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# Improving Housing Energy Efficiency

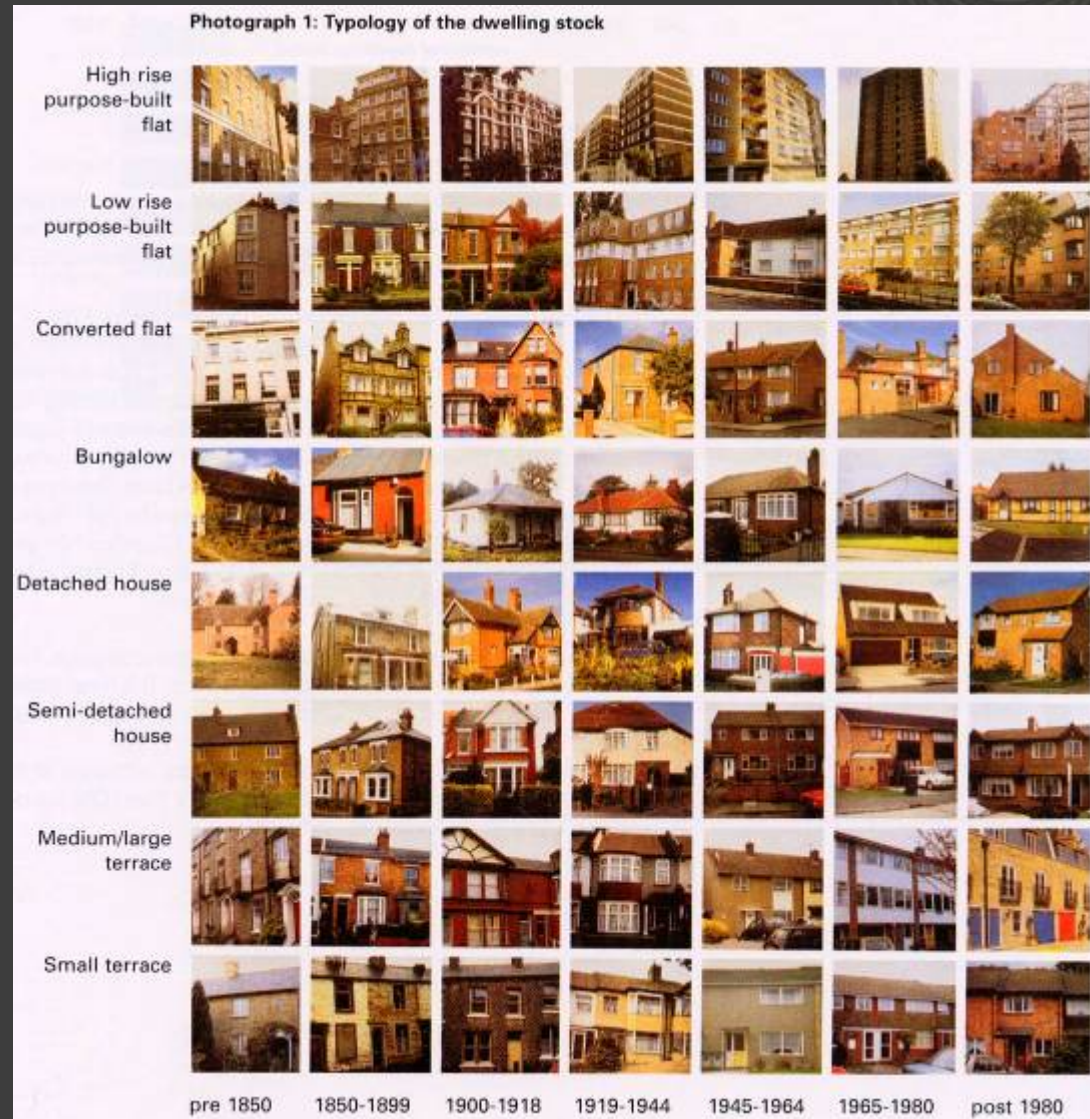
John Riley

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20<sup>th</sup> October 2009

# Energy Efficiency in Housing

- Objectives
- Progress to-date
- The scale of the task
- What's achievable?
- Challenges





80% Reduction in CO<sub>2</sub> Emissions  
by 2050

From Housing

# Key drivers



## Department for Energy and Climate Change

- Department brings together much of the Climate Change Group, previously housed within Defra, with the Energy Group from BERR



