3 Sustainability challenges

Sustainable development, as a global agenda, concerns itself essentially with conservation of the natural resources and environment upon which all human economic and social development ultimately depends. In the context of the Soho pilot project we are primarily concerned with environmental protection 'and assuming continuity in the historic built form and structure of population, and broad pattern of economic, social and cultural activity of Soho.'

Definitions and outcomes

3.1 *Background paper 2* sets out the context for sustainable development, climate change and energy use that conditions assumptions in this study about the future. These will underlie the relative merits of different approaches to retrofitting buildings in Soho that are explored in this study.

3.2 In the context of the Soho pilot project we are primarily concerned with environmental protection. In terms of environmental protection, the overarching goal could be stated as:

'Improving efficiency and achieving reductions in the use of energy, materials, water and other resources, reducing the environmental impact of human activity and improving or maintaining general environmental quality, in the context of expected environmental changes (in particular climate change), and assuming *continuity in the historic built form and structure of population, and basic pattern of economic, social and cultural activity of Soho.'*

3.3 Achieving this goal will result in a set of desired outcomes:

a) Reduction of locally-caused contributions to climate change, in particular carbon emissions. Reduction of Soho's carbon footprint.

b) Adaptation to expected implications of climate change.

c) Reduction in local environmental pollution, in particular air and noise pollution.

d) Mitigation of adverse impacts on, and enhancement of, the built heritage and visible environment.

e) Improvements in the resource efficiency of Soho and reduction of its adverse ecological footprint.

f) Protection and enhancement of local biodiversity.

g) Other improvements to local environmental quality that enhance the quality of life for its resident, working and visiting population.

h) Collection of data on how much carbon is generated in a dense mixed use area that could be used to compare production per head of employment with e.g. a suburban office park to demonstrate relative sustainability.

3.4 Being more efficient in the use of energy and other resources results in a reduction in the rate at which they are used, and should result in a reduction in their broader environmental impact. However, we also need to consider ways in which the need to use resources can be reduced per se, and initiate new or substitute existing ways of doing things that may not necessarily involve a reduction in consumption but are less polluting, promote local biodiversity, or generally improve environmental quality.

Social, cultural and economic sustainability

3.5 Though the clear emphasis of the study is on environmental sustainability, in exploring good practice this will be done whilst being aware of other dimensions, in particular:

a) Cultural sustainability – protecting and enhancing the historic environment in the context of its central importance to communal values, the sense of place and local identity.[1] This is covered partly in the discussion of conservation issues in Chapter 2, conservation policies vis a vis sustainability in Chapter 3, and in Chapter 4. (Maintaining existing building stock also represents an important and environmentally efficient use of embodied energy and resources).

b) Financial sustainability – proposals for improving the environmental sustainability of Soho have to be financially acceptable and self-sustaining in the long-term. It is not possible, within the scope of this study, to be more than indicative about the financial implications (and cost-effectiveness) of a potentially very large range of solutions to a very complex set of challenges. However, we have tried to set out below, a reasoned set of assumptions upon which to make recommendations, including an analysis of the possible middle and longer term trends that will affect property owner's and occupier's investment decisions.

c) Social sustainability and everyday practices – solutions may imply changes to management and everyday practices but such changes are most likely to work if they are acceptable to the existing population and it should be possible for that population to adopt and sustain them in the long-term.

d) Social sustainability and quality of life – solutions should try to maintain or improve the quality of life for the existing population (resident and users), adding to rather than detracting from local amenity value.

e) Economic sustainability – solutions should, if possible, enhance the local economy and underscore the long-term viability and adaptability of the local economy, within the context of changing market conditions and trends.

Who pays? Who benefits? The issue of split incentives

3.6 Soho is primarily an area of commercial tenant occupiers. Most of the residents of the area are also tenants. A financial challenge is that it is landlords who are mainly responsible for investing in improving the thermal and resource use performance of buildings, whilst tenants are mainly responsible for running costs including, in particular, fuel bills.[2] Unless landlords are able to claw back their investment in sustainability measures through increased rentals, the benefits will accrue to the occupiers and not the owners.

3.7 The converse of this is that, if there is little incentive for landlords to invest in improving building performance, it is the occupiers who bear the high costs of the poorer performance. Over time, as the performance of building services and fabric deteriorates, the resulting costs for tenants increase.

3.8 One of the findings of this study is that there are major benefits to be achieved through scaling up and shared sustainability solutions, including Combined Cooling, Heat and Power (CCHP). However, at the individual property level, landlords complain that, with little or no control over user behaviour, and with the additional management overheads, communal heating systems create more problems than they solve[3]. Their preference, therefore is for individualised solutions. This helps to overcome issues like individual tenants leaving heating or lighting on when they do not need it. This may make it more difficult to sell the idea of district heating although newer systems include metering which provides better control on usage and should make it easier to convince landlords that the benefits of scaling up outweigh the disadvantages.

1. English Heritage. 2000.
2. An exception may be the many businesses, such as retail and catering, that occupy ground floor premises. These are normally responsible for installing their own plant and are potentially an important target for measures to improve energy efficiency.

3.9 This is part of a wider issue of the (financial and physical) management of collective solutions to retrofitting sustainability. Buildings in any particular street or street block in Soho contain many different uses and users, often with numerous owners and individual buildings in multiple occupancy. This gives Soho its particular character and dynamism, and offers many opportunities for creative synergies, including in the area of retrofitting sustainability. Creating the mechanisms for co-operation and shared management present perhaps the major challenge for Soho. However, as we argue in this study, it is one that is well worth addressing as it could provide a huge step forward in addressing the sustainability issues of the area.

