Chapter 3: Barriers to Improving Energy Efficiency and Reducing Energy Consumption

Summary

- **Some households and organisations are failing to invest in cost-effective energy efficiency measures and to capture the savings that these offer.**
- **While housing stock has become more energy efficient, more needs to be done. Take-up of energy efficiency measures has been disappointing despite successive campaigns, and behaviours have actually become more energy-intensive.**
- **There are numerous structural barriers to improving energy efficiency and reducing energy consumption. There are also issues of motivation and behaviour.**
- **When energy efficiency measures are implemented, the full potential energy savings are not always realised due to the rebound effect, whereby, for example, people spend the financial or carbon savings made on other goods or services that require energy input.**

3.1 Despite the rising potential for energy efficiency, Chapter 2 has shown that this has not been matched by an overall decline in consumption. Many investors are failing to invest in cost-effective energy efficiency measures and to capture the savings that these offer. Partly this is for structural reasons – the demands of a growing economy and market imperfections – and partly because of policy distortions. It is also due to information barriers or inertia in the form of individuals' and organisations' inability or unwillingness to change their behaviour. This may be partly because energy efficiency does not necessarily mean cheaper energy unless people focus first on the most cost-effective energy efficiency improvements. Furthermore, even with improvements in energy efficiency, overall energy consumption will increase if growth in the latter outstrips improvements in the former.

3.2 Opportunities for cost-effective improvements in energy efficiency exist. However, in the domestic sector, for example, take-up of energy efficiency measures has been disappointing despite successive campaigns, and behaviours have actually become more energy-intensive.[35] The increasingly pro-environmental attitudes expressed in surveys such as the Scottish Environmental Attitudes and Behaviours Survey 2008[36] do not appear to make it through to sufficiently altered actions.

3.3 This chapter identifies a number of barriers to managing demand and achieving step changes in energy efficiency. Some of these are common across social categories and sectors; others are particular to specific groupings. First of all, there are numerous structural barriers to improving energy efficiency and reducing energy consumption. These are summarised in Box 3.1.

Box 3.1 Structural and market limitations

- Energy pricing structures do not fully reflect full environmental costs of producing energy: people lack cost motivation to save energy;
- Heavy focus on the financial costs of energy efficiency measures without emphasis on the benefits: There is inadequate or poor information on the full (i.e. including environmental) costs of energy and on cost/environmental benefits of improved energy efficiency. Businesses and households therefore underestimate the benefits of implementing energy efficiency and focus on short-term costs, which are at the moment high;
- Financial focus on up-front costs of buildings, materials and appliances rather than running costs; higher capital costs of more advanced buildings and technologies; desire to wait until new technologies become mainstream; uncertainty as to whether investment will pay off;
- Cost of new, more energy efficient technologies;

[35] 'Foresight Sustainable Energy Management and the Built Environment Project', *Energy Policy*, Vol 36, Issue 12, December 2008, pp. 4412-13. The barriers outlined in table 3.1 are partly drawn from this chapter.
[36] Scottish Environmental Attitudes and Behaviours Survey 2008 (www.scotland.gov.uk/Publications/2009/03/05145056/0). See Chapter 5 for further detail on SEABS'08.

- Split incentives between those who pay and those who benefit, e.g. for domestic and commercial tenants and landlords where whoever builds or owns a property is not necessarily responsible for paying energy bills. Owners have limited incentive to ensure building fabric or installed appliances and equipment are energy efficient when they do not pay the bills, and occupiers have limited incentive to invest in a building that they do not own. Neither is sure of receiving a payback on their investment. This is complicated further when many individual households need to agree common works;
- Lack of significant domestic energy efficiency sector within Scottish economy; lack of skills in energy efficiency sectors;
- Availability of, or ease of access to, new and emerging energy efficiency technologies and services, e.g. no triple glazing manufacturers in Scotland;
- Spatial separation of modern work, home and leisure activities, requiring extensive travel between these;
- Split decision-making incentives for purchasers, e.g. whether to purchase a product with maximum energy efficiency that may come from abroad, or to support local business, or minimise distance the product travels to market for environmental reasons;
- Policy distortions whereby policies dampen price signals and reduce incentives for end-users to adopt energy efficiency improvements;
- Energy market regulatory barriers, such as treatment of distributed generation technologies.