Climate Change Act 2008

## Climate Change Act 2008

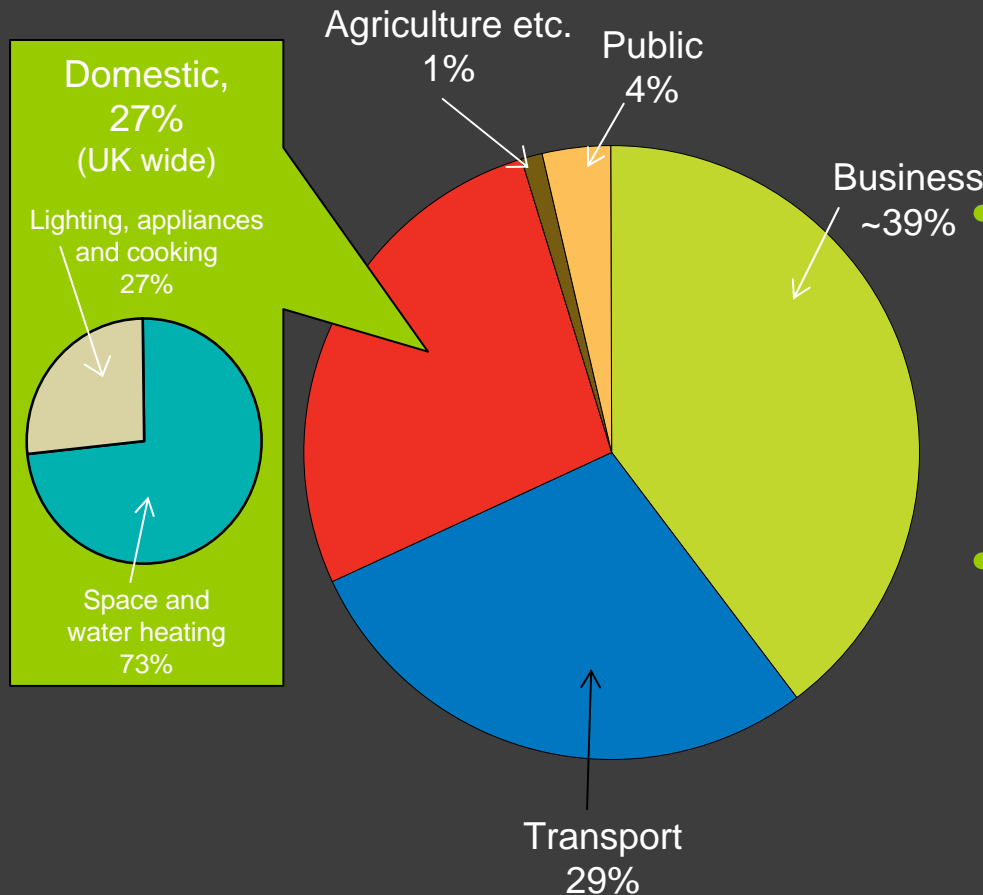
- CO<sub>2</sub> 80% below 1990 levels by 2050
- Act does not outline how this will happen. But it does make provision for the government to implement policies that will help it meet its targets



## Climate Change Committee

- Established as an independent body to provide expert analysis and advice on how the UK can meet its climate change goals
- All sectors should be included
- Energy efficiency is the key factor leading up to 2020

# UK Carbon Emissions



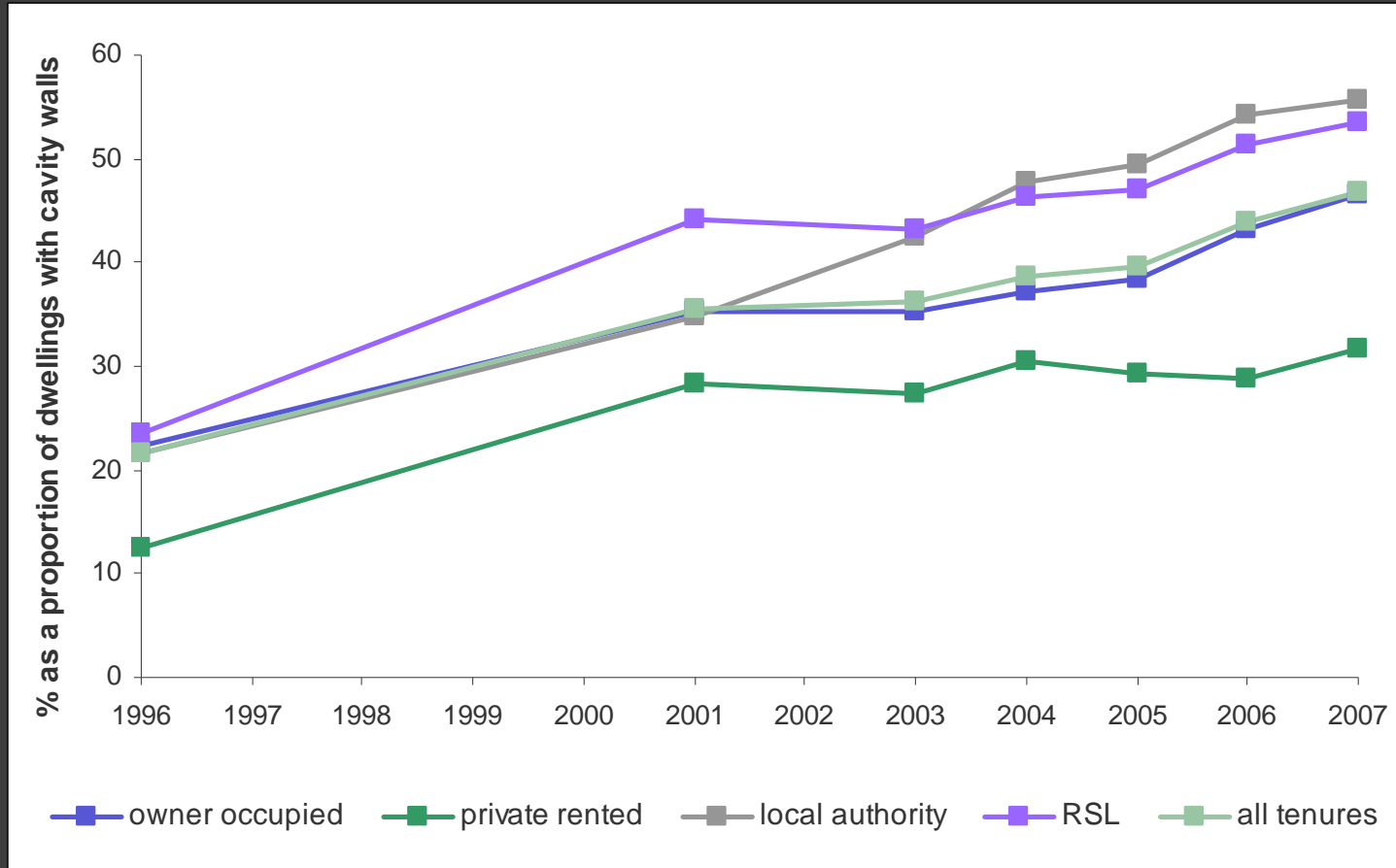
Emissions from the use of electricity and heating fuels by households account for 27% of the UK's total, making 148.5 MtCO<sub>2</sub>

