impact assessment of research initiatives, particularly in the built environment. Eclipse was responsible for monitoring the operation of the Energy Design Advisory Service when it was offered by the Royal Incorporation of Architects in Scotland and the University of Strathclyde between 1987 and 1989 with funding from the UK Energy Efficiency Office. When, subsequently, that service was managed by the Energy Technology Support Unit between 1989 and 1992 as a pilot for a UK-wide scheme, they again monitored its operation and reported on its potential roll-out. Consequently, the Energy Design Advice Scheme was supported by the DTI between 1992 and 1998, and the University of Strathclyde operated as one of four regional centres offering design advice to building design teams and their clients. Eclipse were again invited to monitor the scheme for the whole of that period. A major change occurred in 1998 when the scheme was re-branded as Design Advice, and its operation transferred away from the regional centres to BRE (the former Building Research Establishment) and later to the Epsom-based consultants W S Atkins. However, in 2004, BRE was commissioned by the Carbon Trust to review Design Advice and invited Eclipse to contribute to the review. At the time of writing, BRE is in the process of preparing support materials for an updated Design Advice scheme and again Eclipse is part of the scoping study team.

## **3 Background, aims and operation of SESG**

### **3.1.1 Background**

SESG has a considerable history. The University is itself strong in the development of computational methods and graphic software interfaces. The ESP simulation programme was initially developed in the ABACUS Unit within the Department of Architecture primarily using EPSRC funding. Subsequently the emerging software was promoted through the Energy Design Advisory Service (EDAS), the joint initiative of the Royal Incorporation of Architects in Scotland and the University of Strathclyde, funded by the Energy Efficiency Office between 1987 and 1989. Consequently Professor Clarke and his colleague Professor Maver were jointly awarded the 1989 Royal Society Esso Energy Award, an annual award for outstanding contributions to the advancement of science, engineering or technology leading to the more efficient use or conservation of energy resources. EDAS went on to be operated in Scotland as a regional pilot for a national energy design advice scheme with funding from the Energy Technology Support Unit of the Department of Energy between 1989 and 1992. When the Scheme was supported UK-wide from 1992, the University of Strathclyde and RIAS became (jointly) one of four regional centres (the others were in London, Sheffield and Belfast.) operating under the Energy Efficiency Best Practice programme. The regional basis of EDAS was changed in 1998 and it was operated centrally by BRE, with the four regional centres ceasing to operate. At this point, SESG was formed within the Energy Systems Research Unit, with the aim of embedding energy modelling systems within construction organisations. A pilot programme for the Group ran successfully for two years, ending in November 2001, during which time it is reported to have provided a clear understanding of the potential outcomes and benefits.

### **3.1.2 Funding and management of the present phase of operation**

The present phase of SESG runs from 1 Jan 2002 to 31 December 2004 and follows a successful bid to the European Regional Development Fund under the Western Scotland Objective 2 2000-2006 Programme. Strathclyde European Partnership (an ERDF) and Scottish Enterprise are the main funders, with their grant matched by member subscriptions. The Scottish Executive through the Scottish Energy Efficiency Office have supported SESG by paying for Newsletter production. The Scottish Energy Environment Foundation contributed funds in return for access to SESG members. The University of Strathclyde contributed in kind by providing premises and non-chargeable academic staff time.

SESG is run by the University of Strathclyde and operates from the Faculty of Engineering's Department of Mechanical Engineering on the 3<sup>rd</sup> Floor of the James Weir Building in Montrose Street. It is overseen by Professor Joe Clarke. There are four full time members of staff: - the Director, Lori McElroy; the Administrator, Kathleen Whyte; plus two technical specialists Dr Jon Hand and Dr Iain Macdonald. There are also three members of the academic teaching staff who contribute to the operation.

At the time of writing (early September 2004) Lori McElroy had recently accepted an appointment at the Architectural Policy Unit of the Scottish Office, and Iain Macdonald had been appointed as her replacement. For clarity, in this report Lori McElroy is referred to as 'the former SESG Director' and Ian Macdonald as 'the new SESG Director'.

SESG appears to be well provided for by the university with high quality accommodation. It has a CPD suite, a breakout area, a large meeting room containing a technical library, and high quality staff offices. The whole floor has been recently refurbished to a high standard and presents an attractive environment for visitors. IT facilities seem to be excellent, staff have recent computers and, for training purposes, there is a suite of computers available which are reported as being appropriate to the needs of the group. There is also a loan pool of laptop computers and software lent to member organisations from time to time to enable them to explore new tools for a trial period without having to make a large investment in software that may not suit their specific needs. Temporary licence agreements have been negotiated with software vendors to enable this to happen.

### **3.1.3 Aims and objectives**

SESG seeks to develop the competitiveness of the region's SMEs involved in the design of the built environment by providing an advice and support service for them. Its key objectives are to:

- raise the capacity of architects and engineers to compete effectively through improved business processes, specifically through up-skilling, embedding of innovative IT-based design tools in SMEs and through greater innovation, research and development
- increase awareness of environmentally sustainable building design practices, promote the implementation of sustainable processes and products in the built environment, and improve the building stock by raising comfort levels, reducing fuel poverty, and lowering its environmental impact including carbon dioxide emissions
- enhance the relationship between SMEs and higher education establishments, and facilitate knowledge transfer from research to practice.

### **3.1.4 Operation of SESG**

In terms of its operation, the SESG has a number of functions but the main ones are:

- The formation of a business network of small and medium enterprises
- Organising business network events for small and medium sized enterprises – these are typically held within the University of Strathclyde
- Offering 'Supported Technology Deployments' – these vary in their scope but typically involve a skilled member of SESG staff visiting a member organisation taking an appropriate software tool relevant to the members needs and assisting them to explore its potential on a live project.

- Operating the computer loan pool enabling members of the network to investigate new tools and techniques.

SESG has a number of well-articulated aims, but the key one is to transfer into practice advanced energy and environmental modelling systems, particularly those developed by the academic community. In so doing, it is investing in the Scottish knowledge base, enhancing the services of its member organisations, raising their productivity and providing them with a means to address the complete issues underlying the design and operation of a sustainable built environment. It does this by giving possible users the opportunity to experiment and evaluate the suitability and potential of various simulation tools to meet their needs. Compared with earlier phases of EDAS where consultancy advice was given to enquirers, the current phase invites or challenges consultants themselves to take up these advanced tools so they may discover for themselves their potential. The Group coined the slogan for integrated modelling of ‘cheaper - better - quicker’. The Group also took a decision that it would not seek to impose a particular way of working on the consultants it was supporting, but instead aid them in their own chosen way of working and decision processes, dovetailing the service offered to their individual needs. It does this through ‘supported technology deployments’.

‘Supported technology deployments’ involve one of the SESG staff visiting the consultant’s office with a laptop and appropriate software over a period of two or three days and supporting the consultant by demonstrating the software and assisting the consultant to use it to undertake simulations of building performance, such as daylight factor calculations, computational fluid dynamic analyses, or heat and cooling calculations. At best: the simulation software is taken up by consultants leading to improved service to their clients, raising their capabilities and expertise and increasing their competitiveness, while the buildings they design are more energy efficient (and may incorporate renewable energy technologies) leading to running cost savings and improved comfort, health and well-being for occupants.

Besides the ‘supported technology deployments, there are two other main forms of support to businesses. First, a programme of regular seminars and workshops that deal with energy, climate and sustainability issues, as well as developments in energy efficiency technologies, and forthcoming regulations and directives. Second, workshops and training sessions that take place generally in the IT suite in the University provide hands-on introductions to modelling systems and new software tools; these are offered by both SESG staff and by commercial software organisations. A plan for events was devised early on in the life of SESG which set out monthly themes – such as climate change, daylight in buildings and so on – which typically the seminars and workshops address.

## 4 Aims and conduct of this review

This review evaluates the extent to which the project is achieving the various planned activities and outcomes that were set out in the original project proposal:

- the establishment and maintenance of the industry network club, including its size, composition, membership and growth rate;
- the services provided by SESG to the industry network club, such as the delivery of new information services; the training of staff in emerging technology and life cycle assessment; the support for software applications on live projects (e.g. for the design of buildings incorporating clear micro power systems);
- the effectiveness with which the integrated modelling approach has been transferred to the members of the network club;
- the internal working practices of the member organisations.

It considers the wide impacts of the SESG on outcomes:

- disseminating new knowledge, processes and technologies and facilitating the two-way transfer of knowledge between research institutions and industry;

- the effectiveness of the placement scheme for graduates possessing modelling skills
- the number and type of new jobs created, including the encouragement of a more balanced labour force in engineering through the employment of engineers who are women or from ethnic minorities or differently-abled, and through the promotion of 'softer' engineering practices;
- the benefits within Scotland from reduced energy and environmental impact, improved indoor/outdoor air quality, human comfort and health, and use of local resources, all potentially arising from more informed decision making including explicit appraisal of many options at the design stage;
- the effect on economic development, particularly arising from enhancing the capacity of SMEs through raising their R&D capabilities, enabling them to offer an integrated performance assessment service, and encouraging supply chain development;
- spin-off job creation brought about by the increased demand for innovative products, such as renewable energy technologies, advanced coatings, and smart controls for building services;
- the stimulation of enhanced R&D with the design and construction sector;
- raising awareness in Scotland of environmentally sustainable (clean) processes and products within and beyond the construction sector.

It considers strategic alliances that SESG has established with those involved in related EU networks, such as ENERBUILD, and the impact on Scottish industry's participation in the EC's 6<sup>th</sup> Framework Programme, all as envisaged in the original proposal.

The review also compares the actual outputs of the project against the levels forecast by considering:

- the number of new and existing SME's engaged in the project (target - 35 SMEs engaged);
- the number and impact of business network events (target - 30 major events, 20 SMEs per event);
- the number of instances of advice provided (target - 48 Supported Technology Deployments);
- the extent of sales of new software (target - £550,000 in sales);
- the savings in carbon dioxide emissions (target 24,000 tonnes per annum).

