Natural England Commissioned Report NECR031

Scenarios compendium

First published 27 November 2009

www.naturalengland.org.uk

Foreword

Natural England commissions a range of reports from external contractors to provide evidence and advice to assist us in delivering our duties. The views in this report are those of the authors and do not necessarily represent those of Natural England.

Background

The world in which we live and work is constantly changing and evolving with abrupt change increasingly being seen. The future is inherently uncertain: surprise is inevitable.

Change presents both risks and opportunities for the natural environment and the benefits it delivers to everyone. To maintain and increase these benefits Government and Natural England need to be aware of possible circumstances that could affect the natural environment and the benefits it provides.

As a tool to aid thinking and stimulate new ideas about possible futures, Natural England has drafted four scenarios that portray plausible long-term futures for England's natural environment. This report represents the second edition of Natural England's Commissioned Report NECR031 '*Scenarios Compendium'*. It broadens the analysis to integrate seven additional scenario projects. This includes Foresight's Land Use Futures scenarios and a timeline exploration. It also contains a lessons learnt section derived from interviews held with sponsors and consultants of selected scenario projects.

This report documents forty two scenario projects from organisations across the world. It analyses their relationship to our project, and clarifies how Natural England's scenarios add value.

It is hoped that the compendium's findings will help others explore and understand the factors that are likely to affect their businesses over time, in doing so, being better prepared for change.

Two related scenario reports are also available online:

- Natural England Research Report NERR031 '*England's natural environment in 2060 - issues, implications and scenarios*'. This describes how the future could unfold; the factors that might shape the future; how we might live; and the implications for the natural environment.
- Natural England Commissioned Report NECR030 '*Global drivers of change to 2060*'. This provides a synthesis of global drivers of change representing the most significant trends, factors and pressures that could affect the natural environment to 2060.

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Keywords - Scenarios, environmental change, drivers of change, futures, inventory

Further information
This report can be downloaded from the Natural England website: **www.naturalengland.org.uk**. For information on Natural England publications contact the Natural England Enquiry Service on 0845 600 3078 or e-mail **enquiries@naturalengland.org.uk**.

ISSN 2040-5545

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Non-technical summary

Natural England commissioned a compendium of other work that developed and used scenarios to help place the report *Scenarios for England's Natural Environment to 2060* within the wider body of futures work. It also allowed an exploration of the differences and similarities of our approach with others, including treatment of the environment. The work brings many scenarios developed and used by others together into a common analysis. The compendium documents forty two sets of scenarios from organisations across the world, analyses their relationship to Natural England's scenarios and clarifies how the ScENE scenarios add value to foresight for environmental policy.

In providing a foundation for Natural England's scenarios work, this report assists us in developing our wider futures thinking, including identification of new research needs. It is also hoped that its findings, alongside the scenarios developed by Natural England, will help others explore and understand the factors that are likely to affect their businesses over time, in doing so, being better prepared for change.

Key messages emerging from the scenarios compendium

Four key messages emerge regarding the value of Natural England's scenarios for England's natural environment to 2060.

A unique perspective

Looking ahead fifty years, Natural England's scenarios focus on the entirety of England's natural environment from mountain to seabed. The four ScENE scenarios are unique in this combination of timescale and spatial dimension. In exploring emerging change, many scenario projects concentrate on shifts in the economy and government. The ScENE scenarios include economic and policy changes, but emphasise potential shifts in worldview: they consider changes in how people relate to and communicate with each other, the natural environment, and the built environment.

An enriched approach to scenario building

People's values, culture, and behaviours shaped how England's environment has changed over time. Their values, culture, and behaviours will likewise shape how England's environment could change over the next fifty years. Natural England wanted to explore how various drivers might develop in the context of such social and cultural changes. To do so, the commonly used "axes of uncertainty" scenario method was augmented with a foresight technique called the "Ethnographic Futures Framework" (EFF) that identifies emerging change from a number of alternative worldviews and paradigms.

The ScENE project also incorporated a 'three-horizons' analysis which considered how emerging innovations and paradigms compete for societal dominance over time. Through the creation of a timeline mapping the last century, the project also linked how environmental change *might* evolve to how environmental change *had* evolved.

Using EFF and 'three-horizons' together in this project created vivid scenarios with a robust internal logic and structure. This enabled highly detailed comparison of impacts, outcomes, and strategic environments across the scenarios, and between ScENE project output and other scenario projects.

Complementarity with other projects

Many scenario projects tell similar stories, some of growth, some of collapse, some of transformations. Common themes within these projects included the value of the natural environment; the locus of decision-making; the robustness of the economy; and the impact economic vulnerability might have on environmental management and sustainability.

Analysing the compendium scenarios for common themes, drivers and details identified a set of common 'composite' stories: five primary 'archetypes' of possible futures:

- a 'business as usual' for government and the economy;
- a 'high-tech' future transformed primarily by technological fixes;
- a 'sustainability' future that prioritises the environment, and may do so via efficiencies of scale in urban settings, or by decentralising and focusing on communities and locales;
- a 'paradigm shift' future that overturns current assumptions about governance or the economy, often connected to worldview and value shifts and enabled by new technologies; and
- 'vulnerability' or 'collapse' scenarios, depicting for example, economic difficulties, social schisms, or environmental degradation.

Mapping the ScENE scenarios against these archetypes highlights both ScENE's distinctive contributions, as well as where other scenario projects add value.

How other scenarios add value

Several scenario projects explore issues not covered by Natural England's scenarios, or covered in less detail. Issues not addressed by ScENE include the potential for extreme social fragmentation, the global future of migrant labour, and the impacts that 'dematerialisation' of the economy might have. Others depict detailed changes and impacts in a specific economic sector, environmental or geographical area. Examples include energy, food, property, the built and marine environments, and specific communities, regions or nations. These 'gap fillers' raise questions that can be usefully explored within the context of Natural England's scenarios and wider (including broader partnership) futures thinking.

1. Introduction

1.1 Purpose of this report

Over the past decade, UK government and policy investment in foresight projects has grown steadily. This trend is likely to continue as more abrupt changes, as demonstrated by the recent financial crisis, are seen. The resulting projects have covered topics as varied as flooding, food, tourism, public services, and intelligent infrastructure, and time horizons from five to a hundred years. Embedded in these efforts are scenarios depicting multiple possible futures for the UK, all of which have contributed to policy deliberation and dialogue about our long-term goals as a nation. Similarly, work at the regional level in the EU also contributes to and validates foresight projects here in the UK. Public, private, and non-profit organisations around the world are also exploring possible future outcomes for global society, governance, volunteerism, economy, technological innovation, and land, environment and biodiversity. Natural England developed its scenarios within this sophisticated foresight context.

Natural England has commissioned a compendium to ensure the *Scenarios for England's Natural Environment to 2060* are equipped to inform further discussions and futures work. The compendium documents forty two sets of scenarios from organisations across the world, analyses their relationship to Natural England's scenarios and clarifies how the ScENE scenarios facilitate foresight for environmental decision-making. It is an illustrative, rather than an exhaustive survey: it does not include every scenario project completed in the UK, much less every scenario project in Europe or across the world. The analysis included only those that seemed immediately relevant and contributory to the issues that Natural England's scenarios were designed to explore. Natural England welcomes information about other relevant scenarios for future updates.

In providing a foundation for Natural England's scenarios work, this report assists us in developing our wider futures thinking, including identification of new research needs. It is also hoped that its findings, alongside the scenarios developed by Natural England, will help others explore and understand the factors that are likely to affect their businesses over time, in doing so, being better prepared for change.

1.2 How this report is structured

Chapter 2 introduces the inventory of other scenario projects, and describes the analysis of other organisations' scenario projects, including the creation of a set of composite scenarios derived from common themes and story-lines.

Chapter 3 provides a synthesis of key issues and implications emerging from the scenarios.

Chapter 4 identifies lessons learned for using and applying scenario thinking, including in the wider community.

1.3 Natural England's scenarios: summary description

Natural England, November 2009
'Scenarios for England's natural environment to 2060'
www.naturalengland.org.uk

Consultants/Researchers: SAMI Consulting and CURE at Manchester University
Method chosen: 'axes of uncertainty' matrix plus (augmented by the ethnographic futures framework and the 'three-horizons' analysis)

Aim
The scenarios depict what England's natural environment might look like and how it might function in 2060. Working in a wider Defra partnership and beyond, they will be used to identify critical long-term challenges and opportunities for the natural environment.

Focus
Covering the full span of Natural England's remit, the scenarios depict four paths along which terrestrial and marine environments could develop, including implications for how we might live in 2060. The focal question was 'What could influence the English natural environment by 2060?' How people and society interact with the environment, and how the environment affects people and society, formed a core theme.

Methodology
Natural England created *Scenarios for England's natural environment to 2060 (*ScENE) over six months using in-house expertise complemented by specialist consultancy input from SAMI Consulting (St Andrews Management Institute) and the Centre for Urban and Regional Ecology (CURE) at Manchester University.

Research and interviews identified fourteen global drivers of change to 2060. Over a series of three workshops, participants including staff and key stakeholders prioritised the drivers, identified defining uncertainties, and elaborated possible future outcomes. First, participants mapped those changes having the greatest impact on the environment over the past century. They then discussed how the fourteen change drivers might evolve over the next 50 years. After prioritising the change drivers most likely to affect England's natural environment, three defining uncertainties emerged:

- Will the world have found a way to live sustainably?
- Will technology have provided a 'get out of jail free' card or will lifestyle changes still be necessary?
- What will be the world order? Will it be dominated by free market globalisation?

Workshop discussions explored how these questions might combine to create risks and opportunities. Participants created basic storylines for four scenarios framed by these three questions. The resulting scenarios consequently explore a range of distinctive options facing society: the role of technology, the levers that could move the world towards sustainability, and the nature of society in England by 2060. Natural England deliberately avoided a quantitative, modelling or forecasting approach, given the immense complexity and long time scales involved.

The project team tested and refined the draft scenarios by engaging both Natural England staff and external stakeholders, including members of the public. Engagement included a series of workshops as well as peer reviews from outside the UK. In addition to critiquing the scenarios, these activities also helped to develop timelines for the scenarios up to 2060, and to explore how a range of natural environments would fare across the four scenarios.

Consistent 'narrative threads' frame the scenario stories. Each story starts out grounded in the present, describing current strategic concerns, and also pointing out where emerging trends or issues are ignored or downplayed. The stories unfold from current

concerns until emerging events challenge dominant policies, opening new pathways for action. Each scenario then follows a pathway to possible outcomes in 2060.

Natural England wanted to emphasise the relationship between people and the environment, and to explore how people's values, culture, and behaviours shape the future. With this in mind, the project team adopted the Ethnographic Futures Framework (EFF[1]) as the central unifying structure not only to explore long-term impacts of the change drivers, but also to develop and structure the scenarios. The EFF complements the 2060 timeframe of the scenarios, as people's values and behaviours shift over generations (50 years encompasses almost two generations). The EFF asks where the impacts of change will fall most heavily in the future: this includes impacts on mental models, worldviews, value sets; on how people relate to their environment and each other; and on how they communicate, create goods, and consume resources. This approach supports Natural England's purpose: to ensure that the natural environment is conserved, enhanced and managed for the benefit of present and future generations. People are at the heart of our purpose.

A 'three-horizons' analysis was also utilised that considered how emerging innovations and paradigms might compete for societal dominance over time. Hodgson and Curry summarise the three horizons as,

> "…'1st Horizon': the current prevailing system as it continues into the future, which loses "fit" over time as its external environment changes;
>
> '3rd Horizon' ideas or arguments about the future of the system which are, at best, marginal in the present, but which over time may have the potential to displace the world of the first horizon, because they represent a more effective response to the changes in the external environment. …
>
> '2nd Horizon'; an intermediate space in which the first and third horizons collide. This is a space of transition which is typically unstable. It is characterised by clashes of values in which competing alternative paths to the future are proposed by actors[2]."

The three-horizons analysis helps map the varying rates of change in a complex system over an extended time horizon. This underpins scenario logic and plausibility.

Brief description of future worlds
Four possible worlds:

CONNECT for Life
Life in 2060: People now connect through vast global networks. Decisions and economies are based locally, but through billions of worldwide connections they create a bigger and more effective system – a global super-brain. Social and environmental values have strengthened a lot over the years – loyalty lies with communities connected

[1] The Ethnographic Futures Framework (EFF), devised by Bowman and Lum, categorises change by how it affects how we *Define* ourselves and our environment, how we *Relate* to others and our environment, how we *Connect* to others and our environment, how we *Create* new goods, services, and knowledge within our environment, and how we *Consume* goods, services, and knowledge – and dispose of it – within our environment.

[2] Andrew Curry and Anthony Hodgson, "Seeing in Multiple Horizons: Connecting Futures to Strategy," *Journal of Futures Studies*, August 2008, 13(1): 2-3.

for common purposes across the globe; national government has relatively little influence.

How this scenario emerged: In the early decades of the 21st century there was a major focus on using information and communication technologies (ICT) to improve productivity. At the same time, however, less focus was given to the potential of social networking and internet-enabled democratic decision-making to improve social and environmental outcomes. As social networks became sufficiently large and self-supporting, 'traditional' beliefs and ways of doing things became outdated and unproductive. These then faded as hyper-connected communities became the main focus.

GO for Growth

Life in 2060: Making money is a priority and economic growth continues to be driven by consumption and new technology. Few people worry about the environment and almost everyone continues to consume at will. The country has reacted to devastating events by spending money on food from abroad and developing technology. There is growing concern this may not always solve the problems facing Britain.

How this scenario emerged: Trends dominant in the first part of the 21st century continued. Society remained focused on consumption-based growth through a market economy enabled through accelerating innovation.

KEEP it Local

Life in 2060: Society now revolves around nations feeding and providing for themselves. England's land is largely used either for food production or for housing. Critical decisions (for example, around security and infrastructure) are made nationally, with other decisions made regionally and locally. People are very protective of their local area and belongings, but have a strong sense of national identity. Resources are limited and are tightly controlled, but consumption remains high.

How this scenario emerged: In the early 21st century, society emphasised consumption while paying little attention to working within environmental and resource limits. However, in the 2020s and 2030s, those limits were breached and a series of social and environmental crises emerged. This forced nations to adopt more protectionist positions, slowing and unravelling globalisation.

SUCCEED through Science

Life in 2060: The global economy continues to be driven by innovation and everyone relies on business to keep the country growing. London and the South East are important, but the rest of the country is also booming as both cities and their surroundings produce so much. People trust technology to enable growth within environmental and resource limits, but some worry it may not always have the answer.

How this scenario emerged: The early 21st century emphasised improving productivity in the global market economy. However, this served only to focus attention on driving innovation to achieve short-term economic gains. Long-range consequences for society and the environment received little serious attention. However, new entrants in the global economy recognised that their own long-term competitive advantage required a more forward-looking approach that would safeguard social and human capital in the longer term.

Implications and application

Natural England have undertaken an initial synthesis of the key issues and implications emerging from the scenarios in terms of how the future could unfold, against how society might live and the implications for the natural environment (see Natural England Research Report NERR031 *'England's Natural Environment in 2060 - issues, implications and scenarios'*). Natural England have highlighted key similarities and differences between the scenarios and major strategic implications arising for the natural environment over the period to 2060. Neither the likelihood nor the desirability of those futures has been considered.

The report reveals two critical issues central to how society can better manage the natural environment: 1) recognizing that the natural environment has value in some form, and 2) understanding that people's choices largely determine the future state of the natural environment. Ultimately, the scenarios highlight that the future of the natural environment is largely determined by the ability and willingness of society to articulate its values for the natural environment clearly and to make choices that consciously reflect those values.

2. Analysis

2.1 Inventory of other scenario projects

Appendix three of this report documents forty two sets of scenarios developed by other organisations from across the UK, Europe and the rest of the world. Identifying the sponsoring organisation, the consultants or researchers and the publication date, the inventory summarises the aims, focus and methodology of the scenario projects, briefly describing the 'future worlds'. The description also provides insight into the implications and application of the scenarios, together with their relevance to Natural England's scenarios.

2.1.1 Inventory of scenarios developed by other organisations

CONTENTS

2005

19. Dublin Institute of Technology, in collaboration with the Urban Land Institute, 2005
20. King Sturge and Dublin Institute of Technology, 2005
21. Millennium Ecosystem Assessment Scenarios, 2005
22. Shell International Ltd, 2005

2004

23. Foresight Flood and Coastal Defence Project, 2004
24. Rural Economy and Land Use Programme (RELU), 2004
25. The Commission of Architects and the Built Environment (CABE) and The Royal Institute of British Architects (RIBA), Building Futures 2004
26. Tyndall Centre for Climate Change Research, February 2004
27. The East of England Development Agency (EEDA) with the support of the East of England Regional Assembly, 2004

2003

28. The Countryside Agency, 2003

2002

29. Foresight 2020 scenarios, 2002
30. Stockholm Environment Institute, 2002
31. The Countryside Agency, 2002

2001

32. King Sturge and Dublin Institute of Technology, 2001

2000

33. Foresight: the US Environment Protection Agency, 2000

1999

34. Centre for Social and Economic Research on the Global Environment (CSERGE), Climatic Research Unit (CRU), Policy Studies Institute (PSI), 1999

1996

35. The Intergovernmental Panel on Climate Change (IPCC), 1996

2.2 Comparative analysis of scenarios projects

2.2.1 Categorised by origin and primary focus

Chronological listing can help us see how analytic paradigms and foresight methods developed over time. But considering where the scenarios originated, and what their primary topic was, reveals patterns as well. Table 1 below illustrates how the scenario projects we chose differ in focus and geographic origin. Of the scenario projects we identified that specifically focused on environment, biodiversity, or land use, seven were UK projects, and eight were external. Out of our current pool of forty two projects, sixteen focused on environment, biodiversity, or land use specifically, while the remaining twenty six focused on technology, the economy, or society.

Table 1 Categorised by origin and primary focus

Note: project titles in bold indicate Edition 2 additions.

Focus \ Origin	UK	EU	Rest of World
Environment and biodiversity	• UK EA Water 2050 • UK EA 2030 • Defra Marine Ecosystems	• EU EA PRELUDE 2050 • MEA 2030	• UNEP 2050 • US EPA 2020 • IPPC
Land and land use activities	• **BIS Land Use Futures 2060** • Flood and Coast Defence 2100 • RELU • Housing Futures 2024 • CA 2020	• EU Real Estate 2020 • Global City 2030 • Global Real Estate, 2015	
Technology and economy	• **Orange 2016** • DIUS (SEMBE) 2050 • Intelligent Infrastructure 2055 • Civil Society 2025 • CIPFA 2030 • HSE 2017 • OFGEM 2020 • Hydrogen Futures 2050		
Society and economy	• **Forum Business 2018** • **Public Services Trust 2020** • **ICE, Aviation 2040** • **The Challenge Network 2040**		• Shell Global 2050 • Shell Global 2025 • Humanitarian Futures 2025 • Great Transition

	• **DCLG 2030** • CA 2012 • EEDA 2020 • Yorkshire Futures 2030 • Chatham House • Food Ethics Council 2022 • BERR 2020 • DIUS 2030 • Foresight 2020 • DETR/UKCIP		

2.2.2 Categorised by origin and ethnographic futures framework

Natural England's scenarios benefited from using the Ethnographic Futures Framework (EFF). Appendix 1 presents the forty two sets of scenarios sorted by place of origin and EFF category. As a conceptual schema, EFF focuses not on the sector from which change is primarily emerging, but on what kind of human activities the change will primarily affect. EFF suggests impacts can affect people in five categories: *Define*; *Relate*; *Connect*; *Create*; and *Consume*.

- **Define:** changes to the concepts, ideas, and paradigms we use to define ourselves and the world around us, including changes in:
    - social values and attitudes;
    - scientific models and paradigms;
    - culture;
    - economic models, paradigms, and systems;
    - religion and religious beliefs; and
    - political beliefs and values, and public policy paradigms.
- **Relate:** changes in the social structures and relationships that link people and organisations, and changes in how people relate to their environment, whether natural or built; this includes:
    - demographics;
    - family and lifestyle groups/community;
    - work and the economy;
    - habitats and ecosystems;
    - business models and practices;
    - government and international relations;
    - education; and
    - technology.
- **Connect:** changes in the technologies, broadly defined, used to connect people, places, and things, including:
    - information technology;
    - music;
    - media;
    - visual arts;
    - language;
    - space; and
    - infrastructure.
- **Create:** changes in the processes and technologies through which we produce goods and services, including:
    - engineering;
    - wealth, capital, and investment;
    - manufacturing, economic infrastructure;
    - innovation processes;
    - life sciences;
    - material sciences;
    - nanotechnology; and
    - agriculture.

- **Consume:** changes in the goods and services we create and the ways in which we acquire and use them, and discard and destroy them, including:
    - consumer goods;
    - energy;
    - food;
    - house and home;
    - entertainment and leisure;
    - healthcare;
    - natural resources; and
    - public services.

As a well-written scenario depicts many changes, the projects themselves were not sorted into the EFF categories. Instead, we asked the question, “where do the axes of uncertainty each fall onto this grid?” Where scenarios may convey complex details of emerging change, their defining axes should focus on a single sector. If the method used did not specify or employ axes of uncertainty, we categorised either the primary drivers for the scenarios, or the specific scenario stories themselves.

One caveat: the sorting was a subjective analysis of project content against the EFF, and consequently interpretations could vary; Natural England invite discussion of the results. The outputs reveal a decided preference in selection of axes of uncertainty. Axes tend to load either onto questions of government relations (international political context, or local-national context), or questions of economics and market (either from the perspective of *Create* or *Consume*). The least represented category among the drivers reflected in these projects was *Connect* - only five projects out of forty two had an axis or scenario that addressed how people connect. EFF’s ‘Connect’ category includes all changes related to communication, whether they be advanced networking and media technologies, or new languages and art forms, or spatial design and infrastructure. Given the increasing calls for accountability in government, corporate social responsibility in the private sector, transparency, inclusiveness, and participative decision-making, failing to explore uncertainties in ‘Connect’ impacts seems a strategic vulnerability. It also appears curious in the context of rapidly changing communication and networking technologies which amplify the reach and potential impacts of social movements.

Should we be concerned that so few axes address uncertainties about fundamentally redefining our approaches to problems – often seen as the first step in creative problem-solving? And what does it mean for our ability to convey insights or critical issues to stakeholders and the public that none of the projects addressed uncertainties revolving around how people communicate? This is particularly extraordinary given our “information age” pre-occupation with the impacts on economics, governance, and education, among other topics, of interconnected communication and computing networks, and the subsequent pervasive spread of social networking in the public, private, and civil sectors. One of the great strengths built into the ScENE scenarios were the EFF - derived discussion questions that ensured that each ScENE scenario addresses both stabilities and transformations across the Define, Relate, Connect, Create, and Consume activities of human life.

2.2.3 Categorised by scenario method and researchers

Client, Consultant, and Methodology (analysis)

Why do we need so many different approaches and points of view?

Reality is complex. All our possible futures will likewise be complex – whether expressed for example, as a systems model, or as a story about a possible outcome (a scenario). Viewing complex topics with multiple lenses and filters adds analytic depth to understanding the impacts of change throughout that complexity. Those different lenses and filters can be different foresight methods – systems dynamics, modelling, expert analysis, Delphi research, causal layered analysis, morphological analysis, 2x2 axes of uncertainty, ethnographic futures framework, and more – but can also be the filters of different professional experiences. A glossary of these terms, and others, is provided in Appendix 6.