- 73% of household emissions arise from space and water heating, and 27% from lighting, appliances and cooking

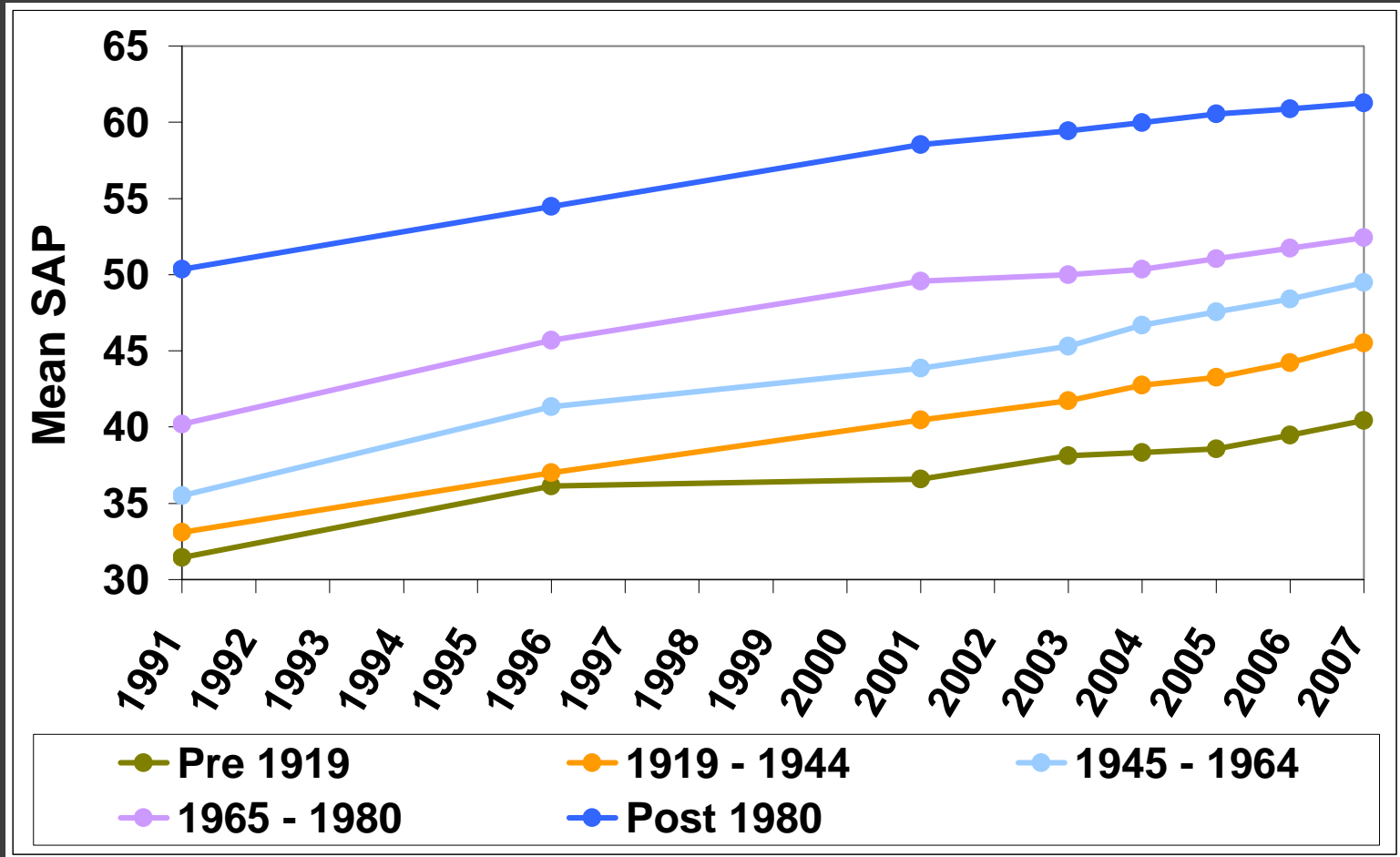
Source: [www.occ.gov.uk](http://www.occ.gov.uk)

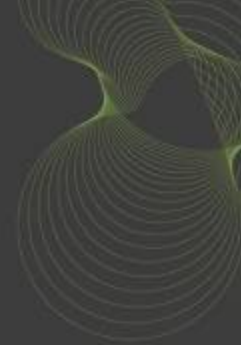
# Progress to-date

- (1) Where are we now? – Baseline
- (2) How has the stock changed over time? - Progress.



