



User-centred design for energy efficiency in buildings

COMPETITION FOR SANDPIT PARTICIPANTS

OCTOBER 2009

The Technology Strategy Board is calling for individuals to take part in a five-day 'sandpit' to explore the challenge of reducing the demand for energy in non-domestic buildings.

Participants from the buildings industry and experts in human factors and user-centred design will work together to create ideas for collaborative research projects that have business potential.

We have allocated up to £2m to fund projects that arise from the sandpit.

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Summary

We are inviting applications to attend an interactive workshop (sandpit) to generate and develop innovative approaches to energy efficiency in new and existing non-domestic buildings, through human factors research and user-centred design.

The focus of the sandpit is to create ideas for projects that have the potential for commercial value. The five-day sandpit will be held at Bailbrook House near Bath on 15-19 March 2010. We have allocated up to £2m to fund industry-led collaborative research arising from the sandpit.

The challenge of reducing the amount of energy used in buildings requires an innovative and multidisciplinary approach. The aim of this sandpit is to bring together a varied group of up to 30 individuals from industry and academia to work together to develop collaborative research proposals. The sandpit will result in the Technology Strategy Board committing funding 'in principle' for consortium research projects developed by the participants.

We welcome applications from industry and academia, and from practitioners in the built environment and experts in user-centred design. Applicants from industry

should ensure that their companies are ready, willing and able to engage in a collaborative project before applying.

What is the challenge?

Society faces a major challenge. Experts have estimated that it would require the resources of three planet Earths to replicate developed countries' patterns of consumption and production worldwide. This is not sustainable. In view of this, the UK Government has committed to an 80% reduction in carbon dioxide emissions by 2050. Within the UK some of the largest environmental impacts come from buildings: 45% of all CO₂ emissions are from buildings; 18% are from non-domestic buildings including offices, schools, hospitals and airports. We will not achieve our carbon reduction targets without reducing the amount of energy used in buildings.

Technology on its own is not the solution to reducing energy consumption. For example, office buildings typically use twice the amount of energy that they were designed to. One reason for this is that humans interact with buildings in ways that designers and manufacturers do not allow for, leading to higher energy use than expected.

Examples of where technical solutions fail to reduce energy use or produce unexpected adverse outcomes include:

- when we improve the insulation of homes, occupants generally choose to enjoy greater comfort rather than lower energy bills
- when automatic systems fail to create a comfortable environment, occupants may intervene: for example, by propping open fire doors to create a draft, or manually closing vents to prevent one. Studies have found that occupants can tolerate higher wind speeds over exposed skin when they have control over their environment: for example, by opening windows to create a draft rather than from air conditioning
- in offices where each room has an individual air conditioning controller, occupants may adjust the temperature settings up and down as often as every 20 minutes in an attempt to stay comfortable, never allowing the system to reach a stable condition. These controls are failing to communicate how the system works
- studies have shown that in housing designed to use low levels of energy, the potential benefits are seriously compromised by the use of more electrical appliances such as tumble dryers, tropical fish tanks and plasma TVs
- post-occupancy evaluations of modern schools show that complex systems mean maintenance staff cannot easily keep new technologies running. In one case staff could not manage the biomass boiler, and the school resorted to using energy-intensive mobile electrical heaters and air conditioners for many months of the year
- as the climate changes, provision of large scale air conditioning at 21°C may be excessively cooling if our cultural codes of acceptable business dress change to shorts and t-shirts.



Creating buildings and technologies that require people to give up their levels of comfort and control has not worked. On paper it may look as if these energy-efficient buildings would use less energy but in practice the occupants manage to reach the comfort levels they desire, often by modifying systems and using the building in unforeseen ways.

Why non-domestic buildings?

Non-domestic buildings include offices, schools, colleges, healthcare and commercial sites, airports, courtrooms, conference facilities and hotels. These present a particular challenge in reducing energy consumption, but also a real chance for better management.

Energy use in non-domestic buildings is affected by the design and usability of technology, and also by the complex interplay between various parties who have their own roles and motivations. Facilities managers can play a major role

in improving energy efficiency but they are challenged by powerful behaviour patterns from others. Consider the situation where a building owner rents out office space to one or more companies. There are four interacting groups whose motivations and decision-making affect energy efficiency:

- The building owner leases heated and lighted space for a flat fee. In this case, he pays the energy bills and employs a facilities manager to maintain the building but has no control over behaviours by occupants that might affect energy use.
- The companies that rent the space are employers whose priority is to maintain productivity and safety in the workplace for their staff. They may also wish their company to be a low-energy consumer but have no control over managing the facilities.
- The facilities manager is responsible for managing the systems in the building to provide safety, cleanliness and comfort for the occupants. He must also liaise

with the companies who lease the space where their activities affect his ability to run the building.

