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The Association for the Conservation of Energy

Energy efficiency in offices:

Assessing the situation

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Energy efficiency in offices: assessing the situation

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Energy Efficiency in Offices: Assessing the Situation

This report updates and expands on the report 'White Collar CO2', written by Ivan Scrase, and published by the Association for the Conservation of Energy, in August 2000. Where they remain relevant, sections of the text from the original report are reproduced unaltered here. The report was presented to the Carbon Trust in July 2002 as part of an on-going project. It was further updated to reflect the progress of the EU Energy Performance in Buildings Directive and the UK Energy White Paper and published in March 2003.

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CONTENTS

1. THE CHALLENGE

Energy efficiency policies and programmes in the UK have focused on the domestic and industrial sectors, and have tended to overlook the service sector. This lack of specific interest in the sector is reflected in the way energy consumption data are compiled. In the annual Digest of UK Energy Statistics (published by the Department of Trade and Industry, DTI, and the Government Statistical Service), commercial services have often been included in 'other final users', along with public administration and agriculture although, since 1997, there has been some disaggregation of the figures.

The Energy Review (PIU, 2002) highlights the need to improve energy efficiency in buildings and recommends action to deliver a phased transition to low energy commercial buildings through development of the Building Regulations. The Government consultation (DTI, 2002) leading to the production of an Energy White Paper asks "*What possible ways are there for encouraging (or requiring) the owners of the existing stock of dwellings and other types of buildings to improve energy performance?*" (paragraph 2.8)

The remainder of this paper considers why this challenge has arisen, and puts forward some initial thoughts on moving forward.

1.1 Energy use in the commercial sector

Energy consumption by 'other final users' has *not* been increasing rapidly compared to other sectors. From 1973 to 2000 there was a 17.5% increase in final energy consumption in this sector compared to 24.6% growth in the domestic sector, and 70.2% growth in the transport sector. (Energy consumption in the industrial sector fell by 44.7% over the same period)(DTI, 2001). However, aggregation of 'other final users' masks the fact that virtually all of the increase in this sector has been in *commercial* services (private offices, retail, leisure, hospitality and warehouses).

In commercial services final energy consumption grew by 68.4% from 1973 to 2000, compared to a 9.5% decrease in public sector services energy consumption (DTI, 1997 and DTI 2001 note 4). Table 1 breaks down the growth in 'other final users' into public services, commercial services and agriculture.

Table 1: Growth in 'other' final energy consumption in the UK, 1973 to 2000.

	Million tonnes of oil equivalent		
	Commercial services	Public[1] services	Agriculture
1973 consumption	7.5	8.9	2.2
2000 consumption	12.6	8.0	1.2
Change 1973-2000	**+68.4%**	**-9.5%**	**-47.2%**

Based on DTI (1997) p. 120. and DTI (2001).

Most critically, there has been no improvement in energy intensity (delivered energy consumption divided by contribution to GDP) in the UK service sector

[1] In the original reference this is labelled 'private services' but the text makes it clear this is a misprint.

since the late 1980s (DTI, 1997 note 5). This is to say that while there has been rapid growth in economic output from the service sector, energy consumption has increased just as rapidly.

DTI projections of energy use in the service sector predict a continuation of this trend with energy consumption rising by around 0.7% (in both high and low price scenarios) per year up to 2010. In a high price scenario this outstrips growth in all but the transport sector (see table 2).

Table 2: Projected annual increase in final energy demand up to 2010 by sector.

	% increase in final energy demand per annum (to 2010)			
	Services	Domestic	Transport	Industry
High Price Scenario	0.7	0.4	1.7	0.5
Low Price Scenario	0.7	0.8	1.9	0.9

Based on DTI (2000), pp.22-31.

In this instance the 'service sector' includes both public and private services. Bearing in mind the low/no growth trends seen over the last 30 years in the public sector (see table 1) this will again mask the true extent of final energy demand in the private services sector.

Another worrying trend is the rate of increase in electricity consumption in the service sector. While *total* energy use in the sector defined as 'other final users' by the DTI increased by 17.5% from 1973 to 2000, *electricity* use more than doubled over the same period, representing 31.4% of total electricity consumption in 2000 (DTI, 2001 note 4).

1.2 CO_2 emissions from commercial sector energy use

Growth in CO_2 emissions from the service sector (public plus private) have been kept in check by fuel switching from coal to gas for heating in buildings and in the electricity generation sector. The DTI, in 2000, projected that total emissions from the sector would be 4% lower in 2010 than 2000, and would then increase slowly from 2010 (DTI, 2000). This contrasts with the predictions made in 1995, for an 11% increase in emissions in the period 2000 to 2010, followed by a 19% increase in the subsequent decade to 2020 (DTI, 1995). The optimistic more recent projections reflect a projected return to the 'dash for gas' seen in the 1990s. This is illustrated in actual CO_2 emissions for this period, which show a decrease of around 10% between 1990 and 2000 (DEFRA, 2001). Emissions stood at 21.2 MtC in 2000, 15% of total emissions.

The projections, which underpin the UK Climate Change Programme (DETR 2000a), assume a continuing decline in carbon intensity in the electricity supply industry. This is illustrated in Figure 1. While total electricity generation is expected to continue its rapid upward trajectory, over the next decade improvements in carbon intensity keep total emissions in check. However this assumes a substantial ongoing role for nuclear power (though all nuclear capacity except Sizewell B is expected to have closed by 2020), continued rapid phase-out of coal-fired generation in a new 'dash for gas', and a heroic threefold increase in the use of renewables.

