

Domestic Energy Requirements

This section of the group project looks at the domestic sector energy demand for the UK, the factors that affect energy demand, the fuels used and the economic effects and technological factors that could be utilized to lower demand in the future. Standards of living have increased over the years, with fewer people now living in fuel poverty. But this means that energy consumption in homes has gone up with the increased use of fuels for heating and the amount of electricity used in home appliances.

It is not entirely necessary to increase energy use in order to improve living standards, however. With fuel insulation and simple energy conservation methods used in homes, fuel consumption can be lowered with comfort levels remaining high. The energy sector in the UK is normally split into three or four components: transport, industry, domestic and services. The domestic energy demand of the UK has virtually remained the same since 1980, whilst the industrial energy demand has seen a decrease of 50%, due to decline in heavy industries such as steel manufacture; the transport industry demand has increased, due to more heavy good vehicles used.

The factors affecting future energy use in delivered consumption in the UK domestic sector are:

1. Size of population and number of households

| Year | Population (millions) | Number of households (millions) | Household Size |
|------|-----------------------|---------------------------------|----------------|
| 1985 | 56.6 | 21.3 | 2.6 |
| 2000 | 57.6 | 23.3 | 2.4 |
| 2010 | 58.0 | 24.1 | 2.4 |

Table1.1 Projections of the UK population and number of households from 1985-2010

Table 1.1 shows that the UK population is slowing down in growth, and will reach an estimated saturation point of 60 million after 2010. The number of households is increasing, largely due to the fact that household size is decreasing, and the increasing

number of people living on their own. This reduction in household size increases energy demand, as more energy is needed for more houses.

2. Average Area of each household
3. Comfort level desired by each household

In 1970, the average internal temperature in a house was 17 degrees Celsius, in 2002 it had risen to 21 degrees Celsius. It is projected to rise further as more people have an increased disposable income to spend on fuel for heating, leading to increased energy demand. Further more, with climate change set to take effect in the future, the temperature of the UK may well increase, and this may cause people to install air conditioning units in the home, which will have to be powered by electricity, increasing energy demand.

4. Demand for non-space heating process (water heating, cooking, appliances) by each household
5. Efficiency with which energy is used to meet space and water heating demand

It is known that the number of houses in the UK is increasing. The demolition rate of houses is around 36,000 a year, and new ones are built to replace them. The replacement rate at the moment however is well under 1% a year. On top of these new houses being built there is around 50,000 to 100,000 new homes adding to the building stock being built every year, further increasing energy demand.

These new homes are being built to new building regulations; Energy Standards Building Regulations 2000 Part L1 – approved Document L1 Conservation of Fuel and Power in Dwellings came into effect on the 1 April 2002. These new houses are built to much higher standards than previous homes, and therefore should help lower domestic demand. But because the replacement rate of houses is so low, the effects will not be seen till after 2010.

Changes to the building regulations include technical changes such as Lower U values being set in houses, and the old Standard Assessment Procedure (SAP) ratings system

being replaced with the Carbon Index method, but still being noted. SAP ratings have improved from 14 in 1970 to 48 in 2001- due to major developments in insulation standards and the replacement of inefficient heating systems, such as open coal fires, by more efficient, gas-fired central heating.

Insulation in houses may have improved, but not dramatically. In 1987 only 3% of houses had full insulation, and this has increased to 15% in 2002. This is mainly due to double-glazing being fitted. In 2002 48% of households had 80% or more of their windows double-glazed. Energy use in homes has also increased because more homes have been fitted with central heating systems. Older houses will still have inefficient boilers installed, and these should all be replaced with more efficient condensing boilers when their functionality has diminished.

New houses built with thick layers of insulation, and sealing cracks would help, as well as improved ventilation systems, which also improves levels of air quality. Energy consumption in the home is not entirely related to economic factors or comfort levels- climate and temperatures also play an important role. Domestic energy consumption per unit of disposable income has fallen and in 2003 was 49% below 1970 level. A study commissioned by the Association for the Conservation of Energy found that a major programme to improve energy efficiency in the UK could create up to 155,000 new jobs.

If the government wished to cut demand in the domestic sector, energy efficiency methods would be a good way to go about it. Investment in energy efficiency measures is highly cost-effective against investment in new supply technologies. They are also quick to install and cause less trouble than say building new power stations, and involve less risk of failure. The effects can be felt immediately in terms of reduced fuel consumption. This increased efficiency reaches peoples fuel bills and stretches fuel reserves into the future. It also reduces environmental impacts- a big bonus.