The review was undertaken by means of a two-day visit to SESG by Sebastian Macmillan to the SESG on 13-14 September 2004. The two days comprised:

- a presentation from Professor Joe Clarke about the SESG and its operation
- inspection of the SESG documentation
- detailed discussions with the four SESG staff – Lori McElroy, Iain Macdonald, Jon Hand, Kathleen White, and informal discussions with Professor Clarke
- a focus group discussion with organisations that are members of the business network and have received 'supported technology deployments'

Additional documentation was requested at this meeting to enable the evaluation to be completed, and this was provided subsequent to the visit.

## 5 Findings of the review

### ***5.1 Membership of the SME business network club and income generated***

At the time of the review (mid-September 2004) 30 organisations were subscribers to SESG: 14 consulting engineers, 6 architectural practices, 3 computer simulation companies, 3 local authorities, 2 universities, 1 utility and 1 housing association. 23 of these are SMEs with fewer than 250 employees including some very small organisations with fewer than 10 employees. We understand from the former SESG Director that membership rose quickly at the start of the project to the mid-30s, then reduced to the mid-20s, finally stabilising at the current level of 30 members. The target number from the original case for support was 35 SMEs to be signed up during the three years of operation, so it can be argued that the target was achieved although current membership is below target (unless further organisations join in the last three months of operation).



Each member organisation is expected to pay a subscription of £500 per year for membership. Income from membership is reported in the quarterly Grant Claim and Progress Report Form, and by the tenth quarter (to 30 June 2004) it totalled £32,000. We understand from the Administrator that a further batch of invoices is due to be sent out in October 2004, worth £8,000. If each and every one of these is settled, total income generated will equal £40,000. This will represent a shortfall of £5,000 on the original target of £45,000, or about 10%.

In addition to the paying members, SESG operates a mailing list of about 500 individuals. These are kept informed of the operation of SESG via email invitations to the network events and copies of the newsletter Hotnews. From descriptions given verbally by former the Director, we understand that SESG is not rigid in supporting only those who have paid their membership fees, but opens its events to non-members and is willing to offer them 'supported technology deployments'.

## **5.2 Business network events – seminars, workshops and training events**

SESG adopted a series of monthly themes for the period between June 2002 and December 2004. An Event Planner showing the monthly themes and the dates of events was printed onto mouse-mats and distributed widely. With the exception of quiet periods in mid-winter and mid-summer, SESG ran monthly network events (seminars or workshops) based around each theme. Some months there were two events. SESG also offered monthly training courses, typically but not always, relating to the monthly theme. About twenty themes were identified as follows:

- *energy efficiency, indoor air quality, design integration, building regulations, lighting systems, life cycle assessment, renewable energy systems, fire engineering, climate change, sustainable cities, small scale renewables, HVAC and controls, electrical services, outdoor air quality, acoustics, value engineering, international developments.*

Some themes appeared more than once in the programme.

SESG set a target to run 30 major events during the three years of operation, and attracting 20 delegates to each event (totalling 600 delegates). SESG has kept records of the numbers of delegates attending its events and a summary table prepared by the Group is included in Appendix 1. This table shows that at the time of writing (September 2004):

- 21 SESG seminars had been run, attended by a total of 311 delegates, and the Group has also supported a joint seminar with the Scottish Energy and Environment Foundation dealing with the Building Regulations which attracted 100 delegates in May 2004, giving a total number of seminar delegates of 411, and at an average of 19 delegates per event;
- 6 Workshops had been run, attended by a total of 46 delegates, and with an average of 8 delegates per workshop;
- 19 Training courses had been run on various software packages, including ESP-r, TAS, FLUENT, Cymap, Radiance, MERIT, Envest, Eco-tect and TRANSYS. These had attracted 184 delegates, at an average of 10 delegates per course. The trainers include SESG staff as well as representatives from software suppliers. SESG staff report that initially it was more junior staff who attended training sessions, but more recently managers have come in order to see the functional capability of the tools available.

[Note that sometimes a seminar and a training course were held on the same day, with one following the other and with the same delegates attending both. This could also apply to a workshop and a training course. For consistency we have followed SESG's record keeping and treated them as separate events although, arguably, this treatment results in slight double-counting of the numbers of delegates.]

SESG has records of the organisations attending the events which show that the delegates represented variously private engineering and architectural consultancies together with local authorities, housing associations, electricity and gas utilities, universities, governmental organisations and research institutes. The majority of delegates appear to be from organisations with fewer than 250 employees and are therefore classified as SMEs according to the usual European definition.

Feedback questionnaires were issued at all the events, although the response rate was, we understand, relatively low. We have looked at but not analysed the completed feedback questionnaires, but Appendix 1 summarises them. Feedback is overwhelmingly positive and there are many examples of complimentary comments. Events are described as well-structured, well-presented, relevant, useful, informative, insightful, and enjoyable. A few delegates suggested additional topic areas they would like to have seen covered or recommended an additional day of training. As a result of running these events for practitioners, SESG has discovered that some topics (such as current and forthcoming legislation) are of greater interest than others, and also that there is a limit on the frequency with which practitioners will attend events; they are unwilling to attend meetings weekly. 5 Workshops and 6 Training courses had to be cancelled or postponed because of lack of delegates, leading to a review of the programme of events.

In addition to running their own events, and joint events with organisations with complementary interests, we understand that members of the team offer presentations at others events. However, we have been given no details of these.

By mid-September 2004 SESG had run or been involved directly in 47 events which had attracted a total of 641 delegates at an average of 14 per event. Compared with the original target of 30 events each attracting 20 delegates, SESG has comfortably exceeded its target. for the total number of delegates attracted, and still has three months to run in its current phase The events themselves focused on topics set out in a planned programme of events, with seminars addressing topics ranging across energy efficiency and heating & ventilating systems through to climate change and sustainable cities. Training has been offered on various software packages concerned with, for example, heat flows, lighting, and computational fluid dynamics, and has been given by both SESG staff and software vendors. Delegates are widely drawn not only from SMEs, but also from local authorities, utilities, government and the universities. Feedback from delegates has been overwhelmingly positive.

### **5.3 *Advice/consultancy support to SMEs: ‘Supported Technology Deployments’***

Supported Technology Deployments arise when a company that has received training on a software package then wishes to apply the model in practice on a live project. One of the SESG staff is deployed into the organisation for 2-3 days, complete with a laptop computer and an appropriate licence agreement in order to help the company up the learning curve of applying the software on the project as well, more generally, as encouraging the company to see how to exploit it fully on other appropriate projects. They help to ensure that modelling does not inhibit the design process. They also help to document success and failures and capture the learning.

A list of supported technology deployments provided to us by SESG is included at Appendix 2. It lists a total of 125 STDs undertaken up to the end of June 2004 (with two further quarters until the end of the project. According to this list, 28 different organisations have received technology deployments. All but three or four, such as Glasgow City Council and the Scottish Executive, appear to be SMEs. The number undertaken substantially exceeds the original approved target of 78 instances of advice to new and existing businesses - by more than 50%.

From discussions with SESG staff we understand that the topics covered by STDs include the following:

- *radiance – glare assessment, daylight factor calculations, wind flows around buildings, fume dispersal around buildings, thermal bridging and mould growth, heating and cooling systems, thermal comfort, computational fluid dynamic assessment internally and externally, renewable energy, modelling of photo-voltaic façade.*

In addition to delivering benefits to the companies receiving support, we have been told by SESG staff that supported technology deployments lead to valuable feedback to vendors concerning issues that arise when their software applications are used in practice by the specialist SESG staff with their broad experience of various software packages.

## **5.4 SESG dissemination activities**

### **5.4.1 Newsletter**

SESG has issued six newsletters since its inception in early 1999, of which 2 were issued during the current phase. Printed on glossy paper, in full colour and well illustrated, the newsletters cover six sides. Each contains a What's New section, a leading article, case studies, reports of past seminars, workshops and training events, membership news, and a factual page with contact details and forthcoming events.

We understand from the Administrator that these are sent out to individuals in the mailing list of which there are up to 500.

With its high production values, and attractive and professional appearance, the Newsletter appears to be an excellent way of keeping members, and others to whom it is distributed, informed that SESG continues to operate. However, there appears to have been no newsletter in 2002, nor any in 2004. It would benefit, therefore, from being published on a more regular basis.

### **5.4.2 Website**

As with the newsletter, SESG has an attractive and informative web-site. This provides an overview of the Group and its activities, the programme of events, links to web sites of organisations offering various software packages, descriptions of the various services and university facilities available, as well as acknowledgements to the funding bodies, and contact details.

### **5.4.3 Email notification of events**

The SESG Administrator maintains a list of email addresses of about 500 parties who may be interested in its work, and she sends out regular emails to everyone on the list notifying them of the programme of events and forthcoming seminars, workshops and training events.

### **5.4.4 Conference Papers**

Eight published papers were given to me as part of the Review. Four were published prior to the present phase of SESG. Typically these earlier papers set out the potential for simulation and offer some general observations about procedures, quality assurance, and risk.

|         |  |
|---------|--|
| Paper 1 | Hand, J., Clarke, J. and Strachan, P., 'Deployment of simulation within design practice' <i>Proceedings of the Sixth International IBPSA Conference</i> , Kyoto, 1999, pp 241-247  |
| Paper 2 | McElroy, L. and Clarke, J., 'Embedding simulation with energy sector businesses' <i>Proceedings of the Sixth International IBPSA Conference</i> , Kyoto, 1999, pp 262-268  |
| Paper 3 | Morbiter, C., Strachan, P., Webster, J., Spires, B. and Cafferty, D., 'Integration of building simulation into the design process of an architectural practice', <i>Proceedings of the Seventh International IBPSA Conference</i> , Rio de Janeiro, Brazil, August 2001, pp 697-704. |

Paper 4            McElroy, L., Clarke, J., Hand, J. and Macdonald, I., Delivering simulation to the profession: the next stage?' *Proceedings of the Seventh International IBPSA Conference*, Rio de Janeiro, Brazil, August 2001, pp 831-836.