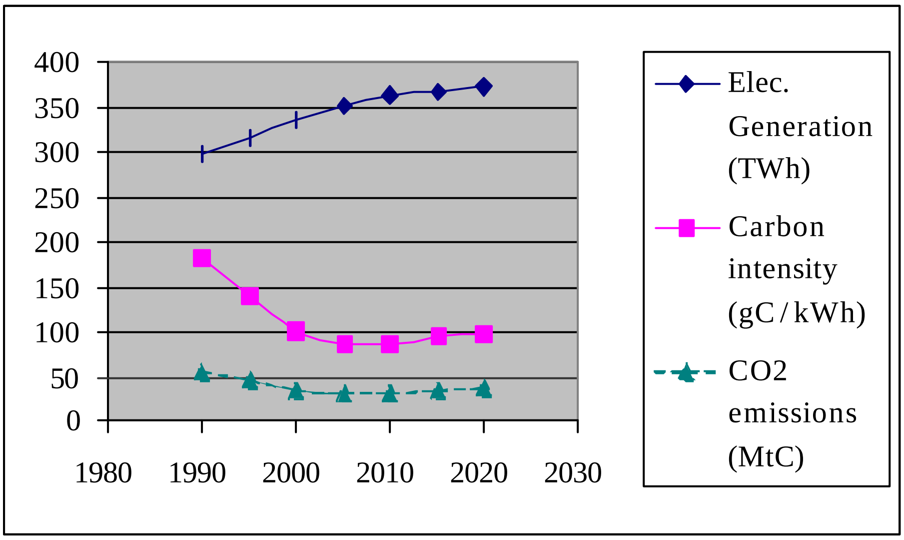

Figure 1: DTI projections for carbon intensity in the electricity supply industry.

Data from DTI 2000 note 8

If there is reason to question these assumptions on the fuel mix in electricity generation, then there is real cause for concern over the near future contribution of the commercial sector to UK CO_2 emissions. Furthermore, from 2010 emissions are set to rise *even under these assumptions*, and they will rise particularly quickly in the rapidly expanding (and electricity intensive) *private* commercial sector.

2. A FOCUS ON OFFICES

2.1 Why offices?

Within the commercial sector, offices, together with warehouses and retail premises, are a significant contributor to energy use and carbon emissions. From these three sub-sectors, offices seem to offer the greatest potential for action to achieve significant savings: the range of technical solutions is not too large as the nature of energy service demands in offices is relatively homogeneous; a significant, highly cost-effective technical potential for savings can be identified; there is scope for a range of solutions tackling the problem from a number of angles if a range of the significant stakeholder groups can be engaged, and action by a small group of large stakeholders could significantly change the market.

DEFRA funded research on energy use in non-domestic buildings (Pout et al, 1998) provides a breakdown of energy use and CO_2 emissions by type of occupier, end use and fuel type. Data for commercial offices are presented in Table 3. Figure 2 presents the proportion of total CO_2 emissions by end use in the sector. These estimates are based on extensive energy audits and national stock data from the Valuation Office, and are therefore quite reliable and complete. Note that CO_2 data include emissions from power stations.

Table 3: Energy consumption and CO_2 emissions in UK commercial offices.

	Fossil fuels (PJ)	Electricity (PJ)	CO_2 (kT)
Heating	46	5	3680
Hot water	5	0	469
Catering	3	3	370
Light	-	16	2238
Cooling	-	11	1319
Small power	-	2	250
IT	-	12	1031
Other	-	2	184
Process	-	3	7
Unknown	-	0.3	121
Total	**54**	**56**	**9669**

Based on Pout *et al.* (1998)

In 1996, the CO_2 emissions from commercial sector offices amounted to almost 10 million tonnes per annum. This is equivalent to 2.6 million tonnes of carbon (MtC).

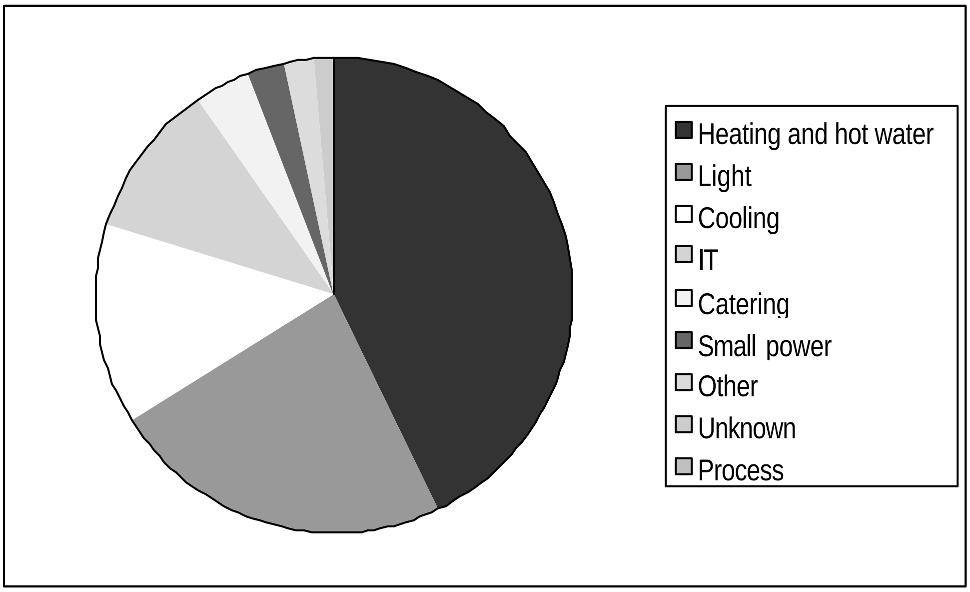

Figure 2: CO_2 emissions by end use in offices.