Domestic Sector use of electricity has risen rapidly as ownership of electricity intensive appliances such as freezers, tumble dryers has spread. The market for these products is

now reaching saturation point; it is less likely to rise in the future. However, growth in demand for electrical home entertainment (digital TV, etc) is rising. In 2001 85% of energy used in households was for space and water heating.

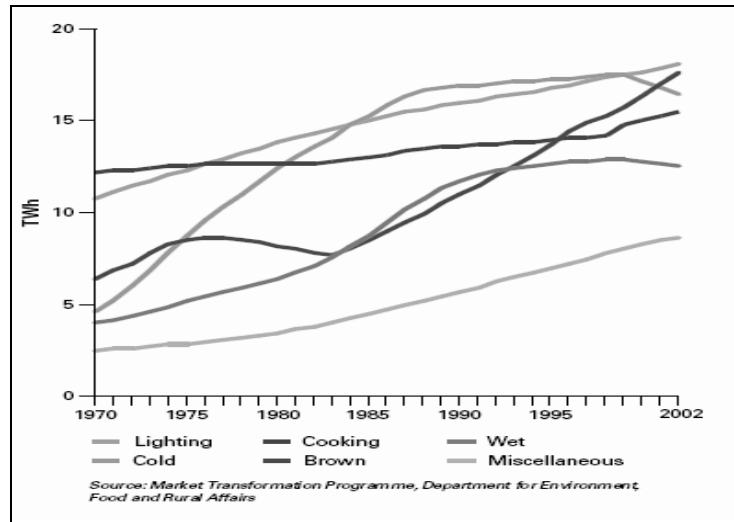


Figure 1.1 Electricity Consumption by household domestic appliance type 1970-2002

Figure 1.1 shows that since 1970 all domestic appliance consumption has risen, with the main growth occurring in brown goods- entertainment goods, CD players, DVDs, VCRs, etc. Cold products such as freezers and fridges and Wet products such as tumble dryers, washing machines and dishwashers all show signs of saturation. Miscellaneous goods are still increasing in consumption, but not as much as lighting, which is increasing dramatically. This is mainly due to use of halogen light bulbs, but in the future new technology LED bulbs, which will cause a decrease in the amount of energy lighting uses, may well replace these. One conservation method for lighting would be to replace all tungsten filament lightbulbs in the home with more efficient fluorescent bulbs, and have better lighting in houses. New houses could be designed for better positioning of windows to minimize heat loss and maximize daylighting. As seen above space heating is the main contributor to household energy use, and will continue to be so in the future, but may be not at such a high level, as efficiency of heating systems improves.

Electricity is not the only fuel used in homes; coal, oil and gas are all used to one degree or another. Domestic coal consumption in the UK in 2003 was 2% of all coal consumption. There has been a decline of 20-40% mainly due to the replacement of

inefficient open fires to central heating systems. Oil consumption in the domestic sector is set to fall 65-75% due to its being displaced by electricity and solid fuel.

Gas consumption in the domestic sector was at record level in 2003, 56% higher than the 1980 level. This is set to rise further by 15- 45% due to increased central heating use in homes. Gas remains the dominant fuel in the UK as its use has also risen in the electricity generation market. Electricity demand in the UK domestic sector was 29% of all electricity. The UK's electricity consumption is also projected to increase by 25-40% due to mainly increased energy consumption by appliances and a shift to electric heating. Renewable sources of electricity are slowly increasing, but at the moment are still very low.

The methodology I applied to achieve my final projections for the UK domestic sector were very much like the Methods used in the 2D02 practical on transport in 2004. I used the digest of UK Energy Statistics (DUKES) to find energy figures for the coal, oil, gas, renewables and total domestic energy consumption of the UK from 1970 to 2003. These figures were in thousand tonnes of oil equivalent so I converted the figures into PetaJoules and plotted them on a graph in excel. I then plotted trend lines 27 years into the future and used the figures from this for my final projections. Because some of the assumptions I made are subjective, these results may not be similar to those found in other sources.

