Homes and Efficiency

Understanding How We Use Energy

Sheet **E.6**

Version 2, October 2008. Produced by the Free Range *Energy Beyond Oil* Project
http://www.fraw.org.uk/ebo/ ebo@fraw.org.uk

10p (where sold)

Judging by the media, we might think that the greatest energy offender in the UK was our homes. This isn't the case. Our homes do account for a small, but significant, part of national energy consumption, but if we are to adapt to Peak Energy we must be able to see the scale of household consumption into the context of total consumption, and then work to reduce it in the future.

Domestic Energy in Context

The government, environmental groups, and consequently the media present household energy consumption as a great problem. It is, but only as one of the constituent parts of a far larger energy system. Your personal share of average household consumption is a fifth to a third of your total energy use. In total our homes are about 30% of the energy supplied to the UK economy (see left-side graph below). Whilst significant, the UK will never reduce its overall consumption significantly just by focussing on housing and household energy uses.

Our homes are reliant upon natural gas. This is storing up problems for the future as North Sea gas depletes and we import more. Again, the emphasis in the media on electricity use is distorting the actual situation. Electricity makes up (on average) a fifth of household consumption, and only about 12% of energy consumed in the home actually requires electricity (i.e, we can't substitute other fuel sources for that demand). *Gas is 68% of domestic consumption!*

In terms of the our need for energy, about 85% of the energy used in the home is heat – for water and space heating (see right-side graph below). Of the rest, some of it is “high grade” (very hot) heat for cooking, and much of the rest is electricity for lighting and appliances. If we are devising solutions to Peak Energy it is important that we distinguish between our *domestic consumption* of energy with our *demand* for fuels. Although our homes consume gas, oil or power, the greatest problem we have to overcome is our use of heat. The remaining 10% to 15%, which is electricity, can be managed in many differing ways (most simply, by switching off!).

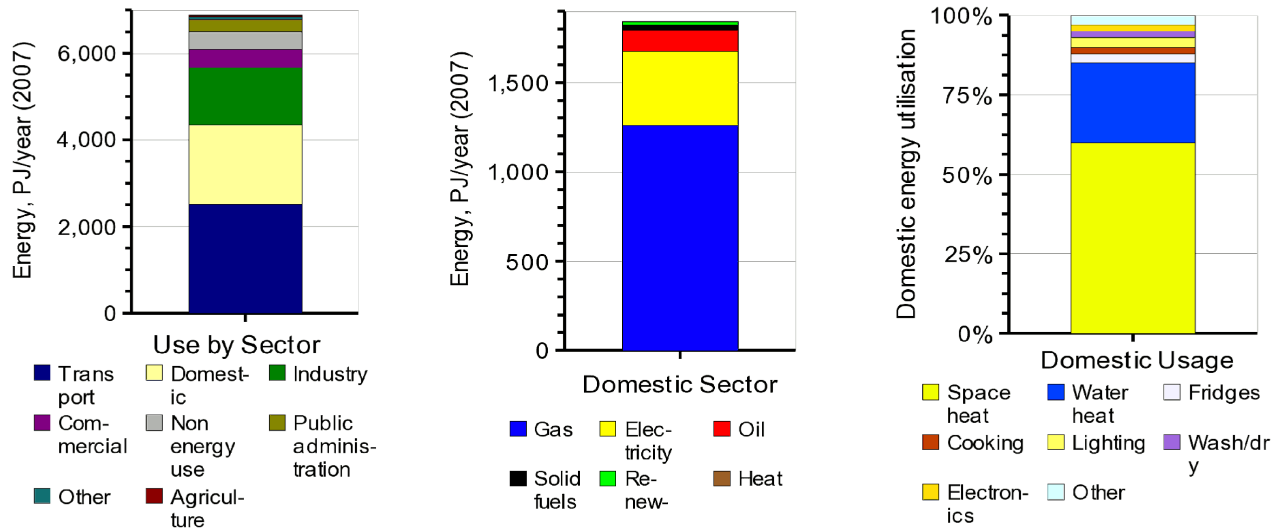
Domestic Efficiency

Home owners are urged to be more efficient by minimising the use of appliances or buying the most efficient ones. In reality energy efficiency has important limitations: efficiency measures are a one-time saving – once carried out you can't repeat them; another problem, created by the *Second Law of Thermodynamics*, is that efficiency savings reduce with time – consequently the more efficient you are, the harder it is to improve. For these reasons, against the background of growth in consumption, efficiency measures only work over the short-term, after which growth inflates consumption once again.

Consumers can buy the most efficient appliances by consulting the *energy label*. Goods are assessed according to their energy performance and are then award a rating under a European scheme. However this system can be entirely misleading. Today we are offered a range of choices between different manufactured appliances, but due to building and design standards they are not necessarily the most efficient appliances possible – they're just the selection that are marketed to the consumer. In energy sustainability terms some of these standards make little sense.