Every new filter reveals different details. These differences of perspective enable exploration of alternative possible futures, and the articulation of transformative preferred futures. Using only one paradigm to view the future is equivalent to monocular vision: flat. Using two or more paradigms or worldviews to view the future is like binocular vision: it creates depth of field, and understanding of where things stand relative to each other. Shared stories, vivid details, depth of field: these qualities are only possible with many people contributing different perspectives to exploring alternative possible futures.

What methods are commonly used to generate scenarios?

Most common

Half (twenty one) of the scenarios projects analysed used an unadulterated 'axes of uncertainty (drivers matrix)' approach for generating scenarios of possible futures. As this method was developed in the UK (with roots in Shell Oil's strategy work), this is no surprise – many of the consultants and researchers who engage in scenario thinking in the UK learned their skills at Shell, or from practitioners with Shell experience. The 'axes of uncertainty' approach is also the most commonly used scenarios method in business and management worldwide. Even people new to scenario thinking and futures research are often familiar with it, and hence clients embarking on a first foresight endeavour will often request it in ignorance of the various other methods available.

Table 2 Categorised by scenario method and researchers

Note: project titles in bold indicate Edition 2 additions.

Researchers \ Method	**In-house**	**Academic**	**Consultants**
Axes +	21. Millennium Ecosystem Assessment (varied spatial / temporal scales) 23. DTI Flood and Coastal Defence (+systems modelling) 25. Tyndall Hydrogen (+ hydrogen energy and transport modelling)	34. DETR/UKCIP (+systems modelling) [CSERGE / CRU / PSI]	2. Food Ethics (+systems +EFF) [Infinite Futures] 3. UK EA 2008 (+3-horizons +EFF) [Futures Co.] 11. HSE (+EFF +systems) [Infinite Futures / SAMI Consulting] 24. RELU (+forecasting) [Institute for Alternative Futures / Manchester University)
Axes	**C. The Challenge Network 2040** 1. OFGEM	12. Humanitarian Futures (Kings College)	**G. Orange 2016** **D. ICE, Aviation 2040** **A. DCLG 2030**

	4. Chatham House 5. BERR 16. UK EA 2006 29. Foresight 2020	18. Marine Ecosystems (various) 19. DIT-ULI 20. DIT-EC 32. DIT-Global	6. DIUS 2008 [Outsights/MORI] 7. SEMBE [Futures Co.] 13. CIPFA [SAMI Consulting] 17. DIUS IIS (+3 horizons) [Futures Co. and Waverley] 26. EEDA [Futures Co.] 28. Countryside Agency, 2003 [Tomorrow Project] 33. US EPA [Institute for Alternative Futures]
Trilemma	22. Shell Global 2025		**B. BIS, Foresight Land Use Futures 2060**
Driving Forces – Pressures – State – Impacts - Responses	14. UNEP		
Emergent / clusters	9. Shell Energy 2050		8. Yorkshire Futures (+ 3-horizons) (Futures Co.]
Morphological	35. IPCC		
Story & simulation		15. EEA PRELUDE	
Causal Layered Analysis			10. Carnegie UK Trust (Futures Co / Infinite Futures]
Expert assessment	30. Stockholm	25. CABE/RIBA	
Scenario paradigms			**E. Public Services Trust 2020**
Systems-based drivers synthesis and contrast			**F. Forum Business 2018**

[31.Countryside Agency, 2002 was not included as it is a vision statement – a preferred future]

New methods: enhanced comparative rigour

The tendency to combine multiple foresight approaches in building scenarios reflects the increasing sophistication of UK foresight clients. The 'axes of uncertainty' approach attracts those unfamiliar with futures thinking because it presents an easily understood frame for a limited number of scenarios. The downside to an easily grasped two-by-two matrix of unambiguously stated, highly aggregated drivers is lack of nuance. A further downside can be lack of rigor in structuring consistent details within each scenario to enable easy comparison across the scenarios.

Several strategies can address these flaws. For example, the consultants proposed using the EFF framework for ScENE's scenario process based on lessons learned by Infinite Futures and SAMI Consulting during the write-up of the Health and Safety scenarios project. The HSE project's scenarios workshop generated a wealth of details across the four scenario spaces. EFF was used following the workshop to structure those myriad details within each scenario. This had two benefits. First, it created a consistent structural framework within each scenario that enabled more rigorous cross-scenario comparisons of change dynamics and impacts. Second, because EFF highlights core paradigms, relationships, values, and communication, its use as an organising template ensures that those concepts are addressed by each scenario. This adds a level of depth with particular regard to worldviews and values that other techniques do not consistently achieve. This effect was heightened in ScENE by building EFF into the scenario workshop process from the start, using it as a series of

provocative questions to drive participants' discussions of change within each of the scenarios.

The analysis of the forty two scenarios in this compendium demonstrates how organisations have tried to improve the scenario process and to enhance analytic nuance, consistency of internal structures, and comparability across scenarios. The 'axes of uncertainty' approach has been mixed with systems thinking and systems modelling for a better understanding of the interconnections, feedback processes, and dynamics of change (BIS Land Use Futures, Challenge Network, Food Ethics, HSE, Floods and Coastal Defence, EEA PRELUDE, Stockholm). To better grasp how changes evolve over time and what conflicts may arise as paradigms and values shift, several projects used the 'axes of uncertainty' approach but elaborated it via different temporal frameworks, such as Hodgson and Sharpe's 'three-horizons' timeline (EA Water 2050, Millennium Ecosystem Assessment, Yorkshire Futures). ScENE augmented the 'axes of uncertainty' approach with both EFF and a three-horizons analysis.

New methods: beyond 'flatland'

This analysis of methods suggests that organisations increasingly want to deepen their understanding of the human narratives and social and political implications of change. Within academic futures, the 'axes of uncertainty approach' is often critiqued for producing what Slaughter describes as 'flatland': sets of scenarios in which current worldview, values, and ideologies were insufficiently problematised or challenged, and simply accepted as natural[3]. In other words, the 'axes of uncertainty' method can too easily create scenarios that are minor variants of 'business as usual', rather than explorations of potentially transformative or disruptive future change driven by emerging paradigms and challenging worldviews. This represents a vulnerability in strategic thinking given not only the fast pace of change, but also the increasingly multi-lateral and culturally diverse context for both business and policy decisions.

This emphasis on values and worldviews surfaces in two ways:

> ScENE 2060, EA Water 2050, and HSE 2017 mixed an 'axes of uncertainty' approach with EFF, a worldview-focused technique; and
>
> Carnegie UK deliberately chose a completely values-and-worldview-focused method, Causal Layered Analysis[4].

Given the increasing ease of mobilising social movements in response to change and its impacts, this deepening interest in how people perceive and value change is understandable.

By incorporating EFF, the ScENE scenarios represent an emerging paradigm shift in scenario methods in that regard. They also incorporated a 'three-horizons' analysis that considers how emerging paradigms compete for societal dominance over time. This strengthens the plausibility of the value and paradigm shifts explored.

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[3] Slaughter, Richard. (2004). Transcending 'flatland'. In *Futures beyond dystopia: Creating social foresight*. London: RoutledgeFalmer.

[4] Causal Layered Analysis (CLA), developed by Sohail Inayatullah, explores issues from the immediately observable layer of current events and public opinions, down through layers of technical and systemic analysis, to worldviews and paradigms, and finally to deep cultural myths and metaphors.

2.2.4 Sorted by scenario categorisation to ScENE 2060 - scenario relevance

The project proposal originally suggested sorting the pool of scenarios by their relevance to the ScENE, into 'highly relevant' and 'contextual/background' scenarios. The second step would sort the contextual scenarios into those which essentially confirmed or validated the primary 'plot points' or insights of the ScENE scenarios, and those which offered significantly new perspectives, or filled gaps in topics or analysis. The third step would synthesise archetype scenarios from the small pool of 'highly relevant' core scenarios. The conceptual diagram illustrating that initial design was this:

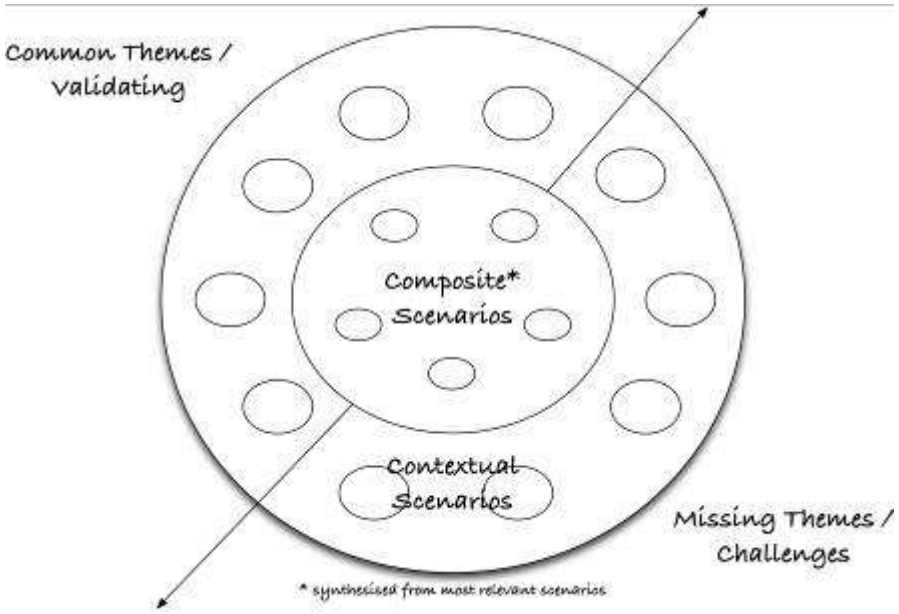


Figure 1 Original analytic schema

After completing most of the inventory and annotation, an informal sort of the scenarios using this diagram as a framework was undertaken. It was concluded that this approach lacked dimension. Validation has a time component: relatively recent (for example, post-2000) scenario projects with common themes may validate ScENE results. Earlier scenario projects do not validate as much as they create context, existing as part of the historical background of the policy dialogue with regard both to foresight methods and discussions generally, and to specific topics. Most of the missing themes or 'gap-fillers' significant for ScENE are also likely to emerge from more recent projects.

For example, an initial list of 'common themes' scenarios very quickly devolves into more recent 'validating' scenarios, and scenarios that have provided a cornerstone foresight role to many UK policy projects, for example, the 2002 Foresight 2020 scenarios, which exist as background and context for the design of much subsequent work.

Table 3 below illustrates these initial results, identifying sixteen scenarios as background, and nine as validating. Note that older scenario projects from a different perspective – the EU, or the USA – retain their 'validating' capabilities over time both because they reflect a different cultural perspective, and are also less likely to have been pervasively absorbed as examples into the UK policy foresight dialogue.

Table 3 Examples of background vs. validating scenario projects

Note: project titles in bold indicate Edition 2 additions.

Background	Validating
• **Forum Business, 2008** • **Public Services Trust, 2009** • **The Challenge Network, 2010** • **DCLG, 2010** • Global City, 2005 • Shell International Ltd, 2005 • Foresight Flood and Coastal Defence, 2004 • RELU, 2004 • Housing Futures, 2004 • Hydrogen Futures, 2004 • Countryside Agency, 2002, 2003 • Foresight 2020, 2002 • Global Real Estate, 2001 • DETR/UKCiP, 1999 • IPCC, 1996	• **BIS, Land Use Futures, 2010** • BERR, 2008 • DIUS, 2008 • Shell International Ltd, 2008 • HSE, 2007 • Humanitarian Futures, 2007 • CIPFA, 2007 • Millennium Ecosystem Assessment, 2005 • US EPA, 2000

The remaining seventeen scenario projects offer value beyond validation. One, the Stockholm Enterprise Institute study, poses a 'meta-question' about long-range futures for humanity and the planet. Four of the projects are primarily validating, with a specific scenario offering a perspective that may be missing elsewhere, for example, the UNEP scenario "*Security*" from their 2007 project. Twelve of them offer a 'deep dive' into a specific topic, like water or real estate. Examples include (see diagram, next page):

- The Carnegie UK Trust project on the future of civil society, 2007, offers a unique and useful focus on the role of voluntarism and the civil sector vis-à-vis community organisation and how that could interact with changes in the natural environment, or managing the natural environment.
- Notions of health and safety that might impinge on the natural environment, especially as a possible worksite, could be extracted from the Health and Safety Scenarios, 2007.
- Regional perspectives that might be missing from UK-wide scenario projects are offered by efforts such as the Yorkshire Futures project, 2008, or the East of England Development Agency scenarios, 2004.
- How water availability and use might change over the next several decades, and what that might mean for the environment, could be explored with comparisons to the UK EA's Water 2050 project.
- How we eat, what we eat, how our food is grown and distributed, are questions raised in the Food Ethics Council's scenarios on the UK food system, 2009, that might fill gaps in detail existing in the current ScENE work vis-à-vis food.
- Whilst focused on the future of air transport infrastructure, the extent to which attitudes about the environment and climate change have changed consumer behaviour and government policy, are considered within the Institute of Civil Engineer's Aviation 2040 project.

This analysis is mapped in below in Figure 2, which sorts the compendium scenario projects by their value to ScENE.

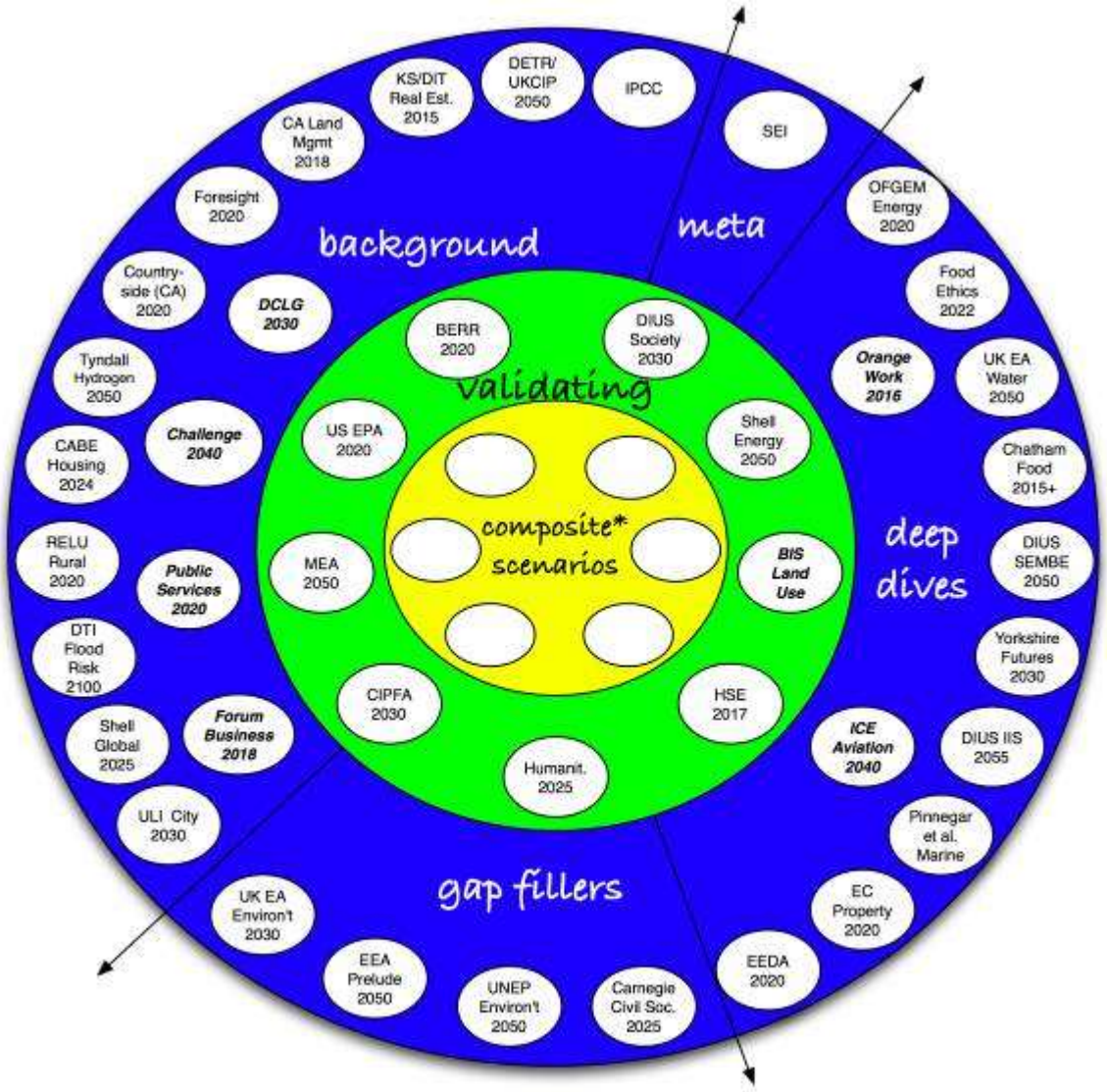


Figure 2 Compendium scenario projects sorted by value to ScENE

Our detailed background analysis underpinning the above is contained in Appendix 2.

2.3 Creation of a set of archetype or meta-scenarios

Many of these scenarios tell similar stories. We analysed the twenty three projects identified as validating, deep dives, or gap fillers for similarities of theme, drivers and details. A map of future 'archetypes' emerged from clustering the similarities. See Figure 3.

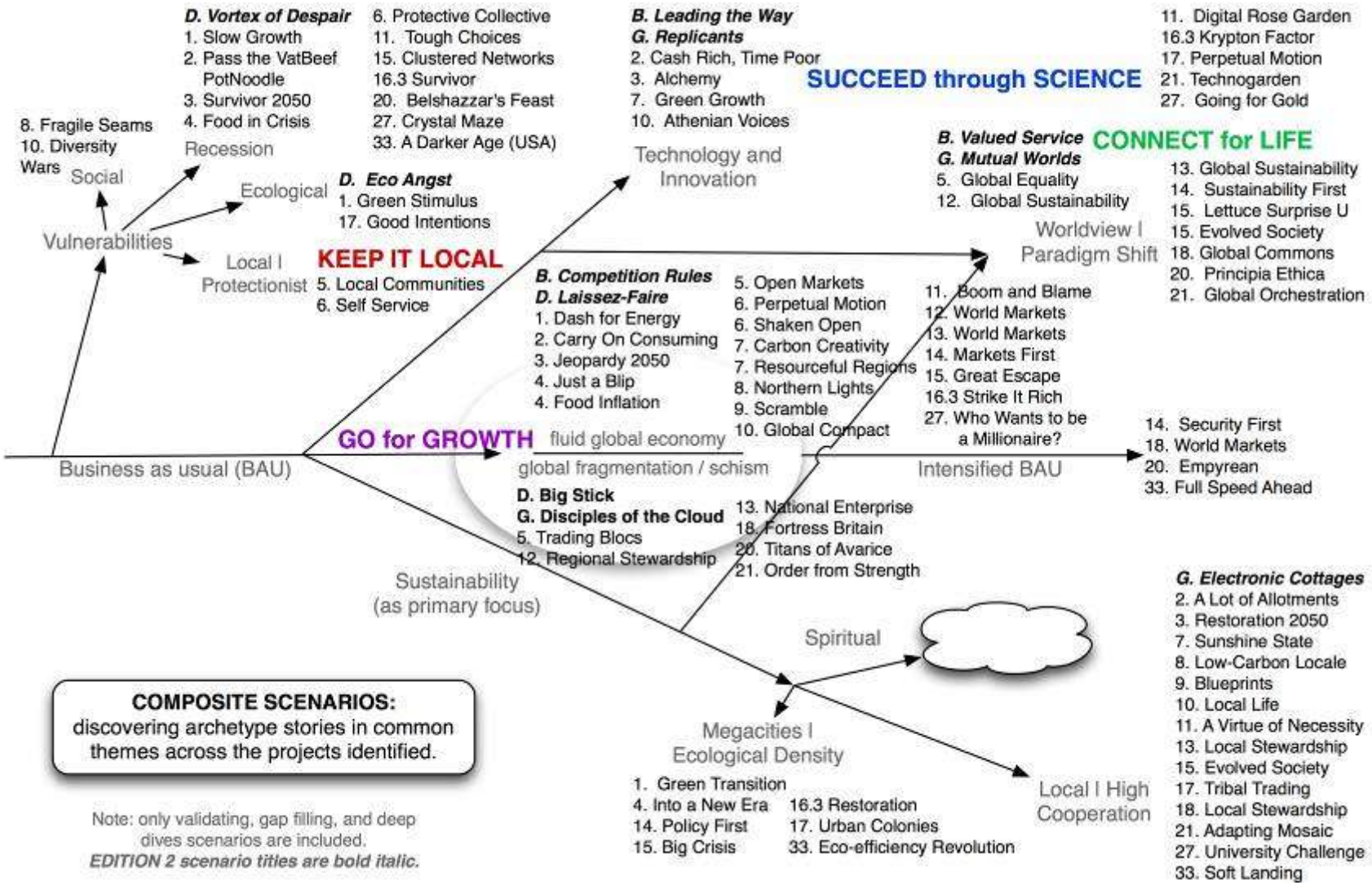


Figure 3 Creating composite 'archetypes' by thematic clusters

The strongest, most consistent archetype portrays a future of 'business as usual' for government and the economy: competitive, market-driven, consumerist, materialist, and featuring little additional change in environmental management. Note that participants in the US EPA project assessed their 'business as usual' scenario as likely in the short run, specifically because it is a continuation of the "current trends and underlying assumptions and preferences" of decision-makers and leaders. But because those same participants also realised that it was "destructive and negative in the long run, with impacts nearly as severe as the most gloomy future...", they judged it as unlikely in the long run[5].

The lesson from a 21st century systems-based (complex adaptive systems) perspective is that 19th century 'business as usual' – where that business is the materialist, consumerist, environmental-cost-externalised global economy based on finite resources – is not feasible in the long-run, and is therefore implausible. "Business as usual" emerged from a mechanistic Newtonian scientific paradigm that focused on modelling linear relationships. The early industrialists took the power of that paradigm and wedded it with a worldview that assumed that infinite growth was good and possible. Daniel Bell identified a key fatal flaw of that view several decades ago in *The Cultural Contradictions of Capitalism*. So, 'business as usual' will slam into system limits; currently, those limits are environmental and climatological. Transformational scenarios of different varieties – collapse, high tech, or sustainability – will also face, at some point, system limits, but they will be different kinds of system limits.

Yet because current assumptions have staying power, all the scenario projects analysed to create our 'archetypes' included a 'business as usual' scenario. Natural England's scenario *'Go for Growth'* aligns with this archetype.

Four other primary archetypes emerge:

- a 'high-tech' future transformed primarily by technological fixes – ScENE *'Succeed through Science'* is an example;
- a 'sustainability' future that prioritises the environment, and may do so via efficiencies of scale in urban settings, or by decentralising via a 'think globally, act locally' approach;
- a 'paradigm shift' future that overturns current assumptions about governance or the economy, often connected to worldview and value shifts and enabled by new technologies – ScENE *'Connect for Life'* depicts a future informed by a complex adaptive systems perspective and its results (for example, social media and social networking; evolving bottom-up governance; focus on ecosystems and biomimicry); and
- 'vulnerability' or 'collapse' scenarios, depicting for example, economic difficulties, social schisms, or environmental degradation. ScENE did not explore a 'collapse' scenario, so scenarios like Health and Safety 2017's 'Tough Choices', Carnegie UK's 'Diversity Wars' or, the Institution for Civil Engineer's 2040 'Vortex of Despair' can help widen their perspective. However, ScENE's *'Keep It Local'* scenario illustrates a protectionist outcome possible in response to rising vulnerabilities.

