Scottish Energy Systems Group

Evaluating the project: 'Extension of the Scottish Energy Systems Group'

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Executive Summary

Eclipse Research Consultants have carried out a review of the operation of the project 'Extension of the Scottish Energy Systems Group' (SESG) which is run by the Energy Systems Research Unit of the University of Strathclyde. The project runs from 1 Jan 2005 to 30 June 2008. The main funders are the Scottish Executive through the Expertise, Knowledge & Innovation Transfer programme (SEEKIT) and Strathclyde European Partnership (a European Regional Development Fund.) Industry club members also make a small contribution to the costs. The University of Strathclyde provides premises and non-chargeable academic staff time as their in-kind contribution.

This Review was undertaken by means of a visit to the Group on 16 May 2008, which provided an opportunity for a formal presentation from the Director, Dr Jeremy Cockroft, for the Group's documentation and publications to be inspected, for a meeting with Professor Clarke, and for a round table focus group discussion conducted with four SME members of the Group. The Review compares the achievements of the SESG against the original proposals, and measures its outputs against the original quantified targets. Dr Cockcroft has kept detailed records of the operation of SESG since his arrival towards the end of 2005 and these were provided to us.

SESG is a business network club for SMEs, originally formed on 1 January 1999. Its primary aim is to transfer advanced energy and environmental modelling systems, and new knowledge, from academia into practice. This will help to address the challenge posed by sustainable development, and meet the requirements of the EU Energy Performance of Buildings Directive (EPBD). Its secondary aims include developing the competitiveness of the region's SMEs involved in the design of the built environment, investing in the Scottish knowledge-base, and enhancing the relationship between SMEs and higher education establishments.

Through its promotion of simulation modelling, 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 currently two members of staff – the Director and a Technical Officer. Until recently there were two other members of staff, one of whom has joined a specialist simulation modelling firm, IES, and the other who is now working for Samsung in Korea setting up a scheme similar to SESG. The shortfall in staff is made up by Research Assistants contributing to the programme on an ad hoc basis.

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 network club; a programme of its own seminars, workshops and training events, collaboration with other networks to promote training events, and 'supported technology deployments' in which a member of SESG staff spends time in a member organisation's offices assisting on a live project using IT tools. SESG has an attractive website, and a mailing list of about 300 contacts. A regular flow of notifications of events of interest, and invitations to its own events is sent to its members at a rate of about one email per fortnight.

Membership of the business network has been successfully maintained. New members are recruited at a rate of about one member per two months, although membership has not, as expected, grown to include companies involved in manufacturing and installation of building products. There is also a steady loss of members, and total membership remains relatively static at just over 30 members in total.

SESG has operated as proposed in terms of seminars, events and in-house support to organisations. The Group has promoted integrated modelling tools to support the EU EPBD. It has successfully

enlarged the capacity for knowledge transfer between the science base and industry and has exceeded its target for supporting innovation and knowledge transfer networks by 76%.

SESG has successfully organised a regular programme of events and has run 34 of them (compared with a target of 42). 174 different SMEs have attended these events, exceeding the target by a factor of three. The maximum attendance was 84 for a seminar on new Building Regulations, and total attendance across all 34 events is over 900.

SESG recognises that over the period of operation, commercial software has gained accreditation for use to demonstrate compliance with the Building Regulations more quickly than the SESG's own open software model ESP-r. Commercial software also offers more friendly interfaces. The use of ESP-r is likely to remain a niche market, therefore, with relatively few specialised users. For this reason the number of 'Supported Technology Deployments' (in which a member of SESG visits an SME to demonstrate how to use the software and to help embed the software in their business) is typically fewer than originally anticipated. SESG's records show 48 separate occurrences of 'low level' advice-giving (approx half-day duration), to 28 SMEs (compared to a target of 57). 20 medium-level Supported Technology Deployments were provided to 10 SMEs, compared with a target of 57. Six SMEs were provided with high level support (lasting about five days) compared with a target of 29.

SESG was, however, successful in attracting 18 new members, although the target was set at 39. One ambition had been to engage product manufacturers who supply advanced controls or smart building products that contribute to improved thermal performance of a building. However, there are relatively few such companies based in Scotland and membership did not expand in this direction.

Many of SESG's member organisations have invested in new products and services. 24 SMEs introduced new services (such as Radiance lighting analysis, Energy Labelling or Carbon Footprinting). This is an excellent achievement, although technically 14% below target. Similarly 14 SMEs have introduced new generic processes, such as lighting analysis, energy modelling and energy analysis; again this is a noteworthy achievement, although technically it represents only 25% of the target originally set. 10 new licensing deals between SMEs and the Science Base were struck (such as airflow modelling software); again this seems a good achievement, although it represents only 30% of the original target.

Mention should be made of SESG's contribution to Safety at Sea. This spin-out company from Strathclyde University initially focused on software to model the effect of collisions at sea. It is now working with two cruise liner companies to improve the efficiency of the hotel-type facilities on board. This is a previously overlooked area and SESG is helping the company by customising the ESP-r software to enable its use in analysing thermal performance of cruise liner accommodation.

If some targets have been missed, others have been considerably exceeded. To the end of the first quarter of 2008, the total value of increased investment in innovation and RTD by SMEs was approximately \pounds 2.29m, exceeding the target level by 53%. Sales increased in assisted businesses by \pounds 2.86m compared with a target of \pounds 2.04. 45 new jobs have been created, exceeding the original target number of 36 by 25%. And 85 jobs have been safeguarded, exceeding the original target of 35 by a factor almost three.

As an academic organisation, SESG has captured and promoted its experience in developing and offering simulation modelling to the international academic and practitioner community at key conferences, specifically Building Simulation 05 and Building Simulation 07.

A round table discussion with four SESG members revealed they are highly supportive of the achievements of SESG. These members confirm the contribution of SESG to their businesses success. They strongly believe there is a continuing need for SESG to support them through training and CPD, particularly in the light of new energy regulations, rising expectations from clients, new international projects in unfamiliar climates, and emerging renewable energy technologies.