3.4 However, there are also issues of motivation and behaviour. Box 3.2 summarises these across all sectors, and then for institutions and house owners and occupiers.

Box 3.2 Issues of behaviour and motivation

Cross-sector

- Inadequate or poor information for businesses, landlords and domestic consumers on how to improve energy efficiency easily;
- Lack of awareness and technical expertise across range of professions and trades engaged in planning for, designing, installing and maintaining domestic and commercial buildings and plant; e.g. planners may put other considerations first; third parties such as builders, electricians and plumbers may take key decisions that affect energy efficiency without considering broader or long-term costs and environmental impacts;
- Lack of awareness of, and follow-through commitment on, the link between energy use and its environmental impacts; little appreciation of potential for energy efficiency to reduce these impacts; little faith in the power of leading by example;
- Little appreciation of impact of energy efficiency measures on energy bills;
- Small and fragmented nature of energy costs, e.g.:
  - energy not seen as core business input; energy bills paid by business areas that have no overview, control or influence over energy demand, so that energy efficiency not seen as core area for investment;
  - energy spend generally not a high proportion of household expenditure and therefore not a prominent issue or priority area for investment.

Institutional / Business

- Related time and financial costs arising from energy efficiency implementation which limit implementation below the expected extent: e.g. cost of searching for information; time to understand the information, carry out cost-benefit analysis, consider medium- and long-term effects; cost of training own staff or employing external expertise to implement energy efficient solutions. In particular, SMEs have other priorities for staff and management time.
- Resistance to structural changes and the associated costs or inconvenience of, e.g., building new facilities or a more energy efficient infrastructure such as decentralised heating;
- Financial constraints in times of economic downturn.

Domestic

- Increase in use of equipment, appliances and gadgets requiring electrical input;
- Influence of social or cultural norms, routine habits and fashion (e.g. with regard to lighting, and consumer goods and materials that contain significant embodied energy); concepts of comfort, cleanliness, convenience which have become embedded in the built environment, technological systems or hardware and are now firmly established in daily patterns of life, e.g. washing machines and daily showers;
- Changing travel norms, e.g. increased mobility and choice in public services, making it difficult to act on messages to reduce driving in order to mitigate climate change (especially when price signals provide a powerful counter incentive);
- Individuals do not consider they have prime responsibility to take action or are able to have much effect;
- Time constraints to search for information and appropriate tradespeople; lack of assurance that information is robust or that tradespeople are fully skilled to deliver work to standard, especially in the case of new technologies;
- aggravation factor, e.g. having internal ceilings removed to install insulation where no loft space;

- low levels of trust in climate change messages, tradesmen etc.; attitudinal resistance to interference or to changing behaviour – 'the old ways seemed to work fine';
- uncertainty or tensions around what is best, e.g. questions around whether it is overall more energy efficient to install a new efficient boiler that requires significant energy inputs in its manufacture and transport, or to use old boiler until end of natural lifetime, thereby maximising use of its embodied energy.

3.5 Boxes 3.1 and 3.2 show that there are significant barriers to reducing energy demand across all sectors and groupings in business and society. Market forces alone clearly will not capture the full potential for higher energy efficiency, and government will need to play a key role in developing the mechanisms to overcome the barriers. The IEA states that whilst effective market forces and good information can accelerate energy efficiency improvement, market failures and barriers will inhibit efficiency gains. It notes that in such cases, 'certain government interventions may be useful in focussing market interest on energy efficiency. These include codes, standards, voluntary agreements, special financing arrangements and clustering small projects into investment portfolios.'[37]