Creating archetype scenarios illustrates common patterns emerging across scenario projects. It can also evaluate how well researchers and participants 'think outside the

[5] See US EPA Foresight Scenarios 2020 evaluative graph.

box' about possible futures. Paradigm shift scenarios are relatively rare – hence the accusation by Slaughter that much of scenario building happens in 'flatland', ie, a space of unquestioned assumptions or worldviews[6]. ScENE's *'Connect for Life'* offers a unique attempt to explore potential shifts in worldview in the next two generations of decision-makers: how will adults who grow up in immersive media and computing environments view the world and each other? how will their children, who grow up designing and programming nanobots and synthetic life forms view the world and each other? how might they use and manage England's natural environment?

Reduce, re-use, recycle vs. shelf-life: why generate new scenarios?
Participative scenario projects can be expensive. Both workshop logistics and gathering, collating, analysing, and synthesising participant contributions, and then fact-checking imaginative extrapolation against evidence, cost money. If so many scenario projects have been completed on the same or related issues, why invest in another? Why not just use the archetypes? Because the archetypes are not themselves detailed scenarios: they merely provide a simple way to cluster similar scenario stories. Why not use scenarios from another project? Because the scenario stories within an archetype are similar, but not duplicates. The strategic focus, and the research question, may vary: the EEA PRELUDE scenarios are well researched, offer challenging images of potential outcomes, and as such are useful. They share several common themes with the ScENE scenarios, and thus validate many of our participants' insights. However, they were written with an EU regional audience in mind, and thus the dynamics of the impacts, not to mention some of the cultural details, are not well tailored to the concerns of UK decision-makers.

This is not to say that scenarios cannot be re-used, and re-used both appropriately and usefully. Within a single organisation, the UK's Environment Agency has consistently applied its 'risk-based' scenarios, 'Alchemy', 'Jeopardy', 'Survivor', and 'Restoration' to different questions. Most recently they have been applied to consider 50-year futures for water use in the UK. But with each re-use, they are updated (and, most recently, retitled) to incorporate new conditions and new horizon scanning data on trends and emerging issues.

Our content analysis indicates that perhaps the best 'value for money' across government has been achieved by the (then) DTI Foresight's *Futures 2020* report (itself a revised and updated version of DTI/OST's *Environmental Futures*, 1998). This report provided the scenarios for four of our forty two projects:

- 13. CIPFA, Public Services 2030;
- 18. Marine Ecosystems;
- 23. Foresight Flood and Coastal Defence; and
- 26. Tyndall Hydrogen Futures to 2050.

The chosen drivers for these scenarios were social values (x-axis) and systems of governance (y-axis). The values ranged from individualistic to community orientated. The governance systems from highly autonomous national decision-making, to more interdependent structures where power moves, or is shared, up to with regional or global agencies, or down to local authorities. These determining axes represent a classic

[6] Slaughter, Richard. (2004). Transcending 'flatland'. In *Futures beyond dystopia: Creating social foresight*. London: RoutledgeFalmer.

background context: no matter what the policy topic, consideration of these values and structural shifts could prove useful. This results in something very close to a generic set of societal scenarios, which perhaps explains the extent to which they have been ‘recycled.’ But if we recycle, we must update: using the Foresight 2020 scenarios now, for example, would require their re-drafting to reflect the current recession.

Rapid changes in our technological milieu also drive changes in social values and consumer expectations. They create both opportunities and threats for governance. Because of this, ‘generic’ scenarios are not necessarily the most useful. Our current recession/post recession environment presents a particular problem, as citizens and policy makers and business people are all considering how the environment should change – and what should remain the same – in order to re-stabilise the economy and revitalise it. In the next decade, UK society may face changes that reach irremediable thresholds – in population, energy, water use, housing, climate – and thus any scenarios we create now should highlight those tipping points and their potential impacts. No matter how archetypal scenarios appear to be, even change itself changes: our thinking about the future requires constant refreshing to accommodate new opportunities as well as new threats.

3. Key issues and implications: key messages derived from the work

3.1 Lessons learnt for scenario building: different methods, different output

Why do scenarios vary so much, even if generated by similar drivers?

The scenario archetypes show clusters of common narrative themes across the compendium's scenario projects. The similarities emerge in part from the choice of similar drivers. Yet despite these similarities, the stories themselves, and their details, vary considerably. Why? The emphases and the immediate personal experiences that people contribute to constructing the stories differ. This feedstock of stimulus varies both across workshop participants and from day to day as media and our social environment bring various trends to our attention. So while similar patterns do arise across groups of scenarios, the devil is truly in the detail: even with similar overarching structures, the impacts on specific decisions in specific environments will be defined by the detail most relevant to those decisions and environments.

Natural England's enriched approach to scenario building

To reflect the central role of people's values, culture, and behaviours in shaping how the future may develop over a long timeframe, Natural England adopted the Ethnographic Futures Framework (EFF) as the unifying structure to explore how various drivers could develop. This deepening interest in how people perceive and value change reflects the increasing ease of mobilising social movements in response to change and its impacts. By incorporating EFF, ScENE represents an emerging paradigm shift in scenario methods in that regard: an 'integral futures' approach[7]. EFF generates questions prompting participants to consider different mindsets regarding issues like consumerism, communications, community structures and relations, economic models, decision-making, and locus of power. People often accept their current worldview and paradigms as 'natural'. EFF helps challenge current worldviews, values, and ideologies in order to explore potential change more thoroughly.

This approach is not philosophical, but strategic. In *Leverage Points: Places to Intervene in a System*[8]*,* modeller and systems scientist Donella Meadows points out that while regulations or incentives affect behaviour in the short-term, their effects do not persist in their absence. Creating durable long-term change requires transforming the paradigms of the system, where its goals, power structure, rules, and culture arise. EFF makes those deep systemic foundations more visible.

ScENE incorporates a 'three-horizons' temporal framework that considers how newly emergent innovations, values, and paradigms compete for societal dominance over time. This strengthens the plausibility of the paradigm and value shifts identified and elaborated in the resulting scenarios. The 'three-horizons' approach supports the internal consistency of scenarios as well as identifying sources of potential social and political conflict generated by emerging change.

Comparison to other compendium scenarios methods

The Health and Safety scenarios and the UK EA Water scenarios both used EFF, but they imposed it on output following workshops as a means to organise and analyse the scenario details. Foresight's IIS used 'three-horizons' primarily to roadmap the emergence of intelligent infrastructure innovations. No other scenario projects

[7] Joseph Voros, "Integral Futures: An approach to futures inquiry", *Futures* 40 (2008) 190–201.
[8] Meadows, Donella, Leverage Points: Places to Intervene in a System.
www.sustainer.org/pubs/Leverage_Points.pdf

augmented their process with both EFF and 'three-horizons' *as discussion templates for participants* from the start of scenario creation (workshops). The resulting level of detail and cross-scenario comparability available for analysis is striking. For example, each of the ScENE scenarios clearly identifies the value emphasis and political, economic, and environmental paradigms that shape each scenario's future.

Comparison to Foresight Land Use Futures Project: scenario method

Scenario building processes take many forms, and one classic design decision is whether to use a deductive approach, or an inductive one. *Deductive*, or 'top-down' approaches, begin by identifying a conceptual structure to organise the evidence. The most common deductive scenario process uses the 'axes of uncertainty,' or a 2x2 drivers matrix, to structure stories and generate scenario details. In contrast, *inductive*, or 'bottom-up' approaches essentially create scenarios by accretion of logically consistent details. The scenario narratives emerge as trends, drivers and impacts are aggregated via pattern-matching: an inductive trilemma conceptual approach enabled the narratives to emerge and evolve with the addition of new data on change and impacts.

The Foresight Land Use Futures project built its scenarios using an inductive, or 'bottom-up' approach. The project team organised a series of workshops in which participants shared perceptions of emerging issues, uncertainties, impacts, and potential futures for land use. These 'story fragments' were clustered thematically, and combined with evidence from the consultants' scanning database and with the Land Use Futures project state of science reviews. The process was iterative, as more details were added based on discussions in subsequent testing workshops. Reference to the extensive land use systems maps produced for the Land Use Futures project ensured internal consistency within the developing scenario narratives.

ScENE used the opposite approach, creating a deductive framework by exploring issues of uncertainty and identifying three key uncertainties that defined a set of scenarios. This deductive approach was augmented by use of EFF and the 'three horizons' timeline framework to add details and depth. Arguments can be made for both approaches, but what's interesting is the difference in the resulting narrative structure: whilst the emphasis of the ScENE scenarios is on describing the resulting future outcomes, the Land Use Futures scenarios focus more on describing how the future unfolds than on depicting the end state.

3.2 Positioning of ScENE's scenarios

Why are there so many time frames, from short-term (years) to long-term (century)?

The issue of time frame is key: the time horizon must suit the harmonics, amplitude and frequency of change for the core topic. For example, short-term horizons may be a necessity where scenarios focus on innovations in consumer technologies, reflecting the rapid changes possible in goods and markets. In contrast, scenarios focusing on UK geology may require a time horizon of millennia, due to slow shifts in bedrock. Where two or more systems are interacting, the design choice is more difficult: coastlines, climate change and social change for example, involve millennial change cycles, century change cycles, and decade change cycles, respectively. So, the most appropriate time horizon for any scenario project must mediate between the topics chosen, and the potential time frame for decision-making and change management. With a focus on how technologies might change the workplace, the Health and Safety Executive scenarios

had a one-decade time horizon; Flooding and Coastal Defence, based on long-term impacts of climate change, needed a ten-decade time horizon.

ScENE's framing of space and time
The scenario projects analysed in the compendium span more than a decade of foresight research. As Table 4 illustrates, the projects vary in focus, spatially from the local and sub-national to global futures, and over time horizons from a decade to a century. No other projects explore futures for England's natural environment from mountain top to seabed looking ahead fifty years. The scenarios specifically depict different outcomes for upland, lowland, settlements, woodland, wetland, coastal, and marine environments. ScENE thus provides a distinctive perspective in terms of its particular timeframe and spatial scales.

Foresight Land Use Futures Project: framing of space and time
In contrast to ScENE, the Land Use Futures scenarios are both more and less constrained in their spatial frame. They encompass the entire UK – England, Wales, Scotland, and Northern Ireland – where ScENE is limited to England. But Land Use Futures stops at the tideline, and ScENE continues out to England's marine habitats. This conceptual limitation does constrain Land Use Futures from fully exploring some possible futures, for example, creating artificial land or expanding urban areas into the marine environment via large floating structures. Both the projects acknowledge connections with the wider global context, but Land Use Futures offers greater detail on how the UK's political and economic international relations evolve and affect the UK across the three Land Use Futures scenarios.

The two projects feature identical fifty-year time horizons (indeed, the ScENE time frame was deliberately adjusted to match that of the Land Use Futures' project). But within that time horizon, the two projects differ in depicting the time span, as noted above. ScENE explains the transformations that created the outcomes for 2060 in each of its scenarios, but focuses on describing daily life in 2060. The Land Use Futures scenarios, in contrast, are mini-histories of the years to 2060, ending with a comparatively brief gloss on current conditions in 2060.

Table 4 Scenario Projects classified by timescale, spatial scale, and relevance to environmental issues (moderately relevant: italics; highly relevant: bold)

Time scale **Spatial scale**	**< 10 years**	**>10-30 years**	**30-50+ years**
Sub-national	31. Countryside Agency	8. Yorkshire Futures *24. RELU* 27. EEDA 28. Countryside Agency	**ScENE**
National	11. HSE 2017	A. DCLG 2030 *D. ICE, Aviation 2040* E. Public Services Trust 2020 F. Forum Business 2018 *G. Orange 2016* *1. OFGEM* *2. Food Ethics*	**B. BIS Land Use Futures** **3. UK EA Water 2050** *7. DIUS SEMBE* 17. DIUS IIS *23. DIUS Flood and Coastal Defense* *26. Tyndall Hydrogen* **34. DETR / UKCIP**

		5. BERR 6. DIUS 2030 10. Carnegie Civil Society 13. CIPFA Public Service **16. UK EA 2030** 25. CABE / RIBA 29. Foresight 2020	
EU	*4. Chatham House Food*	12. Humanitarian Futures **18. Marine Ecosystems** 20. EC Real Estate	**15. EEA/PRELUDE**
International	32. King Sturge Global Real Estate	C. The Challenge Network 2040 19. ULI Global City 22. Shell Global 2025 **33. US EPA**	*9. Shell Energy 2050* **14. UNEP 2050** **21. UN MEA** *30. Stockholm Environmental Institute* **35. IPCC**

3.2.1 How do Natural England's scenarios complement other projects?

Common concerns

Common concerns included the value of the natural environment vis-à-vis the value people place on it, explored by the Millennium Ecosystem Assessment, the UN Environmental Programme, both the UK and the EC Environment Agencies, and the Marine Ecosystems project. Other common concerns included the locus of decision-making (ie the extent to which policies are imposed from a central authority, or whether they incorporate local knowledge within a participative framework); and the robustness of the economy and the impact economic vulnerability might have on environmental management and sustainability. The scenario 'archetypes' identified by our analysis demonstrate how common themes can emerge as common stories.

While addressing these common issues, Natural England's scenarios framed them with an emphasis on people's daily lives and choices when faced with distinct trade-offs. Many of these projects offered detailed 'future histories' and stories of possible futures. Most of them expressed their scenarios using an organizational or national history 'tone of voice' (for example, UK EA, EEA, US EPA). ScENE let people living in its scenarios describe the worlds their choices have created. These personal stories were also visualised as a graphic presentation. This added vivid detail to the scenarios, but also expressed particularly English perspectives and specific local knowledge. Field testing and refinement of the scenario 'sketches' against the experience and values of people living and working across England's different terrestrial and marine environments formed an integral feature of ScENE scenario development. By emphasising England's biotopes as informed by local expertise, ScENE created a scenario set depicting detailed local implications. This will in turn assist local application of the scenarios for strategic thinking.

Commonalities with Foresight Land Use Futures Project

ScENE and Land Use Futures share a palette of concerns about the inter-relationships between people, government, innovation, and the environment. The three Land Use Futures scenarios – *Leading the Way, Valued Service,* and *Competition Rules* – do not

duplicate the ScENE scenarios, but connect with them on several dimensions. The projects also intersect at various points along a baseline timeline of emerging change (see Appendix 5).

Leading the Way, like ScENE's *Succeed through Science*, presents a future wherein the UK is a world leader in biotechnology and environmental innovation and uses these resources to address many environmental problems. But both scenarios raise the issue of how long 'technological fixes' can stave off increasing pressures on the environment. Like *Succeed through Science*, *Leading the Way* leverages the emerging issues of innovations agriculture, including genetically modified crops and bioenergy crops. Synthetic meat is the UK's top export. Innovative wind, wave, and solar installations are built in the transition to a low-carbon economy.

Valued Service offers a more transformational future in which people recognise the need to ensure economic growth is achieved within environmental limits – this value shift echoes the shift in perspective found in ScENE's *Connect for Life*, with its whole systems perspective. With its "Green Grid" initiative, this scenario echoes the blurring of urban and rural best exemplified in ScENE's *Connect for Life*, which leverages emerging issues like "*vertical farming and metropolitan agriculture / urban agriculture are widespread*: food skyscrapers are built in London, Birmingham, and Liverpool; urban greening becomes widespread not only for food production, but for heat management – cities are using a mosaic of approaches, seeing diversity and experimentation as enhancing robust adaptability". *Valued Service* also intersects with *Connect for Life* in exploring emerging approaches to community ownership and financing, and more decentralised and collaborative approaches to decision-making and management.

Competition Rules, like ScENE's *Go for Growth*, presents a future defined in large part by institutional and social resistance to change. The concern over how values drive change, and how values might evolve to the benefit or detriment of the environment, is critical to both projects. Where *Go for Growth* depicts a society squeezing every last resource for productivity to delay the crash into system limits, *Competition Rules* depicts the crash. Consequently, like *Go for Growth* it turns to maximized production, particularly in the agricultural sector. Average farm sizes increase and in the end turn decidedly industrial, connecting to emerging issues like industrial meat production, and industrial agriculture producing energy feedstocks and new materials – but unlike *Go for Growth*, in *Competition Rules* domestic fiscal resources never improve - these agricultural expansions thus only occur with the benefit of international investors and owners.

3.2.2 How do other scenarios add value to ScENE?

Deep dives and gap fillers

Several scenarios explored issues not covered by Natural England's scenarios, or covered in less detail. For example, the potential for extreme social fragmentation, and global futures of migrant labour, were both explored by Carnegie UK; security issues were addressed by the UNEP project; impacts of a severe environmental event were explored by EEA Prelude in 'Big Crisis'; and how 'dematerialisation' might affect the economy by the UK EA scenarios. These 'gap fillers' raise questions that could be usefully asked within the ScENE scenarios as well.

While the ScENE scenarios did explore different English geographic zones in detail, they did not explore different outcomes for energy, food, the built environment and infrastructure, marine environments, property, or specific England regions or

communities in detail. The ‘deep dive’ scenarios highlighted changes and impacts on a particular economic sector or environmental or geographic area. The Food Ethics Council scenarios offered four detailed portraits of how food demand and production might change in the UK, with clear implications for land use and the environment. Likewise, Yorkshire Futures as well as the East of England Development Agency scenarios offered possible futures for local communities that suggest impacts on the local environment. Each of these generated insights valuable in broadening our futures evidence base.

Foresight Land Use Futures: validating, gap-filling, and a deep dive
The Land Use Futures scenarios both fill gaps and provide a deep dive for the ScENE scenarios. They fill gaps by exploring possible futures for the *whole* of the UK that, while focused on land issues, do devote considerable space to broader environmental issues as well. The Land Use Futures scenarios also explore the impacts of the changing global context in more detail than do the ScENE scenarios, and could prove useful as background to ScENE discussions. Land use has a profound impact on the environment, and the Land Use Futures scenarios also provide a deep dive that considers how different patterns of land use might affect the environment and ecosystem services.

The Land Use Futures scenarios raise some questions in common with ScENE, as noted above. This commonality of critical uncertainties helps validate the ScENE content. The extensive system maps the Land Use Futures project created are also a valuable validation resource. They enable consistency checks for logic within any scenarios focused on related issues: discussing the ScENE output in the context of the Land Use Futures systems maps could produce valuable insights.

3.2.3 How do ScENE’s scenarios provide added value?

ScENE’s unique perspective
Content
The preceding explorations of the scenario landscape in UK policy-making show the unique value of the ScENE scenarios. Until now, no scenario project has explored futures for England’s natural environment from mountain top to seabed looking ahead fifty years. Through an emphasis on England’s geographic zones, informed by local expertise, ScENE has created a scenario set depicting detailed local implications of change, which in turn assist local application of the scenarios for strategic thinking. ScENE is also unusual in specifically addressing potential shifts in worldview in the next two generations of decision-makers: ScENE’s ‘Connect for Life’ depicts a future informed by a complex adaptive systems perspective and its results (for example, social media and social networking; evolving bottom-up governance; focus on ecosystems and biomimicry).

Method
The analysis also highlights the state-of-the-art methods design ScENE chose. The project incorporated an initial timeline-mapping exercise, as well as both the Ethnographic Futures Framework and three-horizons analysis, from the start of work using a broadly participative process. This addressed the critiques of the ‘axes of uncertainty’ matrix approach and enhanced the output in four ways:

- provided strong connections with people’s current understandings of how change has evolved by grounding initial discussions in a jointly constructed timeline of past change that sets the context;

- got beyond ‘flatland’ to explore different value sets and paradigms in decision-making, economic models, materialism, and locus of power;
- created a structure for rigorous exploration of impacts at a detailed level that also enabled internal logic consistency checks and easier comparisons of both key dynamics and specific details across the four scenarios; and
- field tested and refined the scenario ‘sketches’ of the initial workshops against local knowledge, worldviews, and values of people living and working with specific biotopes.

While grounded in current evidence of emerging change, the resulting narratives depicted four different futures that are broadly different enough from the present. As such they could well serve as strategic exploratory landscapes not only for decision-makers within Natural England and Defra, but also across local and national government within the UK.

ScENE also focused on accessibility in the expression of its scenarios: people living in the scenarios describe the worlds their choices have created. Animated, multimedia output including drawings, cartoons, photo-montages, narration, and timeline murals enhance the accessibility and portray the flow of change from the past to multiple alternative futures. This emphasised the concept of choice and creation of both our potential and preferred futures.

Common Themes

Other scenario projects revealed concerns and opportunities similar to those in Natural England’s scenarios. Common concerns included the value of the natural environment, the locus of decision-making, the robustness of the economy and the impact economic vulnerability might have on environmental management and sustainability. Clustering themes, drivers and details from different scenarios to create composite scenarios or ‘archetypes’ confirmed that many scenarios tell similar stories. Five primary archetypes of possible futures emerged:

- a ‘business as usual’ for government and the economy;
- a ‘high-tech’ future transformed primarily by technological fixes;
- a ‘sustainability’ future that prioritises the environment, and may do so via efficiencies of scale in urban settings, or by decentralising either in a highly cooperative context;
- a ‘paradigm shift’ future that overturns current assumptions about governance or the economy, often connected to worldview and value shifts and enabled by new technologies; and
- ‘vulnerability’ or ‘collapse’ scenarios, depicting eg economic difficulties, social schisms, environmental degradation, or retrenching as a response to those threats.

The archetypes confirmed the presence of common themes and validated common areas of concern about critical uncertainties. But they also demonstrated that the specific details on which the various projects differ provoke different strategic policy questions and possibilities.

Contrasts with Foresight Land Use Futures Project

Comparing the ScENE and Land Use Futures projects in the context of the Compendium’s scenarios analysis highlights each project’s unique contributions to UK foresight and policy discussions. In summary, while complementary, these two projects clearly differ on several dimensions:

- ScENE's deductive approach against the inductive approach of Land Use Futures;
- ScENE's tight focus on England in contrast to the mandate of Land Use Futures to consider the entire UK, and the scenario's details vis-à-vis the world context;
- ScENE's inclusion of marine habitats against the tideline boundary of Land Use Futures;
- ScENE's adds biotope details where Land Use Futures adds extensive exploration of wider systemic interconnections;
- ScENE's 'future snapshot' depiction of conditions in 2060 versus the 'history perspective' and current events depiction of Land Use Futures; and
- ScENE's 'day in the life' vignettes and multimedia presentation contrasted with the high-level 'stories' of Land Use Futures.

What the projects share is concern over the best use and care of the environment and ecosystem services into the long-range future. In this regard their results augment and strengthen each other.

4. Next steps: applying the findings

4.1 Strategic monitoring: linking scenario timelines with horizon scans

How can we leverage change in the direction we want? Where will opportunities arise to do that? Scenario explorations help to challenge assumptions of 'life as usual', but are most useful when they offer ideas for concrete strategy formulation to further policy. Looking for potential leverage points among emerging changes is one way to use horizon scanning data in conjunction with scenarios. Where do the patterns of change suggested by the various ScENE scenarios match up with actual changes we observe emerging? How might we use that conjunction to further policy goals?

This second edition of the Compendium explored those issues by comparing events depicted in the ScENE scenarios timelines against an emerging issues baseline. It then compared common intersections between ScENE scenario events and those emerging issues to the events depicted in the Land Use Futures scenarios. The exercise identified common issues and opportunities for solutions among emerging innovations, as were summarised in the previous section, and in Appendix 5. These emerging innovations can themselves be monitored, with the object both of updating the scenarios, and of informing practical strategy formulation.

