Contents

Introduction

This Report will:

- Focus on the energy demand for the UK service sector with a primary focus on the commercial sector.
- Analyse the historical trends that have appeared in the sector across current fuel types principally between 1970 and 2009.
- Assess the key drivers of energy demand within the commercial sector.
- Include demand projections by fuel type across the sector from 2009 to 2030.
- Investigate the regulatory frameworks and technological improvements influencing low energy building design.
- Discuss the factors that will reduce total demand for energy in the sector over the next 2 decades.
- Focus on low energy commercial building design.

The service sector is comprised of 2 sub sectors: commercial & public administration. The commercial sector is made up of businesses such as retail and the financial sector. Public administration consists of all the Government department buildings and includes their estates.

Overall the service sector contributed to 12.8% of the total demand for energy in 2008. This equated to a demand of 814 petajoules out of a total UK demand of 6841 petajoules.

Service Sector Fuel Mix

Figure 1 below illustrates the demand from each sub sector within the service sector. It can clearly be seen that retail businesses represent the largest demand at 23%. They rely on multi site operations that require large amounts of heating and refrigeration. For example Tesco now has over 2700 stores in the UK. In 2008 the UK had 547,870 retail premises.

The Hotel & Catering sector is also a large energy consumer at 16% of the service sector total. Warehouses come in a close 3rd at 15%. Much of these warehouses will feed the last 2 categories, part of our UK supply chain. In 2008 there were 205,954 warehouse premises.

Commercial offices make up 11% of the demand from over 300,268 offices in England & Wales (Source: Communities and Local Government analysis of Valuation Office Agency figures).

The rest of the demand is made up of sport and leisure, education, Health, Communication & Transport and Government. The Government and education sectors contribute only 15% of the total demand, and the rest is from private business operations.

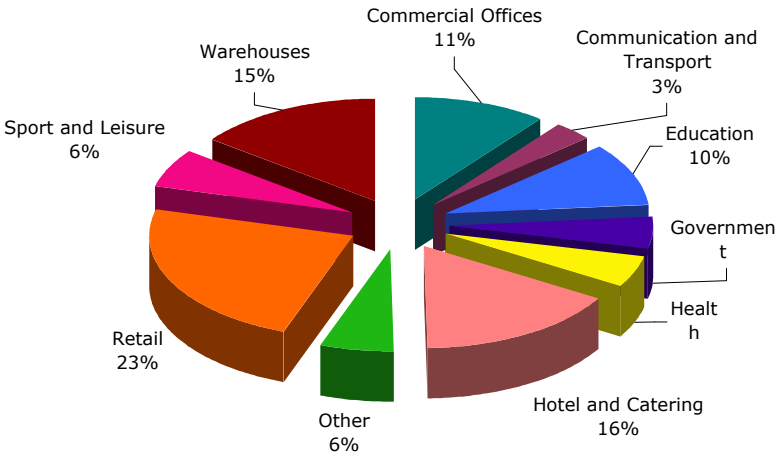

Figure 1. Sub Sector Energy Demand 2007

Change in Fuel Mix

The service sector has seen a huge change in the fuel use supplying its demand since 1970. Figure 2 is a breakdown of the fuel mix in 1970. It can clearly be seen that oil made up the majority of the fuel, followed by electricity, coal and gas.