Environmental sustainability challenges for Soho

3.10 As previously noted, our brief for this study was to focus on environmental sustainability issues for Soho, in particularly as they affect the built heritage. The following chapters are concerned primarily with the challenges to reducing Soho's carbon footprint through reducing the use of energy in buildings, or contributing to the more efficient production of electricity through local CCHP schemes. Adaptation to expected climate change forms part of this package. However, other important environmental sustainability issues remain to be addressed, as follows:

Air and noise pollution, vehicular movements

3.11 As a very dense, mixed-use area, *local* environmental pollution, in particular air and noise pollution poses a major challenge. Air pollution is in part a consequence of the continuing high vehicular traffic flows in Soho's narrow streets and focuses attention on management of the public realm.

3.12 On-street parking is restricted and the area has a few car parks that are available to limited numbers of car users during the day and night. Recent overall traffic management changes such as the Central Congestion Area Charging Scheme has had an impact on the overall number of vehicles entering the area and the Low Emissions Zone has reduced the number of heavily polluting vehicles over 12 tonnes. This has now be extended to those vehicles over 7.5 tonnes from the beginning of July. However, the heavy concentration of business, retail, catering and entertainment uses in Soho underpins the substantial level of vehicular traffic required to service the area, to deliver supplies and remove waste.

3.13 Noise is increasingly a problem for all city residents. However, residents living in the proximity of bars, pubs and clubs are particularly likely to suffer noise late at night when the clientele are leaving premises and in the early morning as well which is increasingly the preferred time for deliveries to these and other premises. The smoking ban has recently intensified the problem with many pubs having almost as many patrons standing drinking outside as remaining inside the premises. Where residents rely on windows to provide ventilation or cooling in summer months, severe disturbance problems can arise. The City of Westminster is currently drawing up a noise strategy for the borough and is one of the first local authorities to do so.

3.14 Clearly over time the introduction of quieter, cleaner vehicles could go some way to addressing some of the noise and local pollution issues. Electric vehicles are non-polluting at the point of use and even if they are not charged from renewable sources, they emit less CO_2 emissions than other modes.[4] Small electric cars such as the GWiz and a few electric delivery vans are making their appearance and are able to park without charge. Hybrid and LPG are encouraged but do not have the same benefits, as their needs are different.

3. Discussion at the Westminster City Council Seminar on 'Retrofitting the historic environment' on 10th April 2008 (Westminster City Council. 2008b).

4. Ecolane Consultancy.

3.15 Westminster City Council provides free parking for electric vehicles at any pay and display parking bay. The City Council also provides the UK's largest on-street recharging scheme with 12 on-street recharging points ('juice points') currently available for an annual fee of £75.[5] It also offers significantly reduced rates for electric vehicles at City Council car parks on payment of a single annual fee.[6] It has 48 re-charging points in 13 off-street car parks.[7] The nearest on-street re-charging points to Soho are in Marylebone, Mayfair and Covent Garden. Within and adjacent to Soho, 4 off-street points are available in Chinatown car park and there are 7 points in Leicester Square car park.

Waste

3.16 Apart from energy use, there are challenges in improving the resource efficiency of Soho more generally, and reducing its ecological footprint. Like all central city areas Soho produces a huge amount of waste all of which must be delivered in the first place.

3.17 The problem is best addressed at source, in reducing the quantity of waste that building occupiers produce in the first place. However, at present there is little awareness amongst many firms of the need to think through their operations to minimise waste.

3.18 Nationally, waste that is not recycled often ends up in landfill sites where it produces methane, a far more powerful greenhouse gas than carbon. In some cases it may be incinerated which can be more sustainable if the energy produced in the incineration is used for heating or electricity production, but incineration still produces carbon dioxide.

3.19 In the case of Westminster City Council, the majority of residual waste is processed in a waste-to-energy plant, which generates electricity and is designed with the potential to supply a heat network. A very low percentage is sent to landfill, and where this is sent, there is methane gas recovery.

3.20 The figure for municipal waste recycling has been improving rapidly since as a consequence of UK implementation of EU legislation. According to the Audit Commission, in 2006-7 the City of Westminster re-cycled around 20% of its household waste, slightly above its statutory target.[8] The composting rate for Westminster, which related to biodegradable waste, is below 1%. The household composting figure is inevitably low in Westminster. Although this is encouraged where possible, only 11,000 homes have private gardens.

3.21 The weekly door-to-door recycling service covered 93,018 households (around 75% of the total). According to the Planning Department, waste from commercial sources represented 60% of the 190,000 tonnes collected in 2005-6 (with 30% from household sources and 10% from street cleansing).[9] As an area with a concentration of catering premises a lot of food waste is produced that needs frequent and regular collection. This represents a potential composting resource.

5. Westminster City Council b.
6. Westminster City Council e.
7. Westminster City Council f.
8. Westminster City Council a.
9. Westminster City Council. 2007a. Issues and Options relating to the Core Strategy. p13.

3.22 Recycling is a particular challenge in Soho because pavements are generally narrow and there is little space for the on street storage of waste prior to collection. Larger businesses are usually able to make provision within their building for the separation and storage of recyclables pending collection should they choose to do so. However for small and medium-sized enterprises (SMEs) collections from within premises are often too expensive to be cost effective and the lack of parking space means that recycling vehicles cannot be left without an acute risk of parking fines in order to carry out such collections.

3.23 On-street recycling which can be used by shoppers, tourists and workers is best done through separation in collective storage areas. However, Soho is critically short of this kind of space. The current provision at Dufours Place and Ramillies Street is limited to a small range of euro bins (designed to connect with the hydraulic systems on collection lorries).