More importantly, it demonstrated that our tools will work in a variety of situations, but that producing significantly different outcomes will depend in turn upon significantly different behaviours arising from shifts in our values and mental models. The two most transformational futures among the ScENE and Land Use Futures scenarios – *Connect for Life* and *Valued Service* – assume transformations in how we model the world, our relationship to it, and our relationships to each other. These deep transformations and paradigm and value shifts may emerge natural as an outcome of generational shifts over the next fifty years. But they could potentially be accelerated and amplified by both incentives and education, and that might be a subject for further policy research.

4.2 "Lessons learnt": best practice in scenario process and application

The Scenarios Compendium creates a context for Natural England's own scenarios work. As a literature review, it highlights ScENE's unique contributions to the foresight policy dialogue within the UK. The Compendium's annotated inventory of scenario projects and processes is descriptive, rather than prescriptive. For the second edition, selected scenario project sponsors and consultants were interviewed as an aid to others who may embark on scenarios work. Essentially, the 'lessons learnt' survey asked "was it a success? why, or why not?" for the given scenarios project.

These interviews provided material for short "lessons learnt" that augmented the annotation of selected scenario projects. They focus on identifying unexpected (for the better or the worse) outcomes either *during* the process (participation) or *after* the process (engagement), and drawing insights for future scenario projects. As such they provide valuable rules of thumb for both creating and applying scenarios effectively.

4.2.1 Managing your scenarios project:

- Do you really need to do it?
    - consider **recycling** previously written scenarios instead: have a look at existing scenarios and consider using them instead of developing your own from scratch. It could save you time, money, debate over 'who thought these up?', and gets you to exploring strategic context more quickly; or

    - consider **upgrading** existing scenarios rather than completely renovating: stories that persist in your organisational culture create extended engagement – persistence is valuable.
- **To develop the most useful process and products, know from the outset who will use them and what for:** help the client clarify what they want from the process; identify the main purpose clearly.
- **Make sure that those who have commissioned the work understand scenarios and scenario planning:** make the concept, the benefits, and the limitations clear at the outset.
- **Think carefully about how the scenarios work fits into the larger project:** what can and should the connections be to your other research and policy work?
- **Regard a scenario project like any other project:** what's your objective? what's your timeline and budget? who should be involved?
- **Factor in time to build support for the work:** you will need time to find funding and, most importantly, people who will take part in it – of whom the most important is a champion who understands the work and how you might use it.

4.2.2 Scenario methods:

- **The futures toolkit contains more scenario methods than just the 'axes of uncertainty' 2x2 matrix:** understand what the different methods deliver, and why – be an informed foresight customer.
- **It's quite possible to do quick and dirty scenarios that have a big impact on people's thinking, exploring, and strategy:** don't be too wedded to a large-scale scenarios process – scenario thinking is a tool you can revise to fit different scales.

4.2.3 Participants and participation/facilitation:

- **Engage widely – involve representatives from external as well as internal stakeholders:** good scenarios are those where insights have been derived from stakeholders with whom we are not normally engaged, so do everything you can to bring together people with different perspectives in the problem – as long as you can help them bridge their differences and communicate constructively.
- **Give ownership to others, including the stakeholders:** engage stakeholders and participants by investing them with responsibility for parts of the project.
- **Keep the processes for participants simple and understandable:** participants should not only understand the immediate task, but also how it fits into the wider process.
- **Keep all parts of the process as transparent as possible to participants:** you will lose trust and the scenarios will lose credibility if parts of the process are accomplished off-stage or in camera.
- **Make the workshop sessions as enjoyable as possible:** it can be fun, and fun supports more creative thinking.
- **Provide enough time and space for ideas to be developed properly and relationships to be forged with others:** the sessions need to be long enough to explore the issues and drivers in some depth, to hear a range of voices, and to acknowledge tensions and differences of opinion, because they pinpoint areas of uncertainty.
- **Do not impose ideas or lock in messages or process:** do get excellent process facilitation.

- **Continue to build your base knowledge community:** continually add new expertise every time you use the scenarios as a basis for discussion – you will be adding new participants and possible champions as well as continually quality-checking content.

4.2.4 Content:

- **Caution: scenarios widely used may be widely utilised because they have over-simplified or over-aggregated concepts on axes,** resulting in stories that are too generic to be useful.
- **Once specific issues are "collapsed" to create an axis and renamed, you lose the nuance for future readers and over-simplify in ways that may be inaccurate** – so keep accurate and complete records of your discussion 'evidence'.
- **Be faithful to your material:** both the evidence base of the trends and drivers, and the evidence base of the discussion.
- **Involve people who have an in-depth understanding of the field, but use your intuition and judgement more than evidence:** story-telling and imagination offers the primary value.
- **Suspend reality / disbelief whilst you are developing scenarios:** using scenarios helps you to understand that 'any policy can be made to work' into the future.
- **Generate quantitative estimates (ie benchmarks) of what the future may be like (for example, population forecasts, water demand estimates):** this helps adoption of scenarios, making them more usable by providing the information people need to link scenarios to implementable plans and policies.
- **Don't worry if the scenarios need to highlight unpalatable messages:** that's what they're for. *Corollary*: **don't be frightened of your material:** it is telling you something. You must be honest with it.
- **Ensure sufficient time is given to considering the potential strategic implications** of your scenarios.

4.2.5 Communicating the scenarios:

- **In writing up your project, consider how to make it useful to others:** include discussion toolkits and tips for use, to make your project output interactive.
- **Consider your audience carefully:** if you are exploring into the future, consider involving the 'stakeholders of the future', ie, young people, as well as senior decision-makers and stakeholders – a diverse audience can be as important as diverse participants.
- **Communicate the scenarios clearly and have a simple approach to do that:** the more clearly they are communicated and understood, the more complex and sophisticated the uses to which they can be put.
- **It generally becomes more difficult to handle and communicate scenarios as their number increases:** consider having fewer with more branching points.

4.3 Conclusion

The findings of this report create a strong foundation of evidence for ScENE and, will also be used to develop Natural England's wider futures thinking. Combined with outputs and insights derived from other futures initiatives, such as horizon scanning, the compendium's results will contribute to a review of future challenges, risks and opportunities, including the identification of new research needs.

It is also hoped that the report's findings, alongside the scenarios developed by Natural England, will help others explore and understand the factors that are likely to affect their businesses over time, in doing so, being better prepared for change.

In particular and working closely with Defra, we anticipate that the work will form an important contribution to the government's Natural Environment White Paper, which is due for publication in Spring 2011. This will set out the Government's ambitions for the future of our natural environment. This will be based on a clear view of the importance of the natural environment. We believe that our scenarios work, in helping to identify critical factors affecting the pathway to the future of the natural environment, will help to realize the Government's ambitions.

As we experience more abrupt change in the world in which we live and work - for example as evidenced by the financial crisis, we believe that futures work using scenarios will continue to become an increasingly important tool in helping us become better informed about the range of possible future outcomes. We hope our scenarios work will help others adopt disciplines to similarly help their own organisations become more confident in facing change.

Appendix 1 Categorised by origin and ethnographic futures framework (EFF)

Note: project titles in bold indicate Edition 2 additions.

Focus \ Origin		UK	EU	Rest of World
Define	• changes in social values and attitudes	• **The Challenge Network 2040, how the world's dominant populations go about seeking solutions, including how they see themselves and each other (social values)** • **BIS Land Use Futures 2060, degree of societal resistance to change, including at the global scale (social values and attitudes)** • **DCLG 2030, diverging attitudes towards resources and assets (social values and attitudes)** • DIUS 2030, x-axis: social values (values and attitudes) • HSE 2017, y-axis: public tolerances to risk (values and attitudes) • CIPFA 2030, x-axis: nature of society (values) • Defra Marine Ecosystems, x-axis: societal values (social values) • Flood and Coast Defence, x-axis: nature of society (values) • Hydrogen Futures 2050, x-axis: nature of society, (values) • DETR/UKCiP, x-axis: nature of society (values) • Foresight 2020, x-axis: nature of society (values)	• EEA Prelude, 2050, *Evolved Society* (values and beliefs)	• Humanitarian Futures, x-axis: social values (values and attitudes) • UNEP 2050, *Sustainability* scenario (values) • Shell Global 2025, y-axis, cohesion/justice (social values and attitudes) • US EPA 2020, y-axis - social cohesion (social values and attitudes) • SEI, *Great Transition,* shift in values (values)
	• scientific models and paradigms			

Focus \ Origin		UK	EU	Rest of World
	• culture	• **The Challenge Network 2040, how the world's dominant populations go about seeking solutions, including how they see themselves and each other (culture)** • Civil Society, scenario 3, *Diversity Wars* (culture)		
	• economic models, paradigms, and systems	• Yorkshire Futures, scenario 1- market orientated/consumer values (economic systems)		• UNEP 2050, *Sustainability* scenario (economic systems)
	• religion and religious beliefs	• Civil Society, scenario 3, *Diversity Wars*, (religions)		
	• political beliefs and values, and public policy paradigms	• **ICE, Aviation 2040, government attitude towards aviation (political values and policy paradigms)**		
Relate	• changes in demographics			
	• family and lifestyle groups/community	• RELU 2020, y axis - extent to which the countryside becomes socially cohesive (community) • CA 2020, y axis - extent to which countryside becomes socially cohesive (family and lifestyle groups/community)		• Global City, *Gone With the Wind*
	• work and the economy	• **The Challenge Network 2040, systems issues dominate that demand an international response vs. resource supply issues dominate managed by price mechanisms (economic systems)** • **DCLG 2030, increasing or decreasing social mobility (work and economy)** • Food Ethics, y-axis (economy) • Chatham House, d: global	• EEA Prelude, 2050, *Great Escape* (economy)	• Global City, *Profit with Principle* and *With or Without You* scenarios • UNEP 2050, *Markets* and, *Security* scenarios *(*economy*)* • SEI, *Conventional Worlds, relations between policy and the economy* (economy)

Focus \ Origin		UK	EU	Rest of World
		economic/political response to change (economy) • BERR 2020, y-axis; trade/political relations (economy) • Yorkshire Futures, scenario 2, limits of carrying capacity (economy) • Yorkshire Futures, scenario 4, inequality/disruption (work and economy) • HSE 2017, x-axis, economic competitiveness (economy)		
	• habitats and ecosystems	• **The Challenge Network 2040, systems issues dominate that demand an international response vs. resource supply issues dominate managed by price mechanisms (ecosystems)** • **BIS Land Use Futures 2060, rate of climate change, and the degree of adaptation to environmental change (habitats and ecosystems)** • Yorkshire Futures, scenario 2, limits of carrying capacity (environment)	• EU Real Estate 2020, x axis - sustainability (environment)	• IPPC (ecosystems)
	• business models and practices	• **Forum Business 2018, analysing the scenario narratives, Patched-up Globalisation (business)** • **Forum Business 2018, analysing the scenario narratives, Global Interest (business models and practices)**		
	• government and international relations	• **Forum Business 2018, analysing the scenario narratives, Patched-up Globalisation (international relations)** • **Forum Business 2018, analysing the scenario narratives, National**	• MEA 2050, y-axis globalisation versus regional focus (government) • EEA Prelude, 2050, *Great Escape and Big*	• Humanitarian Futures, y-axis (government) • UNEP 2050, *Markets, Policy* and *Security scenarios (*government*)* • SEI, *Conventional*

Focus \ Origin		UK	EU	Rest of World
		Interest (international relations) • **Public Services Trust 2020, focusing on the individual scenario narratives, Steady as she goes (government)** • Ofgem 2020, y-axis (government, international relations) • Food Ethics, y-axis (international relations) • Chatham House, d, response to change (international relations) • BERR 2020, y-axis, trade/political relations (government) • DIUS 2030, y-axis, open/multi-national relations (government and international relations) • DIUS (SEMBE), x-axis, how international institutions relate (government and international relations) • Yorkshire Futures, scenario 2, limits of carrying capacity (government) • CIPFA 2030, y-axis (government) • Flood and Coast Defence, y-axis (government) • Hydrogen Futures 2050, y-axis (government) • UK EA 2030, y-axis, governance systems (government) • UK EA 2050, y-axis, governance systems (government) • Defra Marine Ecosystems, y-axis (government) • Foresight 2020, y-axis (government) • Civil Society, scenario 4, *Global*	*Crisis* (government) • EU Real Estate 2020, y axis - political cohesion (government)	*Worlds,* relations between policy and economy (government) • Shell Global 2025, z-axis, security (government) • Shell 2050, *Blueprint,* co-ordinated actions for the environment *(*government and international relations*)* • SEI, Barbarization (government) • Global Cities, *Oh My Gosh!* (political and social unrest) • Global Real Estate 2015, x axis - government/public intervention (government)

Focus \ Origin		UK	EU	Rest of World
		Compact (government) • DETR/UKCiP, y-axis nature of governance (government)		
	• education	• **DCLG 2030, increasing or decreasing social mobility (education)**		
	• technology (how people relate to technology)	• **Orange 2016, y-axis – control of data - theirs - yours (technology)** • Intelligent Infrastructure 2055, x axis - degree of acceptance of intelligent infrastructure (technology)		
Connect	• changes in information technology	• **Forum Business 2018, analysing the scenario narratives, Me and Mine, On-line (information technology)** • **Public Services Trust 2020, focusing on the individual scenario narratives, Into the sunset (information technology)** • Civil Society, scenario 2, *Athenian Voices* (information technology)		
	• Music			
	• Media			
	• visual arts			
	• language			
	• space	• **Orange 2016, x-axis – the nature of working relations - somewhere - anywhere (space)**		
	• infrastructure (how infrastructure enables people to connect)	• EEDA 2020, y-axis - relative pace and quality of infrastructure development (infrastructure)		
Create	• changes in engineering			• Shell Global 2025, x-axis, efficiency (wealth)

Focus \ Origin		UK	EU	Rest of World
	• wealth, capital, and investment	• Ofgem 2020, x-axis, speed of global economic recovery/investment (wealth) • BERR 2020, x-axis, global GDP, socio-economic development (wealth)	• MEA 2050, x-axis - ecosystem management versus economic growth and public goods (wealth)	• Global Real Estate 2015, y axis - economic growth (wealth) • US EPA 2020, x-axis - economy (wealth)
	• manufacturing, economic infrastructure	• **BIS Land Use Futures 2060, concentration of people and economic activity within the UK (manufacturing and economic infrastructure)** • EEDA 2020, x-axis - the relative balance of the region's economic focus - manufacturing vs. innovative (manufacturing)	• EEA Prelude, 2050, *Clustered Networks* (economic infrastructure)	
	• innovation processes	• DIUS (SEMBE), y-axis, new systems • EEDA 2020, x-axis - the relative balance of the region's economic focus (innovative)	• EEA Prelude, 2050, *Lettuce Surprise* (innovation processes)	
	• life sciences			
	• material sciences			
	• nanotechnology			
	• agriculture	• Chatham House, c - current supply capacity/global production (agriculture)		
Consume	• changes in consumer goods	• **ICE, Aviation 2040, demand for travel (consumer goods and services)** • UK EA 2030, x-axis (consumer goods) • UK EA 2050, x-axis (consumer goods)		
	• Energy	• **ICE, Aviation 2040, demand for travel (energy)**		

Focus \ Origin		UK	EU	Rest of World
	• food	• Food Ethics, x-axis, role of food in UK society (food) • Chatham House, b - the growth of global demand for food (food)		
	• house and home			
	• entertainment and leisure			
	• healthcare			
	• natural resources	• Chatham House, a - changing price of oil (natural resources) • Yorkshire Futures, scenario 3 - resource costs soar and carbon emissions are aggressively reduced (natural resources) • Civil Society, scenario 1, *Local Life* - resource scarcity and energy costs (natural resources, people back to community) • UK EA 2030, x-axis (natural resources) • UK EA 2050, x-axis (natural resources) • Intelligent Infrastructure 2055, y axis - the availability of transport that has a low environmental impact (natural resources) • RELU 2020, x axis - extent to which the countryside becomes environmentally sustainable (natural resources) • CA 2020, x axis - extent to which the countryside becomes environmentally sustainable (natural resources)		• Shell 2050, *Scramble,* guarantee of energy supplies (natural resources)

Focus \ Origin		UK	EU	Rest of World
	• public services	• **Public Services Trust 2020, focusing on the individual scenario narratives, Stormy weather (public services)**		•

*NOTE: As they are not true scenarios, RIBA/CABE and CA 2012 were not categorised.

Appendix 2 Scenario projects categorised by value to ScENE

Note: project titles in bold indicate Edition 2 additions.

	SCENARIO CATEGORIZATION				
Scenario	***Background***	***Validating***	***validating with 'deep dive'***	***plugging the gap***	***big picture meta question***
A. Department of Communities and Local Government (DCLG), 2010	**x**				
B. Foresight, Land Use Futures Project, 2010		**x**			
C. The Challenge Network , 2010	**x**				
D. Institution for Civil Engineers, 2009			**x focus on future air transport infrastructure, with insight on changes in attitudes about the environment and climate change (UK view)**		
E. Public Services Trust, 2009	**x**				
F. Capgemini and The Forum for the Future, 2008	**x**				
G. Orange, 2006			**x focus on how people live, particularly the role technology plays (UK context)**		
1. OFGEM Energy Generating Infrastructure			x short-time horizon (2020) scenarios focused on economy, investment, and how we generate electricity		
2. Food Ethics Council, 2009			x how we eat, what we eat, how our food is grown and distributed (UK view)		

	SCENARIO CATEGORIZATION				
Scenario	***Background***	***Validating***	***validating with 'deep dive'***	***plugging the gap***	***big picture meta question***
3. UK Environment Agency Water, 2009			x deep dive into water resources, demand, and use issues		
4. Chatham House, 2008			x global circumstances around future supply of food (worldwide)		
5. Department of Business, Enterprise and Regulatory Reform Team (BERR), 2008		x			
6. Department of Innovation, Universities and Skills (DIUS), 2008		x			
7. Sustainable Energy Management and the Built Environment (DIUS), 2008			x focus on innovations in energy and sustainable power infrastructure		
8. Yorkshire Futures, 2008			x (sense of place, regional identity/distinctiveness)		
9. Shell International Ltd, 2008		x			
10. Carnegie UK Trust, 2007				x (added value derived through people's values, culture and behaviours; perspective helps to balance/counteract hard economic perspective)	
11. Health and Safety Executive, 2007		x (lifestyle scenarios, with tough choices possibly filling economic collapse gap)			
12. Humanitarian Futures Programme, 2007		x			

	SCENARIO CATEGORIZATION				
Scenario	***Background***	***Validating***	***validating with 'deep dive'***	***plugging the gap***	***big picture meta question***
13. The Chartered Institute of Public Finance and Accountability (CIPFA), 2007		x			
14. The United Nations Environment Programme**,** 2007				x (added value around security, including with respect to interface with markets first and policy first)	
15. European Environment Agency (EEA) PRELUDE Scenarios, 2007				x (more focus on people, choices, values, social structures)	
16. UK Environment Agency, 2006				x (added value derived through focus on changes in consumer behaviour; ScENE does not really question consumer materialistic society)	
17. Foresight Intelligent Infrastructure Project, 2006			x (offers an extra dimension/deep dive around cities)		
18. Marine Ecosystems, 2006			x (offers an extra dimension/deep dive around marine)		
19. Dublin Institute of Technology, in collaboration with the Urban Land Institute, 2005	x				
20. King Sturge and Dublin Institute of Technology, 2005			x (deep dive into geographical dimension)		

	SCENARIO CATEGORIZATION				
Scenario	***Background***	***Validating***	***validating with 'deep dive'***	***plugging the gap***	***big picture meta question***
21. Millennium Ecosystem Assessment Scenarios, 2005		x			
22. Shell International Ltd, 2005	x				
23. Foresight Flood and Coastal Defence Project, 2004	x (adjusted from validation with extra dimension due to earlier 2004 publication; recycled Foresight 2020 scenarios)				
24. Rural Economy and Land Use Programme (RELU), 2004	x				
25. The Commission of Architects and the Built Environment (CABE) and The Royal Institute of British Architects (RIBA), Building Futures 2004	x				
26. Tyndall Centre for Climate Change Research, February 2004	x (recycled Foresight 2020 scenarios)				
27. The East of England Development Agency (EEDA) with the support of the East of England Regional Assembly, 2004			x (added value derived through regional distinctiveness)		
28. The Countryside Agency, 2003	x				
29. Foresight 2020 scenarios, 2002	x heavily recycled in subsequent projects				

	SCENARIO CATEGORIZATION				
Scenario	***Background***	***Validating***	***validating with 'deep dive'***	***plugging the gap***	***big picture meta question***
30. Stockholm Environment Institute, 2002					x (explores how we transform; asks the big question central to whole mindset: business as usual, v business collapse v transformational)
31. The Countryside Agency, 2002	x				
32. King Sturge and Dublin Institute of Technology, 2001	x				
33. Foresight: the US Environment Protection Agency, 2000		x (from outside the country ie completely outside futures, consultancy, and policy communities)			
34. Centre for Social and Economic Research on the Global Environment (CSERGE), Climatic Research Unit (CRU), Policy Studies Institute (PSI), 1999	x builds on earlier Foresight scenarios				
35. The Intergovernmental Panel on Climate Change (IPCC), 1996	x foundational/seminal; background				

Appendix 3 Inventory of scenarios developed by other organisations

Background

This appendix documents and describes a range of scenarios developed by other organisations. Included is a section relating to their relevance to Natural England's scenarios for the natural environment to 2060 (ScENE).

Scenario projects added in Compendium, edition 2

A. Department of Communities and Local Government (2010)

Scenarios for local government and communities in 2030
Not yet published / not yet available on-line
Consultants/Researchers: The Futures Company
Method chosen: 'axes of uncertainty' matrix

Aim
To provide DCLG with scenarios for local government and communities for 2030, particularly for use in wind-tunnelling.

Focus
Changes and outcomes affecting UK communities and patterns of life, and the pressures those might produce for local government.

Methodology
There are two main axes of importance and uncertainty:

- increasing or decreasing social mobility – mobility of knowledge as well as mobility of people; and
- diverging attitudes towards resources and assets in the community – whether they should be shared or private.

Four future worlds are described according to their position on this matrix.

Brief description of future worlds
Four different worlds:

- **Market Green**
  A world in which the aftermath of economic turmoil is leaner public services, strong private sector engagement in delivery of services, and much stronger association with local communities.
- **Corporate Wellbeing**
  A future world in which the private sector has taken the lead in delivering public services and public investment – framed by regulation and tax incentives to improve sustainability outcomes.
- **Shared Security**
  A world in which concerns about energy and food security, exacerbated by climate change shocks, has led to large-scale public investment in infrastructure and resilience.

Mutual Action
A world in which our response to environmental damage and resource scarcity is a return to local values and concerns – but with recognition of the global nature of the challenges we face.

Implications and application
Scenarios are described as material for wind-tunnelling so it is assumed that they will be used to help future-proof new plans and policies. The scenarios have yet to appear on the DCLG website so there appears little scope at present for them to be used by other bodies.

Relevance to ScENE
These scenarios depict possible future societies, communities and economic dynamics in England, including effects on business and regulation. The changes in patterns of life imply potential impacts on England's natural environment.
Perceptions on how might relate to EFF: increasing or decreasing social mobility: Relate (education, and work and the economy); diverging attitudes towards resources and assets: Define (social values and attitudes).
Dimensions: Not oriented to the natural environment but scenarios do take account of climate change and likely mitigation actions such as lower energy consumption. Little or no mention of global/international context.

