

# IESD

## Institute of Energy and Sustainable Development

Climate change, and the impact it will have on our lives, is one of the greatest problems facing mankind. The UK is at the forefront of global efforts to reduce the emission of greenhouse gases, and strategies for adapting to the global warming that will inevitably occur are being developed. The Institute of Energy and Sustainable Development (IESD) plays an important role in this by working to reduce energy consumption in buildings; to develop and apply renewable energy systems; to understand the social, economic and technical implications of climate change; and to educate current and future generations of the need to develop more sustainably.

The IESD's research work is conducted by a team of professors, readers, lecturers and research fellows – supported by higher degree students – who are internationally respected for the quality of their work. Their disciplines range from mathematics and physics, through engineering, to economics, sociology and psychology. This diverse range of skills enables staff to lead multi-disciplinary, multi-university projects and address inter-linked environmental, economic and social problems.

Their expertise enables IESD staff to:

- Provide strategic advice to central government departments and to regional and local policy makers and planners
- Act as environmental design consultants to architects and engineers working on architecturally significant and award-winning buildings both in the UK and overseas
- Offer advice to numerous small businesses and local authorities who are seeking to adopt more sustainable business practices.

The IESD provides a high quality environment for doctoral study and its Master's programmes cater for a wide range of graduates and professionals wishing to increase their knowledge of environmental issues in an interdisciplinary context or to work more effectively as building design professionals.

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Institute of  
Energy and Sustainable Development



# IESD

## Research

- Urban energy management and policy
- Simulation of buildings and energy systems
- Low and zero carbon technologies for heating, cooling, ventilation and lighting
- Multi-disciplinary research into socio-technical issues
- Behavioural and social factors of climate change



# IESD Research

Success is based on research excellence and a common commitment to the Institute of Energy and Sustainable Development's (IESD) mission:

*The mission of the IESD is to make a worthwhile and significant contribution to sustainable development through research, consultancy and education provision of the highest standards. The Institute's work focuses on the clean, efficient use of energy in the built environment and developing ways in which greater use can be made of renewable energy in the built environment.*

## Areas of research

Research projects span the range from basic research and the modelling of fundamentals, through community, city and regional sustainable development, to national and international energy policy work. In recent years the Institute's research has been in four main areas:

### Low and zero carbon technologies

Investigation into energy efficiency techniques and both active and passive building-integrated energy technologies. Supported by computer simulation, laboratory experiments and full-scale performance monitoring, specific research topics include:

- Daylighting and visual comfort
- Hybrid ground source heat pumps
- Passive draught evaporative cooling
- Technology for coping with extreme weather events
- Cybernetic model of human thermal comfort
- Solar air systems for ventilation preheating.

### Urban energy management

Development of tools for urban scale management of carbon emissions including mechanisms by which the non-technical barriers to sustainable development might be overcome. Sample projects include:

- Mapping of city-scale carbon footprints
- Design and monitoring of low-energy domestic and commercial buildings
- National and regional scale carbon emissions modelling
- Developing planning guidance for local authorities
- Social and psychological benefits of urban green space.

### People and climate change

Research into individual action, communication and climate change awareness. The growing research portfolio in this field includes projects on:

- Assessment of domestic energy information systems
- City-scale carbon management and the impact of individual carbon trading schemes
- Social and psychological barriers to low-carbon living
- The acceptability of renewable energy technologies.

### Simulation systems

Development of models, simulation systems, analysis methods, building control strategies and data collection techniques that underpin the above research areas. Examples include:

- Prediction of energy demands in buildings
- Simulation of renewable energy technologies
- Modelling human occupancy factors in naturally ventilated buildings
- Cybernetic model of human thermal comfort.

## Research collaboration

Collaborations with other universities bring together a community of researchers with a wide range of experience and expertise, and the facilities to tackle large scale issues.

Two major research projects are:

### • Carbon Reduction in Buildings (CaRB)

A multi-disciplinary consortium of five universities, led by the IESD, to produce computer models that pinpoint effective ways of cutting emissions arising from energy use in buildings. CaRB is the largest project in the Carbon Vision Building Programme funded by the EPSRC and the Carbon Trust

### • Measurement, Modelling, Mapping and Management (4M)

A consortium of four universities, led by the IESD, and funded under the EPSRC SUE2 programme, to produce an evidence-based methodology for understanding and shrinking the urban carbon footprint, paying particular attention to carbon sequestration, buildings, transport and individual carbon quotas.

Membership of other consortium projects includes:

- Faraday Partnership – the Integration of New and Renewable Energy in Buildings
- Sustainable Urban Form – the influence of urban form on economic, social and environmental wellbeing of dense urban areas
- TARBASE – carbon reduction in existing buildings through integrated technologies for building fabric, energy generation and appliances
- CCC – user-centred control systems for comfort, carbon saving and energy efficiency in residential buildings.

International partnerships are an important and growing feature of our research and collaborative links have been established with Lawrence Berkeley Laboratories, USA, and Universities of Stuttgart, Eindhoven, Lausanne and Hong Kong.

## Research outputs

In the last seven years, the IESD has produced or contributed to over 300 high quality research publications, including over 130 refereed journal papers and 25 major reports and books. More significant is the originality and high impact of IESD's research output, which is respected internationally. Examples include:

- The world's largest multi-national exercise, to validate dynamic thermal models of buildings
- The internationally leading model of human thermal comfort, which has attracted interest across the globe for clothing, building, automobile and space travel research



- Research and design on advanced naturally-ventilated buildings, which won CIBSE and RIBA awards for research and innovation
- The groundbreaking daylighting assessment methodology using dynamic computer simulation based on real weather data.

The IESD is also active in knowledge transfer to industry and in engaging with the general public, in particular with young people, to raise awareness of sustainable development issues and solutions.

## Funding and facilities

The IESD has been very successful in winning research grants/contracts from the Engineering and Physical Sciences Research Council (EPSRC), Economic and Social Research Council (ESRC), European Union (EU), central and local governments and industry. Current annual turnover exceeds £1.8 million, with a research portfolio worth close to £5 million.

The Institute occupies the award-winning naturally ventilated Queens Building and enjoys excellent research facilities. Recent significant investments in equipment have added further state-of-the-art facilities for computing and experiments.

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