Introduction

Using energy more efficiently is usually the most cost effective way to reduce carbon emissions and fuel bills, and local authorities have an important role in stimulating local action to improve energy efficiency. Energy efficiency complements the development of renewable energy projects in developing a comprehensive response to climate change and can be broadly separated into:

- Behavioural measures - such as turning off unwanted lights and appliances, but also including energy management
- Physical measures - such as insulation, low energy lights and appliances, efficient heating systems and improvements to heating/lighting controls.

Energy efficiency could make a major contribution to carbon emissions reduction and has a vital role to play in achieving our carbon emissions targets. The potential impact of energy efficiency at a large scale is illustrated by the fact that although Japan's wealth (in the form of its per-capita gross domestic product) is similar to the USA's it is achieved with less than half the mass of carbon dioxide per capita.

There are four key areas for local authority action on energy efficiency:

- Energy and Carbon management - local authorities are significant energy users so have the opportunity to show leadership in energy efficiency within their own properties.
- The Home Energy Conservation Act (HECA) - placed an obligation on all housing authorities to prepare an energy conservation report identifying measures that could significantly improve the energy performance of homes within their area and monitor progress towards implementation. Most authorities have adopted targets of around a 30% improvement in domestic energy efficiency by 2010.
- Regulation - local authorities are increasingly able to promote energy efficiency in newbuild and refurbishment projects through planning policy and through the Building Control department's role in policing the energy performance requirements of the building regulations.
- Outreach - many authorities undertake outreach programmes to promote energy efficiency to homes and businesses.

Technology

The majority of local authority energy use is in buildings, so energy efficiency initiatives are likely to focus on energy saving within the built environment (either in council buildings or in the domestic sector through HECA). A wide range of energy efficiency measures are available, **Table 1** lists the most common energy efficiency measures for homes and the approximate costs and savings for each.

Action	Installed Payback period (years)	Example Installed Cost (£)	Example DIY Cost (£)
Insulation			
Roof insulation (new installation)	1	£250	£330
Roof insulation (top up of loft insulation)	3-4	£240	£240
Cavity wall insulation	1-3	£260	n/a
Ground floor insulation (solid floor)	8+	-	-
Ground floor insulation (timber floor)	3-5	£100 (materials only)	£100 (materials only)
Internal solid wall insulation	7+	£40 m^2	£1900
External solid wall insulation	7+	£1800 (b)	£1800 (b)
Windows and doors			
Energy efficient windows (a,b)	5-6	-	-
Secondary glazing	8+	-	-
Insulated doors (b)	10+	-	-
Heating and hot water			
A-rated condensing boiler (b)	1	-	-
Upgrade cylinder insulation	6 months	n/a	£10
Replace hot water cylinder with high-performance model	3-5		
Full heating controls package	4-6	£200	-
Reducing set points (i.e. the temperature the thermostat is set to)	zero cost	zero cost	zero cost
Ventilation			
Seal any disused fireplaces	less than 1	-	-
Draught-stripping and sealing	6-7	£75	£45
Lights and appliances			
Energy efficient lighting (4 lamps)	1-3	-	£15
A-rated white goods (b)	1-3	-	-
Turning appliances, heating and lighting off when not in use	zero cost	zero cost	zero cost

Table 1. Common actions used to reduce energy consumption in buildings and their associated approximate payback periods and cost. (Note the payback periods and costs are for typical domestic properties, for business premises the payback period might be more or less, and costs will scale with the size of the building.) [data from EST]. (a) Windows achieving a BRFC rating in band C or above, (b) Marginal cost, i.e., the additional cost of specifying a more energy-efficient option to work already being undertaken, e.g. an A-rated condensing boiler, as opposed to a B-rated one, or supposing that the house was to be re-rendered.

Generally measures with the lowest payback period should be prioritised, before moving on to more costly measures.

