

## **EXECUTIVE SUMMARY**

The UK residential sector can deliver a 60% reduction in carbon emissions by 2050, in line with the targets outlined in UK Government's 2003 Energy White Paper. Such a reduction is essential in light of the growing impact of climate change. This represents a significant challenge that requires some hard, but necessary, decisions to be made if these savings are to be achieved. Urgent problems require radical solutions – current policy is not taking us to where we need to be.

Many of the constituents of the 40% House scenario, for 2050, are challenging, but that demonstrates the scale of change needed. Whilst this represents just one solution to the issues faced, it is clear that the overall target is non-negotiable – if less is done in one area or sector, more will need to be achieved in another.

- The focus is on the role of households in securing emissions reductions, covering the building fabric, lighting and appliances, and building-integrated technologies.
- The aim is market transformation of the total housing stock to the average of a 40% house, with the emphasis on strong regulation and product policy. A proactive, rather than reactive approach, is taken.
- All four principles in the Energy White Paper are addressed in achieving the 40% House: the 60% target, fuel poverty, security of supply and competitiveness.
- These savings are achievable even with the constraining assumptions made, including a 33% increase in household numbers between 1996 and 2050, a smaller average household size (from 2.4 to 2.1 people per household), stable emissions factors from 2030 and no reliance on unknown technological advances.

Over a span of 50 years, substantial changes will occur – technologies, appliances, housing styles not even thought of today could form part of everyday life. In five decades from now most central heating systems and appliances would have been replaced at least three times, the majority of power stations replaced twice, and almost the whole of the electrical and gas distribution network renewed. As well as illustrating the level of change that will occur over this timeframe, this also highlights the considerable opportunities for intervention that exist, fitting in with the natural cycles of replacement. Action must be taken now to ensure that the appropriate technologies are available to match these cycles. The improvements set in motion now to reach the 60% reductions target will continue to provide benefits to 2050 and beyond.

### **Housing**

The efficiency of the UK housing stock is improved substantially by 2050. This occurs through altering the standard of the existing stock, the quality of new-build and the relative proportions of each.

#### **Current stock**

- Two-thirds of the dwellings standing in 2050 are already in existence.
- A substantial programme to upgrade these existing houses is required to give an average space heating demand of 6500 kWh per annum.
- This requires insulation of 90% of all cavity walls, 30% of all solid walls, 100% loft insulation (to a depth of 300 mm), 100% high performance doors and 90% high performance windows.

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- The aim is to achieve as much as possible through retrofit measures, before resorting to demolition, which is more disruptive and expensive.
- The worst houses, around 14% of the current stock, are removed through a targeted demolition strategy – care must be taken not to invest money in upgrading those homes that will ultimately be demolished.
- This requires demolition rates to be increased to four times current levels, rising to 80 000 dwellings per annum by 2016.

## New-build

- Construction rates are increased to replace the demolished homes and to meet the rise in demand for housing due to the growing population.
- New build makes up a third of the stock in 2050.
- This requires an average construction rate of 220 000 per annum.
- These new homes are built to a high energy-efficient standard, with an average net heating demand of 3000 kWh pa in all new dwellings from 2020.
- Appropriate design and siting limits the requirement for air conditioning. Cooling is achieved through passive measures.

## Housing stock in 2050

- By 2050, the number of households will have increased to 31.8 million, housing a population of 66.8 million, with an average of 2.1 people per household.
- The average efficiency of dwellings is a SAP rating of 75, with a SAP of 51 (the current average) as the minimum standard.
- Fuel poverty has been eliminated, with affordable warmth and cooling for all households.
- The needs of single people are recognised through the provision of smaller housing in appropriate locations.