3.24 According to Westminster City Council, specific areas of the West End are excluded from on-street recycling bins on Metropolitan Police security advice. This obviously limits the scope for any major initiative to fund the provision of well-designed and high profile open access on-street facilities throughout the West End. It suggests, however, that alternative provision with managed community access should be explored if the rate of recycling is to be increased.

Mike Theis

Figure 3.1: Recycling bins at Ramillies Street and Dufour's Place

3.25 Where redevelopment or major renovation is going on, space for recycling may be allocated as part of the planning consent for the scheme. The City Council has specific policies to require waste and recycling storage as part of developments, where feasible, and applies planning conditions accordingly. However, under normal circumstances with the very high level of site coverage by buildings in the area and fragmented ownership patterns, chances to provide this type of facility are limited at present.

3.26 By the nature of the business that goes on in Soho, there will be bulky items of waste to be collected and disposed of on a continuous basis. It is important that this is done sustainably. A range of service companies exist that do this, but it is up to occupiers to find out who they are. Designing an integrated recycling and waste management strategy for mixed use areas like Soho is a major challenge.

Water

3.27 As with waste, the problem of water management should first be addressed at source, through reductions in use. Obviously there are opportunities during renovation for replacing existing fittings with new fittings that are more economic in their use of water.

3.28 According to our preliminary survey, more than 65% of the surface area in Soho is roof so most rain falling in the area will end up in the storm water drains. The opportunities for incorporating sustainable urban drainage systems at ground floor level are very limited, with most outdoor space being public street space. There are very limited opportunities to make surfaces semi-permeable to reduce storm water run off.

3.29 As a whole, Soho is not in particular danger from flooding as it is built on an incline 19-26m above sea level and well above the Thames flood plain zone. This suggests that, in the case of flash floods exceeding the capacity of storm water drainage, the bulk of excess water is likely to flow away to the areas to the south. However, the slope is not even and any dips in the area could give rise to localised flooding in certain circumstances.

Protection and enhancement of local biodiversity

3.30 Green space in Soho is effectively limited at present to the two public squares, Soho Square and Golden Square, St Anne's Gardens at the bottom of Wardour Street and a few scattered landscaped courtyards and roof gardens. There are almost no private gardens and preciously little private external space of any kind. The streets are too narrow and the sub surface too intensely used by services for planting with significantly more street trees than currently exist.

3.31 Clearly, those green spaces that exist need to be carefully managed and protected but there are opportunities to increase the biodiversity in the area. Smaller scale street planting would be possible with permanent pedestrianisation and landscaping of certain street sections. Additionally, there are very large areas of flat roof surfaces that could be adapted as green roofs. Green roofs provide a triple win in terms of slowing rain water run off, improving the thermal mass of roofs and their insulation properties and also an important opportunity to provide green corridors between the major parks and open spaces of central London particularly for insects and birds. They are also visually attractive.

Time scales of retrofitting for sustainability in Soho

3.32 The report of the Brundtland Commission (1987) highlights the effect of current generations taking short-term decisions in their own interest but which have detrimental effects on future generations (such as emitting greenhouse gases now that will add to the environmental pressure on future generations).[10] However, in order to have a better understanding of what the 'needs of future generations' might mean in the context of the Soho study, it is necessary to try to give a definition to the time scales the study will be referring to.

3.33 A range of time scales are involved, in particular those relating to the maintenance, renewal and life cycle management of building and infrastructure assets. A central area, with a preponderance of small businesses such as Soho, arguably experiences a more rapid turnover of population and businesses than elsewhere, although there will also be a minority of long-term residents and long-established businesses.

10. Brundtland, G. (ed.). 1987.

3.34 In terms of social sustainability and population stability/change, however, it is reasonable to look at a long-term time scale of a single generation (i.e. around 25 years). While climate change scientists try to model human impacts up to the end of the century, impacts are already beginning to be felt in some parts of the world and major impacts (floods and disrupted water supplies in Asia due to melting glaciers; water scarcity in Africa and Australia) are expected within the next 20-25 years.

3.35 At current rates of consumption, with known reserves, according to an oil industry, oil is predicted to last another 42 years[11] but perceived supply constraints will kick in well before (and many would argue that the era of cheap oil is already over and these 'post-peak' constraints are already in place).

3.36 The Government has set short-term and medium-term target dates for carbon emissions reductions of 2012 (termination of the Kyoto Protocol) and 2030, 22 years hence. The time frames of inter-governmental treaties are obviously crucial as, although there is now general acceptance of human-induced climate change through greenhouse gas emissions, without an international framework of agreement there is little incentive for a national government to act on its own. UK Government policies are also conditioned by what is laid down in EU directives where different time frames for targets may be introduced.

3.37 The *London Carbon Scenarios for 2026* report, referred to in this study, took a 20-year time frame in order to help inform strategies for London within the Government's and the Mayor's medium-term target period. While it is not within the scope of this study to model carbon scenarios for Soho, a time frame of 20-25 years would seem appropriate for considering retrofitting strategies in more general terms.

3.38 Building developers, are looking for a payback period on their investment, typically, of 10-25 years, depending on current property market risk assessment of different types of asset. Landlords also have to look at the risks associated with future rental income and risk loss of income from properties standing empty where rents are set too high. Variations in payback periods can have a major impact on the cost effectiveness of sustainable renovation measures.