- Occupants have little knowledge of the energy being used and so have little sense of responsibility to minimise it. Their behaviours tend to seek comfort, ease of use, functionality and convenience.

No one group can make the building perform in an energy-efficient way. There is therefore the potential for large energy savings if we can understand the motivations and decision-making of these interdependent groups, and find solutions where they can all work to reduce energy use.

Where are the business opportunities?

We believe that a greater understanding of user–building interactions offers opportunities to develop commercial benefits while delivering a better working environment and lower emissions of CO₂. The focus of the sandpit is to create ideas around user-centred design with commercial potential for business. Examples of potential outcomes from the sandpit include:

- development of innovative products and services
- new routes to market
- new business models
- more satisfied customers, clients and occupants
- increased demand for human factors expertise
- meeting emissions reduction targets.

More expertise in human factors research and user-centred design is needed in engineering consultancies, product manufacturers, building designers, facilities management companies and others. User behaviour is widely considered to be either common sense or too complex to deal with; however, there are behaviours that are highly predictable and possible to model, and that can be used to develop and improve products and services. Building these skills will open additional markets.





Why a sandpit?

The sandpit is an intensive, interactive and free-thinking environment where a diverse group of participants from a range of disciplines and backgrounds get together for five days – away from their everyday worlds – to immerse themselves in creative problem-solving. The concept of a residential sandpit for creative problem-solving has been successfully pioneered in the UK by the Engineering and Physical Sciences Research Council (EPSRC) and has proved to be an effective way of getting people new to the challenge area to generate new and unexpected ideas, and to convert them into exciting projects.

Sandpits are a different funding mechanism to our usual collaborative R&D competitions. In the case of the sandpit, you apply to participate in the five-day event as an individual with an interest in the area. Getting into the sandpit is competitive, and once your place has been secured it is not transferable to anyone else. At the sandpit you will work with the other participants to explore and shape ideas to produce exciting collaborative proposals. You should not restrict your vision to preconceived solutions, but come with an open mind to develop new ideas with the people you meet at the event. Genuinely novel approaches tend to come from open-ended discussions between people who work in very divergent fields.

How will the sandpit work?

The sandpit will run over five days, and participants are required to attend for the full five days. The sandpit will be led by a director whose role is to assist in defining the topics and aid facilitated discussions at the event. The director will be joined by several mentors who will take full part in the sandpit; however, they will not be eligible to receive research funding so will act as impartial peer reviewers.

The sandpit process can be broken down into the following stages:

- defining the scope of the challenges
- evolving common languages and terminologies among people from different backgrounds and disciplines
- sharing understandings of the challenges, and the expertise brought by the participants to the sandpit
- taking part in break-out sessions focused on the challenges, using creative-thinking techniques
- capturing the outcomes in the form of ideas for highly innovative research projects.

At the sandpit, groups of participants will form around various ideas that are generated during the week. These self-formed groups will then develop projects for funding that will be peer reviewed and 'agreed in principle' on the final day, up to the limit of the available funding. Participants will convert the projects agreed in principle into written proposals; these will then be assessed by

the director and mentors within a specified time. Details of this process will be given to participants at the sandpit. The intention is that projects agreed at the sandpit will receive funding after review, unless the project has changed significantly from the proposal developed during the sandpit.

Who should apply?

Having the right mix of participants influences the success or failure of such an event. We require individuals from a broad range of disciplines, and applicants should not feel limited by conventional perceptions; the whole sandpit approach is about bringing people together who would not normally interact.

We encourage both practitioners and experts to apply. 'Practitioners' are individuals working in the buildings industry. By 'experts' we mean individuals who are experts in energy efficiency, user-centred design and human factors, drawn from commercial companies and academia. Practitioners and experts will work together for five days to explore the challenge and develop solutions.

In the practitioner camp, we welcome applications from individuals with an understanding of the challenge and those whose companies will be able to exploit the solutions generated. For example, manufacturers, property owners and managers, utilities, clients, facilities managers, buildings services companies, designers, architects and engineers.

In the expert camp, we welcome applications from individuals from commercial or academic sectors with expertise in the following areas: design, psychology, social science, ergonomics, engineering, architecture, arts and humanities, action research, user-centred design, customer-focused products, human factors, human-computer interaction, consumer testing and post-occupancy evaluation.

We welcome suitable individuals from all levels within industry, business and academia. You should obtain the support of your employer before applying and ascertain the appetite in your organisation for R&D activity in this area. Commonly, commitment to fund specific projects developed at the sandpit is obtained on the fourth and fifth days through phone calls and emails to budget holders within the participating companies.

Where and when will the sandpit take place?

The sandpit will be held on 15-19 March 2010 at Bailbrook House, near Bath. By applying to participate you are committing to attend for the full five days.