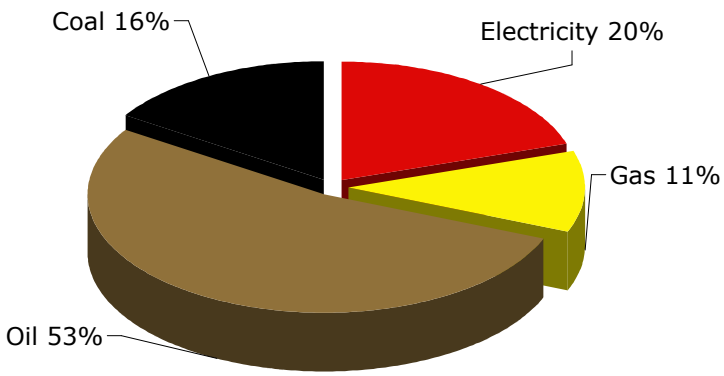

Figure 2. Service Sector Fuel Mix in 1970

If we look at the fuel mix for the sector in 2008 in figure 3 we can clearly see a significant change in the proportion of energy coming from these fuels. Coal has virtually disappeared as a fuel in this sector and oil has gone from a 52% share in 1970 to only an 8% share in 2008. The share of energy coming from gas and electricity has conversely increased as coal and oil has decreased. Gas has moved from 11% in 1970 to 46% in 2008, the biggest increase of all.

Electricity has also seen a huge rise from 20% to 45%. In 2008 we are also seeing approximately 1% of the demand being met by building integrated renewable energy (BIRE).

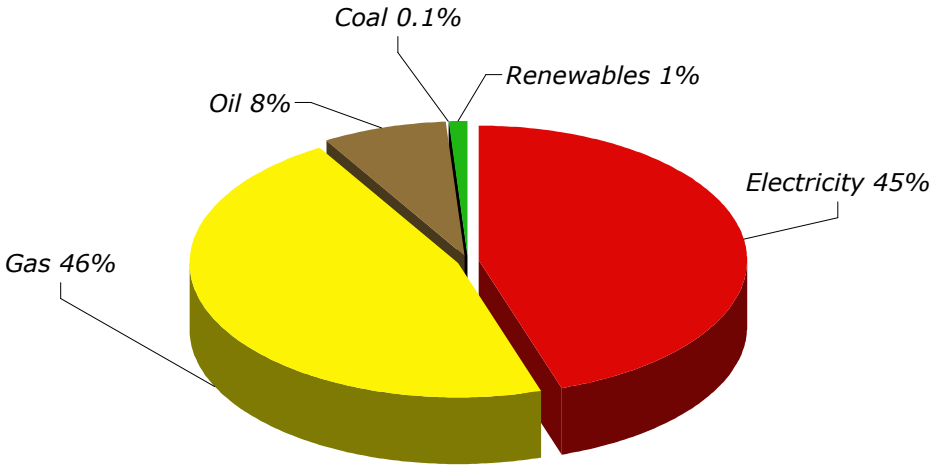

Figure 3. Breakdown of service sector fuel mix in 2008

This change in fuel mix over time can be seen very clearly in Figure 4 below.

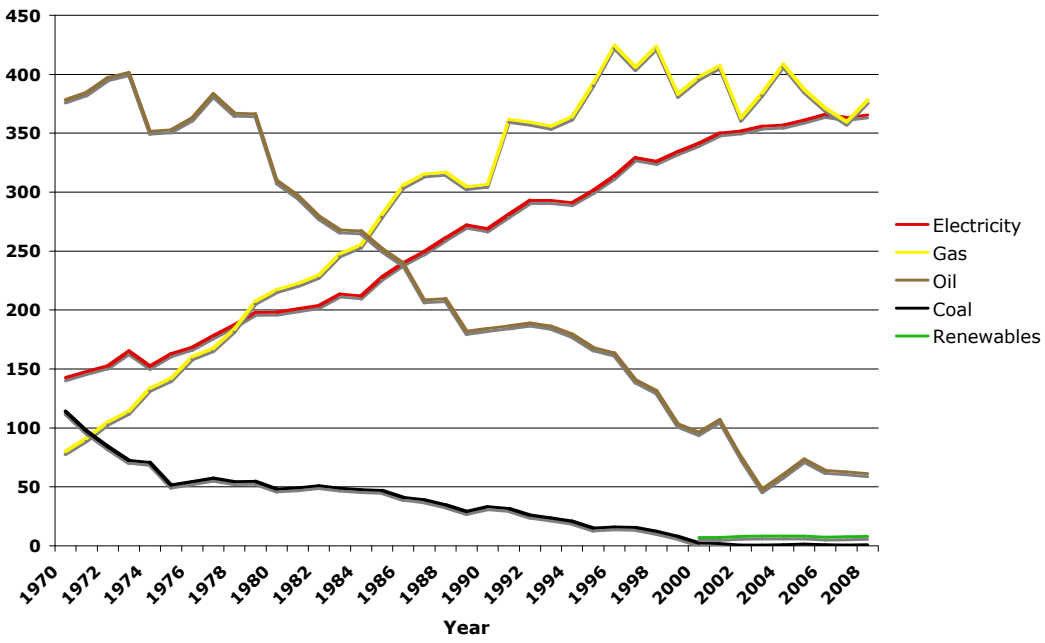

Figure 4. Service Sector fuel type demand from 1970 to 2008.