Four more were published in 2003 during the current phase, all at the IBPSA 2003 Conference:

Paper 5            Hobbs, D., Mortitzer, C., Spires, B., Strachan, P. and Webster, J., 'Experience of using simulation within the design process of an architectural practice', *Proceedings of the Eighth International IBPSA Conference*, The Netherlands, August 2003, pp 491-498

Paper 6            McDougall, S., & Hand, J. 'Using simulation to move daylighting issues to first use of the new UK carbon emissions calculation method', *Proceedings of the Eighth International IBPSA Conference*, The Netherlands, August 2003, pp 839-846

Paper 7            McElroy, L., Elrick, B., Grant, R., Telfer S. and Elliot, G., 'Simulation as an enabling technology for cooperative working', *Proceedings of the Eighth International IBPSA Conference*, The Netherlands, August 2003, pp 847-854

Paper 8            Tamburrini, M., Palmer D. and Macdonald I., 'Calibrating models for simulation use in design practices', *Proceedings of the Eighth International IBPSA Conference*, The Netherlands, August 2003, pp 1273-1278

Papers 3, 5, 6, 7 and 8 include practitioners as joint authors. Often reporting by academics, for whom papers at refereed conferences and international journals is one of the key measures by which they are assessed, deliberately excludes practitioners as authors. Here by contrast practitioners appear to be actively engaged in reporting their experiences to the conference. Papers 5, 6, 7 and 8 present examples of the use of simulation in practice from a practitioner perspective, and cite the experience gained in particular building projects, in contrast to the earlier papers which are more general in scope.

In addition to these papers at international conferences focusing on simulation, 4 papers about SESG were presented at the 2003 annual conference held jointly between CIBSE and ASHRAE. Professor Clarke chaired a session at the conference devoted to Building Simulation and gave a keynote address entitled: Putting Theory into Practice, while the other three papers were:

Paper 9            McElroy, Lori, 'Using Simulation to meet new Building Performance Legislation Requirements'

Paper 10           Spires, Brian, (Building Services Director, HLM Design, UK) 'The Use of Simulation within an Architectural Practice'

Paper 11           Palmer, David (Director, The Campbell Palmer Partnership Ltd, UK) 'Quality Assurance of Simulation in an Engineering Practice'

Overall, dissemination of SESG's operation, its events programme, and its achievements appears to be excellent. Through its newsletter and its conference presentations it has reported back to the international building simulation research community and also reached out to practitioners. Both types of dissemination are valuable. Reporting back to the building simulation research community provides feedback to the developers of software about the use of their products in practice. Reporting to practitioners at industry conferences, by contrast, is valuable as a means to illustrate to potential new users some of the practical issues that arise as well as the anticipated benefits. Though in many ways exemplary, a further opportunity for dissemination to practitioners would be to seek to obtain coverage in the professional and technical press, such as *Building Services Journal* and *Building* magazine.

## **5.5 Knowledge transfer between research and industry**

### **5.5.1 Technology transfer to industry – the adoption of integrated modelling software**

A discussion with the new SESG Director about the adoption of simulation software demonstrated that the Group has good knowledge of the capabilities of its member organisations. According to the information provided verbally, 15 of the member firms are using ESP-r, 5 are using IES software, 5 are using Radiance, 4 using Cymap, 3 using Hevacomp, 1 is using Fluent and 1 TAS.

Member organisations are reported as varying in the extent to which they exploit these new technologies. At one extreme, some are considered to have attended workshops and training courses primarily to learn about the latest developments and keep up with the current state of the art. At the other extreme, three of the member organisations have been so enthused by the new ways of working and new design tools that they have used the TCS scheme to undertake joint industry-academic research into computer simulation working with the University of Strathclyde, and subsequently employed the research assistant to embed the new techniques within their organisation and offer them commercially. (This is described further below as part of the report on the focus group discussion.) Of the 15 member organisations which are using ESP-r, about 6 are thought to use it regularly and routinely on projects.

In the original proposal, a target was set for sales of new software of £550,000. It has not been possible to verify to what extent this target has been achieved. It is in any case made complicated by the fact that during the funding period, ESP-r came to be offered as ‘open source code’ and thus available to users at no cost.

In reviewing the effectiveness with which the integrated modelling approach has been transferred to the members of the network club, we can report then that SESG has been successful in encouraging the take-up in practice of new computer based simulation tools for assessing building performance. Most positively, three engineering consultancies have used the TCS scheme and support from SESG to embed the new tools into their working practices. The majority of members have adopted the new technologies to a greater or lesser extent, while the remaining handful attend workshops and training largely in order to keep up with the state of the art. (rather than actively using these tools in practice). It has not, however, been possible to calculate the sales of software arising from the take up of these new tools.

### **5.5.2 Two-way transfer of knowledge between research institutions and industry.**

The original application refers to the ability of SESG to facilitate the two-way transfer of knowledge between research institutions and industry. When asked how this was achieved in practice, the SESG Director drew attention to the close contact between the SESG and the Collaborative Training Accounts system (formerly Masters Training Package programme) operated by the Engineering and Physical Sciences Research Council. The University of Strathclyde’s Engineering Department receives funding for 9 Masters courses under the CTA, and one of the key CTA objectives is to promote better links between industry and academia. Each May, the University arranges a Student Project Day to which 700 organisations are invited and between 100 and 150 actually attend. The aim of the day is partly to showcase university R&D but also to obtain feedback from industry about the relevance and appropriateness of current research efforts.

## **5.6 Job creation and student placement**

In the original case for support, SESG was anticipated to contribute to the placement of graduates possessing modelling skills, and to encourage a more balanced labour force in engineering including the employment of engineers who are women and/or from ethnic minorities and/or differently-abled. The target was to create 30 new jobs.

The Department of the University which houses SESG offers 9 Masters courses of which three are relevant to SESG:

- Energy Systems and Environment – with 20-30 students

- Sustainable Development of the Urban Environment – with 5 students
- Integrated Building Design – with 10 students

According to the former SESG Director, students on these courses arrive with a mixed range of backgrounds and the courses themselves introduce them to a range of tools, including ESP, IES software, and TAS. As a result of their education and training, those with interest and aptitude acquire skills in simulation modelling which make them highly sought after. She has good knowledge of where Masters students from the University are employed after graduation. Through her regular contact with the network member organisations and more generally from her contact with employers through her role as Chair of CIBSE Scotland, the former SESG Director is able to keep abreast of their employment needs and recruitment, and keeps notes about employment and job creation. Every quarter, she transfers her knowledge of these to the SESG quarterly Grant Claim and Progress Report forms that are submitted to the main funding organisation. According to these quarterly records, by the end of June 2004, 26 jobs had been created (target 30). Of these were 11 for women (target 9) and 2 for ethnic minorities (target 3); 18 were for people under 25 (target 15); and 25 relate to environmental activity (target 30). About 20 have modelling skills. These figures illustrate that the SESG has been extremely successful in creating employment and placing Masters level students, although strictly (at the time of writing) it has under-shot its overall target by about 10%. The high number of women placed mean that SESG can claim to have contributed – as anticipated – to a more balanced labour force in engineering.

### **5.7 Working practices of members – results of a focus group discussion**

A focus group was arranged for 14 September. It was attended by:

- Neil Phillips, Development Officer, The Wise Group – Strathclyde and Central Energy Efficiency Advice Centres
- Stephen McKinley, Regional Director, Hulley and Kirkwood Consulting Engineers (140 employees in UK, including 80 in Scotland)
- Owen McNee, Associate, RSP Consulting Engineers (45 employees in two Scottish offices)
- Dr Christoph Morbitzer, Building Simulation Leader, HLM Architects (120 employees in UK, including 20 in Scotland)

#### **5.7.1 Job creation and placement**

Stephen McKinley of Hulley and Kirkwood explained that their firm had used the TCS scheme to work with two graduates (TCS associates) through the scheme. One associate had been engaged in a project concerned with standards of service to clients, the other with the place of simulation in practice, including quality assurance issues. Both TCS Associates has subsequently been employed full time by the company. Both were male and under 25.

Christoph Morbitzer explained that HLM Architects too had used the TCS scheme to work with two TCS Associates – one on the use of simulation in practice, the other on sustainability issues. Both Associates had gained PhDs and both been subsequently taken on by the company. Both were young and male.

Neil Phillips reported that he had been involved in the delivery of Masters training at the University and confirmed that 3 of his post-graduate students (including 2 women) had gone on to gain employment in firms offering simulation.

Owen McNee said that his firm, RSP Consulting Engineers had had some involvement in the TCS scheme.

All four participants confirmed that in their experience SESG was creating jobs and assisting in the placement of graduates with simulation skills.

While this is anecdotal evidence from a limited number of member organisations, it supports the claims made by the SESG Director about the achievements of SESG in terms of job creation and the placement of graduates skilled in simulation.

### **5.7.2 Additional sales by member companies**

The four participants were asked about the contribution to increased sales brought about by up-skilling. Again all four confirmed that in their view, the additional expertise and the new services they were able to offer that were gained as a result of engagement with SESG had led to additional sales. Stephen McKinley said that new work had definitely been generated and they were now selling an enhanced service in mechanical and electrical consultancy. Christoph Morbitzer said HLM Architects were definitely expanding their services particularly in the area of sustainability, where he believed they were now better able to talk the same language as building services engineers with whom they work. In turn this was reported as leading to a more collaborative design approach – which was also appreciated by clients. Raised expertise in sustainability issues was reported to be helping them to win commissions and helping clients to secure project funding, particular where sustainability was an important aspect. Owen McNee reported similarly that, after an evaluation of IES software, many in the firm had now been trained in its use and the firm is now offering it as part of their range of services. Relatedly, they have recruited an engineer with skills in energy management which has further enhanced their skill base. Neil Phillips said his interests were currently in using simulation modelling to evaluate renewable energy technologies to raise confidence in their potential so as to justify grant awards more easily.