1 Overview

Eclipse Research Consultants were asked to review and evaluate the operation of the project 'Extension of the Scottish Energy Systems Group' (SESG). SESG is an industry club or business network club for small and medium enterprises (SMEs). Its aim is to transfer advanced energy/environment modelling systems from academia into practice together with appropriate training. Ultimately this will benefit the design of new buildings and the refurbishment of existing ones, making them more energy-efficient and more comfortable for occupants, and improving social and economic outcomes while reducing environmental impact. A previous phase of the SESG ran from 2002 to 2004 and the current phase runs from 1 Jan 2005 to 30 June 2008.

This report covers the operation of SESG for the period 2005-2008. It gives a stand alone account, but further information about the background to SESG may be found in our 2004 report which covers the period of operation from 2002 to 2004.

2 Suitability of Eclipse Research Consultants to conduct this review

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, Eclipse 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.

Following the conclusion of that scheme, ESRU established the Scottish Energy Systems Group and Eclipse reported on its operation 2002-2004. Eclipse also reported to the Carbon Trust on the operation of the Low Carbon Design Initiative (LCDI) in Northern Ireland, which operated between 2003 and 2006.

3 Aims and operation of SESG

3.1 History and staffing

SESG has a considerable history, which is rehearsed in our 2004 review and assessment and is not repeated here. The present scheme is an extension of the scheme that ran 2002-2004 under the title 'Transferring Integrated Modelling Systems to Energy Sector SMEs'.

This present phase of SESG runs from 1 Jan 2005 to 30 June 2008 and follows a successful bid to the Scottish Executive Expertise, Knowledge and Innovation Transfer Programme (SEEKIT). European Regional Development Fund (ERDF) matched funding was provided by the Strathclyde European Partnership (SEP). SESG is run by the University of Strathclyde's Energy Systems Research Unit, and operates from the Faculty of Engineering's Department of Mechanical Engineering on the 3rd Floor of the James Weir Building in Montrose Street. It is overseen by Professor Joe Clarke.

As at early June 2008, there are two full time members of staff: - the Director, Jeremy Cockroft, and the Technical Officer Aizaz Samuel. Dr Cockroft took over as Director during 2006 from Dr Ian McDonald.

When Dr Cockroft arrived in 2006, there were three staff::

- Dr Jon Hand
- An Administrator
- Aizaz Samuel

The Administrator left during 2007 and the Director decided to replace her with a Researcher, Ya Liu, recruited from Heriot-Watt University. At the end of March 2008, Ya Liu resigned from SESG to join the specialist simulation modelling company IES, a company which is itself a spin-off from Strathclyde University and was set up about 20 years ago. Dr Hand left SESG in early 2008 to spend nine months in Korea working for Samsung in their modelling division setting up a scheme similar to SESG.

The successful moves of these two staff to prestigious specialist simulation modelling organisations, reflect well on the expertise contained with SESG. The moves left the Director and Aizaz Samuel as full time with SESG. The Director has brought in others – generally Research Assistants in the University – to support events and to develop ESP-r software.

3.2 Aims, objectives and operation

The project summary from the original application to SEEKIT is given in table 1.

Table 1 Project summary from original funding proposal to SEEKIT

The proposal is to expand the operation of the Scottish Energy Systems Group (SESG), which has assisted local companies to adopt IT systems for the design of low energy buildings. The SESG is predicated on the premise that such systems, in the form of integrated building performance assessment tools, provide an apt means to address the issues and challenges underlying sustainable development and, thereby, raise the competitiveness of construction-oriented companies. By treating all aspects of performance simultaneously (human comfort, indoor air quality, energy consumption, carbon emissions, environmental impacts etc), such tools address the inherent complexity while allowing new options to be easily assessed and compared. Also, by supporting inter-disciplinary working, these tools enable the formation of apt partnerships; this is an important new capacity in a sector that is SME dominated. The project is in line with an EU directive that calls for member states to introduce legislation prescribing the use of integrated modelling in new build projects and major refurbishments. The proposed activities will transfer significant new knowledge to local energy sector SMEs.

The specific proposal is to expand the SESG activities to include the following.

- 1) An expanded membership covering manufacturing and installation companies in addition to the engineering and architectural practices who presently participate.
- 2) The delivery of a continuous cycle of monthly seminars, program training events and in-house support activities designed to bring about the embedding of integrated modelling tools within member businesses.
- 3) Support for the use of integrated performance modelling tools in the context of the new EU Energy Performance of Buildings Directive, which will require buildings to be given operational and asset ratings based on the outputs from modelling.
- 4) Occupant focus groups to extract relevant messages for industry from those who will be impacted upon by the decisions taken on the deployment of energy efficiency and embedded renewable schemes.

The knowledge transfer activities comprise a continuous cycle of monthly seminars, program training events and in-house support activities designed to bring about the embedding of integrated modelling tools within member business. This delivery mechanism has been proven to be effective in the first phase of operation.

The intended operation of the scheme from the SEEKIT funding application is shown in table 2.

Table 2 SESG Operations as proposed

The present proposal is to continue the operation of the SESG and widen its activities to include the following.

- 1. An expanded membership to include manufacturing and installation companies in addition to the engineering and architectural practices who presently participate. Such companies will be required to produce the components and systems that underpin sustainable design.
- 2. The delivery of a continuous cycle of monthly seminars, program training events and inhouse support activities designed to bring about the embedding of integrated modelling tools within member businesses.
- 3. Support for the use of integrated performance modelling tools in the context of the EU's Energy Performance of Buildings Directive, which will require buildings to be given operational and asset ratings based on the outputs from modelling.
- 4. Occupant focus groups to extract relevant messages for industry from those who will be impacted upon by the decisions taken on the deployment of energy efficiency and embedded renewable schemes. The aim is to ensure that adopted schemes represent value proposition for citizens. How acceptable will clean small scale combined heat and power plant be if local air quality worsens and maintenance costs rise? How acceptable will the operational rating of buildings be if it lowers property values or reduces the incentive to invest?