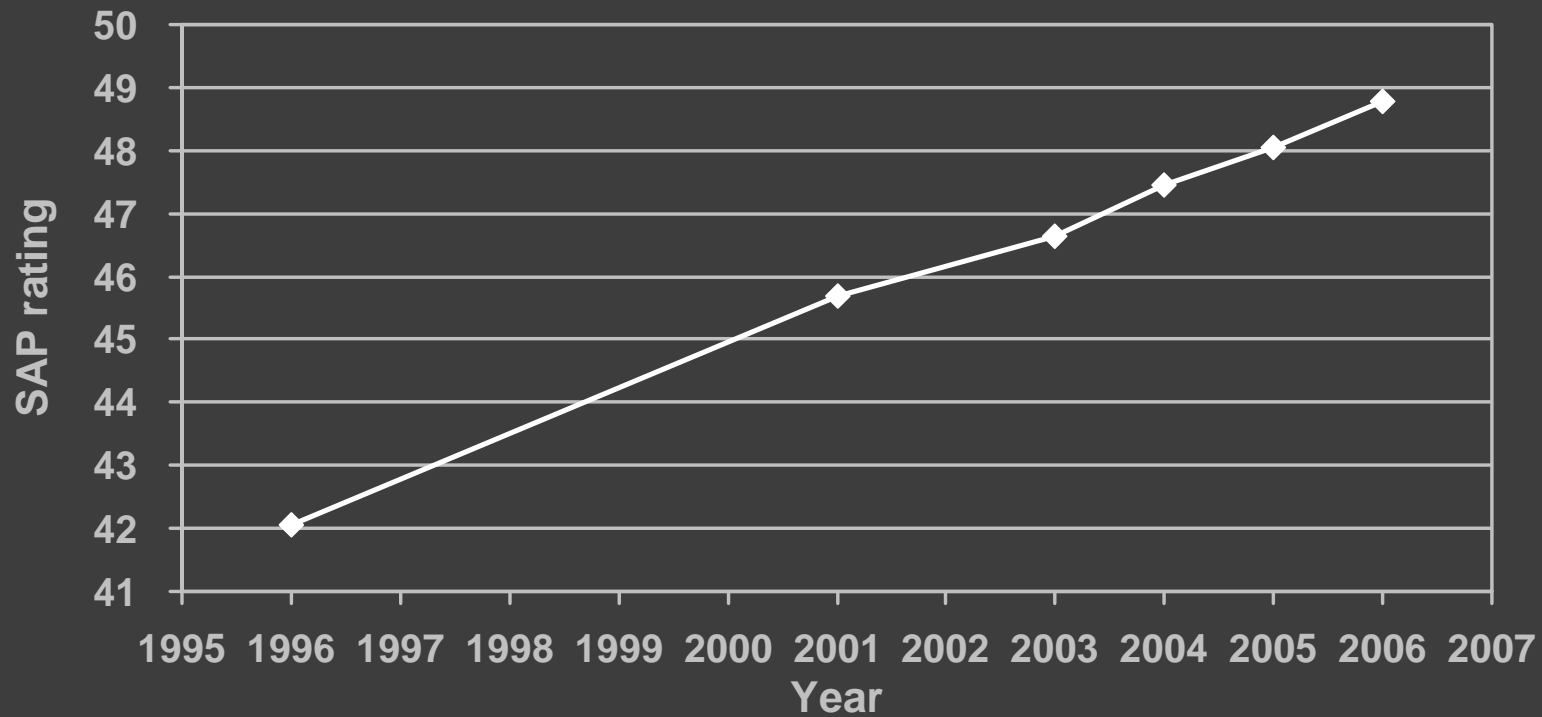
# SAP by Dwelling Age

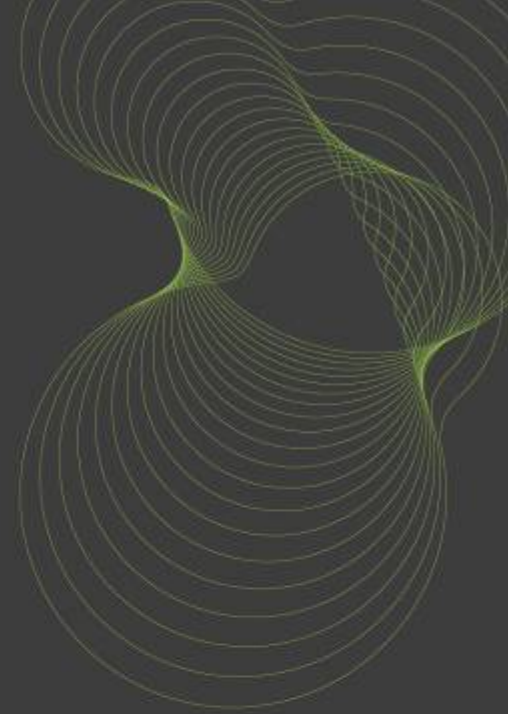




# The scale of the task for England

## Average SAP rating 1996-2006

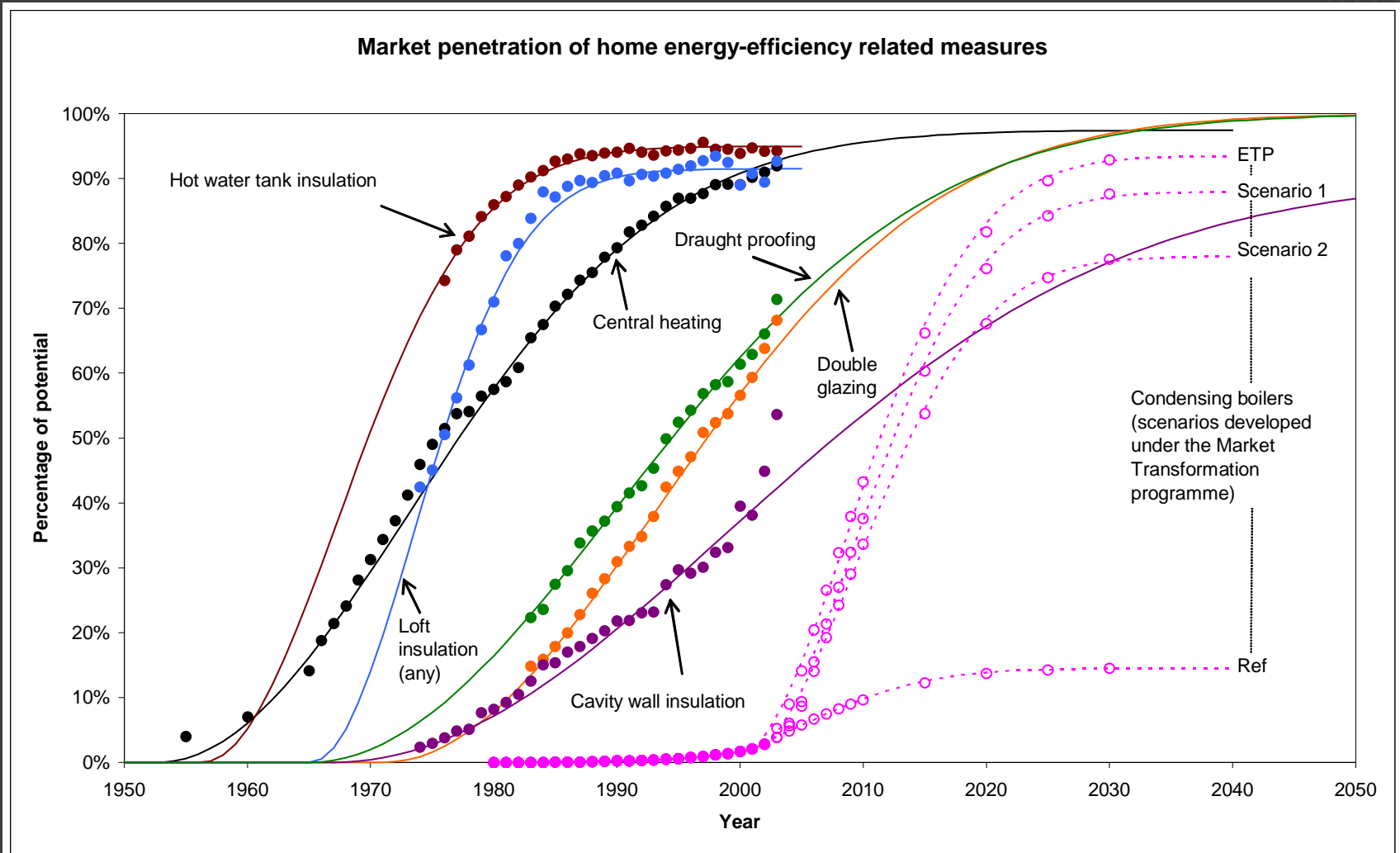




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Understanding the scale of the task

# Use of trend data to assess likely future developments – used for developing scenarios



# Example of an Energy Performance Certificate

Energy Performance Certificate

17 Any Street,  
 Any Town,  
 County,  
 YY3 5XX

Dwelling type: Detached house  
 Date of assessment: 02 February 2007  
 Date of certificate: [dd mmmm yyyy]  
 Reference number: 0000-0000-0000-0000-0000  
 Total floor area: 166 m<sup>2</sup>

This home's performance is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO<sub>2</sub>) emissions.

### Energy Efficiency Rating

	Current	Potential
Very energy efficient - lower running costs		
(92-100) <b>A</b>		
(81-91) <b>B</b>		
(69-80) <b>C</b>		<b>73</b>
(55-68) <b>D</b>		
(39-54) <b>E</b>	<b>37</b>	
(21-38) <b>F</b>		
(1-20) <b>G</b>		
Not energy efficient - higher running costs		

**England & Wales** EU Directive 2002/91/EC

The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills will be.

### Environmental Impact (CO<sub>2</sub>) Rating

	Current	Potential
Very environmentally friendly - lower CO <sub>2</sub> emissions		
(92-100) <b>A</b>		
(81-91) <b>B</b>		
(69-80) <b>C</b>		<b>69</b>
(55-68) <b>D</b>		
(39-54) <b>E</b>		
(21-38) <b>F</b>	<b>31</b>	
(1-20) <b>G</b>		
Not environmentally friendly - higher CO <sub>2</sub> emissions		

**England & Wales** EU Directive 2002/91/EC

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO<sub>2</sub>) emissions. The higher the rating the less impact it has on the environment.

### Estimated energy use, carbon dioxide (CO<sub>2</sub>) emissions and fuel costs of this home

	Current	Potential