Unfortunately none of the four organisations was able to estimate the extent of their increased sales, but these members of SESG report that by working with SESG they have developed new areas of expertise and, in consequence, won new business. Again this is very much in line with the expectations set out in the original SESG bid.

### **5.7.3 Increased investment in innovation and R&D**

Christoph Morbitzer reported that engagement within SESG has stimulated greater interest in R&D within HLM Architects, and that the company perceives itself to be at the forefront of new technology. They are involved in PFI projects where simulation expertise had helped to win the commission. Stephen McKinley reported that Hulley and Kirkwood wanted to build simulation modelling into the company and use it to look for new business opportunities. He offered an example of 5 PFI secondary schools in which they had been involved at the early stages and were able to use their simulation expertise to assess the possibilities for natural ventilation in deep classrooms. Owen McNee reported that simulation expertise enabled the company to give more scientific estimates of future energy use compared with traditional rules of thumb. Simulation, however, was only as good as the input information and in terms of whole life costing there is a need for a better database of information – while the expected lifetimes of mechanical and electrical services were relatively well understood, there was uncertainty about other building elements; academics needed to be involved in contributing to this database.

### **5.7.4 Benefits in Scotland from better designed buildings**

The original proposal made the claim that there would be benefits to the Scottish building stock from reduced energy and environmental impact of buildings, improved air quality and better comfort, well-being and health.

Stephen McKinley said that in his opinion visualisation software was valuable for marketing new buildings to clients and for making presentations that convinced planners. Refurbishment and renovations also benefited from modelling. He gave an example of a 21 storey building where his firm was working with a developer, and where computer modelling of sunlight and shadows was valuable to ensure that the expected quality of light was retained in the development and to convince the planners. Simulation is being spread to each of the firm's 9 UK offices. Christoph Morbitzer also agreed with the original proposition that there were benefits to architecture, occupant comfort, and energy and environmental issues from using simulation, which was as valuable to architects as it was

to engineers. He reported that in HLM Architects, 3 or 4 architects were keen on environmental design and sustainability, and that knowledge of the importance of these issues was spreading throughout the firm from the Glasgow office to the other three offices (one in Sheffield, two in London). During the period when he had been a TCS Associate, one of the firms Directors had become interested in sustainability issues, and he now had an appointment to attend a Directors meeting and to report to the Chairman about sustainability and the enhanced services they could offer. Owen McNee reported that his firm had been using the thermal calculation tool Hevacomp, but working with SESG had enabled them to review various more advanced simulation tools as a result of which they had decided to become users of IES software. The firm found that simulation was a selling tool – making it possible to show clients what they were going to get and helping them to understand the building better, for example through the visual impact of daylight. By giving the design team new insights, computer modelling could on occasion give even the design team a surprise, and again this was a benefit. While initially they had been extremely cautious, the firm now uses computer modelling more often than not, and had introduced a policy in both their Glasgow and Edinburgh offices to use simulation where appropriate.

### **5.7.5 Stimulus to increased demand for innovative products**

The focus group moved on to discuss whether take-up of simulation modelling, though its ability to increase the accuracy with which building performance could be predicted, would increase demand for innovative products, such as advanced glazing materials, smart controls and renewable energy technologies. Owen McNee said that in his view demand for such advanced products arose from enlightened clients who wanted their buildings to be green. Stephen McKinley, however, said that he thought modelling would increase this demand and offered as an example high specification glass – through simulation it was possible to assess the benefits more accurately which would raise demand. Also, while as consulting engineers his firm was mostly concerned with mechanical services in buildings, simulation provided the opportunity to understand better the contribution to building performance of the building fabric. Christoph Morbitzer reported that he had used modelling to explore the potential for using sun-pipes and, although they had not proved feasible in the particular case, it was his belief that generally simulation was leading to better integration of new technologies into buildings. Stephen McKinley said he too had become interested in the potential of sun-pipes to increase the perception of daylight in hospital wards.

Owen McKinley reported that they now had a discussion group within the firm on renewable energy technologies and are involved with manufacturers – simulation was valuable for it increased the accuracy with which the benefits could be assessed. He said that typically the firm would over-design in order to build in a margin of safety, but this margin could be reduced when using simulation since the results were more accurate. He reminded the focus group that use of simulation modelling of performance gains credits in BREEAM assessments.

### **5.7.6 Other issues discussed in the focus group**

The participants were asked whether they had publicised their interest in simulation modelling. Owen McNee said their publicity had been internal, but it had been promoted to their clients through their company newsletter and fliers sent to clients. Stephen McKinley said his firm had done the same, and building simulation was also listed in their company website. None of the focus group participants had made any significant attempt to promote simulation through the professional or technical press.

All the participants confirmed they had invested in simulation modelling and gained resulting benefits. They also said that they could not have done what they had done without the support of the SESG, nor could they do what they planned to do without it. Stephen McKinley said that developers were approaching them as engineers to use simulation to explore site layouts, plot sizes, building massing, and glazing, rather than going to architects, since architects did not have the ability to do simulation-based analyses.

Owen McNee said his firm had realised that if it was to retain its big clients it had to stay ahead of the game, and offering simulation modelling was one of the ways of doing so.



While we have consulted only a sample of the members of the business network, the evidence collected through the focus group indicates that the integrated modelling approach is being effectively transferred to members of the business network, that some are now offering an integrated performance assessment service and have invested in R&D. All these developments are as projected in the original bid for funding by SESG, and they illustrate that it is successfully changing the landscape of building design in the way that was forecast.

In addition to the focus group, we have been given copies of three letters prepared in support of the forthcoming proposal to continue the SESG beyond the current phase of funding. These are from Rybka, Campbell Palmer Partnership and Hulley & Kirkwood. All three letters are highly positive about the contribution that SESG has made to their ability to offer dynamic building simulation, and about the benefits to them as organisations from SESG support as well as the benefits for their clients and the gains to the buildings they advise on. One cites as an example, a 20,000 sqm development in Edinburgh where SESG's assistance enabled them to achieve the best results in terms of lighting and thermal zoning. Another draws attention to the forthcoming European Buildings Directive and the challenges it will pose to the design of buildings as an example of the climate of innovation to which they will have to respond by developing new expertise. The continuation of SESG is seen as highly valuable and relevant to each of them.

### **5.8 Economic development, R&D and supply chain improvements**

According to the former SESG Director, when SESG started, few of the organisations in the business network had any member of staff responsible for simulation modelling. Today, she reports that several organisations – Rybka, Enconsult, Campbell Palmer Partnership, RSP, and Buro Happold – do have one or more such staff members and are offering an integrated performance assessment service. She gave as an example Rybka where lighting and acoustics engineers were brought together by a design team meeting and were able to discuss and negotiate options based on performance assessments using simulation modelling. She also noted that some firms had won work that they would have been unable to before, and this was confirmed in the focus group discussion reported below.

SESG also claims to have helped in the building of supply chains; the former Director reported that SESG had assisted members of the network to work with companies that they had not previously worked with, and SESG networking events had brought together companies with mutual interests.

These descriptions from SESG demonstrate that the Group has contributed to economic development by enhancing the R&D capacities of SMEs, enabling them to offer an integrated performance assessment service, and encouraged supply team development – all as envisaged in the original project proposal.

### **5.9 The benefits within Scotland from better designed buildings**

The original case for support identified that the project would lead to informed decision making including explicit appraisal of many options at the design stage, which in turn would bring about benefits within Scotland from:

- reduced energy and environmental impact,
- improved indoor/outdoor air quality,
- human comfort and health,
- and use of local resources.

A clear example of these benefits has been reported in a paper written jointly by an engineering consultancy and SESG staff<sup>1</sup> which includes a case study of a large factory suffering from severe overheating. As a result of disparities between simulation results and measured conditions, it was

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<sup>1</sup> Tamburrini, M., Palmer D., and Macdonald I., 'Calibrating models for simulation use in design practices', *Proceedings of the Eighth International IBPSA Conference*, The Netherlands, August 2003, pp 1273-1278

discovered that nine-tenths of the ventilation fans in the factory were inoperative. In consequence, planned installation of air conditioning was deemed unnecessary, resulting in a capital cost saving of about £100,000 and annual running cost savings of 715,000 kwh, worth about £36,000 p.a. It was also found that a planned new insulated roof would need only modest insulation, saving a further £50,000. The cost of the simulation was £4,000. This may be an extreme example of improved comfort levels, high costs savings and environmental benefits, but it demonstrates the potential benefits from simulation.

The cost/benefit ratio in this case is spectacular, though it is doubtful that it is typical of every project where simulation modelling is applied. Our past experience of monitoring the Energy Design Advice Scheme between 1992-1998 is relevant. There, predicted energy savings were estimated for every single instance of advice-giving, and revealed that the '80/20' rule applied – the majority of the measurable benefits arose from a relatively small number of key projects, although the vast majority of projects also delivered some benefit. It seems possible that the same trend would occur here – that most of the instances of applying simulation modelling lead to modest but nevertheless valuable benefits, while in a small proportion of cases, the benefits are spectacular. Unfortunately it has not been possible to examine all the member organisations instances of applying simulation modelling to examine the scale of the resulting benefits in any detail.

### **5.10 Savings in carbon dioxide emissions**

SESG has devised a means of calculating the savings in carbon dioxide emissions arising from its advice-giving. It is based on several assumptions:

- the floor area of an 'average' building project
- the number of jobs advised by SESG
- a improvement in energy use in the buildings receiving advice from 'good practice' levels of energy usage to 'best practice'

According to the calculations undertaken by the former Director based on these assumptions, SESG has resulted in carbon dioxide savings of 26,250 tonnes. This may be compared with a target figure in the original case for support of 24,000 tonnes. It has not been possible within this review to check these calculations, which in any case are subject to several assumptions.