3.39 Currently, values in the commercial market are falling, yields are on the increase and property developers and owners are looking to shorter pay back periods for any new investment. On the other hand, in a buyers' or prospective tenants' market, purchasers or potential occupiers are looking for properties that offer the best performance for their money. Sustainable buildings have low running costs, particularly when energy costs are high and will, if the rationale behind the government's Energy Performance Certificate policy is correct and energy price hikes are sufficiently large, should command the best prices or rents and be easier to dispose of.

3.40 Landlords have the added complication of having to fit renovation measures around cycles of occupancy. Upgrading and repairs to the building envelope can be carried out while buildings are occupied but sustainable renovation is likely to involve envelope work that is disruptive (replacement of windows, internal insulation) and works to internal building systems that are logically associated with larger internal renovation works (changes to layout, new services, fittings and fixtures, and redecorations).

3.41 While major property owners may have the possibility of temporary re-housing tenants in a larger rolling programme of renovation, this obviously adds considerably to the costs, particularly if there were any business disruption involved. In practice, in an area like Soho, renovation is more likely to be done on an ad hoc basis as tenants vacate and leases are up.

11. Economist. 2008. This figure is based on figures from BP's 'Statistical review of Word Energy'. The Energy Information Administration. 2008. World Consumption of Primary Energy by Energy Type and Selected Country Groups 1980-2005 carries the same figure. New reserves are being discovered but consumption is also increasing, having grown by 124% in the past 24 years according to the Energy Information Administration (China's consumption increased by 363% over the same period).

3.42 To add to the complexity, many properties are in multiple occupancy and it requires a high degree of care and responsibility on the part of the landlord to plan and negotiate large-scale renovation in such circumstances. Additionally, given the nature of the land uses in the area (retail, office, restaurants and bars, theatres, cinemas and clubs), a relatively large proportion of the carbon emissions are the result of fittings and equipment installed by the occupiers.

3.43 To obtain the full benefits of sustainable renovation, a life cycle or whole life costing approach should be adopted. This should include an assessment of the embodied energy/carbon costs of retrofitted elements as well as the costs in use. Calculating embodied costs is not a simple matter and a range of methodologies are available.[12]

3.44 There are different views on how to account for the embodied carbon in existing structures and it is especially difficult to calculate what these are. In practice, it makes sense to start with the situation as it exists, aiming to minimise future emissions, and ignore the carbon 'sins of the past' (although this obviously will not work at the level of inter-governmental negotiations between developed and developing countries) although previous investments of energy should not be wasted, as far as possible. The retention of historic buildings, for example, can reduce construction waste which is one of the largest sources of waste in London.

3.45 A whole life costing approach is one that assesses the total cost of an asset over its whole life based on construction and performance in use. It is particularly effective in highlighting the cost benefits associated with sustainable forms of construction and refurbishment. A useful starting point is the web pages of the Joint UK-Sweden Initiative on Sustainable Construction on the 'Constructing Excellence' web site, which lists some basic principles of whole life costing and best practice in sustainable construction.[13]

3.46 Optimising the performance of retrofitted building elements requires looking at the life cycle within which they perform effectively. Traditionally, this has been done, heuristically, on an understanding of approximately how long different building elements last and a pragmatic approach to fitting replacement into major cycles of renovation. Buildings typically need major refurbishment every 20-30 years.[14] However, with new forms of building technology associated with increased sustainability requirements, owners are moving into unfamiliar territory. In these circumstances, better formal methodologies for estimating life cycle costs can provide additional reassurance and a basis for a better-planned approach to sustainable renovation.

3.47 With proper maintenance, the life times of building elements can be extended considerably, in some cases indefinitely, but replacement and repair/maintenance costs have to be set against one another. Alternatively building elements may be left un-maintained and in place beyond their natural lifetime as buildings fall into disrepair with the costs and consequences falling upon tenants and occupiers.

3.48 The Building Cost Information Service (BCIS) of the Royal Institution of Chartered Surveyors (RICS) has recently updated its publication, *Life Expectancy of Building Components: A practical guide to surveyors' experience of buildings in use.* This is an important source for carrying out a life-cycle approach to retrofitting sustainability. It includes information on over 300 building components, the factors to be considered when assessing the life expectancy of each component and checklists

12. Arup's give the following definitions: 'Embodied Energy takes into account all the energy consumed over a defined lifecycle of a product and includes energy used right at the start of the cycle, such as the winning of raw materials and their transportation. Embodied Carbon also measures all energy consumed during a defined lifecycle, but it takes into account the source of the energy and its impact on the environment. While a building using coal energy and a building using wind energy might have the same Embodied Energy value, they would have a vastly different value of Embodied Carbon (ARUP).

13. UK Sweden Sustainability. 2006.

14. The Carbon Trust b.

Table 3.1: Typical lifetime of selected building elements

Building Component	Typical life (median)[16]	Range	Minimum life (median)	Maximum life (median)
Gas/Oil Fired Boilers: Packaged Water Boilers: Gas or oil fired; on/off or high/low type	20 years	5 to 40 years	10 years	25 years
Pitched Roof Structure: Timber: Generally	75 years	5 to 100 years	50 years	100 years
Roof Drainage: PVCu: Rainwater pipes/gutters/roof outlets	25 years	5 to 100 years	20 years	30 years
LV Cables: Un-Armoured Cable: PVC insulated and sheathed single core cables: 300/500 Volt grade: solid or stranded copper	30 years	10 to 80 years	20 years	35 years
Floor Finishes: Insitu Screed: Latex Cement: 5mm; two coats; to concrete base	20 years	1 to 100 years	15 years	30 years

(Source: BCIS. 2006)

identifying causes of early deterioration for each component. Table 3.1 gives examples from the report showing the wide range of lifetime expectations for a few selected building elements:[15]

3.49 The complexity of life cycles suggests that there are major barriers to any strategic and co-ordinated approach to retrofitting sustainability and that the main efforts should go into measures that direct and guide a fairly ad hoc process. Market pressures will be key, but awareness-raising, training and effective guidance have an important role to play. However, given the level of uncertainty and complexity, appropriate Government policies and legislation are critical for ensuring that retrofitting for sustainability will take place. Building regulations are the main instrument and these continue to be tightened to achieve higher levels of sustainability. However, as far as conservation areas are concerned (90% of Soho and 78% of Westminster as a whole), planning policies and the views professional judgements of conservation officers generally take precedence.