For the purposes of this evaluation, we have drawn together the contents of table 1 and table 2 in order to report on:

- The formation and membership of the business network
- The delivery of seminars, training events and in-house support to companies
- Promotion of integrated modelling tools to support the Energy Performance of Buildings Directive
- The bringing together of occupant focus groups to extract relevant messages for industry.

A general description of the business network and its operation is given in section 4. Section 5 reports on the meeting of measurable targets.

3.3 Changes to the SESG operation during the period of support

Dr Cockroft explained that, compared with commercial software such as IES, TAS and Hevacomp, ESP-r is likely to remain a niche product. The academic team at ESRU does not expect to invest the time needed to create the equivalent simple interface of these commercial models. ESP-r is therefore more suited to those who wish to undertake highly detailed modelling and to see the code which enables this. In addition the commercial developers of models have invested heavily to gain accreditation for their models so that they can be used to undertake SBEM-type assessments to meet the requirements of the Building Regulations for non-domestic buildings.

The majority of busy practitioners who are members of SESG have moved towards commercial software and have also developed their skill in software usage. Having gained initial help and support from SESG to allow them to explore the various tools available, many now have a reduced need for Supported Technology Deployments (STDs) – although they continue to need updating in new developments, new technologies and new regulations. For this reason, SESG's focus is moving more towards the provision of CPD, seminars, and the general promotion of simulation in response to continuing demand. The number of STDs is expected to reduce.

4 General operation of SESG compared with original proposal

4.1 Formation of the business network, email list and expanded membership

At the beginning of the present scheme in 2005, SESG already had in place a business network. In Eclipse' 2004 report, we noted that 30 organisations were subscribers to SESG, paying an annual fee of £500. Between 2002 and 2004, this number had fluctuated between 25 and 35. Between 2005 and 2008 the membership system was continued. During this period there were 18 additions to the membership, but also some losses. As at May 2008, the current membership is 32, and includes 12 firms of consulting engineers, 6 firms of architects, 4 local authorities, and 10 other organisations. In terms of the objective to expand membership to include manufacturing and installation companies that produce components and systems, there is no evidence to suggest this has been successful. The only SESG members involved in manufacturing or contracting are Crown House(a specialist engineering contractor) and Ceratherm.

In addition to its set of paying members, SESG operates a mailing list of about 300 individuals and organisations who are sent regular emails announcing SESG events and seminars, as well as relevant events organised by other related business networks. The mailing list uses the academic Mailman system, and allows organisations to subscribe or unsubscribe to the list.

Key finding 1: Membership of the business network has been successfully maintained, but with a notable exception (compared with the original bid): membership has not expanded as anticipated to include companies involved in manufacturing and installation of specialised building products.

4.2 Delivery of monthly seminars, training events and support activities.

SESG has provided a regular programme of monthly seminars, training events and in-house support activities for SMEs fully in line with the proposal. The meeting of precise targets is described below in section 5.

Key finding 2: SESG has operated precisely as proposed in terms of seminars, events and inhouse support to organisations.

4.3 Promotion of integrated modelling tools to support new regulations

SESG has provided extensive support for the use of integrated modelling tools to support the Energy Performance of Buildings Directive in line with the originally stated objective. For example, during 2007, seven workshops took place in Scotland organised by BRE to provide training in the use of SBEM (the Standard Building Energy Model which will be used for assessing compliance with the Energy Performance of Buildings Directive at the design stage). These were signposted to SESG members and those on the mailing list. Four of these were organised jointly by with BRE Scotland and took place at the University of Strathclyde.

Key finding 3: SESG has operated precisely as proposed in terms of promoting integrated modelling tools to support the Energy Performance of Buildings Directive.

4.4 Occupant focus groups to extract relevant messages for industry

There is no evidence to show that this proposal has been acted upon in practice.

Key finding 4: SESG has not supported occupant focus groups.

4.5 Conclusions about the general operation of SESG

Overall, SESG has operated largely as envisaged. Specifically, SESG has supported a group of 32 organisations that form a business network, has provided training, and has helped them to share knowledge and experience. The continuous cycle of training events and seminars has been run as envisaged. A great deal of training of companies has been provided about how to meet the requirements of the forthcoming EPBD.

The exceptions are that membership has not been extended to manufacturers or installers of specialised building products, nor have occupant focus groups bringing relevant messages back to industry been formed.

Key finding 5: in general SESG has operated just as envisaged in the proposal, although membership has not expanded to the extent nor in the direction anticipated, nor have occupant groups been supported.

5 Comparison of measurable outputs and impacts against targets

5.1 Performance targets

Columns 1 and 2 of Table 3 below show information relating to the original application to SEEKIT. Section 12 of the application to SEEKIT identified the expected OUTPUTS and RESULTS, while section 13 of the application identified the IMPACTS shown. Column 3 of table 3 shows the actual figures recorded in the period up to 31 March 2008.

The figures in column 3 are as compiled by the Director of SESG, who keeps records of attendance at events, and also undertakes an informal quarterly telephone survey of SESG members in order to obtain the relevant data.

OUTPUTS	TARGET ¹	ACTUAL to 31 March 2008
Knowledge Transfer Capacity building.	1	1
No. of innovation/knowledge transfer networks supported.	29	44
No. of events held.	42	33
No. of SMEs attending events.	57	174
No. of SMEs helped with advice/information.	57	48
No. of new links between SMEs and Research Institutions.	39	18
No. of SMEs assisted.	57	20
No. of SMEs assisted with High Level support.	29	6
No. of SMEs undertaking Innovation/ R&D projects.	63	38
RESULTS		
Increased investment in Innovation/ RTD by SMEs.	£1,50m	£2.29m
No. of new patents issued/IPR registrations made.	0	0
No. of new products introduced.	29	24
No. of new processes introduced.	57	14
No. of new licensing deals between SMEs and Science Base.	35	10
No. of new spin-outs/SMEs formed.	2	0

Table 3 Measurable targets and achievements

¹ After a year of operation, the project was extended from 36 to 42 months and the figures given here are the enlarged targets for the 42-month period of operation.