### **5.11 Spin-off job creation and demand for innovative products**

The original proposal said that SESG would bring spin-off job creation by increased demand for innovative products such as advanced coatings, smart controls for building services, and renewable energy technologies. This subject was raised with the focus group as reported above under 6.8.5 who confirmed that there was spin-off job creation and gave examples. Professor Clarke offered further examples, such as where a housing association being advised by the Group had decided to invest in photo-voltaics and this led to the construction of the UK's first hybrid photo-voltaic roof. Professor Clarke reported that in his view specifiers would like to use the new technologies but are held back partly by lack of expertise on site, and the Group was working with both CIBSE and the CITB on training for technicians and site operatives, although no further details were obtained. He also reported that several companies were negotiating with the Group about simulating control algorithms. He cited a company that manufactures double skin facades as being in discussion about the development of algorithms to represent the façade performance, a firm of blind manufacturers was discussing control algorithms for the blinds, and they were also talking to a firm making low cost structural and thermal insulation panels and another making ducted wind turbines.

Professor Clarke went on to say that despite these connections with manufacturers, these activities have not been as great as he would like. It would be his hope to work with the Heating and Ventilating Contractors Association (HVCA), the CITB and other similar bodies including more manufacturers, to increase their involvement with SESG and help them with the process of raising skill and expertise in the installation of new energy technologies. He would like to increase the dialogue between specifiers and installers.

From these views and explanations, there is evidence that SESG has been successful in increasing demand for innovative products although, by Professor Clarke's admission, the Group would like greater engagement with suppliers and manufacturers, and their associations, to help bring this about. He did not, however, indicate what actions he proposed in order to raise the level of engagement.

### ***5.12 Enhancing R&D within the design and construction sector***

SESG has contributed to research and development activities among companies that are part of its business network. This was discussed during the focus group, where organisations taking part confirmed that their involvement in the TCS scheme was a direct plan to engage more with R&D activities. Other companies in the network have sent their employees on Strathclyde's Masters courses. Additional evidence of the growth of interest in R&D is the authorship of conference papers where, as previously noted, practitioners are increasingly reporting their engagement with R&D.

### ***5.13 Raising awareness in Scotland of sustainable technologies***

The original project proposal envisaged that the project would raise awareness in Scotland of environmentally sustainable (clean) technologies and products within and beyond the construction sector. Renewable energy systems have been one of the monthly themes for the Group's events, and several of the events addressed renewables. Professor Clarke reported that many supported technology deployments relate to the integration of renewable energy technologies into buildings, helping to promote clean technologies. He also reported that the Group had made presentations at BRE on renewables, and was involved with the Scottish Energy Efficiency Office in key renewables events. SESG's involvement in the REASURE programme (see 5.15 below) shows it is helping to raise awareness of environmentally sustainable services. Again, it can be seen that the Group has met its obligations to awareness raising of clean and sustainable technologies as set out in the original case for support.

### ***5.14 Strategic alliances***

SESG has networked effectively with a number of international organisations. For example, the Group operates as the Scottish representative body on the International Building Performance Simulation Association (IBPSA) and, as noted above, has reported its work internationally at IBPSA conferences. The Group also acts as a Scottish facilitator for REASURE, a European programme concerned with design and advice support to promote the use of renewable energy in buildings. Professor Clarke participated in the EU network ENERBUILD (now concluded) concerned with the promotion of energy efficiency in buildings. The former Director attends cluster meetings of the European network USOBUILD. These activities have all been undertaken as envisaged in the original case for support.

The original case for support also referred to the SESG having a positive impact on Scottish industry's participation in the EU Sixth Framework programme. We understand from Professor Clarke that the Group actively engaged in encouraging companies to participate in Sixth Framework bids, but none was successful, indeed built environment projects generally did not fare well. He went on to claim however, that participation in the proposals had made industry more aware of the opportunities under the Sixth Framework and this would be reflected in their involvement in the next call in December 2004.

Additionally, the former SESG Director is the chair of CIBSE Scotland, which has resulted in joint events and raised interest within the building services profession of the work of the Group. The Group is also reported to have collaborated with the Scottish Energy Environment Foundation including participation in the production of a vision statement for energy efficiency within Scotland. The former Director has encouraged SMEs to engage in the EPSRC's Collaborative Training Accounts system, helping to transfer R&D from the university to industrial participants. Continuing Professional Development events have been run with the Scottish Environmental Design Association and with GAIA Architects. The Group also participates in an EPSRC-funded network concerned with comfort in buildings and run from Oxford Brookes University.

## **6 Summary of findings**

### **6.1 This review**

Eclipse Research Consultants have carried out a review of the operation of the project ‘Transferring Integrated Modelling Systems to Energy Sector SMEs’, which is run by the Scottish Energy Systems Group (SESG), part of the Energy Systems Research Unit of the University of Strathclyde. SESG is an industry club for SMEs, whose overall aim is to transfer advanced energy/environment modelling systems from academia into practice. The project runs from 1 Jan 2002 to 31 Dec 2004. The main funders are Strathclyde European Partnership (an ERDF) and Scottish Enterprise, together with its industry club members. In addition the Scottish Executive through the Scottish Energy Efficiency Office paid for Newsletter production. The Scottish Energy Environment Foundation contributed in return for access to SESG members, and the University of Strathclyde provided premises and non-chargeable academic staff time as their in kind contribution.

This review was undertaken by means of a visit to SESG by Dr Sebastian Macmillan on 13-14 September 2004. Professor Clarke gave a presentation about SESG and its operation, detailed discussions were held with the SESG staff (the Director, the Administrator and the two technical staff), project documentation was inspected, and a focus group discussion was held with four members of the business support network. Some additional information relating to events organised and support given to businesses was requested and subsequently provided by SESG to enable the review to be completed.

### **6.2 SESG’s aims and activities**

SESG has several mutually supportive aims. These include developing the competitiveness of the region’s SMEs involved in the design of the built environment, facilitating knowledge transfer from research to practice, investing in the Scottish knowledge-base, enhancing the relationship between SMEs and higher education establishments, and promoting the application in practice of innovative IT-based design tools. These tools are concerned with the simulation of the performance of buildings. Their application in practice offers the potential of improving the building stock by bettering its performance – raising comfort levels, reducing fuel poverty, and lowering its environmental impact including carbon dioxide emissions – leading to improved health, well-being and productivity for occupants and making buildings more environmentally sustainable.

To achieve these aims, SESG’s main activities are:

- the formation of a business network of small and medium enterprises
- organising a programme of seminars, workshops and training sessions, and
- making the IT tools available to companies within their own offices on a live project through ‘supported technology deployments’.

Other activities include engagement with the building professions in Scotland, and presentations at non-SESG events including academic and professional conferences.

### **6.3 SESG staffing and premises**

SESG operates from Department of Mechanical Engineering. It is overseen by Professor Joe Clarke and there are four full time members of staff: – the Director, Lori McElroy; the Administrator, Kathleen Whyte; plus two technical specialists Dr Jon Hand and Dr Iain Macdonald. At the time of writing (mid-September 2004) Lori McElroy had accepted an appointment at the Architectural Policy Unit of the Scottish Office, and Iain Macdonald had been appointed as her replacement. This review refers to Ms McElroy as the former Director and Ian Macdonald as the new Director. There are also three members of the academic teaching staff who contribute to the operation.

SESG has been provided with attractive accommodation by the University. It has a CPD suite, a breakout area, a large meeting room containing a technical library, and high quality staff offices. IT facilities appear excellent - staff have recent computers and there is a suite of computers available for training. A loan pool of laptop computers and licensed software enables machines to be lent to member organisations.

#### **6.4 Business network membership and income generated**

At the time of the review, 30 organisations were members of the network – 14 consulting engineers, 6 architectural practices, 3 computer simulation companies, 3 local authorities, 2 universities, 1 utility and 1 housing association. At its maximum membership rose to 35. Each member pays a £500 annual subscription and the total received from members by September 2004 was £32,000, with a further £8,000 due to be invoiced in October 2004. If each and every invoice is settled, this will bring total membership income up to £40,000, £5,000 below the target figure of £45,000 cited in the original proposal.

#### **6.5 Business network events**

SESG planned a comprehensive programme for the 30 months from mid-2002 up to the end of 2004, based around monthly themes such as energy efficiency, indoor air quality, climate change, HVAC and controls. Each month, it runs network events (seminars, workshops and training events) based around each theme. By mid-September 2004:

- 24 seminars had been run, attracting 411 delegates (including one joint seminar with Scottish Energy Environment Foundation which attracted 100 delegates)
- 6 workshops had been run attracting 46 delegates
- 19 training courses had been run offering training on various simulation modelling software packages, and which had attracted 184 delegates.

In total then 47 events had attracted a total of 641 delegates. (Note seminars and training sometimes ran consecutively on the same day, but attendance at each has been counted separately.) Both totals compare favourably with the original target of 30 events attracting an expected total of 600 delegates. Feedback questionnaires were used at events and the response rate was low – however, the feedback received is overwhelmingly positive and contains many complimentary comments.

#### **6.6 Supported Technology Deployments**

Supported Technology Deployments arise when a company that has received training on a software package then wishes to apply the model in practice on a live project. One of the SESG technical staff is deployed into the organisation for 2-3 days, complete with a laptop computer and an appropriate licence agreement in order to help the company up the learning curve of applying the software on the project as well as, more generally, encouraging the company to see how to exploit it fully on other appropriate projects. They also help to document success and failures, and feedback is provided to vendors.

By June 2004, SESG reported it had undertaken 125 supported technology deployments. This is substantially in excess of the original target of 78 instances of advice to new and existing businesses. SESG's records of STDs, given in Appendix 2, show that 28 different organisations has received technology deployments, all but three or four being SMEs. The subject matter is wide ranging, from daylight and glare, to thermal bridging and mould growth, and to modelling of a photo-voltaic façade.

