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Environment Agency scenarios 2030

Science Report SC050002/SR1

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Our work includes tackling flooding and pollution incidents, reducing industry's impacts on the environment, cleaning up rivers, coastal waters and contaminated land, and improving wildlife habitats.

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For further information on how best to use this set of scenarios, please see Exploring the future: guidance toolkit for using the scenarios report, also available on the Environment Agency's National Publications Catalogue. Further copies of both publications can be ordered throughThe Environment Agency's National Customer Contact Centre by emailing enquiries@environment-agency.gov.uk or by telephoning 08708 506506

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Science underpins the work of the Environment Agency. It provides an up-to-date understanding of the world about us and helps us to develop monitoring tools and techniques to manage our environment as efficiently and effectively as possible.

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- **Delivering information, advice, tools and techniques,** by making appropriate products available to our policy and operations staff.

Steve Killeen

Head of Science

Contents

1. Introduction

1.1 Background to the project

Henley Centre Headlight Vision was commissioned in 2005 by the Environment Agency and Department for Food, Environment and Rural Affairs (Defra) to develop a set of scenarios that explored the possible changes in the pressures on the UK Environment between now and 2030. The scenarios are intended to answer the question set at the start of the project:

> *Given the scale and diversity of social, economic, technological and other change over the next 25 years, what is the range of plausible futures for the pressures on the UK environment between now and 2030?*

This report describes the scenarios developed through the project, together with a set of accompanying indicators. It also describes the process by which the scenarios were developed, and assesses the similarities and differences between these scenarios and others that may be commonly used by the Environment Agency, Defra and key stakeholder groups.

The scenarios contained in this report were developed using a highly participatory process that involved a number of key workshops with stakeholders and experts alongside Environment Agency and Defra staff. The core project team included officials from the Environment Agency and Defra, working alongside a team of researchers and consultants from Henley Centre Headlight Vision. In addition, a team of experts from the Centre for Environmental Strategy at the University of Surrey and Ian Christie, formerly of Henley Centre Headlight Vision and now Head of Sustainability at Surrey County Council and an Associate of Green Alliance and the New Economics Foundation, contributed. The project received Director-level sponsorship and was overseen by a combined Environment Agency–Defra Project Board.

The project process followed a 'drivers based' scenario development methodology. This began with an intensive research process, which involved extensive desk research and use of the Defra Horizon-Scanning database, alongside a significant number of executive interviews. Those people interviewed in the initial stages of the work included Board members from the Environment Agency, officials from Defra and a number of other key Government Departments, as well as selected external experts. As highlighted above, a number of workshops were also held throughout the process to develop and test the scenarios. These workshops involved officials from the Environment Agency, Defra, Department of Trade and Industry's (DTI's) Office of Science and Technology (OST) and a number of key external stakeholder groups (see Annex 14.4).

The scenarios and indicators contained within this report reflect and build upon a synthesis of the discussions that took place within and around the workshops. The project team is indebted to all those who gave their time and energy to contribute to

this highly participative process, and would like to thank all those involved for their many different contributions.

1.2 Project purpose and scope

The key purpose of the project was to develop a generic set of scenarios that could be used by policy makers in the Environment Agency, Defra and among other key stakeholder organisations to help them explore the possible future pressures on the UK environment, and thereby inform future strategy and policy. The objective was not to make recommendations for future policy and strategy, but to provide a generic, wide-ranging scenario framework that could be used to inform a more forward looking and future-focussed approach to strategy and policy development in this area.

Prior to the commencement of the project, there was already a significant body of relevant scenarios literature available in this area, some of which was already being used by some parts of the Environment Agency, and in Defra, to inform policy and strategy development.

For example, the scenarios developed in the OST Foresight Futures 2020 project[1] were used to inform the current Environment Agency Water Resources Strategy published in 2001[2], and also a specific piece of Foresight work on Future Flooding[3]. Further socio-economic scenarios were also developed and published for the UK Climate Impact Programme (UKCIP), to inform regional planning for climate change in the UK alongside the specific UKCIP climate change scenarios, the latest set of which were published in April 2002[4]. The UKCIP climate change scenarios were themselves derived from the original Foresight Futures work and from the Special Report on Emissions Scenarios (SRES) work on future greenhouse gas emissions commissioned by the Intergovernmental Panel on Climate Change (IPCC) and published in 2000[5]. A number of other scenario sets have also been developed at a global level to look at potential futures for the global environment[6].

The scenarios contained in this report attempt to fill a perceived gap in the above literature, based on the previous experience and reflections of Environment Agency staff. Some of the scenario sets outlined above were felt to be too generic (in terms of their global nature or lack of specific relevance to UK environmental pressures) or too specific (for example, because they considered only those issues relevant to, for

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[1] The work was originally published by the DTI's Office of Science and Technology as *Environmental Futures in 1999*, and then updated and published by them in 2002, as *Foresight Futures 2020, updated scenarios and guidance*.

[2] *Water Resources for the Future*, Environment Agency, 2001.

[3] *Future Flooding*, DTI Office of Science and Technology Foresight Programme, 2004.

[4] *Thinking Ahead: Socio-Economic Scenarios for Climate Change Impact Assessment*, UKCIP, 2001, and *Climate Change Scenarios for the United Kingdom*, UKCIP 2002.

[5] '*Emissions scenarios 2000: Special Report of the Intergovernmental Panel on Climate Change* Nakicenovic and Swart (eds), 2000.

[6] For example, the *Ecosystems and Human Well-Being* series published by the World Resources Institute as part of the Millennium Ecosystem Assessment Panel's work.

example, climate change). As a result they were difficult for Defra and Environment Agency policy makers to use in the course of their work.

The scenarios in this report are designed to fill this perceived gap, to provide a slightly more specific set of socio-economic scenarios focussed on the possible future pressures on the UK environment, which can therefore be used by policy makers across the full range of Environment Agency responsibilities. However, they are *not* intended to replace more detailed scenarios work that looks into specific issues (for example, those listed above in relation to the future impacts of climate change, which have a different and more specific purpose).

Despite this, and the different scope of this work compared to the scenarios developed, for example, by the OST Foresight, UKCIP and the IPCC, there are some significant similarities between some of the core aspects of the scenarios presented in this report and those presented elsewhere. For example, our 'Restoration' scenario bears some similarities to the Foresight 'Global Sustainability' scenario and elements of the SRES 'B1' scenario and storyline. They represent futures in which more global solutions to environmental, economic and environmental sustainability are pursued and developed, alongside the pursuit of relatively dematerialised forms of economic growth by a more equitable and globally conscious society focussed around sustainable development values and policies. Similarly, our 'Survivor' scenario bears some resemblance to elements of Foresight's 'Local Stewardship' scenario and the 'B2' scenario and storyline presented in the SRES work, in which a greater emphasis on more traditional values and self-reliance plays a key role in shaping social behaviour and related economic activity. However, in each case the scenarios presented in this report give greater emphasis and supporting narrative around the core socio-economic elements of the scenarios and how they relate to potential pressures on the UK environment.

Despite these similarities, the scenarios contained in this report do not attempt to second guess or re-interpret analysis of issues such as climate change that are the subject of more detailed quantitative analysis and modelling in the related scenario sets. For the sake of clarity, the core project team did not question current assumptions surrounding the nature and extent of future climate change over the period to 2030, given that more detailed scenarios have been developed around this subject. For this reason, the project team assumed a reasonably consistent level of climate change across the four scenarios described in this report. However, the scenarios do assume different responses or reactions to the effects of climate change, and different adaptive capacities can be assumed in each case. Equally, they also interpret the current debates about the nature of the scarcity of natural resources, and the likely responses, in very different ways. This latter point is a key determinant of the way the future unfolds in each of the different scenarios.

1.3. Using these scenarios

The scenarios contained in this report reflect very different perspectives on how the future might look in 2030 and the implications this may have for future pressures on the environment. As such they are intended to present a generic framework that can be used by policy makers and stakeholders to discuss the future and explore its implications for future policy. We reflect on learning from this project and others of a

similar nature in the final section of this report, to give some initial guidance on how to interpret these scenarios. This includes guidance on when to use this particular set of scenarios. It also outlines some ways to avoid common errors that can be made by organisations and policy makers when discussing and reviewing scenarios as part of a wider policy or strategy process.

More detailed and practical guidance on how to use the scenarios as part of a wider strategy and policy development process is contained in the accompanying *Futures Toolkit*"[7]. This toolkit, contained in a separate document to accompany the Environment Agency 2030 scenarios, includes suggestions for practical exercises designed to help policy makers use the scenarios. It is intended as a practical set of tools and techniques for policy makers and stakeholders who want to understand how the scenarios should be used to inform their work.

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[7]*Exploring the Future: Guidance toolkit for using scenarios*, A report by Henley Centre Headlight Vision for the Environment Agency, 2006

2. Executive summary

2.1 Introduction to futures thinking and the scenario process

Scenarios help organisations understand and manage the future more effectively. They allow them to explore different views of how the future might play out. They are not based on traditional forecasting methods, which often extrapolate existing trends, but instead are derived from an understanding of how drivers, trends and other factors could combine to produce a series of divergent, robust and internally consistent, plausible future worlds. They are designed to allow organisations and stakeholders to better understand what could emerge and allow them to explore and rehearse, rather than predict, the future.

The Environment Agency and Defra have already used scenarios to feed into strategic thinking and policy development in a number of areas and were keen to develop a set of scenarios for 2030 specific to the wider environmental policy needs of the Environment Agency and its partners. This report outlines the process followed, and presents the final scenarios together with additional background information and analysis.

The project process followed was highly participative and designed around a series of key workshops that allowed a wide range of stakeholders to collaborate and co-create a final output jointly with the combined Henley Centre Headlight Vision–University of Surrey–Environment Agency project team. There were four broad stages to the project:

- *Drivers analysis and prioritisation:* Review of existing research material, reports and other scenario sets to identify and analyse key drivers of change;

- *Scenario development and exploration:* Prioritised drivers are analysed and clustered to develop two key 'axes of uncertainty' that form the basis of the scenarios;

- *Implications:* Further detail in the scenario narratives is added together with an initial indicative assessment of impact on key pressures on the environment;

- *Project follow-up:* To ensure ongoing use of the scenarios after completion of the project, a Guidance Toolkit was developed. This provides resources to help policy makers and stakeholders to use the scenarios to inform the future development of strategy and policy.

2.2 Description of the scenarios

The scenario space is defined by the juxtaposition of two 'axes of uncertainty' derived by clustering a series of prioritised drivers (outlined in more detail below) into key opposing dimensions.

One axis focuses on UK societal attitudes and behaviour around consumption. At one extreme of the axis, consumption patterns are constrained with a focus on well-being

and sustainability. At the opposite extreme, individuals exist in an intensified materialistic 'desire economy' in which the possession of goods and experiences outweighs any concerns around wider or longer term impact or sustainability concerns.

The second axis refers to UK governance systems. At one extreme, governance systems and decision making focus on longer term sustainability concerns, such as global warming and resource depletion. At the opposite end, governance is directed towards short term socio-economic concerns, such as short-term international competitiveness and continued economic growth.

The schematic below outlines the main parameters of the scenarios.
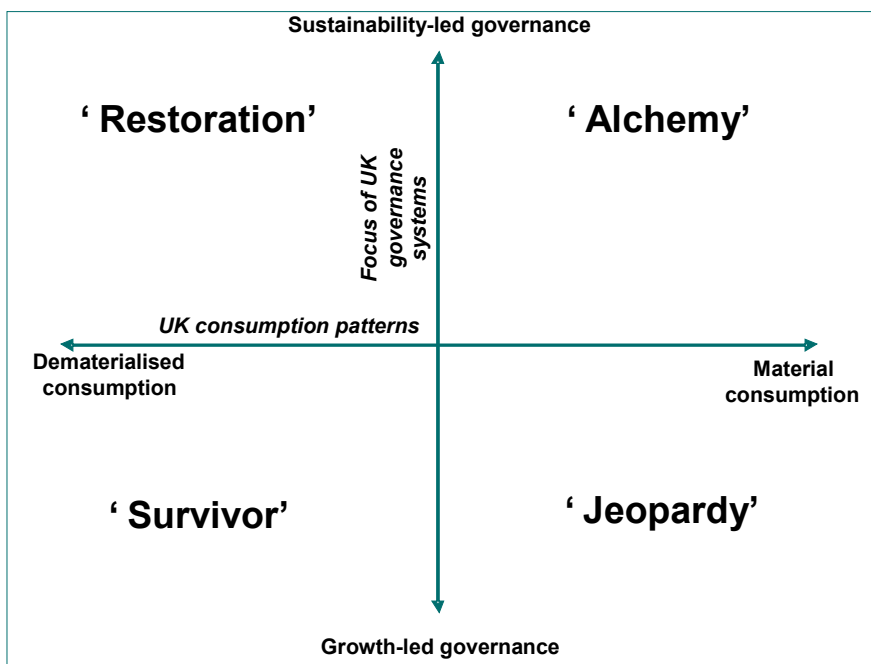
Short summaries of the scenarios follow with further detail provided in the full report. Importantly, we have assumed that a similar rate of climate change applies across all of the scenarios. Each of the scenarios expresses different responses to climate 'events' and the way in which society in that 'world' engages with those kind of issues.

'Restoration' (sustainability-led governance, dematerialised UK consumption)

A scenario in which there is a heightened concern at a macro-economic and political level about the environment. Societal values and behaviour are oriented more towards sustainable development goals as a result of greater awareness and perception of environmental risk. There is also stronger global political leadership in relation to environmental issues. More investment is made to develop and renew key infrastructure, including renewable sources of energy, and there is a shift towards materials recovery, repair and re-use of goods and some de-centralisation of business.

'Alchemy (sustainability-led governance, material consumption)

A scenario in which aggressive technology-update programmes and a new regulatory environment act as a spur to innovation in new technologies and an information and communications technology (ICT) knowledge-intensive UK economy in response to global competition. New clean technologies and efficient production processes, driven by new standards of producer responsibility, drive stable economic growth, despite earlier concerns about the long-term stability of energy supplies. Most individuals are able to enjoy a good standard of living and have few concerns about the global environment, believing that technology can minimise the impact of their increasing consumption of goods and services.

'Survivor' (growth-led governance, dematerialised consumption)

A scenario in which the UK, like many other countries across the globe, is recovering from an earlier economic collapse, partially linked to rises in the price of energy and other key resources, with consumer spending in relative decline as people become more frugal and self-reliant. Manufacturing processes are forced to become less resource intensive by economic pressures, and there is a resurgence in more traditional regional and local cultures and values.

'Jeopardy' (growth-led governance, material consumption)

A scenario in which a more intensive and materialist 'consumption culture' pervades across much of the UK (and the world), accompanied by a rise in social fragmentation. A deregulated environment provides added stimulus to innovation and economic growth and there is little societal interest in sustainability concerns. Investment to increase capacity among oil-producing countries results in a continuing reliance on non-renewable forms of energy, with little concern to ensure equitable supply to all, and many people assuming that supplies of key resources will remain plentiful for some time to come

2.3 Key observations

- The scenarios reflect the possible development paths for socio-economic structures and values already present in some way in UK society today. Across the scenarios, different aspects are amplified or become critical driving factors depending on the extent to which environmental risks have been recognised and the manner in which these risks are managed.

- In 'Restoration', the interaction of shared fears among individuals in local, national and international communities serves to create a global consciousness around environmental concerns. This facilitates the introduction of new forms of regulation and a shift to post-materialist consumption.

- In 'Alchemy', recognition of the ecological challenge is met by a strong drive towards supply-side change based on an assumption that technology innovation and implementation will overcome key pressures and problems.

- 'Jeopardy' reflects an exaggerated version of the short-termist tendencies that can be found today and investment in new infrastructure is seen as less than critical.

- 'Survivor' is the sole scenario in which socio-economic systems are severely disrupted because environmental pressures have not been managed but run out of control.

- There are various points of convergence between these scenarios and other existing sets. In all, the analytical framework tends to be defined, on the one hand, by approaches to governance and, on the other, responses to attitudes towards models of consumption. This allows us to explore the implications of different paths of development, but care must be taken to ensure none appears preferential to others.

- It is important to remember the scenarios are not predictions; in reality, the future we see in 2030 is likely to contain some elements of all four scenarios.

- Though this may have been driven in part by the topicality of this issue, a key concern that dominated thinking throughout the project and the final output is the potential constraint in resources. It is important to recognise that resource constraints are not universal, as many commodities are not in short supply now and will not be in the near future. However, it is clear easy access to affordable energy resources will be a significant future challenge, which is reflected in the scenario narratives.

- Similarly, carrying out early investment in the necessary infrastructure may help to reduce such future pressures on the society and the economy, in association with changes in behaviour, but will require significant commitment, common focus and, no doubt, further reviews and assessments.

3. Introduction to scenarios and futures thinking

Scenarios are intended to help people imagine, understand and manage the future more effectively. They are not intended to be definitive forecasts of what *will* happen, but are alternative views of what *could* happen if certain trends and other drivers of future change – many of which are observable today – play out in different ways over the long term.

3.1 What are scenarios?

Many organisations are good at spotting the key trends and drivers that affect their current business. Scenario development looks at how these drivers, trends and other factors can combine to produce a number of robust divergent and internally consistent, alternative plausible future scenarios. Traditional forecasting methods often extrapolate existing trends to form forecasts of the future that attempt to predict what will happen. Other scenario methods look to create best-, mid- and worst-case scenarios. The scenario development methodology that Henley Centre Headlight Vision used in this work for the Environment Agency adopted a slightly different approach, based on the fact that it is impossible to predict the future accurately; not all of the variables are known or can be accurately quantified. Scenarios therefore attempt to understand what might emerge, to allow organisations to explore and rehearse, rather than predict, the future.

The result of the process, presented in this report, is a set of stories or narratives about the evolving dynamics of the future that could result from different combinations of drivers, trends and key events.

3.2 Scenario development methodology

The approach used was based on defined best practice in this area, in line with the Cabinet Office report, *Understanding Best Practice in Strategic Futures*, which is available online[8].

Firstly, a broad range of change drivers (factors which could shape the future environment) were assembled, including trends which are highly visible now and others which are less so. These were then prioritised and analysed further to enable the identification and exploration of key areas of uncertainty that could result from different combinations of these change drivers. These critical uncertainties were then used to develop a series of divergent, robust (internally consistent), and plausible scenarios that explore the evolving dynamics of the future and what these may mean in terms of future pressures on the UK environment.

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[8] See: http://www.strategy.gov.uk/downloads/files/understanding.pdf

Science project: SC050002

Stakeholders were involved from the first stage of the process –identifying, assessing and reviewing the drivers of change – through to the development of the scenarios and accompanying indicators.

The methodology assumes that the four scenarios that emerge are equally probable and likely and should be treated on that basis. The scenarios, although very diverse in their nature, are not designed to be mutually exclusive. The 'real' future that emerges in 2030 could contain some elements of all four scenarios presented in this report. Similarly, the scenarios were not designed, and should not be treated as, 'worst', 'best' or 'mid-point' scenarios, but instead should be seen as a diverse set of 'possible' futures, establishing a boundary space and robust framework in which to think about the future.

3.3 Using scenarios

The purpose is not to choose one of the scenarios as a future vision (bearing in mind they are intended to represent fairly extreme possibilities), but to use them to help shape and develop future strategies and policies that move towards a realistic and desirable view of a 'preferred' future vision. Strategies and visions linked to a clear sense of trends, drivers and future scenarios make an organisation better able to shape the future they prefer and to seek out 'no regrets' policies, whatever the outcome.

By exploring the future uncertainties and effectively 'rehearsing' the future, an organisation should better understand how things could change, and in doing so be better prepared to deal with these changes. The nature of scenarios is that they will contain certain drivers and trends that are outside the direct or indirect control of any one organisation. Some people often wrongly conclude that, because of this, it is futile to look at the future. However, this ignores that by understanding future possibilities, organisations are better able to manage the risks and seize the opportunities that can help to shape a preferred or desired future by influencing some of the drivers and outcomes that are identified.

The scenarios (and accompanying indicators) contained in this report can be used to evaluate policy options, refresh visions and identify strategic priorities, objectives and success criteria for the future. They can also be used to assess the potential effectiveness, strengths and weaknesses of different policy instruments, recommendations and other decisions that are 'on the table'. A *Guidance Toolkit*, which provides information on processes and practical exercises to help with using the scenarios for these different purposes, accompanies this report.

Discussion of the scenarios should enable a strategic conversation for organisations, their stakeholders and delivery partners to start thinking seriously and practically about what might lie ahead, to explore the multiple futures that they might be faced with and to apply the shared understanding and learning that results into future strategy. By exploring the future in this way, organisations should be able to see the consequences of making decisions that face them today.

4. Overview of the scenario planning process

4.1 Scenario Development at the Environment Agency

Crafting strategy that is sufficiently flexible to respond to uncertain future challenges and therefore generate better outcomes for the environment is recognised by the Board as a high priority for the Environment Agency.

The Environment Agency appreciates a range of techniques exist for thinking about the future, but decided that scenarios would be the most appropriate tool for its needs. It values the fact that scenarios can provide a robust, risk-based framework for thinking about the future, and therefore provide an alternative to flawed 'predict and provide' methods. Water Resources applied the 2001 Foresight Environmental Futures Scenarios[9] to inform the Water Resources Strategy, which was very successful.

The scenarios were used to derive plausible forecasts of future demand for water. While the approach was useful, the scenarios themselves were hard to interpret as they lacked detail on environmental policy indicators and implications. The Flood Risk team faced similar challenges when working on the Future Flooding report with OST.

With demand from Director level, the Environment Agency thus decided to apply some critical thinking to the scenarios approach, taking into account the Foresight scenario set among others (see Section 12 for further detail), to see how a new set of scenarios, more relevant to its specific business needs, could provide consistency across Environment Agency policy development. This should support the development of strategies that are 'future-proof', in other words robust and sufficiently flexible to cope with a variety of different outcomes.

The primary adopters of this work were identified early on as Water Resources and Waste Strategy so, although emphasis was placed on creating a generic set of scenarios applicable to all areas, particular attention was given to these, as reflected to a degree in the composition of the Project Board.

4.2 Overview of the project process

Throughout the project, the Henley Centre Headlight Vision worked in collaboration with specialist partners. From the University of Surrey's Centre for Environmental Strategy, the project team included Professor Roland Clift, Dr Walter Wehrmeyer and Dr Jonathan Chenoweth. In addition, we worked with Ian Christie (associate of Green Alliance and NEF, joint Head of Sustainability at Surrey County Council).

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[9]*Environmental Futures*, revised and updated as *Foresight Futures 2020, updated scenarios and guidance*' DTI Office of Science and Technology, 1999, 2002

We worked closely with Alison Richards, the Environment Agency Project Manager, throughout the process. A Project Board of key stakeholders from the Environment Agency and Defra was involved in signing off key deliverables and outputs and actively took part at key stages of the project process, adding real value to the scenario development.

There are a number of different approaches to the development of scenarios, but the most robust, and most widely used, is a drivers-based approach, which was followed here. Workshops also formed a key component of the project methodology. These ensured that a wide range of stakeholders were engaged in the process of developing and validating outputs at each stage of the process.

The project focussed around a key project question that framed and directed our thinking through out the process: '*Given the scale and diversity of social, economic, technological and other change over the next 25 years, what is the range of plausible futures for the pressures on the UK environment between now and 2030?*"

Broadly, the process consists of a number of sequential steps as highlighted in *Figure 4.1* and below.