As discussed, the fuel mix has change considerably, but what has happened to the overall energy demand for the sector? The growth in demand has risen by 5.6% from 778 PJ in 1970 to 824 PJ in 2008. This is an interesting fact when we consider the change in the number of people employed in the sector.

Figure 5 below shows graphically the total energy demand for the sector. The peak demand was in 1997, where it hit 925 PJ, which is nearly a 16% increase from 1970 levels.

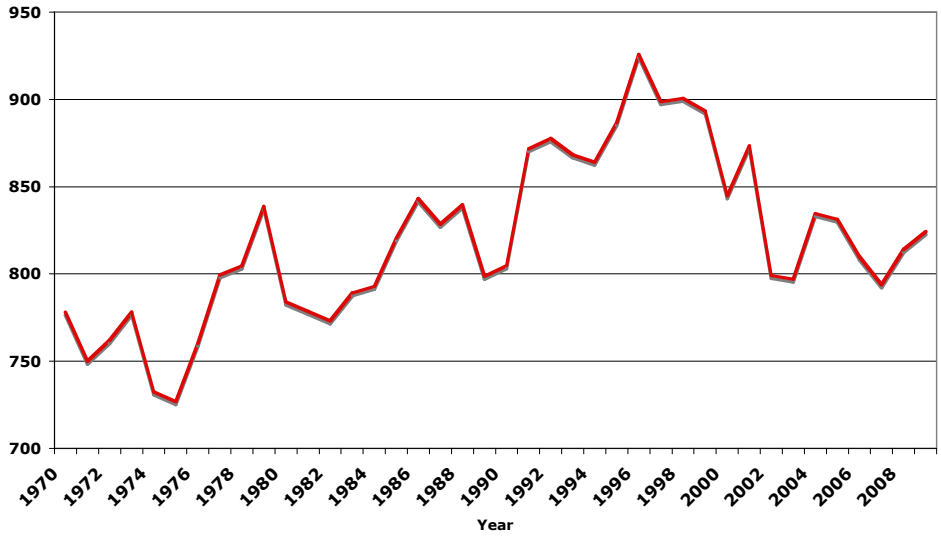

Figure 5. Energy Demand in the Service Sector 1970 to 2009

Growth in Employment & Energy Intensity in the Service Sector

In economic terms this increase in use demonstrates a small success in the efficient use of UK fuel to supply business adding value and GDP to the UK economy. We can see from figure 6 that the number of people employed in the service sector has risen from 16,527 in 1970 to 25,574 in 2008, a considerable increase of 9047 people or 35% in 40 years. Conversely there has been a decline in the proportion of people employed in the energy intensive industrial sector. This could certainly be considered a win for reducing the energy intensity of economic output in this country and a more efficient use of our energy resources, although of course it leaves us at the mercy of price volatility in the global export market by having a limited or smaller industrial sector.