3.50 This leaves property owners and users in an area of uncertainty as regards the level of retrofitting measures they can safely undertake. Given that there may be additional costs associated with such measures, this is likely to discourage the more socially responsible property owners and landlords and provide a let-out for the less scrupulous.

3.51 It seems certain that energy costs, whilst volatile, and currently falling after the recent peak, are likely to remain high for the foreseeable future, and possibly set to increase as the cheaper sources of fossil fuels run low and demands for making energy use cleaner continue to grow.[17] Higher energy prices, combined with taxes like the Climate Change Levy, are likely to increase the demand for more fuel-efficient properties and their rental potential. In the longer term, the demand for continuity of power supply particularly among computer-dependent creative businesses could increase the attractiveness of local power generation capacity.

15. BCIS. 2006.
16. Median estimates being those in the centre of a range of estimates of lifetimes of building elements.
17. The International of Energy Agency, in its 2008 World Energy Outlook, suggests that the end of cheap oil is over, that prices could soon be back over $100 a barrel and as high as $200 by 2030. Mukherjee.S. 2008.

3.52 The actual lifetime of the retrofit is likely, in many cases, to be considerably longer than the payback period. In terms of reducing carbon emissions of resource use, performance has to be measured over the full life cycle as well as in use, and include the resources used and carbon emitted in the production and installation of retrofitted elements. Items that are going to last twenty years or more will need to be designed to be efficient over their full life-time, which means taking a view on environmental conditions some way down the line.

Pollution, climate change and carbon reductions

3.53 For a summary of the worldwide factors effecting these issues see *Background paper 2: Sustainable development, climate change and energy use*, but according to most modelled climate change scenarios the pace of temperature rise in the 21st century is far more rapid than in the 20th. In the case of the UK, for example, the expectation is that climate change will bring warmer winters, hotter drier summers, more heatwaves, reduced rainfall in the Southeast but more intense weather events (with increased flooding risks).[18] According to best case and worst case modelled climate change, maximum temperatures in London in the summer months are set to increase by 0.5 to 1°C in the 2020s, 2 to 4°C in the 2050s and by 3.5 to 7°C in the 2080s.[19]

3.54 This will lead to increased demand for summer cooling (and decrease in demand for winter heating).[20] Rising sea levels and increased winter storms could increase closures of the Thames Barrier. Increased temperatures could attract more tourists, but also leading to an exodus of people from London in the hot summer months.[21] With the danger of increased stress and mortality from heatwaves, the attraction of an area like Soho in the summer could be adversely affected.

3.55 The trend of rising global temperatures for the past two centuries, according to the scientific consensus, is set to continue and intensify. However, this rise has not been even and has been accompanied by periods of temperature decline sometimes lasting decades. Recent scientific reports suggest that there are countervailing trends which could cause temperatures to remain static or fall until 2020 before the rising trend sets in again.[22]

3.56 Soho's microclimate, being at the heart of London's urban heat island, is protected from the wind and generates large amounts of energy from its day time and night time activities. A 'heat island' is an area of warmer city air that sits in a region of cooler rural air, with the difference in temperature resulting from the nature of the land cover.[23] The impact is felt mainly between 11pm and 3 am in the Summer, as the solar energy absorbed in the urban surface during the day is released at night. When the effect was first discovered at the beginning of the nineteenth century, differences of up to 2°C were noted. By the mid-sixties, the difference in nocturnal temperatures reach 4-6°C and more recently extreme UHI intensities of 7°C or more have been noted, reaching 9°C in the 2003 heatwave.[24] (Figure 3.2 shows the pattern of air temperature difference (°C) between a rural reference climate station and a number of urban climate stations located across London under calm and dry conditions at 0200 – 0300hrs for six urban heat island events during the summer of 2000 (July 1st to September 30th)).[25]

18. Hulme, et al. 2002.
19. Greater London Authority. 2006b.
20. Greater London Authority. 2004. p170.
21. ibid.
22. German researchers have recently modelled the impact of a natural cycle of ocean temperatures of 60-70 years on climate change in Black, R. 2008. See also NOAA News.
23. Greater London Authority. 2006b.
24. ibid.
25. ibid. p4.