Based on Pout *et al.* (1998)

2.2 Major drivers affecting energy demand and energy efficiency

The rapid growth in energy consumption in offices over the last three decades reflects expansion in floor space, and increased heating, lighting, IT and air conditioning (A/C) loads in individual buildings.

2.2.1 End uses

The increase in electricity use in the sector reflects growing demand for increased levels of illumination, the growth of A/C and use of IT equipment. The extent to which this has delivered increased levels of energy service is unclear.

The results of the E-commerce Inquiry 2000 show that 92% of UK businesses now use PCs, workstations or terminals (Williams, 2001).

Energy consumption for cooling is particularly high in offices. Electricity demand for cooling is expected to increase rapidly in coming years, since "*…only a small proportion of service sector floor area currently has air conditioning plant fitted and…newer premises are more likely to be air conditioned. These factors indicate that cooling energy use may increase substantially in the future*" (Pout *et al.*, 1998 p. 63).

Over half of new office premises built in the 1990s had A/C. In the 1980s and 1970s these proportions were 43% and 36% respectively. Over the last decade UK sales (by volume) for A/C chiller-units have more than tripled (55,500 units were sold in 1988, compared to just over 220,000 in 2001) – almost all of these units were sold to the commercial sector, with around 45% installed in commercial offices (BSRIA, 2002). If this trend continues, coupled with the rapid increase in floor area discussed below, energy consumption will continue on its rapid upward trajectory.

2.2.2 Floor space

Figure 3 demonstrates the rapid growth in commercial office floor space since the early 1970s in England and Wales. From 1970 to 1994 office floor space almost doubled. The data for 2000 shows a marked increase in the floor space since 1994. This is consistent with a growth in the amount of out-of-town business parks, but the intervening data have not been located through statistical research so far.

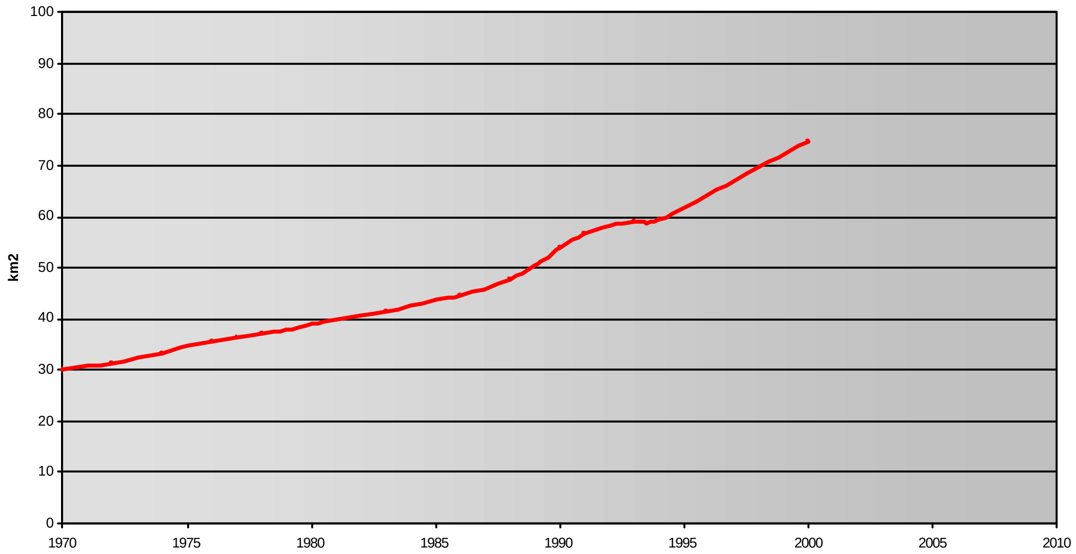

Figure 3: Growth in commercial office floor space in England and Wales 1970 to 2000

Data from Pout *et al.* (1998) Pout *et al.* (2002) and DTLR (2001)

2.3 Office energy use: major end uses

The Energy Efficiency Best Practice Programme has studied typical and good practice energy consumption in 4 types of offices (DETR, 2000b). The office types are as follows:

1. Naturally ventilated cellular
2. Naturally ventilated open-plan
3. A/C, standard
4. A/C, prestige.

Table 4 presents good practice and typical energy consumption for these office types. It demonstrates the following:

- A typical prestige office consumes 2.8 times more energy per unit of floor area than a typical naturally ventilated cellular building.
- Typical offices use 60% to 90% more energy than offices using good practice.
- A/C offices use substantially more energy than non-A/C offices to deliver energy services such as heating, lighting and ventilation.