An iterative process

Approx 45-50 drivers identified → Key drivers prioritised and tested → Axes → Scenarios developed and tested → Implications → Strategy & Policy

Drivers Workshop

Scenario Workshop

Indicators Workshop

Waste & water Workshops
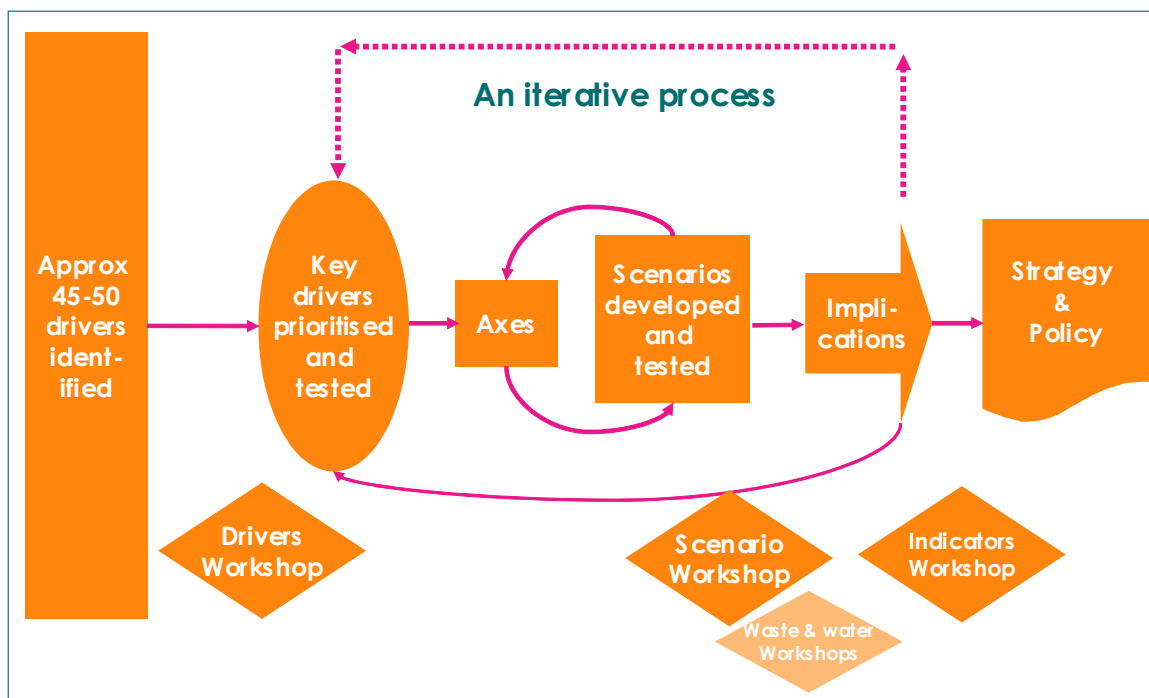
Figure 4.1. Scenario development process.

- *Drivers analysis and prioritisation:* Around 50 drivers were identified through a review of existing scenario sets, other research material and a series of executive interviews with key internal and external stakeholders. A drivers workshop allowed over 30 participants to collaborate and prioritise the drivers.

- *Scenario development and exploration:* The priority drivers were analysed and clustered to develop two key axes, which formed the basis of the scenarios. A first workshop explored, tested and further developed the initial outline scenarios. This was followed by a second workshop that further reviewed the scenarios and

validated a series of key indicators used to define and differentiate the scenarios. The results of the discussion in this final workshop were then synthesised and summarised as a set of indicators, which are both embedded in the scenarios and attached as an appendix to this report.

- *Implications:* An additional workshop allowed participants to test the scenarios for strategic implications, focussed primarily on understanding the potential issues for water and waste management and used to inform reviews of the Environment Agency's Water Resources Strategy[10] and the Defra Waste Strategy[11] for England.

- *Project follow-up:* Part of the project purpose was to ensure all the potential stakeholders would have access to resources and materials to use in future decision-making and policy development after completion of the project. These form part of the deliverables included in the accompanying Guidance Toolkit.

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[10]The existing strategy, currently under review, is *Water Resources for the Future: a strategy for England and Wales*, published by the Environment Agency in 2001.

[11]Defra's Waste Strategy Review led to the publication of *Consultation Document on the Review of England's Waste Strategy*, which can be found online at www.defra.gov.uk/environment/waste/strategy/review/index.htm

5. Description of key drivers

5.1 Overview of driver development

The scenarios process began by formulating an evidence base through an initial phase of scanning and review of existing material. This review included extensive desk research, a review of the internal Henley Centre Headlight Vision knowledge and that available to other members of the project team, a review of the Defra Horizon Scanning database and interviews with a wide range of experts and key stakeholders, including Environment Agency Board members, specialists from within the Environment Agency and Defra, and a wide range of key stakeholders from within and outside government. This wide-ranging and intensive research process enabled us to identify a list of 'drivers' of change that represented a range of factors and variables likely to impact on the range and extent of future pressures on the UK environment between now and 2030.

For the purposes of this project, a *driver* was defined as *a key factor, force, trend or issue that could significantly influence the pressures on the environment in 2030*. The project's initial research, therefore, looked for such 'drivers' of future change across the so-called 'STEEP' categories (social, technological, economic, environmental and political). We also looked for changes at the macro-, meso- and micro-layers of change, which ranged from micro-changes in citizen and consumer attitudes and behaviour at one end of the spectrum to macro-shifts in socio-economic and technological trends. In doing so we also considered possible counter trends and drivers, including potential responses to some of the drivers (for example, from society or government), which might create new potential drivers of change.

When developing scenarios it is important to ensure that the list includes drivers and issues over which the client organisation (in this case the Environment Agency) and its partners have little or no control, as well as those that they can influence to some degree.

The initial long list of over 50 drivers developed for this project is contained in Section 14.1.

A drivers workshop allowed a range of participants to discuss the drivers and collaborate to prioritise a key set of drivers from the 50 or so that were presented for discussion. In doing so, this workshop identified a shortlist of 19 drivers that participants felt would have the most significant impact on the nature of pressures on the UK environment between now and 2030. These drivers are described briefly in Section 5.2 as a summary of the key drivers prioritised through this initial phase of the project.

5.2 Prioritised drivers

Rise in global population

The global population is expected to reach nine billion by mid-century, with the population of England and Wales growing by about 5 per cent over the next 20 years (*Figure 5.1*).
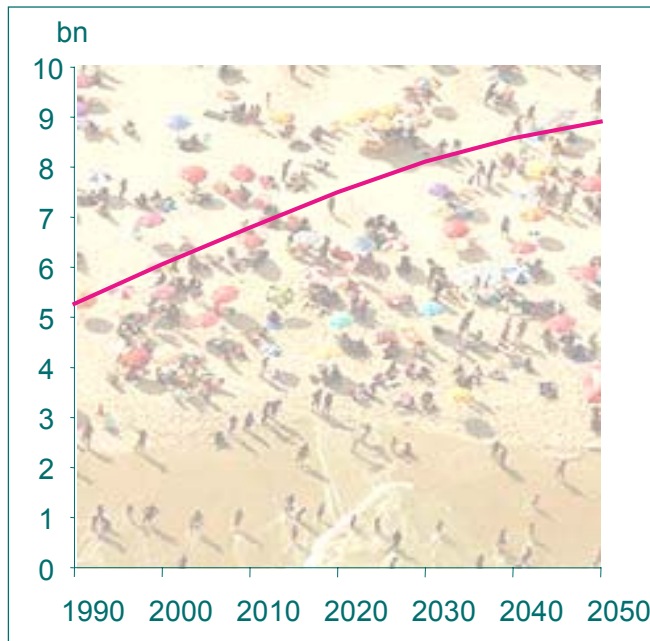
Figure 5.1. Projected world population. Source: UN Population Division statistics, 2004.

A significant impact of this will be a rising demand for natural resources. Moreover, increased populations have the potential to exceed the carrying capacity and resilience of ecosystems, which leads to degradation of the environment.

Globalisation

There are two important elements to this driver. In the first instance, it refers to increasingly global supply chains and the rapid growth in world trade; there has been an average growth of 5.5 per cent per annum between 1983 and 2003[12]. The globalisation of trade has helped China, India and Brazil grow economically, affording them increasing power and influence in the future. There is an additional impact on the global environment as these markets develop and become important consumers in their own right; consumption of global resources in China rose by 15 per cent in 2004 and is forecast to jump by an additional 9 per cent in 2005[13]. China is likely to be a major source of tourists in coming decades.

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[12]*Consensus Forecasts*, 2005.

[13]*China Statistical Yearbook*, 2004.

The second instance refers to the more intangible aspect of globalisation: the increased global circulation and harmonisation of socio-political ideas, attitudes and behaviour, born out of faster and less formal communication, increased short- and long-term migration (*Figure 5.2*) and greater opportunities for travel.
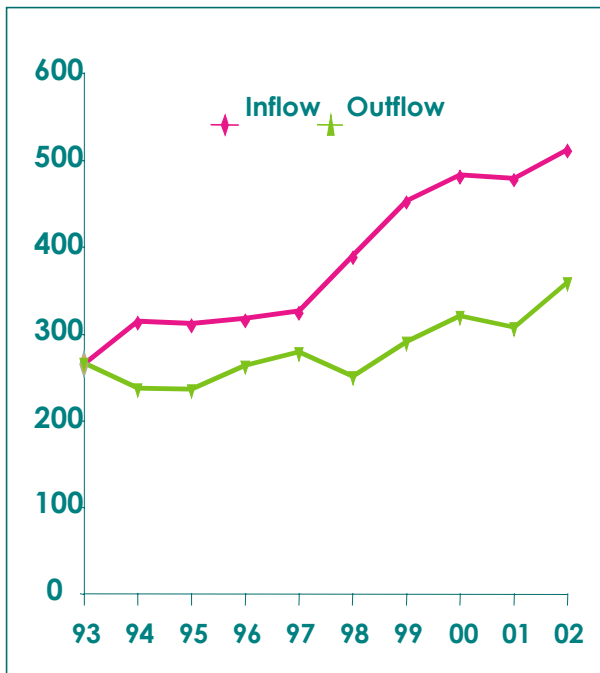
Figure 5.2. Migration to and from the UK (thousands). Source: *ONS Population and Migration*, 1993-2003.

Opportunities for the exchange of ideas and values may also lead to a significant confrontation of different assumptions about lifestyles and attitudes, including the environment.

Uncertain future of international governance

International and multilateral agreements are increasingly important to deal with a wide range of issues. However, successful co-operation at this level is patchy. The United Nations (UN) has come under increasing criticism over the past decade. The Kyoto Protocol is a vivid reflection of the conflict between international action and national concerns on environmental issues and, while the 2005 G8 summit at Gleneagles made some progress on the rhetoric of cutting poverty, little was done in terms of climate change.

Furthermore, with the growing importance of developing economies, the role and level of influence held by the USA may change. This may, in turn, impact on that country's willingness to stand alone on environmental issues and the approach it has to engaging with international agreements.

Future of Europe

The European Union (EU) has been responsible for a significant proportion of the growth in environmental legislation in recent years. However, how far this will continue in the future is unclear given recent developments. In May 2004, the EU expanded eastwards to cover 25 states and include 455 million people with the opportunity of further expansion with the admittance of neighbouring countries, including Turkey. At the same time, public rejection of the EU constitution in France and the Netherlands has halted, in the short term, deeper and still wider integration.

These uncertainties that surround the future of Europe prompt important questions for the future of environmental legislation: will there still be the same environmental drive and focus in such an uncertain Europe? And will new countries, most of whom have fewer safeguards in place, be as keen on accepting environmental legislation?

Changing nature of environmental legislation

There has been a gradual move away from traditional regulation, which focuses on production and penalties, towards regulation of consumption and behaviour using market tools, such as pricing incentives and taxation. It is recognised that regulation and legalisation need to become increasingly subtle and sophisticated to deal with the challenges of influencing and changing individual consumer behaviour and the complexity of global modern manufacturing processes. Examples of recent initiatives include congestion-charging schemes in London and taxes on disposable plastic bags in Ireland.

A key trend is the shift away from the site-based regulation of industries according to the 'command and control' model to the regulation of products and the way in which they come about and are being used and/or disposed of. Life-cycle based regulation, which takes better into account the whole value chain, is gaining popularity.

Increasing consumer environmental awareness

At all levels, there is increased awareness and exposure to environmental issues, from special supplements in magazines to dedicated sections in the national school curriculum. Connected to this is a greater public feeling of responsibility: 79 per cent of the UK population believe that human beings are primarily responsible for climate change[14].

As *Figure 5.3* shows, consumers claim to be concerned about a range of environmental issues.

[14]*Observer*/ICM poll, June 2005.
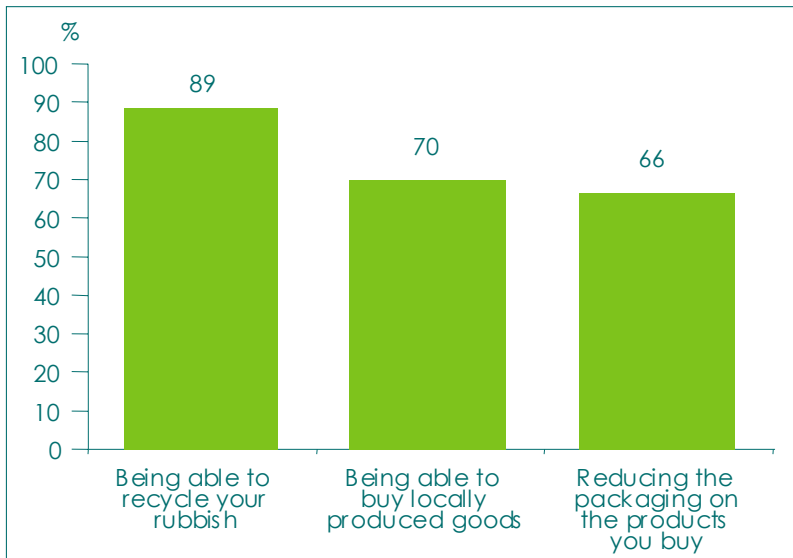
Figure 5.3. Percentage response to 'Which of the following are important to you personally?'. Source: Henley Centre Planning for Consumer Change, 2004.

Yet despite this, there is a gap between values and action: four in five UK consumers feel reasonably informed about what they could personally do to do be environmentally friendly, but only one in 15 regularly undertake environmentally friendly behaviours[15].

Role of self-interest in responding to environmental change

Despite growing awareness of environmental problems, consumers are likely to change their behaviour only when an issue or event affects them personally or when the change is easy to effect.

Concentrating on the individual rather than wider society is a stance that can be discerned in the rise of single-issue politics and the 'not-in-my-back-yard' (NIMBY' mentality. For example, people will campaign against plans to build wind farms near their homes as they feel it may reduce their house prices and alter the landscape they are familiar with. The perceived adverse impact for the self outweighs any consideration of the potential positive impact on society and the environment.

This self-interested attitude is also present in everyday behaviour. While a majority of people may believe making fewer journeys by car would make a big difference to the environment, a significantly lower number actually appear to use their car less all or most of the time to protect the environment. Consumers often only act more responsibly when there is an easy option that requires no extra time or effort, such as switching to unleaded petrol.

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[15]Brook Lyndhurst, *Bad Habits & Hard Choices: In search of sustainable lifestyles*, 2004.

Consumption culture

For the majority of UK consumers, the long-term consequences of consumption behaviour are not a major cause for concern. Attitudes to energy consumption and waste, just like those to personal savings, are focussed on the short term. For example, four in ten people are happy to have short-term debt to buy themselves the things they want[16].

This attitude extends to consumers' attitude towards energy resources. Energy consumption is on the rise, with the total electricity consumption by domestic household appliances having doubled over the past 30 years[17]. Individuals struggle to make the connection between their own personal consumption and the environment. It is still a minority (albeit a significant minority) that alter their everyday behaviour in the interests of reducing energy consumption; just one in ten consumers agree 'they use their car less to protect the environment' all of the time[18].

Rise of personal mobility

There has been a marked rise in personal transport demand in the UK. The first indication of this is an increasing reliance on the car; in 1987, 24% of UK households had two or more cars, rising to 38% in 2004[19]. In part this is because the cost of public transport has risen much faster than the cost of private car use.

The second indication of this driver is the expected increase in demand for international travel, facilitated by the rise of low cost air travel. This is currently expected to continue; the Government predicts a rise in British aircraft passengers from 180 million to 476 million over the next 25 years[20].

Lifestyle attitudes indicate that consumers continue to expect current levels of mobility and resent the prospect of curbs on that freedom, as is conveyed by the above driver relating to the role of self-interest in responding to environmental change.

Increased focus on well-being

There is an increasing emphasis on well-being and quality of life. People are making a more conscious effort to consider their well-being: in 2004 19% of the UK population agreed that they have successfully changed how happy they are in themselves and/or their spiritual well-being, and 7% agreed that they had tried but failed[21].

There is also a growing recognition that money and profit are not the primary sources of happiness. Over 80% of consumers consider family, friends and personal education

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[16]Henley Centre, PCC, 2004.

[17]Environmental Change Institute.

[18]Brook Lyndhurst, *Bad Habits & Hard Choices: In search of sustainable lifestyles*, 2004.

[19]BMRB TGI 1987-2004.

[20]Select Committee on Environmental Audit, 10 March 2004.

[21]Henley Centre, PCC, 2004.

and knowledge to be an important source of pride, compared with just 57% for wealth[22]. This finding is reinforced by the Cabinet Office Strategy Unit's research on life satisfaction, which showed that, beyond a certain level, there is no correlation between wealth and happiness[23].

A change in the importance of material possessions can be linked with a more pronounced thirst for meaning and spiritual fulfilment. People are becoming increasingly interested in a more natural and/or slow way of life; for example, around half of the entire UK baby food market is now organic, which reflects a broader interest in more 'authentic' produce.

Changing household set-up

The traditional household has undergone significant change in recent decades, with a current trend towards more single-person, multi-person (members who are non-related) households and childless couples. In 2001 single-person households constituted 30 per cent of total households, but this is predicted to increase to 33 per cent in 2011[24].

The change in household set-up has led to a need for more housing and services, as the Urban White Paper and Sustainable Communities Plan's ambitious agenda for new housing indicates[25]. In the UK, development is focused on the South East – an area with already strained resources and facing increased risks of flood damage as the climate changes.

An additional implication of this driver is a potential correlation between the rise in single-person households and more wasteful consumption; appliances are likely to be increasingly used for an individual rather than for a family or household unit and extra packaging is increasingly being used for goods that cater for singles. Family break-up will continue to have impacts on consumption as the increased numbers of households need to be equipped with appliances.

GRIN Technologies

There is a growing recognition of both the existence of and the possibilities to exploit each the following technologies:

- genomics;
- robotics;
- informatics;
- nanotechnology.

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[22]Henley Centre, HenleyWorld, 2003.

[23]Strategy Unit, UK Cabinet Office, *Life Satisfaction: The state of knowledge and implications for Government*, 2002.

[24]ONS, Census 2001.

[25]ODPM, *Sustainable Communities, Building for the Future*, 2003.

There is the potential for exponential change through the combination of these four emergent technologies, with nanotechnology already being utilised to achieve greater accuracy in pollution monitoring. However, it is important to note the uncertainty around their longer term impact or the way in which their use can be controlled – with some saying, "Nanotechnology – no one really knows enough about its impact. Could this be another asbestos?"[26]

Developing and implementing environmental technologies

There is growing interest in understanding the mechanisms and instruments that can be used to encourage a shift towards implementing new technologies designed to assist in reducing the environmental impact of production, consumption, waste processing and energy generation.

Many technologies that help to address environmental problems already exist, such as energy derived from wind, wave, fuel cell technology and combined heat and power (CHP). However, to access the benefits of the technologies requires significant investment to counterbalance the existing infrastructure assets in energy and transport. As well as financial investment, take-up of new technologies will depend on political and social will and interest.

Increasing pressure on public spending

There is continued financial pressure on the Government, with public expenditure increasing year on year and increasing demand for a wider range of services and a growing sense of 'entitlement' (*Figure 5.4*).

This pressure is intensified by the consensus view among politicians that top statutory income tax should remain at around 40% – much lower than in the rest of Western Europe (especially Sweden and Finland). As a consequence, despite recognition of the importance of the environment, the amount of funds allocated to this issue is limited and small relative to increases in other areas. Environmental care may now be taken into account by the Treasury for the first time through the recent Comprehensive Spending Review, but it is still debatable whether environmental issues receive greater Government attention.

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[26]Henley Centre Headlight Vision executive interviews 2005.
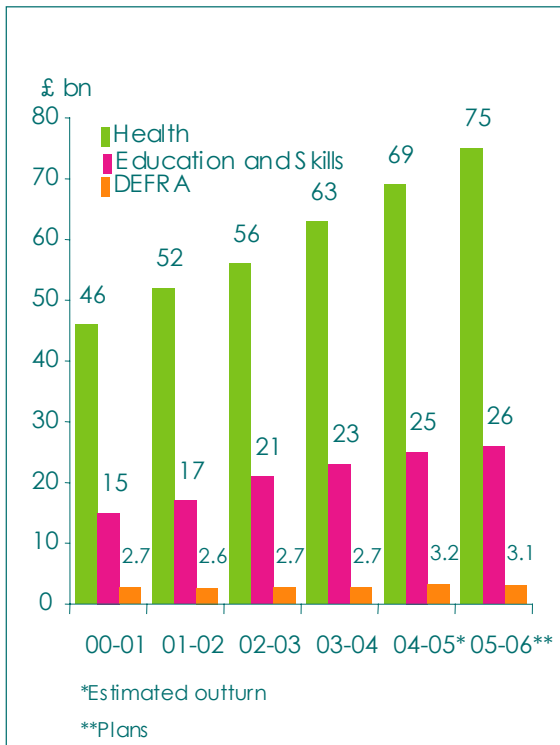
Figure 5.4. Resource Budgets 2000/01 to 2005/06. Source: HM Treasury, Public Expenditure, Statistical Analyses, PESA April, 2005.

Increasingly stressed infrastructure

Under investment in capital assets, ageing infrastructure and lower levels of maintenance after the privatisation of utilities is increasing the stress on infrastructure systems, such as those for transport and water.

This appears to have a number of wide-ranging impacts. For instance, this trend is linked to increases in insurance premiums, with the potential removal of insurance from houses at risk of flooding (this is already a threat in the Thames Gateway).

The current infrastructure is poorly equipped to tackle any extreme weather impacts and other potential future environmental problems.

Changing patterns of land use and food production

Over the past 15 years changes in land use have including increased specialisation within farms and regions, as well as changes in crop and stock holding.

Recent Common Agricultural Policy (CAP) reform may provide a renewed focus on a more sustainable basis for agriculture, notably through, for example, increased decoupling of subsidies from production and increases in agri-environment schemes.

Despite current trends of declining agricultural production in the UK, some stakeholders suggest there could be increasing competition over land use in future,

with a potential growth in non-food crops (particularly energy crops) and urban areas competing for land[27].

While food production and consumption have become highly internationalised over the past generation, domestic food production is slowly moving away from production-related subsidy and towards diversification, often away from food crops. Both these developments depend on cheap energy and the large-scale production of low cost food overseas for export.

This could change as fossil fuel constraints increase, thus driving up production and transport costs, and as climate change affects growing conditions and crop suitability in many parts of the world. As a result, some people claim there could well be a return to more production for local consumption in some areas, whether as a planned policy or as a result of economic and social dislocation caused by severe climate change impacts. Food production and consumption will also need to adapt to shifts in growing seasons and crop suitability as weather patterns and land character change, and to new patterns of production (including loss of productive capacity) in overseas markets[28].

Climate change and social response

In the face of overwhelming evidence and consensus among scientists, there is a growing political and public acceptance that human-induced climate change is a reality.

The area covered by sea ice in the Arctic has shrunk for a fourth consecutive year (*Figure 5.5*) and the IPCC suggests the global average temperature could, on present trends, be between 1.4 and 5.8°C warmer in 2100[29]. Recent evidence of climate shifts and impacts in the Arctic and elsewhere suggests that warming is proceeding more rapidly than expected, and there is now widespread concern that important ecological thresholds or 'tipping points' might be approaching, if they have not already been crossed.

The regional and local impacts of climate changes are more complex and even harder to predict than are long term changes to the global climate. A key uncertainty is the nature of the responses from societies, businesses and governments around the world to these changes, particularly as the rate of change is likely to be much greater than anything we and our ecosystems have experienced. While research suggests that some species will be able to adapt by changing their distribution[30], the pace of change may be faster than many species and ecosystems are able to adapt to.

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[27]Henley Centre Headlight Vision executive interviews, 2005.

[28]Henley Centre Headlight Vision executive interview, 2005.

[29]IPCC 1999.