IMPACTS		
Increase in sales in assisted businesses.	£2.04m	£2.86m
Total no. of gross new jobs.	36	45
Total no. of gross jobs safeguarded.	30	92

5.2 Knowledge Transfer Capacity Building

This is the purpose of the SESG and is fundamental to its existence and operation. It has been successfully achieved through the workshops and knowledge transfer network activities.

Key finding 6: SESG has successfully enlarged the capacity for knowledge transfer between the science base and industry.

5.3 No. of innovation/knowledge transfer networks supported.

These represent events that the SESG has engaged in and promoted to its members and mailing list, but not been responsible for running itself. 44 events have been supported in this way compared with a target of 25. These include events with the Construction Industry Environmental Forum (7-Dec-05), with the Chartered Institution of Building Services Engineers (7-Feb-06, 7-Mar-06, 29-Nov-06), with the Carbon Trust (28-Feb-06), and with the Energy Savings Trust (24-Oct-05). Numbers of delegates attending these supported networks are not recorded.

Key finding 7: SESG has exceeded its target for supporting innovation and knowledge transfer networks by 76%.

5.4 No. of SESG events held.

These are in-house SESG events. The target number was originally 36, one per month for the original 36 months of operation and was increased to 42 when the period of operation was increased from 36 to 42 months. 42. At the time of the review 33 had been held, with one more planned for June 2008, giving 34.

Key finding 8: SESG has successfully organised a regular programme of its own events. These total 34, although the target number was 42. This represents 81% of the target.

[Note: The total number of delegates was not one of the targets set. Nor were the records of delegates who attended events in 2005 provided to us. Nevertheless, it is possible to comment on the total number of delegates who will have attended. In the 12 events held during the 16 months between 1 January 2007 and 30 April 2008, a total of 349 delegates attended. Numbers of delegates varied between 3 (for an ESP-r workshop) and 84 for a seminar on the Building Regulations) and the average attendance per event was 29. If this figure is extrapolated to the 34 events, it suggests approximately 986 attendances.]

5.5 No. of SMEs attending events.

Detailed records are available from the first quarter of 2006. These show a total attendance of 141 SMEs from the period 1 October 2005 to 17 April 2008. The 13th financial claim to 31 March 2008 shows a total attendance of 174 SMEs implying that 33 SMEs attended during the first three quarters of 2005. This latter figure seems reasonable in the light of the other figures. We counted SMEs in the spreadsheet (for the period March 2006 to March 2008) and believe that the Group's figure of 174 SMEs is a true record of the number of different SMEs that have attended events.

Key finding 9: 174 SMEs have attended events compared with a target of 57; the target is exceeded by a factor of three.

5.6 No. of SMEs helped with advice/information.

One of the key services provided by SESG is Supported Technology Deployments or STDs. 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. Supported technology deployments assist members of the business network to adopt new technology. The level of support varies from half a day to five days or more.

The figure recorded against this target represents the number of SMEs who had 'low-level' supported technology deployments – that is half-day or one-day support. SESG records show that 48 low-level STDs were provided from the beginning of 2005 to 31 March 2008. Detailed records were given to us for the period from the third quarter of 2005 to 31 March 2008. These show that that 22 different organisations were supported during this period. Extrapolating to cover the period from 1 January 2005 to 31 March 2008 implies about 28 different organisations were supported.

The target number of SMEs to be supported is 57.

It is unclear whether the original target was intended to imply 57 different SMEs helped, or 57 occurrences of help being provided to SMEs. If the number of occurrences of help to SMEs was the target then the 48 compared with the target of 57 represents an achievement of 84% of the target. Conversely, if this target is interpreted as 57 different organisations, then the achievement of 28 represents exactly half the target.

Key finding 10: There are 48 occurrences of SESG providing advice to 28 SMEs. The target was 57 SMEs to be helped with advice or information. Depending on whether this was intended to represent occurrences of advice-giving or different organisations supported, the achievement represents either 84% or 50% of the target.

5.7 No. of new links between SMEs and Research Institutions.

This has been defined as new members joining the SESG: 18 new members were recruited to SESG compared with target of 39.

Key finding 11: 18 new members joined SESG compared with a target of 39. This represents 46% of the target.

5.8 Number of SMEs assisted,

Against this target have been recorded the number of medium-level supported technology deployments. The total number of these is 20 compared with a target figure of 57 which is 35% of the target figure. The 20 medium-level STDs were provided to a total of ten different organisations. If the original target was intended to imply 57 different organisations would be assisted, the achievement is only 18% of the target.

Key finding 12: 20 medium-level Supported Technology Deployments were provided to 10 SMEs. The target was 57 SMEs assisted at this level. If the target refers to different SME's the achievement is only 18% of the target, or 36% if the target refers to occurrences of assistance.

5.9 Number of SMEs assisted with High Level support

High level Supported Technology Deployments are defined as those lasting for 5 days or more. The target for this was 29. SESG records show that six high level STDs were provided between commencement and 31 March 2008. This represents 21% of the target.

Key finding 13: Six SMEs were provided with high level support compared with a target of 29: the achievement represents 21% of the target.

5.10 No. of SMEs undertaking Innovation/R&D projects.

SESG has defined this as SMEs acquiring new software. In the SESG records for the period from the fourth quarter of 2005 to the first quarter of 2008, 30 were recorded as doing so. In the 13th financial statement, the number achieved is given as 38, implying 8 did so during the first three-quarters of 2005. This number seems reasonable.

Examples of this activity include Buro Happold investigating use of the internet technologies for data collection, Hulley & Kirkwood taking on IES software, Assist Architects taking on daylighting software, and White Young Green taking on Hevacomp.

The original target for this was 55, so only 70% of the target has been met.

Key finding 14: 38 SMEs acquired new software capability compared with a target of 55.

5.11 Other outputs – Score project with Safety at Sea

As reported in section 6.1.4, SESG is working with in the development of simulation modelling software to assess the thermal efficiency of cruise liners. Comparable with hotels in many respects, these liners have to cope with a wider range of climatic conditions and SESG is customising a version of the ESP-r software to cope with these wider variations.