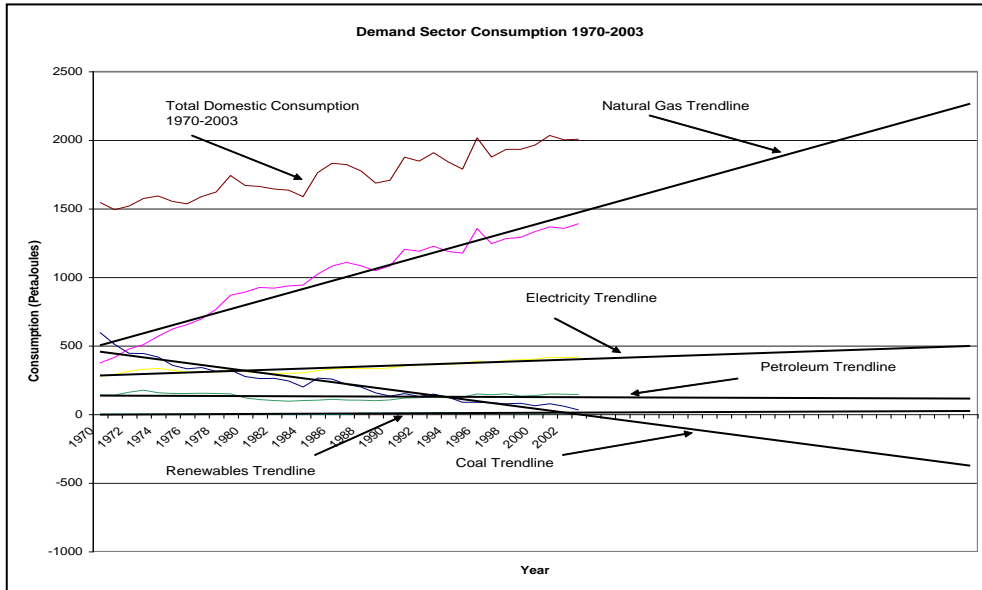


Figure 1.2 Demand sector projections showing oil, coal, gas, renewables and total consumption

Figure 1.2 shows that gas consumption is likely to rise above 2000 PetaJoules by 2030, electricity is still increasing but not as sharply, and I think that the electricity consumption may increase more than is projected in the trendline. Oil (Petroleum) is shown to only decrease slightly on the trendline and again I think there will be a sharper decrease than this.

Coal disappears off the chart at around 2004, and this is not true to reality, although I believe coal consumption levels have decreased considerably and will remain at low levels in the future. Table 1.2 shows final predictions for gas, coal, oil, electricity, renewables and the total energy demand for the domestic sector for the following years: 2003, 2010, 2015, 2020, 2025 and 2030. On the whole, I predict an increase in energy demand for the domestic sector, but the use of fuels changes as gas becomes much more widely used, renewables start to become more widely used, and oil and coal are phased out.

| Domestic Energy Demand | 2003 | 2010 | 2015 | 2020 | 2025 | 2030 |
|------------------------|--------|--------|--------|--------|--------|--------|
| Total | 2005.3 | 2323.6 | 2553.9 | 2633.4 | 2867.9 | 3039.6 |
| Gas | 1389.6 | 1674.7 | 1842.1 | 1925.9 | 2135.2 | 2260.8 |
| Coal | 30.7 | 20.9 | 20.9 | 16.7 | 12.54 | 12.5 |
| Oil | 143.9 | 167.4 | 167.4 | 146.5 | 146.5 | 146.5 |
| Electricity | 416.8 | 418.6 | 460.5 | 481.4 | 502.4 | 544.2 |
| Renewables | 10.3 | 41.8 | 62.8 | 62.8 | 71.1 | 75.3 |

Table 1.2 Domestic energy demand predictions in PetaJoules for 2010, 2015, 2020, 2025 and 2030.

The UK energy policies, although improved, are not working because they are failing to address problems of gross inefficiency in supply and use of energy and are still looking towards fossil fuels for the future of the UK's energy supply. The UK government should be looking at implementing major conservation schemes for the domestic sector in order to reduce energy use, such as grants for putting in full insulation, CHP district heating schemes and keep running such schemes as the clear skies initiative. They should also be looking at using renewables for electricity generation for the future.

References

Building Regulations 2000 L1 conservation of fuel and power in dwellings, DTLR

Digest of UK Energy Statistics found at www.dti.gov.uk

Energy Paper 68

Energy use and energy efficiency in the UK domestic sector up to the year 2000, Energy Efficiency Office

Energy use and energy efficiency in the UK domestic sector up to the year 2010, Energy Efficiency Office, HMSO publications

Flood, M., 1986, Energy without end; the case for renewable energy, Friends of the Earth

UK energy in brief, July 2004, DTI