

UK Energy, Water and Waste Roadmaps to 2050:

A Synthesis of Drivers, Technologies, Targets and Policies

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Introduction

Roadmaps can be defined as: *‘simple, adaptable ‘strategic lenses’ through which the evolution of complex systems can be viewed, supporting dialogue and communication.’*

{Phaal, R. and Probert, D. (2009). *Technology Roadmapping: Facilitating Collaborative Research Strategy*. Centre for Technology Management, Department of Engineering, University of Cambridge}.

Technology roadmaps, which also draw on other foresight approaches such as scenarios, Delphi surveys and forecasts, are useful for framing major socio-technical system changes, or technological transitions. In essence they combine three different ways of understanding the future through ‘expectations’, ‘desires’ and ‘promises’. They address key questions which include:

- Where do we want to go? Where are we now? How can we get there?
- Why do we need to act? What should we do? How should we do it? By when?

The aim of the three technology-based roadmaps included in this document, which relate to the energy, waste and water sectors, is to identify the key drivers, technology trends, targets and policy landscape which will underpin change in these sectors at a national UK level to 2020 and beyond. We have not sought to include devolved constituent targets for all parts of the UK because of space limitations.

In order to highlight the fundamental changes needed to reach a sustainable 2050 future we have also highlighted both ‘business as usual’ facts and figures, and information which highlights what needs to be done in each sector to achieve the national targets.

The information presented in these roadmaps has been synthesised from a wide range of sources which are referenced within each roadmap.

UK Energy Roadmap (adapted from the Carbon Plan 2011)

		Prior to 2008	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2030	2050	
Drivers	Key drivers	Population growth, climate change, energy costs, behavioural change, legislation.																
	Significant	Living /working /transport patterns, reputation , standard of living expectations and aesthetics.																
Technology Trends	Solid State Lighting				5% of lighting market											50% (2029)	75%	
	Thin film inorganic + organic solar cells														Grid parity for PV			
	District Heating							Growth of District Heating Networks										
Targets	Carbon Budgets		22% Reduction (on 1990 levels) (2008-12)					28% Reduction (2013-17)				34% Reduction (2018-22)			50% Reduction (2023-27)		80%	
	Low Carbon Supply														15% Renewables		Nearly zero	
	Buildings																Nearly zero	
	Technology Delivery	Low cost measures - cavity wall and loft fill + build supply chain for lighting + appliances																
									1.5m solid wall installations up to 2020				1-3.7m SWI up to 2030					
						Build supply chain for low carbon heat and cooling				Mainstream delivery low carbon heat								
Policy	Domestic	CERT (ends 2012) EPC Building Regs			FITS	RHPP	Green Deal + ECO start, Revised EPC + RHI (phase 2) starts			New homes Carbon Zero from 2016		Private rented housing and commercial rented property min Band E (EPC)						
	Non Domestic	EPC,CCA,CCL, Building Regs			CRC, FITS	RHI (Phase One)	Green Deal and ECO start			New non domestic buildings Carbon Zero from 2019								
	Appliances					Minimum EU performance standards and labelling conventions agreed.												
	Real time information						Smart Meters roll out ,complete by 2019											

Energy: key facts

Business as usual?

In 2009:

- Power sector accounted for 27% of carbon emissions
- Achieved 3.3% of supply from renewables
- Buildings accounted for 37% of emissions (25% domestic, 12% non domestic)
- Domestic Transport accounted for 24% of emissions (emissions are no lower than 1990 levels)

What do we need to do to change?

- In order to meet the 80% reduction targets by 2050 we need to retrofit one building every minute for the next 40 years.
- Estimated cost - £85 billion for homes alone

Key references for roadmaps:

- DECC (Department of Energy and Climate Change) (2011). The Carbon Plan: Delivering Our Low Carbon Future.
- Carbon Trust (2009). Focus for Success: A new approach to commercialising low carbon technologies. Carbon Trust.
- BIS (Department for Business Innovation and Skills) (2011). Innovation and Research Strategy for Growth
- ARUP (2011) UK Legislation Timeline : Emissions Energy Efficiency
- Scenarios for Urban Retrofit Workshop 1, Workshop report (2011)
- Retrofit Expert Reviews ER13 and ER14