Energy Use	453 kWh/m <sup>2</sup> per year	178 kWh/m <sup>2</sup> per year
Carbon dioxide emissions	13 tonnes per year	4.9 tonnes per year
Lighting	£81 per year	£65 per year
Heating	£1173 per year	£457 per year
Hot water	£219 per year	£104 per year

Based on standardised assumptions about occupancy, heating patterns and geographical location, the above table provides an indication of how much it will cost to provide lighting, heating and hot water to this home. The fuel costs only take into account the cost of fuel and not any associated service, maintenance or safety inspection. This certificate has been provided for comparative purposes only and enables one home to be compared with another. Always check the date the certificate was issued, because fuel prices can increase over time and energy saving recommendations will evolve.

To see how this home can achieve its potential rating please see the recommended measures.

Remember to look for the energy saving recommended logo when buying energy-efficient products. It's a quick and easy way to identify the most energy-efficient products on the market.

For advice on how to take action and to find out about offers available to help make your home more energy efficient, call 0800 512 012 or visit [www.energysavingtrust.org.uk/myhome](http://www.energysavingtrust.org.uk/myhome)

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# EPC Measures included

## EPC Low cost measures (less than £500):

- installation of cavity wall insulation, where the wall is of cavity construction;
- installation or upgrade of loft insulation which is less than or equal to 150mm to 250mm, where the dwelling is not a mid- or ground-floor flat and where the loft does not constitute a full conversion to a habitable room;
- installation or upgrade of hot water cylinder insulation to a level matching a 160mm jacket. Recommended where the current level is less than 25mm of spray foam or less than a 100mm jacket.