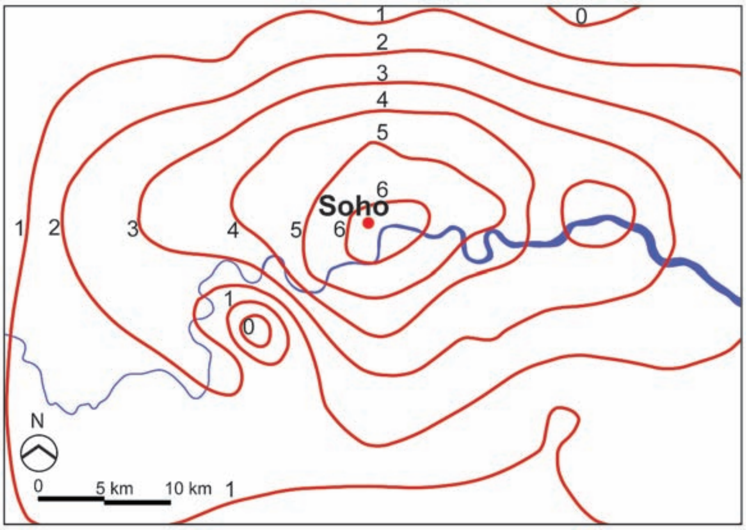


Figure 3.2: London's heat island effect
(Source: Adapted from Greater London Authority.2006b. p4)

3.57 As a consequence of its concentration of commercial buildings, Soho's cooling load is much higher, relative to the winter heating load compared to surrounding, more residential areas, regardless of the heat island effect. In addition, the concentration of evening and late night entertainment activity in the area means that energy use, heating and cooling loads and emissions are generated over a much longer period than just normal commercial office hours.

3.58 Heat waves, hotter drier summers and warmer winters will further affect the balance between heating and cooling loads and could potentially affect the specification of heating and cooling systems to meet these requirements, particularly where potentially highly efficient 'trigeneration' (combined heat, cooling and power) systems are being considered.

3.59 The UK Government target of a 60% reduction in greenhouse gas emissions by 2050 in the draft Climate Change Bill is based on stabilising atmospheric levels of CO_2 at 550ppm (c.f. 381ppm in 2006). This is regarded as the prudent level at which any increases in global CO_2 annual levels means surface temperature should not exceed the figure of 2°C above the pre-industrial level, agreed by the European Council. The world has warmed by 0.7°C since pre-industrial times and, as a result of the time delay between the release of CO_2 into the atmosphere and its effect on temperature, we are locked into another 0.6°C increase. Future emissions, therefore, need to be at a level that limits the increase to 0.7°C in total.

3.60 The 550ppm target arose out the 2000 Report of the Royal Commission on Environmental Pollution (RCEP) and was endorsed in the Mayor of London's Energy Strategy with the hedge that the 550ppm limit should be kept under review. The RCEP is standing by its recommendation of 550ppm but recognises that this is at the 'upper level of prudency' and should be kept under review.[26]

3.61 One of the best current options for urban areas to substantially reduce their carbon footprint in the medium term would appear to be greater use of combined heat and power (CHP or 'co-generation').[27] This is highlighted, in the case of London, in the London Carbon Scenarios to 2026 report. These are commonly gas-fuelled, though there are with opportunities for greater use of biomass fuels in the future, although probably not in Soho because of the limitations of space and constraints on the delivery of bulky fuels by road. Even where the fuel is gas, however, the far greater efficiencies in the use of fuel can have a major impact of our consumption and the simple replacement of aging gas boilers with new, more energy efficiency models could therefore also have a major impact.

26. London Energy Partnership. 2006.
27. …and perhaps more usefully in the longer term - Combined Cooling, Heat and Power (CCHP or 'tri-generation') schemes. In this case, however, there are technical constraints which are discussed in Chapter 5.

Box 3.1: Carbon Target Scenarios for London

The previous Mayor's targets for London were subsequently raised to a 20% reduction on 1990 levels by 2010 and a 60% reduction on 2000 levels by 2025. The new Mayor has revised this to a 60% reduction on 1990 levels by 2025. This represents a reduction in London target as CO_2 emissions fell between 1990 and 2000. However, the difference is not substantial and the target remains highly ambitious. London's emissions of CO_2 were estimated at 45 million tonnes per annum (tpa) in 1990 and 42 million tpa in 2003. The origin of the eomissions in 2003 were as follows (in rounded percentage figures – see also Appendix 7):

- 21% transport
- 44% domestic
- 7% industrial
- 29% commercial

The London Energy Partnership's report on London Carbon Scenarios for 2026 looks at a range of 'stretch' or aspirational targets for the 20-year horizon of 2026. It based on 2050 targets of 60%, 80% and 100% reductions with the highest target aiming to keep within a ceiling of 440ppm and a global per capita carbon emissions limit of 0.33 tons per year by 2030 (a 90% reduction on current levels). This is advocated by the Campaign against Climate Change, following the principle of contraction and convergence to a single long-term per capital target across the globe – a principle agreed by the RCEP. Boris Johnston's target, although less ambitious than that of Ken Livingstone, is well in excess of those considered in the London Energy Partnership study.[28]