#### **6.7 Promotional activities and dissemination**

During the current phase of operation, SESG has published two newsletters, in similar format to four newsletters published during the previous phase. We understand they are sent to a mailing list of some 500 interested individuals. Entitled 'Hot News', the newsletters have high production values and are well written and illustrated. They contain a 'What's New' section, a leading article, case studies, reports of past seminars and training events, membership news, and a factual page with contact details.

Ideally they would be produced on a more regular basis, but nevertheless they portray SESG as an active, lively, and professional organisation.

SESG has an attractive and informative web-site, which provides an overview of the Group and its activities, its programme of events, links to web sites of organisations offering various software packages, descriptions of the various services and university facilities available, contact details and acknowledgements to the funding bodies. As with the newsletter, it portrays SESG as an active and lively organisation.

Monthly emails are sent out to about 500 individuals on the Group's database, notifying them of the forthcoming month's events.

SESG staff have published several papers about their work, setting out the potential for simulation and offering general observations about procedures and issues such as quality assurance and risk. At the 2003 International IBPSA Conference, they presented four papers each of which included practitioners as joint authors with SESG staff and which reported on case studies of using simulation from a practitioner perspective. At the 2003 joint conference of the Chartered Institution of Building Services Engineers (CIBSE) and American Society for Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), Professor Clarke chaired a session devoted to Building Simulation and gave its keynote address, the SESG Director gave a paper, and two industrial members of the club presented their experiences of using simulation in practice.

By presenting at IBPSA, the Group has reported its experiences to the international building simulation community, contributing to future research, while the CIBSE/ASHRAE Conference presentations are geared to practitioners and help to promote take-up of simulation modelling to building services professions in the UK. The Group's dissemination activities are commendable, and meet the claim made in the original case for support that SESG would be responsible for disseminating new knowledge, processes and technologies. Only two suggestions are offered for improvement: first, that the newsletter be published regularly – even if this is at six monthly intervals – and secondly, that attempts are made to obtain coverage in the professional and technical press, such as *Building Services Journal* or in the magazine *Building*.

## **6.8 Job creation and student placement**

The SESG Director has kept notes about employment and job creation based on her regular contact with the member organisations, her knowledge of where Masters graduates from the University go, and more generally from her contact with employers through her role as Chair of CIBSE Scotland. Every quarter, she transfers her knowledge of these to the quarterly records that are submitted to the main funding organisation. According to these quarterly records, by the end of June 2004, 26 jobs had been created of which 11 were for women (target 9) and 2 for ethnic minorities (target 3). 18 were for people under 25 (target 15) and 25 relate to environmental activities (target 30). These figures illustrate that the SESG has been extremely successful in creating employment and placing Masters level students, although at the time of writing it has under-shot its overall target by about 10%.

## **6.9 Working practices of members and demand for innovative products**

A focus group discussion with four SME members of the industry club was held as part of this review. Three of the organisations (two engineering consultancies and one architectural practice) reported they had been involved in the TCS scheme – a government funded initiative that aims to strengthen the competitiveness and wealth creation of the UK by stimulating innovation through collaborative partnerships between the science, engineering and technology base. Graduates had worked in the companies while being supervised by both the company and the university. All four participants in the focus group confirmed that in their view SESG was successfully creating jobs and assisting in the placement of graduates with simulation skills. All four also confirmed that, in their view, the additional expertise they were able to offer as a result of engagement with SESG has led them to be able to offer new services and in turn had won new commissions and raised their earnings. Each was

able to give examples, although none of them was able to estimate the scale of the increased sales. The focus group delegates also confirmed that they were investing more in innovation and R&D, although again it was not possible for them to estimate the scale of that investment.

Simulation modelling, the delegates confirmed, could lead to greater demand for innovative products, since it made it possible to estimate their benefits with greater precision. Another benefit identified was less need for over-design, since performance could be estimated with greater accuracy through modelling. All four delegates confirmed they would not have found it possible to achieve these many benefits without the support of SESG.

### **6.10 Impact on buildings in Scotland**

When asked about the impact of their new skills on buildings in Scotland, the focus group delegates gave examples of where this had occurred. These included better exploitation of natural lighting arising from computer simulation of sunlight and shadows in high-rise housing and better understanding of visual impact; both of which were important in negotiating with planners. Design teams themselves gained new insights, and sometimes surprises, from computer modelling. More generally, the firms reported that they are increasingly engaging with the issues of environmental design and sustainability, with benefits to the environment and quality of life.

A documented example of the impact on buildings in Scotland is contained in one of the joint papers published at the IBPSA 2003 Conference, where simulation was used to help diagnose the cause of overheating in a factory building – leading to capital cost savings from avoidance of air conditioning plant and unnecessary roof insulation, savings in running costs and carbon dioxide emissions from the operation of the now-unnecessary air conditioning, and better comfort levels of occupants. A high profile project in which SESG has been involved is the interior lighting design of the new Scottish Parliament building.

The former SESG Director devised a method for calculating the savings in carbon dioxide emissions arising from its advice giving. This makes a number of assumptions about the number and type of buildings where modelling has been applied and the improvements in energy efficiency achieved. Overall, her calculations indicate a carbon dioxide savings figure of 26,500 tonnes, which may be compared with an original target of 24,000 tonnes.

### **6.11 Two way transfer of knowledge between research and industry**

SESG has good knowledge of the simulation models in use by its members which shows that as a result of the seminars, workshops, training and supported technology deployments, 15 of the member firms are using ESP-r, 5 are using IES software, 5 are using Radiance, 4 using Cymap, 3 using Hevacomp, 1 is using Fluent and 1 TAS. This illustrates the success with which transfer from a research environment to practice is taking place. The supported technology deployments are one routes by which knowledge transfer operates in the opposite direction, as SESG staff using the modelling tools on live projects are able to identify issues for the research community and software vendors to address. A more general route for feedback from industry to the research community is through the TCS scheme in which three SESG members have participated and, more widely, the University's Collaborative Training Accounts in which masters courses responsive to the needs of industry are run. A student project day which attracts 100-150 industry visitors showcases the University's R&D but is also used to obtain feedback from industry about the relevance and appropriateness of current research efforts.

### **6.12 Economic development, R&D and supply chain improvements**

The original bid referred to the contribution of SESG to economic development, and further R&D arising from increased demand for innovative products such as smart controls and advanced coatings. The focus group confirmed they believed this was happening and offered examples. Professor Clarke also offered examples such as a housing association being advised by SESG that had constructed a hybrid photo-voltaic roof. He is negotiating with a number of manufacturers and it is his hope to work

with them more closely in the future about the simulation of product performance, and practical issues about product installation.

### ***6.13 Awareness of environmentally clean/sustainable technologies***

Renewable energy technologies was adopted as one of the monthly themes around which seminars were presented, and we understand that renewable energy technologies are the subject of a number of supported technology deployments. Members of SESG have made presentations to BRE on renewables and been involved in key renewables events put on by the Scottish Energy Efficiency Office. SESG acts as a facilitator for the European programme REASURE which is concerned with design, advice and promotion of renewables.

### ***6.14 Strategic alliances***

SESG has, as proposed in the original bid, networked effectively with international organisations. It acts as the Scottish representative body on the International Building Performance Simulation Association (IBPSA) and has reported its work internationally at IBPSA conferences. It acts as the Scottish facilitator for REASURE. Professor Clarke participated in the EU network ENERBUILD, and the former Director attends meetings of the European network USOBUILD. SESG encouraged companies to participate in the EU Sixth Framework though none of the bids was successful. The former SESG Director is the chair of CIBSE Scotland, and the Group has collaborated with the Scottish Energy Environment Foundation. Continuing Professional Development events have been run with the Scottish Environmental Design Association and with GAIA Architects. The Group also participates in an EPSRC-funded network concerned with comfort in buildings.



## Appendix 1      **SESG's record of its business network events**

### **SESG EVENTS 2002 – 2004**

#### **THEME: INDOOR AIR QUALITY**

SEMINAR & TRAINING: Computational Fluid Dynamics (CFD) Software System – FLUENT

DATE:               :       Tuesday 9 July 2002, 9.30 – 4.30pm  
VENUE               :       Room M4.12, University of Strathclyde  
DELEGATES       :       7 (Seminar & Training)  
SPEAKERS         :       3

Comments               :       Good turnout of delegates. Well presented. Very informative. Useful tool for future projects.

WORKSHOP & TRAINING: Computational Fluid Dynamics (CFD) Software System (IES LTD)

DATE                :       Thursday 25 July 2002, 2 – 4pm  
VENUE               :       Room M4.12, University of Strathclyde  
DELEGATES       :       15 (Workshop) (10 Training)  
SPEAKERS         :       2

Comments               :       Good turnout of delegates. Positive feedback. Overall, the Workshop was found to be very relevant to delegates current workload. Very good workshop (seriously). Having never used cfd myself on a project, I saw this as an introduction to the possibilities – intend to try to use it in the future. Interesting and applicable to many service issues. Any chance of a fluent demo? (to try up at Hulley's office). Would have liked a variety of speakers e.g. from Industry.

#### **THEME: DESIGN INTEGRATION**

SEMINAR           :       Design Integration  
DATE                :       Friday 9 August 2002  
VENUE               :       Room M4.08, University of Strathclyde  
DELEGATES       :       19  
SPEAKERS         :       3

*Comments                Good turnout of delegates. Positive feedback. Very relevant. Was very seful, as a student, it opens my eyes to what I should know for a good advantage for when looking for employment. Quite informative, does provide lots of food for thought. Already in discussion with IES re further information! Interesting to hear other people's experience. Concentrated solely on DTM though. Good presentations.*

TRAINING           :       ESP-r Training  
DATE                :       14-16 August 2002  
VENUE               :       Room 6.32, University of Strathclyde  
DELEGATES       :       13  
SPEAKERS         :       1

Comments               :       Positive feedback. All delegates had used ESP-r before.  
*Did you get out of the course what you expected? Yes, it was very interesting. In most of the cases Yes and then some! Many thanks, course provided a great insight to some of the aspects of ESP-r that I was unfamiliar with. Majority of delegates found: location, organisation, length, pace, depth of coverage, of assistance & presentation style between good and excellent.*

WORKSHOP : Design Integration Feedback Workshop  
 DATE : 22 August 2002  
 VENUE : M4.12, University of Strathclyde  
 DELEGATES : 4  
 SPEAKERS : 1

Comments : Found to be interesting and informative.