Key finding 15: One 'Other Output' is the support to the Score project with the company 'Safety at Sea' (described in section 6.1.4).

5.12 Increased investment in Innovation/ RTD by SMEs.

SESG has calculated this as a combination of:

- A investment by members of the business network in seminars and training associated with those attending SESG seminars and workshops
- B investment in initial training given to new employees.
- C investment made by taking on new employees
- D investment made by acquiring new software licences

It can be seen from this description that the calculation is based around a mix of known and estimated figures.

To the end of the first quarter of 2008, the total value of increased investment in innovation and RTD is calculated as $\pounds 2.29m$, as shown in table 4. The original target was $\pounds 1.50m$, so the target has been exceeded by 53%.

Description	Number	Value	Totals
Numbers at seminars	462	£250 per half-day	£115,500
Numbers at training courses	127	£500 per day	£63,500
Numbers of new employees requiring	45	£5,000 each for training	£225,000
training			
Number of new employees	45	£30,000 basic salarye	1,350,000
Number of new software tools acquired	30	£18,000 per software licence	£540,000
	TOTAL		£2,294,000

Table 4 Increased investment in innovation and RTD

Key finding 16: To the end of the first quarter of 2008, the total value of increased investment in innovation and RTD exceeded the target level by 53%.

5.13 No. of new patents issued/IPR registrations made.

The target number of this was zero.

Key finding 17: No new patents were anticipated and none has been made.

5.14 No. of new products introduced.

SESG has defined this as SMEs undertaking new services, such as energy labelling or daylighting calculations. In the SESG records for the period from the fourth quarter of 2005 to the first quarter of 2008, 24 were recorded as doing so.

Examples of this activity include Jacobs offering a Performance Assessment Analysis, Atkins offering a Radiance lighting analysis, Ryybka offering Energy Labelling, and Whye Young Green offering Carbon Footprinting.

The original target for this was 28, so 86% of the target has been met up to the first quarter 2008 and with one further quarter until completion of the project.

Key finding 18: 24 SMEs introduced new services (such as Radiance lighting analysis, Energy Labelling or Carbon Footprinting) compared with a target number of 28.

5.15 No. of new processes introduced.

SESG has defined this as SMEs undertaking new generic processes, such as simulation modelling. In the SESG records for the period from the fourth quarter of 2005 to the first quarter of 2008, 10 were recorded as doing so. In the 13th financial statement, the number achieved is given as 14, implying 4 did so during the first three-quarters of 2005. This number seems reasonable.

Examples of this activity include: Atkins deploying lighting simulation, Crown House and Enconsult each deploying Energy Modelling, Wallace Whittle taking on Energy Analysis, and the Campbell Palmer Partnership deploying Quality Assurance to support simulation modelling.

The target for this was 57, so only 25% of this particular target has been met.

Key finding 19: 14 SMEs have introduced new generic processes, such as simulation modelling; compared with the target of 57.

5.16 No. of new licensing deals between SMEs and Science Base.

In the SESG records for the period from the fourth quarter of 2005 to the first quarter of 2008, 7 instances of new licencing deals were recorded. In the 13th financial statement, the number achieved is given as 10, implying 3 did so during the first three-quarters of 2005. This number seems reasonable.

Examples of this activity include: Whitby Bird and Crown House licensing ESP-r, Buro Happold licensing Merit, and Atkins licensing Airflow modelling software.

The original target for this activity was 34.

Key finding 20: 10 new licensing deals between SMEs and the Science Base have been achieved (such as airflow modelling software) compared with a target of 34.

5.17 No. of new spin-outs/SMEs formed.

No new spin-outs or SMEs have been formed. The target was 2.

Key finding 21: No new spin-outs or SMEs have been formed, against a target of 2.

5.18 Increase in sales in assisted businesses.

SESG has maintained a spreadsheet that is used to calculate, quarter by quarter, an estimate of the increase in sales in assisted businesses. The spreadsheet is quite detailed and is based on three main components -A, B and C:

A Additional sales relating to new employees

- The number of new employees taken on (as surveyed)
- Their salary level (estimated)
- The value of their initial training (estimated)
- The number and value of further jobs taken on by the firm arising from its additional capacity (estimated)

B Sales of new software tools

The number of new software tools acquired (as surveyed)

• The value of licenses of new software tools (estimated)

C Sales arising from Supported Technology Deployments

- The provision of STDs to organisations (from SESG records)
- The value of sales to customers arising from STDs (estimated).

The calculation is based around a mix of known and estimated figures.

To the end of the first quarter of 2008, the total value of increase in sales from assisted businesses is calculated as $\pounds 2.86m$. This separates into:

	Item	Sales per individual item	Totals
А	45 new employees	annual sales per individual £50,000	£2,250,000
В	30 licenses	£18.000 each	£540,000
С	74 STDs	£1,000 each	£74,000
	TOTAL		£2,860,000

Key finding 22: The total value of increased sales from assisted businesses is $\pounds 2.86m$, exceeding the target of $\pounds 2.04$ by 40%

5.19 Total no. of gross new jobs.

Table 5 shows the number of gross new jobs created, quarter by quarter from the third quarter of 2005 to the first quarter of 2008. Prior to this a further 6 jobs were created, so the overall total is 45. The target number of new jobs anticipated in the original proposal was 36 and it can be seen that the target has been comfortably exceeded.

Oct-05	IES	1
Nov-05	IES	1
Dec-05	IES	1
Dec-05	ESRU	1
Jan-06	IES	1
Jun-06	Jacobs	2
Jun-06	Faber Maunsell	2
Sep-06	Jacobs	2
Dec-06	HLM	2
Mar-07	Rybka	2
Jun-07	BuroHappold	1
Sep-07	Pick Everard	1
Sep-07	BuroHappold	1
Sep-07	Jacobs	2
Sep-07	Faber Maunsell	2
Sep-07	WYG	1
Sep-07	Enconsult	1
Sep-07	WallaceWhittle	1
Sep-07	WhitbyBird	2
Dec-07	Arup	2
Dec-07	Jacobs	1
Dec-07	HLM	1
Dec-07	Hulley&Kirkwood	1
Dec-07	WallaceWhittle	3
Dec-07	WhitbyBird	1
Mar-08	Pick Everard	1
Mar-08	WYG	1
Mar-08	IES	1
	TOTAL	39

Table 5 Number of new jobs from October 2005

Key finding 23: The total number of new jobs at 45 exceeds the target by 25%.