The workshop environment will encourage free and open-minded thinking, which is vital for the purposes of this event. There will be ample facilities for relaxing and recharging, such as a swimming pool, sauna and gym.

We will meet the costs for accommodation, breakfast, lunch and dinner. Participants must meet all travel expenses and incidental costs.

What about intellectual property?

It is essential that you can share your ideas freely at the sandpit to explore business opportunities and future collaborations, so all participants will need to sign a confidentiality agreement before attending. This is to protect existing intellectual property and to enable participants to fully disclose expertise and capabilities at the event.

How will we assess applications?

Applications will be considered by a selection panel comprising the sandpit director and mentors, Technology Strategy Board staff and an assessment specialist. Up to 30 participants will be chosen to take part in the sandpit. To ensure a mix of expertise, experience and personal qualities the selection panel will look for evidence of the following:

- individual expertise that will significantly add value
- indications of an open, flexible and creative outlook
- the ability to work constructively and positively with others – the stamina and relish to engage with strangers intensively over five days away from the familiarity and comfort of office or home
- the ability to communicate your expertise and ideas to those from other sectors
- the commitment and capability of your organisation to meet the challenge.

Please note that because of the large number of applications expected, we will not be able to give individual feedback to unsuccessful applicants.

What funding is available?

We have allocated up to £2m to fund collaborative research and development projects arising from the sandpit, that address the challenge indicated above and involve science-to-business or business-to-business interactions. We usually fund up to 50% of the total cost of a project.

Additional funding from the EPSRC may be available for projects where there is a significant high-quality academic component and that demonstrate added value to the EPSRC portfolio, by building on or complementing existing research programmes.

This competition builds on the momentum generated by the 'People, Energy and Buildings' competition, in which the Research Councils' Energy Programme and EDF Energy are jointly investing £4m in collaborative research on the social, economic and technical aspects of the energy efficiency of buildings. The similar timing of these complementary initiatives should help to build expertise in the UK in this area.



How to apply

You can download an application form, the guidance for applicants and the confidentiality agreement form from the Current Competitions area of the Technology Strategy Board website at www.innovateuk.org/deliveringinnovation/forthcomingcompetitions.ashx. By submitting an application form you are agreeing in principle to the confidentiality agreement. If you have any queries about this agreement, email Fionnuala.costello@tsb.gov.uk.

In the application form you should convince us that you have the suitable skills and attitude to participate in the sandpit. The completed application form should be no longer than two pages. No other documents will be accepted. When completed, upload your application to the Competitions area of our website.

The deadline for applications is Thursday 17 December at midday. We will not consider late submissions.

We will inform you of the result of your application by 29 January 2010. If selected to participate in the sandpit, the details from the first page of your application form will be made available to other participants to facilitate networking at the event. You will need to sign and send us the confidentiality agreement before you arrive. This agreement is available to download now.

Background reading list

The Royal Society for the encouragement of Arts, Manufactures and Commerce has provided the following reading list on user-centred design:

- Dan Ariely, 2009, *Predictably Irrational*. Chapter 6: 'The Problem of Procrastination and Self-Control'
- Defra, 2008, *A Framework for Pro-environmental Behaviours*. Executive Summary. www.defra.gov.uk/evidence/social/behaviour/documents/behaviours-jan08-report.pdf
- BJ Fogg, 2003, *Persuasive Technology*. Chapter 3: 'Computers as Persuasive Tools'
- Don Norman, 2002, *The Design of Everyday Things*. Chapter 1: 'The Psychopathology of Everyday Things'
- Richard Thaler and Cass Sunstein, 2009, *Nudge*. Chapter 5: 'Choice Architecture'

Further information

Further information about this challenge, a discussion forum and a blog are available at www.peopleinbuildings.ning.com

For more information about this and other competitions and details of how to apply, see Current Competitions at www.innovateuk.org

Further information about our Low Impact Buildings Innovation Platform is available at www.innovateuk.org under Innovation Platforms.

Competition helpline:
01355 272155

Email:
competitions@tsb.gov.uk

Publicity

The Technology Strategy Board frequently publicises the results of competitions and this includes engagement with the media. All applicants will be given a chance during the competition process to opt out of any publicity. Willing applicants will be asked to provide an agreed form of words for use in publicity material. E-mail pressoffice@tsb.gov.uk with any queries.

Key dates

Competition opens	13 October 2009
Deadline for receipt of applications	17 December 2009, midday
Decision to applicants	29 January 2010
Sandpit	15-19 March 2010



The Technology Strategy Board is a business-led executive non-departmental public body, established by the Government. Its role is to promote and support research into, and development and exploitation of, technology and innovation for the benefit of UK business, in order to increase economic growth and improve quality of life.

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