Rebound Effect

3.6 In this context, it is worth considering what is known as the 'rebound effect', as this can impact on the effectiveness of energy saving activity. When energy efficiency measures are implemented, the full potential energy savings are not always realised in practice. This is generally for one of two reasons. Firstly, people frequently spend the money they save on making their house warmer or on other goods or services that require an energy input. Secondly, they may consider that the carbon saved provides them with a type of carbon account that can be used in other ways, e.g. that walking to work allows them to use the lift when they get there. Behavioural responses such as these have come to be known as the energy efficiency rebound effect. This has implications for the impact of energy efficiency policy in all sectors. Some examples are outlined in Figure 3.1 below.

Figure 3.1 Examples of the Rebound Effect

Domestic (direct)	Consumers may reap the benefits from improved insulation or energy efficient central-heating by turning up the thermostat in their homes. In this case, the energy efficiency improvement is observed as an increased standard of living rather than energy saving.
Domestic (indirect)	Consumers may use the cost savings from energy efficiency improvements to purchase other goods and services which themselves require energy. For example, the cost savings from a more energy efficient central heating system may be put towards an overseas holiday.
Industry (direct)	Producers may use the cost savings from energy efficiency improvements to increase output, thereby increasing consumption of capital, labour and materials inputs which themselves require energy to provide.
Industry (indirect)	Cost-effective energy efficiency improvements will increase the overall productivity of the economy, thereby encouraging economic growth. The increased consumption of goods and services may in turn drive up energy consumption.
Transport	As a combination of technical progress and consumer choice encourages vehicles to become more efficient and produce less emissions, the cost of each additional kilometre travelled will reduce. Such savings could lead to increases in kilometres travelled, potentially reducing the savings estimated from more efficient vehicles.

3.7 The impact of different aspects of the rebound effect gives rise to questions as to how we should account for the different aspects of this economic variable in policy decisions. The direct rebound effect was considered in the recent report by the Committee on Climate Change, where the estimated energy and carbon savings were reduced by 15% to take account of this effect.[38]

[37] See, IEA, 'Toward Solutions: Sustainable Development in the Energy Sector', p. 9 (www.iea.org/textbase/papers/2002/toward_solutions.pdf).
[38] The Committee on Climate Change, 'Building a Low Carbon Economy', December 2008 (www.theccc.org.uk/reports/building-a-low-carbon-economy).

3.8 However, the overall impact of this on energy efficiency policy is unclear as the extent of the rebound effect cannot be measured accurately. This is largely because, in reality, the relationship between a change in energy efficiency and a subsequent change in energy consumption is likely to depend on a number of contributing variables and there is no precise way to establish what the energy consumption would have been without the energy efficiency measures. The available literature does provide some estimates of the impact of the rebound effect, usually measured in terms of a percentage reduction in expected savings from the efficiency measures (see Figure 3.2 below). However, this allows for a considerable degree of uncertainty. Examination of the evidence suggests that economy-wide rebound effects will probably be at least 10%, and in many cases often higher.

Figure 3.2 Estimates of the Impact of the Rebound Effect

End Use	Range of Values	'Best Guess'	Number of Studies
Personal automotive transport	5 – 87%	10 – 30%	17
Space heating	1.4 – 60%	10 – 30%	9
Space cooling	1 – 26%	1 – 26%	2
Other consumer energy services	0 – 49%	<20%	3

Source: UK Energy Research Centre, The Rebound Effect, 2007

3.9 Clearly the rebound effect needs to be factored into policy assessments that attempt to overcome the barriers to energy efficiency. Chapter 4 of this consultation examines the potential kinds of energy efficiency targets that need to be set in Scotland, with discussion highlighting the difficulty in setting these targets accurately. Part 2 then focuses on possible mechanisms to overcome the barriers in Scotland, looking first at the issue of changing attitudes and behaviours, and then in turn at the areas of domestic, non-domestic and public sector buildings; other issues that cut across the built environment; transport; and business and skills.