B. BIS Foresight Programme (February 2010)
Land Use Futures
http://www.foresight.gov.uk/OurWork/ActiveProjects/LandUse/LandUse.asp
Consultants/Researchers: Waverley Management Consulting
Method chosen: 'trilemma inductive' approach (designed by Shell)

Aim
The Project commissioned a contractor to develop, in association with leading experts and stakeholders, three 'Land Use Futures scenarios'. These explore different ways in which the pressures and forces acting on UK land use might play out over the next fifty years. In doing so, they offer insights into different policy choices and challenges that the UK might face in the future.

Focus
The project explored the following questions:

- What land use challenges could the UK face over the next 50 years?
- Will existing structures and mechanisms help us to meet those challenges?
- What opportunities are there to use and manage land differently now so that UK society continues to enjoy a good quality of life in the future?

Foresight worked with leading experts to assemble the latest evidence and research on land use topics.

The project covers the whole spectrum of land use from urban to rural and is sponsored by Defra and DCLG.

Methodology
Forming a component of the Land Use Futures project, three scenarios were developed as a tool to aid people's thinking about possible long-term futures.

The scenario process began by considering how drivers of change affecting land use might interact with each other. The drivers were identified via a series of drivers workshops, the project's systems analysis, existing scenarios, and the project's evidence reviews.

Three critical uncertainties for UK land use over the next 50 years emerged from the drivers and uncertainties workshops, focus group discussions and the review of the systems analysis:

- The rate of climate change, and the degree of adaption to environmental change;
- The degree of societal resistance to change, including at the global scale; and
- The concentration of people and economic activity within the UK.

The 'trilemma' scenario framework combined the three critical dimensions of uncertainty assuming for each scenario, that two of the axes would be dominant, providing a focus on two sides of the triangle.

Brief description of future worlds
Three possible worlds:

- **Leading the Way**
  In this scenario, nations collaborate closely to tackle the challenge of climate change and the UK government takes a hands-on approach to driving through the changes required to ensure that the UK makes the transition to a low carbon economy. Despite the scale of the challenge and the strength of government intervention, the British public is pleased to see positive action to tackle climate change and to address the needs of future generations as well as present ones. Changes in UK land use reflect the needs of the age; the amount of productive arable land has fallen by around one third, but productivity has doubled; the average farm size in the UK has increased; forest cover has expanded; and renewable energy production is high. The UK's track record of investing in environmental research and technology developments has made it a world leader in biotechnology and environmental engineering. Land based and land related industries now account for a large proportion of UK GDP and the strength of the sector means that more people live in or close to the productive rural centres of the UK. London and the South East of England is under significant water stress. A new 1800 acre reservoir built to the west of the city has improved the short term situation, but continuing population growth means that this may be a short lived solution. Accordingly, the government is considering plans to disperse citizens to three new towns in Dumfries and Galloway, Northumberland and Powys – now engines of innovation and growth at the centre of the UK's land based industries.
- **Valued Service**
  In this scenario, western societies have recognised the imperative to ensure economic growth is achieved within environmental limits. While there is still work to be done to ensure that growth can be sustained across all nations, innovative business models that minimise resource use and still deliver growth are feasible, practical and successful. Consumer attitudes have changed significantly; people now take a longer term view and strive to be more sustainable in their daily lives. These haven't been easy changes to make; however, better and more visible information about the impact of lifestyles on the environment has helped consumers understand the need to be more responsible. The ecosystem services approach has been placed at the heart of land use policy. The planning system has been reformed to facilitate the collaborative decision making that is needed to make the ecosystem services approach work. Planning regions have local autonomy – with guidance set by central Government – to develop their own plan based systems and legally binding plans. Government guidance is focused on remodelling UK landscapes around greenways that connect urban areas with the surrounding countryside, green wedges that provide access to green spaces and shape urban growth, and sustainable urban drainage systems that integrate with wider river basins. The aim is to bring the benefits of the countryside into cities. The

next phase of development is to secure wellbeing for residents in rural areas, in market towns and villages.

- **Competition Rules**
  In this scenario, governments around the world have struggled to agree a co-ordinated approach to tackling the challenges of population growth and environmental insecurity. The challenge of securing food and energy supplies remains, particularly in the developing economies. The Common Agricultural Policy has been removed in order to completely stop subsidised production, and opportunities to create more favourable conditions for long term investment in agriculture in Asia and Africa are sought. The UK's agricultural sector has struggled to thrive in the post CAP era and short term economic survival has to take precedence. Insufficient investment in and protection of the natural environment has resulted in a sharp decline in biodiversity. Co-ordination of land use policy in the UK is limited, and London's prosperity is under threat. Having attracted businesses and residents it has failed to improve or guarantee access to critical resources such as water. A growing number of foreign governments are interested in investing in the UK's land base in order to establish large scale agricultural experimentation stations to test new crop and production technologies.

Implications and application
The Foresight Land Use Futures project was devised to explore potential pressures and challenges facing UK land use especially in the given "perfect storm" of population pressures, resource constraints, and climate change forecast to emerge in the next twenty years. These scenarios were designed to "highlight difficult policy dilemmas that government and other actors may need to consider in the future [and to] play-out courses of action that would lead to different outcomes."

Relevance to ScENE
Patterns of land use will both affect the natural environment, and be affected by it. These scenarios explore different planning and regulatory approaches to managing land use in different economic contexts and with different social priorities. They offer a useful contrast to the broader environmental considerations of the ScENE scenarios.
Perceptions on how might relate to EFF: rate of climate change, and the degree of adaption to environmental change: Relate (habitats and ecosystems); degree of societal resistance to change, including at the global scale: Define (social values and attitudes); concentration of people and economic activity within the UK: Create (manufacturing and economic infrastructure).
Dimensions: These scenarios focus on the degree of government and economic transformation within a broader context of environmental challenges and patterns of population dispersal within the UK.

C. The Challenge Network (February 2010)

Scenarios for 2040
http://www.chforum.org/scenario2009/press_release.shtml
http://www.chforum.org/scenario2009/scenarios.shtml
Consultants/Researchers: In-house, The Challenge Network
Method chosen: systemic approach with approximate 2x2 matrix

Aim
To provide generally applicable scenarios for organisations as a first step for building robust approaches to tackling challenges of the next few decades.

Focus
These scenarios were devised to address four fundamental questions:

- **Will the international community address what we have called "systems issues",** and if so how will they do this? This includes issues connected with security, law and policing, with environmental and resource balances, with public health and related issues.
- **What does a development path look like for the poor nations as we move towards 2040?** Is there a viable pathway, given the many obstacles that the systems issues present?
- The overused word "sustainability" has rather passive connotations: essentially, that we meet our future by doing more with less, existing on a declining pathway as our marginal improvements contribute less and less. We ask, therefore, **how can we transcend this pathway, and so blossom into something new?** What will the most capable communities be doing when they undertake commerce, government or individual daily life in 2040?
- **What will the dynamics and impacts be of new politics of conflicting narratives?** The project offers a complex definition for 'narratives' that includes the way that a group of people see themselves as members of that group, including their values, expected behaviours, and social bonds?

Methodology
Broad participative method to identify issues thought to be important in 2040; topic papers produced and discussed. Identify predetermined factors; based on appreciation of impacts of these, look at the key dimensions that will frame how the stories will unfold. Approximate 2x2 matrix developed to capture the multiple dimensions:

- x-axis*:* systems issues that demand an international response vs. resource supply issues dominate managed by price mechanisms
- y-axis: how the world's dominant populations go about seeking solutions, including how they see themselves and each other.

Key building blocks from which the scenarios were constructed:

- How do people(s) think about identity?
- How does identity map onto geography. How might the nation state and its traditional patterns of politics be affected by changes in this?
- How to think about capability in 2040: which societies are capable of what? Addressed through the concepts of tangible and intangible infrastructure.
- What are the rival political narratives in 2040?
- What might economic growth look like, and how might this affect the relative weights of potential political blocks?
- What are the systems challenges that have to be faced? What happens if the world is in no fit state to address them?

Brief description of future worlds
Three different worlds:

- **Neglect and Fracture**
  Slow growth, stable prices and a more peaceful and tranquil world in the early period. System-level issues are not tackled but emergence of crises creates fragmentation and polarisation. Reaction is case-by-case but with occasional, ad hoc, and short-lived collaboration and coordination.
- **Yesterday's Future**
  Growth picks up quickly; productivity grows (medical advances, later retirement and priority for efficiency). Demand is minimised and the future and system-level issues

become the way of thinking and acting. Natural resources are monetised and environmental limits become a reality...a 'consumer-lite' society emerges but access to resource-consumption is restricted and controlled. Complexity creates vulnerability.

- **Waking Up**
  Begins as **Yesterday's Future**. After 2025, experts, networks, elites and science dominate the way society works. Productivity and wealth grow significantly. Society moves beyond consumption to "new dreams, new ways of existing and living which consumers have not and cannot discover for themselves". Collaboration, working with and through partnerships, is the only way to succeed.

Implications and application
These highly detailed scenarios are openly available and have already been widely discussed within the futures community. Open discussion and comments are encouraged. The thinking involved in developing the scenarios is laid out in detail.

Relevance to ScENE
The scenarios focus on society, community, politics and economy, but resources and environmental limits feature strongly. Scenarios note that there will not be a single dominant global order, but that different parts of the world will develop differently with competing rationales playing out in different places at different times.
Perceptions on how might relate to EFF: systems issues dominate that demand an international response vs. resource supply issues dominate managed by price mechanisms: Relate (ecosystems and economic systems); how the world's dominant populations go about seeking solutions, including how they see themselves and each other: Define (social values and culture).
Dimensions: The scale is global, within which the project explored interconnections among identity, political values, and economies and infrastructure.

D. Institution for Civil Engineers (November 2009)

Aviation 2040: Future scenarios for aviation and airport infrastructure
http://www.ice.org.uk/aviation2040/
Consultants/Researchers: Arup Foresight
Method chosen: 'axes of uncertainty' matrix

Aim
In November 2008 the Institution for Civil Engineers produced the report, *State of the Nation – Transport*, that identified goals critical for a sustainable national transport system and related challenges. The report made clear that challenges abound in identifying the role of aviation and airport infrastructure within a transport network geared up to meet sustainability goals. This study was thus designed to inform the debate around longer term objectives and strategies for UK air transport infrastructure.

Focus
How much, if any, new airport capacity does the UK need in the coming decades and why? Where should it be located? How much attention should be paid to integration with other transport modes? resilience to natural hazards and terrorist threats? environmental issues such as noise, habitat, and biodiversity? What are the implications of a world where carbon is a scarce resource?

Methodology
These scenarios were developed in two workshops facilitated by Arup in July and October 2009. The first workshop identified the uncertainties to serve as the organising axes, and sketched out four possible worlds. They suggested timelines to

create those worlds, and explored their implications for aviation. The second workshop involved participants in testing the four scenarios and adding further detail, including implications and strategy actions.

The two main axes of importance and uncertainty participants chose were:

- government attitude towards aviation: encouraging or stifling; and
- demand for travel: high vs. low.

These describe four future worlds according to their position on a matrix bounded by the endpoints of these axes.

Brief description of future worlds
Four different worlds:

- **Eco Angst 2040**
  Three characteristics that define this world are economic localisation, peak oil, and eco-awareness. Government encourages aviation, but demand is low. Society has become acutely aware of the effects of climate change, and air travel has suffered: those who do need to fly do so discretely for fear of vilification. Westminster, however, sees needed economic value in air travel and reduces taxes to stimulate demand. Local food campaigns have led to a modal shift for freight to ground transportation and shipping. Video-conferencing has drastically reduced business and personal travel.
- **Laissez-Faire 2040**
  Three characteristics that define this world are 'light-touch' government, regional prosperity, and advanced climate change. Government encourages aviation, and demand is high. The global economy has grown rapidly and credit is cheap and plentiful. Airport expansion is virtually self-regulating, with the government employing a light touch as regulator. Economic growth has led to job creation and an increase in disposable income. Combined with demand from a prosperous Asia, aviation booms. When impacts of climate change begin to take hold, adaptation becomes a priority – and airports start building flood defences.
- **Big Stick 2040**
  Three characteristics that define this world are interventionist government, economic prosperity in South East (UK), and carbon rationing. Government stifles aviation despite consumer interest. The government encourages a reluctant domestic population to shift transport modes, driven primarily by political concerns about climate change. Road pricing is introduced and rail fares are subsidised. Freight shifts from air to rail and ship. The cost of flying is generally high, but those who can afford it continue to fly. Cleaner air travel spurs long-haul demand globally.
- **Vortex of Despair 2040**
  Three characteristics that define this world are political flux, economic malaise, and fear. Government cannot afford to support the air infrastructure, and rising unemployment makes air travel a luxury. The global economic centre shifts east to Asia. Rather than an uninterrupted period of status quo in the UK, there is regular political change. Airports become a political football leading to stasis. Periods of prolonged economic contraction have led to high unemployment. Disposable income shrinks while the cost of travel increases. The whole transport network stagnates.

Implications and application
ICE used feedback on the scenarios to produce a new strategic policy document on airport infrastructure. People who wish to respond were asked to download the

consultation document from **www.ice.org.uk/aviation2040** and return it to **aviation2040@ice.org.uk**.

Relevance to ScENE
These scenarios offer glimpses of UK futures with details of the political dynamics, economy, consumer attitudes and environmental concerns, and climate impacts relevant to air transport infrastructure. They specify not only attitudes about the environment and climate change within each scenario, but the extent to which those attitudes have changed consumer behaviour and government policy: as such, they provide additional useful perspectives for ScENE.
Perceptions on how might relate to EFF: government attitude towards aviation: Define (political values and policy paradigms); demand for travel: Consume (consumer goods - and services, and energy).
Dimensions: Oriented more to large-scale infrastructure, and to the economic and government support needed to maintain it, than to the natural environment. The scenarios do consider the interactions among infrastructure systems, the economy, policy, and the environment. The primary focus is the UK at the national level, with international and local details mentioned only as context.

E. 2020 Public Services Trust at the RSA

Commission on 2020 Public Services (June 2009)
Drivers for change: Citizen demand in 2020
http://clients.squareeye.com/uploads/2020/documents/STC%20Drivers%20for%20Change.pdf
Consultants/Researchers: Paul Flatters and Michael Willmott, Trajectory
Method chosen: scenario paradigms (business as usual, positive, negative)

Aim
The *Scoping the Challenges* series is designed to transform the nature of debate on public services in three ways: 1) to broaden the national conversation; 2) to bring new structure to the debate; and 3) to liberate thinking about solutions. As part of this, *Drivers for change: Citizen demand in 2020* uses scenarios to depict both on how emerging trends will reshape the purposes and priorities for public services, as well as the challenges and opportunities for more effective delivery.

Focus
The damaging impact of the current financial crisis on the public finances is becoming clearer each day. It is demonstrating the need both for tough decisions about public spending priorities in the future, and pressures to deliver more with less. But if fiscal constraints are creating powerful and immediate drivers for change, to be effective the response must also take account of the broader trends that will shape our society in the future.

Methodology
Over 30 trends were studied within four themes (demographics; economics; culture and values; and technology) that may affect public services in the future. Trajectory asked experts to rate each trend for the likelihood that it would continue and for the degree of impact it would have on public services.

This analysis was used to create three scenarios. The first was a core scenario based on the trends that were rated as being likely to continue and as having a high degree of impact on public services. Two alternative scenarios were developed around trends that were thought less likely to continue, but that would have a high degree of impact on public services if they did. One of the alternative scenarios took an optimistic view of these trends while the other took a negative view.

Brief description of future worlds
Three possible futures:

- **Steady as she goes**
  This is the core scenario. The population is older, but healthier than today. However, some challenges such as reducing the period of morbidity at the end of life remain. Britain's economy is competing successfully in a globalised world – particularly in creative services. The workplace is more gender-neutral, with issues of workplace equality gradually being addressed. While citizens are increasingly demanding about service standards and there is a focus on individual choice, there remains the need for collective policies in areas where there is no public agreement – such as climate change.
- **Into the sunset**
  The main aspects of the positive alternative scenario are a quick recovery from the recession, strong economic growth and consensus about the role and size of the state that sees increased funding and public support for public services. There is also a high degree of social cohesion as agreement is reached about immigration levels and the rights of minority groups. Technology has been key to delivering new and innovative public services with access for all.
- **Stormy weather**
  The key aspects of the negative alternative scenario are sluggish levels of economic growth with cuts in many public services. There is also a reduced willingness to pay for such services through taxation. Chronic health problems remain as people reject what are seen as 'nanny state' public health campaigns. The one positive aspect of this negative scenario is that cuts in public services have prompted innovative community-based solutions in some areas. However, the patchy distribution of these initiatives is a potential further source of inequality.

Implications and application
The paper identifies five major challenges facing public services in the future, whatever the economic situation; demographic driven demand, shifting identities, meeting diverse demands, rising citizen expectations and technology.

The report also highlights three dilemmas for policy makers arising from these trends:

- Cost pressures, in many instances, irrespective of the current public finances
- Consent for the state to act where solutions are clear but require behavioural change by citizens, and
- Capabilities of government to harness the power of technology and the information on service performance that citizens hold.

Relevance to ScENE
These scenarios encompass a relatively short time horizon and so have relevance to horizon scanning and hot topics. Pen portraits are used to bring the scenarios to life. The scenarios identify longer term challenges that will have implications for how Natural England operates and delivers its vision.
Perceptions on how might relate to EFF: focusing on the individual scenario narratives, Steady as she goes: Relate (government); Into the sunset: Connect (information technology); and Stormy weather: Consume (public services).
Dimensions: Investigates perceptions, values and wellbeing surrounding the use and the likely response to technology, health and climate change and the demands on public services.

F. Capgemini and Forum for the Future (December 2008)

Acting now for a positive 2018, preparing for radical change. The next decade of business and sustainability
http://www.forumforthefuture.org/projects/acting-now-for-a-positive-2018
Consultants/Researchers: Forum for the Future
Method chosen: systems-based drivers synthesis and contrast

Aim
To understand the changes that are likely over the next decade and the implications for business and Government. The main aim is to generate real actions from business now to address the sustainability challenges we face and to provoke Government and regulatory responses to actions businesses take on their own initiative to enable sustainable solutions to emerge.

Focus
How businesses should respond to the current circumstances and the possible changes they will face over the next decade by embedding sustainability into their business practices proactively. How Government and regulators can create an environment that will allow solutions to emerge that protect society from environmental collapse and create the conditions for a sustainable economy.

Methodology
The last decade has allowed business expansion based on cheap credit, energy, labour and materials. This has had environmental consequences beyond the crisis linked to financial disruption. Climate change and disruption of other natural processes such as the water cycle and soil development also challenge current business models.

The key axes around which these scenarios are framed are not explicitly stated in the report. However some main distinctions are:

Finance
- Scenario A: a utility, not a casino
- Scenario B: finance is nationalised
- Scenario C: innovative finance solutions to sustainability challenges
- Scenario D: finance goes peer-to-peer

Environmental overshoot
- Scenario A: serious but slowing
- Scenario B: serious and accelerating
- Scenario C: slowing but serious
- Scenario D: serious and policed by civil society

Consumers
- Scenario A: avoiding debt and choosing smart services
- Scenario B: consumers are patriotic
- Scenario C: consumers are looking for low cost
- Scenario D: prioritise experience over ownership

Manufacturing
- Scenario A: always has end-of-life next use in mind
- Scenario B: forced to bring operations home
- Scenario C: migrating to Africa

- Scenario D: distributed manufacturing dominates

Governments
- Scenario A: regulate to avoid catastrophic risks
- Scenario B: each country regulates differently but always in its own interest
- Scenario C: global regulation aims for market-led solution
- Scenario D: regulation trying to catch up with networks

Brief description of future worlds
Four possible futures:

- **Global Interest**
  An effective globalised response to global challenges prompts increased resource productivity and low-carbon growth. Companies have to play a greater role in supporting public services and infrastructure but reap the benefits of a broadly free, stable and prosperous world.
- **National Interest**
  Nations hoard their own resources and tighten their borders in a retreat to nationalism and protectionism. Global businesses all but disappear and companies are expected to support the national interest.
- **Patched-up Globalisation**
  Emerging markets rise as China stalls. Low-carbon technologies thrive, particularly biofuels. Successful companies are multinationals with a local feel, helping to deliver local development needs.
- **Me and Mine, Online**
  A highly networked world undermines individual countries and companies. Successful companies are now more like branded hubs, coordinating often temporary and short-lived supplier relationships to deliver customised products.

Implications and application
The results imply that sustainability issues will become increasingly important for business across all the scenarios in different ways. If business wants to retain a global free-market world that benefits everyone they should take the lead on the changes that will address these challenges. This will give governments the confidence to support emerging sustainable business solutions rather than respond entirely through national controls and tight regulation. Resource productivity, re-use of materials and whole life approaches to supply chain management are all regret-free developments around which businesses should build alliances and promote government actions. One scenario, “Global Interest”, is seen as a desirable direction of travel and in the interest of business overall. It requires significant change and joint action to enable government and regulators to establish policies that will help realise the opportunities this scenario depicts.

Relevance to ScENE
These scenarios consider what future environmental changes and climate change pressures imply for business in addition to the pressures caused by the financial crisis, recovery from the recession and global demand for natural resources. Each scenario underlines that business as usual is not an option for business and explores how business today might act to shape the future for their longer term survival and success.
Perceptions on how might relate to EFF: analysing the scenario narratives, “Global Interest”: Relate (business models and practices); “National Interest*”:* Relate (international relations); “Patched-up Globalisation”: Relate (business and international relations); “Me and Mine, On-line”: Connect (information technology).

Dimensions: The context is global, but the scenarios focus on the UK government and business as actors. The scenarios illustrate different patterns of economic connection, financing, consumer behaviour, and extent of environmental stress.

G. Orange, Orange Future Enterprise Coalition (2006)

The way to work: space, place, and technology in 2016
http://www.business.orange.co.uk/servlet/Satellite?c=OUKPage&pagename=Business&cid=1044133326057
Consultants: Henley Centre Headlight Vision (now The Futures Company)
Method chosen: 'axes of uncertainty' matrix

Aim
The aim was to help organisations understand what they can do now to stay productive and competitive, and retain high calibre motivated people and start to prepare for the future. Handling uncertainty and taking risks are acknowledged attributes of entrepreneurs, but not of most established organisations. This work highlights the importance of preparing for change and having the skills to spot opportunities for the organisation.

Focus
To make sense of the challenging landscape and understand how to navigate a course through it, the Orange Future Enterprise coalition has been identifying the trends that will shape the business environment of 2016. The project focused on exploring how the location, design, and concept of the workplace might change as communities and lifestyles change, and as emerging information technologies create new work opportunities.

Methodology
The report identified two axes of uncertainty likely to influence the future: workplaces and the role that technology has to play within them and the nature of working relations and the control of data. The four scenarios emerged from the two axes.

Each of the scenarios depicts key social, economic, political, environmental and organisational drivers of change. These include changing transport, environmental awareness, the role of community, working patterns, employer/employee relations, globalisation, social exclusion and more. The drivers interact in different ways in each scenario.

At the 'theirs' end of the axis depicting how data is controlled, information is centralised and monitored, as are the employees working with it. Powerful networks prohibit access to and adaptation of data for personal use. At the 'yours' end of the axis, technology allows for fluid identities as the boundaries between people and information blur. This end of the spectrum is open source. It is more egalitarian than 'theirs', but systems of hierarchy have emerged.