Table 4: Typical and good practice energy consumption in offices in the UK.

	kWh/m² of treated floor area							
	Type 1		Type 2		Type 3		Type 4	
	Good practice	Typical	Good practice	Typical	Good practice	Typical	Good practice	Typical
Heating & hot water	79	151	79	151	97	178	107	201
Cooling	0	0	1	2	14	31	21	41
Fans, pumps and controls	2	6	4	8	30	60	36	67
Humidification	0	0	0	0	8	18	12	23
Lighting	14	23	22	38	27	54	29	60
Office equipment	12	18	20	27	23	31	23	32
Catering	2	3	3	5	5	6	20	24
Other electricity	3	4	4	5	7	8	13	15
Computer room	0	0	0	0	14	18	87	105
TOTAL	**112**	**205**	**133**	**236**	**225**	**404**	**348**	**568**

Based on DETR (2000b)

Furthermore, energy consumed for cooling, fans, computer rooms, humidification, pumps and controls tends to be electricity. Therefore the CO_2 emissions are even more divergent between A/C and naturally ventilated buildings: a typical prestige A/C office emits almost 4 times as much CO_2 per unit of floor area as a typical naturally ventilated cellular office (see Table 5 and Figure 4).

The data in table 5 and figure 4 demonstrate that:

- The difference between good practice and typical CO_2 emissions in A/C offices is of roughly equal magnitude to *total* CO_2 emissions in a *typical* naturally ventilated office. Therefore if one is aiming to reduce total CO_2 emissions from the office sector, much greater savings are possible in A/C offices than in traditionally ventilated buildings.
- A typical prestige A/C office produces 3 to almost 4 times as much CO_2 per unit of floor area as naturally ventilated offices. (It should be noted that some of the additional energy consumption and CO_2 emissions in prestige offices arise because of energy consumption for dedicated computer rooms. This is effectively 'process' energy and could be discounted, but CO_2 emissions still remain 2.3 to 3 times as high as in naturally ventilated offices).

These observations are particularly pertinent given the rapid switch to A/C in new offices.

Table 5: CO_2 emissions per unit of floor area for 4 office types

	kgC/m² treated floor area							
	Type 1		Type 2		Type 3		Type 4	
	Good practice	Typical	Good practice	Typical	Good practice	Typical	Good practice	Typical
Cooling, fans, pumps, controls & humidification	0.3	0.8	0.6	1.3	6.6	13.8	8.8	16.6
Heating & hot water	4.1	7.9	4.1	7.9	5.0	9.3	5.6	10.5
Lighting	1.8	2.9	2.8	4.8	3.4	6.9	3.7	7.6
Other	2.2	3.2	3.4	4.6	6.2	8.0	17.7	21.7
TOTAL	**8.3**	**14.8**	**11**	**18.7**	**21.3**	**38.0**	**36.6**	**56.4**

Based on DETR (2000b)

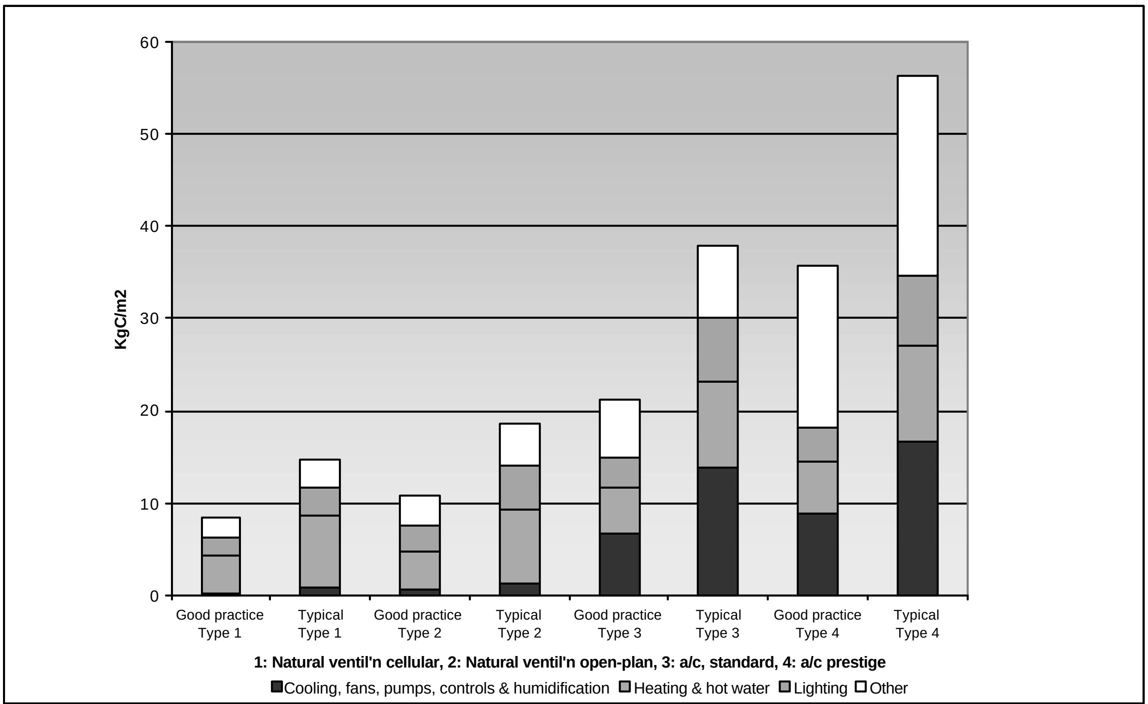

Figure 4: CO_2 emissions for different office types

2.4 Cost-effective energy efficiency improvements

Using readily available and cost effective technologies to save energy in non-domestic buildings would save 4.14 to 4.60 MtC per annum (19 to 21% of total commercial sector CO_2 emissions) (Pout et al, 2002). (This range of savings is obtained by defining cost-effectiveness using discount rates of 15 and 6% respectively). In the commercial sector alone savings of up to 2.46 MtC per annum could be made – around 20% of this coming from commercial offices. The measures that could be installed include the following:

- Condensing natural gas boilers
- Compact fluorescent lamps

- Low energy computing equipment and accessories
- Thermostatically controlled radiator valves
- Improved design and use of A/C systems
- Replace electric room heaters with natural gas room heaters
- Loft and cavity wall insulation
- Hot water tank lagging
- Lighting timers
- CHP

It should be stressed that much greater carbon savings than those stated above are technically possible, but these estimates refer only to ‘cost-effective’ options that save businesses money and were readily available in 2000.