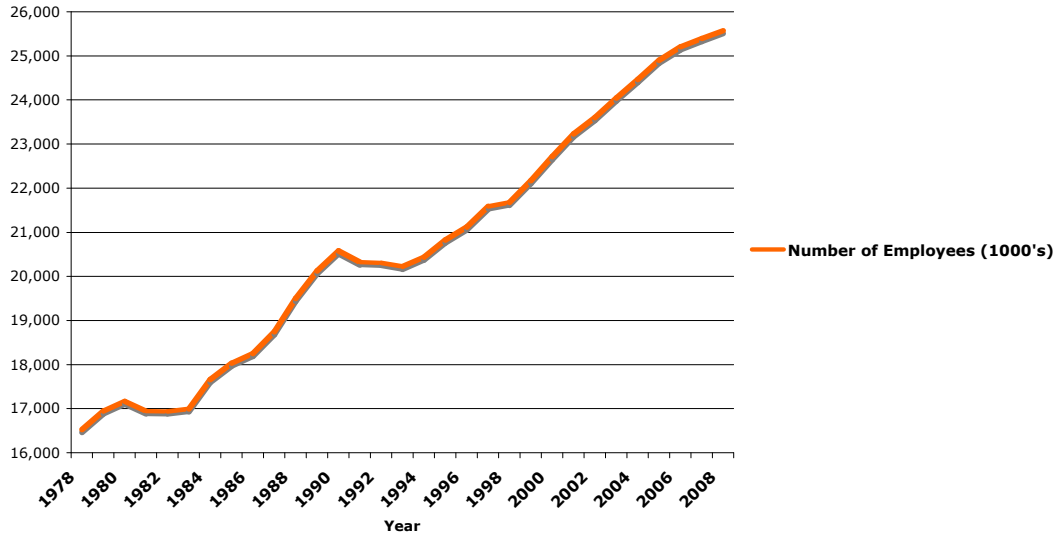

Figure 6. Service Sector Employment from 1970 to 2008

The change in energy intensity can be seen graphically in figure 7. A large proportion of the increase of economic output from the service sector has come from the growth in the financial sector, which now accounts for approximately 8% of total UK GDP.

Key Energy Drivers in the sector

The service sector's energy demand is primarily driven by the requirement for energy coming from buildings used in daily operations. Whether that is a warehouse, supermarket or a commercial office skyscraper, they all require energy for different functions.

Figure 8 below illustrates the percentages of energy demand for these different requirements. As there is a close similarity for the energy demand drivers for the service sector as a whole and commercial offices I will move on to analysis of the drivers for commercial offices, which can be seen in Figure 9.

Space heating drives the largest demand for energy at 46% for the overall sector and a huge 56% for commercial offices. This heating demand will be almost entirely met by gas boilers, which has driven the increase in gas demand as the number of people employed in the sector has increased. The UK has a large number of office buildings, which are poorly insulated and poorly designed when it comes to energy efficiency.

Many commercial offices still only have single glazing for example, which has very low r-values. Heating water adds a further 6% to the demand, so really water heating in commercial office buildings represents 62% of energy requirements assuming water is heated gas boiler central heating systems.

The second largest driver for energy demand in commercial offices is from lighting at 15%. This is an area with very large potential to decrease electricity demand substantially. Commercially attractive LED lighting has emerged as a solution after compact florescent technology, which has been available for several years. T8 compact florescent tube lights are now replaceable by a more efficient T5 tube.

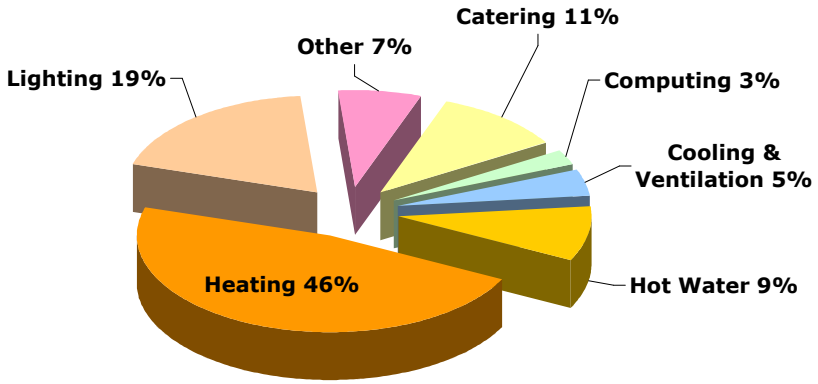

Figure 8. Drivers of energy demand in the total UK service sector (2007)