At the 'somewhere' end of the axis depicting the nature of working relations, geographical ties are central to innovation and work being carried out. The meeting of people and data with place is important to getting jobs done. Time and place matter at this end of the spectrum.

At the 'anywhere' end of the axis, people and data interact directly, but work is not dependent upon location or place. This side of the axis has strong global links.

Brief description of future worlds
Four possible worlds:

- **Disciples of the Cloud**
  The far-reaching, ultra-mobility of data and employees predicted ten years previously has not emerged. Individuals and organisations alike increasingly emphasise the importance of face-to-face interaction in the workplace. A highly competitive business environment is driving companies to focus on efficiency. Global economic growth has been sporadic and unstable in the preceding years, leading companies and workers to play safe. Companies have chosen to consolidate local market positions rather than gamble on overseas expansion. The dominant business model is central ownership.
- **Electronic Cottages**
  It is 2016 and in the preceding years the cost of personal transportation has risen dramatically due to both green taxation and high oil prices. The increasing availability and decreasing cost of communications technology has helped to make decentralised working both attractive and practical. The new nature of work is reminiscent of the pre-industrial world and its cottage industries; the notion of the 'workplace' as somewhere people gather and work alongside one another has shrunk away. Instead, people have workspaces within their homes, serviced by computers and rapid network connectivity. The rise in home working has seen a revival of the local economy as people spend more and more time and money in the area where they live. This shift in working practices has created some dramatic changes in the housing market. Home locations are now chosen much more on the basis of lifestyle rather than proximity to the work place.
- **Replicants**
  The work of organisations has become even more global. In contrast to previous generations, the dominant model is 'open source/ distributed'. In the preceding decade organisations responded to the fast pace of change and need for constant innovation by becoming less centrally managed and more flexible. More and more, former core functions such as new product development and innovation have been spun off or outsourced to specialists. It is increasingly understood that greater individual and corporate benefits are possible from a more open approach to commerce and intellectual property (IP). Company boundaries have become more fluid and flexible; working for a company is no longer an all or nothing affair. Individuals are now commonly participants in, rather than employees of, a business network. Global innovation and development of IP are centred in local 'knowledge hubs' and 'lifestyle centres'.
- **Mutual Worlds**
  The combination of online mapping services, social networking and complexity-based management systems has given fresh energy to a traditional form of business organisation which has previously been written off: the rise of the mutually networked world. Technology is connecting people, services, and their physical or geographical surroundings in entirely new ways. This has enabled new grass roots business models to evolve where 'altruistic' behaviour is recorded and reciprocated.

Many business models are organised on a peer to peer basis with very little organisation at a higher level. The ability of technology to efficiently manage services and enforce the rules governing their usage has created an environment where cooperation is fostered because good 'citizenship' is rewarded and bad 'citizenship' is not. In manufacturing, flexibility and speed have become more important than pure cost and economies of scale. Unexpected new social patterns have resulted. First, the notion of 'joining' a membership organisation to support one's working life creates a more formal distinction between work and social life – people 'log in' when they start work, and 'log out' when they finish. The second is that people can choose how hard they want to work. Quality does pay: people will wait longer for a repair by a

carpenter with a good reputation, and don't mind paying more. Finally, the rise of electronic networks is enabling new currencies to emerge; the time-bank movement, which enables people to use skills in their neighbourhood, is flourishing.

Implications and application
This report was developed by the Orange Coalition, a group of approximately 20 people from a range of backgrounds that include: consultants, academics, business experts. It paints a picture of the potential futures for organisations. The report identifies a number of challenges for organisations over the next few years. These include: innovation, leadership capacity, quality, cultural, operational, technological, brand and regulatory challenges.

A summary is provided which describes the specific challenges faced by business moving from the established ways of doing business and adapting to change from many different areas.

No information is available on how these scenarios have been used by the coalition or others.

Relevance to ScENE
The scenarios are focused on private sector organisations and particularly established major players who may have to defend their position to be successful through the changes.
Considerable similarities exist between these scenarios and ScENE as can be seen in the summaries above.
A range of media are used to present and explain the scenarios, including a report, illustrated pictures of the scenarios, case studies and a podcast.
Perceptions on how might relate to EFF: x-axis – the nature of working relations (somewhere-anywhere): Connect (space); y-axis – control of data (theirs-yours): Relate (technology).
Dimensions: Within a UK context, these scenarios consider people from a number of perspectives: as employees, as consumers and as citizens with shared values. They explore how people will live their productive lives, focusing particularly on the role technology plays.

Scenario projects included in Compendium, edition 1

1. Office of Gas and Electricity Markets (Ofgem), October 2009

Project Discovery Energy Market Scenarios
www.ofgem.gov.uk
Consultants/Researchers: In-house
Method chosen: 'axes of uncertainty' matrix

Aim
Ofgem's Project Discovery began in early 2009 with the objective of exploring whether current market arrangements are capable of delivering secure and sustainable energy supplies over the next 10-15 years, and what the costs to customers will be. The investigation uses scenario analysis to put the debate regarding UK energy in the wider global and environmental context.

Focus
Since privatisation in the late 1980s and 1990s, Ofgem's focus in protecting consumers has been to promote effective competition in the supply of gas and electricity. Energy markets are now being tested and challenged, requiring arrangements to be re-examined.

Against this backdrop, Ofgem's statutory duties were extended in 2008 to put more emphasis on the achievement of sustainable development and to consider the interests of future as well as current customers. Ofgem's duties are to protect current and future customers; included is the need to tackle climate change and ensure security of supply.

The ability of energy markets to deliver secure and affordable energy and at the same time meet environmental objectives is also taking place in the context of a number of initiatives within the UK and, significant policy developments in Europe.

Methodology
In developing the scenarios a wide range of uncertainties were considered. From these, two key uncertainties were selected which were believed to most likely shape different future outcomes for the Great Britain energy markets. These are, first the speed of global economic recovery (rapid, slow) and, second the extent of globally co-ordinated environmental action (rapid, slow). The combination of these drivers yields four scenarios.

Brief description of future worlds
Four possible worlds:

- **Green Transition**
  Rapid economic recovery, significant expansion in investment in green measures, global agreement on tackling climate change; the EU 2020 renewables target is met, energy efficiency measures are effective, carbon dioxide emissions reduce rapidly; new nuclear and CCS demonstration projects operational by 2020; total energy demand is lower towards the end of the next decade, investment in gas and electricity infrastructure worldwide is significantly higher; a world of high gas and carbon prices but relatively low coal prices.
- **Green Stimulus**
  Slow recovery from the recession, global agreement on climate change, governments across the world implement 'green stimulus' packages, direct government investment in large generation and infrastructure projects; low energy demand, significant effort in improving energy efficiency; considerably reduced investment in international gas and electricity infrastructure; a world of relatively low

commodity prices but high carbon prices, governments pursue strict environmental policies; renewables targets would be met, carbon dioxide dioxide emissions would fall significantly.

- **Dash for Energy**
  Recession proves short-lived; security of supply concerns prevail over environmental concerns in Europe, negotiations on tackling climate achieve limited success; high gas demand results from strong growth in the global economy, significant expansion of gas-fired generation in GB and across Europe; EU indigenous gas production levels are relatively high; this is a world of high commodity prices; we assume new nuclear plant do not become operational before 2020 due to planning and supply chain constraints.
- **Slow Growth**
  Recession and the ensuing effects of the credit crisis continue to drag on for a long time, international gas and electricity infrastructure investment reduce considerably; future pipeline gas supplies to the EU and indigenous gas production are relatively low; relatively low commodity and carbon prices, UK renewables targets are not met; limited investment in new nuclear, focus shifting to obtaining life extensions for existing nuclear assets.

Implications and application
Project Discovery comprises three stages:

- First, identifying the scale of the challenge and risks facing the GB and wider European and global energy markets over the next two decades through scenario and stress test analysis;
- Second, reviewing the current market arrangements to see if they are appropriate for this challenge; and
- Third, if there are areas that need changing, identifying policy responses and testing these against our scenarios and stress tests.

Work on the second and third stages of the project is ongoing. An assessment of how current market arrangements could be improved will be set out, in particular whether they enable appropriate response on both the demand and supply side. Ofgem views will also be set out as to whether any further policy responses are required to deliver secure and sustainable energy supplies. In making these recommendations Ofgem will consider what level of security of supply is acceptable to current and future customers in terms of balancing risks against costs, and how the policy responses are likely to affect this trade-off.

Relevance to ScENE
Energy (demand and supply), forms one of ScENE's underpinning global drivers of change to 2060.
Perceptions on how might relate to EFF: x-axis - the speed of global economic recovery/ investment activity to create new infrastructure: Create (wealth); and, y-axis - the extent of globally co-ordinated environmental action: Relate (government/international relations).
Dimensions: A UK energy focus, with an emphasis around prospects for secure and sustainable energy supplies, set within a wider global and environmental context.

2. Food Ethics Council, March 2009

'Future Scenarios for the UK Food System. A Toolkit for thinking ahead'
www.foodethicscouncil.org
Consultants/Researchers: Infinite Futures

Method chosen: ‘axes of uncertainty’ matrix plus (+systems and ethnographic futures framework)

Aim
A set of scenarios have been developed to help the Food Ethics Council think about how the UK’s food system could develop over the next couple of decades. What might we be eating in 2022, and why? Where could it have come from? Where might we be eating it - and how might it get there?

Focus
The need to plan for a sustainable, ethical food system has never been greater. Improving food security, tackling hunger, obesity and injustice, supporting animal welfare, and preserving the environment, all demand urgent action in pursuit of long-term aims.

How can people striving for a better food system - civil society groups, public policymakers and businesses - begin to plan campaigns, policies or products for the future if it looks so uncertain? And how can we avoid the opposite trap, of assuming that the future will be like today, only more so?

Methodology
The scenarios were created through extensive desk research, interviews and a series of workshops, with experts drawn from industry, government agencies and civil society. Possible trends and drivers of change that might shape the future to 2022 were identified, clustered and ranked. The two most important and highly uncertain drivers of change were agreed as the role of food in UK society and the shift of global political, cultural and economic influence from West to East. Around these, two questions were framed:

- in 2022, will the dominant UK culture and food system treat food primarily as fuel to keep us going or as a way, not only of gaining nutrition, but also of expressing deeply held values?; and
- by 2022 will China, India and other rapidly growing economies have eclipsed ‘the West’ as we know it, to become the dominant economic, political and cultural powers, or will the current global powers still be stronger, albeit waning?

These two uncertainties were placed on the x and y axis of a two by two scenario matrix, the x-axis ranging from ‘foodies to fuelies’; the y-axis ranging from looking East to looking West.

Brief description of future worlds
Four possible worlds:

- **Pass the VatBeefTM QuikNoodle**
  All the latest technology, including biotech, in-vitro meat and milk and hyper-efficient closed loop recycling systems are brought to bear on growing problems of nutrition and hunger in the UK. Cost and convenience are key consumer priorities, with general disdain shown towards any pretension around food - as long as it’s safe and filling, who really cares where it comes from, unless it carried a heavy toll in Carbon credits?
- **Carry on consuming**
  Personalisation and segmentation are key. An explosion of brands sees ever tighter targeting of products at smaller and smaller groups, including the widespread marketing of nutraceuticals and functional foods. Supply chains are dominated by a handful of companies, but global competition and the demands of

CSR policies on carbon and food safety have led to greater reliance on production and processing within the Europe+ region.

- **Cash rich, time poor, experience hungry**
  Enter a world of seemingly limitless choice, gourmet bragging and web-based recommendations and retail. Only those with the luxury of time to spare can personally track down the most exclusive eco-friendly purchases, or chat with the artisanal producers now gaining increasing power in the food system. Still, the vast majority of people benefit from automatically ordered, cleverly managed doorstep deliveries. Concern about 'quality' food – low input, traceable, fairly produced - is generally high, even if knowledge about whether the system is really that low-carbon is limited.
- **A lot of allotments**
  Food growing has penetrated and surrounded the urban jungle. With multi-storey farms and a widespread commitment to growing your own (wherever there's a space), people's understanding of where their food comes from hasn't been higher in generations. Food is a key part of the social and cultural - as well as physical - fabric of towns and cities. High street retail is back in vogue and localism is a dominant theme, with the biggest retail and foodservice companies turning their attention to larger markets and margins elsewhere in the world.

Implications and application
The scenarios formed part of the evidence for a Food Ethics Council project on food distribution. The project report, 'Food distribution: an ethical agenda', examines the impact of food distribution networks on our environment, economy, culture and communities, and their contribution to climate change. It offers a sustainable vision for the future of food distribution, providing a roadmap for government, business and civil society.

Relevance to ScENE
Reference provided to varied issues around food production with related implications for the environment. Food security forms one of ScENE's underpinning global drivers of change to 2060. Raising questions on how we eat, what we eat and how our food is grown and distributed, the scenarios might fill gaps in detail around food not present in the current ScENE work. A similar global context is taken with exploration of impact on the UK.
Perceptions on how might relate to EFF: x-axis - the role of food in UK society: Consume (food) and, y-axis - shift in extent of global political/economic power from West to East: Relate (economy and international relations).
Dimensions: Whilst a food focus, placed within a broad socio-economic and political context.

3. Environment Agency, 2008

'Social Scenarios for Water Resources 2050', 2008
Consultants/Researchers: Henley Centre Headlight Vision (now The Futures Company)
Method chosen: 'axes of uncertainty' matrix with EFF analysis

Aim:
A range of scenarios were developed as a tool to inform the Environment Agency's assessment of water and waste-related policies.

Focus:
The scenarios represent a refreshment and extension of the Environment Agency's 'Risk-based Scenarios', which were developed in 2005-06 to inform the Agency's assessment of water and waste-related policies. The initial scenario set looked out to

2030. The versions of the scenarios presented here have been extended to 2050, using a number of analytical futures techniques to ensure a proper understanding of the dynamics of the scenarios under this longer time-frame.

Methodology:
The scenario space is defined by the juxtaposition of two 'axes of uncertainty' derived by clustering a series of prioritised drivers into distinctive themes, and then identifying the differences at the extremes.

Based on the original Environment Agency 'risk-based scenarios', the x-axis focuses on UK societal attitudes and behaviour around consumption, in particular of 'material' goods. At one extreme of the axis, consumption patterns are constrained. At the opposite extreme, individuals exist in an intensified 'desire economy' in which there is greater consumption of goods and experiences.

The y-axis refers to international 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 based on rules concerning competitiveness and open markets, for reasons of sustaining economic growth.

To reflect the role of people's social values in shaping how the future may develop, analysis using the Ethnographic Futures Framework was undertaken. Adopting the four categories of relate, connect, create and consume (the fifth category, 'define' was not used), critical dimensions were identified for each scenario.

Brief description of future worlds
Four possible worlds:

- **Alchemy 2050**
  'Our scientists and technologists can solve the problems of environmental damage through their ideas and innovation.'
- **Jeopardy 2050**
  'The rich shall inherit the earth – because we're worth it.'
- **Survivor 2050**
  'It is better to have fewer wants than greater resources.'
- **Restoration 2050**
  'We can design out resource use through different ways of managing our societies and our relationships.'

Implications and application
The scenarios will be analysed on their completion.

Relevance to ScENE
In addition to being strongly focused on water resources, the scenarios explore the role played by people's social values in shaping how the future may unfold. An insight is also provided on changes in consumer behaviour (materialised and de-materialised).
Perceptions on how might relate to EFF: x-axis - UK societal attitudes and behaviour around consumption (ranging from de-materialised to material): Consume (consumer goods and natural resources); y-axis – international governance systems (ranging from sustainability led to growth led): Relate (government).
Dimensions: Whilst a core water resource environment focus, placed within a broader social, economic, technological (and other factors of change) context. The scenarios also have a social values component.

2008
4. Chatham House, May 2008

'Thinking about the Future of Food. The Chatham House Food Supply Scenarios' Chatham House Food Supply Project, CH BP 08/03
www.chathamhouse.org.uk
Consultants/Researchers: In-house
Method chosen: 'axes of uncertainty' matrix

Aim
Demand for food is increasing because the global population is rising and major developing economies are expanding. Global supply capacity, meanwhile, is struggling to keep up with changing requirements. Four global food supply scenarios were developed to consider the challenges created and their impact on the EU/UK. Across the world the responses to change will be conditioned by uncertainties surrounding the availability of sufficient energy, water, land and skills. The scenarios specifically, were a means of engaging the UK's wheat and dairy supply networks in a debate about strategic developments and future food supply prospects.

Focus
The scenarios depict a range of global circumstances in which the UK may be placed in the years ahead. They summarize the range of overall conditions that could form a backdrop to UK decisions about government food policy and food industry strategy.

Methodology
Sourced from existing data and research, driving forces were identified that, separately or in combination, were considered to continue to exercise significant influence on political, economic and social developments. These break down broadly into four categories: the changing oil price, the growth of global demand for food, issues around current supply capacity (with a focus on the expansion of global production) and the global political and economic responses to change. Key uncertainties were subsequently identified around the main drivers and their interdependencies mapped. Story-lines were developed and considered in plenary research team discussions and bilateral consultations with experts. Workshops involving stakeholders from around the UK's wheat and dairy supply networks and the projects stakeholder panel, enabled the scenarios to be further refined and enabled outputs to be secured on the effects of the global scenarios on the UK's own food supply arrangements.

Brief description of future worlds
Four possible worlds:

- **Scenario 1: Just a Blip (5 years)**
  High food prices prove to be a temporary blip and soon return to the long-term trend line. There is a possibility however, that if food prices fall back sharply, financial speculation in commodities will operate in reverse and lead to exaggerated food price volatility.
- **Scenario 2: Food Inflation (10 years)**
  Food prices stay high for a protracted period. They contribute significantly to inflation, but the economy adapts and the existing food system copes.
- **Scenario 3: Into a New Era (10 + years)**
  Input prices initially stay high as per capita production falls steadily. In response, the system of food production is required to shift dramatically so that increased yields are delivered efficiently through 'regenerative' rather than purely 'extractive' uses of resources.

- **Scenario 4: Food in Crisis (5 years)**
  Multiple shocks disrupt food production and supply. Prices skyrocket as stocks plummet, triggering food shortages, famine and civil panic.

The scenarios are medium-term and designed to play out over differing time-scales - a five-year period or less for **Just a Blip** and **Food in Crisis**, but perhaps ten years or more for **Food Inflation** and **Into a New Era**.

Implications and application
The scenarios reveal significant points of debate and questions for all stakeholders across the EU/UK food supply system (including around agriculture, industry, government and civil society). Across the world the responses to change will be conditioned by uncertainties surrounding the availability of sufficient energy, water, land and skills. A next phase of research will examine the implications for the UK in more depth; this will help EU/UK stakeholders to start planning to develop new food supply systems that are up to the task (which include avoidance of short-term responses that might serve to exacerbate rather than resolve current pressures in the system).

Relevance to ScENE
Reference is provided to energy, food security and global political economic changes; factors which are reflected in ScENE's underpinning global drivers of change to 2060. Focusing on food supply and demand, the scenarios could fill in gaps in detail around food not present in the current ScENE work. A similar global context is taken, with exploration of impact on the EU/UK.
Perceptions on how might relate to EFF: a - changing oil price: Consume (natural resources); b - the growth of global demand for food: Consume (food); c - current supply capacity/global production: Create (agriculture); d - global political and economic response to change: Relate (economy and international relations).
Dimensions: Whilst a focus on food, placed within a broad socio-economic and political context.

5. Department of Business, Enterprise and Regulatory Reform Team (BERR), Energy and Climate Change Strategy Team, 2008

Long term scenarios project, 2020
www.berr.gov.uk
Consultants/Researchers: In-house
Method chosen: 'axes of uncertainty' matrix

Aim
Building on analysis conducted for the 2007 Energy White Paper, and in order to test the robustness of its long-term energy strategy, BERR has developed comprehensive global long-term scenarios.

Focus
The work built on a large body of existing scenarios work, including the International Futures Cross-Whitehall project that covered the period 2010 to 2020, and also external futures work by Shell and the International Energy Agency (IEA). It involved engagement of staff from across the Energy Group, in other Government Departments and external scenario experts.

Methodology
The first step was to conduct a literature review to assess the existing work, workshops were then run to engage input from across Energy Group. Key drivers of

change were identified and the scenarios developed around global social and economic uncertainties:

- Development (eg GDP growth); and
- Openness (eg trade and political).

A standard matrix type methodology was adopted with two of the key drivers identified placed on axes to create a framework of four conceptual scenarios. Whilst the x-axis reflecting socio-economic development ranged from stagnant development to fast development, the y-axis ranged from open (co-operative) to closed.

Using expertise from within BERR, the internal consistency of the scenarios including whether they were wide-ranging enough to challenge the overall long-term energy strategy was tested.

Brief description of future worlds
Four future worlds were described:

- **Global equality** - a socially responsible world focused on reducing the social divide at the expense of economic growth.
- **Open markets** - a market-driven high growth world.
- **Local communities** - an inward looking world with little co-operation and growth.
- **Trading blocs** - a world dominated by large trading blocs with little co-operation but where growth is driven though competition.

Implications and application
The scenarios have been used to understand the implications for BERR's long-term energy policy.

Key proposals were cited for embedding the scenarios with the Energy Group:

- *Overall Strategic Thinking:* to enable an assessment of the overalls risks to and opportunities of BERR's long-term energy strategy;
- *As a Framework for Future Policy Development:* the scenarios provide a consistent framework for using scenarios for policy development within the Group;
- Updating: it is proposed that the scenarios be reviewed every two years, and updated at this point if deemed necessary; the scenarios will be updated every five years at a minimum.

Relevance to ScENE
Energy (demand and supply), forms one of ScENE's underpinning global drivers of change to 2060. A global context is similarly provided, with exploration of impact on the UK.
Perceptions on how might relate to EFF: x-axis - global GDP/socio-economic development; Create (wealth); y-axis - open/closed trade and political relations: Relate (economy and government).
Dimensions: Whilst a socio-economic focus, drivers were broad, embracing climate change and resources.

6. Department of Innovation, Universities and Skills (DIUS)

Foresight Horizon Scanning Centre, Government Office for Science, Scenarios for DIUS, 2008
UK Futures: Society and Economy 2030
www.dius.gov.uk

Consultants/Researchers: Outsights and MORI
Method chosen: 'axes of uncertainty' matrix

Aim
Commissioned by DIUS, the overall objective was to develop a set of scenarios that could be used to analyse DIUS policies and strategies, so improving their robustness. They were designed to explore what would happen to policies if our assumptions about the future turn out to be false and to be useful for DIUS, its partners and other related governmental departments.

Focus
Focused around what the UK's economy and society might look like to 2030, the scenarios provide a context within which a wider range of policy issues can be explored.

Methodology
- The scenarios were built on an evidence base of drivers of change. Ten dimensions of uncertainty considered to be important for the future of the UK economy and for society were identified (global balance of power and international architecture; economic integration, models and governance; layers of power; communities and communications; demographics and migration; education and skills; values and beliefs; inequalities; research and innovation; climate change and natural resources). A supporting paper was written for each dimension which was reviewed by a panel of experts.
- Two axes or dimensions were developed as a framework on which to develop the scenarios, the x, social values axis ranging from individualistic to collectivist, the y, global economic and political context, axis ranging from open (multilateral) to closed (unilateral/bilateral).
- A participative approach was taken to scenario development which over eight months, involved workshops, interviews, online brainstorm, stakeholder group meetings, research programme, expert group meetings, and work with Her Majesty's Treasury (HMT). A number of DIUS partner organisations were involved in their construction.

Brief description of future worlds
- All worlds start from the same common position - an economic crisis.
- But the nature of the crisis and society's responses vary differently across the scenarios.