3. MOVING FORWARD: INITIAL THOUGHTS

3.1 Existing initiatives

3.1.1 Building Regulations

Recent policy activity in both UK and Europe is attempting to address non-domestic buildings. Amendments to the provisions for energy efficiency in the UK Building Regulations published in 2001 (DTLR, 2001) stipulate that office buildings with over 200 m^2 of floor area, and with A/C or mechanical ventilation, should meet maximum emissions targets and show compliance via calculation of a 'Carbon Performance Rating'. The proposal is that the emissions should be no higher than those for the *typical* buildings in their class, based on the data presented above in Table 6. Given the large difference between typical and good practice CO_2 emissions this seems a rather unambitious stipulation. The resultant CO_2 savings, not surprisingly, would be rather small (though highly profitable in energy cost savings, with a net present value of £3.50 per £1 invested) (DETR, 2000c).

In total the proposed amendments to the Building Regulations are predicted to result in annual CO_2 savings in the entire non-domestic sector of less than 0.4 MtC. This is rather small compared to the Building Research Establishment's estimate that up to 2.46MtC could be saved each year using cost-effective and readily available technologies in the commercial sector alone (see Section 2.4 above).

3.1.2 European Buildings Directive

However, to achieve these higher savings, more stringent legislation is needed to improve energy efficiency in existing buildings. The Energy White Paper (DTI, 2003 p.36) has now committed the Building Regulations to review every 5 years, partly to comply with the Buildings Directive.

The EC directive on the energy performance of buildings (European Union, 2003) will not only ensure the application of minimum requirements on the energy performance of *new* buildings, but also on large *existing* buildings (>1000m^2) that are subject to major renovation. Through the Directive, Member States will be required to review minimum building standards at least every 5 years and take appropriate steps to bring standards up to date with modern building practices.

In addition the Directive proposes that all buildings carry an energy certificate, valid for a maximum of 10 years that is made available at every change of tenancy/ownership. Public buildings and those frequently visited by the public (>1000m^2) must display their energy certificate in a prominent place. The Directive will therefore provide a tool for tackling energy performance in existing buildings and provide a framework for stepwise improvement of energy efficiency in both new and existing commercial buildings. However, although it was ratified in 2003 at the earliest, it can take up to 6 more years to enter into force, as Member States have three years to transpose the Directive into national law and a further three years if needed to implement certain of the requirements.

3.1.3 Climate Change Levy

The Climate Change Levy is sending a small but positive signal to businesses about the need to conserve energy (despite the fact that recycling of the revenue into a reduction in National Insurance premiums will mean that many service sector businesses will make a net financial gain). This signal is a positive change, but there may be a limit to its effectiveness in a sector where energy bills represent such a small proportion of total costs.

3.1.4 Enhanced Capital Allowances

Enhanced capital allowances have been introduced for a limited range of energy efficiency investments in properties, alongside the introduction of the Climate Change Levy. This is a positive gesture, and consideration should be given to some of the other proposed incentives. However, unless these incentives are very large it is doubtful that they would have a marked effect on new and existing buildings given the barriers which exist.

The leisure industry is another sector in which similar trends to those in commercial offices are observed. In this case, the industry has entered a voluntary agreement with the government to reduce its energy consumption (EIBI, 2000). This is the first sector in which such an agreement has been made relating to energy use in buildings rather than in industrial processes, and the agreement has been reached without the incentive of an exemption from the Climate Change Levy.

3.1.5 Information provision and advice

Aside from policy and fiscal incentives there is also a major information provision initiative designed to promote best practice in the commercial sector. Action Energy (formerly EEBPP) is a government funded service, designed to support and promote best practice in the industry. It provides free publications offering practical guidance and impartial information, as well as numerous events and design advice services for new-build projects and refurbishments.

3.1.6 Business led initiatives

In addition to government led initiatives there are also some key industry stakeholders working together to promote best practice in office development and re-fit. The British Council of Offices "Office Fit Out Guide " is currently being developed by a team including representatives from Land Securities, Bovis and Jones Lang LaSalle (BCO, 2003). Co-ordinated by the BRE Environment group and the BCO the new guide to office fit out is designed to inform building clients, in particular, with a good background about the requirements for a fit-out project. This will include information on judging the environmental impact of fit-out options(through assessing embodied energy, lifecycle costs etc).

It is hoped that the updated guide will have a wide and receptive audience, as it has been designed by and for those with a stake in the commercial office sector. However, unlike the Action Energy information and guidance, it perhaps does not go the full distance towards promoting very best practice in building energy efficiency and developing strong environmental credentials.

3.2 Stakeholders

There are a number of factors which contribute to the problem of low energy efficiency in commercial offices by discouraging action amongst key stakeholder groups.