[30]Berry, P.M., Dawson, T.P., Harrison, P.A. and Pearson, R.G. 2002. Modelling potential impacts of climate change on the bioclimatic envelope of species in Britain and Ireland. *Global Ecology and Biogeography* **12** 453-462.
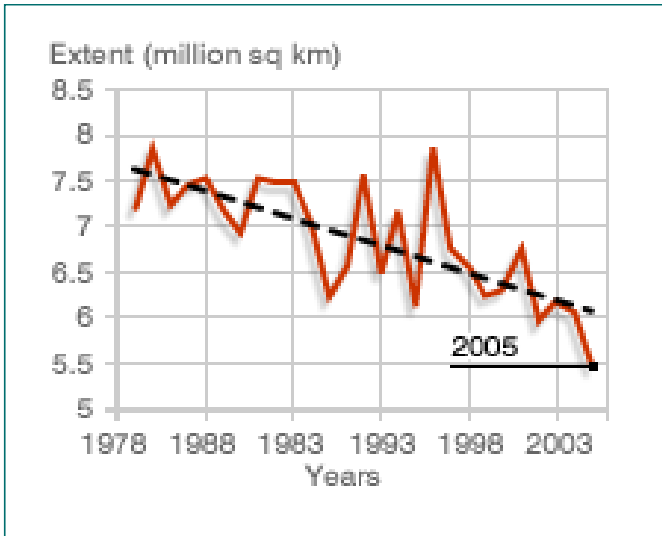
Figure 5.5. Arctic sea extent, 1978-2000. Source: National Snow and Ice Data Center (NSIDC).

Climate change will have a number of impacts on the UK environment. A key concern is the possibility of rising sea levels and increased risks of flooding. Climate change could see the number of people in the UK at 'high risk' of flooding rise from 1.5 million up to 3.5 million by 2080[31].

Changes in temperature will also impact the rural environment with the potential for changes, for instance, in crops patterns, migration behaviour for birds and a wide range of flora and fauna[32].

Resource-constrained growth

Availability of and access to key resources is an increasing concern, to be seen alongside the capacity of the biosphere to accommodate wastes and emissions. No new major oil fields have been found since 1976. Combined with the increased energy demand from rapidly developing economies, such as China, this has pushed up primary energy prices. Some commentators have suggested that peak oil production will be passed within the next few years. However, there are extensive non-conventional hydrocarbon resources – examples include oil sands in Alberta and 'heavy' deposits in Venezuela – where exploitation is not just economic, but profitable at current and foreseeable energy prices. Rather than running out of hydrocarbons, the likely future is therefore one of continuing high prices (*Figure 5.6*). It is possible to argue that climate change and the difficulty of carbon capture and storage rather than resource availability is likely to constrain the use of carbon-based fuels.

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[31]Environment Agency, *State of the Environment*, 2005.

[32] Berry, P.M., Dawson, T.P., Harrison, P.A. and Pearson, R.G. 2002. Modelling potential impacts of climate change on the bioclimatic envelope of species in Britain and Ireland. *Global Ecology and Biogeography* **12** 453-462.

Much the same applies to other non-renewable resources such as metals. However, the class of metals know as 'relatively scarce' (that is, the precious metals, significantly including the platinum group metals), which are only available in geographically localised deposits, could become constrained rather than just expensive.
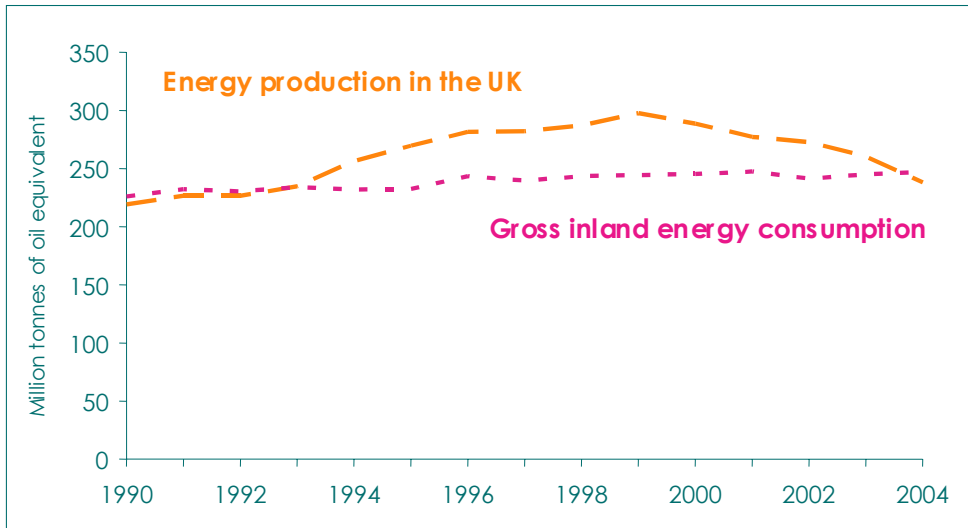
Figure 5.6. UK indigenous oil production and gross inland energy consumption. Source: DTI, Sustainable development indicators, ONS, 1990-2004.

While there has been an increased focus on renewables, this has had limited success. The UK Government plan to source 10 per cent of electricity from renewables by 2010, but in 2003 renewable sources represented just 2.7 per cent[33].

Alongside increasingly expensive energy supplies, water may become a critical issue. Recent studies[34] have highlighted the growing issue of global water scarcity; with competition for limited resources and many countries approaching the limit of their easily exploitable water resources the need for demand management is paramount. In the UK, water resources are already over-exploited in parts of the South East and East Anglia where significant development is planned.

Controls on waste are becoming increasingly pervasive and there is a growing focus on sustainable consumption and resource efficiency. In a growing number of industries, manufacturers are required to take increasing responsibility for their goods across the value chain. This includes 'end of use' disposal of their goods, in accordance with directives such as those governing Waste Electronic and Electric Equipment (WEEE) or the End of Life Vehicles (ELV) directives on ensuring an acceptable environmental

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[33]Defra, *Climate Change: the UK Programme* (2000).

[34]Arnell, N.W. 2004. Climate change and global water resources: SRES emissions and socio-economic scenarios. *Global Environmental Change*, **14**, 31-52; Milly, P.C.D., Dunne, K.A. and Vecchia, A.V. 2005. Global pattern of trends in streamflow and water availability in a changing climate. *Nature*, **438**, 347-350.

Science project: SC050002

or social profile of materials, according to the Registration, Evaluation and Authorisation of Chemicals Directive (REACH) (*Figure 5.7*).
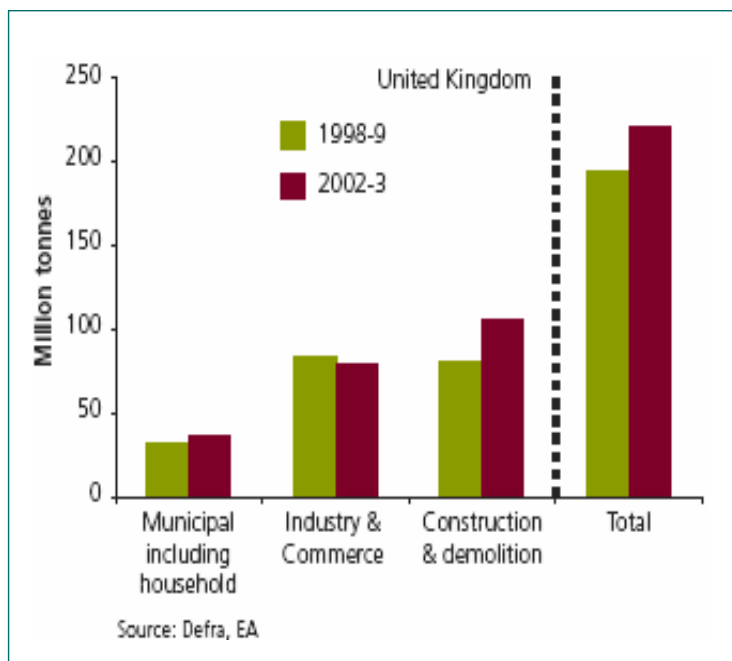
Figure 5.7. Waste arisings by sector, 1998/9-2002/3. Source: Defra, Environment Agency, ODPM, Sustainable development indicators, ONS, 1998-2003.

Increasing scientific understanding of systems that underpin ecological change

Recently, there has been a shift in approaches to developing scientific understanding in the area of environmental change. Twenty-five years ago there was little detailed understanding of the links between social and environmental systems. Defra now spends £15.6 million on Hadley Centre research to analyse both past and projected trends in our climate system and improve our understanding of the social causes and effects. The Economic and Social Research Council has run a major multi-centre programme on Global Environmental Change, investigating the linkages between social systems and environmental change; Defra is supporting research into sustainable consumption and behavioural change. One further example of continuing work in the field is the programme directed by the Natural Environment Research Council (NERC), Quantifying and Understanding the Earth System (QUEST).

A relatively new area for ecological research to support public policy is the disruption of and change to the nitrogen cycle. An example of the increasingly globalised nature of such research is the new EU initiative NitroEurope, a 5-year programme of study that involves India and China as well as 17 EU states, in work on links between the nitrogen and carbon cycles. In addition, the EU Eurolimpacs Project addresses issues that surround climate and the EU Water Framework Directive.

6. Scenario development and testing

6.1 Driver analysis

Following the initial prioritisation exercise carried out in the initial workshop with stakeholders, a further analysis was carried out on the prioritised drivers. This further analysis was undertaken to assess the importance and level of uncertainty of each driver in relation to their overall impacts on the project question (that is, the nature of future pressures on the environment). To identify the level of importance and uncertainty of each of the 19 prioritised drivers, the project team mapped the interdependencies between these drivers.

This interdependency analysis enabled the team to identify, for each driver:

- a dominance score (which represents the level of relative importance of this driver in relation to the nature of future pressures on the environment);

- a dependency score (which represents an assessment of the relative uncertainty that surrounds the impact of a particular driver).

The resulting matrix, shown in *Figure 6.1*, represents the relative importance and uncertainty of the key drivers based on the dominance and dependency scores derived from the analysis above. This analysis allowed us to categorise the drivers into four groups:

- The first group of drivers (in the orange zone, left-hand column) contains those that are *very important, but not that uncertain* (for example, demographic change). These drivers act as a background *context* and are fed as inputs into all the scenarios.

- The second set of drivers (in the pink zone, bottom right) contains those that have *low 'importance' scores, but have relatively high scores for uncertainty*. The outcome of these drivers varies as a result of other drivers that shape the scenarios. They are not key driving forces in terms of future change, but can be considered as outputs or outcomes that may differ in each of the scenarios.

- The third group of drivers (in white, bottom left) consists of those with *low scores for both importance and uncertainty*. This means they are usually not major influences on the overall future, but are still worth keeping in mind.

- The fourth group of drivers (in the red zone, top right) contains those that have fairly *significant levels of importance and uncertainty*. It is these important *and* uncertain drivers that are the key focus of most attention at this stage, as they represent the key uncertainties that could lead to the most divergent views about the future.

The drivers in the top right-hand 'important and uncertain' zone coloured in red on the matrix below were then clustered to help identify a set of key uncertainties that could be used to frame the boundary space of future possibility in which the scenarios were then developed.

High dominance/ importance		**Globalisation**	**Resource constraints** **Climate change and societal response** **Increasing environmental awareness**
Medium dominance/ importance	**GRIN technologies** **Future of Europe** **Rise in global population**	**Uncertain international governance** **Rise of personal mobility** **Increased focus on well-being** **Role of self-interest in responding to environmental change**	**Consumption culture** **Changing nature of environmental legislation** **Developing environmental technologies** **Increasingly stressed infrastructure**
Low dominance/ importance	**Changing household set up** **Increased scientific understanding of environmental systems**	**Increased pressure on public spending** **Changing land-use patterns**	
	Low dependency/ uncertainty	**Medium dependency/ uncertainty**	**High dependency/ uncertainty**

Figure 6.1. Matrix of drivers.

6.2 Axes development

Those drivers that emerged from the above process as both important and uncertain were clustered to identify two 'axes of uncertainty'. These axes capture the critical uncertainties in relation to the major forces that drive future pressures on the environment and thereby help to define the range of possible outcomes to be captured by the scenarios.

One axis focused on *UK societal attitudes and behaviour* around *consumption*. This captured the issues around drivers such as the prevailing consumption culture, increasing environmental awareness, increased focus on well-being, rise of personal mobility and the role of self-interest in responding to environmental change. At one extreme of the axis, consumption patterns are likely to be more constrained with attitudes and behaviour centred on seeking the intangibles of life, such as well-being and being more concerned about sustainability issues. At the opposite extreme, consumption of material goods and services is unconstrained. Individuals exist in a 'desire economy' in which the possession of goods and experiences outweighs any concerns around wider or longer term impact.

The second axis refers to **UK governance systems**. This was intended to capture drivers such as the future of globalisation, uncertain international governance, stressed infrastructure, the changing nature of environmental legislation, the development of environmental technologies, and the nature of responses to climate change and resource constraints. At one extreme, governance systems and decision making primarily focus on longer term sustainability concerns, such as global warming and resource depletion. There is likely to be increased (public and private sector) investment in infrastructure, new technologies and longer term planning to protect

natural resources at the national and international level. At the opposite end of the spectrum, governance focuses on shorter term socio-economic concerns such as international competitiveness and continued economic growth, rather than on longer term sustainability. Likewise, there is likely to be little (public or private sector) investment in new infrastructure or new technologies at a global level.

The scenario axes were then juxtaposed to create a two-by-two schematic that outlines the main parameters of the scenarios. This created four divergent but plausible future scenarios, as highlighted in *Figure 6.2*. These potential futures were explored, tested and developed through an iterative process of stakeholder workshops. The scenarios, along with full supporting narratives, are described in Sections 7-10 below, with additional supporting information on the key indicators and assumptions provided in an appendix.

It is important to highlight that we have assumed that a similar level of climate change (in line with the range of outcomes set out in the latest UK climate change scenarios produced by UKCIP[35]) applies across all of the scenarios. However, each of the scenarios assumes a slightly different nature of response to climate change, in line with the overall concepts contained within the scenarios themselves (for example, depending on the 'perceived' level of threat the public have to climate change, or the level of investment in flood prevention measures).
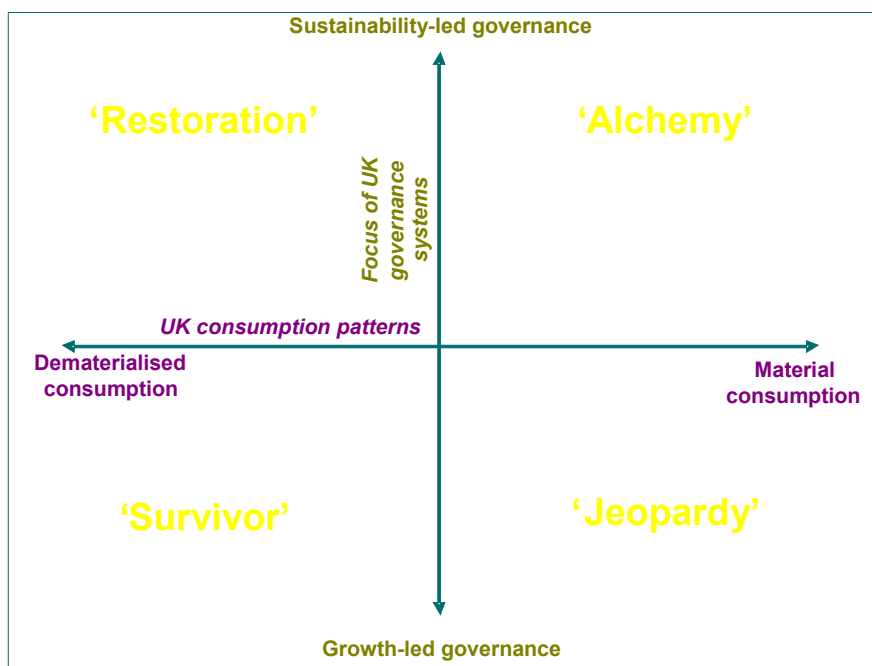
Figure 6.2. Four divergent scenarios.

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[35] 'Climate Change Scenarios for the United Kingdom', UKCIP, April 2002

Science project: SC050002

7. 'Restoration' (sustainability-led governance, dematerialised UK consumption)

7.1 Summary

In this scenario, 2030 sees a world with heightened concerns about the environment and strong global political leadership in relation to environmental issues. Stronger governance at UK and global levels has been focused on reducing the impacts of consumption for some years, with strong adaptation measures and long-term planning to take account of increased resource costs and climate change impacts, both domestically and internationally.

Such concern, particularly over the wider social impacts of environmental change, and an accompanying shift in values has resulted in part from the economic realities posed by increased resource costs at a global level. However, there is also greater societal awareness, particularly in the developed world, of the environmental impact of resource-intensive consumption, which arises from a highly intensive period of environment related events and/or near disasters in a relatively short space of time in the years between 2010 and 2020. This experience, and the awareness of the worse-case scenarios that arise from much more powerful computer modelling of climate changes and resource constraints, and intensive economic and social research on the financial and human costs of pessimistic scenarios, have done much to change attitudes and priorities within policy communities.

During this period the sheer scope and intensity of these environmental events and their impact – both real (in terms of the displacement of people and destruction of communities) and perceived – in certain parts of the world shifted the value set of a significant segment of society in the developed world towards a new social and environmental altruism combined with enlightened self-interest. This has added to the pressure on governments to act, at both a local and global level. New measures to shift consumption patterns and influence behaviour, in turn, have also had a gradual impact in changing attitudes and values.

7.2 Full scenario narrative

In the years between 2005 and 2020 China and India continued to rise as powerful global economies, demonstrating an increasing ability to safeguard natural resources, principally oil, to sustain their growth rate. However, the impact of this continuing growth of the developing economies had a major impact on local, regional and, longer term, global environment(s) during this period. Increased carbon emissions and increasingly visible evidence of the impact of climate change have become an increasing concern of both citizens and politicians.

A new global consciousness around environmental and social sustainability issues has emerged, pushing the political agenda at a global level. The Maldives 2020 accord has replaced all previous global agreements on the environment, such as Kyoto, Rio, etc. This awareness is prefigured in the growth of global non-governmental organisation (NGO) networks and business sustainability networks in the 1990s and 2000s, and in the decisions by China in 2006 to redirect economic growth and place far greater priority on domestic eco-sustainability.

A more far-sighted tendency in UK Governments has been at the forefront of this movement, slowly introducing and increasing intervention (including consumption taxes) in some areas to make both business and consumers more aware of the full cost of their consumption patterns. (Increasingly complex road charging arrangements, higher fuel taxes and household waste collection charges calculated by volume are but three examples.) UK Governments since the mid-2000s have also worked on the basis of cross-party consensus on climate change, making it far easier to present ambitious demand management measures to the public. This was mooted in 2006 in Parliament and by the 2009 general election was enshrined in a multi-party compact, which has held good since then.

The digitalisation of society and the intensification of global migration patterns have improved people's knowledge and concern about the environment. They are better educated about the reality of global resource constraints and the impact this has on developing countries in particular. In a world in which significant proportions of the population are economic migrants from less developed countries, the political pressure to act to reduce the developed world's environmental impact has increased.

This was particularly the case in the 10 years from 2010 to 2020. A number of well-reported floods and international extreme-weather events (for example, recurring heat waves, storms, slowly rising sea levels and more widespread local flood incidents in the UK), along with growing evidence of the impact of climate change in higher latitudes, on parts of Sub-Saharan Africa, Southern Europe and the US wheat belt, have built a growing perception of a more fragile global environment among a greater proportion of the developed world.

The spectre of significant displacement of people has also fed the emergent 'ecological' consciousness. The shift in lifestyle choices and purchasing behaviour (such as avoiding items that appear to have high 'product miles') has been a notable consequence of this efficient dissemination of information in the digital world. This wider global consciousness was also advanced by the increasing displacement and migration of people across the globe, with economic migrants and other displaced communities becoming more vocal and influential forces in the developed world, placing a heightened culture pressure on political leaders in the developed world to act.

Partly as a result of the new forms of regulation and taxation, and also a heightened concern about environmental impacts, a new socially driven environmental consciousness has been brought to bear, just as discussions of world poverty were highlighted at the end of the 20th century. A significant segment of the UK and other developed societies are now actively, and voluntarily, reducing their consumption levels, partly as an ethical response to environmental damage and social inequalities,

but also because the threat of individual carbon quotas looms on the political agenda. However, this is not an uncontested view among all in society, it is a majority view that is spreading among the population at large. This move has been driven to a large extent by the availability and affordability of micropower systems, by the aspirational elements of the 'green life' as popularised in TV series on living ethically. These took off for the first time in the mid-2000s and have become ever more sophisticated and popular as awareness has grown and the supply–demand pressures have reached a 'tipping point' for ecologically responsible consumption.

Recognising the growing public awareness and new-found 'fear' that surrounds environmental impacts, as well as the increasing risk resource constraints pose to the world economy, politicians, including those from the key economic powers, made strengthened commitments on the environment in the Maldives accord of 2020. Global emissions trading schemes are a key feature and all measures are governed by a newly strengthened UN and more interventionist EU. The social and environmental chapters in the latest draft of the EU's Stockholm treaty are more significant than ever before. Global governance is strong – and increasingly convergent in its view of future priorities, which reflects the concerns of society at large. Across the EU, environmental action has always been one of the areas for collective action that has been popular and understandable to national publics: this factor has helped generate support for more radical measures and to strengthen international governance for the environment and sustainable development.

The UK Government has welcomed these new measures. Quite apart from the public pressure, they were fearful that they would otherwise be unable to compete for increasingly scarce and expensive carbon-based energy reserves. The new measure should also help to stem the growth of India and China, both of whom have had significant negative impacts on the UK's economic growth for the past 10 years.

As a result, the Government made significant investments in improving certain types of infrastructure. Public transport is now much more efficient and, given the costs of energy, the only real option for those who can't afford expensive petrol-fuelled vehicles, or the latest hybrid models run from renewable energy sources, which are favoured by a growing segment of the population. The UK motor manufacturing industry has been largely replaced by a motor service industry, with a network of highly efficient service repair outlets replacing showrooms across the country (similar to the models seen in Belgium, Switzerland and Austria at the turn of the century). The overall capacity and environmental efficiency of the UK transport network has improved dramatically, rivalling the best in Europe in 2030.

The move towards renewable energy sources has been part of a strong and co-ordinated mitigation strategy in relation to resource constraints and climate change. Demand-side management measures have been combined with an intensive programme to provide more renewable forms of energy, such as wind turbines alongside some wave and a small increase in nuclear capability. New planning guidance has taken a much more long-term view of future developments and the impact of climate change. The latest plans for urban regeneration, following the success of the Northern Way programme of the first two decades of the 21st century, plan major expansions of housing and related social infrastructure programmes in the

North West, North East and Yorkshire, in an attempt to encourage a more balanced growth of the population across the UK and less resource-intensive growth in London and the surrounding areas in the East and South East of England.

Similarly, the UK water infrastructure has been drastically improved, with major replacement programmes taking place in the previous 10 years, because of significant levels of public investment, particularly in and around major cities. Fewer leakages occur. Universal water metering has been introduced across the UK, while local waste-water recycling and dual reticulation schemes have been introduced in some parts of the country, especially in and around new urban developments. On a global scale a significant investment in the capital costs of desalination plants and associated management skills has been promised by the G12, part of the latest plans flowing from the Newcastle summit in early 2030.

Education and information campaigns, effectively run in partnership between the Government and the wealth of environmental NGOs to encourage more sustainable forms of consumption in the home, have been successful in the UK, with resource efficiency seen as key. Individually, significant numbers of citizens are more responsible and 'respectful' of natural resources. New developments, as well as renovations of older property, have to meet an increasing number of environmental standards before they can proceed, for example with regard to insulation. More houses are built with showers, instead of baths, while commercial properties often include a dedicated space for recycling. The hosing down of cars is viewed as an antisocial activity. A greater focus on conserving resources has also spurred greater availability and take-up of recycling at the local level. Overall resource efficiency has improved significantly in the past 10 years.

The rise in single-person households seen between 2000 and 2020 has begun to level off. In part this is on account of property prices and a renewed focus on the family but it is also results from a growing recognition by the lower quartile of society that living communally is both cheaper and more environmentally sustainable. The number of multi-person households (with three or more unrelated people) has continued to rise as a result.

The structure of the economy has continued to move towards the service sector. Services are increasingly in demand in 2030 – including some of those that seemed to be disappearing at the end of the 20th century. The demand for more technical and skills-based work has been aided by a slight increase in the trend to repair electrical and other durable goods rather than purchasing new ones.

Another facet of the economic structure has been a move towards long-term investment income for many consumers. Overall, however, the economy has slowed down with consistent year-on-year falls in consumer expenditure since 2025. People are choosing to save rather than spend. The UK savings ratio has seen rises in 7 of the previous 10 years. Levels of disposable income have been pretty much at a standstill for the past 5 years, with wage pressure on the younger generation acting as a further break on their behaviour, and a significant proportion of new consumption now appears to come from the public, rather than the private sector.