Perpetual motion
- Global free markets
- Mosaic of self-reliant individuals
- Export-driven emerging economies grow rapidly, competing with the West
- Deep pockets of poverty
- Open markets in resources, though market failures occur

Shaken open
- Strongly-regulated global economy
- Strong collective identities
- Export-driven emerging economies grow rapidly, collaborating with the West
- Moderate inequality - high redistribution
- State intervention in resource provision

Self-service

- Market barriers and protectionism
- Competitive individuals, strong families
- Resource-rich emerging economies grow in wealth
- Moderate inequality within the UK
- Access to resources is constrained, with local adaptation and pricing mechanisms

Protective collective

- Market barriers and strong nations
- Strong collective identity within the UK
- Resource-rich emerging economies grow in power
- Low inequality within the UK
- Access to resources is constrained, with high state intervention and rationing

Implications and application

To illustrate how the scenarios could lead to the Government facing very different policy issues and priorities, a description of the UK's status in 2030 is provided for each scenario against each of the nine Strategy Unit challenge areas identified in the Cabinet Office Strategy Unit's report 'Realizing Britain's Potential: Future Strategic Challenges for Britain' (2008).

The scenarios have been used by HMT to look at prosperity and by DIUS to look at elements of the HE Framework.

Relevance to ScENE

A core focus is provided to societal response. People's values, cultures and behaviours are central to the ScENE scenarios. A global context is similarly provided, with exploration of impact on the UK.
Perceptions on how might relate to EFF: x-axis - from individualist to collective social values: Define (values and attitudes); y-axis - open/multi-national relations to closed: Relate (government and international relations).
Dimensions: Two dimensional (economy and societal).

7. Department of Innovation, Universities and Skills (DIUS)

Powering Our Lives: Sustainable Energy Management and the Built Environment (SEMBE) (October 2006 – November 2008)
www.foresight.gov.uk/OurWork/ActiveProjects/SustainableEnergy/ProjectHome.asp
Consultants/Researchers: The Futures Company (formerly Henley Centre Headlight Vision)
Method chosen: 'axes of uncertainty' matrix

Aim

The project was designed "to explore how the UK built environment could evolve to help manage the transition over the next five decades to secure, sustainable, low carbon energy systems that meet the needs of society, the requirements of the economy, and the expectations of individuals."

Focus

The key question driving the study was, "How could the UK built environment evolve to help manage the transition over the next five decades to secure, sustainable, low carbon energy systems that meet the needs of society, the requirements of the economy, and the expectation of individuals?" The time horizon for the study was 2050.

Methodology
The project used the classic two-axis 'deductive' scenarios approach, developed initially at SRI (Stanford Research Institute) and elaborated and popularised by the Global Business Network. It ranks relevant drivers of change by their uncertainty and their importance to the project's focus issue, and chooses the two most important uncertainties to express as axes that create four scenario spaces. The scenario process was led by Henley Centre Headlight Vision (now The Futures Company). Development of the scenarios occurred in five stages:

- define the scoping question;
- identify an initial set of drivers for the future, and prioritise them via a scoping workshop with stakeholders;
- develop an initial set of scenarios based on the two drivers prioritised as the most important uncertainties in the drivers workshop;
- test the draft scenarios in another stakeholder workshop;
- evolve scenarios with additional workshops, and with a series of exploratory technological roadmaps (developed by Cambridge University's Institute for Manufacturing, using expert input and workshop discussions); and
- analyse the scenarios further to explore their implications for policy.

While not involving public participation per se, the scenario development process did rely on broadly representative stakeholder participation.

The drivers analysis identified seven major 'clusters' of forces, drivers, and trends affecting energy and the built environment: climate change and the environment; demographic change; infrastructure; technology and materials; public attitudes; economy (market forces); and the political framework. Drawn from a literature review by the Office of Public Management of 27 relevant studies, the drivers were chosen because they adopted a futures perspective, were focused on energy management and the built environment, and between them covered a broad range of methodological approaches.

The uncertainties chosen for the scenario axes focus first on global political and economic context, and secondly the type of innovation attracting investment.

- x-axis: from 'open and independent' relationships, usually involving multi-lateral agreements or institutions, at a global or regional (ie, continental) level, to 'bounded but independent' states, with relationships characterised by bi-lateral and short-term relationships.
- y-axis: at one end, policy-makers and investors prefer to foster emerging systems, innovations and technologies, with novelty preferred, while at the opposite end of the continuum, innovation is deployed to optimise current systems.

The report cautions that for both energy and the built environment these axes represent 'centres of gravity' rather than exclusive conditions.

Brief description of future worlds
Four possible worlds:

- **Resourceful Regions**
  Political trust globally has diminished, but bilateral agreements continue. Most UK energy comes from fossil fuels, and innovation focuses on optimising existing systems. The focus is more on energy security and less on climate change impacts. Water is widely understood to have an energy cost. The countryside is

used more intensively for food production, mining, and other activities. Emphasis on urban green space for heat control.

- **Sunshine State**
  International solidarity collapses in the face of climate change and expensive energy, and the UK government emphasises localism to respond to energy shortages, and encourages a shift in values, switching from GDP as a measure of progress to a “Sunshine Index.” People are active energy users and know the energy use of everything they own. Green roofs, parks, and extensive local sustainable drainage systems to counter flooding are common. Use of renewables has expanded, including solar energy and biomass (with obvious impacts for agriculture).
- **Green Growth**
  Novel technologies are seen as the best response to serious concerns about fossil fuel and climate change. Social values emphasise universalism and benevolence, and the economy and government emphasises decoupling growth from carbon emissions - with a carbon tax to drive change. Most energy comes from renewable sources, often big projects like the Severn Barrage, offshore wind farms, and solar energy farms in Africa. This is complemented by some local renewable energy, including energy-from-waste schemes.
- **Carbon Creativity**
  Decarbonisation is a major theme in this future, featuring a global carbon market in which all goods and services carry a carbon price. But considerable investment in Carbon Capture and Storage allows a continued reliance on fossil fuels, and renewables are small in scale and volume. Existing stock in the built environment has been extensively retrofitted.

Implications and application
The scenarios were used for a series of ‘wind-tunnelling’ workshops exploring how different policies and strategies might play out in the four future worlds. This highlighted several key issues, including:

- critical need to identify at what level of government any policy interventions might be most effective with regard to managing sustainable energy and the built environment; and
- critical need to explore ‘system lock-in’, that is, how do we maintain the flexibility of sustainable energy systems to adapt and evolve with innovation: will market-based mechanisms alone ensure best fit, or does the critical nature of the issue call for ‘strong, active intervention’?

The project subsequently identified pertinent incentives and enablers for sustainable energy management.

Relevance to ScENE
People’s use of energy and our design of the built environment deeply affects the natural world. These scenarios provide glimpses into how varying the design and use of the built environment, and related energy demands, could create knock-on changes to the UK’s natural environment. A global context is similarly provided, with exploration of impact on the UK.
Perceptions on how might relate to EFF: x-axis - how international institutions relate: Relate (government and international relations); y-axis - how the UK creates new systems for sustainable energy and the built environment (novelty vs. incremental improvement): Create (innovation processes).
Dimensions: Multi-level government and organisational relations affecting the climate of innovation, research, and entrepreneurial activity regarding energy and the built environment.

8. Yorkshire Futures, published 2008

'The Future of Yorkshire and Humber: trends and scenarios to 2030'
www.yorkshirefutures.com
Consultants/Researchers: Henley Centre Headlight Vision (now The Futures Company)
Method chosen: emergent / clusters + 3-horizons

Aim
To explore what Yorkshire might be like in 2030 and how trends impacting on the region now may affect it in the long-term.

Focus
Explores what might happen to social, economic, health and environmental inequalities in the future. Inequalities and health form specific areas of emphasis, with a geographical focus also provided on Leeds City region, as a means to explore how regional trends play out in a specific geography.

The key question framing thinking for the project was: What is the range of plausible and coherent futures for Yorkshire and Humber and the Leeds City region to 2030? What is the evidence and rationale for these, and which scenario is most likely? Furthermore, what does the drivers and scenarios indicate will happen to social, economic, health and environmental inequalities going forwards?

Methodology
The project was highly participative, involving key stakeholders across four stages:

- Drivers analysis and prioritisation;
- 'Most plausible' scenario development;
- Variant scenarios development; and
- Scenarios exploration and implications.

28 drivers were prioritised via workshops with key stakeholders, which were grouped under eleven 'dimensions of change'. Further analysis was done of the drivers, including an assessment of the interdependencies between them. The drivers which emerged as being both relatively important and relatively uncertain were then clustered to capture the key emerging themes. The four clusters were: energy, resources and climate change; consumers, society; workforce and economy; governance.

A '3-horizons' approach was utilised allowing rates of change of the four clusters to be analysed, the first horizon covering the roll-out of new but understood policy and socio-economic activity (business as usual), the second horizon being the domain of current public and private research, which may result in innovation and invention and may lead to disruption.

Brief description of future worlds
Four worlds were explored:

- **Most plausible** - what if... the ***trends*** evident now ***continue*** without large disruptions?
- **Northern Lights** - what if… London has reached the limits of its potential for expansion?
- **Low Carbon Locale** - what if… resource costs soar and carbon emissions are aggressively reduced?

- **Fragile Seams** - what if…inequality within the region becomes so acute that it dominates social and economic policy?

Implications and application
A series of ten strategic questions emerged from the analysis of the drivers, trends and scenarios.

Relevance to ScENE
With a focus on a region, the scenarios provide a sense of place, highlighting regional identity and distinctiveness, a perspective which might be missing from UK-wide scenario projects. Summary leaflet a useful example of material that communicates the possible futures to a lay audience. Innovative horizons approach enabling rates of change of key drivers to be analysed.
Perceptions on how might relate to EFF: scenario 1 - market orientated, consumer values: Define (economic systems); scenario 2 - London reaches limits of carrying capacity: Relate (economy, government and environment); scenario 3 - resource costs soar and carbon emissions are aggressively reduced: Consume (natural resources); scenario 4: inequality increasingly causes social disruption: Relate (work and economy).
Dimensions: Wide socio-economic, health and environmental perspective.

9. Shell International Ltd, 2008

Shell energy scenarios to 2050
www.shell.com/scenarios
Consultants/Researchers: In-house
Method chosen: emergent / clusters

Aim
Shell has developed a range of global scenarios over the last three decades to help think about the future of energy. This is one of the two most recent (the first follows as item 22).

Focus
Considers how the global energy system a century from now might transform, based on the development dilemma - prosperity versus poverty; the trust dilemma - globalisation versus security; and the industrialisation dilemma - growth versus the environment. Humanity faces a challenging outlook for energy and the planet, summed up by: ‘more energy, less carbon dioxide’.

Methodology
The scenarios bring out the impact of critical differences in the pace and shape of political, regulatory and technological change, with climate change a key constituent. Three key drivers: exponential demand in energy use; supply struggling to keep pace with demand; increasing environmental effects. Energy-related differences between the scenarios are in demand, resources, technology and the environment, constituent drivers of the latter being land use, pollution, climate/biodiversity, water.

Both scenarios have challenging outlooks, rooted in detailed analyses of energy supply, demand and technology fundamentals.

Brief description of future worlds
Two future worlds were depicted:

- **Scramble**
  National governments scramble to secure their own energy supplies - policymakers pay little attention to more efficient energy use until supplies are tight, likewise, greenhouse gas emissions are not seriously addressed until there are major climate shocks.
- **Blueprints**
  Growing local actions begin to address the challenges of economic development, energy security and environmental pollution - the coalitions begin to add up to a new energy framework. A price is applied to a critical mass of emissions giving a huge stimulus to the development of clean energy technologies, such as carbon dioxide capture and storage, and energy efficiency measures. The result is far lower carbon dioxide emissions. Shell considers that **Blueprints** offers the best hope for a sustainable future.

Implications and application
Sketching the landscape of possibilities, constraints, opportunities and choices, both scenarios describe an era of revolutionary transformations in the global energy system.

To get the most out of the storylines, it is recommended that they be reviewed with a number of specific questions in mind, such as: 'what are the potential milestones or events that could particularly affect us?'; 'what are the most significant factors that will influence our environment and how could these play out?' and, 'what should we do in the next five years to help prepare for, or shape, the turbulent times ahead?'.

Relevance to ScENE
Energy (demand and supply), forms one of ScENE's underpinning global drivers of change to 2060. Their global context and similar timeframe are also common features.
Perceptions on how might relate to EFF: scenario 1: *Blueprint* – co-ordinated actions for the environment: Relate (government and international relations); scenario 2: *Scramble* - national governments scramble to guarantee energy supplies: Consume (natural resources).
Dimensions: An energy focus, with an emphasis around reductions in carbon emissions, set within context of effect on the environment.

2007
10. Carnegie UK Trust, 2007

'The Shape of Civil Society to Come' and, 'Scenarios for Civil Society' to 2025
www.carnegieuktrust.org.uk
Consultants/Researchers: Henley Centre Headlight Vision (Infinite Futures as subcontractor)
Method chosen: causal layered analysis (CLA)

The first report referenced above outlines the analysis of the drivers of change that are likely to affect the future nature and role of civil society, looking out to 2025. The second complementary report describes a number of scenarios that are both plausible and challenging, illustrating what the future might hold for civil society.

Aim
In 2006, the Carnegie UK Trust launched an Inquiry into the Future of Civil Society in the UK and Ireland, the goals of which were to:

- Explore the possible threats to and opportunities for the development of a healthy civil society, looking out to 2025.

- Identify how policy and practice can be enhanced to help strengthen civil society.
- Enhance the ability of civil society associations to prepare for the challenges of the future.

Drawing on the findings of the first phase of the Inquiry against the above, the Inquiry Commission will identify a number of 'burning issues' to explore in further depth in 2008. The second phase of the Inquiry will draw back to the present and identify how policy and practice might be enhanced in the near-term so as to better take advantage of emerging opportunities or diminish possible threats for civil society.

Focus
Core sociological focus, with consideration of values core. The Inquiry's working definition of civil society has three dimensions. Civil society is understood by the Inquiry as a goal to aim for (a 'good' civil society), a means of achieving it (through civil society associations such as voluntary and community organisations, trade unions etc), and a framework for engaging with each other about ends and means (arenas for public deliberation).

Methodology
- Undertook research to identify the key drivers of change that are likely to affect civil society.
- Held a series of futures workshops across the UK and Ireland for the purpose of gathering insights about what the future might hold. Around 400 people with diverse professional and life experiences participated.
- Conducted semi-structured interviews with key informants.

Recognising the importance of values in understanding the future of civil society, an unconventional scenario process was adopted. Known as 'Causal Layered Analysis', this explored possible futures as being constructed from multiple layers; from 'litany', to 'systems', to 'worldview', to 'metaphor'. The scenarios were built up deductively through the uncertainties generated by the re-framing of current prevailing 'worldviews' (for example, if a current 'worldview' is that 'A few voices are privileged', then an alternative worldview might be that 'All voices are privileged').

The drivers were prioritised and organised into three categories: The first category represents contexts. These are important but largely certain drivers over which civil society associations have little influence (yet civil society associations will need to respond to them). The second category are those drivers which present the greatest uncertainties for civil society. These drivers of change are variable, and can therefore be influenced by the actions of civil society associations.

The uncertain drivers have been clustered into the following headings: limits of economics (such as growing socio-economic divides and pressure on global resources); personal values (such as rising individualism and shifting identities); shifting activism (such as disengagement with formal politics and the rise of 'digital natives'); state and individual (such as the visibility of the security state and the regulation of civil life).

The third and final category of drivers of change are those which represent outcomes of some of the contextual and/or uncertain drivers (such as the increasing complexity of family structures and the 'professionalisation' of third sector organisations).

Having identified the key drivers of change for civil society, participants explored how the drivers of change might affect civil society in the future. The analysis of these

insights led to the development of nine faultlines that present significant challenges or opportunities for civil society.

Brief description of future worlds
Four possible worlds:

- **Local Life**
  Resource scarcity and energy costs lead to the regeneration of local life. Civil society has been in the vanguard of this process, and as a result has gained significant political influence. But there is insularity and competition between localities.
- **Athenian Voices (Electronic Age)**
  Technology and innovation leads to far greater involvement and engagement in politics, and in more inclusive debate. But technology can also facilitate and encourage atomisation; it indulges individualism and can transform media from a 'broadcast' to a 'narrowcast' paradigm.
- **Diversity Wars**
  Cultural, religious, and ethnic diversity - along with social divisions arising from inequalities of income and environmental impacts - has led to conflicts between and within communities over resources and values. But younger generations have more in common - and large scale environmental problems require co-operation to be managed.
- **Global Compact**
  The security state constructed for the 'war on terror' is no longer regarded as effective. Civil society associations have led the campaign against the exploitation inherent in cheap goods and together with global agencies play a key role in monitoring labour practices. But migrant labour, which is increasingly needed in Europe, is a different story. States oscillate between local populism and a global view.

Implications and application
A number of implications emerged overall for the future of civil society; these were framed into a series of seven questions that can be applied to the scenario set. Issues identified include those relating to the emerging conflict between conventional economics and environmental and resource issues.

Relevance to SCENE
Insight is provided to how civil society might respond and shape future issues (includes those relating to emerging conflict between conventional economics and environmental and resource issues; future values; governance; and development of technology). The perspective provided by the scenarios helps to balance/counteract the hard economic view. People's values, cultures and behaviours are central to the ScENE scenarios. The scenarios also explore the potential for extreme social fragmentation and, the global futures of migrant labour, issues not addressed in ScENE.
Perceptions on how might relate to EFF: scenario 1, Local Life: resource scarcity and energy costs: Consume (people back to community, natural resources); scenario 2, Athenian Voices (Electronic Age): technology and innovation lead to greater involvement and engagement: Connect (information technology); scenario 3, Diversity Wars: Define (culture, religions); scenario 4, Global Compact: local-government accords: Relate (government).
Dimensions: Whilst a core sociological focus, placed upon a broad socio-economic, environmental, technological and political and organisational context.

11. Health and Safety Laboratory, 2007

'The future of health and safety in 2017' Health and Safety Executive, Report RR600

http://www.hse.gov.uk/research/rrhtm/rr600.htm

Consultants/Researchers: Infinite Futures (SAMI Consulting as subcontractor)

Method chosen: 'axes of uncertainty' matrix plus (+ ethnographic futures framework and systems)

Aim

To depict a range of possibilities for workplace health and safety in Great Britain in 2017 over a ten year time horizon.

Focus

Britain's Health and Safety Commission (HSC) and the Health and Safety Executive (HSE) are tasked with protecting people's health and safety by ensuring that risks in the changing workplace are properly controlled. In order to assess risks emerging from change and innovation, HSE established a Horizon Scanning system.

Methodology

HSE policy makers and outside experts participated in the scenario process. Twenty six issues provided the starting point for building the scenarios, which were prioritised and clustered. Two critical uncertainties emerged as primary drivers describing possible futures for health and safety:

- Will the UK increase its competitiveness in the global economy? This cluster also linked to harmonisation of regulations, numbers of the differently in employment, incorporation of migrants, vitality of the enterprise culture, expectations of well-being and social cohesion.
- Are public attitudes towards risk those of personal responsibility, or of the blame culture? This cluster also included attitudes towards adoption of technology, ability to absorb impacts from conflicts and resilience in the face of economic, social or other shocks.

The uncertainties were used to construct a scenario cross (two axes) around which different scenarios were built.

Opposite possible outcomes of these two questions created the four arms of a scenario matrix, the x-axis ranging from decreased to increased UK competitiveness; the y-axis representing ranging public attitudes towards risk.

Brief description of future worlds

Four different worlds:

- **The Digital Rose Garden**
  Britain has harnessed the creativity of its diverse society to service both the economy and the environment.
- **Boom and Blame**
  The global economy of 2017 is a dog-eat-dog arena. Privatisation is up and the market is free.
- **Tough Choices**
  The present is a landscape littered with tough choices: the future seems nasty and brutish. Any comparative advantage that Europe once enjoyed on the global economic stage has evaporated.

- **A Virtue of Necessity**
  Britain now resembles one great seaside town. More and more UK communities, even cities, consist of older people, needing services more than consumer goods.

Implications and application
The scenarios have been deployed twice to generate policy generation and ideas:

- at the HSE Horizon Scanning Conference in November 2006 to spark wide-ranging discussion of possible challenges facing the HSE; and
- in a subsequent wind-tunnelling workshop to demonstrate how scenarios can be used to consider specific policies in the face of potential change.

Relevance to ScENE
Lifestyle scenarios which provide insight into economic collapse. Provide useful examples of scenario summaries for communicating to a wider audience, together with a step-by-step process for wind-tunnelling. Global context similarly provided. Perceptions on how might relate to EFF: x-axis - UK economic competitiveness: Relate (economy); y-axis - public tolerances to risk: Define (values and attitudes). Dimensions: Whilst a health and safety focus, placed with a broad context, including with respect to people's behaviours.

12. Humanitarian Futures Programme

School of Social Science and Public Policy, King's College London, Humanitarian Futures Programme, 2007.
Humanitarian Futures: Planning from the Future
www.humanitarianfutures.org
Consultants/Researchers: Academic
Method chosen: 'axes of uncertainty' matrix

Aim
As part of the Humanitarian Futures Programme, a number of scenario development exercises were undertaken which explored the extent to which present policy planning mechanisms have the capacity to anticipate, mitigate and respond to the potential humanitarian crises of the future.

Focus
The scenarios are based on the Programme report 'Trends and drivers of change in humanitarian action 2025'. A number of challenges were assumed across all scenarios (including increase in world population growth, global warming will continue with regional variation, sea levels will rise, increased need for humanitarian support).

Methodology
The scenarios were developed in conjunction with a number of expert groups, composed of academic specialists, humanitarian and development-policy makers and practionners, corporate experts and military planners.

The scenario space comprised two drivers of change, the x-axis representing social values (ranging from individual to community), the y-axis, systems of governance ranging from coherent (where power increasingly moves to multinational institutions) to fragmented (where power remains at a national/regional level).

Three possible worlds were identified which reflect and integrate key economic, demographic, environmental, security, scientific and political trends through and beyond 2025. Each scenario mirrors a particular global perspective, and each in turn

forms the basis for analysing broad human vulnerability trends, including those that could result in natural and technological disasters as well as in conflict-induced crises and societal collapse.

Brief description of future worlds
Three future worlds:

- **World markets** - a world that continues present trends and in which the rich get richer and poorer get poorer.
- **Global sustainability** - a world of global cooperation and global citizenship.
- **Regional stewardship** - a world characterised by fear and suspicion.

Implications and application
One of the Humanitarian Futures Programme's main outcomes is to enable organisations to be more strategic in their planning and more sensitive to the environments in which that planning takes place. The scenarios will be used to provide a framework for the development of scenarios for US foreign aid beyond 2025.

Relevance to ScENE
Their global context is a common feature.
Perceptions on how might relate to EFF: x-axis - social values, individuals to community: Define (values and attitudes); y-axis - coherent to fragmented systems of governance: Relate (government).
Dimensions: Humanitarian, social focus, though based on broad economic, demographic, environmental, security, scientific and political context.

13. The Chartered Institute of Public Finance and Accountability (CIPFA) published 2007

'The future of services to the public - reviewing the pressures and challenges for long term change'
www.cipfa.org.uk/shop
Consultants/Researchers: SAMI Consulting revising original SPRU DTI Foresight scenarios.
Method chosen: 'axes of uncertainty' matrix

Aim
Whilst the future of services to the public has been widely discussed, this study brings to the debate a longer term perspective - towards 2030 and consideration of the possible world orders at that time. A dominant factor is the changing balance of economic power over the next decades (eg EU countries having a decreasing share of the world economy).