## EPC Higher cost measures (more than £500):

- upgrade to central heating controls, for boiler driven systems, typically to a stage where a room thermostat, a central programmer and thermostatic radiator valves (TRV's) have been installed (although the range of upgraded controls can vary depending on the heating system);
- upgrading to a class A condensing boiler using the same fuel (mains gas, LPG or fuel oil), where a non-communal boiler is in place;
- upgrading existing storage radiators (or other electric heating) to more modern, fan-assisted storage heaters;
- installation of a hot water cylinder thermostat where a storage cylinder is in use but no thermostat exists;
- replacement warm-air unit with a fan-assisted flue, where the original warm-air heating unit is pre-1998;



# EPC Measures not included

## EPC Low cost measures:

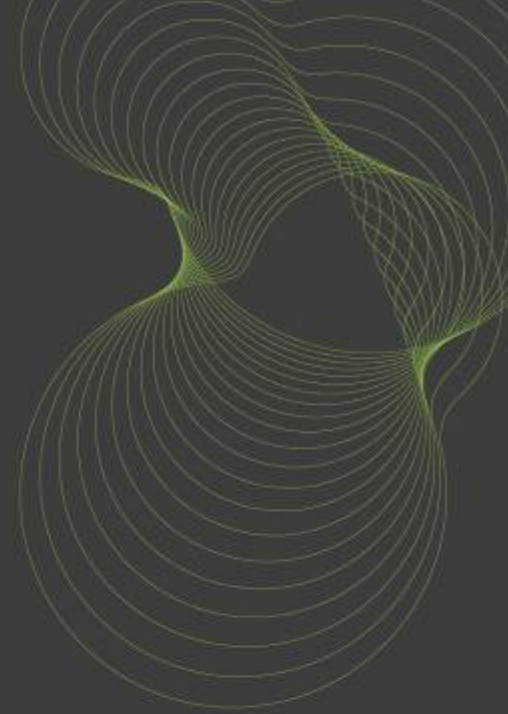
- Draught proofing single glazed windows;
- Low energy lights.
- EPC Higher cost measures:
- Installation of a manual feed **biomass boiler** or **wood pellet stove** where an independent, non-biomass solid fuel system exists. This measure was assessed to identify the number of homes that would benefit from this measure but was *not* included in the post improvement energy efficiency rating or carbon dioxide emissions (reported in section 4) due to modelling complexity.

## Other more expensive measures:

- Solar water heating;
- Double or secondary glazing;
- Solid wall insulation;
- Complete change of heating system to class A condensing boiler (including fuel switching);
- Solar photovoltaics (PV) panels.

# EPC recommended energy efficiency measures

	size of applicable group (000s)	number of dwellings that would benefit from the measure (000s)	percentage of applicable group (%)
<b>low cost measures (less than £500)</b>			
loft insulation	19,908	8,871	45
cavity wall insulation	15,527	7,088	46
hot water cylinder insulation	13,711	3,874	28
<b>higher cost measures (more than £500)</b>			
heating controls	19,499	7,784	40
boiler upgrade	19,258	15,455	80
storage heater upgrade	2,322	361	16
hot water cylinder thermostat	13,711	1,884	14
replacement warm air system *	241	30	12
install biomass system <sup>+</sup>	654	113	17



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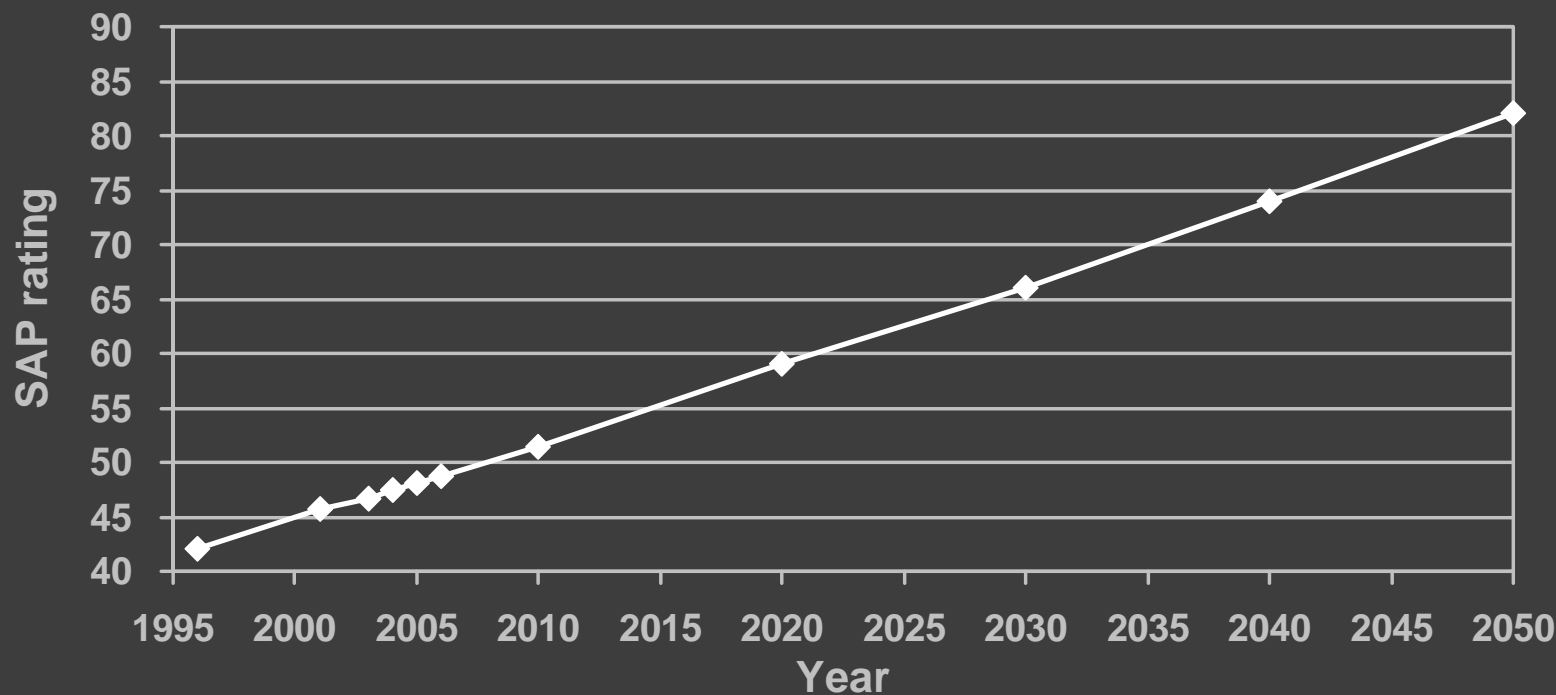
Predicting change – What is achievable?