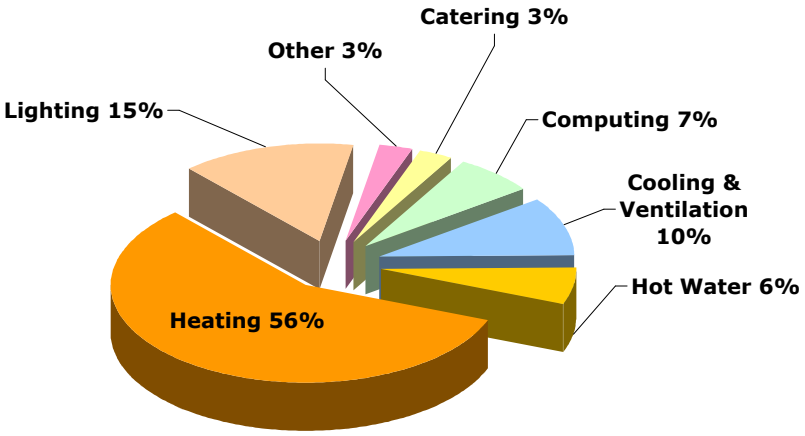

Figure 9. Drivers of energy demand in UK commercial offices (2007)

Cooling & ventilation is the 3rd largest driver of demand through the use of air conditioning, particularly in warmer months when poorly designed buildings cannot regulate their own temperature. The demand from air conditioning may continue to rise as we face warmer summers as a result of changes in UK climate as a result of global warming.

Computing can be attributed to 7% of the demand through the daily use of PC's in office environments and server requirements. This demand from IT is likely to decrease as less energy hungry laptop and computer phones replace desktop computers. This in turn will cause less heat to be emitted, consequently reducing the need for cooling from air conditioning units.

Which factors will contribute to reduced energy demand in the commercial sector?

Now the scene has been set in terms of the trends and drivers within the service sector. The second part of this report will investigate the factors that are likely to contribute to reducing energy demand in the service sector up to 2030.

The main factors that will bring about reductions in energy demand in the commercial sector:

1. Legislation & regulations
2. Improved Energy Management

3. Employee energy Awareness schemes
4. Technological Improvement & Sustainable building design

Legislation & regulations

New legislation has been passed in the UK to focus businesses on reducing their energy requirements and increasing energy efficiency in the form of the Carbon Reduction Commitment Energy Efficiency scheme (CRCEES), which begins its "footprint year" on the 1st April 2010.
The CRC will affect large, non-energy intensive organisations in the public and private sector ranging from retail chains and the hotel and leisure industry to local authorities, large hospitals and educational establishments. It is estimated that some 20,000 organisations will be effected by this legislation.
The CRC is likely to have a very positive effect on energy demand reductions as organisations look for ways to reduce their consumption across their operations to reduce the risk of paying inflated prices above the standard allowance price of £12 a tonne of CO2.

Energy Management

One of the key ways that the business and public sector might achieve significant energy demand reductions is through energy management.
Energy management has become a hot topic in recent years, and involves detailed measuring, monitoring, analysis and regular reporting of energy consumption within an organization, with the aim to target and act to reduce inefficiencies or waste.
The cost of energy will certainly become more volatile over various points in the future as fossil fuel supplies dwindle, which adds an additional risk to business, so employment of energy managers or private consultants is an attractive practice as when done well it can offer large savings in energy and financial terms.

Clearly the extent of energy reduction possible, depends on the efficiency of the existing organisation and the level of measures taken by a business once it becomes aware of it energy consumption patterns, so estimations for savings are hard to make,

although it wouldn't be unreasonable to suggest that good energy management could provide 5-10% reductions in energy demand.
Energy management works most effectively when incorporated within other aspects I will discuss in the remainder of this report.