## Policy

- The various aims would be best incorporated into a long-term, over-arching UK energy and housing strategy that covers both the rate of turnover in the housing stock and the resultant energy use and carbon emissions.
- The strategy would have a full remit to consider the implications of location, tenure, size and density of housing developments over the next 50-100 years.
- The housing strategy clearly defines the role of grants in improving the stock of dwellings and the extent to which these should be primarily focused on eliminating fuel poverty, as at the moment, and whether additional resources should be available for encouraging best practice.
- Responsibility for implementing the energy and housing strategy is largely devolved to local and regional authorities.
- The Building Regulations set the minimum standard for new build and renovation. A clear strategy for standards (and their enforcement) over the next 40-50 years is required to identify the necessary technologies and appropriate timescales to ensure transformation of the housing stock.
- Providing information to consumers and local authorities on the energy performance of a dwelling is essential to guide policy and push the market towards more efficient homes. A universal, address-specific database of the energy efficiency of individual homes (on an established scale), collated at the level of each housing authority, would provide this detail.

## Lights and appliances

All households, new and existing, are installed with energy efficient appliances and lighting throughout, representing the best technology currently available. Further

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savings are possible through new and unforeseen technologies that may emerge over the next 50 years, but do not form part of the quantified scenario.

- Household electricity demand for domestic lights and appliances (excluding space and water heating) is reduced to 1680 kWh per annum – almost half current levels.
- The key technologies installed include vacuum insulated panels (VIPs) for refrigeration and LED (light emitting diode) lighting in all households.
- Peak demand is reduced through appropriate appliance design.
- The rapid turnover of the stock of lights and appliances means that savings can be achieved quickly, once appropriate policies are implemented. This would contribute additional savings to achieve the UK's Kyoto targets for 2008-12.

## Policy

- Market transformation is already established as the main policy approach in this sector, but has not yet been used to full effect. The emphasis needs to be on stronger, more focused measures, such as minimum standards.
- Replacing policy on energy efficiency with policies on absolute energy demand would encourage downsizing and could reverse the present trend towards larger (more energy consuming) equipment.
- Manufacturers must be encouraged to view energy-efficiency as a vital component of product design to prevent energy-profligate equipment appearing on the market, and this could be achieved under the European Energy-using Products Directive.

## Space and water heating

The way in which the space and water heating needs of the residential sector are met is revolutionised, with an average of two low and zero carbon (LZC) technologies per household.

- LZCs cover community CHP (combined heat and power), micro-CHP (at the household level), heat pumps, biomass, photovoltaics (PV), solar hot water heating and wind turbines.
- In all new build, LZCs are installed as matter of course. Existing dwellings are retrofitted when and where appropriate.
- This would be sufficient to meet total residential electricity demand from low-carbon sources and turn the residential sector into a net exporter of electricity by 2050.

## Policy

- A complete market transformation to LZC could be achieved over the course of 2005 to 2050, which could be considered as three heating system replacement cycles of 15 years each.
- Building regulations specify the minimum standard for LZC technologies in new build and renovations.

## Consumers and society

Society has been transformed to become more community-minded and environmentally-aware, providing the necessary framework and support for successful implementation of the required policies.

- If UK society continues to develop along current trends, no carbon emissions reductions are expected by 2050.

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- Only societies where environmental concern and awareness are much stronger than today will produce significantly reduced carbon emissions.
- Changing social priorities is an important Government action as part of meeting its carbon reduction target.

## Policy

- Feedback and information are an essential part of raising awareness. The design of utility bills, electricity disclosure labels, the tariff structure and the existence of the standing charge all need to be considered in terms of discouraging consumption and improving the energy-literacy of society.
- As an example of an appropriate framework, personal carbon allowances (PCAs) offer an equitable solution to achieving greater carbon awareness amongst consumers, by placing a cap on individual consumption.

## Conclusions

Securing a 60% reduction in carbon emissions from UK households is a considerable challenge that requires a radical shift in perspective in the housing, appliance and electricity supply industries and policy co-ordination across a number of Government departments. Current policies, programmes and trends are not sufficient to put the UK on a trajectory that will lead to this level of emissions reductions by 2050. A clear over-arching strategy that deals with both the energy and housing needs of UK dwellings, with an emphasis on carbon mitigation is necessary.