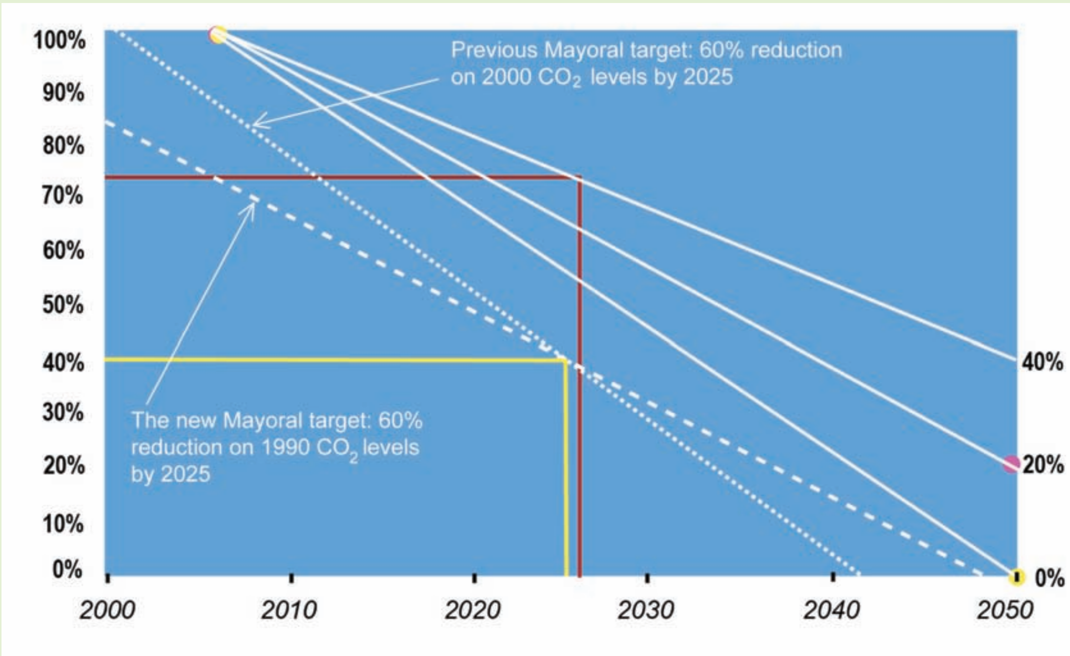


Figure 3.3: Carbon Target 2026 and 2050
(Source: Max Lock Centre, Adapted from London Energy Partnership. 2006

28. Greater London Authority. 2008.

Carbon emissions and energy demands in Soho

3.62 We have estimated CO_2 emissions for the Soho area based on the figures for the two 1 km^2 cells within which Soho is located in the London Energy and CO_2 Emissions Inventory 2003 (LECI) grid for London (see Appendix 5). Soho is almost equally distributed over both cells and the figures for the cells are similar. On this basis we have assumed an estimate based on 25% of the sum of both cells – the study area covering almost exactly 0.5 sq. km. This gives a figure for annual emissions of nearly 102,000 tonnes. Thus, the intensity of carbon emissions per unit area for Soho is 68% higher than that of Westminster as a whole and nearly eight times that of London as a whole, as in Table 3.2.[29] This reflects not only the development density of the area which, according to our estimates is very high (see Background Paper 1, page 7), but the high energy use per unit of floor space associated with commercial uses.

3.63 Nationally, the transport sector is responsible for about 28% of the UK's carbon emissions[30] and 20% of London's carbon emissions (LECI data, omitting aviation and shipping). In Central London, the figure *proportionately* is much lower – just over 8% for Soho. This is because emissions from buildings are so much higher in central areas. As to be expected, the *intensity* of carbon emissions from transport in Soho is somewhat higher than in Westminster as a whole and nearly three times as high as London as a whole.

3.64 Soho is primarily a destination for commuters, shoppers and other visitors and relies on public transport for most passenger traffic. Though it is not a large scale source or destination of heavy freight movement, traffic levels, including buses, taxis, private vehicles at night, delivery vans and other commercial and service vehicles, are very high and pose a significant environmental challenge for Soho. Although not the main source of carbon emissions, noise and air pollution from vehicles are a direct threat to the health and quality of life of Soho's residents and working population. Moreover, buildings cannot be operated in an environmentally efficient way if windows need to be closed to keep out noise and air pollution.

3.65 The high intensity of carbon emissions per unit area for Soho, even allowing for a large margin of error, is mainly a consequence of the very high proportion of non-residential floor space, in particular office/business space and retail and catering, and the extremely high density of development. Most private land is covered with buildings and the resulting deep floor plates are almost impossible to light, ventilate and cool without the use of energy intensive fittings and plant.

3.66 Commercial uses, in general, are far more carbon intensive than residential and use a much higher proportion of electricity from the grid as opposed to gas. This is a consequence of how energy is used within the premises.

3.67 The Government have set benchmarks for 4 types of office – naturally ventilated cellular, naturally ventilated open plan, air conditioned standard and air conditioned prestige.[31] Much of the office space in Soho will fit into the first category, being 'relatively small simple buildings; typical sizes from 100-3,000 m^2' or, less frequently, purpose-built air-conditioned standard office buildings (2,000-8,000 m^2). Given the density of development and high use of IT in Soho, much of the smaller accommodation will have mechanical ventilation or air conditioning and be closer in performance to air-conditioned offices.

29. We also made an estimate using the methodology employed in the London Energy Partnership's London Carbon Scenarios for 2026, employing the benchmark figures for different types of use referred to in that study and our own first estimate of floor space by use in Soho. This produced an estimate of carbon emissions that was several orders of magnitude larger, which suggests that further research and a robust testing of the various methodologies in use is required.

30. Defra. 2007. p5.

31. The Carbon Trust. 2000.

Table 3.2: Energy consumption and carbon emissions in Soho compared to Westminster, London Central Core and London as a whole