Problems begin at the design stage, with clients rarely demanding energy efficient buildings, and architects rarely forcing it on to the agenda (this may improve now that sustainability considerations are a requirement in all British architecture degree course design projects). Architects, surveyors and letting agents all have a financial interest in upping the specifications of buildings, since their commission reflects total cost, although the extent to which this affects actual practice is unclear. Environmental engineers are then called in to design building services to overcome the effects of inappropriate building design (Bordass 1993). The result may be an inefficient, uncomfortable and unhealthy building, but this will not necessarily be reflected in a lowered valuation if it is otherwise of 'investment quality'. Indeed, the opposite situation is more likely: when confronted with a non-standard product (such as a highly energy-efficient building), UK valuers actively mark down prices (Gibson & Lizieri, 1999).

Conservatism and vested interests across the property professions inhibit provision of the kinds of workplaces occupiers actually want. So why do occupiers not press for change? The report 'Towards sustainability: a strategy for the construction industry (SCFS, 2000)' describe it as a circle of blame as shown in Figure 5.

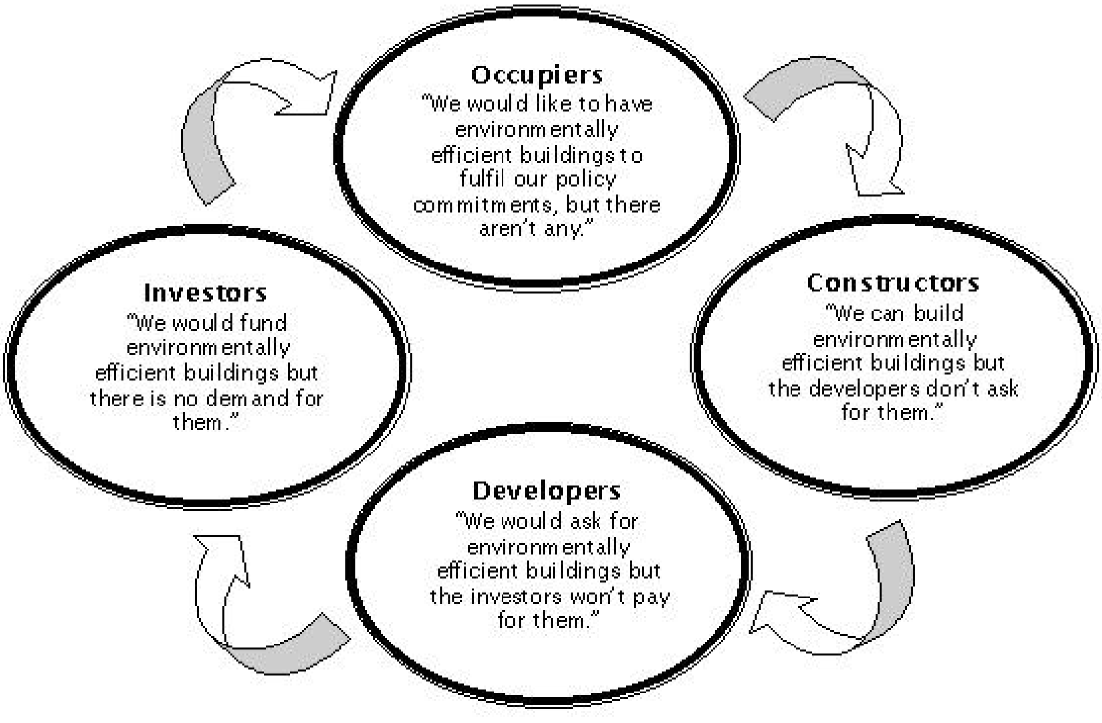

Figure 5: The commercial building "Vicious Circle of Blame"

A report (Parnell & Sayce, 1999) by leading quantity surveyors Drivers Jonas and Kingston University explores the attitudes to 'green buildings' among property investors, developers, bankers and consultant chartered surveyors.

In a postal survey of 100 property professionals, 89% responded that they were 'quite' or 'very' concerned about the state of the environment. However, only 17% said they were 'frequently' able to make a contribution towards the promotion of environmentally friendly new buildings or refurbishments.

Among property professionals canvassed for the report there was a widely held view that environmentally friendly buildings cost more and that the additional cost of cannot be recouped in higher rental values and investment yields. Investment companies and surveyors were particularly sceptical, though the majority of all respondents thought that in 5 years' time environmental issues would affect rents and yields. Well over half of the respondent developers and financial institutions believed environmental factors would affect their strategy within 5 years, yet only a minority of investment companies and surveyors shared this view. *The worrying revelation is that these statements almost exactly mirror the results from a similar survey conducted 5 years previously.*

The report goes on to consider respondents' views on 5 possible financial incentives for investment in green buildings:

- A carbon tax. Three quarters of respondents felt that a carbon tax would be effective and over half were in favour of its introduction. However 70% felt it would be difficult to implement.
- Rates discounts for 'green' buildings. This proposal was very popular, though two thirds thought it would be difficult to implement.
- Capital allowances incentives. This proposal was very popular and considered likely to be effective and easy to implement.
- Lower VAT on green building materials. This proposal was also popular and considered likely to be effective, but half of respondents foresaw problems with implementation due to difficulties in identifying green products. They also felt that interference in the markets for products might be politically unacceptable.
- An environmental sales tax. A sales tax based on independently assessed criteria was the only suggestion that was rejected by the majority of respondents. Over two thirds thought it would be effective, but few thought it would be straightforward to implement.

Overall 90% of respondents were in favour of financial incentives, and interestingly the response to the carbon tax proposal shows that 'sticks' as well as 'carrots' might be welcomed. Over three quarters of respondents felt that the UK government should take the lead in creating financial incentives for greening the property industry.