Employee Energy Awareness Training

As part of effective energy management, carefully created employee energy awareness training is vital to incorporate the right behaviours needed for personnel to focus on individually & collectively making energy savings through conservation. Where there is a lack of intelligent technology particularly in older buildings, simple efforts such as turning off lights, PCs, air conditioning and reducing the temperature by turning thermostats down can have a large effect on energy demand. Also when employees become focused on this subject they should be encouraged and rewarded to suggest further ways of reducing energy needs in all areas of operations. Incentive schemes can be quite effective in encouraging staff to get involved in saving energy. Awareness and educational materials, such as posters and leaflets in strategic points around premises can also help remind staff of the need to be energy conscious.
The leadership of a organizations needs to be mindful of how the importance of energy savings is pitched to the employees as not all may be concerned with the resultant CO2 emissions but may be more likely to respond for financial saving potential. A balance of the 2 is possibly the most effective approach!
Employee awareness driven through good training and leadership has the potential to make further savings possibly in the region of a further 5%, but once again the success levels are clearly highly variable.

Technological Improvements and Low Energy Building design

Low energy technology is experiencing large growth as buyers are becoming increasing more focused on ensuring running costs and energy demand during a product life is kept as low as possible. Lighting is a classic example where there have been some really interesting developments in technology for the commercial sector. LED lighting has now started to take off as the next generation of lighting, but it is still not as embedded as compact florescent (CF) lighting, which has replaced some of

the incandescent market. Below is a table that shows the timescales for the phasing out of incandescent bulbs in the UK.

1 September 2009 – From this date, manufacturers will not be able to place on the market clear lamps equivalent to 100W incandescent lamps, or above, must be minimum C class energy rating (leaving only halogen retrofit halogen lamps). Non-clear (frosted / pearl) lamps must be minimum Energy Label A-class.
1 September 2010 - From this date, manufacturers will not be able to place on the market 75 W clear incandescent lamps.
1 September 2011 - From this date, manufacturers will not be able to place on the market 60 W clear incandescent lamps.
1 September 2012 - From this date, manufacturers will not be able to place on the market all remaining clear incandescent lamps (i.e. 40W and 25W).
1 September 2016 - Raising the minimum level to B class for clear retrofit lamps (i.e. phasing out C-class retrofit halogen lamps).

Table 1. Timeline for the phasing out of incandescent bulbs in the UK.

Its is difficult to estimate the level of energy demand reduction we can expect from replacing incandescent bulbs with CF or LED bulbs over the next 5 years, but we can be certain it will have an effect on the total demand. Some CF or LED bulbs can save up to 80% of the demand for electricity versus they incandescent equivalents (e.g. 100w to 20w CF), so where there are large scale replacements of bulbs, significant reductions could be realised.

From the earlier analysis heating has been identified as the largest driver of energy consumption within the sector, which is primarily used for heating space.
The boiler industry has made good progress in efficiency improvements over the last 10 years with new models reaching over 90% efficiency. As of 2005 all existing boilers had to be replaced with more efficient condensing boilers, so we can predict that each year as many existing commercial boilers are replaced they should lead to a reduction in demand in many premises.

In order to make the most from improvements in boiler efficiency, it is crucial to improve insulation. Insulation should be improved before any investment into a new boiler system is made (except if a boiler is at the end of its life), coupled with a highly efficient boiler, energy demand could be reduced in the region of 10-20%.

From an energy saving perspective, demolishing old energy inefficient buildings and replacing them with new low energy buildings is attractive and we will see some examples of this occurring in the UK. We will also see the retrofitting of existing structures with, passive heating and natural ventilation design, intelligent lighting systems, and many other improvements to lower energy demand.

In the new building arena there are already some inspiring examples of commercial buildings in many sub sectors that are being built with up to 50% less energy demand than building built only 3-5 years ago. UK supermarkets are engaging in low energy design stores. Sainsburys PLC opened a large supermarket in Dartmouth in 2008, which according to their 2009 Corporate Responsibility Report uses 50% of the energy through its design than older stores in its estate. This building also recorded an “excellent” rating under the independent BREEAM 2006 Retail Building Assessment Scheme.

The Adnams distribution centre is another excellent example of a low energy design. The Suffolk based brewer saved approximately 30% of its demand for gas through the design for example.

There are many other leading examples of low energy and sustainable buildings being built or planned in the UK. It is difficult once again to estimate the overall contribution to savings that new building design will have. If it’s a direct replacement or retro fitting to an existing structure then the like for like savings are easy to calculate. New buildings in new locations clearly are adding to the overall demand, but if they are very low energy demanders, then they will have less impact on the total demand.