5.20 Total no. of gross jobs safeguarded.

Table 6 shows the number of gross jobs safeguarded, quarter by quarter from the third quarter of 2005 to the first quarter of 2008. This is based on quarterly surveys undertaken by the SESG Director. The total number of jobs declared in the 13th financial statement is 92, implying 7 were created in the first three-quarters of 2005. This seems reasonable in the light of the later figures.

The target number of new jobs anticipated in the original proposal was 30 and it can be seen that the target has been exceeded by a factor of three.

Table 6 Number	of jobs	safeguarded	auarter l)v (warter
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Feb-06	IES	1
Mar-06	IES	1
Mar-06	RMJM	2
Jun-06	RMJM	1
Jun-06	Faber Maunsell	2
Sep-06	Jacobs	2
Sep-06	Rybka	2
Dec-06	Jacobs	2
Dec-06	HLM	6

Dec-06Atkins	1
Dec-06Crown House	2
Mar-07Safety at Sea	1
Jun-07Campbell Palmer	1
Sep-07Pick Everard	2
Sep-07Rybka	3
Sep-07BuroHappold	4
Sep-07Jacobs	3
Sep-07 Faber Maunsell	6
Sep-07HLM	1
Sep-07WYG	2
Sep-07Enconsult	3
Sep-07WhitbyBird	2
Dec-07Arup	2
Dec-07Campbell Palmer	1
Dec-07Jacobs	5
Dec-07HLM	2
Dec-07Hulley&Kirkwood	5
Dec-07WhitbyBird	2
Dec-07Max Fordham	2
Mar-08Pick Everard	2
Mar-08Jacobs	1
Mar-08 <mark>RSP</mark>	2
Mar-08 Faber Maunsell	6
Mar-08WYG	3
Mar-08Enconsult	2
TOTAL	85

Key finding 24: The total number of jobs safeguarded at 85 exceeds the target by a factor of almost three.

6 Meeting with SESG members

6.1 Round table discussion group

During my visit to SESG a meeting was organised at which I was able to meet four of the members of SESG:

- Kieran Dodworth of Safety at Sea Ltd
- David Thirlwell of Jacobs
- Tom Shearer of Atkins
- Bruce Elrick of Hulley & Kirkwood

6.1.1 Atkins

Tom Shearer said that Atkins in Glasgow has 120 staff across architecture, structural engineering and mechanical & electrical engineering. Formerly they did not have modelling capability but acquired the it through their links with SESG and adopted ESP-r. They have one dedicated person trained in its use and others in the firm are also starting to use it. As a result of acquiring the software, they have increased their fee income and won new work. They have even obtained consultancy work purely to undertake modelling. He believes that the training element has been important for the firm, although they may move across to commercial software in order to use SBEM capability – as both IES and Hevacomp have SBEM accreditation. He went on to explain that part of the motivation for this relates

to regulations that have to be met, including the Merton Rule whereby 10% of the energy in the building has to be generated by renewable sources on site. Comfort is also a driver for the use of simulation. And clients don't want inefficient buildings; this has a public relations dimension. Another area of work for Atkins is acting as technical advisers to clients (for example, a bank) and checking proposals prepared by others under the Private Finance Initiative. PFI projects have tight performance requirements for the delivery of comfort conditions, with the rental reduced if these conditions are not met. As part of a due diligence programme, ESP-r has provided the company with the capacity to check that the specification requirements will be met in practice. Another example of the use of ESP-r was for a project in the Middle East with a Spanish architect, where modelling was used to examine the effect of the sun-path on the building.

6.1.2 Hulley & Kirkwood

Bruce Elrick said that he had been the Teaching Company Associate taken on by Hulley & Kirkwood to promote the use of ESP company-wide. The need for simulation had expanded, particularly when the firm took on major hospital work and this necessitated moving to commercial software from TAS and IES. ESP is still used for CFD analysis. Their firm is keen to up-skill engineers to use simulation modelling rather than using dedicated modellers. They have recently taken on half a dozen building design engineers on placement from Strathclyde and are training them up. He himself has obtained accreditation as a Low Carbon Consultant via the CIBSE and is on the threshold of training up 20 employees. He believes that clients are primarily concerned with meeting regulations and the forthcoming Energy Performance Certificates will place new expectations on clients. He pointed out that there is no overheating check in the Building Regulations in Scotland so there is less often a need to make a thermal model of a building, although he concurred with the other three representatives that overheating and comfort issues do drive simulation. Offering simulation modelling is no longer just a matter of better public relations – it is increasingly expected by clients and particular important for international commissions such as those in hot climates.

6.1.3 Jacobs

David Thirlwell said that his firm used SESG more as a basis for training staff, rather than for accessing ESP-r as a tool. The firm has one dedicated person in the Glasgow, London and Leeds offices and they generally use commercial packages – IES and TAS. He confirmed their capacity to use these tools has enabled them to maintain their market position. He reported that interest in low energy design can go beyond simply public relations. He has two projects where a commercial tenant has asked him to assess costs and benefits of various renewable energy technologies over a 20-year payback period. The rise in capital cost has contributed to an increase in fees, although one client has been willing to pay extra fees for the extra service to be provided. In relation to Low Carbon Consultants, his firm has six staff accredited. Among the specialist commissions requiring simulation modelling, his firm has used CFD for analysing smoke movement, and also for assessing heat dissipation in the Dublin Metro and London Underground.

6.1.4 Safety at Sea

Safety at Sea is a spin-out company from Strathclyde University and whose clients are owners of cruise liners. Initially the company focused on software to model the effect of collisions at sea in terms of ship stability. It then moved to looking at means of escape in case of fire. Cruise liners are like floating hotels and while ship propulsion is a well-research area, energy efficiency standards in the passenger accommodation areas are poor and energy usage is high. Safety at Sea are engaged now in advising on how to improve energy efficiency. Simulation modelling offers opportunities but, compared with simulation of buildings, many issues are raised such as different ambient temperatures, wind speed and direction, and movement of the vessel relative to the sun. Some building technologies are unsuited to the unstable conditions on board ship.