3.3 Landlord-tenant issues

One commonly cited reason for the lack of investment in energy efficiency in buildings is that energy represents a small percentage of total occupancy costs, and therefore it is given little attention. However, in offices, particularly air conditioned ones, energy and the maintenance of heating and cooling equipment comprises a significant proportion of service charges. Although these are a small proportion of overall costs, they may be an area which tenants are concerned about and hence may provide a potential lever for action.

In 2000, A/C office buildings had an average annual service charge of £53.82 per m^2, compared to £37.24 for non-A/C buildings (Jones Lang LaSalle, 2001). Table 6 breaks these service charges down by components. Thus, in A/C offices energy itself represents 16% of total service charges; by including maintenance of heating and A/C systems this brings the proportion up to 35%. These are significant proportions, and therefore one might expect that tenants would be interested in lowering energy consumption in their premises.

Table 6: Service charges in UK offices by component percentages in 2000

	A/C	Non A/C
Energy	16 %	11 %
Heating and A/C maintenance	19 %	9 %
Other	65 %	80 %

Based on Jones Lang Lasalle (2001)

Unfortunately this is often not an option. In the commercial sector almost half of the stock (by value) is owned by institutional investors (Callender & Key, 1997). In 1990 52% of offices and 35% of retail outlets were owned by institutional investors (Scott, 1996). Total UK commercial property stock had a value of £265 billion (bn) in 1995 (Callender & Key 1997). The largest investors are long term insurance companies, with £36.4 bn worth of assets (14% of total UK commercial property stock). The other large investors are UK quoted property companies (£28.2 bn, 11% of total stock), pension funds (£24.3 bn, 9%) and foreign investors (£12-15 bn, approximately 5%). Other insurance interests, property unit trusts and investment trusts hold a further £4.1 bn (1.6%) of the UK assets. Traditional landowners, such as the Crown Estate, Church Commissioners, Oxbridge colleges and urban estates such as the Grosvenor and Bedford, own a further £8 bn worth of commercial property assets. Institutional investors dominate in the prestige and A/C end of the market, where buildings are considered to be of 'investment quality'.

Just 10% of commercial property is occupied by the freeholder, and 70% of commercial buildings are multi-tenanted (Herring et al, 1988). Thus we have a classic landlord/tenant barrier to improving energy efficiency: tenants are unable or unwilling to invest in improving the efficiency of buildings owned by another party, and the owners are happy to pass on the fuel costs to the tenants. An extended quote from Gibson and Lizieri (*op cit*) illustrates the problem. Their research focuses on the mismatch between office space provision and the needs of businesses, but the arguments apply equally to the provision of energy services in commercial buildings:

"The major financial institutions, defined as both institutional investors, pension funds and life assurance companies, and property companies, continue to dominate the UK property market. With properties viewed purely as an investment asset, such firms have been unwilling to act as providers of product and service to occupiers. The cost and time involved in 'management' of the property investment are seen as a disadvantage for property investment when compared to other asset classes…Many financial institutions thus outsource the management of their investment portfolios to property consultants who see it purely as an administrative function. Their measures of performance are related to minimising voids, keeping management costs down and ensuring that tenants

are paying promptly and meeting their obligations. The client is the financial institution, not the tenant, who has little power or influence.

This arm's length attitude to space provision contributed to the development of the UK institutional lease with its long term, onerous conditions and FRI (full repairing and insuring) provisions...This lease structure minimises the involvement of the landlord and maximises the input of the tenant....'

3.4 The role of the insurance industry

The insurance industry, which owns almost £40 bn worth of commercial property assets in the UK (15% of the total value) (Callender & Key, 1997), might be expected to take a lead in improving energy efficiency in its property stock. For example, Prudential Property Portfolio has called for legislation to ensure that every commercial building is audited every 5 years, with recommendations to be implemented before the next audit (EIBI, 1999). Furthermore, Prudential has already taken steps to assist its tenants to save energy, in particular by making efforts to ensure that all tenants receive individual bills based on their energy consumption rather than on floor area alone. Individual metering and billing is required under Article 3 of the EC SAVE Directive 93/76. In addition, the amendments to the Building Regulations covering conservation of fuel and power also require sufficient information to be provided to tenants/occupiers to operate and maintain building services effectively (DTLR, 2001 note 19). This includes enabling occupiers to measure their own actual energy consumption even where this requires sub-metering. Enforcing compliance with this regulation would be a positive step, but a limited amount can be saved before attention must be turned to the building fabric, heating and cooling systems.

The insurance industry is concerned about the impacts of climate change, particularly in terms of extreme weather events, which could lead to heavy insurance claims. In a United Nations Environment programme Insurance Industry Position Paper on Climate Change (UNEP, 1996) it states:

"Man made climate change will lead to shifts in atmospheric and oceanic circulation patterns. This will probably increase the likelihood of extreme weather events in certain areas. Such effects carry the risk of dramatically increased property damage, with serious implications for property insurers" (UNEP, 1996, para. 2.1.2).

Over 60 insurance companies from 23 countries are now signatories to a United Nations Environment Programme 'Statement of Environmental Commitment by the Insurance Industry' (UNEP, 1995). This calls for precautionary action to reduce greenhouse gas emissions, and states:

"The insurance industry recognises that economic development needs to be compatible with human welfare and a healthy environment. To ignore this is to risk increasing social, environmental and financial costs. Our industry plays an important role in managing and reducing environmental risk, in conjunction with governments, individuals and organisations. We are committed to work together to address key issues such as pollution reduction, the efficient use of resources, and climate change. We endeavour to identify realistic, sustainable solutions".