# Potential improvements in energy efficiency (SAP) ratings, CO2 emissions and fuel costs by dwelling age, 2007

	current performance			post-improvement			difference		
	SAP (rating)	CO2 (tones/year)	cost (£/year)	SAP (rating)	CO2 (tones/year)	cost (£/year)	SAP inc. (rating)	CO2 saving (tones/year)	cost saving (£/year)
<b>pre-1919</b>	40.4	9.0	853	49.4	7.4	713	8.9	1.6	139
<b>1919-44</b>	45.5	7.2	678	57.3	5.4	527	11.7	1.8	152
<b>1945-64</b>	49.5	6.2	598	61.6	4.5	453	12.1	1.7	144
<b>1965-80</b>	52.4	5.7	558	63.7	4.2	425	11.3	1.5	133
<b>1981-90</b>	56.6	5.1	508	64.3	4.1	420	7.7	1.0	89
<b>post 1990</b>	64.7	4.5	457	69.7	3.8	397	5.0	0.7	60
<b>all ages</b>	<b>49.8</b>	<b>6.6</b>	<b>634</b>	<b>59.8</b>	<b>5.1</b>	<b>507</b>	<b>10.0</b>	<b>1.5</b>	<b>128</b>

# The scale task for England

## Projected average SAP rating 1996-2050



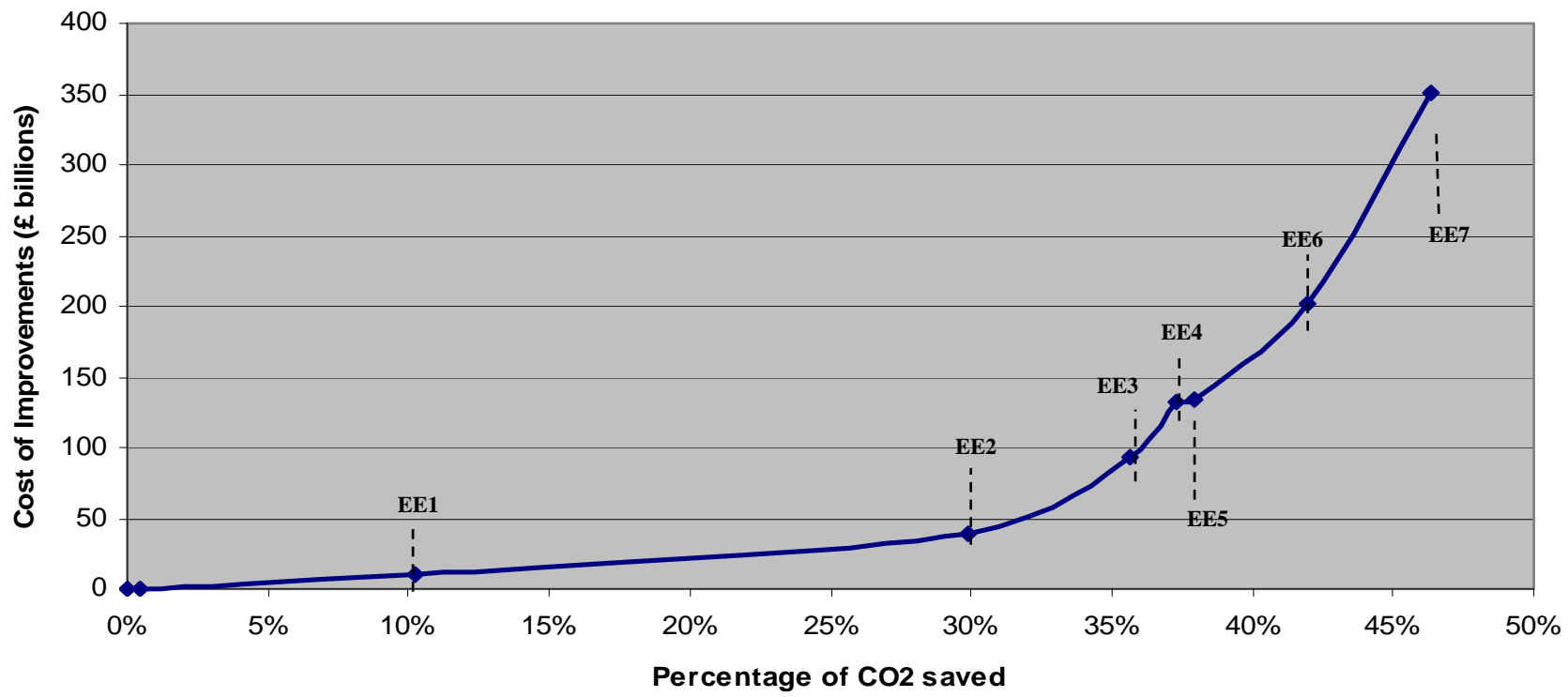
# What is required?