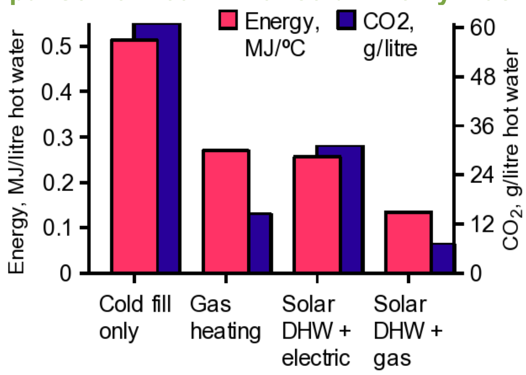
For example, consider washing machines. Due to a recent decision by manufacturers nearly all “wet appliances” are now cold-fill-only – you cannot plumb

Domestic Energy Use, 2007



them into your hot water system. So, if you have a solar hot water system the "green" hot water it produces is completely useless to wash your clothes with! Instead you must rely on the electricity grid for the energy to heat the water. This means that a new, *A+* rated washing machine might use more primary energy, and emit more carbon dioxide, than an old machine. This is because it's more efficient to heat water in your home with a gas boiler and feed a hot fill machine than produce electricity at the power station and heat the water with electricity.

Comparison of hot fill with cold-fill-only machines



Clearly, if the objective of the energy labelling system is to decrease primary energy consumption and the emission of carbon dioxide, the failure to effectively measure the introduction of cold-fill-only wet appliances is a retrograde step.

Energy Descent in the Home

Domestic energy efficiency solutions are ultimately limited, and given the information available to the consumer, arbitrary. For this reason the only viable approach we can take in the home is to reduce the demand for energy. There are three ways to do this: to reduce losses through better thermal insulation; offsetting energy supply with on-site production; and to cut energy use in real terms.

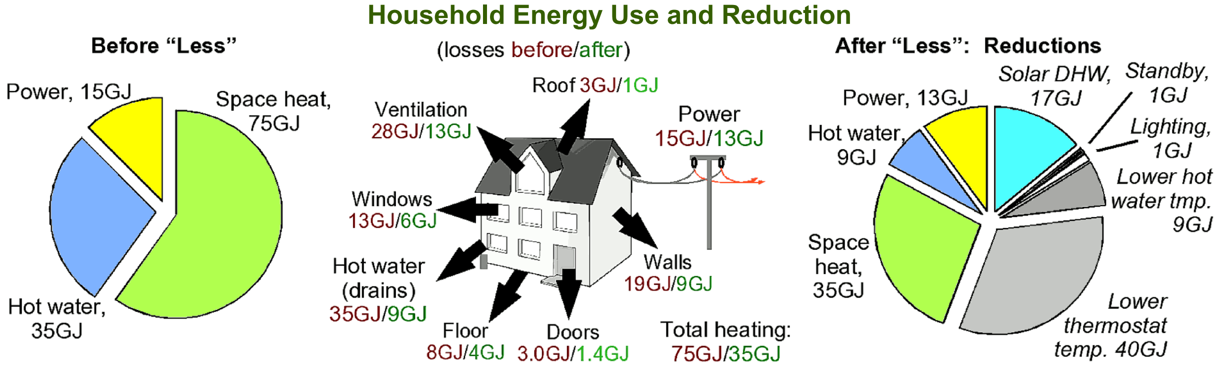
Reducing losses traditionally implies improving insulation. However it takes energy to manufacture insulation, and depending upon the type of insulation material, and the distance it is transported, even relatively thin sections of insulating material can take more energy to manufacture and transport than they will save over their life (for example, with plastic foams – such as polystyrene – the thickness at which you use more energy than it saves can be as little as 10cm to 12cm). Also reducing losses through retrofitting is only minimally effective. To make a significant saving you have to partially dismantle the house and rebuild it, which again takes energy, and on the national scale a lot of time (there are over 24 million homes in Britain).

On-site production has more recently, with photovoltaic (PV) panels or small wind turbines, become fashionable. But as noted earlier, most household demand is for heat, not power. For these reasons solar thermal (hot water) or ground source heat pumps meet our needs far more effectively than PV or wind turbines; for each £1 spent, solar thermal will produce 30 to 40 times more energy than solar PV.

To be realistic energy production must include some element of storage or it is not really effective. For example, most of the PV and small wind turbines that are for sale today will not produce power if your mains supply is cut (battery storage is possible for power-producing renewables, but it is more expensive). Heat storage is also possible, but it can require a lot of building work to install it in the home.

The most practical solution is to reduce consumption. The energy losses in the home are proportional to the difference between the internal and external temperature. As we reduce the internal temperature the energy consumed will therefore fall significantly – at least 10% for each degree (for the first few degrees). Just by reducing the temperature of the space and water heating it is possible to save almost half of household consumption. Other minor changes, such as solar domestic hot water (DHW) systems, can save another 10% to 20% without any significant building work. Then, rather than use energy to heat the whole house, you employ the most efficient means to keep yourself warm... *wear sensible clothes for the time of year!*

Household Energy Use and Reduction



This example takes a detached house and projects how energy consumption can be cut without any significant building work/insulation. The greatest savings are achieved by reducing the average internal temperature of the house from the "average" 21ºC down to an average 16ºC (an "average 16ºC" because you only heat the rooms regularly used to around 18ºC in the day-time, rather than the whole house with central heating), and reducing the hot water temperature from the average 70ºC down to 55ºC. This reduces consumption by around 40%. A solar domestic hot water (DHW) system saves a further 14%. Finally, and by comparison, using low energy lights and removing standby devices only saves 2% to 4%!