7.3 Key events

- Between 2005 and 2020: Continued rapid economic growth of Brazil, China, Russia and India.

- Between 2010 and 2020: Series of environmental disasters and/or extreme weather events across the world (for example, recurring heat waves, violent storms, flooding, etc.) that involved the significant displacement of peoples, and food and freshwater shortages.

- 2020: International Maldives Accord that set new targets to improve environmental performance, including stricter global emissions targets.

- 2020 onwards: UK government invests in developing public infrastructure (transport, energy, housing, etc.).

7.4 Review of key characteristics

UK economy

Governance at national level is `strong. New forms of regulation and taxation have been introduced for both businesses and consumers as part of the requirements to fulfil international agreements around environmental performance and manage the impact of increased resource costs. Economic performance has been slow and stable, with new consumption driven by increased public spending. There has been significant investment in developing key infrastructures, such as public transport, housing, energy and water. The Sustainable Communities programme has shifted large-scale building and investment in upgraded infrastructure from a small number of growth areas to a much larger number of sustainable development growth points (SDGPs, also known as New Garden Cities). These have acted as seedbeds for much wider take-up of micropower, water-efficient technologies for buildings, home composting and community recycling and reuse, and so on.

Manufacturing and industry

UK manufacturing and heavy industry continues to decline, partly in response to the introduction of increased resource costs and stricter environmental performance standards, but also as a result of increased competition from lower cost developing economies. A number of players have changed their business models in response to the shift in patterns of consumption, operating service businesses focused on repair and re-use rather than production. Other businesses have decided to decentralise and operate on a smaller, more local scale as a way to improve efficiency. A key new growth industry is materials recovery, recycling and what some have called 're-manufacturing' based on modular design for disassembly and re-use of many consumer products. Major construction and engineering programmes are generally public (rather than private) projects and are built in accordance with the principles of sustainable development. Utility companies increasingly operate as Sustainable

Resource Flow businesses, providing infrastructure development that covers energy, water and materials management, and design and development of distributed local networks for renewable energy and CHP from waste.

Services

The service sector grows in importance with increased demand for technical and skills-based work. Part of this results from the shift in focus from manufacturing to service and repair as consumers find it more affordable to retain and maintain products purchased rather than to purchase anew. Such skills are also valued in the drive to achieve energy efficiency in existing housing stock. Media and education are important, in particular with regard to driving societal awareness of the wider environment.

Agriculture and food

While there is a preference for locally sourced and organic food in some areas of the UK, this is not always possible because of competition for land use for other agricultural purposes. However, there is an increase in the use of more natural forms of production (for example, non-synthetic nitrogen fertiliser). There is some increase in energy crops and biofuels in some areas (along with community energy schemes based on woodfuel from short rotation coppices), but this is limited by demand management measures and the increased use of energy-saving technologies. The proportion of land given over to growing traditional crops decreases. Agri-environment schemes grow in importance, especially in certain areas to protect high-value ecosystems and landscape values. Government-backed forestry-management measures are also in place, although few additional forests have been established since the turn of the century.

Spatial development and land use

There is a limited amount of construction of new housing stock as the increased cost of property, a renewed focus on family values and a recognition that communal living is cheaper and more environmentally sustainable means that the growth in single-person households and thus the demand for more new properties drops off. Where there is any expansion in urban areas, it is sensitively done. Care is taken to redress the balance of pressure on resources that comes from the higher population density in the South East.

Transport

With relatively high fuel costs, most individuals prefer to travel using the well-developed public transport network, which has continued to improve following large-scale investment and repair in the rail and urban light transit networks in the 2000s and 2010s. Hybrid cars that run on renewable energy sources are becoming increasingly popular, but have yet to become completely mainstream. The widespread introduction of road charging has further served to deter private travel. A substantial proportion of commercial transportation has also shifted away from the road to rail.

Energy

In the face of growing demand from developing countries, the rising cost of energy based on fossil fuel- and concerns over energy security led to threats of economic instability. The government launched a spending programme focused on developing renewable energy sources, in particular wind and wave with a some small increase in nuclear capability. In some areas, energy is also derived from biofuels. There is an extensive network of energy-from-waste facilities of various scales, using residual wastes for incineration, gasification, pyrolysis and anaerobic digestion. Demand-side management measures have reduced energy consumption at an aggregate level among both businesses and consumers.

Society

With higher environmental awareness and understanding, there is an increase in wider social and ethical concerns, which drives a broad shift in values among a significant segment of society. Individuals are generally content to accept a lifestyle plateau once a certain level of affluence has been attained, and now obtain satisfaction from local and community interaction. Income polarisation has decreased with increased emphasis on social equity and less pursuit of ever higher levels of material affluence beyond what is regarded as the 'comfort zone'. Well-being and leisure are far less dependent on affluence and much more on community and social interaction.

Environmental and sustainability concerns

The state of the environment is driving behaviour at all levels – internationally and nationally, and among governments and private citizens. There have been a number of environmental disasters, which have been globally acknowledged and have helped to raise awareness and consciousness. Concerns over potential constraints to economic growth drive the government to intervene. New regulation to change business and consumer behaviour is introduced. Some changes in behaviour are based on values and personal conviction; for many others, changes in the values held are a longer term consequence of effective measures to influence behaviour. In addition, the government works in partnership with NGOs to drive up environmental awareness and encourage sustainable forms of behaviour. Concern for the environment is holistic and wide-ranging, and incorporates interest about economic sustainability, ethics and social equity. Thanks to these changes in attitudes, there have been some improvements in levels of biodiversity, though there are still 'winners' and 'losers' across different habitats.

International governance and relationships

The international community is working together, driven by a shared global understanding around the importance of environmental and social sustainability. Co-ordination and co-operation are focused on setting targets to improve environmental performance. International decision-making bodies, such as the UN, have strengthened powers to help protect and enforce agreements. The scope of their responsibilities has generally increased and they are more willing to take an interventionist and active role. The G8 has been extended to include key developing

nations and thus ensured their commitment to complying with new global agreements around emissions targets, etc.

7.5 Review of key indicators

Indicator	Baseline	'Restoration'
UK GDP average growth per annum over past 5 years	+2.3% per annum	Little change overall in rate of economic growth, but based on different principles (greater re-use of materials)
		+2% per annum approx.
Income distribution (proportion of income held by poorest 10% to richest 10%)	1:4 £164:£654	Marginal shift to less polarised society through greater political will for social equity and redistributive impact of new policy measures, especially personal tradable carbon allowances
		1:3.75
Gross government expenditure (as percentage of GDP)	42%	A significant increase to government financial expenditure, but very little change to activity expenditure (related to employee base)
		50% approximately
Gross value added by sector as percentage of total UK economy: services (S), manufacturing (M), agriculture (A)	S: 76% M: 23% A: 1%	Little change in manufacturing sector as traditional industries have been replaced with refurbishment, remanufacturing and recycling (classed as manufacturing). Slight increase in service sector through growth in repair industry. Some growth in value of agricultural sector with more locally sourced food products and focus on non-food crops
		S: 75-77% M: 22-24% A: 1-1.5%
Number of households	24.1 million	Total number of households will increase to some extent in line with overall population growth, though tempered by increase in communal living
		27.2 – 27.5 million

8. 'Alchemy' (Sustainability-led governance, material consumption)

8.1 Summary

In this scenario, 2030 sees a highly technology- and knowledge-led UK, with consumers continuing to consume in a relatively resource-intensive manner. The focus is on reducing the harmful consequences of consumption patterns, rather than changing consumer behaviour. This approach is in line with the political sensitivities in the 1990s and 2000s that inhibited Governments from trying to manage demand and led them to emphasise technological innovation as the key to reducing the impacts of consumption. Supply-side measures are the key focus, including investments in new environmental technologies, and greater control and regulation of supply chains and manufacturing processes.

The greater investment in technology and in infrastructure came about 15 years previously, as a result of a foresighted view of EU competitiveness and the growth of developing economies, particularly China and India, both of whom were thought to be making similar investments in infrastructure. Other key factors were the requirement to moderate the consequences of global consumption patterns and remove the potential economic constraints posed by increased competition for access to natural resources to support continuing economic growth.

Consumption growth has continued pretty much unabated for the past 40 years, despite fears of an economic slowdown 10-15 years previously. The growth of the knowledge and service sectors of the global and UK economy and continuing desire for goods that are smaller, more technically advanced and experiential are key bases for economic growth. Because of the absence of any major environmental concerns in the developed world the environment is not a major concern for citizens at large. For many of them, it is something that is dealt with increasingly by Government regulation and technological advances – and not something they need to worry about too closely in terms of their everyday lives.

8.2 Full scenario narrative

In 2030 the UK is benefiting from an aggressive technology-update programme followed during the first quarter of the century. This focused on driving international competitiveness in relation to new technologies such as genomics, informatics and nanotechnology, but also resulted in a major technology update in relation to environmental technologies as a result of Government investment well over a decade previously.

The UK Government took this course of action prompted by concerns about the impact of increasing competition from the economic growth of newly developing economies, in particular China. Not only were these high-growth markets pushing up demand for and prices of key energy resources, but they were also known to be investing in new environmental technologies and alternative sources of supply in an attempt to secure their own future growth. This caused concern for a long-sighted UK Government and European Commission in 2012. The fear that the sheer volume of knowledge and skilled labour in China could allow them to seize the economic initiative even more if they developed a clean fuel prompted a foresighted response earlier than many had expected.

The UK was at the forefront of this new EU-sponsored initiative. Like other major European economies, it was prompted to take action to ensure the long-term sustainability of the UK economy. A wave of investment in a technology-update programme led to the construction of a new, indigenous energy infrastructure, focused primarily on nuclear power with additional supply from a number of other sources, including carbon sequestration and some additional wind and wave power. Measures were also taken to develop a water grid to relieve water stress in the South East and East of England, along with the development of new reservoirs. Around the same time a raft of new environmental directives was introduced and implemented to ensure that industry would move towards more sustainable business practices and processes designed to improve resource efficiency and environmental performance. Environmental and corporate social responsibility reporting is mandatory and large corporates are fined for underperformance in certain areas.

New models have emerged in parts of the construction industry. For example, a growing proportion of new developments in the South East, which remains the focus of UK economic and population growth, is being designed and built with solar panels and individual wind turbines to improve their resource efficiency.

The measures introduced have been broadly successful. Although some experts were forecasting a slowing UK economy around 2020, the technology-update programme and other regulatory measures appear to have removed concerns over potential resource constraints. This has enabled the economy to continue on a path of stable growth for the past 10 years, while allowing consumer consumption to flourish unrestricted.

Dealing with the resulting waste has become a pressing issue, however. The WEEE Directive has been continually extended and strengthened by the EU to cover other product categories. However, there is controversy over further regulation of industry, with many companies fed up with constantly having to change and adapt production processes and supply chains to deal with both changing regulation and fragmented, ever-changing consumer needs and demands. They claim the earlier raft of regulation introduced was more than enough and that given continuing competitive pressure, a period of stability and deregulation would be more beneficial.

The basic structure of the UK economy has undergone some changes over the past 25 years, partly as a result of the new regulatory environment, but these have been evolutionary from the pattern of the late 20th century and early 21st rather than radical

shifts in production and employment. Globally, trade is vibrant. The high-tech and knowledge-base sectors have continued to grow rapidly, with new markets created in some areas where regulation has acted as a spur to innovation. Ownership of intellectual property is a key source of revenue for the organisations involved. There have been a number of notable successes, such as the launch of a series of expertly designed and engineered luxury vehicles that run on new types of biofuels, all of which are designed in the UK or Germany and look set to breathe much needed life into the European motor industry. However, with greater regulation of the supply chain, most 'mass, manufacturing continues to be done in the developing world to maintain global competitiveness.

Nevertheless, with the scope and remit of the European Environment Agency increasing, along with multi-agency implementation of environmental regulation across the globe, most major manufacturing economies have been obliged to comply with the standards and regulations introduced in the UK. Initially, there was concern that this may not be possible, but the intervention of multinationals, increasingly influential as both economic and political players, resolved the issue – accepting the need for more global standards to ensure a level playing field.

The UK landscape has undergone some changes. With a focus on sustainability at the national level, the quality of local environments frequently suffers, particularly around highly developed areas such as the South East of England. In these a number of new desalination plants have been built and major new flood defences planned to protect new urban developments from the predicted impacts of climate change. The proportion of the rural land given over to intensive agriculture has increased slightly with the development of crops such as biofuels, through incentives such as new tax breaks, grants and subsidies.

Developing a new domestic energy infrastructure led to the construction of new nuclear power stations across the country and a huge series of wind turbines off the East Coast of England using local technologies and knowledge, and creating new jobs as a result. In recognition of increasing problems with congestion on major roads, a new road building programme has been developed. There has been investment in public transport infrastructure to attract users, though this has not achieved any major change in travel patterns or habits.

Responding to the trend towards smaller households, additional sustainable housing has been constructed following the successful example of the Thames Gateway initiative. In addition to these measures, initiatives that responded to the challenge of possible future climate change have been developed, with the result that the coastlines of the South East and East of England are now dominated by new flood defences and the odd wind or wave turbine.

UK consumers have become interested in travelling to destinations where they are able to experience completely unspoilt natural environments, where the surrounding society is relatively safe to visit. It's much harder for the affluent majority to find these places, but the most popular holidays in recent years have included cruises in the Arctic Circle, allowing individuals the chance to walk on the remaining stretches of the polar ice cap. Visitor numbers in areas such as Switzerland, Greenland and Canada

are also increasing – boosted by a feeling that this may be the 'last chance to see' many of these natural attractions.

International travel has continued to grow, though air travel is an area in which major breakthroughs to improve performance are still to arrive. Some are pushing for the launch of a 'green airline' service, but the industry has yet to develop a model with radically improved performance standard, having decided to focus initially on areas with the greatest potential for mass demand. A new market is developing in virtual experiences and travel, facilitated by advances in new technology that allow household TVs to offer 3D virtual projections that make the virtual experience seem 'real'. Virtual dinner parties are the latest social trend, allowing friends to meet and eat with others across the globe while sat in the safety and comfort of their own home (and with less washing up!). The developed world really does seem very small and easily accessible for the affluent middle classes.

The UK has prospered in relative socio-economic terms compared to most other developed countries. Concerns over shortfall in the labour force as the result of an ageing population have reduced with the increased productivity and efficiency made possible by technological advances and an influx of newly skilled economic migrants. However, social tensions have emerged on occasion as a result, particularly in relation to local issues, where different areas have different levels of employment, health and environmental quality. On the whole, though, income inequality has decreased as investments in education have paid off and increasing numbers of individuals are able to access well-paid jobs in a fairly stable economy.

Overall, then, the environment is not top of people's agenda. The focus on growth has led new market solutions to emerge, often off the back of initial intervention by a Government that was focused on long-term sustainability earlier than most. Nevertheless, with energy prices at their lowest for 5 years some parts of the media are jokingly saying 'remember when we all thought the world was at an end'. Stories of the growing impact of climate change across the globe still appear in the media from time to time, but do not generate great concern among the developed world. The solution is seen as simple by most citizens – reduce poverty in the less developed areas and provide technological solutions to mitigate the worst impacts of climate change where possible. However, a small minority still claims that, despite the measures that were introduced, there is profound invisible environmental degradation 'beneath the surface' and the issues of resource constraints and climate change will resurface within the next 10-20 years.

8.3 Key events

- 2005-2015: Rapid growth of developing economies, in particular China and India, causes concern for developed markets.

- 2012: European Commission responds by introducing a suite of new environmental directives to ensure industries moves towards more sustainable business practices focused on improving resource efficiency and environmental performance.

- 2015: Foresighted UK invests in an aggressive technology-update programme, investing in developing new environmental technologies and alternative sources of supply.
- 2020 onwards: The UK economy has adapted to these new measures and entered a path of stable economic performance.

8.4 Review of key characteristics

UK economy

Up to 2015 there were concerns over the sustainability of economic growth with increasing pressure on costs coming from developing economies. There was a period of instability following the introduction of new environmental regulations as businesses struggled to adjust. However, grants and incentives encouraged industry to invest in developing new solutions. The UK is the leader in a number of environmental technologies. Certainty over low-, medium- and long-term energy prices has helped to provide market confidence and encouraged stable economic performance, driven predominantly by unrestricted consumer spending. There has been major public infrastructure investment with a substantial number of projects financed by private partners, for instance, a new high-speed Northern rail line and extensions to the underground network. The Sustainable Communities programme launched in the 2000s has developed a large-scale infrastructure for the growth areas of the South East. The environmental impacts are managed through new technology, creation of a new water grid (with some supplementary reservoirs and desalination plant) and connection to the new nuclear grid and, to a lesser extent, to renewables and micropower. Sustainability is approached through production systems and the aim is to influence consumers through technical change and adaptation and not through restraint on demand.

Manufacturing and industry

The new regulatory environment has had an impact on the structure of the economy. Following major investment in education, research and development, the high-tech sector has grown rapidly, with new markets created in some areas in which regulation has acted as a spur to innovation. Ownership of intellectual property is a key source of revenue for some. Many of the most innovative players are small and medium enterprises that have the organisational flexibility to be able to change their business. In the face of increasing material and energy prices, and increasingly strict measures to enforce extended producer responsibility for waste, a number of businesses are investing in innovation of their production processes to ensure maximum resource efficiency and to identify further opportunities for resource recovery.

Services

The service sector is an increasingly important part of the economy. Leisure and travel services increase as, in this consumption-driven economy, individuals seek satisfaction from experiences as well as material goods. For the wealthy, this is about travelling to

destinations where there is an unspoilt natural environment; for the less affluent, virtual experiences are becoming increasingly common and driven by advances in new technology.

Agriculture and food

Pressure on agricultural land comes from demand for land to grow biofuels. With the requirement for more intensive agriculture, genetic modification (GM) and other new developments have been introduced across a spread of crop types. Advancements in agricultural science and technology have had a significant impact in improving productivity with minimal environmental impact, and Government has backed moves to establish short rotation coppices and even some more traditional forms of high forestry management. Significant amounts of land are no longer in agricultural production as a result of increased agri-environment schemes (now under threat) and an increase in land owners who have no particular interest in agriculture, turning land into hobby farms and leisure facilities for others to enjoy.

Spatial development and land use

Competition for land use comes from a variety of sources, including the new construction of homes and supporting infrastructure across many areas of the country. The development of a new energy infrastructure has meant increased construction. UK biodiversity continues to decline despite the increase in agri-environment schemes, which are accused of being ineffective and are under threat as a result. Important habits are destroyed to make way for new housing, wind turbines, roads, etc. There are also some moves towards counter-urbanisation as a result of the advances in technology and minimisation of the need for (non-virtual) face-to-face social contact.

Transport

Personal mobility remains critical. With stable energy prices, the cost of private car travel remains very affordable to the majority. Many now drive vehicles with improved environmental performance. New road infrastructure and new road pricing schemes are developed to combat congestion. There has been investment in public transport infrastructure to attract users, though this has not achieved a major shift in habits .

Energy

Concerns over ensuring the long-term stability of energy supply led to investment in developing an indigenous energy infrastructure, focused primarily on nuclear power, with additional supply coming from wind and wave power in certain regions. Reliance on carbon-based forms of energy has diminished, and the impact of these is limited through extensive use of carbon sequestration. A new energy infrastructure has meant that stable energy prices are guaranteed.

Society

There is limited interest in the wider community as a distinct entity; most individuals are content to lead lives focused on achieving their own personal satisfaction, generally derived through the consumption of material goods and experiences. Though the majority are able to enjoy a fairly good standard of living (there are higher levels of affluence in the UK compared to most other developed countries), there is some inequality at a local level because of differences in employment, health and environmental quality. This causes dissatisfaction among some; others accept this as the trade-off to have access to the other aspects of life they enjoy. Developments and advances in technology impact in many areas of life, including how people spend their leisure time. Given the increasing cost of travel, a new popular form of entertainment and socialising is the use of virtual reality technologies, even including virtual reality dinner parties.

Environmental and sustainability concerns

Concerns over the security and stability of the supply of key resources and the impact of resource prices on economic growth have led to a focus on improving efficiency and implementing environmental technologies. However, biodiversity has suffered as this is seen as a lower priority compared to this desire to ensure stable growth and development. For the individual, the state of the global and national environment is not a priority concern or something that has any conscious impact on their lives. Though there is some knowledge about environmental disasters that occur in other parts of the world, for most the belief is that technology can provide the solution. The most significant area in which environmental pressures and resource constraints have been felt by consumers is in relation to waste and water. Waste recycling is one area in which penalties and positive incentives to affect behaviour have been used, given the constraints on landfill, and communities have had to accept a large expansion in waste treatment facilities, including energy-from-waste incinerators. In relation to water, the South East is now largely metered and new reservoirs have been constructed, along with new grid systems to shift water from the west and north. In water-stressed areas there is considerable take-up of water efficiency and conservation technologies, but elsewhere penetration remains low and patchy.

International governance and relationships

In the face of increasing competition from developing countries for key resources and economic advantage, the UK and other developed markets have co-operated in drafting a raft of measures focused on improving environmental performance. Implementation and monitoring also takes place at a joint level with the strengthened European Environment Agency as well as a number of multi-agency initiatives. International trade is vibrant, and has grown in a number of new areas, for example, the export of nuclear waste for re-processing and stabilisation. Most 'mass' manufacturing continues to be done in the developing world to maintain global competitiveness.

8.5 Review of key indicators

Indicator	Baseline	'Alchemy'
UK GDP average growth per annum over past 5 years	+2.3% per annum	Increase in rate of growth Likely to be variation across economic sectors
		+2.5% per annum approx.
		£22,500 to £23,000
Income distribution (proportion of income held by poorest 10% to richest 10%)	1:4 £164:£654	Small increase in income polarisation, though overall average levels of wealth increase
		1:4.5
Gross government expenditure (as percentage of GDP)	42%	Some increase in absolute expenditure with greater investment in infrastructure (but part of this comes through private sector funding)
		42-43% approx.
		31-33%
Gross value add by sector as percentage of total UK economy: services (S), manufacturing (M), agriculture (A)	S: 76% M: 23% A: 1%	Increase in importance of knowledge-based business means growth in service sector – value of agricultural sector increases in absolute terms with introduction of non-food crops
		S: 80-82% M: 17-19% A: 1%
		2.2-2.3
Number of households	24.1 million	Some increase in number of households with population growth
		28.7-30 million

9. 'Survivor' (growth-led governance, dematerialised consumption)

9.1 Summary

In this scenario 2030 sees the continuation of major resource constraints that appeared 10-15 years previously. Market forces have driven changes in consumer behaviour towards less resource-intensive consumption. A desire for long-lasting goods and less of a 'disposable' culture, in which things are thrown away and replaced, has come to the fore, largely of necessity, in the UK and other parts of the developed world.

This shift has come as a result of an economic shock and collapse about 10-15 years previously, brought about by a global drive for growth, increased competition for resources and a lack of global and national political leadership in relation to the environment. With global agreements such as Kyoto and its successors unimplemented or found ineffective, major instability in the oil-producing countries of the world and a short-term policy focus on economic growth and international competition, energy prices reached unsustainable levels much earlier than many had predicted. Oil-dependent developed economies were the first to buckle in the late 2010s, closely followed a few years later by those such as China and India who depended on such economies as their main markets for cheap consumer goods.

A lack of concerted political leadership at the global level during this period led to fragmented regional and local responses to this so-called 'Great Collapse' of 2020. This has, by and large, continued, and as a result in 2030 there is less of a global free-market for goods and services. In many areas of the developing world instability and climate impacts, and the economic and social effects of much higher energy costs, have driven investment in self-sufficiency (renewables, production of food for local consumption) and eroded export activity considerably. However, some regional trading blocks, such as the EU, still exist. At a local level in the UK, there is less emphasis on technological advances and more on social contact, community-led action and good quality local goods and services.

9.2 Full scenario narrative

The rapid growth of China and India in the late 20th century and early 21st century frightened political leaders in Europe and the USA, who were concerned that it would reduce the living standards of their own populations, with a resulting backlash.

20 years before many politicians could be heard echoing the Clinton phrase, "It's the economy, stupid". It was the economy. So they concentrated on increasing productivity and growth, with initiatives such as the revised Lisbon Agenda (focused on the

transition to a new highly competitive knowledge and R&D based economy), a key focus of economic policy in the EU.