Life and health insurance companies should carefully examine the dividends in terms of loss prevention afforded by investing in healthier, more energy efficient real estate. One US author(Mills, 1997) has identified 33 energy efficiency measures which can contribute to 8 categories of insurance loss mitigation. These are fire and wind damage, ice and water damage, extreme temperature episodes, power failures, professional liability, theft, and health and safety liability relating to indoor air and lighting. There are positive signs:

"We are committed to manage internal operations and physical assets under our control in a manner that reflects environmental considerations" (UNEP, 1995, para. 2.2).

Presently this appears only to mean gestures to help tenants reduce their consumption, at no cost to the freeholder.

3.5 Under-sold benefits of energy efficiency

In manufacturing industry there is mounting evidence of a significant positive correlation between productivity and energy efficiency (Boyd & Pang, 2000). In the services sector, productivity in terms of worker output is a difficult concept to measure empirically. This has been overcome by measuring workers' perceptions of their own productivity, as it relates to their working environment.

The first study of this kind, in 1987, reported on the causes of 'building sickness' (Wilson & Hedge, 1987), also known as 'sick building syndrome' or 'building related sickness'. Using a questionnaire survey of over 4000 workers in 46 buildings, the report found that 80% of workers experienced symptoms that they associated with being in their place of work. They found that '*air-conditioned buildings had consistently higher rates of sickness than buildings with either natural or mechanical systems of ventilation*'. Furthermore, perceptions of comfort were no greater in A/C buildings. A lack of perceived control over one's local environment, plus an oppressive feeling of exclusion from the outside world (which is associated with the deep plan structures that A/C facilitates), added to the dissatisfaction and perceived reduction in work productivity.

Subsequent surveys (Leamann & Bordass, 1999) have confirmed and extended these conclusions. They warn that it is very difficult to isolate causes and effects in buildings: '*..there is no such thing as an independent variable in a building!*' Nonetheless, "*there is a consensus that indoor environment factors improve output, as well as a lot of evidence to show associations with a cluster of related factors such as perceived health, comfort and satisfaction. There are also data to show that some of the management, design and use characteristics which improve perceptions of individual welfare also contribute towards better energy efficiency, thereby closing the loop on a potential 'virtuous' circle*"

Leaman and Bordass (*ibid*) identify four clusters of building-related variables which affect worker productivity: personal control over the work environment; responsiveness to problems as they arise; building depth; and size of workgroups. A/C buildings often perform badly in all respects. By allowing building depths greater than 15 metres, and reducing options to control personal environments (by opening windows, for example) workers often find themselves in large, deep, open-plan spaces with large workgroups. Dependence on sophisticated technology to control the interior environment creates problems where building management is unresponsive or incompetent when problems arise. Lack of perceived control significantly increases intolerance of discomfort. Though A/C is not *necessarily* a cause of low worker productivity, it is clearly implicated.

US research confirms the importance of indoor environments in the workplace for health and productivity (Fisk & Rosenfeld, 1998), and that "*numerous* *building technologies and practices have the potential to simultaneously increase productivity and save energy".*

3.6 Stakeholder communication

As identified earlier there is a "circle of blame" that commercial office stakeholders are using as an excuse for inaction. There is the perception that it is always the responsibility of another member of the chain to demand or implement energy efficient, environmentally sound office buildings.

A number of groups are now working on projects to increase communication between some or all of the stakeholders involved in producing new buildings or retrofitting existing ones. From building occupiers to investors there is considerable scope to promote dialogue and interaction that allows all parties to spell out their needs, and discuss the options open to them.

Work commissioned by the BCO with Arup Associates looks to bridging the gap between developer and occupier (Beavan, 2002). The work explores the opportunities for trade off between different areas of a building and its services to achieve more sustainable buildings. Case study examples of this approach show that by involving the occupier at an early stage their requirements can be met, and energy efficiency built in, without compromising the desirability of the building for future tenants.

Additional work from BRE Environment and the British Institute of Facilities Managers has also been striving to improve communication between Building Services and Facilities Managers and Building Designers (see projects.bre.co.uk/design). Through the involvement of facilities managers from the outset the design process can benefit from the addition of specific expertise that goes beyond initial specification and into running and maintenance. This results in a better specified building that is more responsive and based on a more (energy) efficient system.

On a larger scale, research in the US into the barriers to developing energy efficient buildings proposed a solution loosely defined as a "Collaborative Process Model" that encourages all actors in a new build project to interact and communicate with each other (Reed et al, 2000). The strategy proposed by the report takes a team approach whereby the architect, engineers, interior designers, site planner, mechanical and electrical contractors etc are all involved at every stage of the design, and also implementation process.

Although the 'circle of blame' is a clear contributory factor to the lethargy in advancing sustainable buildings, enhancing communication and creating a forum for dialogue between stakeholders is showing itself as a clear opportunity for promoting energy efficiency whilst meeting the needs of all players.

4. Conclusion

Although this paper has given considerable thought to meeting the challenge, the authors were disappointed by the effort put into answering the question cited from the consultation for the UK White Paper (see page 1) in the Energy White Paper itself (DTI, 2003).

No new challenges were presented to business, merely a repetition of the "package" already in place – the Climate Change Levy, Emissions Trading and Enhanced Capital Allowances. Some encouragement was given to using energy efficient plant and to reporting on environmental impacts.

It appears that far more emphasis needs to be given to the roles of stakeholders and to the landlord-tenant issue, in order to lead to real change.

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