Projections and conclusions

An attempt has been made to look at the factors that will affect future energy demand in the service sector.

Figure 10 shows a possible scenario for the energy demand for this sector. It can be

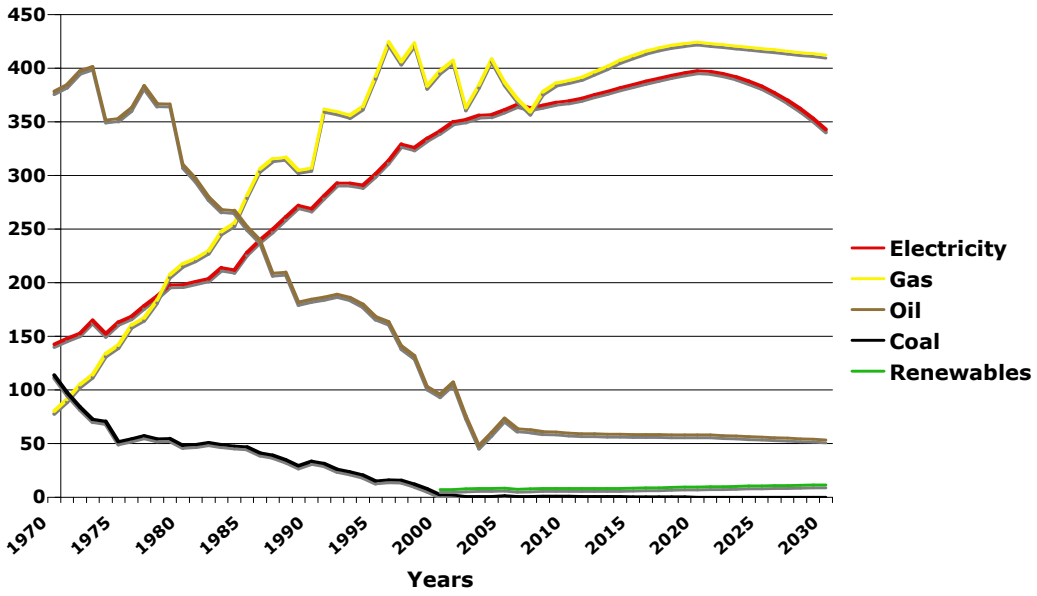

Figure 10. Service Sector energy demand projections from 1970 to 2030

observed that demand will continue to rise for gas and electricity, but by 2020 the various aspects discussed in this report will gradually slow demand for energy. Demand for oil will continue to decrease from 2009.

Businesses are becoming more aware of the need for efficient use of energy within their operations to reduce costs, comply with regulation and make themselves more publicly attractive to consumers by not being wasteful or emitting unnecessary carbon emissions. Climate change issues may also have a wider affect on individuals and they actions they take within an orgainsiation. Coupled with good energy management and energy awareness training significant energy demand reductions are plausible. When low energy technology and intelligent lighting systems are brought into the picture, further savings are very possible.

Sustainable architecture and construction techniques are improving every year, which will be the final piece of the reduction puzzle. Designing out the waste is the key. More natural lighting, (when appropriate), natural ventilation, and passive heating,

less energy hungry electronics, IT, catering equipment will all help drive demand down. Clearly this is against a backdrop of growth in employment in the sector, but there is considerable optimism that the various actions discussed in this report will easily offset this growth and by 2020 start to produce gradual year on year energy demand reductions for the service sector.

	2009	2010	2015	2020	2025	2030
Electricity PJ	368	370	385	398	383	343
Gas PJ	386	389	412	424	418	412
Oil PJ	60.65	59.81	58.51	58.15	56.00	53.50
Coal PJ	0.92	0.85	0.50	0.15	0.00	0.00
Renewables PJ	8	8	8.6	9.5	10.5	11.5
Total PJ	824	827	864	890	868	820

Table 2. 5 yearly projections up to 2030 for energy demand in the service sector across major fuel types.