In a world in which essential resources already appeared insufficient to meet rising demand, prices simply spiralled upwards – reaching $30 for 1 litre of petrol as early as 2013. The developed economies buckled first, despite first trying to secure scarce resources through the use of military power. Many of them slumped into major recession after 2015. Once they'd gone, China and India lost their main markets, and their economies, too, went into sharp decline a few years later. In many areas of the developing world instability and climate impacts, and the economic and social effects of much higher energy costs, have driven investment in self-sufficiency (renewables, production of food for local consumption) and eroded export activity considerably.

Organisations that might have helped manage these conflicts, such as the UN, World Trade Organisation (WTO) and the International Monetary Fund (IMF), had long lost any influence or credibility they might have had for the way they'd consistently promoted the interests of the developed world at the expense of the developing countries. Looking back, at least there seems to be a little bit more equity about how the pain has been shared out between the developed and developing world. In spite of the self-interest and the lack of political leadership at a global level, no-one seems to be a major winner this time around.

In the world in 2030, the UK's attitudes towards the environment have become curiously dualistic. On the one hand, land that can be used for crops generally is. As a result of a shift in values towards the local, our awareness of the value of land and its management has increased. At the same time, we have more interest in the wild places – and there are more of these now that some areas have largely been abandoned because of the recognition of future flood risk. With more people taking most of their holidays closer to home, they care more about the land on their doorstep and the local environment that surrounds them.

For most people frugality is a consequence of economic pressures and resource constraints: water stress and rising fossil fuel costs lead to a large take-up of measures for water conservation and recycling, home composting, micropower and sharing of facilities to reduce costs and impacts. Some of this is high tech – some is basic do-it-yourself (DIY). Ingenuity in achieving self-sufficiency and comfortable frugality becomes a sought-after skill set and a source of social kudos for many. Many commentators now claim, looking back from 2030, that the planet 'sleepwalked its way to disaster'. There was certainly a lack of longer term planning and real action or recognition of the very real resource constraints that could lay ahead. Governments around the world constantly claim that, even knowing what they know now in 2030, if they could do things differently with the benefit of hindsight, it's not clear that events would turn out any differently. It seems everyone's self-interest was too strong during the period after the turn of the 20th century. The latest statements from the Government suggest that in 2030 they have decided to simply focus on the situation with which the UK is faced.

The UK economy has slowed in comparison with the consistent growth rates seen in the years between 2005 and 2014. The great majority of the population is significantly

less wealthy, in real terms, compared to 2005. Only the relatively affluent can afford their own car and the personal mobility it affords them. Even so, people can live comfortably enough if they are careful. People don't travel as much as they used to and there is less consumer spending across the economy than there was 30 years previously. People value possessions, but keep them longer. The convenience culture and disposability of material goods that existed 25 years before has turned. People care more about the quality of goods, and buy less cheap global produce (especially food and clothes). The most desirable material goods tend to be those that are good quality and long lasting, and tend to be made in Europe or the UK, not the developing economies in the Far East.

However, highly technical goods and most electronics are developed and produced in these developing economies, who have also found growth in niche markets by introducing new technologies into the developed economies of Europe, the USA and Japan. However, those at the lower end of society mend things more than they used to. Small professional repair shops have popped up everywhere on the local high street, with traditional trades and skills reappearing in some areas (albeit among a younger generation of workers) and new highly specialised tech-repair shops appearing in other areas. People tend to reuse stuff when they can rather than pay the additional disposable costs that are now placed on goods at the point of disposal. For certain goods, there has been the rise of an informal barter economy.

Shortages of key resources remain; the position since the Great Collapse of 2020, during which the global economy went into major recession, has not become much better. Prices remain high, particularly for energy, and producer nations have every interest in keeping hold of what they've got, and selling it slowly. In particular, energy costs are high. Oil is at around €200-€250 a barrel.

When the great collapse arrived, it brought about a retrenchment, with many countries turning in on themselves. The UK, like much of Western Europe, has been forced to become less dependent on trade and imports, and has instead started to grow more food locally, and develop higher cost substitutes for resources that had gone missing.

Despite growing evidence of climate change, there is little concern for international issues beyond self-interest for the national and local economy. The EU has closed its external borders, shutting its doors on environmental refugees from elsewhere. However, it continues to allow labour and goods to move internally, albeit with some restrictions in place. Goods move around less than in the free-market days of the late 20th century, partly because freight costs are prohibitive for all but the lightest materials (sea-based trade flows are growing once again), but people continue to circulate. There is a live national debate about whether the pits in Durham and Nottinghamshire would function without the expertise of the Poles who moved here to help re-open them.

One of the more striking features of the UK in 2030 is the extent to which leadership is local. Although, at a national level, there has been little investment in infrastructure, some populist local leaders have engaged their communities and used local capacity to build CHP schemes and other projects to share resources across their areas.

There is some innovation, albeit of a fairly low tech nature. Micro-generation units have flowered within local communities, largely as the result of strong local leadership and a renewed sense of community leading to shared resource pools. Governance is much more local on issues of the delivery of key resources. Each community has to live more within its means, according to centrally determined targets, but how they do so is very much left to them. The regular power cuts of the late 2010s are now mostly a thing of the past. Household-based rainwater harvesting becomes relatively popular, while grey water schemes begin to be adopted in drier parts of the UK (such as the South East), particularly in blocks of flats where such initiatives are instituted on a collective basis. Solar panels and wind turbines can be seen across the country in many areas.

More generally, the core infrastructure has recently been described by a leading commentator as "being in a high level of low level tattiness". All over the country, there is slowly decaying infrastructure, including leaking pipes and decaying boilers. Older urban developments are particularly vulnerable to such decay, and generally have very low levels of water quality and high levels of local pollution as a result of the slowly decaying infrastructure. Additional desalination has been discounted as economically unviable because of the prohibitive energy costs.

Waste levels have fallen. Consumption is less resource intensive and more of the products are made to last longer. There's less waste from packaging as well. Larger retailers have had to change their business models to stay in business, given their previous dependence on oil. Supermarkets in most urban areas have large dispensers from which consumers can refill branded food containers from, rather than endless rows of packaged goods. Wealthier retailers prefer to use other forms of non-plastics packaging for those consumers happy to pay the premium for the convenience of packaging.

Values have started to shift as well. People are more frugal than they used to be, and in this respect the economic shift was aligned with the so-called 'green value shift', which had been noticeable before 2015. There's more social contact in this world, partly because there is less traffic and people use the pavements to get around more than they used to, but also an increase in virtual contact via the habitual use of video conferencing (rather than business travel). People look healthier and there's some (disputed) evidence that mental health has improved as a result. A certain segment of wealthy consumers are unwilling to accept the compromises they must make on the their quality of life and flee to other countries. These are often places rich in oil where it is possible to use one's affluence to purchase the lifestyle of choice.

Some people feel that the government should do more. Fuel rationing schemes and individual carbon quotas have been introduced intermittently in the UK and other parts of the EU, primarily to respond to short-term crises. There's social unrest in many poorer areas of the UK, with a growing underclass of socially excluded resource 'have-nots, emerging, particularly in those areas with no effective political leadership or without the necessary resources to invest in micro-units or other relatively expensive technological solutions. The introduction of some protectionist economic policies (permitted under the so-called EU 'compromise clause') pushed prices up, but kept more people in work than would otherwise be the case. The UK economy has seen a

slight resurgence in knowledge-based manufacturing in the past 5-10 years, just one result of such policies.

One predictable side-effect of the change in environmental and economic circumstances is that the previous boom in the number of single households has dissipated. People simply can't afford the energy or property costs involved in living on their own. Family breakdown rates are much as they were in the early 2000s, but people are now far more likely to share with others to spread costs. There are far more multi-person households than there used to be and the number of single-person households has been in decline for the past 5 years. The result overall is that the number of households is about the same as it was in 2005. Press reports suggest a growing trend for developers to create new shared housing from houses that were converted into single-person flats during the property boom 30 years previously.

9.3 Key events

- 2005-2015: UK economy grows at a rapid rate, but begins to struggle in the face of increasing energy prices and growing resource constraints.
- 2020: Great Collapse occurs, with most economies falling into recession following instability and excessive increases in oil prices and other resources.
- 2020: Introduction of fuel rationing and individual carbon quotas in operation on an intermittent basis; other measures followed.

9.4 Review of key characteristics

UK economy

The UK economy has been greatly influenced by developments in the international arena. Both increases in and instability in energy prices have slowed growth in all sectors. Consumer spending has dropped as people have become more frugal and prefer to keep and reuse goods rather than purchase new items. Though there is some central planning and provision, each local area or community has greater responsibility for determining how to live within its means (Proximity Principle was introduced in waste management and, together with the high cost of transport, has led to greater regionalisation of physical resources management).

Manufacturing and industry

The nature of manufacturing has shifted to reflect the change in focus in consumption. Products are made to last longer and manufacturing processes altered to become less resource intensive. Improving quality and performance has become critical, with a growth in R&D-intensive advanced manufacturing. With limited investment in capital and infrastructure, smaller scale production becomes more prevalent. With unpredictable and increasing oil prices, most forms of packaging become increasingly

expensive and a luxury only the wealthy can afford. Refills are available across an increasing range of categories.

Services

One of the key areas of growth has been the rise of repair services. As consumers often cannot afford to purchase new products, there is a preference to keep items for as long as possible. With the increased importance of community living, service delivery is often also local. With increased focus on social contact, the communications sector becomes important. As a result, employment levels are high, although most jobs in manufacturing were lost and most new jobs focus on repairing and servicing the existing infrastructures.

Agriculture and food

Following the Great Collapse, ensuring some kind of food security and/or self-sufficiency has become more of a priority at the national level, with transport and production costs increasing. Farming is generally very local in scope and organised to cater to the needs of the community. Few can afford international products because of the effect rising transport costs has had on relative prices. Consumption of seasonal foods is more prevalent by far than before the global turbulence, and as a result there is much more home- and allotment-based growing for local consumption. GM technology was used for a short period in some areas as a way to guarantee food security in some parts of the UK and yet avoid the kind of environmental damage associated with post-war intensive farming methods in the 20th century. More organic forms of production are also evident, partly as a reaction to the introduction of GM technology and also because of the localness they represent.

Spatial development and land use

There is little competition for land use as there is limited new development and construction (which tends to be on re-used land). With increased pressures on disposable incomes and a growth in the popularity of communal living, multi-person households find increasing favour across the country and therefore reduce the pressure and demand for new housing in most parts of the country. A greater proportion of land is actively used for farming food and energy crops (including biofuels) with a reduction in set-aside and increased amounts of green belt being put to agricultural use. In some wealthier areas, the management of green belt land and wild places is preserved by local governance, but in many other areas local environments are exploited and neglected.

Transport

With reductions in affluence, levels of personal mobility decrease. Only the relatively affluent are able to afford private vehicles and to take holidays abroad. Others struggle, using public transport, which, with little investment in improving infrastructure or capacity, provides a limited service. With a renewed focus on community and local living, many find they have less need to travel.

Energy

With no international co-ordination, planning or regulation over demand, energy prices have reached record levels. Consequently, there has been a drive to exploit more accessible forms of energy, in particular coal. Mines were re-opened and dependent on skilled lower cost labour from Eastern Europe. There has been some investment in developing renewable energy, but this was determined very much at the local level. Some areas have built bio-energy-fired CHP units, while others have focused investment on wind turbines and solar panels. Rationing and conservation measures have slowed overall energy demand.

Society

With lower levels of affluence, consumers have had to accept reduced standards of living and modified lifestyles. This has had knock-on consequences in terms of social structures and social interaction. Living on one's own becomes too expensive and shared living becomes more prevalent, a shift that was heralded in the 1990s and 2000s as house prices rose steadily and priced people out of the market, until well into their 30s in many cases. Dealing with power cuts, fuel rationing and other such restrictions has served to instil a strong sense of community in many areas. These attitudes and feelings are not shared among the very poor. There is a growing underclass of socially excluded resource –'have-nots' who live in areas with very badly degraded infrastructure and where there has been no investment in developing local resources. These individuals threaten the tranquillity of other areas. The most affluent in society use their wealth to 'escape' to other countries where they are able to enjoy a better quality of life.

Environmental and sustainability concerns

The UK Government has focused on securing economic growth, so concern for the environment is a lower priority. However, the impact of increasing prices caused by growing resource constraints has forced the Government to take measures to impose more sustainable forms of behaviour. With the adoption of more frugal, less materialistic lifestyles, consumer understanding and concern for the environment has grown. For many, this interest stems from ideological principles as much as from an interest in increasing personal quality of life. However, for most people frugality is a consequence of economic pressures and resource constraints: water stress and rising fossil fuel costs have led to a large take-up of measures for water conservation and recycling, home composting, micropower and sharing of facilities to reduce costs and impacts. Some of this is high tech – some is basic DIY. Ingenuity in achieving self-sufficiency and comfortable frugality has become a sought-after skill set and a source of social kudos for many. The status of UK biodiversity is a similarly mixed picture, with the natural environment flourishing in some areas as economic decline creates 'neglected spaces'; while the push for growth in other areas leads to a collapse in biodiversity and protection of landscape values and habitats.

International governance and relationships

In the period leading up to the Great Collapse, there was limited international co-ordination with the focus of major international agencies on promoting the interests of developed over developing countries. Following the Collapse, there is not much regard for international issues beyond commercial trade interests and whatever impacts national self-interest. Regional trade blocks still exist, but in general trade has dropped with increased self-sufficiency and higher transportation costs. However, developed economies rely on imports of more cutting-edge technologically advanced products from China and India, which have been able to create a valuable niche in this area.

9.5 Review of key indicators

Indicator	Baseline	'Survivor'
UK GDP average growth per annum over past 5 years	+2.3% per annum	Some decline compared to present day – significant slump in the interim period 2010-2020 – rise of informal batter economy
		+1.25% per annum approx.
		£16,500-£17,000
Income distribution (proportion of income held by poorest 10% to richest 10%)	1:4 £164:£654	To some extent, overall greater equity in wealth distribution with the flight of the very rich to the remaining stable oil- and/or coal-rich countries
		1:3.25
Gross government expenditure (as percentage of GDP)	42%	Slight increase in government spending as percentage of overall GDP, though lower in absolute terms
		45% approx.
Gross value added as percentage of total UK economy: services (S), manufacturing (M), agriculture (A)	S: 76% M: 23% A:10%	Significant slowdown in international trade – fewer exports
		20-22%
		S: 76-78% M: 20-22% A: 2-3%
		2.5-2.6
Number of households	24.1 million	Little change (falls a little after an increase)
		25-25.2m

10 'Jeopardy' (growth-led governance, material consumption)

10.1 Summary

In 2030, this scenario provides a picture of the UK in which consumption patterns intensify, with greater consumption of goods and services than in the present day. A 'consumption culture' pervades in the UK, but it is not evenly spread across society with the better placed able to enjoy affluent lifestyles.

There has been little intervention to curb consumption patterns, partly because the economies of the developed world are largely dependent on increased levels of consumer spending, but also because the predicted resource constraints and energy crises have not come to fruition as early as many experts had predicted. The much hailed economic pressure and increased energy demand from China and India has also not materialised as expected, largely through internal political constraints, social conflict and unexpectedly large improvements in resource-use efficiency in these countries.

There is also less intervention in the market place, partly because of the harsh realities of obtaining agreement in an enlarged EU, but also because of a belief in largely free-market economies and deregulation.

The global effects of climate change are visible to all, but this greater awareness of environmental impacts does not manifest itself in major changes in consumption behaviour. Serious environmental incidents and impacts are largely ignored by the UK population, except through donations to charities and contributions to disaster relief organisations.

By 2030, in the UK climate change is not yet associated with serious domestic problems or risks of disaster. It is assumed that gradual adaptation and application of new technologies will be sufficient to enable the UK to handle climate change. The argument has been won that economic growth must not be compromised as, first, it secures UK competitiveness and, second, it generates the wealth and technology required to deal with climate change at home and abroad.

10.2 Full scenario narrative

In the first 30 years of the 21st century the global economy has seen a lot of turbulence. However, the key political and economic powers remain as they have been for the previous 40 years. The global resource scarcity that was predicted and feared by many in relation to food, energy, water, etc., has, by and large, not yet had a major

impact on the economies of the developed world. As a result the environment remains a secondary issue for most consumers and political leaders of the developed world.

The influence from China and India on the more developed economies that was anticipated at the turn of the century has not quite materialised. While these economies saw strong growth in the first 5-10 years of the 21st century, political barriers to further growth, particularly in China, emerged more quickly than many had predicted. The newly affluent middle classes, eager to hold on to their new found wealth, found themselves at odds with demands from the poor and working classes, on whom so much of the growth had been founded. Social and political conflicts emerged, and have yet to be fully resolved. Growth slowed as industrial disputes began to emerge, with the middle classes effectively putting a brake on growth. Despite rising labour costs, China continues to be a supplier of relatively cheap goods to the rest of the world, but it has not threatened the developed world's position as leaders in the knowledge economy of the 21st century.

As a result, the more developed economies continue to thrive, based on increased, and in many parts, intensified consumption. The global economy is increasingly based on a highly technical, knowledge- and service-based industries, and a constantly updated and improved range of products and services. Innovation is key.

At the global level, world poverty remains an issue, with the gap between rich and poor nations intensifying over the previous 30 years, despite regular, repeated pronouncements from the discredited G8. Despite regular vocal protests about the issues, there remains a lack of concerted action on issues that relate to both poverty and wider sustainability (there is certainly increasing evidence of environmental damage, including climate change impacts, in parts of Sub-Saharan Africa). International bodies such as the G8, UN and WTO are widely discredited, seen as ineffectual in dealing with these global issues. However, this general concern doesn't transform itself into changed behaviour or consumption patterns in the developed economies that are responsible for a significant part of the global environmental impacts.

In fact for many in developed society there is no real perception of the serious environmental damage that has resulted over the past 25 years. Certainly, the widely predicted energy crises have not emerged, despite the odd rise in prices from time to time. This is largely through investment in developing infrastructure and improving supply capacity in oil-producing countries. And most developed societies have seen very limited environmental damage in their own countries, which appear to have more resilient environments than those in other parts of the world. The political debates tend to be focused around the socio-economic problems of the poorer parts of the world, and there is little focus on the environmental damage in these areas, despite reports of the social repercussions of climate change and water shortages in many of the areas.

The exceptions, as in 'Alchemy', relate to waste and water, but these have not had a major impact on lifestyles or overall values and attitudes. Awareness of waste and recycling was established by the 2000s as a marker of being a concerned green citizen, and there has been little resistance to further measures to boost recycling and develop new local waste facilities. Water demand management is established in areas

prone to drought across the South East and East Anglia, but the limited lifestyle changes required have been absorbed with no impact on the rest of consumers' behaviour. The UK has prospered, with stable levels of growth over the past 15-20 years and continual rises in the level of consumer spending and disposable income. However, this story of increasing affluence, choice and prosperity is not shared by everyone in the country. The polarisation of UK society has increased since the turn of the century. Large parts of the population are little, if any, better off than they were 25 years ago. The relative gap between the bottom 10% of the UK population and those in the top 10% has increased for a wide range of indicators, including economic wealth and social indicators (such as health and indexes of social deprivation), as well as environmental and wider quality-of-life considerations. This has had negative implications in terms of increasing social conflict in some urban communities. A rise of gated communities has ensued, with affluent households increasingly ensuring that they have everything they need in house, including water and energy supplies. With crime on the increase, regulation has focused on maintaining security, stability and the status quo. Security at a national, as well as global level is key – certainly more important than any concern for the environment and wider concerns about social sustainability.

UK domestic policy has focused on continuing economic growth, and the national and, increasingly, local management of environmental impacts. The dominant environmental issues that remain on the (diminished) public agenda are local responses to global concerns and issues, such as urban regeneration, environmental deprivation and exclusion, contaminated land, waste and pollution control, and traffic management. Contingency plans for emergency global mitigation technologies (such as carbon sequestration, solar deflectors, etc.) have been discussed for the past 10 years, but are yet to be implemented because of continuing uncertainty about the risks involved.

There has been little sustained effort to curb consumption patterns over the long term, partly because the economy remains dependent on increased levels of consumer spending, particularly among the affluent middle classes. However, problems of congestion are increasing and much of the UK infrastructure that was creaking at the turn of the century is now in disrepair.

Short-term measures have been introduced and improvements made in some instances, for example in reaction to rising numbers of sewage treatment failures, which caused public health concerns in many parts of the country in 2020. In most other cases, society has simply adapted its behaviour, as it did during the continuing power cuts of 2022, which resulted in a growing demand for private generators and solar and wind power in the home.

The rising population in the UK, much of it resulting from new forms of economic immigration, has led to increased congestion and an increased demand for housing in and around urban areas. There is a continuing desire for single-person households, which has consequences in terms of increased resource consumption. There is less need for social interaction in this post-digital world, in which technology enables face-to-face interaction via a screen at the touch of a button. Nevertheless, the desire for personal mobility and foreign travel (particularly for leisure purposes) remains.

The regulatory framework has not moved on much for the previous 25 years. At a European level, fears of competition from the developing economies of India and the Far East during the first 10 years of the century have combined with a crisis of confidence in the EU project and entry of additional member states to limit the ability or willingness of the EU Commission to intervene too strongly on social and environmental issues.

Europe has become very much a political and economic project. Agreement on longer term social and environmental issues has been much harder to obtain in an enlarged EU, with many member states still struggling to put the necessary arrangements in place to bring their systems into line with the more basic EU requirements. The implementation of directives agreed at the turn of the century has also been patchy, with the Commission seemingly unable to enforce stringent penalties on member states.

As a result, a host of local environmental management issues is arising. The socio-economic polarisation of society is also seen in relation to the relative quality of local environments. For example, while the creaking infrastructure means that UK water quality is lower than it was 25 years previously, there are very significant differences across the country and between neighbouring localities. The lowest quality water can be found in deprived urban areas, while neighbouring affluent areas can afford micro-filtration facilities to serve their community, or bottled water supplies (in which there is an ever-increasing market). Similar patterns exist in relation to congestion levels and air pollution. In many cases the response to environmental problems has been privatised: air conditioning units, water storage and filtration units, housing insulation and solar and wind power generators are all growth markets, in many cases minor status symbols for the population at large.

NIMBY mentality reigns in many parts of the country, particularly in relation to waste management. Incineration and CHP plants are on the increase, but remain unseen by the affluent majority who boycott their location in their neighbourhoods.

In fact, this export of the environmental impact can be seen throughout society at both a national and global level. After all, the UK has been exporting much of its waste as raw materials to other countries for the past 20 years, along with many of our other environmental problems…

10.3 Key events

- 2015: Political and economic turmoil in the developing economies limits their further economic growth.
- 2015 onwards: Strong growth of UK economy.

10.4 Review of key characteristics

UK economy

The UK, along with other Western European economies, has prospered following the removal of competitive pressures from China and India, and potential constraints on key resources. With high levels of consumer spending among the affluent majority, demand across all sectors remains high. There is little regulation or intervention in the marketplace with a belief in free-market principles.

Manufacturing and industry

Developing countries continue to be important suppliers of low-cost manufactured goods. However, in the face of buoyant global demand, there is strong growth in the UK industry. Companies invest in developing high tech or specialist offers, driven by booming consumer demand. Innovation drives the market place in this consumption-led society as individuals seek new and interesting ways to spend money.

Services

The service sector grows in absolute and relative terms. With increasing levels of affluence among an important middle class, there is demand for the provision of higher end and specialised services, in particular around media, communication and leisure. The informal service sector grows: with increasing polarisation in society, more people are excluded from the mainstream job market and take low-skill, low-pay jobs.

Agriculture and food

There is little self-sufficiency in food supplies with a heavy reliance on imports. Agricultural subsidies have been cut back and increased competition forces farmers to look for ways to improve productivity. There is a polarisation between farming that relies on input from improvements in biotechnology and more intensive production methods to cut costs and prices, and farming of more organic, natural or local foods sought by the wealthy. This leads to some very polarised and localised variations across the UK, with attractive market gardens being planted in areas of affluence, generally around London and the South East, and major agri-food businesses operating from large estates in certain parts of the country. Elsewhere, less well-off areas are surrounded by fields sown with GM crops and sprayed with significant doses of synthetic fertiliser. There is little positive management of landscapes in lowland areas, where the lack of suitable agri-environment provision has left little for traditional farming families to depend on. Food is mostly imported and processed, but with added 'functional' benefits and ingredients for those who can afford them.