	Estimated pop. 2003	Area sq.km	Energy BWh/yr	Energy % by area	CO_2 tonnes p.a.	CO_2 % by area	CO_2 /sq.km
Soho	**3,000**	**0.5**	**320**	**100%**	**101,860**	**100%**	**203,720**
Residential	3,000		21	6.6%	5,999	5.9%	11,998
Non-residential			267	83.4%	87,417	85.8%	174,834
Transport			32	10%	8,453	8.3%	16,906
Westminster	**216,800**	**23**	**8,979**	**100%**	**2,790,505**	**100%**	**121,331**
Residential	216,800		1,743	19.4%	454,501	16.3%	19,761
Non-residential			6,031	67.2%	2,009,076	72%	87,351
Transport			1,205	13%	327,028	11.7%	14,219
London Central Core	**230,000**	**25**	**13,736**	**100%**	**4,387,934**	**100%**	**175,517**
Residential	230,000		1,369	9.9%	340,761	7.8%	13,630
Non-residential			10,908	79.4%	3,644,967	83.1%	145,799
Transport			1,459	10.7%	402,206	9.1%	16,088
London	**7,364,100**	**1,577**	**156,467**	**100%**	**42,520,327**	**100%**	**26,963**
Residential	7,364,100		69,671	44.5%	16,444,590	38.7%	10,428
Non-residential			56,572	36.2%	17,679,210	41.6%	11,211
Transport			30,224	19.3%	8,396,527	19.7%	5,324

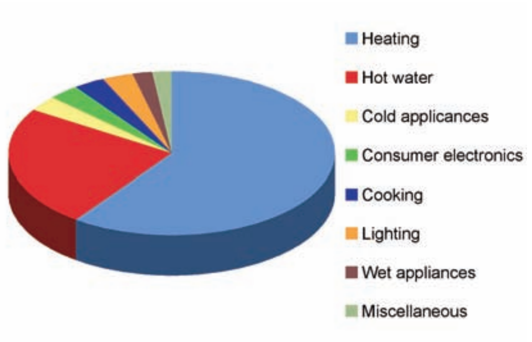
(Source: Max Lock Centre using data from Greater London Authority. 2006a)

3.68 Typical air conditioned standard offices use twice as much energy as naturally ventilated cellular offices. In terms of CO_2 emissions, standard offices produce two and a half times as much as naturally ventilated cellular offices (38 kg/m^2 c.f. 14.8 kg/m^2). Following good practice, the figures can be reduced by 80% in both cases.[32]

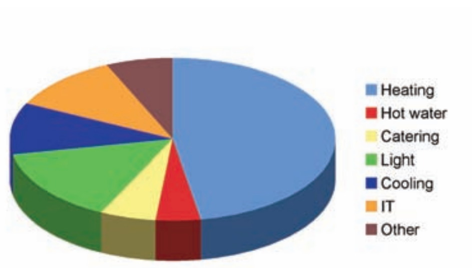
3.69 The rate of growth of energy consumption in the UK commercial sector was three times greater than the growth in domestic energy consumption in the period 1975-2000, equal or exceeding the growth in the contribution of the sector to the UK economy.[33] This growth reflects growth in floorspace and heating, lighting, IT and air conditioning loads. As the same source notes: 'energy efficiency policies and programmes in the UK have focussed on the domestic and industrial sectors, and have tended to overlook the service sector.'[34]

3.70 Energy costs can represent a significant proportion of occupancy costs, but occupiers are generally tenants who may pay energy costs as a part of overall service charges. Also, landlords tend simply to pass on energy cost increases directly to the occupiers. Around half of UK commercial property is owned by institutional investors who regard buildings purely as financial assets and are little concerned with managing their energy efficiency.[35]

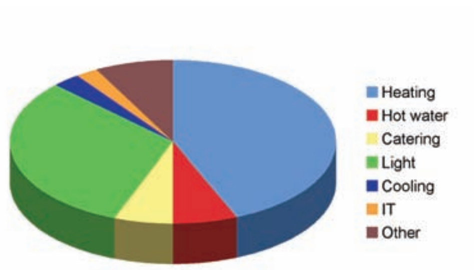
32 McAllister, I and Sweett, C. 2007.
33 Scrase, I. 2000. p3.
34 ibid.
35 Scrase, I. 2000. See also interview with Jonathan Lane in Appendix 3.
36 GVA Grimley LLP. 2007, p125.



Domestic Energy Consumption	
Heating	60%
Hot Water	24%
Cold appliances	3%
Consumer electronics	3%
Cooking	3%
Lighting	3%
Wet appliances	2%
Miscellaneous	2%



Commercial Office Energy Consumption	
Heating	47.1%
Hot Water	4.6%
Catering	5.5%
Light	14.8%
Cooling	10.2%
IT	11.1%
Other	6.7%



Retail Energy Consumption	
Heating	43.6%
Hot Water	6.4%
Catering	5.7%
Light	31.4%
Cooling	2.9%
IT	2.1%
Other	7.9%

Figure 3.4: UK energy consumption in buildings by use for domestic and non-domestic sectors

(Sources: Department for Communities and Local Government. 2006b. McAllister, I and Sweett, C. 2007)

3.71 The dependence of much of the creative industries so heavily concentrated in Soho on computer technology will certainly be expressed in very large power demands for running this equipment and for associated cooling. It is reflected in the concern with maintaining security of power supply stated as the number one priority in the Westminster's Creative Industries report.[36]

3.72 The relatively smaller heating load and larger use of electricity for lighting, cooling and IT in commercial office and retail buildings is reflected in the LECI figures for energy use in Soho with gas accounting for about 52% of the total non-domestic building energy use and electricity accounting for most of the rest.

3.73 As electricity consumption accounts for a larger share of carbon emissions, proportionately more than gas used directly for heating and hot water, electricity use in all buildings accounts for nearly 66% of Soho's carbon emissions. Electricity use in commercial buildings accounts for 43% of all energy and 62% of all carbon emissions from the area.

3.74 According to LECI data, the pattern of commercial energy consumption in London corresponds closely to the pattern of carbon emissions generally and undoubtedly is the major factor in accounting for concentration of carbon emissions in the central core of London (see maps showing pattern of carbon emissions across London in Background Paper 2).