Kieran Dodworth reported that the company is using ESP-r to look at energy conservation possibilities. For them ESP-r as open source code is ideal because of the possibility of customising it for this sort of unusual project type. A key benefit for them has been in marketing. It is very difficult

to win commissions from cruise liner companies, but his company has promoted their capacity to offer simulation modelling as an specific selling point and has won consultancy work as a direct result. This has enabled them to take on a dedicated energy modeller.

Key finding 25: A round table discussion with a selection of SESG members revealed they are highly supportive of the achievements of SESG. These members confirm the contribution of SESG to their businesses success.

6.2 Is there a continuing need for SESG?

At the review meeting on 16 May, Professor Clarke identified the following as evidence of a need for SESG to continue beyond June 2008:

- New entrants to building engineering need support in the use of simulation modelling tools
- There is growing interest in the integration of renewable energy technologies into buildings, specifically encouraged by the implementation of 'the Merton Rule' and this will demand tools that enable performance to be predicted and cost-benefits analyses to be undertaken
- The regulatory environment is changing with expectations for higher standards and increasingly complex tools needed to demonstrate these standards are being met

In a telephone survey after the meeting, we asked each of the four SESG members whether they considered there is an on-going need for continuation of the Group. All were convinced there is such a need and were enthusiastic to see SESG continue. The following comments were made

- Kieran Dodworth said that the work his organisation is doing to assess performance of ships that are in effect like floating hotels (i.e. a type of building) was not a natural area for him and he greatly welcomed the customising of the ESP-r software to allow them to undertake the type of analyses that it enabled. Safety-at-Sea's only alternative would be to approach IES, who would almost certainly regard them as a small and insignificant customer. They are committed to ESP-r and need to work with an academic institution and for them the fact that it is Strathclyde is idea. They will certainly continue to maintain their membership of SESG.
- David Thirlwell said he considered SESG very useful for the training it provides and the courses it runs. Jacobs regularly sends both graduates and principal engineers to SESG for training and he believes they have been represented at every, or almost every, event run by SESG. He finds these particularly usefully for keeping up with innovations in simulation technology. And the firm then runs in-house training sessions to cascade the SESG-information through the company.
- Bruce Elrick said that SESG has facilited the knowledge acquistion by the firm. Specifically, although they do not use the ESP-r software, they believe that SESG keeps them updated on other key topics and issues. He quoted an example of a seminar about achieving an A-rated building under the EU Energy Performance of Buildings Directive, and another which reviewed whether electric heating was still a technology of last resort.
- Tom Shearer was equally enthusiastic as the other three interviewees about the need to continue SESG. SESG has kept his company abreast of developments in simulation modelling and energy conservation measures. His firm continues to be a user of ESP-r and he believes that the transparency it provides and the potential for customising it, makes it an excellent teaching aid. It forces the user to think deeply about the phenomena being analysed and therefore has a strong educational function. He believes that the SESG brings intellectual awareness to the practical problems he faces in the industry. For his engineers it is highly valuable to be working alongside academic building physicists in the development of new software code to solve new problems.

Key finding 26: The members of SESG who were interviewed by telephone confirmed that they strongly believe there is a continuing need for SESG to support them through training and CPD, particularly in the light of new energy regulations, rising expectations from clients, new international projects in unfamiliar climates, and emerging renewable energy technologies.

7 Disseminating best practice in simulation modelling to the international community

SESG continues to contribute to the international community of organisations involved in simulation modelling. The following sections list papers to the Building Simulation 05 Conference in Montreal, Canada, and the Building Simulation 07 Conference in Beijing, China.

7.1 ESRU papers in Building Simulation '05. Montreal, Canada

INTEGRATION OF CONTAMINANT BEHAVIOUR PREDICTION WITHIN WHOLE BUILDING SIMULATION Samuel, A. A.; Strachan, P. ASSESSING THE TOTAL ENERGY IMPACT OF OCCUPANT BEHAVIOURAL RESPONSE TO MANUAL AND AUTOMATED LIGHTING SYSTEMS Bourgeois, D.; Reinhart, C.; Macdonald, I. A.

IMPROVING THE DATA AVAILABLE TO SIMULATION PROGRAMS Hand, J. W.; Crawley, D. B.; Donn, M.; Lawrie, L. K.

CONTRASTING THE CAPABILITIES OF BUILDING ENERGY PERFORMANCE SIMULATION PROGRAMS Crawley, D. B.; Hand, J. W.; Kummert, M.; Griffith, B. T.

ENCAPSULATION OF VALIDATION TESTS IN THE ESP-r SIMULATION PROGRAM Strachan, P. A.; Kokogiannakis, G.; Macdonald, I. A.

SIMULATION-BASED ASSESSMENT OF THE VIABILITY OF FUTURE HEAT AND POWER SOURCES FOR THE UK DOMESTIC SECTOR Kelly, N.

QUALITATIVE ANALYSIS ON THE USEFULNESS OF PERCEPTUALIZATION TECHNIQUES IN COMMUNICATING BUILDING SIMULATION OUTPUTS Prazeres, L.; Clarke, J. A.

SIMULATION-BASED DESIGN PROCEDURE TO EVALUATE HYBRID-RENEWABLE ENERGY SYSTEMS FOR RESIDENTIAL BUILDINGS IN KOREA Clarke, J. A.; Hong, J.; Kim, J.; Strachan, P.; Hwang, I.; Lee, H.

THERMAL MASS, INSULATION AND VENTILATION IN SUSTAINABLE HOUSING - AN INVESTIGATION ACROSS CLIMATE AND OCCUPANCY Tuohy, P.; McElroy, L.; Johnstone, C.

TRANSFERRING SIMULATION FROM SPECIALISTS INTO DESIGN PRACTICE Macdonald, I. A.; McElroy, L. B.; Hand, J. W.; Clarke, J. A.