Spatial development and land use

Competition for land further increases with the growth in single-person households and demand for more secure forms of housing in the face of increasing social tension. These pressures are particularly acute in the South East and East of England, where

little has been done to redress stresses and strains on key infrastructures and most major housing developments have been located over the previous 10 years. High-rise accommodation dominates in certain areas and the social infrastructure, such as public sector schools and hospitals, are overloaded in many of the most densely populated areas. The wealthy have ensured that their living spaces remain untouched by 'unsightly developments'. Gated communities have become common in urban areas.

Transport

As fuel remains affordable, there has been no constraint to personal mobility nor a step change in the nature of vehicles driven. Car use has increased with continued growth in single-person households, a consequent increase in the dispersal of the population and a greater need to travel to be with others. Air travel is generally regarded as a 'right' that few would question.

Energy

There has been little major investment in new forms of infrastructure over the period. There is general reliance on non-renewable forms of energy, which remain affordable following investment in increasing capacity among oil-producing countries. In a market dominated by private companies, there has been little concern to ensure equitable supply to individuals. Basic infrastructure has degraded and there are frequent power cuts. An increasing proportion of wealthy consumers have invested to ensure their own energy supply, for instance by purchasing private generators, or installing solar panels and energy storage systems. Others, in less affluent areas, have constructed incineration and CHP plants.

Society

Increasing affluence, choice and prosperity is not shared by everyone in the country. The gap between the bottom 10 per cent of the UK population and those in the top 10 per cent has increased on a wide range of indicators, including economic wealth, social indicators (such as health and indices of social deprivation) and environmental and wider quality-of-life considerations. Social tension flares into conflict in a number of areas. There is increased physical fragmentation across society with the rise of gated communities in urban areas and a reduction in the need for true face-to-face interaction with improved communication technologies. Status consumption, including ownership of the latest high-tech gadgets, is a key trait of the very affluent.

Environmental and sustainability concerns

Though there have been a number of environmental disasters, concern about the condition of the global environment has yet to intensify in the minds of most individuals in developed economies. These events have had relatively little impact on their lives. With supplies of key resources still plentiful, and reluctance on the part of Governments to introduce measures that will shift consumption patterns and alter behaviour, there has been little incentive to adopt more sustainable forms of behaviour. The exceptions relate to waste and water, but these have not had a major impact on lifestyles or overall values and attitudes. Awareness of waste and recycling was established by the

2000s as a marker of being a concerned green citizen, and there has been little resistance to further measures to boost recycling and develop new local waste facilities. Water demand management is established in areas prone to drought across the South East and East Anglia, but the limited lifestyle changes required have been absorbed with no impact on the rest of consumers' behaviour. Attitudes towards biodiversity are similarly dependent on individual responses, with the wealthy acting out of self-interest to ensure a small number of areas have greater protection against a general backdrop of continued decline in biodiversity, as most people do not regard this as a priority.

International governance and relationships

International decision-making bodies and agencies have little influence or authority in helping to address global inequality or enforcing environmental targets or regulations. International relations and activity tend to be dominated by wealthy nations. who seek to protect their own economic interests. Support for poorer nations tends to be in the form of *ad hoc* charitable donations in response to disasters and crises as and when they occur.

10.5 Review of key indicators

Indicator	Baseline	'Jeopardy'
UK GDP average growth per annum over past 5 years	+2.3% per annum	Some increase in growth rate compared to current rate
		+3% per annum approx
		£25,500-£26,000
Income distribution (proportion of income held by poorest 10% to richest 10%)	1:4 £164:£654	Increased income polarisation – paying for 'basics' takes up large proportion of the income for the poor
		1:5.5
Gross government expenditure (as percentage of GDP)	42%	Significant decrease in government expenditure with increased privatisation and many services beyond the basics provided through other channels and corporations
		Under 40%
		33-35%
Gross value add by sector as percentage of total UK economy: services, S; manufacturing, M; agriculture, A	S: 76% M: 23% A: 1%	Likely to be continuation of current trends: shift to services with decline in manufacturing – agriculture sector is small but fairly stable
		S: 77-79% M: 20-22% A: 1%
		1.99-2.1
Number of households	24.1 million	Significant growth in number of households with growth in single-person households
		32.9-35.3 million

11. Comparing the scenarios

11.1 Review of key socio-economic indicators across the scenarios

Indicator	Baseline	'Restoration'	'Alchemy'	'Survivor'	'Jeopardy'
		Sustainability-led governance; dematerialised UK consumption	Sustainability-led governance; material consumption	Growth-led governance; dematerialised UK consumption	Growth-led governance; material consumption
UK GDP average growth per annum over past 5 years	+ 2.3%	+2% approx.	+2.5% approx.	+1.25% approx.	+ 3% approx.
Annual real household disposable income	£12,521	£20,000-£20,500	£22,500-£23,000	£16,500-£17,000	£25,500-£26,000
Income distribution (proportion of income held by poorest 10% to richest 10%)	1:4£164:£654	1:3·75	1:4·5	1:3·25	1:5·5
Gross government expenditure (as percentage of GDP)	42%	50% approx.	42-3% approx.	45% approx.	Under 40%
UK exports chained volume measure (as percentage of GDP)	£289,007 million (27%)	25-27%	32-34%	20-22%	27-29%
UK imports chained volume measure (as percentage of GDP)	£330,436 million (31%)	28-30%	31-33%	24-26%	33-35%
Gross value add by sector as % of total UK economy: services, S; manufacturing, M; Agriculture, A	S:76% M: 23% A: 1%	S:75-77% M: 22-24% A: 1-1.5%	S:80-82% M: 17-19% A: 1%	S:76-78% M: 20-22% A: 2-3%	S:77-79% M: 20-22%% A: 1%
UK population	59.6 million	66-68 million	66-66 million	63-65 million	67-69 million
Average household size	2.4	2.4-2.5	2.2-2.3	2.5-2.6	1.9-2.1
Number of households	24.1 million	27.2-27.5 million	28.7-30 million	25-25.2 million	32.9-35.3 million

11.2 Observations

As highlighted earlier, the four scenarios are not predictions. They are descriptions of diverse views of the future, each of which should be plausible and internally consistent. In reality the future is very likely to contain elements of all four scenarios, within countries and social groups, and across the global system. It is likely some developments that we have not imagined will prove significant.

The scenarios reflect the possible workings of important tendencies, value systems, technological pathways and socio-economic structures that are already established or clearly emergent in the UK and beyond.

In 'Restoration', change in the wider environment amplifies existing societal and political concerns about the risks from ecological degradation and these both promote and are reinforced by changes in policy, technology and incentives. The dominant ethos behind change is one of emerging 'altruism' and an 'enlightened self-interest', which in practice are hard to tell apart and which have similar effects. The assumption behind the development of this scenario is that a tipping point is reached in the evolution of this ecological consciousness before many dangerous tipping points are triggered in the global ecology itself. The interaction of shared concerns among states, communities and individuals generates a kind of global 'consciousness' that underpins effective innovations in international governance and facilitates new forms of regulation. The scenario thus envisages a widespread influence of what are currently minority 'post-materialist' values, through both environmental changes and through a shift from resource-intensive consumption to service and 'experiential' consumption. This is reinforced by developments in ICT and the introduction of policy measures to restrict resource intensity and promote resource efficiency and conservation.

In 'Alchemy' and 'Jeopardy' the salience of the global environment is much less, for different reasons. In 'Alchemy', the recognition of the ecological challenge has been met not by a mix of demand-side and supply-side changes, as in 'Restoration', but by an aggressive emphasis on supply-side measures and, particularly, supply-side technology. This scenario thus takes forwards a clear and strong tendency in current responses to environmental risks, namely an assumption that new technology and human ingenuity will ensure that risks can be overcome, coupled with a deep political and public reluctance to contemplate radical changes in consumption and in personal choice. 'Alchemy' assumes that supply-side policies can be successful, if not in overcoming global ecological problems, then at least in containing some of them and insulating society and economy. By contrast, in 'Restoration', the political and social consensus is that such insulation is neither possible nor justifiable.

'Jeopardy' projects a future in which the aggressive supply-side investment that underpins 'Alchemy' has not been seen to be necessary. The lack of overwhelming external pressures of environmental disruption and international economic competition for market share and resources have not been felt to anything like the extent in the other scenarios. To a large extent, then, Jeopardy is a scenario that offers a heightened version of the short-termist and divisive tendencies in present-day society, politics and economy, and sees their effects as becoming increasingly dominant over the longer term.

'Survivor' is the sole scenario in which the modern political and economic system has been severely disrupted. Change has not been managed, as in the other scenarios, but has instead run out of control. Ecological and economic 'tipping points' have been reached, which results in a general crisis and 'phase change' of the system that greatly reduces complexity, interaction and the global impact of human activities. However, while some environmental risks and resource pressures might be lessened by the effects of the 'Great Collapse', for example the increased use of recycling, importantly the retrenchment of economic activity and the increased regionalism and localism of governance and trade do not lead to the improved environmental conditions that are a benefit of much more constrained consumption and self-reliance. Lack of capacity for infrastructural investment and maintenance along with increasing pressure to secure key local resources mean that local environmental quality actually declines in many places of the UK.

One can consider the nature of the UK's adaptive capacity and likely responses to climate change under each of the scenarios. The 'Restoration' scenario, with its greater emphasis on longer term sustainability and foresighted planning, would probably have a more proactive and anticipatory approach to mitigation and adaptation. This could be driven centrally to avoid the impacts before they occur where possible, and perhaps also on a global scale, for example in relation to the most at-risk areas of the world. By contrast, the 'Jeopardy' scenario is likely to have a more reactive approach to adaptation, using the economy's ability to pay to address impacts when and where they happen rather than making any additional upfront investments in adaptive measures. This is, for example, reflected in the concentrated nature of development and population density in this scenario, with significant increases in both the East and South East of England. The 'Alchemy' scenario is more inclined to use technical solutions to adapt to climate change, such as new flood defences to deal with such circumstances, particularly given the relative high levels of prosperity and public funding available in this scenario. However, such investment in high-tech adaptation measures is less affordable in the 'Survivor' scenario. In this the approach is likely to be more reactive, as the economy and country have a limited ability to do anything else given other short-term priorities, except, perhaps, at a very local level and therefore in a very polarised fashion.

Overall, then, these scenarios operate on the basis of assumptions about the interaction of global environmental and economic pressures with the distribution of resources that we see now in the UK and the rest of the world. The pathways that might lead to the four scenarios are shaped by the salience of environmental risk and the experience of global climate change impacts versus the degree to which it can be suppressed or ignored, and by the degree to which international interdependence develops by contrast with international competition. These interactions lead to very different patterns of governance and material consumption and suggest a range of different responses to manage the pressures on the UK environment and the common concerns of global environmental change.

12. Review of other socio-economic and environmental scenario sets

As highlighted earlier, other leading scenario frameworks in use by policy makers concerned with globalisation, environmental change and technological innovation were reviewed as part of the process to develop our thinking. In the following section, we comment on their scope, aims and processes, and indicate points of overlap and divergence from the scenarios developed as a part of the current project.

We have reviewed the following scenario systems:

- UKCIP BESEECH (Building Economic and Social Information for Examining the Effects of Climate Change) framework for socio-economic and political analysis to complement UKCIP's detailed climate change scenarios[36];
- UK Government Foresight programme's scenario framework[37];
- Shell's 2005 scenario set[38];
- IPCC's SRES framework for socio-economic and political scenarios to complement detailed climate change impacts and emissions scenarios[39];
- Millennium Ecosystems Assessment[40];
- OST Future Flooding[41];
- OST Intelligent Infrastructures[42];
- Great Transition scenario set[43].

12.1 UKCIP and Foresight

The UKCIP programme of scenarios for climate change is complemented by a set of scenarios for the wider social and economic background. These were developed with the Engineering and Physical Sciences Research Council (EPRSC) in a consortium called Building Knowledge on Climate Change (BKCC), with research support from the Policy Studies Institute in a research project called BESEECH. The goal of the

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[36]Policy Studies Institute, BESEECH *(*Building Economic and Social Information for Examining the Effects of Climate Change*),* September 2005.

[37]Department of Trade and Industry, Foresight Futures 2020*,* September 2002.

[38]Shell International Unlimited, The Shell Global Scenarios to 2025*,* June 2005.

[39]IPCC (Intergovernmental Panel on Climate Change), Emissions Scenarios, 2000.

[40] Millennium Ecosystem Assessment, *Ecosystems and Human Well-being*, 2005.

[41]Department of Trade and Industry (Office of Science and Technology), Future Flooding Executive Summary*,* 2003.

[42]Department of Trade and Industry (Office of Science and Technology), Intelligent Infrastructure Futures – The Scenarios Towards 2055*,* Feb 2006.

[43]Stockholm Environmental Institute (Global Scenario Group), *Great Transition,* 2002.

BESEECH project was to meet the need for 'consistent socio-economic information, additional to that provided in the UKCIP Socio-Economic Scenarios (UKCIP 2001), for use by the individual BKCC projects'.

The main objectives of the BESEECH research project are as follows: 'to conduct innovative work on the adaptive capacity of systems in the built environment; to use the results to generate enhanced socio-economic scenarios for use by the existing BKCC suite of projects; and to synthesise the socio-economic elements of the BKCC portfolio'.

The BESEECH framework for UKCIP is the same as that devised for the UK Government Foresight 2020 programme. This framework is intended to be a consistent background analytical system for scenarios and technological foresight work across a very wide range of projects and subject areas.

The framework is based on two axes:

- governance : interdependence contrasted with autonomy;

- values: consumerism contrasted with community.

These generate four quadrants for scenarios:

- World Markets: globalisation proceeds apace, great international interdependence, dominance of consumerism as a value set, global governance geared to market development and trade;

- National Enterprise: personal autonomy and consumer values are strong, but in a context that places emphasis on national identity;

- Local Stewardship: community-based identity and values, environmental focus for economy and technology, predominantly regional and local scale for economy;

- Global Sustainability: ecological focus for values, combined with high level of international integration in economy, governance and technology.

The BESEECH summary of the key features of the scenarios is as follows:

- The National Enterprise scenario sees people aspiring to personal independence and material wealth within a nationally based cultural identity. Liberalised markets together with a commitment to build capabilities and resources to secure a high degree of national self-reliance and security are believed to best deliver these goals. Political and cultural institutions are strengthened to buttress national autonomy.

- In the Local Stewardship scenario, people aspire to sustainable levels of welfare in federal and networked communities. Markets are subject to social regulation to ensure more equally distributed opportunities and a high-quality local environment. Active public policy aims to promote economic activities that are small-scale and regional in scope, and acts to constrain large-scale markets and technologies. Local communities are strengthened to ensure participative and transparent governance.

- In the World Markets scenario, people aspire to personal independence, material wealth and mobility to the exclusion of wider social goals. Integrated global markets are seen as the best way to deliver this. Internationally co-ordinated policy sets framework conditions for the efficient functioning of markets. Wherever possible, the

provision of goods and services is privatised, under the principle of minimal government. Rights of individuals to personal freedoms are enshrined in law.

- Under the Global Sustainability (renamed Global Responsibility in DTI's application of these Foresight scenarios) scenario, people aspire to high levels of welfare within communities with shared values, more equally distributed opportunities and a sound environment. These objectives are thought to be best achieved through active public policy and international co-operation within the EU and at the global level. Social objectives are met through public provision, increasingly at an international level. Markets are regulated to encourage competition among national players. Personal and social behaviour is shaped by commonly-held beliefs and customs.

Alignment between the UKCIP scenarios, Foresight Futures 2020 and the Environment Agency 2030 scenarios

This scenario framework has some important points of contact with the scenarios presented in this report of work for the Environment Agency 2030 scenarios. Their governance axis has a good deal in common with the axis this project has used around sustainability-led versus growth-led governance, but in the Foresight BESEECH axis the emphasis is on the spatial scale of governance rather than the perspective brought to bear on policy making. There are overlaps here, such as supra-national systems might be more likely in many ways to take a sustainability-led view of problems and policies and, to the extent that they do, there is much common ground between the scenario axes and the results they generate.

However, we argue that there is no intrinsic connection between level of governance and the perspective on policy problems and solutions, as indicated by the horizons of bodies such as the G8 and IMF and by the persistent NGO critique of short-termism in international governance organisations. The nature of the policy perspective axis used in this Environment Agency–Henley Centre Headlight Vision scenario framework reflects this general point and provides, we think, a stronger basis for contrasting scenarios.

On the other axis, the Foresight BESEECH model focuses on value sets rather than material intensity. We contend that both the axes developed in this project provide an implicit indication of possible value sets as well as allowing for an axis related to the basis of productive power in the economy. By contrast, the Foresight BESEECH model derives its more material qualities from the interaction of two 'value-based' ideas that govern the axes.

12.2 SRES scenarios from IPPC

A more elaborate system has been constructed for the IPCC to complement the emissions scenarios developed for climate change policy research. SRES contains a range of scenario 'families', with variations developed for each that depend on assumptions about the energy mix. In all, 40 scenarios are generated from the families.

The scenario families are:

- A2 – emphasis on self-reliance and preservation of local and regional and other forms of traditional or rooted cultural identity; mainly regional scale for economic activities;

- B1 – service-based economic development; ICT-intensive economy and society; focus on relative dematerialisation of economic growth; focus on sustainable development values and policies;

- A1 – very rapid economic growth; globalisation proceeds intensively and there is a high level of economic interdependence;

- B2 – a more locally focused variant of B1.

Here there are clear overlaps with both Foresight BESEECH and with the scenarios developed as part of the Environment Agency 2030 project. However, there is less coverage of the kinds of social disruption we have attempted to outline as a consistent scenario in the 'Survivor' scenario.

SRES introduces complexity and variability into the families above through sub-scenarios that focus on how each of the above handle three different models for the energy mix:

- fossil-fuel intensive development;

- balanced fossil, renewables and other mix;

- mainly non-fossil fuel.

Alignment between the SRES set and Environment Agency 2030 scenarios

Significant comparisons can readily be drawn between the SRES scenarios and the scenarios developed for the current project.

In SRES the A1 storyline and scenario family describes a future world of very rapid economic growth, global population that peaks in mid-century and declines thereafter, and the rapid introduction of new and more efficient technologies. Major underlying themes are convergence among regions, capacity building and increased cultural and social interactions, with a substantial reduction in regional differences in per capita income. The A1 scenario family develops into three groups that describe alternative directions of technological change in the energy system. The three A1 groups are distinguished by their technological emphasis: fossil intensive (A1FI), non-fossil energy sources (A1T) or a balance across all sources (A1B). There is a clear parallel here in the initial growth phase (note that SRES goes well beyond our 2030 limit) with elements of our 'Jeopardy' scenario (and also, to a lesser extent, with 'Alchemy') and with Foresight's World Markets scenario (and, to a lesser extent, National Enterprise).

The A2 scenario family describes a very heterogeneous world. The underlying theme is self-reliance and preservation of local identities. Fertility patterns across regions converge very slowly, which results in a continuously increasing global population. Economic development is primarily regionally oriented and per capita economic growth and technological change are more fragmented and slower than in other storylines. The parallels here are with the Foresight Local Stewardship scenario and with Eco-

communalism from the Great Transition study (see below) and, to a lesser extent, with the 'Survivor' scenario presented in this report.

The B1 storyline and scenario family describes a convergent world with the same global population that peaks in the mid-21st century and declines thereafter, as in the A1 storyline, but with rapid changes in economic structures towards a service and information economy, with reductions in material intensity and with the introduction of clean and resource-efficient technologies. The emphasis is on global solutions to economic, social and environmental sustainability, including improved equity, but without additional climate initiatives. The companion scenarios from the Environment Agency 2030 set are 'Restoration' and, to a lesser extent, 'Alchemy', and the Foresight equivalent is Global Sustainability.

The B2 storyline and scenario family describes a world in which the emphasis is on local solutions to economic, social and environmental sustainability. It is a world with continuously increasing global population at a rate lower than in the A2 intermediate levels of economic development, and with a less rapid and more diverse technological change than in the 'B1' and 'A1' storylines. While the scenario is also oriented towards environmental protection and social equity, it focuses on local and regional levels. Again, there are parallels with the Foresight Local Stewardship scenario and with Eco-communalism from the Great Transition study (see below). Limited parallels can also, perhaps, be made with elements of the 'Survivor' scenario presented here, and also, to some extent, with our 'Alchemy' scenario.

12.3 Shell 2005 scenarios

The Shell Corporation is famous for its long-term development of scenarios for business planning. Over the years many formats have been tried and the scenario framework varies in the number of narratives produced. The latest framework uses three scenarios based on the interaction of three key shaping factors that influence values and policies. The factors are:

- efficiency and market focus;

- social cohesion and 'force of community';

- security.

These form a triangle of factors that generate three scenarios:

- Low Trust Globalisation: globalisation predicated on strong national security interests and market regulation that is rooted in competition and 'realism' rather than aspirational values concerning co-operation and interdependence;

- Open Doors: globalisation that is rooted in more open and co-operative values and a sense of interdependence, respect for local identities and ecological sustainability;

- Flags: much less global co-operation and sense of interdependence; dogmatic cultural values drive policy and international and national interactions; more prevalence of conflict and potential for social tension and aggression.

Again, there are clear parallels with aspects of the scenarios framework developed as part of this project and with the other systems outlined above. Shell does not focus

mainly on environmental issues in its analysis using the scenarios, but does cover climate change in some detail. It posits that while Open Doors is the world most amenable to sustainable development values, it is also a world in which environmental impacts are magnified by the extent to which it facilitates globalisation of trade, travel and technology transfer. By contrast, the other scenarios, rooted in values that are far from 'green', tend to create less global ecological impact because of the constraints they place in their different ways on globalisation.

12.4 UN Millennium Ecosystem Assessment

This major UN-led initiative is a comprehensive analysis of the state of key environmental 'services' generated by ecosystems around the planet. The Assessment also includes scenarios that complement the specialist environmental research and models in its report. These scenarios are developed using quantitative models and qualitative analyses and the output also has much in common with the Foresight BESEECH system and with the scenarios developed as part of the Environment Agency 2030 work. The four scenarios are:

- Global Orchestration;

- Order from Strength;

- Adapting Mosaic;

- TechnoGarden.

Each scenario is described below in the Assessment report's own words.

Global Orchestration depicts a globally connected society that focuses on global trade and economic liberalisation and takes a reactive approach to ecosystem problems but that also takes strong steps to reduce poverty and inequality and to invest in public goods such as infrastructure and education. Economic growth in this scenario is the highest of the four scenarios, while it is assumed to have the lowest population in 2050.

This appears to have a mixture of different elements of our 'Restoration', 'Alchemy' scenarios and also to various of the Foresight scenarios, particularly Global Sustainability.

Order from Strength represents a regionalised and fragmented world, concerned with security and protection, emphasising primarily regional markets, paying little attention to public goods, and taking a reactive approach to ecosystem problems. Economic growth rates are the lowest of the scenarios (particularly low in developing countries) and decrease with time, while population growth is the highest.

There are elements here of Shells' Flags model and echoes of the 'Survivor' scenario from the Environment Agency 2030 project.

Adapting Mosaic shows how regional watershed-scale ecosystems are the focus of political and economic activity. Local institutions are strengthened and local ecosystem management strategies are common; societies develop a strongly proactive approach

to the management of ecosystems. Economic growth rates are somewhat low initially but increase with time, and population in 2050 is nearly as high as in Order from Strength.

This has echoes of both the 'Alchemy' and 'Restoration' scenarios from the Environment Agency 2030 work.

TechnoGarden *depicts a globally connected world relying strongly on environmentally sound technology, using highly managed, often engineered, ecosystems to deliver ecosystem services, and taking a proactive approach to the management of ecosystems in an effort to avoid problems. Economic growth is relatively high and accelerates, while population in 2050 is in the mid-range of the scenarios.*

This scenario appears to be very closely aligned to the 'Alchemy' scenario presented in the Environment Agency 2030 work. In fact, it could be said to be the most closely aligned with 'Alchemy' of all of those reviewed in this section of the report.

12.5 OST Foresight Programme: Future Flooding Scenarios

Within the UK Foresight framework the Future Flooding project analysed future flood risk in a scenario framework for the whole country. The analysis forecasts "increasing flood risk unless current flood management policies and investment levels are changed, with an increase of up to 20-fold in economic risk by the 2080s".

The Future Flooding work makes use of the UKCIP climate change impact scenario framework and integrates this input with the overarching Foresight Futures 2020 scenario set described earlier.

