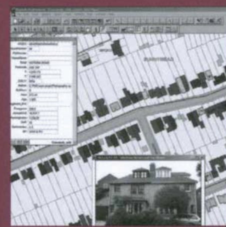
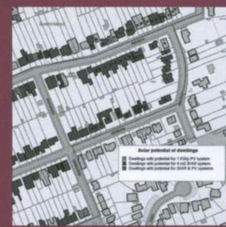
pictures left to right:

Dr Rajat Gupta

Using MapInfo to display results in the form of colour-coded thematic maps

Generation of thematic map showing solar potential for individual dwellings





DECoRUM: an innovative GIS-based model for calculating carbon emissions from cities

DECoRuM is a next generation Geographical Information Systems (GIS) based domestic energy, carbon-counting and carbon-reduction model with the capability to evaluate energy consumption in, and CO2 emission reductions from, the UK housing stock, and the cost of a range of measures to reduce both.

DECoRuM was developed by Dr Rajat Gupta, a Research Fellow in the Department of Architecture. The methodology underpinning the model has been published in academic papers and reported widely in newspapers.

The model estimates current energy-related CO2 emissions from existing UK dwellings, and evaluates the potential and financial costs for domestic CO2 emission reductions. Its effectiveness has been demonstrated in an Oxford case study.

DECoRuM has significant benefits over existing alternatives; some of its unique features include:

- Use of GIS software, MapInfo, to extract input data for the underlying energy models and display results in the form of colour-coded thematic maps with an individual dwelling displayed as the basic unit of resolution.
- Use of well-established underlying energy models to estimate domestic energy consumption.
- Employment of data reduction techniques such that the input data is derived from the GIS urban map, built form and age of construction of the dwelling.
- Use of robust filtering criteria to select the most suitable dwellings for each CO2 reduction measure deployed in DECoRuM.
- Generation of thematic maps showing the solar potential for individual dwellings.

DECoRuM is now on its way to becoming an industry standard in the UK for carbon emission reduction planning - discussions are ongoing to employ DECoRuM in Oxford city and London Borough of Merton. Funding of around £38.5k has been secured from the South East Proof of Concept Fund and will enable a robust GIS-based toolkit to be made available to UK local authorities, energy advisers, building surveyors and real estate professionals to assist them in counting, costing and reducing domestic carbon emissions, as required by the Home Energy Conservation Act.

repair of UV damage in archaea

Dr Shirley McCready, in the School of Biological and Molecular Sciences, has worked on Ultraviolet (UV) damage and repair for 25 years, studying the response of micro-organisms as well as plants and human cells to UV irradiation.

Living cells have been exposed to UV radiation in sunlight since life began some 3.5 billion years ago. UV rays penetrate cells and cause chemical damage to the genetic material - the DNA. If the damage is not dealt with, the cell may become mutated or die. In humans, sunlight-induced mutations can lead to skin cancer. But it isn't only human cells that are at risk; all organisms living in sunlight are susceptible to genetic damage caused by sunlight.

Interestingly, different organisms show very different sensitivities to UV because the molecular and cellular responses to UV varies in different organisms. Human cells, for example, are especially sensitive to UV.

Currently Dr McCready's group is focusing its research on an unusual and intriguing group of micro-organisms known as the archaea. These organisms are believed to resemble the earliest forms of life that existed on Earth and they can live in the Earth's most extreme environments. One group of archaea – the extremely halophilic (salt-loving) archaea – populate saline lakes and salt crystalliser ponds found in deserts and locations such as the Dead Sea, the Great Salt Lakes in Utah and coastal areas around the Mediterranean. In these hypersaline lakes and ponds, under intense sunlight, the water takes on a red/orange hue due to the huge numbers of orange, halophilic micro-organisms growing in them. The reason for our interest in these micro-organisms is that they are unusually resistant to UV radiation. We want to understand how these archaea are able to survive such high UV levels as well as to understand the evolution of UV repair systems and the relationship between repair of UV damage and other cellular processes.

The complete DNA sequence of all the genes in Halobacterium was worked out in 2001 and computer analysis of this information has suggested that about 100 of the 2600 genes may code for proteins that are directly involved in repairing DNA or recovering from UV irradiation. For the past two years the group has been funded by a BBSRC grant of £103,000 to analyse the functions of these genes. The grant has supported Dr Ivan Boubriak, a radiobiologist from Ukraine, to work with Dr McCready. Also working in the group is Ng Wooi Loon, a PhD student from Malaysia. They have found out which genes are used for DNA repair and what other responses occur at the cellular level, using microarrays specially designed for use with Halobacterium by collaborators at the University Of Maryland in the United States. Dr McCready and Dr Boubriak presented some of their findings at a Gordon conference held in Oxford in August 2005, where they were also able to meet with their American collaborators, and they presented results obtained since then at the University of Newcastle in February 2006.