UK Water Roadmap

		Prior to 2008	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2030	2050	
Drivers	Key drivers	Population growth, climate change, resilience, energy costs, behavioural change, legislation.																
	Significant	Habitats Directive, increased pressure on water availability in SE England, increasingly sporadic precipitation UK wide.																
Technology Trends	Infrastructure				SUDS													
	Buildings (Demand)			Ultra Low flush toilets, aerated low flow shower heads														
	Disruptive			Recycling of grey water														
Targets	Carbon Budgets		22% Reduction (on 1990 levels) (2008-12)					28% Reduction (2013-17)				34% Reduction (2018-22)			50% Reduction (2023-27)		80%	
	Supply		Provide a sustainable supply and demand balance - energy efficiency in treatment and supply															
	Management/ Utilities		Reducing leakage. + greater integration of utility companies working together to improve energy efficiency.															
	Demand		Reduce per capita potable water consumption to 130 l/head by 2030 (England and Wales), reuse and recycle															
	Technology Delivery		Detecting leakage in supply and in buildings															
Policy	Legislation		2015 - EU Water Framework Directive/ 2000/60/EU target date for achieving objectives. Protection and improvement of water environment ground waters and surface waters															
			Future Water 2008 (Defra)			Water White Paper 2011 Water for Life												
			Urban Waste Water Treatment Directive /98/15/EEC					A Blueprint to safeguard Europe's water resources 2012										
			Water Companies 25 year water resources management plans (statutory requirement since 2007)															
			Water meters															
	Real Time Information		Water meters															

Water: key facts

Business as usual?

- England—average person uses 150l/day or a tonne of water per week
- Heating water is a major use of energy in UK homes
- Energy represents 28% of operating costs of water industry
- UK has over £250bn invested in water infrastructure of varying age and condition, with £8bn pa on capital and operating costs

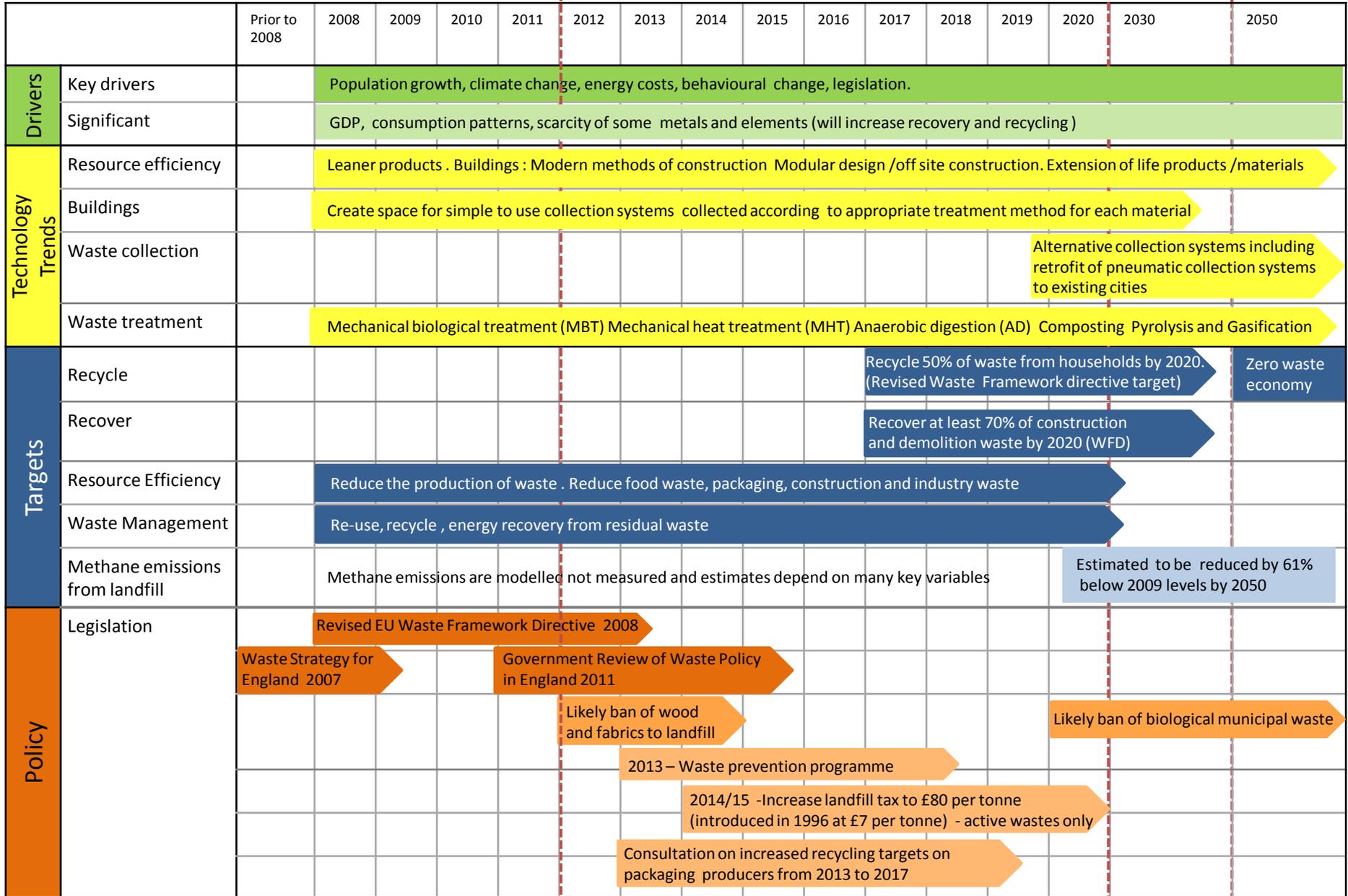
What do we need to do to change?