Local authorities have a key role in promoting domestic energy efficiency through their HECA responsibilities. This is a vital opportunity for local authorities to influence local action on climate change as homes are responsible for around 27% of all UK carbon emissions.

Similar measures are applicable to public buildings. Most authorities already have an officer with responsibility for energy management, who should be able to develop a prioritised list of energy efficiency measures for Council buildings.

Issues

Calculating energy use

The first stage in considering energy saving measures is to monitor current energy use. If the authority has an energy manager it is likely that they will already monitor fuel bills and implement energy related capital works (including energy saving measures). Most energy managers know their authority's energy use and heating systems very well, so are key stakeholders in improving energy efficiency.

Energy bills can be used to analyse energy use month by month and year to year. Additional monitoring may be required to get more detailed information, for example installing temporary sub-metering for an annexe building.

Reviewing current energy performance will often help to prioritise which energy saving measures should be implemented first. Going through this process before investing in renewable energy systems can help to correctly size the renewable energy system as well as maximising the carbon and fuel cost savings.

Calculating CO_2 Emissions

Once energy use is known, in kWh/annum, for the different fuels, the amount of carbon dioxide this emits can be calculated by multiplying energy use by the emission factors given in **Table 2**.

This process will show where the greatest CO_2 savings can be made.

Natural gas	0.191 kg/kWh
LPG	0.235 kg/kWh
Oil	0.265 kg/kWh
House coal	0.298 kg/kWh
Manufactured smokeless fuel	0.343 kg/kWh
Electricity	0.53 kg/kWh

Table 2.
Energy emission factors. [BRE].

Wider benefits

Energy efficiency can have wider benefits than cost and carbon emissions reduction. For example:

- It has a vital role to play in addressing fuel poverty
- It can help to improve comfort levels within Council buildings to ensure compliance with health and safety regulations
- It can help in the conservation of buildings and improving public health by maintaining a warmer, drier, more stable environment within buildings.

Legislation

Regulation and legislation is increasingly driving investment in energy efficiency. For example, the Energy Performance of Buildings Directive of the European Commission is now being implemented in the UK. This will require all public buildings to generate an energy performance certificate and display it in a visible location as a driver to improve the energy efficiency of public buildings. The implementation of the directive will also result in all homes that are sold in the UK (both new and old properties) having to generate an energy performance certificate that will be provided with the details of the home. The energy performance requirements within building regulations are steadily being improved and planning guidance is driving larger new developments towards being "Carbon neutral" (i.e. very energy efficient and generating all their energy from renewable sources) in the near future.

Finance

Payback Period

The Payback period is broadly defined as the time it will take to recoup the money spent on energy efficiency measures with fuel bill savings. The payback period is defined as:

$$\text{Payback period (years)} = \frac{\text{Capital cost £}}{\text{Annual saving £/year}}$$

"Simple" payback is commonly used, however this does not take into account issues such as changes in fuel prices. Many local authorities have rules specifying the maximum length of payback for energy efficiency measures (often three to five years). This can create a significant barrier to further reductions in carbon emissions. There are several measures that can help to alleviate this:

- Increasing the maximum payback can allow the implementation of many more measures with slightly longer paybacks.
- Some authorities have also ring-fenced cost savings (or at least a proportion of savings) resulting from energy efficiency measures for further energy efficiency and renewable energy measures. This effectively creates a revolving fund for carbon emissions reduction.
- Introducing new measures for assessing energy efficiency and renewable energy proposals, for example calculating the cost per tonne of carbon saved.

Further Information

For Free and Impartial Domestic Energy Efficiency Advice:
Energy Efficiency Advice Centre, 0800 512 012
Industrial, commercial organisations and local authorities:
The Carbon Trust (www.carbontrust.co.uk).
The Energy Saving Trust (www.est.org.uk).

References

EST, Energy Saving Trust's domestic energy primer, 2006.
BRE, Building Research establishment, Delivered Energy Emission Factors for 2003