7.2 ESRU papers in Building Simulation '07. Beijing, China

IMPACT OF USING DIFFERENT MODELS IN PRACTICE - A CASE STUDY WITH THE SIMPLIFIED METHODS OF ISO 13790 STANDARD AND DETAILED MODELLING PROGRAMS

G Kokogiannakis, J Clarke, P Strachan

THE EFFECT OF EXTERNAL SURFACE PROPERTIESON THE THERMAL BEHAVIOUR OF A TRANSPARENTLY INSULATED WALL D Heim, P Klemm, P Strachan

A MULTI-CRITERIA PERFORMANCE STUDY OF AN INTEGRATED DEMAND/SUPPLY ENERGY SYSTEM FOR LOW AND ZERO CARBON TECHNOLOGIES WITHIN DOMESTIC BUILDING DESIGN J Kim, J Clarke, J Hong, C Johnstone, P Strachan, I Hwang, H Lee

A WINDOW OPENING ALGORITHM AND UK OFFICE TEMPERATURE: FIELD RESULTS AND THERMAL SIMULATION HB Rijal, P Tuohy, F Nicol, MA Humphreys, J Clarke

COMFORT DRIVEN ADAPTIVE WINDOW OPENING BEHAVIOR AND THEINFLUENCE OF BUILDING DESIGN P Tuohy, HB Rijal, MA Humphreys, JF Nicol, A Samue, J Clarke

CFD ASSESSMENTS WITHIN STRONGLY TRANSIENT DOMAINS A Samuel, J Hand

SIMULATION-BASED PERFORMANCE ASSESSMENT OF SLIT-TYPE VENTILATION SYSTEM FOR DOMESTIC BUILDINGS IN KOREA I Yook, D Kim, Y Jung, J Kang, S Lee, J Kim

DELIVERING BUILDING SIMULATION INFORMATION VIA NEW COMMUNICATION MEDIA L Prazeres, J Clarke, J Hand, J Kim

THE ROLE OF DSM+C TO FACILITATE THE INTEGRATION OF RENEWABLE ENERGY AND LOW CARBON ENERGY TECHNOLOGIES WITHIN BUILDINGS J Clarke, J Hong, C M Johnstone, NJ Kelly

BUSINESS SUCCESS THROUGH PROCESS BASED APPLICATION OF SIMULATION L McElroy, J Cockroft, J Hand

Key finding 27: SESG has captured and promoted its experience in developing and offering simulation modelling to the international community at key conferences, specifically Building Simulation 05 and Building Simulation 07.

8 Summary of key findings including achievements against targets

The key findings of this review in terms of the meeting of targets are as follows:

1. Membership of the business network has been successfully maintained but, with a notable exception, has not expanded as anticipated to include companies involved in manufacturing and installation.

- 2. SESG has operated as proposed in terms of seminars, events and in-house support to organisations.
- 3. SESG has operated as proposed in terms of promoting integrated modelling tools to support the Energy Performance of Buildings Directive.
- 4. SESG has not supported occupant focus groups.
- 5. In general SESG has operated just as envisaged in the proposal, although membership has not expanded to the extent nor in the direction anticipated. nor have occupant groups been supported.
- 6. SESG has successfully enlarged the capacity for knowledge transfer between the science base and industry.
- 7. SESG has exceeded its target for supporting innovation and knowledge transfer networks by 76%.
- 8. SESG has successfully organised a regular programme of its own events. These total 34, although the target number was 42. This represents 81% of the target.
- 9. 174 SMEs have attended events compared with a target of 57; the target is exceeded by a factor of three.
- 10. In terms of the number of SMEs helped with advice or information, SESG's records show 48 separate occurrences of 'low level' advice giving (approx half-day duration), to 28 or 29 SMEs. Depending on whether the original target was intended to represent occurrences of advice-giving or different organisations supported, the achievement represents either 84% or 50% of the target..
- 11. In terms of new links between SMEs and Research Institutions 18 new members joined SESG compared with a target of 39. This represents 46% of the target.
- 12. 20 medium-level Supported Technology Deployments were provided to 10 SMEs. The target was 57 SMEs assisted at this level. If the target refers to different SME's the achievement is only 18% of the target, or 36% if the target refers to occurrences of assistance.
- 13. Six SMEs were provided with high level support compared with a target of 29: the achievement represents 21% of the target.
- 14. 38 SMEs acquired new software capability, compared with a target of 55.
- 15. The target for Other Outputs was 1 and this has been achieved through support to the company Safety at Sea.
- 16. To the end of the first quarter of 2008, the total value of increased investment in innovation and RTD was approximately £2.294m, exceeding the target level by 53%.
- 17. No new patents were anticipated and none has been made.
- 18. 24 SMEs introduced new services (such as Radiance lighting analysis, Energy Labelling or Carbon Footprinting) compared with a target number of 28.
- 19. 14 SMEs have introduced new generic processes, such as simulation modelling; but this compares with a target of 57.
- 20. 10 new licensing deals between SMEs and the Science Base have been achieved (such as airflow modelling software) compared with a target of of 34 instances.
- 21. No new spin-outs or SMEs have been formed, against a target of 2.
- 22. The total value of increased sales from assisted businesses is £2.86m, exceeding the target of £2.04 by 40%.
- 23. The total number of new jobs is 45 and exceeds the target by 25%.

- 24. The total number of jobs safeguarded at 85 exceeds the target of 35 by a factor of almost three.
- 25. A round table discussion with a selection of SESG members revealed they are highly supportive of the achievements of SESG. These members confirm the contribution of SESG to their businesses success.
- 26. The members of SESG who were interviewed by telephone confirmed that they strongly believe there is a continuing need for SESG to support them through training and CPD, particularly in the light of new energy regulations, rising expectations from clients, new international projects in unfamiliar climates, and emerging renewable energy technologies.
- 27. SESG has captured and promoted its experience in developing and offering simulation modelling to the international community at key conferences, specifically Building Simulation 05 and Building Simulation 07.