- Reduce per capita water consumption to 130 l/head by 2030 (England and Wales) Reducing individual consumption by 20 litres a day would mean water companies could reduce GHG emissions by up to 8% (equivalent to annual emissions from 90,000 cars, or from supplying the population of Liverpool with electricity for a year)
- Reduce leakages (England and Wales) Using current technology, it would cost companies about £100 billion to replace existing pipe networks and every customer's supply pipe

Key references:

- Defra (Department for Environment, Food and Rural Affairs)(2011) Water for Life
- Defra (Department for Environment, Food and Rural Affairs)(2008) Future Water: The Government's Water Strategy for England
- Hall, J. W., Henriques, J. J., Hickford, A. J. & Nicholls, R. J., Ed.s (2012). *A Fast Track Analysis of strategies for infrastructure provision in Great Britain*. Environmental Change Institute, University of Oxford, Oxford.
- GOS(2011) Taking Responsibility for Water
- Defra /OFWAT (2011) Innovation Priorities for the Water Sector
- UKWIR (2007) R& D Roadmap
- Retrofit Expert Review 17 and 18
- EKTN (2008) Energy Efficient Water and Waste Water Treatment
- Ofwat (The Water Services Regulation Authority, England and Wales) : 'Waste not, want not' making the best use of our water (2010)

UK Waste (solid) and Resource Efficiency Roadmap



Waste: key facts

Business as usual?

- In 2009 - emissions from the waste management sector represented a little over 3% of the UK total. Nearly 90% of this is from landfill methane.
- Packaging accounts for a fifth of household waste
- Over 13Mt of waste material is exported annually

What do we need to do to change?

- £10-£20bn is needed over next 10 years in UK to fund new materials recycling and energy recovery infrastructure
- UK businesses could save over £22 billion via low and no-cost resource efficiency measures
- Energy-from-waste has the potential to meet 15% of the UK's electricity from renewable sources commitment and a third of the country's residential gas demand (up to 12% of total UK demand)

Key references:

- Defra (2011) Government Review of Waste Policy in England
- DECC (Department of Energy and Climate Change) (2011). The Carbon Plan: Delivering Our Low Carbon Future.
- ICE (2010). State of the Nation: waste and resource management. Institution of Civil Engineers, London.
- Hall, J. W., Henriques, J. J., Hickford, A. J. & Nicholls, R. J., Ed.s (2012). *A Fast Track Analysis of strategies for infrastructure provision in Great Britain*. Environmental Change Institute, University of Oxford, Oxford.
- Phillips, P., Tudor, T., Bird, H., Bates, M (2011) *A critical review of a key Waste Strategy Initiative in England: Zero Waste Places Projects 2008–2009*, Resources, Conservation and Recycling 55 (2011) 335–343
- Retrofit Expert Review 19
- SITA UK. Driving Green Growth: The role of the waste management industry and the circular economy (2012)