The 20-fold increase in risk that is described above is an outcome of the interaction of climate change impacts with the growing value of national household, industrial and infrastructural assets. Potential responses to flooding vary widely in the Foresight socio-economic scenarios. However, what the study calls 'social vulnerability to flooding' is expected to increase regardless of the scenario that occurs. The study concludes that "there will be a major need for engineering responses to meet the increased flood risk in all of the future worlds".

The study considers which scenarios could produce responses more likely to be effective in reducing the risk and states that "It is clear from this analysis that sustainability is, overall, closely related to scenario, with the two higher emission, consumer oriented futures failing on many more [of the selected] metrics than the lower emission, community-centred scenarios. While, no response scored highly in effectiveness and sustainability across all four scenarios, it is noteworthy that Catchment-Wide Storage, Land-Use Planning and Coastal Defence Realignment [strategies] potentially produce environmental benefits, reduce flood risk and have little or no sustainability penalties. These can therefore be considered to be reasonably robust to socioeconomic and climatic change."

The report argues that, on this basis, the Foresight Global Sustainability and Local Stewardship futures "would support many more sustainable responses than would 'World Markets' or 'National Enterprise'". In practice, application of principles of social equity and precautionary [sic] in the design and implementation of responses to flood risk would improve sustainability irrespective of the wider socio-economic scenarios.

12.6 OST Foresight programme: intelligent Infrastructure Systems

The Foresight Project on Intelligent Infrastructure Systems (IIS) set out to examine the challenges and opportunities for the UK in bringing 'intelligence' to its infrastructure – the physical networks that deliver such services as transport, telecommunications, water and energy. In particular, the project explored how, over the next 50 years, we can apply science and technology to the design and implementation of an intelligent infrastructure for robust, sustainable and safe transport, and its alternatives. The project focused on the acceptance of intelligent infrastructure and the environmental impact of transport as the key uncertainties in the application of IIS in transport.

The project (undertaken by Henley Centre Headlight Vision) generated four scenarios. The scenarios arise from two 'axes of uncertainty'. These axes encapsulate the uncertainties for the future, and help frame the scenarios and possible future outcomes.

The first axis, 'Accepting of intelligent infrastructure vs Resistant to intelligent infrastructure' describes social attitudes.

At one extreme, there is the 'digital native' generation, which has grown up using technology and is confident that technology will continue to deliver and protect. Personal data and identity are protected, and continuous investment in physical and information technology (IT) infrastructure allows the development of systems that are flexible, adaptive and integrated. Businesses take advantage of the integrated intelligent infrastructure to form wide-reaching networks.

At the other extreme, intelligent technologies are in place, but are not integrated. Terrorism, viruses, identity theft and fear of disruption and instability mean that people are mistrustful of integrated intelligent systems. Economic uncertainties add to their risk aversion. People rely on legacy infrastructure – or even bypass it where possible. Groups of businesses, and the affluent, use private networks and services.

The axis 'High-impact transport vs Low-impact transport' describes the various consequences of the transport system on the environment, economy and society.

The scenarios emerging from the axes are:
- Perpetual Motion: here the demand for hypermobility (driven primarily by economic activity) is not constrained, but there are supply-side innovations on a large scale to allow travel to grow without unsustainable environmental impacts;

- Urban Colonies: here mobility is constrained by strong environmental policy and by the design of urban space and infrastructures to minimise the need for travel – society and the economy are dominated by compact sustainable urbanisation;

- Tribal Trading: here mobility is highly constrained, but by a general socio-economic collapse brought on by resource shocks rather than by deliberate policy;

- Good Intentions: here the environmental policy goals of the first two scenarios in the set are imperfectly applied and only in reactive rather than precautionary ways, with resulting impacts on economic development and quality of life.

Some of the scenarios have clear overlaps with the set developed for this Environment Agency project. For example Tribal Trading is very similar in origins and nature to 'Survivor'. Similarly, the 'Alchemy' scenario presented in this report for the Environment Agency shares the supply-side focus of the IIS Perpetual Motion scenario. However, a background commonality to most of the scenarios in the IIS set is not shared in the set presented here in the Environment Agency 2030 work. In the IIS set the pressure for environmental sustainability is felt and responded to in significant ways, rather than ignored as far as possible (as in 'Jeopardy') or handled strictly through supply-side measures that aim to maintain business as usual. This may be because they represent scenarios for 2050 rather than 2030 and over this longer time scale the environmental pressures and need for greater sustainability and appropriate responses are potentially much harder to ignore.

12.7 The Global Scenarios Group: Great Transition scenarios

The Global Scenarios Group (GSG) published its analysis of the need for a global shift to sustainable development in the study Great Transitions (Stockholm Environmental Institute, 2002).

The study makes use of three classes of scenarios: Conventional Worlds, Barbarization and Great Transitions. These scenarios "are distinguished by, respectively, essential continuity, fundamental but undesirable social change, and fundamental and favorable social transformation". The classes are each divided into two specific scenarios that are distinguished by "distinct responses to the social and environmental challenges". Note that the analytical framework envisages global pressures as a blend of ecological, social, cultural and economic stresses and risks: environmental factors do not necessarily dominate in determining outcomes.

In the Conventional Worlds class, the scenarios are distinguished by laissez-faire policy versus governmental intervention to secure stability: the Market Forces scenario is said to "rely on the self-correcting logic of competitive markets". The Policy Reform scenario "depends on government action to seek a sustainable future".

The Barbarization model contains the scenario Fortress World , in which it falls to the armed forces to impose order, protect the environment and prevent a collapse into the second scenario Breakdown. The latter is a general civilisation collapse.

The Great Transitions pair of scenarios "envision a sustainable and desirable future emerging from new values, a revised model of development and the active engagement of civil society". The scenarios are Eco-Communalism and New Sustainability Paradigm. The former is a benign localist 'living lightly' model of sustainable society, and is acknowledged to be the least plausible one from the point of view of current global development patterns. The study sees it emerging potentially from the Barbarization model rather than from willed policy change. Such a change would make it more plausible and also give it many parallels with Foresight's Local Stewardship scenario and the 'Survivor' scenario detailed in this report.

There are evident overlaps here with the Foresight standard scenario model and with the Environment Agency 2030 set detailed in this report. The Conventional Worlds set has many similarities with the 'Alchemy' and 'Jeopardy' scenarios presented in this report, as well as the Foresight World Markets and National Enterprise scenarios. Our 'Survivor' scenario and the Tribal Trading scenario from the Foresight IIS have much in common with Fortress World and, to a lesser extent (because it is less benign), with Eco-Communalism. The Foresight Global Sustainability scenario model and the 'Restoration' scenario presented in this report are very similar to the New Sustainability Paradigm in the GSG study.

12.8 Further observations on scenario sets

The scenario frameworks outlined above have numerous points of contact with the scenario developed as part of the work presented in this Environment Agency 2030 scenario set. There is a tendency in all to consider axes of possibility that relate to the extent of globalisation and to versions of national, regional or 'traditional' reactions to it, and to the extent of movement away from long-established forms of intensive industrial development. These choices of analytical framework reflect both the consensus opinions of policy communities and research communities in the developed world, and the strategic preoccupations of the consumers of scenario research.

There is reassurance to be had from the convergence between the scenarios used by widely differing expert organisations. However, we should be on our guard lest the convergences blind us to scenarios that are unwelcome or based on extrapolations of marginal but significant issues not currently 'on the radar' of policy makers. This is one reason to include a world such as that shown in the 'Survivor' scenario: a world that in many ways no longer functions adequately to sustain civilisation and progress in the way we have become so used to in recent times.

It is also important to note the drawbacks and problems to be found in all the scenario worlds we have drawn up, as one risk in creating scenarios is that one or more scenarios in a two-axis system take on 'ideal' or 'best case' characteristics rather than being rounded and plausible. This is something that we tried to guard against during the drivers analysis and scenario development sessions, but it is interesting that many of the other scenario sets have graduated towards at least one scenario that seems to be have more positive aspects than the others.

Finally, the Foresight model also used by UKCIP has become a *de facto* standard in scenario work by Government departments and many public bodies. This is a tribute to

the richness of the applications to which it can be put, and to the flexibility and usefulness of the concepts that underpin the axes, but there is a risk that the framework will become an unquestioned backdrop to strategic forecasting in some quarters.

Scenarios need to be subject to continuous challenge and revision if they are to provoke thinking as they should. For this reason, we recommend that the shelf life of any scenario work, including that presented in this report, be no more than 5 years before it is at least revisited to see if the nature of the key uncertainties have changed.

13 Recommendations and reflections on interpreting these scenarios

The scenarios that are the focus of this report are intended for use by policy makers in the Environment Agency, Defra and also by key stakeholders. The main objective of the work was to provide a future-focussed way in which those who develop policy and strategy can consider and interpret the possibilities that could lie ahead in terms of the future pressures on the environment. However, the development of strategy and policy covers a wide range of activities, and scenarios are suitable for some but not all these activities. We have therefore provided some guidance and notes of caution when using this scenario set as part of a strategy or policy development process.

13.1 Tools and techniques

The most useful scenarios are those that lead to improved strategy, policy and decision making as a result. Scenarios are almost always regarded as interesting, but are also often criticised as a tool because stakeholders and policy makers do not always have the appropriate knowledge or tools at their disposal to use them as part of a strategy- or policy-development process. For that reason, Henley Centre Headlight Vision has also developed a 'futures toolkit' to help policy makers better understand the ways in which this set of scenarios could be used to help inform future policy and strategy.

The toolkit contains a number of practical steps to help tailor the scenarios to a specific policy area, and to interpret the findings as part of a wider strategy development or policy-making process. In brief, it contains exercises for those who want to use the scenarios to:

- inform, develop or test future vision or high-level strategy, to ensure that priorities and objectives are rooted in an understanding of the potential risks and opportunities that could arise in the future;
- explore the potential range of environmental outcomes for a particular area of policy responsibility (for example, water resources);
- help develop and test recommendations or assess the potential strengths and weaknesses of different policy options;
- 'future proof' planned investments or other decisions that are 'on the table', to ensure that potential future risks and unintended consequences of the decision are identified and considered as part of overall risk management.

Given the long-term, complex and highly uncertain nature of many of the issues that policy makers in the Environment Agency and in central Government deal with in relation to future environmental change, we strongly recommend the use of some kind of scenario analysis to help inform any major strategy or policy development process.

Three projects have already made use of the scenarios contained in this report to help inform their own work.

- early work on a revised Environment Agency Water Resources Strategy (updating the previous strategy published in 2001[44]) has been informed by a workshop held in November 2005 to discuss the high-level implications of the scenarios for the future of water resources in England and Wales;

- a similar workshop also used the scenarios to inform Defra's review of England's Waste Strategy, and thereby ensure that the views contained in the consultation document[45] published on 14 February 2006 (available online at the time of writing) were informed by a view of the potential risks and opportunities that could emerge in the future;

- in addition, a further workshop was held to consider the land-management implications of the scenarios to help inform some (Environment Agency funded) research being carried out by the Department of Land Economy at the University of Cambridge, which is looking to develop future forecasts of land use and management change[46].

13.2 A note of caution

However, there are some occasions on which the use of the scenarios contained in this report may not be the most appropriate option, or for which, at least, the scenarios contained in this report should be used with some caution.

Two particular examples are worth elaborating on, for the sake of clarity:

- Climate change. These scenarios are not suitable to interpret and assess the levels of future climate change. In developing the scenarios, the project team has assumed that the rate of climate change will be consistent across all four scenarios, and within the range of climate change forecasts contained in the most recent research on the subject. Other scenario sets are available for those who want to understand the range of future climate change outcomes, for example the UKCIP, Foresight and SRES scenarios[47], reviewed in Section 12 of this report, which are used for the UKCIP programme.

- Detailed local (for example, catchment area) planning. Given the generic UK-wide nature of the scenarios in this report, we advise against using them for detailed local planning. While we have, where relevant, referred to regional variations in the scenarios, and also highlighted spatial development considerations, the level of detail given on regional and local level implications is insufficient to allow the scenarios to be used with confidence at a local level. They may, however, be useful

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[44]*Water Resources for the Future*, Environment Agency, 2001.

[45]*Consultation Document on the Review of England's Waste Strategy*, Defra, 2006.

[46]Environment Agency research project SC030107: *Scenario based forecasts of land use and management change*.

[47]*Climate Change Scenarios for the United Kingdom*, UKCIP, April 2002; *Emissions scenarios 2000: Special Report of the Intergovernmental Panel on Climate Change*, N Nakicenovic and R Swart (eds), 2000.

once they have been tailored (as advised in the accompanying toolkit) to help inform strategic planning at a regional level.

13.3 Guidance on interpretation

It is also worth pointing out some broader reflections on the interpretation of the scenarios, based on the experience of the core project team from Henley Centre Headlight Vision, who have worked with a wide range of public and private sector organisations on projects of a similar nature.

The first reflection is a common misunderstanding about the nature of a scenarios exercise. The four scenarios detailed in this report are certainly not the only scenarios possible in 2030. They instead represent, when taken together, a range of potential 'future spaces'. The methodology used here led to four divergent, plausible, internal consistent and coherent views of how the future might look. The purpose of the methodology is to develop a diverse range of scenarios to map a boundary space of 'possibilities' that ensure the nature of future uncertainty is fully explored. Normative and deductive scenarios, such as these, are about the better understanding of uncertainty.

Indeed, the actual future that we are faced with in 2030 is likely to contain some elements of all four scenarios. Other scenario development methodologies could have led to different scenarios. There are many potential 'alternative futures'.

For this reason, as well as the generic complexity and uncertainty that surrounds the nature of pressures on the environment, a subject in which the science is still felt by many to be emerging, we advise potential users to be wary of focussing too much on the detail of the text of any of the scenarios. Futures work is, by its very nature, about assumptions. The development of scenarios involves (and actually requires) the combination of rational analysis and often subjective judgement. It is therefore not an exact science, and should not be treated as such.

For the same reason, the range of outcomes illustrated in the quantification of the associated indicators should be treated with caution. Our advice is that they should not be interpreted as detailed future forecasts without further additional analysis. The indicators described in this report merely represent a synthesis of the illustrative estimates of those experts and stakeholders involved in discussions during the project about the direction and magnitude of change in some key (mostly socio-economic) indicators. Where indicators have been quantified, this has been done with reference to estimates and forecasts from other publicly available data sources.

Finally, a word of warning for those who do not consider scenarios (this set or any other) as part of their longer term planning and policy-making process, or who discount them as unlikely to happen, and therefore irrelevant. In our experience, and that of others who have studied the issues in more depth, the inability to consider a future often represents a potential 'blind spot' in organisational thinking. Typically, these blind spots represent a risk to current or planned strategy and policy and do not fit with the assumed view of the future that is dominant within an organisation or department. As a result it is often comfortable for these views of the future to remain 'unlikely' and

'irrelevant' within the organisational culture, and much harder to consider and deal with the risks or discomfort they represent to current thinking, strategy and plans.

However, a significant body of literature has been written on the importance of considering scenarios that are considered 'uncomfortable' or 'unlikely', and the part they play in the reasons why most projects fail[48]. Strategy is improved by listening more carefully to 'weak signals' or 'emerging trends'; and consideration of future scenarios can help to make these more visible. If the scenarios are created through a proved methodology, as here, the focus of attention should not be on querying whether the scenarios themselves will occur, but on considering their implications for future strategy. In short, scenarios work is about considering the implications of what could happen, not predicting what will happen.

The need to push the boundaries of thinking should, we believe, be a critical part of any long-term strategy and policy-development process, particularly so around issues that are as complex and as uncertain as the future of our environment and the pressures placed upon it.

In summary, we hope the scenarios presented in this report will make a positive contribution to more forward-looking policy and strategy at all levels of Government. However, we are also aware of the enormity of the challenges that face decision makers in this area of policy. Developing internally consistent, forward-looking strategy or policy is only the beginning. The implementation of such strategies and policies, and the delivery of the benefits they aim to promote, will remain the ultimate challenge.

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[48]Paul Nutt's 'Surprising but true: half the decisions in organisations fail' (published in Volume 13, number 4 of the *Academy of Management Executives* in November 1999) outlines research that uncovers why most projects and decisions fail. Four main reasons are given, including 'the context in which the decision is taken is too narrow'. As an aside, the other three reasons for failure are significantly reduced by the participatory-based approaches to scenario development and strategic planning that Henley Centre Headlight Vision uses in this kind of work. Examples of other relevant literature in this regard include 'Inevitable surprises' by Peter Schwartz, 2003, published by Penguin. And 'Predictable Surprises: the disasters you should have seen and how to prevent them' by Max Bazerman and Michael Watkins, published in 2004 by Harvard Business School Publishing Corporation.

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14. Annex

14.1 Full list of drivers

Below is a complete list of the 51 drivers identified through the desk-research stage of the project and supplemented by the drivers' workshop. This is a summary of the key elements of each driver. Detailed information on each is not contained here but within a 'Drivers Pack Appendix' available from the Environment Agency.

During the prioritisation process, some of the drivers found in this full list were merged to form new composite drivers. This is true of the prioritised driver of 'Globalisation', which was merged with 'Growing importance of developing economies' and 'Increased migration', as well as 'Resource constrained growth', which combined 'Risk of energy shortfall', 'Increasing water scarcity' and 'Increased focus on waste'. Here, however, the drivers are listed in their original, separated form.

1. Rise in global population

The global population is increasing and is expected to reach nine billion by the middle of the 21st century.

2. Ageing population

In the developed world the number of old people is increasing as a proportion of the population.

3. Surplus youth

In developing countries the bias of the population is towards the younger generation, resulting in a surplus of (especially male) youth.

4. Changing household set-up

The traditional household has undergone significant changes in recent decades, with a current trend towards more single-person and multi-person (members who are not related) households and childless couples.

5. Rise of personal mobility

There has been a marked rise in personal transport demand in the UK, with increasing car use and overseas travel.

6. Increased migration

The levels of both inward and outward international migration in the UK are rising.

7. Globalisation

Rapid growth in world trade, with increasingly global supply chains and increased connection and cultural influence across markets.

8. Urbanisation of culture

Dramatic global trend towards urbanisation in the past few decades.

9. Growing importance of developing economies

Countries such as China, India and Brazil will have increasing power and influence in the coming years.

10. Changing structure of the UK economy

The continuing shift from manufacturing to services in terms of consumers' expenditure and contribution to GDP.

11. Experience economy

The growing tendency for consumers to spend more on experiences and less on material 'basics'.

12. Convenience-driven consumers

Consumers' increased focus on convenience, driven by their sense of lack of time and energy.

13. 'Always on' society

The rise of the 24/7 culture in which nothing ever shuts, with clubs, bars, shops and the internet available all day and all night.

14. Information overload

Consumers have more information and choice than they can manage, with a proliferation of media channels and supermarket product lines.

15. Increasing capability of electronic networks

The rise of the internet and increased digitisation changes the way organisations are structured, people's working patterns and the way in which people form relationships.

16. Embedded technology

The rise of embedded technology (for example, Radio Frequency Identification (RFID) and chips) that will expand the amount of information that can be contained and the way in which applications are used.

17. Future skills shortage

With increased specialisation and changes in the structure of the economy, there are growing concerns over the availability of individuals with key skills in a range of areas.

18. GRIN technologies

There is a growing recognition of both the existence of and the possibilities to exploit genomics, robotics, informatics and nanotechnology (GRIN).

19. Developing environmental technologies

Growing interest in understanding what mechanisms and instruments can be used to encourage a shift towards environmental technologies.

20. Increasing consumer environmental awareness

At all levels, there is increased awareness and exposure to environmental issues.

21. Climate change and societal response

In the face of overwhelming evidence and consensus among scientists, there is growing political and public acceptance that human-induced climate change is a reality.

22. Risk of energy shortfall

There are concerns over the fragility of the UK energy supply, in particular oil.

23. Increasing water scarcity

At a global level, water supplies are expected to become an increasing focus of attention.

24. Changing rural land use

Over the past 15 years there have been changes in land use, with an increased focus on a more sustainable basis for agriculture.

25. Depletion of biotic resources

Damage to land and water habitats through urban development, modern farming practices and fishing have led to a threatened position for a number of species of plants and animals.

26. Increased focus on waste

Controls on waste are becoming increasingly pervasive.

27. Long-term UK economic stability

The UK economy is expected to remain stable, with the Government's economic goal to ensure that fiscal rules are met at all times and that inflation remains low.

28. Increasing inequality

The gap between the most wealthy and the least wealthy sections of British society is widening.

29. Consumption culture

Attitudes to energy consumption and waste, just like those to personal savings, are increasingly short term.

30. Growing interest in community values

Local community remains a strong concept in people's minds, driven by an increasing desire for identity and belonging.

31. Increased focus on wellbeing

Increasing focus on wellbeing and quality of life.

32. Rise of the empowered consumer

The consumer is becoming more and more assertive, with higher expectations of service and more complaints about goods and services.

33. Rise of single-issue politics

There is greater engagement with single-issue politics, with declining voter turnout and falling membership of political parties.

34. New communities of interest

Community and identity are no longer simply based on geography, age or gender, but on shared interests, causes or beliefs.

35. Rise in extremism

There is a rise in fundamentalism and extremism on a global scale.

36. Increasing pressure on public spending

Continued financial pressure on the Government, with an increased demand for a wider range of services anticipated for the future.

37. Increasingly stressed infrastructure

Under-investment in capital assets, ageing infrastructure and lower maintenance after privatisation of the utilities is increasing systems stress.

38. Increasing emphasis on partnerships

The private sector plays an increasingly important role in the public sector at both local and national levels.

39. Rise of big business

Major conglomerates have a growing influence on the business agenda, processes and protocols.

40. Declining trust in institutions

A long-term decline of trust in all types of institutions, including Parliament, the Civil Service and the legal system.

41. Risk-averse society

People feel a sense of risk across an increasing number of areas of life.

42. Uncertain future of international governance

While international and multilateral agreements are becoming increasingly important to deal with a range of issues, the form of the governance that guides these agreements is uncertain.

43. Changing attitudes towards the USA

Over the past decades, the role and relationship of the USA with the rest of the world has changed.

44. Devolution

Devolved Government has been a clear trend in Scotland and Wales and central Government is inclined to devolve limited powers to regions and localities.

45. Future of Europe

The EU has been responsible for a significant proportion of the growth in environmental legislation in recent years, but the future of this political body is uncertain.

46. Increasing intensity of regulation

A raft of new EU environmental regulations have been introduced to regulate organisations and consumers for their contribution to environmental damage.

47. Changing nature of environmental legislation

A shift from regulating production to regulating consumption and behaviour combined with the growing use of market tools (for example, incentives and taxation).

48. Increased scientific understanding

There is growing knowledge and evidence around environmental change within the science world, increasingly allowing us to understand the cause-and-effect relationships.

49. Role of self-interest in responding to environmental pressure

Consumer behaviour is driven more by self-interest than by an impulse to protect the environment.

50. Responsiveness of small-to-medium enterprises (SMEs) to environmental regulation

SMEs tend to find environmental regulation a greater challenge than do large businesses, which are already regulated and easier to regulate. As a result, small businesses may be the next area to focus on to achieve environmental compliance.

51. Increasing links made between the environment and health

The growing trend to see a good physical environment as beneficial to other areas of government policy, such as health.

14.2 Full list of indicators

The indicators were developed during the workshop process in collaboration with key specialist and expert stakeholders. As with the development of the scenario narratives, we did not challenge current assumptions around the rate of climate change. It is also important that the level of climate change assumed was consistent between the scenarios. Our focus instead was to consider the difference in responses to managing the impact of climate change between the scenarios. We provide quantified ranges for a number of the key socio-economic indicators as follows.