TRAINING : CYMAP  
 DATE : 30 August 2002 – POSTPONED

#### THEME: BUILDING REGULATIONS

SEMINAR : Building Regulations  
 DATE : 6<sup>th</sup> September 2002  
 VENUE : Room M4.22a  
 DELEGATES : 52  
 SPEAKERS : 7

Comments : This was a first-class seminar with good organisation & expert delivery. Investment in energy plant and measures is affected by the return in producers energy unit charges - should the Government also consider the regulators role in fair domestic energy changes, v commercial results. Useful & Interesting, thank you! Is self certification a reality? (as some structural application). Non dwellings of particular interest and proving compliance. Services related Part J topics i.e. pipe-work, plant insulation & carbon performance calculations. Part J topics, SAP Calculations, carbon emission Method. Part J sessions were particularly relevant. More detail on the impact of the new standards (Part J) on general building services practice – perhaps no-one is ready to give this talk yet! Excellent summation of subjects. Good structure for day; more of these!

TRAINING : TAS – Training & Demonstration  
 DATE : 11 September 2002  
 VENUE : Room M4.12  
 DELEGATES : 11  
 SPEAKERS : 1

Comments : Very interesting - Benchmarking CD would be useful. Would like Energy Benchmark CD! Very interesting! Compliance checker software looks useful

TRAINING : VE/Thermal/Mechanical  
 DATE : 17<sup>th</sup> September 2002  
 VENUE : M4.12  
 DELEGATES : 8  
 SPEAKERS : 1

Comments : Good overview of package & its possible applications.

TRAINING : ESP-r  
 DATE : 18-20<sup>th</sup> September 2002  
 VENUE : Room M6.32  
 DELEGATES : 8  
 SPEAKERS : 1

Comments : The course should be held over more days and combine a larger variety of subjects, could take place in different countries. It was sometime assumed that everyone had reached a particular stage, before moving on. I was left behind on one occasion. On a few occasions, when many people were asking questions, there weren't enough tutors to go around! I enjoyed the course immensely and found it extremely useful. I am very pleased with the skills I have developed here. Thank you. The course was very useful for beginners to get started with ESP-r simulation. 5 days would be better – more time to try what was explained.

WORKSHOP : Building Regulations  
DATE : 26 September 2002  
- Postponed due to large turnout and discussion at seminar.

#### THEME: LIGHTING

SEMINAR : Lighting Systems  
DATE : 22 October 2002  
VENUE : The Lighthouse, GLASGOW  
DELEGATES : Approx. 15  
SPEAKERS : 2

SEMINAR & TRAINING : VE/Lighting/VE Thermal/Mechanical  
DATE : 17-18<sup>th</sup> October 2002  
VENUE : Room M6.32  
DELEGATES : 4  
SPEAKERS : 1

Comments : Well presented. Informative.

SEMINAR & TRAINING : RADIANCE  
DATE : 21-22<sup>nd</sup> October 2002  
VENUE : Room M6.32  
DELEGATES : 5  
SPEAKERS : 1

Comments : Very good course. Very thorough course, explained lots of useful code ESP-r – Radiance – Gemms! Radiance not quite so scary as first thought! Fab! ☺

WORKSHOP : Lighting Systems  
DATE : 31<sup>st</sup> October 2002  
VENUE : Room M6.32  
DELEGATES : 3  
SPEAKERS : 1

Comments : Thanks! Interesting.

#### THEME: LIFE CYCLE ASSESSMENT

SEMINAR : Life Cycle Assessment  
DATE : 8<sup>th</sup> November 2002  
VENUE : Room M4.08/9  
DELEGATES : 9  
SPEAKERS : 2  
Comments : Very interesting topic. Well presented. Very informative.

SEMINAR & TRAINING : ENVEST Seminar plus Training  
DATE : 13<sup>th</sup> November 2002  
VENUE : Room M4.12  
DELEGATES : 15 – Seminar (13 – Training)  
SPEAKERS : 3

Comments : A very interesting presentation of a very wide ranging topic. Envest II appears to be a powerful tool and I await a further demo if possible after it is fully tested. Well presented. A case study of one of KJ Tait Engineers' Buildings would be welcome. (For a 10 year whole Life Cycle Cost Analysis). Despite the technical hitches, informative! Should have been a good introduction to the tool operation.

TRAINING : VE/COST - Training  
DATE : 14<sup>th</sup> November 2002  
VENUE : Room M6.32  
DELEGATES : 5  
SPEAKERS : 1

Comments : A well presented and informative demonstration. A really useful design and project management tool. Very interesting. Assistance on doing a Whole Life Cycle Cost Exercise on a live project. Assistance on doing a Whole Life Cost Exercise on a live project.

TRAINING : ESP-r  
DATE : 18-20<sup>th</sup> November 2002  
VENUE : Room M6.32  
DELEGATES : 5  
SPEAKERS : 1

Did you get out of the course what you expected? Overall they did with one saying - Yes – but had expected more on flow networks.

WORKSHOP : Life Cycle Assessment  
DATE : 28<sup>th</sup> November 2002  
VENUE : M6.32  
DELEGATES : 6  
SPEAKERS : 1  
Comments

Found it relevant to work, interesting, not really related to my work but interesting and informative, overall good feedback.

TRAINING : MERIT – Postponed - 3 people trained in-house – will re-run next year.

SEMINAR : Renewable Energy Systems Seminar  
DATE : 6 December 2002  
VENUE : Room M3.29  
DELEGATES : 17  
SPEAKERS : 6

Comments: All delegates found it relevant to their work, really good speakers, very interesting.

Merit Training – 9 December 2002

Postponed until next year – updating MERIT software

Renewable Energy Systems Workshop –  
10 December 2002: Postponed until 2003 (too close to Christmas)

## **2003**

### **THEME: FIRE ENGINEERING**

SEMINAR : Fire Engineering  
DATE : 11 March 2003  
VENUE : M3.28  
DELEGATES : 13  
SPEAKERS : 2

**Comments:** Well presented. Very interesting. Most found it relevant to their work. Useful.

TRAINING : IES Fire Simulation Software Seminar & Training  
DATE : 20 MARCH 2003  
VENUE : M3.28  
DELEGATES : 6  
SPEAKER : 1

**Comments:** Good software. Relevant to their work. Interesting

WORKSHOP : Fire Simulation Workshop  
DATE : 27 MARCH 2003  
VENUE : M3.22A  
DELEGATES : 6  
SPEAKER : 2  
**Comments :** Interesting discussion. Positive feedback

### **THEME: CLIMATE CHANGE**

SEMINAR : Climate Change Seminar  
DATE : 15 April 2003  
VENUE : SCOTTISH EXECUTIVE, Victoria Quay, Edinburgh, Conference Room 1  
DELEGATES : 35  
SPEAKERS : 5

**Comments:** Positive feedback, most found it relevant to their work, well presented

TRAINING : Climate Change Software – HTB2 – 16 April 2003  
Postponed – new date tbc.

TRAINING : Climate Change ESP-r Training  
DATE : 23-25 April 2003  
DELEGATES : 5  
SPEAKERS : 1

**Comments:** Positive feedback.

Climate Change Workshop  
DATE: 25 April 2003  
Cancelled

### **THEME: SUSTAINABLE CITIES**

SEMINAR : Sustainable Cities Seminar  
DATE: : 2 May 2003  
DELEGATES : 13  
SPEAKERS : 4

Comments: Excellent clear presentations. Good, especially the discussions that developed.  
Overall positive feedback.

TRAINING : ENTRAK  
DATE : 23-25 April 2003  
Postponed: Software being updated. New date tbc.

WORKSHOP : SUSTAINABLE CITIES –  
DATE : 29 May 2003  
CANCELLED : All issues covered adequately in discussion at seminar.

### **THEME: SMALL SCALE RENEWABLES**

SEMINAR : Small Scale Renewables  
DATE : 6 June 2003  
DELEGATES : 19  
SPEAKERS : 6

Comments: Positive feedback. Jennifer Miller's presentation useful – re P Strachan & N Kelly – more detail on technologies would be interesting. Make more on the practical side. What can be achieved of now has practicalities. Don't mean to be a pain, I really enjoy being at the coal-face, and problems foreseen are problems avoided. Ducted wind turbines.

TRAINING : ESP-r  
DATE : 16-17<sup>th</sup> June 2003  
DELEGATES : 8  
SPEAKERS : 2

Comments: Positive feedback.

WORKSHOP : Small Scale Renewables Workshop  
DATE : 26<sup>th</sup> June 2003  
DELEGATES : 18  
SPEAKERS : 1

Comments: Very interesting. Positive feedback. Popular topic.

### **THEME: HVAC, ELECTRICAL SERVICES & CONTROL**

SEMINAR & TRAINING : VE Mechanical  
DATE : 14-15<sup>th</sup> October 2003  
DELEGATES : 6 day one and 5 day two  
SPEAKERS : 1

Comments: Found training relevant to work. Course notes/manual, as this 2 day course is very intense. This should make a review easier, help future use of the software. Would like a course which details all sections i.e. Microflo etc. Some handouts would have been welcome. Presentation material very good. Pace & quality of presentation good also.

#### **THEME: HVAC, ELECTRICAL SERVICES & CONTROL**

SEMINAR & TRAINING : ESP-r  
DATE : 23-24<sup>th</sup> October 2003  
DELEGATES : 5  
SPEAKERS : 2

Comments: Used ESP-r before, enjoyed course. Hadn't used it before but when asked if they got what they expected they said 'yes and more'. Very useful. Should make it a lot easier to get started when back at work. Yes used before, really a very helpful and personally nice course, thanks.

