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The Role of the Built Environment in a Sustainable UK Energy Economy

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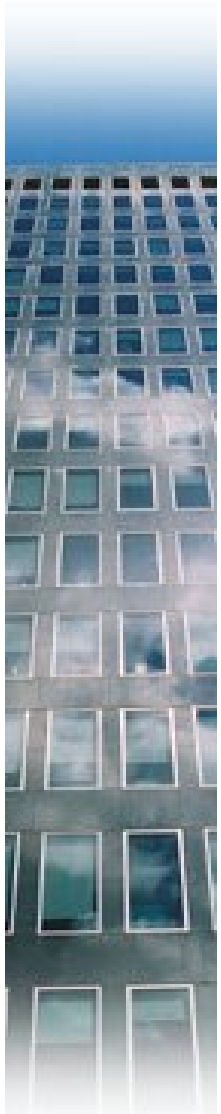
Energy in Buildings

- sustainability necessitates controlling energy demand in addition to developing renewable/low carbon energy supplies
- the built environment is the largest final energy consumer
- the domestic sector alone accounts for 28%[1] of final energy consumption and 42 million tonnes of carbon (MtC) per annum[2]
- in the built environment 40%[3] of the energy consumed is used is for space heating with most heating systems running on natural gas
- overall energy consumption is on the increase with a 19% rise in the domestic sector and 17% rise in the services sector since 1990[3]
- driven by:
  - demographics (increasing # of households 18.6M – 24.2M 1971-2005[4])
  - comfort expectations (average internal temperatures have risen 5^{o}C since 1970[5])
  - lifestyle (multi-source lighting, increasing use of electrical appliances)



Sources 1 DUKES 2005, 2 NS Social trends 3 Energy consumption in the UK 4 NS Social trends, 5 domestic energy fact file 2001

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Energy Efficiency Potential

- historically the built environment has been a poor performer in terms of energy efficiency
  - up to 40% of energy is wasted[1] in older buildings which account for 90% of the building stock[2]
- consequently there is enormous potential for energy and emissions savings
  - significant energy savings achievable with best practice and current technologies
  - further reductions could be achieved by utilising alternative heat and power sources (renewables, biomass, heat pumps, etc.)[3]
- up to 80%[4] energy savings quoted in the literature – corresponding to emissions savings of 34 MtC per annum
- average household carbon footprint could be reduced from 2 to 0.5 tonnes of carbon per annum

1 Johnstone S, Greener Buildings: the environmental impact of property, MacMillan, 1993
2 Ove Arup, Building Design for Energy Economy
3 RURASU
4 Olivier, Building in Ignorance 2001

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Benefits and Barriers

- significant energy and emissions savings are achievable in the short term from basic measures:
  - more stringent regulations and more rigorous enforcement
  - investment in improved operation and maintenance
  - monitoring of performance and comparison of energy use
  - analysis of energy performance at the design stage through modelling
- these will be driven by legislation (e.g. EBPD) and possibly energy costs
- however there are barriers
  - low energy cost (historical)/unfavourable tariffs
  - a fragmented industry
  - lack of skills for the design, installation and commissioning of low energy projects
  - lack of energy performance data

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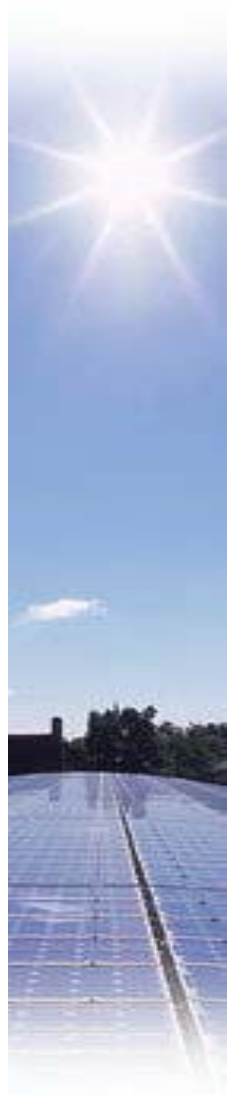
Towards 2050

- in future building projects, energy performance could be improved by designing for low energy consumption e.g. through the integration of passive solar features or passive ventilation
- local energy supply technologies and hi-tech solutions could also reduce emissions but their emergence is uncertain*
  - μ-CHP
  - heat pumps
  - embedded renewables
  - advanced use of information technology
  - intelligent demand management
- *radical* energy reductions will only occur if
  - energy performance is properly assessed at the design stage and is central to the building design process
  - energy performance is monitored and maintained/improved over the lifespan of the building



*fluctuating gas costs could be a barrier for some technologies such as fuel cells and μ-CHP.