Socio-economic data

		Baseline	'Restoration'	'Alchemy'	'Survivor'	'Jeopardy'
1	UK GDP average growth per annum over past 5 years	+2.3% pa	Little change overall in rate of economic growth, but based on different principals (greater reuse of materials).	Increase in rate of growth. Likely to be variation across economic sectors.	Some decline compared to present day. Significant slump in the interim period 2010-2020. Rise of informal batter economy.	Some increase in growth rate compared to current rate.
			+2% p.a. approx.	+2.5% p.a. approx.	+1.25% p.a. approx	+3% p.a. approx
2	Annual real household disposable income	£12,521	Linked to overall economic developments – focus of wealth and consumption has shifted.	Some increase – levels of personal wealth have increased.	Decrease in levels of affluence.	Significant increase in personal wealth for most, though variations across regions and income groups.
			£20,000-£20,500	£22,500-£23,000	£16,500-£17,000	£25,500-£26,000
3	Income distribution (proportion of income held by poorest 10% to richest 10%)	1:4 £164:£654	Marginal shift to less polarised society through greater political will for social equity and redistributive impact of new policy measures, especially personal tradable carbon allowances.	Small increase in income polarisation, though overall average levels of wealth increase.	To some extent, overall greater equity in wealth distribution with the flight of the very rich to the remaining stable oil- and/or coal-rich countries.	Increased income polarisation. Paying for 'basics' takes up large proportion of the income for the poor.
			1:3·75	1:4·5	1:3·25	1:5·5
4	Gross government expenditure (as percentage of GDP)	42%	A significant increase in government financial expenditure, but very little change in activity expenditure (related to employee base).	Some increase in absolute expenditure with greater investment in infrastructure (but part of this comes through private sector funding).	Slight increase in government spending as percentage of overall GDP, though lower in absolute terms.	Significant decrease in government expenditure with increased privatisation and many services beyond basics provided through other channels and corporations.
			50% approx.	42-43% approx.	45% approx.	Under 40–
5	UK exports chained volume measure (as percentage of GDP)	£289,007 million 27%	Some decrease in export of services – greater decrease in manufacturing.	Strong trade in new technologies and services means overall level and value of exports increase.	Significant slowdown in international trade – fewer exports.	Decline in export of manufactured goods, but some increase through new value creation in other sectors
			25-27%	32-34%	20-22%	27-29%
6	UK imports chained volume measure (as percentage of GDP)	£330,436 million 31%	Some decrease in imports with an economy less driven by consumption.	With increased wealth and consumption, growth in value of imports.	As above, significant slowdown in international trade.	Some increase in level and value of imports driven by consumption culture and desire for particular goods.
			28-30%	31-33%	24-26%	33-35%

		Baseline	'Restoration'	'Alchemy'	'Survivor'	'Jeopardy'
7	Gross value added by sector as percentage of total UK economy: services, S; Manufacturing, M; agriculture, A	S:76% M: 23% A: 1%	Little change in manufacturing sector as traditional industries have been replaced with refurbishment and/or remanufacturing and recycling (classed as manufacturing). Slight increase in service sector through growth in repair industry. Some growth in value of agricultural sector with more locally sourced food products and focus on non-food crops.	Increase in importance of knowledge-based business means growth in service sector. Value of agricultural sector increases in absolute terms with introduction of non-food crops.	Service sector grows with strong repair industry. Some decrease in value of manufacturing, but maybe for local rather than foreign production. Agricultural sector will become more significant.	Likely to be continuation of current trends: shift to services with decline in manufacturing. Agriculture sector is small but fairly stable.
			S: 75-77% M: 22-24% A: 1-1.5%	S: 80-82% M: 17-19% A: 1%	S: 76-78% M: 20-22% A: 2-3%	S: 77-79% M: 20-22%% A: 1%
8	UK population	59.6 million	Some increase in population numbers largely through increased immigration, partly from displaced peoples.	Overall population numbers may increase slightly against projected trend with influx of skilled workers. Medical improvements increase life expectancy - significant with an ageing population.	Slight decrease in population relative to projected trend growth rates as expected immigration is not likely to take place and increase in death rates.	Some growth in population thanks to the globalisation of labour markets with increased immigration from Eastern Europe.
			66-68 million	66-66 million	63-65 million	67-69 million
9	Average household size	2.4	Higher cost of living means people are less likely to live on their own (slow down in trend towards single-person households).	Slight decrease broadly in line with current trends.	Average household size likely to increase with increased interest in communal living.	Continuation of current trends – decrease in average household size as more likely to live on their own.
			2.4-2.5	2.2-2.3	2.5-2.6	1.9-2.1
10	Number of households	24.1 million	Total number of households will increase to some extent in line with overall population growth, though tempered by increase in communal living.	Some increase in number of households with population growth.	Little change (falls after slight increase).	Significant growth in number of households with growth in single-person households.
			27.2-27.5 million	28.7-30.0 million	25-25.2 million	32.9-35.3 million

		Baseline	'Restoration'	'Alchemy'	'Survivor'	'Jeopardy'
11	Land use Rural (including agriculture, woodland and forestry) versus urban	R: 86% U: 14%	Little change in land use mix compared to current situation.	Some decrease in rural as space required for new developments (which include more than housing, such as infrastructure, etc.).	Some increase in rural with more land being taken out or set aside and put to agricultural use, including energy crops.	Urban sprawl continues, with decrease in land classified as rural.
12	Percentage of new developments built on previously developed land or through conversions	58%	Slight increase – minimal increase in households means no major pressure to expand urban areas (and where this is done, it is done sensitively).	Likely to be some increase, but with regional variation reflecting constraints of particular areas where little opportunity for reuse in push for growth (for example, the South East).	Some increase (significant percentage of green-belt land put to agricultural use). Most development (although minor) is therefore on previously developed land.	Potential for decrease: brown-belt land has been saturated in interim period, while pressure for development and deregulatory approach leads to more overspill into green-belt and previously undeveloped areas.
13	Synthetic nitrogen fertiliser usage on arable crops	149 kg/hectare per year	Though increase in agriculture's GVA, legislation against the use of synthetic fertiliser likely; non-synthetic nitrogen fertiliser more prevalent.	Small decrease in use of synthetic fertiliser because of increased interest in organic farming coupled with impact of technological efficiency and government regulation.	Likely to be slight decrease in use as nitrogen fertiliser production is a highly energy intensive process potentially to be avoided in the interests of energy conservation.	Some decrease in use through changes in land use and practices (less agriculture) and regulation.
14	Patterns of spatial development	Focus around urban areas, in particular in the South East.	Greater focus on equitable patterns of development. Limited new builds, most of which are in the North East.	Planned new builds are in areas of low density, but with some development continuing in the South East in response to market demand and as part of the Sustainable Communities project.	Limited amount of new build. Little variation from current situation.	Most new development is focussed in the South East.
15	Agricultural subsidies *(percentage for agri-environment schemes)*	£2.832 billion Agri-environment subsidies: 17.2%	Significant decrease in subsidies overall (to around £1.4-1.6 billion), but a greater proportion of this is given for agri-environment purposes.	Small decrease in value of subsidies (more private funding – less need for government support) but increase in proportion allocated to agri-environment schemes.	Financial support for agriculture wound down after Great Collapse, because of budget pressures. Individual governments may consider recreating an equivalent CAP on the national level (to incentivise food and energy security, but unlikely to be significant in the UK.	Significant decrease in value of subsidies/CAP, though agri-environment subsidies represent an increasing proportion.
16	Levels of biodiversity	Clear deterioration in species and habit status; continuing decline in farmland and woodland bird species	Some increase in levels of biodiversity (although, as ever, there are 'winners' and 'losers' across different habitats).	Continuation of current trends means continued deterioration; biodiversity is a lower priority in the desire for growth and development.	Mixed picture on status of biodiversity. Natural environment flourishes in some areas as economic decline creates 'neglected spaces'; push for growth in other areas leads to collapse in levels of biodiversity.	Continuation of decline in biodiversity decline – more fragmentation of habitats. Wealthy residents acting out of self-interest ensure a small number of areas are given greater protection.

Transport

		Baseline	'Restoration'	'Alchemy'	'Survivor'	'Jeopardy'
17	UK passenger transport (annual passenger kilometres per capita within GB)	13,233 km	Some decrease in passenger kilometres against projected trend with decline in 'travel culture' and greater use of ICT for communication, and more novel virtual reality technologies.	Some increase in kilometres travelled with more car ownership and usage thanks to higher levels of affluence. Levels of community may decrease with new patterns of home working.	Significant decrease in kilometres travelled because of increased cost of oil. Foreign travel also impacted as disruption in many countries previously favoured for tourism.	Passenger kilometres likely to increase with more commuting and individual living and family dispersal. (Also continued increase in foreign travel.)
			13,000-14,000 km	16,000-17,000 km	12,000-13,000 km	18,000km-19,000 km
18	UK passenger transport (%) Air Rail Road – public transport Road – personal transport (Domestic travel only)	Air: 1.1% Rail: 6.2% Public use: 5.9% Personal use: 86.1%	Decrease in air and personal road transport because of flying. Meanwhile, significant increase in rail and public road transport due to government investment in the transport infrastructure.	Some increase in air travel (continuation of current trends). Small increase in use of rail and public road transport (and thus decrease in personal transport) through investment in public transport infrastructure encouraging some to abandon reliance on private vehicles.	Rail and public road transport represent an increased proportion of travel with significant decrease in personal road transport. Much of this is dictated by impact of increase in oil prices.	Continuation of decline in use of rail and public road transport, in particular the latter. Significant increase in air and personal road transport. Freight transport would follow these trends.
			Air: 0.75-1.25% Rail: 7-10% Public use: 7-10% Personal use: 80-83%	Air: 1.0-1.5% Rail: 5-8% Public use: 5-8% Personal use: 84-87%	Air: 0.5-1% Rail: 9-12% Public use: 9-12% Personal use: 76-79%	Air: 1.5-2% Rail: 4-7% Public use: 3-6% Personal use: 89-92%

Water

		Baseline	'Restoration'	'Alchemy"	'Survivor'	'Jeopardy'
19	Average household water consumption (litres per day per capita)	153 litres	Significant decrease in consumption through more efficient water infrastructure, better product design and a population more 'respectful' of resources.	Small decrease in levels of consumption, but this is not through behaviour change but impact of more efficient housing and product design.	Likely to be significant decrease in consumption. (Though usage decreases, poor state of infrastructure means leakage levels will increase. More grey water and rainwater harvesting.)	Potential for increase in level of water consumption offset by design efficiency sought because of cost pressures. Degradation in national water supply infrastructure.
20	Percentage of waste water going into tertiary treatment	38%	Significant increase in treatment of waste water at this level up to 45% as a result of continued investment in infrastructure.	Increased proportion of water treated to this level through more efficient technology and desires of a more demanding society.	Some decrease in water treated at this level because of cost pressures.	Slight increase in proportion of water treated to this level to around 40%, though with regional variation: some local communities have installed micro-filtration facilities.
21	Percentage of river lengths meeting (current) biological and chemical standards	Biological: 68% Chemical: 65%	Increase in number of 'clean' rivers by current standards, but standards will increase.	Likely to be increase in proportion of rivers that meet standards with changes in manufacturing and agricultural practices.	Potential for increase in rivers failing standards with deterioration in key infrastructures.	Mixed picture: though point-source pollution may decrease with decline in manufacturing, agricultural pollution may worsen.
22	Number of UK properties at risk of flooding	2 million	Properties at risk likely to decline thanks to investment in flood defence infrastructure.	Some decrease in number of properties at risk, mostly because new developments constructed outside of risk areas.	Likely to be regional variation dependent on local action. In some areas, potential for increase in at-risk properties with forced abandonment of flood defences.	Levels of at-risk properties not evenly distributed across country – higher risk in densely populated, less affluent areas.
23	Annual flood management costs	£800 million	Very significant increase in expenditure on flood defence systems.	Some increase in flood management costs, though greater emphasis is given to construction outside of risk areas.	Some decrease in flood-management spending as lower priority. (Likely to be increased role for local government level.)	Overall, less investment in flood-resilience measures; will be provided at personal level and be patchy across country.
24	Annual average cost of damage due to flooding	£1400 million	Improved flood management leads to less flood damage.	Thanks to investment in preventative measures, flood-damage costs decrease significantly.	Flood damage costs increase (as a consequence of above trends).	Significant increase in cost of flood damage as result of 'reactive' attitude to flooding risks described above.

Waste

		Baseline	'Restoration'	'Alchemy'	'Survivor'	'Jeopardy'
25	Annual waste arisings: total level; municipal (Mun); industry and commerce (I&C); construction and demolition (C&D)	Total: 219 million tonnes Mun: 16% I&C: 35% C&D: 46%	Significant decrease in waste arisings across all sectors (on account of high waste taxes and steady improvement in sustainable product design and take-back systems).	Small increase in levels of total waste arisings through growth in overall economy. Small decrease in proportion of municipal waste (impact of improved product design). Increase in waste from construction because of need to demolish or renovate existing housing stock to meet new sustainability standards).	Overall of level of waste arisings decline. Lower levels of personal consumption mean municipal waste represents a smaller proportion.	Though total waste production may increase, likely that some would pay to export abroad. Thanks to dominance of 'consumption culture', significant increase in municipal waste; with decline in manufacturing, industrial waste may decrease.
26	Total municipal waste (kg per household per week)	26.4 kg	Significant decrease in municipal waste through introduction of household waste collection charges, improved collection systems and people's desire to conserve resources.	Mixed picture as various trends balance one another out: stricter regulation around packaging stabilises impact of continued trends towards individualised consumption.	Decrease in personal consumption leads to lower levels of production of municipal waste.	Significant increase in levels of personal consumption will lead to increased municipal levels of waste.
27	Waste arisings by disposal	Landfill: 43% Recycled: 43% Other recovery: 10% Other disposal: 2% Energy recovery: 2%	Significant decrease in proportion going to landfill with growth in disposal through re-use and recycled, other recovery and energy recovery.	Significant decrease in waste going to landfill as impact of stricter regulation leads to increased proportion being recycled and used for recovery purposes.	Significant decrease in landfill (illegal disposal may go up). Significant increase in re-used and recycled and other recovery, with significant increase to energy recovery (NB from low base). Little change in other disposal.	Though overall waste arisings increase, amount of waste going to domestic landfill not likely to change – some waste is exported abroad instead. Increase in volumes of waste going for energy and other recovery (less affluent seeking scarce resources).

Energy and emissions

		Baseline	'Restoration'	'Alchemy'	'Survivor'	'Jeopardy'
28	Domestic energy use per capita (tonnes of oil equivalent)	0.8 tonnes	Some decrease in energy consumption through more efficient design and population more 'respectful' of resources.	Small decrease in consumption through the impact of new efficient designs (e.g. in housing), which reduces energy need for heating.	Significant decrease in energy consumption driven primarily by increase in cost of oil and introduction of fuel rationing.	Energy use increases with no curbs on consumption.
29	UK energy consumption by type (on an energy supplied basis): *coal, C; petroleum, P; gas, G; electricity, E; renewables, R; other, O*	C: 1.8% P: 43.3% G: 34.8% E: 18.2% R: 0.5% O: 1.4%	Some increase in use of coal, but with increased carbon sequestration. Significant decrease in petrol usage caused by change in transport habits. Decrease in use of gas. Renewables grow in importance.	Carbon-based energy becomes less important with more balanced energy portfolio. Significant growth in use of nuclear energy.	Greater reliance on coal and significant decrease in use of petrol. Renewables become more important, but with local variation as micro-generated. Overall, shift towards decentralised energy production.	Continued reliance on petroleum and gas energy. Growth in use of nuclear energy.
30	Renewable electricity (as percentage of total electricity generated)	2.7%	Significant increase in renewable electricity generation.	Some increase in importance of renewable energy with the construction of wind farms, etc.	Significant increase in renewable energy often generated at household level.	Slight increase in renewable energy to a tokenistic ceiling.
31	Carbon dioxide emissions by end user (million tonnes of carbon equivalent): industry ,I; transport, T; domestic, D; other (agriculture, non-industrial commercial ,O	Total: 152.4 million tonnes I: 28% T: 29% D: 27% O: 16%	Significant decrease in overall emissions through change in transport habits, increased reliance on renewable energy sources and improvements to housing stock.	Some decrease in overall emissions through use of carbon sequestration and different energy mix. Though kilometres travelled has increased, impact of transport emissions mitigated by greater use of public transport.	Some decrease in overall emissions. Increase in emissions from industry with greater reliance on coal fuel power and limited capital to build new plants. Some decrease in domestic and transport emissions as levels of air and personal transport have decreased.	Increase in overall emissions offset to some extent by efficiency gains. Reduction in industry emissions (through decline in manufacturing), but significant growth in transport emissions, in particular because of continued desire for personal transport.

14.3 Bibliography

Sources and consistency checks used for indicators

Socio-economic data

		Source for baseline *Date*	Baseline (status in 2003/4)
1	UK GDP average growth over past 5 years	ONS *Average growth 2000-2005*	2.3%
2	Annual real household disposable income	ONS Economic Trends *2004 data*	£12,521
3	Income distribution (proportion of income held by poorest 10% / richest 10%)	ONS *Distribution of real household income at 2002/03 prices (£ per week)*	1:4 £164:£654
4	Gross government expenditure (as % of GDP)	Eurostat *2002 data*	42%
5	UK exports chained volume measure (as % of GDP)	ONS Blue Book 2005 *2004 data*	27%
6	UK imports chained volume measure *(as % of GDP)*	ONS Blue Book 2005 *2004 data*	31%
7	Gross value add by sector as percentage of total UK economy: services, S; Manufacturing, M; Agriculture, A	ONS Blue Book 2005 *2004 data*	S: 76% M: 23% A: 1%
8	UK population	ONS/GAD *2003 data*	59.6 million
9	Average household size	Calculated	2.4
10	Number of households	ONS *2003 data*	24.1 million

Land use and agriculture

		Source for baseline *Date*	Baseline
11	Land use Rural (including agriculture, woodland and forestry) versus urban	ONS Sustainable Development Indicators *2003*	Rural (including agriculture, woodland and forestry): 86% Urban: 14%
12	Percentage of new developments built on previously developed land or through conversions	ONS Sustainable Development Indicators *2001 data*	58%
13	Patterns of spatial development	N/A	Focus around urban areas, in particular the South East
14	Synthetic nitrogen fertiliser usage on arable crops	Defra (British Survey of Fertiliser Usage) *2003 data*	149 kg/hectare per year

15	Agricultural subsidies (percentage for agri-environment schemes)	Defra (Agriculture in the UK) *2004 data*	£2.832 billion Agri-environment subsidies: 17.2%
16	Levels of biodiversity	ONS Sustainable Development Indicator *2004 status*	Clear deterioration in species and habit status; continuing decline in farmland and woodland bird species

Transport

		Source for baseline *Date*	Baseline
17	UK passenger transport (annual passenger kilometres per capita within GB)	ONS Social Trends *2004*	13,233 km
18	UK passenger transport (%): Air Rail Road – public transport Road – personal transport (Domestic travel only)	ONS Social Trends *2004 data*	Air: 1.1% (9 billion km) Rail: 6.2% (49 billion km) Road (public transport): 5.9% (47 billion km) Road (personal transport): 86.1% (684 billion km)

Water

		Source for baseline *Date*	Baseline
19	Average household water consumption (litres per day per capita)	ONS Sustainable Development Indicators *2003 data*	153 litres
20	Percentage of waste water going into tertiary treatment	Ofwat 2003 data	38%
21	Percentage of river lengths meeting (current) biological and chemical standards	ONS Sustainable Development Indicators *2002 data for England*	Biological: 68% Chemical: 65%
22	Number of UK properties at risk of flooding	OST Future Flooding 2005 *2003/4 data*	2 million
23	Annual flood-management costs	OST Future Flooding 2005 *2003/4 data*	£800 million
24	Average household water consumption (litres per day per capita)	OST Future Flooding 2005 *2003/4 data*	£1400 million

Waste

		Source for baseline *Date*	Baseline
25	Annual waste arisings: Total level Municipal Industry and commerce Construction and demolition	Defra *2002/3 data*	Total: 219 million tonnes Municipal: 16% Industry and commerce: 35% Construction and demolition: 46%
26	Total municipal waste (kg per household per week)	Defra *2003/4 data for England*	26.4 kg
27	Waste arisings by disposal: Landfill Recycled Other recovery Other disposal Energy recovery	Defra *2002/3 data*	Landfill: 43% Recycled: 43% Other recovery: 10% Other disposal: 2% Energy recovery: 2%

Energy and emissions

		Source for baseline *Date*	Baseline
28	Domestic energy use per capita (tonnes of oil equivalent)	DTI *2004 data*	0.8 tonnes of oil equivalent
29	UK energy consumption by type (on an energy-supplied basis): Coal Petroleum Gas Electricity Renewables Other	DTI *2004 data*	Coal: 1.8% Petroleum: 43.3% Gas: 34.8% Electricity: 18.2% Renewables: 0.5%
30	Renewable electricity *(as percentage of total electricity generated)*	DTI *2003 data*	2.7%
31	Carbon dioxide emissions by end user Total Industry Transport Domestic Other (agriculture, non-industrial commercial)	ONS Sustainable Development Indicators *2003 data*	Total: 152.4 million tonnes carbon equivalent Industry: 28% Transport: 29% Domestic: 27% Other (agriculture, non-industrial commercial): 16%

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14.4 Organisations participating in the process

- Association of British Insurers
- Biffa
- Brook Lyndhurst
- Cambridge University
- Chartered Institute of Waste Management
- Confederation of British Industry
- Cranfield University
- Defra
- Demos
- East of England Development Agency
- English Nature
- Environment Agency
- Environmental Services Association
- European Union Joint Research Centre, Italy
- Forum for the Future
- Green Alliance (and members of its Energy Entrepreneur Network)
- Local Government Association
- National Trust
- National Industrial Symbiosis Programme
- Natural England
- Office of the Deputy Prime Minister
- Office of Science & Technology – Foresight
- Ofwat (The Water Services Regulation Authority)
- Oxford University
- Policy Studies Institute
- Royal Society of Protection for Birds
- Treasury
- UK Climate Impacts Programme
- Water UK
- Waterwise
- Welsh Assembly Government

14. 5 Glossary of terms

Strategic Futures work

The use of future scenarios and other techniques to understand the nature of future uncertainty and apply the learning to strategy and planning.

Scenario

A coherent and internally consistent view of a possible future state or world that is developed from an understanding of how significant trends, drivers and key events may combine to change the social, economic, political and environmental fabric of the present day (that is, a plausible statement of what *could* happen at determined point in the future).

Scenarios are *not* definitive predictions or forecast of what *will* happen, but do provide realistic and plausible descriptions of what *could* happen in the future.

Once developed, scenarios can be used to explore the future and understand the implications for future strategy, policy and plans (see *strategic futures* work).

Storyline (also referred to as the scenario narrative)

The description of the evolving dynamic of the possible future world defined by the scenario, usually including a description of the end-state scenario and the essence of the combination of drivers, trends and events that led to this end state. The story behind the *scenario*.

Forecast

A fixed statement (usually including but not limited to quantitative data) or estimate of what will happen at a future point in time, often expanded to include a range of 'more' or 'less' desirable indicative outcomes around a mid-point.

Prediction

A statement or forecast about what *will* happen in the future, usually containing a element of prejudged certainty or accuracy on behalf of the person making the prediction.

Wildcard

A high probability, low impact future *event*, that usually contains an element of unpredictability or surprise and is disruptive to the future system being analysed.

Often these events can be spotted from an investigation of combinations of drivers and trends. Typical examples to consider are natural disasters, major global conflicts, etc.

Wildcard events are often confused with scenarios (which are not isolated events, but a description of an evolving dynamic view of the future that may result from a combination of drivers and key events). The guidance toolkit explores the use of wildcards as a tool to further stretch and test the scenarios and potential policy options under consideration.

Drivers

Macro or primary driver
A major force and influence that will shape the future (for example, globalisation, demographic change, technology change).

Meso or secondary drivers and trends
A significant societal trend, usually something that emerges as a result of a primary drivers (for example, convenience culture, consumption culture, rise in personal mobility).

Micro or tertiary drivers and responses

An individual or group response or outcome that usually results from or is a reaction to either primary or secondary drivers (for example, role of self-interest in responding to environmental change, increased scientific understanding of environmental systems).

Impact or dependency matrix

A tool to assess how drivers relate to one another. It tests in a structured fashion which drivers most influence and which are most influenced by others. This enables a judgement to be made of how each driver influences the overall outcome of the particular system being analysed by the futures project question.

Mapping process (driver analysis)

An analytical process in which connections between individual drivers are identified and 'mapped'. Arrows are drawn between drivers to indicate both what each individual driver influences and what other drivers it is influenced by, and to what extent.

It is typically used as a means to identify the most important and uncertain drivers from any given list – those that influence or are influenced by the greatest number of other drivers are considered the most important and most uncertain, and typically represent key uncertainties in the futures system being analysed.

Wind tunnelling, backcasting, future proofing

These are terms used to describe different 'strategic futures' techniques that can be used for policy analysis, risk management and strategy development, often using scenarios as a framework against which to assess strategy and policy options. Each technique is explained in more detail in the individual exercises described in the guidance toolkit.

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