WORKSHOP : HVAC, ELECTRICAL SERVICES & CONTROL  
DATE : 30<sup>th</sup> October 2003  
DELEGATES : Cancelled – discussion at Seminar & Training covered the issues.

#### **THEME: OUTDOOR AIR QUALITY**

TRAINING : VE Microflo (Date changed to 17<sup>th</sup> November 2003)  
DATE : 17<sup>th</sup> November 2003 @ IES Offices instead of here  
DELEGATES : 4  
SPEAKERS : 1

#### **THEME: ACOUSTICS**

SEMINAR : Acoustics Seminar Ecotect Demo & Training  
DATE : 5<sup>th</sup> December 2003  
DELEGATES : 15 – Seminar (11 Training)  
SPEAKERS : 3

Comments: Very interesting. Good general overview. Interesting and exciting. Excellent arrangement and presentation

SEMINAR & TRAINING : Advanced ESP-r Course  
DATE : 22-23<sup>rd</sup> January 2004  
DELEGATES : 5  
SPEAKERS : 1

Comments: Very interesting. Well presented.

#### **THEME: VALUE ENGINEERING**

SEMINAR : VALUE ENGINEERING  
DATE : 5 March 2004  
DELEGATES : 16  
SPEAKERS : 3

Comments: Very Interesting. Well presented and very informative.

TRAINING : VALUE ENGINEERING/COST  
DATE : 17 March 2004

Comments : Postponed: In House training carried out for one company instead.

**THEME: VALUE ENGINEERING**

SEMINAR : RENEWABLES – From Macro to Micro (in assoc. with CIBSE)  
(INSERT)  
DATE : 20 April 2004  
DELEGATES : 17  
SPEAKERS : 3

Comments: Very Interesting. Well presented and very informative.

**THEME: INTERNATIONAL DEVELOPMENTS**

SEMINAR : ENERGY PLUS Overview Seminar & Workshop  
DATE : 21-22 April 2004  
DELEGATES : 17 for seminar & 9 for training  
SPEAKERS : 1

Comments: Very informative, very good. Very good has provided the background necessary for me, very good seminar, very useful, this was an excellent course.

**THEME: BUILDING REGULATIONS**

SEMINAR : TRNSYS Seminar & Training Session  
DATE : 17-18<sup>th</sup> May 2004  
DELEGATES : 7 for seminar 5 for training  
SPEAKERS : 1

Comments: Very Interesting. Well presented and very informative.

SEMINAR : NEW ENERGY SYSTEMS FOR DOMESTIC DWELLINGS  
( SEEF/SESG Seminar)  
DATE : 24 May 2004  
DELEGATES : 100  
SPEAKERS : 5

Comments: Very Interesting. Well presented and very informative.

TRAINING : ESP-r Introductory Course  
DATE : 10-11 June 2004  
DELEGATES : 9  
SPEAKERS : 1

Comments: Basic skills in ESP-r acquired, found it mostly what expected but would like to run it on my own pc, another day added to the course i.e. 3 day course so that the participants could have a go at producing their own model, maybe a project they are familiar with and with this, possibly a questions and answers session where the participants could ask how to carry out certain tasks that may be of interest to them. Overall though, a very good.



## Appendix 2      **SESG's record of its Supported Technology Deployments**

| <i>Quarter</i> | <i>Company name</i>  | <i>STDs</i> | <i>Summary</i>   |
|----------------|----------------------|-------------|--|
| Q1 2002 – Q1   | RMJM                 | 3           | Scottish Parliament, summer temperatures/<br>ventilation– Extended STD<br><br>Introduction to simulation (TAS)<br>Daylighting analysis with Radiance |
|                | Hulley and Kirkwood  | 6           | In house training in simulation (ESP-r)<br>Tanfield House, data collection for simulation  |
| Q2 2002 – Q2   | Rybka                | 2           | Lanark Court, natural ventilation<br>Introduction to simulation (Cymap)  |
|                | RSP                  | 1           | Edinburgh Council, indoor air quality/<br>distribution   |
|                | EnConsult            | 5           | In house training in simulation (ESP-r)–<br>Extended STD   |
|                | Dinardo Partnership  | 3           | Parliament House, natural ventilation<br>Parliament House, daylight availability(ESP-r)  |
| Q3 2002 – Q3   | CampbellPalmer       | 2           | Albion motors, ventilation and model calibration   |
|                | Oscar Faber          | 2           | Introduction to simulation (ESP-r)   |
|                | TETA                 | 1           | Introduction to simulation (ESP-r)   |
|                | Hulley and Kirkwood  | 3           | Tanfield House, model building/ approach<br>Tanfield House, indoor air distribution/ quality<br>Introduction to simulation (IES:VEcost)              |
|                | Glasgow City Council | 2           | Introduction to simulation (ESP-r)   |
|                | GHA                  | 3           | Introduction to simulation (IES:VEcost)  |
|                | Scottish Executive   | 2           | Introduction to modelling – variety of tools   |
|                | McEachan McDuff      | 1           | Simplified tools for architects – LT, etc.   |
|                | Hypostyle            | 2           | Simplified tools for architects – LT, etc.   |
|                | Wallace Whittle      | 1           | Advice on CFD support  |
|                | RMJM                 | 4           | Galashiels, natural ventilation design support –<br>Extended STD   |
|                | EnConsult            | 1           | Assistance with ESP-r for new members of staff   |
|                | HLM                  | 2           | Thermal simulation requirements – new<br>software  |
|                | Oscar Faber          | 2           | Debenhams, model building/ approach (ESP-r)  |

| <i><b>Quarter</b></i> | <i><b>Company name</b></i> | <i><b>STDs</b></i> | <i><b>Summary</b></i>   |
|-----------------------|----------------------------|--------------------|---|
|                       | CampbellPalmer             | 1                  | Knitwear factory, model building/ approach (ESP-r)  |
| Q4 2002 – Q4          | RMJM                       | 2                  | Training in simulation (TAS)  |
|                       | Oscar Faber                | 2                  | Debenhams, condensation study (ESP-r)   |
|                       | EnConsult                  | 3                  | New hardware configuration<br>Introduction to simulation (IES:VE)   |
|                       | Dinardo Partnership        | 1                  | Daylighting availability (Radiance)   |
|                       | Rybka                      | 1                  | Comparison of simulation tools (IES:VE/ESP-r)   |
| Q1 2003 – Q5          | FHA                        | 1                  | Hospital, model building/ approach (ESP-r)  |
|                       | Hulley and Kirkwood        | 1                  | Primary school, natural ventilation (ESP-r)   |
|                       | James Campbell             | 2                  | Office block, model building/ approach (ESP-r)  |
|                       | CampbellPalmer             | 2                  | Glasgow Science Centre, model building, calibration and QA (ESP-r)  |
| Q2 2003- Q6           | Glasgow School of Art      | 5                  | Model QA in ESP-r and Radiance – extended STD   |
|                       | Rybka                      | 1                  | Model QA in ESP-r   |
|                       | Hulley and Kirkwood        | 4                  | New hardware configuration<br>Gates factory, model calibration (FLUENT – CFD)<br>Setting up in house documentation procedures |
|                       | Glasgow School of Art      | 2                  | Double skin facade, model building/ approach and daylighting (ESP-r, Radiance)  |
|                       | Muller                     | 4                  | Office daylighting, model building/ approach  |
|                       | HLM                        | 2                  | Office daylighting, model building/ QA (in-house software)  |
| Q3 2003- Q7           | DASS                       | 1                  | House, natural ventilation  |
|                       | Oscar Faber                | 1                  | Ventilation strategy in shopping mall   |
| Q4 2003– Q8           | EnConsult                  | 3                  | Roslyn Chapel, ventilation, de-humidification, model calibration  |
|                       | FHA                        | 1                  | Factory, natural ventilation  |
|                       | Schmidlin                  | 2                  | Double skin facade modelling approach   |
|                       | HLM                        | 1                  | Daylight simulation approach (Radiance)   |
|                       | Mike Whalley               | 2                  | Natural ventilation strategies/ interpretation (ESP-r)  |

| <i>Quarter</i> | <i>Company name</i> | <i>STDs</i> | <i>Summary</i>  |
|----------------|---------------------|-------------|---|
|                | Hulley and Kirkwood | 5           | QA procedure refinement<br>Hospital, overheating analysis<br>Advanced glazing, model building/ approach   |
|                | John Gilbert        | 1           | Simplified tools for architects – LT, etc.  |
|                | Chris Stewart       | 1           | Simplified tools for architects – LT, etc.  |
| Q1 2004 – Q9   | HLM                 | 3           | QA of simulation models (development of new procedures)<br>Update of systems with regard to QA mechanisms<br>Environmental impact assessment (Envest) |
|                | Hulley and Kirkwood | 2           | Data collection for in house use with simulation tools<br>Assistance with data sharing between different software tools, aiding QA                    |
|                | FHA                 | 1           | Software configuration on new hardware  |
|                | DASS                | 1           | Assisting user to configure software for use in different EU countries  |
|                | Rybka               | 1           | Assisting with use of simulation to aid company marketing strategy  |
| Q2 2004– Q10   | Muller              | 4           | Natural ventilation strategies<br>Modelling heat gains from people  |
|                | Rybka               | 1           | Final assistance with Waterloo Place project  |
|                | EnConsult           | 1           | Geometry input/ model building for thermal simulations  |
|                | GAIA Architects     | 3           | Abertay University, model building and assessment   |
|                | DASS                | 2           | Shopping centre modelling approach<br>Natural ventilation in office block   |
|                | ESRU                | 3           | Model building with ESP-r   |
|                | NRCan               | 1           | Modelling human interactions with building controls (ESP-r)   |
|                | CampbellPalmer      | 2           | Hardware configuration  |
| <b>TOTAL</b>   |                     | <b>125</b>  |   |