## Pushing harder

- Basic insulation (LI, CWI, TI)
- Installation of heating systems and controls
- Efficient boilers
  
- Further insulation (SWI, DG, FI)
  
- Solar thermal water heating
  
- Micro generation
  
- Other?



## Total Cost of improvements vs Percentage of CO2 Saved from 1991

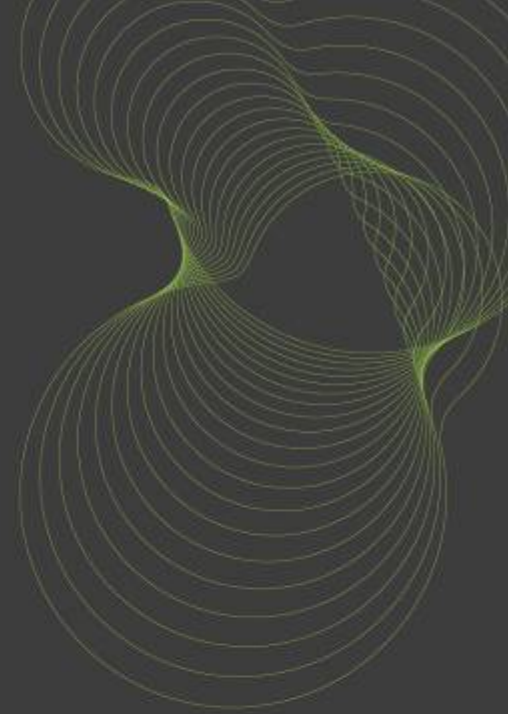


# Reaching the 80% target by 2050



Need to add in:

- Decarbonisation of the power supply
- Low carbon heat
- Advances in technology
- Changes in occupant behaviour



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## The Challenges for Retrofitting



# Retrofitting Challenges

- Drivers
- Scale and time
- Technical
- Financial
- Occupant



# Hard to Treat stock

Category of HTT	Dwellings Included	Dwellings not included
<b>Solid wall</b>	<ul style="list-style-type: none"><li>▪ Traditional 9" masonry</li><li>▪ Single leaf masonry</li><li>▪ &gt; 9" walls</li><li>▪ Concrete walls</li><li>▪ Metal panelled walls</li><li>▪ Timber panelled walls</li></ul>	<ul style="list-style-type: none"><li>▪ Cavity walls that cannot be filled for technical reasons</li></ul>
<b>Off gas network</b>	<ul style="list-style-type: none"><li>▪ Dwellings with no mains gas system present</li></ul>	<ul style="list-style-type: none"><li>▪ Dwellings with communal heating systems</li></ul>
<b>No loft</b>	<ul style="list-style-type: none"><li>▪ Dwellings surveyed as having no loft</li><li>▪ Dwellings with mansard, chalet or flat roofs built pre-1990</li><li>▪ Dwellings with pre-1990 loft conversions</li></ul>	<ul style="list-style-type: none"><li>▪ Dwellings with mansard, chalet or flat roofs built post-1990</li><li>▪ Dwellings with post-1990 loft conversions</li></ul>
<b>High rise flats</b>	<ul style="list-style-type: none"><li>▪ Flats at least 6 storeys high</li></ul>	

# Hard to Treat stock



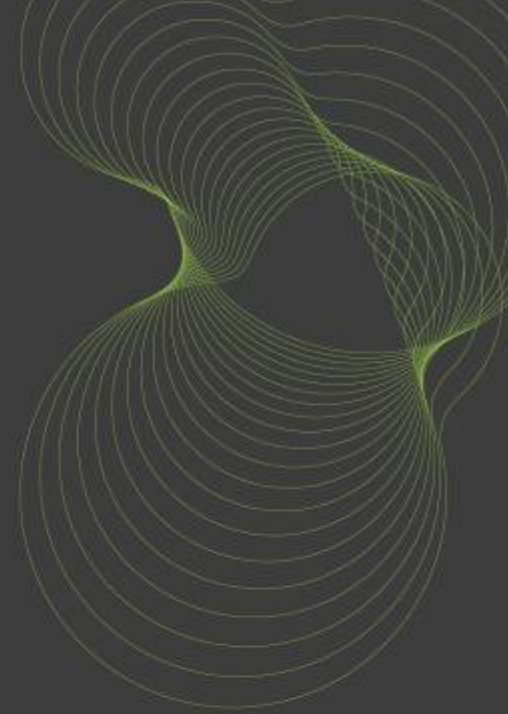
		Number of dwellings (000s)	% of all dwellings	% of Hard to Treat stock
Hard To Treat?	Yes	9,206	43	
	No	12,343	57	
	<i>Total</i>	<i>21,549</i>	<i>100</i>	
Solid wall		6,599	31	72
Off gas network		2,769	13	30
No loft space		1,475	7	16
High rise flat		326	2	4



# Retrofitting Challenges



- Drivers
  - Government
- Scale and time presents capacity issues - Can the industry deliver?
  - Energy efficiency market is complex and fragmented
  - Most activity is supported by grant or subsidy though programmes (e.g. CERT):
    - *Managed by large organisations, but*
    - *Delivery of products and services is by large number of SME's, and*
    - *There is also a substantial DIY market*
  - Insufficient skills to undertake whole house low-carbon refurbishment
  - Selecting the right programmes
- Technical
  - Advances... much more to come
- Financial
  - Pay As You Save (PAYS)
  - Incentives – green mortgages, reduced VAT, Stamp Duty rebates, feed-in tariffs for micro-gen
  - Reducing costs over time as markets develop
- Occupant
  - Involvement



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# Improving Housing Energy Efficiency

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20<sup>th</sup> October 2009