Focus
Although the UK's standard of living will increase, the UK will increasingly be unable to define the rules of engagement, the implications for services to the public being severe - for example by 2030, services to the public will certainly not be all delivered by public sector workers or paid for out of the public purse. What the potential configurations are is posed eg what future role for government in the specification, monitoring and delivery of services to the public in the future?

The study was underpinned by the following questions:

- What is different by 2030?
- Can the Welfare State survive another 20 years?

- What are the services that only the State can provide?

Methodology
The scenarios utilise the Office of Science and Technology Foresight 2020 scenarios - these are four scenarios which explore the nature of UK society and economy. The two axes of change are the nature of society, individually focused vs. community focused (x-axis) and, the nature of governance - interdependence vs. autonomy (y-axis).

They are underpinned by the following: international context, economy and sectoral trends, employment and social issues, regional development, education, welfare and health, environment and sustainability and, implications for services to the public.

The scenarios were developed by a team of researchers at SPRU - Science and Technology Policy research, University of Sussex, in consultation with stakeholders from business, government and academia for the DTI (Department of Trade and Industry).

Brief description of future worlds
To inform discussion, the four different worlds can be compared to different countries as role models:

- **National Enterprise - Switzerland**
  People aspire to personal independence and material wealth within a nationally-rooted cultural identity. Liberalised markets 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 a more fragmented world. Economic growth is medium-low.
- **Local Stewardship - Denmark**
  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. Public policy promotes economic activities that are small scale and regional, and constrains large-scale markets and technologies. Local communities are strengthened to ensure participative and transparent governance in a complex world. Economic growth is low.
- **World Markets - USA**
  People aspire to personal independence, material wealth and mobility to the exclusion of wider social goals. Integrated global markets are presumed to be the best way to deliver this. Internationally co-ordinated policy sets framework for the efficient functioning of markets. The provision of goods and services is privatised wherever possible under a principle of ‘minimal government’. Rights of individuals to personal freedom are enshrined in law. High economic growth.
- **Global Sustainability - Netherlands**
  People aspire to high levels of welfare within communities with shared values, more equally distributed opportunities and a sound environment. There is a belief that these objectives are best achieved through active public policy and international co-operation within the European Union and at a global scale. Social objectives are met through public provision, increasingly at an international level. Markets are regulated to encourage competition amongst national players. Economic growth is medium to high.

Implications and application
Conclusions are set against the key questions in the context of 2030, and global trends to 2050.

Relevance to ScENE
The scenarios provide insight into the future of public services. Their global context and similar timeframe are also common features.
Perceptions on how might relate to EFF: x-axis - nature of society (individual/community): Define (values); y-axis - nature of governance (interdependence vs. autonomy): Relate (government).
Dimensions: Whilst focused on the future of public services, the scenarios are placed within a strong global context of changing balance of economic power.

14. The United Nations Environment Programme, 2007

Fourth Assessment, 'Global Environmental Outlook: environment for development GEO-4.'
http://www.unep.org/geo/geo4/report/09_The_Future_Today.pdf
Consultants/Researchers: In-house (with inputs from members of the high-level consultative group and technical inputs from coordinating lead authors)
Method chosen: drivers-pressures-state-impacts-responses (DPSIR) GEO-4 conceptual framework

Aim
Since 1997, UNEP has used its global environment outlook (GEO) scenarios to frame its long term analyses, specifically assessments of the interactions between environment and society, with its core mandate of 'keeping the global environment under review'.

Focus
Designed to ensure synergy between science and policy, while maintaining its scientific credibility and making it responsive to policy needs and objectives, the fourth assessment is a comprehensive report, providing analysis and information for decision-making. Providing an overview of the global and regional environmental, social and economic state and trends over the past two decades, it highlights the interlinkages, challenges and opportunities which the environment provides for development and human wellbeing and, explores plausible futures to the year 2050.

The scenarios focus on the implications of various actions, approaches and societal choices at regional and global levels for the future of the environment and human wellbeing. Each scenario outlines a pathway into the future up to the year 2050, shaped by divergent assumptions about these actions, approaches and choices. Each looks at who is making the key decisions (the dominant actors), how these decisions are made (the dominant approaches to governance) and why these decisions are made (the dominant priorities).

Methodology
In utilising the World Commission on Environment and Development's 'Our Common Future' (the latest in the series of UNEP reports on the state of the global environment), as a reference to assess progress in addressing key environmental and development issues, the continuing evolution of drivers as the future unfolds is provided (a feature not often done - current drivers being generally assumed to remain static). As such, UNEP sought to capture different flavours and varying emphases in the critical uncertainties to define the scenarios. This means that while the scenarios are not so extreme, they are more nuanced. Key drivers include demographics; consumption and production patterns; scientific and technological

innovation; economic demand; markets and trade; distribution patterns; institutional and social-political frameworks and value systems.

The GEO-4 assessment uses a drivers-pressures-state-impacts-responses (DPSIR) framework to analyse the interaction between environmental change over the past two decades as well as in presenting the four scenarios. The concepts of human well-being and ecosystem services are core in the analysis, with assessment covering the entire environment and the interaction with society. The framework attempts to reflect the key components of the complex and multidimensional, spatial and temporal cause-and-effect that characterizes the interactions between society and the environment. The GEO-4 framework is generic and flexible, and recognises that a specific thematic and geographic focus may require a specific and customised framework.

The framework contributes to society's enhanced understanding of the links between the environment and development, human well-being and vulnerability to environmental change. It places, together with the environment, the social issues and economic sectors in the 'impacts' category rather than just exclusively in the 'drivers' or 'pressures' categories.

A broad based global and regional consultation process was undertaken, first to seek the inputs of policy-makers on the scope and objectives of the assessment and second, for scientific and policy experts to research and draft the content of the report. More than 100 governments and 50 partners were engaged.

Brief description of future worlds
Four future worlds were depicted:

- **Markets first** - where government supports the private sector in pursing maximum economic growth as the best way towards the goal of improving the environment and human well-being for all.
- **Policy first** - in which government implements strong polices directed at the goal, while still emphasising economic development.
- **Security first** - this entails government and the private sector competing for control, mainly to improve or maintain human well-being for the rich and powerful ('me first').
- **Sustainability first** - which involves collaboration by government, civil society and the private sector to improve the environment and human wellbeing for all, with a strong emphasis on equity.

Implications and application
A summary for decision makers, synthesises the key scientific findings, gaps and challenges in the form of key relevant policy messages. It highlights the role and contribution of the environment and the services provided by ecosystems needed for development. In this way, it analyses the ecosystem services and human wellbeing interface and explores the complex and dynamic interactions taking place in time and in different spatial dimensions.

Relevance to ScENE
The scenarios provide a perspective on security issues, an area not addressed in ScENE. Their global context and similar timeframe are however common features. Innovative approaches are used, for example the scenarios look at the continuing evolution of drivers as the future unfolds; and, have sought to capture different flavours and varying emphases in the critical uncertainties to define the scenarios.

Perceptions on how might relate to EFF: scenario 1, *Markets first* - government supports the economic sector to maximise growth: Relate (economy and government); *Policy first* - government implements strong policies directed at the goal: Relate (government); *Security first* - government and private sector competing to secure wealth for the wealthy: Relate (economy and government); S*ustainability first* - collaboration between government, private sector and civil society to improve the environment and human well-being for all*:* Define (economic systems and values).
Dimensions: Core environmental focus, with specific assessment of the interaction between environment and society.

15. European Environment Agency (EEA), 2007

'Land use scenarios for Europe: qualitative and quantitative analysis on a European scale', 2050.
The content of report is derived from the PRELUDE project (Prospective environmental analysis of land-use development in Europe) of the EEA, 2007
http://www.eea.europa.eu/multimedia/interactive/prelude-scenarios/
Consultants/Researchers: Academic team
Method chosen: story and simulation

Aim

- To inspire and inform a discussion about the potential impacts of changes currently taking place in society on Europe's future land use and landscapes.
- To support decision-making in policies with relevance to land use and landscape change, particularly in agriculture, rural development and transport.

Focus

Exploring impacts of change affecting Europe's land use and landscapes, the scenarios explore how long-term socio-environmental objectives might be met. An indispensable part of the European culture, landscapes define regional identities, function as tourist attractions and are connected with many invaluable ecological services. Land also is limited as a resource and under pressure. It must provide diverse, competing services like food, timber, fuel, housing, road and rail capacity, biodiversity, and recreational landscapes. Land use change can have major environmental impacts and is the subject of a range of policy interventions and budget implications.

Methodology

A modified version of the so-called 'story-and-simulation' (SAS) approach was taken, conceptualised and designed in earlier scenario works of the European Environment Agency. Approach combines the strengths of participatory qualitative scenario development with quantitative model analysis (EEA, 2001).

The main parts of the approach are :

- A group of stakeholders forms a stakeholder panel. They develop qualitative storylines, based on in-depth discussions about key uncertainties.
- Underlying driving forces of social, technological, economic, environmental and political development.
- Experts form data and modelling groups. They translate the qualitative information into quantitative model input and underpin qualitative analysis by quantitative modelling as feedback into the process.

- Stakeholders and experts engage in an iterative process of refining storylines and quantification until a set of compelling, plausible and relevant stories and simulations about the future is reached.
- The whole process is facilitated by external partners with no interest at stake.

The approach was modified with regard to the degree of responsibility that stakeholders had for the overall scenarios who had full decision-making power concerning the scenario logistics and narratives (rather than fulfilling a more traditional consultation role). Every approach has its drawbacks and this one is no exception: it can be a time-consuming and costly approach; it demands a high level of engagement and availability from stakeholders and modellers; and it requires the use of transparent methodologies in the 'translation' of quantitative statements into quantitative modelling inputs.

This approach can lead to interesting results when analysing long-term developments: scenarios can be developed without the restrictions of existing *state of the art* models and data limitations in mind, include issues that science may not yet be able to model in quantitative terms, while, simultaneously benefiting from the rigour and consistency check that models can provide.

Exploring plausible futures to 2050, the scenarios were underpinned with spatially explicit data from land-use simulation models which provided quantitative assessment of changes in land-use/cover on a European level. Developed with the specific aim of constructing spatially-explicit land use scenarios for Europe, the Lovain-La-Neuve land use/cover change model was utilised. Six land use/cover classes were simulated (urban, cropland, grassland, bio fuels crops, forests, abandoned land), with three sub-models utilised to estimate different land use changes (urban, agriculture, forest).

The assessment of changes in the bio-physical environment were combined with simultaneous changes in the socio-economic environment. Five core aggregated drivers, environmental awareness; solidarity and equity; governance and intervention; agricultural optimisation; and, technology and innovation, were used to underpin the development of scenario storylines.

A participative approach was adopted - twenty two stakeholders from across Europe with a broad diversity of backgrounds (policy makers, academic researchers, representatives of interest groups, independent thinkers) were brought together in a stakeholder panel. A review and moderation process, drawing on EEA staff and further modellers and experts, was also included.

Brief description of future worlds
Five possible worlds:

- **Scenario 1: *Great Escape* - Europe of Contrast**
  Economic globalisation increases global competition pressure, market concerns dominate political agenda. High technological innovation. Living conditions worsen for many, societal tension as relatively poor immigrants move to city centres. Rich gated communities in the countryside vs. urban ghettos.
  Agricultural markets are liberalised. Climate change affects the growing conditions for agriculture. Mainly large-scale farms with intensive management are able to survive. Production intensifies but total agriculture diminishes. Many grasslands are abandoned or converted into arable. Agricultural intensification and urban sprawl affect the rural environment negatively. Many nature reserves and extensive farmland areas with high nature value are lost. However, in some areas of

agriculture abandonment, soil and water quality improve and more diverse natural habitats may develop.

- **Scenario 2: *Evolved Society* - Europe of Harmony**
  Heavy floods and high energy prices reinforce environmental awareness. A revival of the countryside takes places as many people move away from densely populated and most vulnerable (lowland) areas and settle in more rural and safe areas, especially in Eastern Europe. Local community action is getting new impetus by concerns for social equity. Policies focus on rural development and eco-efficient technologies.
  Farming is high-tech and increasingly organic. The agricultural area remains approximately the same while farming intensity decreases. In areas that are prone to repeated flooding, cropland is reduced considerably. Overall land use changes are not dramatic, and extensive farmland with high nature value is relatively well conserved.
- **Scenario 3: *Clustered Networks* - Europe of Structure**
  Globalisation propels economic growth, but environmental conditions and health, especially in the urban centres, gets worse. People in the countryside also struggle as many local shops and services close down. The needs of an ageing society lead to the development of coherent spatial planning policies. Migration away from polluted urban areas is encouraged. New so called thematic cities with a service economy are founded in peripheral regions where they serve as focal points for regional economic and social development.
  Urbanisation is concentrated and rural development focuses on ‘green belts’ around urban centres. Agriculture marginalises. As a result of large-scale land abandonment, cropland and grassland strongly decrease. Climate change is a less prominent driver in this scenario. Biodiversity, water, soil and air quality benefits from receding agriculture and creation of green belts. Natural habitats develop in the wider countryside, but at the detriment of high nature value farmland.
- **Scenario 4: *Lettuce Surprise* - Europe of Innovation**
  A major food security crisis hits Europe. As crisis management fails, faith in governments and in the health and environmental safety of Europe’s food supply decreases strongly. An alternative food production and control regime and regional self-sufficiency with regard to food and energy are strived for. Political decentralisation becomes the new paradigm. New communication technologies facilitate local participatory decision-making and open-source development of technologies. Migration is limited and urbanisation patterns do not really change. Environmental awareness grows, leading to widely demands for environmental friendly produced food. Technological innovations offer new opportunities: New crop varieties enable higher yields with lower inputs. Agriculture in the core production areas is high-tech, clean and relatively small-scale. Cropland decreases strongly, grassland decreases at a slower rate. The reduction of agricultural area and input leads to an increase of biodiversity and improvements in soil, water and air quality. Land abandonment affects high nature value farmland moderately.
- **Scenario 5: *Big Crisis* - Europe of Cohesion**
  A series of environmental disasters highlights Europe’s vulnerability and lacking capacities to effectively adapt. There is a strong support for centralised government and new concerns for solidarity and equity arise. New policies for sustainable and regionally balanced development are consolidated at the European level. Public transport is strongly promoted as environmental awareness grows.
  Agricultural intensification is largely reversed after 2015: Agricultural oversupply is being diminished; the main focus of agriculture is on landscape stewardship. Land use changes are limited. The population in current urban core areas decreases slightly. Cropland and grassland decrease moderately. The initial environmental pressures are relieved. Soil, water and air quality benefit from agricultural

extensification and limited land abandonment. The loss of high nature value farm-land remains relatively small.

Different land use patterns are associated with each of the scenarios.

Implications and application
A number of implications of the scenarios were identified for policy and strategy analysis; included are results which lead us to expect a further decrease of agricultural area in Europe, and a change in rural landscapes. Acting as a prompt for questions such as 'what is needed to reach long-term (environmental) objectives if we see a Europe of Contrast evolving? or a Europe of Innovation'?, the scenarios should help rethink current approaches towards biodiversity and landscape protection.

Relevance to ScENE
Focus on land use/cover (at a European scale), with an emphasis on the safeguard of biodiversity and landscape. Whilst principles are transferable, application in UK constrained by the absence of an equivalent Lovain-La-Neuve land use/cover change model. A similar long-term timeframe is utilised. In the scenario 'Big Crisis' the impacts of a severe environmental event, are explored, an issue not addressed in ScENE.
Perceptions on how might relate to EFF: *Great Escape*: changing relations between government and market change international relations, comparative advantage, etc. Relate (government and economy); *Evolved Society* is value driven, people's beliefs are changing: Define (values and beliefs); *Clustered Networks* focuses on changes in the economic infrastructure as small shops shut down, new cities are built, Create (economic infrastructure); *Lettuce Surprise* centres around innovative technologies as enablers creating opportunities to restructure politics and economics, Create (innovations); *Big Crisis* sees a restructuring and strengthening of centralised government, Relate (government).
Dimensions: Strong land use and environmental focus, including biodiversity and landscape protection.

2006
16. Environment Agency
a) Environment Agency Scenarios 2030, August 2006
Science Report: SC050002/SR1
Consultants/Researchers: Henley Centre Headlight Vision with Centre for Environmental Strategy, University of Surrey
Method chosen: 'axes of uncertainty' matrix

Aim
To look at a range of plausible futures for the pressures on the UK environment to 2030. They are intended for use by policy makers in the Environment Agency, Defra and key stakeholders. The main objective of the work was to provide a future-focused 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.

Focus
Strategic questions set for the project were:

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

Methodology
Nineteen key drivers were prioritised; these included the changing nature of environmental legislation, increasing consumer environmental awareness, role of self-interest in responding to environmental change, developing and implementing environmental technologies, changing patterns of land use and food production, climate change and social response and, increasing understanding of systems that underpin ecological change.

Drivers were placed on a two by two axes, the x-axis focused on UK societal attitudes and behaviour around consumption (ranging from de-materialised to material), the y-axis referring to UK governance systems (ranging from sustainability led to growth led).

A highly participative process was employed, designed around a series of workshops enabling a wide range of stakeholders and experts alongside Environment Agency and Defra staff to collaborate.

Brief description of future worlds
Four different worlds:

- **Restoration** - sustainability led governance, de-materialised UK consumption
- **Alchemy** - sustainability led governance, material consumption
- **Survivor** - growth led governance, de-materialised consumption
- **Jeopardy** - growth led governance, material consumption

Implications and application
Recommendations and reflections on interpreting the scenarios were provided.

Three projects have made use of the scenarios to help inform their work:

- Early work on a revised Environment Agency Water Resources Strategy has been informed by a workshop held in 2005 to discuss the high-level implications of the scenarios for the future of water resources in England and Wales.
- A similar workshop used the scenarios to inform Defra's review of England's Waste Strategy. Views contained in the consultation document published 14 February 2006, 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.

Relevance to ScENE
The scenarios are strongly focused on the environment, with an emphasis around the remit of the Environment Agency. They contain insight on changes in consumer behaviour (materialised and de-materialised).
Perceptions on how might relate to EFF: x-axis - UK societal attitudes and behaviour around consumption (ranging from de-materialised to material): Consume (consumer goods and natural resources); y-axis - UK governance systems (ranging from sustainability led to growth led): Relate (government).
Dimensions: Whilst an environment focus, placed within a broader social, economic, technological (and other factors of change) context.

b) Exploring the future: guidance toolkit for using Environment Agency scenarios 2030, August 2006

Science report: SC050002/SR2

To ensure ongoing use of the scenarios after the project, the toolkit was developed to help policy makers and stakeholders use the scenarios to inform the future development of strategy and policy.

c) Using science to create a better place. Scenario-based forecasts of land use and management change, December 2006

Science report: SCO30107/SR

Aim

Land use is a key determinant of environmental quality, and so anticipating land uses is central to planning for future environmental risks. This report explores the implications for land use of four scenarios for 2030.

The aims of this study were to:

- test the usefulness of the scenarios in developing implications for environmental impacts;
- explore the major changes in land use and management that could result from these scenarios;
- allow experts and groups involved in land management to test assumptions about the direction and magnitude of the changes implied; and
- highlight priority issues and risks for regulation and policy on land use management.

The study was based on the Environment Agency's scenarios to 2030 - the implications of the scenarios for land use being subject of a workshop held in February 2006.

Focus

Four categories of land use formed the basis for the scenarios: land released for development, agriculture, forestry, and biodiversity/ecosystem services. Future land uses will depend on relative financial returns, government policies, and on public preferences and legal and social institutions. Development, agriculture and forestry are all heavily influenced by government. There are strong demands for land for development, but also equal and opposite forces limiting development. The likely pattern of future farming will depend particularly on reforms of the Common Agricultural Policy. Beyond this, the position is uncertain, with either continuing decline or a renewed demand in the face of food and/or energy shortages. Timber outputs to 2030 are relatively predictable, but the extent of forestry areas planted and managed remains uncertain. Here too, government policy is fundamental. Biodiversity and ecosystem services (such as flood alleviation or carbon sequestration) are in turn affected by land use, often in ways that are not fully understood.

Methodology

In developing the four scenarios, a wide range of drivers of change were considered against two intersecting axes of 'governance' (long-term to short-term) and 'consumption' (material and de-materialised) (Environment Agency, 2006). These were further developed at a workshop held in December 2005. The implications for land use were the subject of workshop held in February 2006 involving staff from the Environment Agency, Defra and other Departments, Agencies and NGOs. Information was circulated prior to the workshop on both the scenarios and a

preliminary analysis of their implications for four categories of land use: land for development; agriculture; forestry; and biodiversity/ecosystem services. Wider conclusions for land use, planning and policy were also captured from the workshop.

Brief description of future worlds
Four possible worlds:

- **Restoration** (long-term governance, de-materialised consumption) - a relatively favourable scenario with a far-sighted government and public support promoting environmental protection. Development shifts to the north of the UK and is of a higher environmental standard. Land remains in agricultural and forestry production, with some growth of energy crops, but production practices are subject to tighter regulation. Government intervenes in support of biodiversity and ecosystem services. However, there are signs of the economy slowing down, under pressures of higher production costs and the increasing dominance of the public sector.
- **The Krypton factor** (long-term governance; material consumption) - a long period of economic growth based on investment in new technologies is reflected in a technological approach to environmental problems. Although this seems to be effective, there is a sense that fundamental problems are neglected as pressures on the environment continue to grow. There are possible contradictions within the scenario, such as how agriculture can be profitable in an era of free trade or why stronger preferences for the environment have not developed in a period of economic prosperity.
- **Survivor** (short-term governance; de-materialised consumption) - an economic crisis in the mid- 2010s has left a weakened economy in a state of slow recovery. The reduced demand for materials has environmental benefits, but the best agricultural land is under pressure, although the position in the uplands is uncertain. There is a much stronger local orientation in production and governance, and changes in production reflect this. Some localities are well managed, but others tend towards decay and social tension.
- **Strike it rich** (short-term governance; material consumption) - the UK has had an extended period of economic growth. Low levels of environmental damage have brought little change in behaviour. However, substantial polarisation means that wealthier individuals seek private ways of improving their personal environments. Planning is weak and agriculture and forestry are run by large businesses where profitable, though some areas are abandoned. There are mixed implications for the environment.

Implications and application
This report reviews the scenarios, discussing environmental and resource qualities, capacities and limits, public preferences and responses to the scenarios, and political processes and decision-making. The scenarios offer a useful context within which to explore the implications of future land uses. Some attempt at quantification might help to strengthen assessments and identify inconsistencies.

Relevance to ScENE
The scenarios are strongly focused on land use and land management change as key determinants of environmental quality. Sections are provided on the implications of the scenarios for each individual land use (land for development, agriculture, forestry, biodiversity and ecosystem services); key biodiversity and ecosystem services impacts; and, possible scenario impact indicators.
Perceptions on how might relate to EFF: x-axis - UK societal attitudes and behaviour around consumption (ranging from de-materialised to material): Consume (consumer

goods and natural resources); y-axis - UK governance systems (ranging from sustainability led to growth led): Relate (government).
Dimensions: Whilst a land use/management focus, placed within a broader social, economic, technological (and other factors of change) context.

17. Foresight Intelligent Infrastructure Project

'Intelligent Infrastructure Futures: The Scenarios - Towards 2055'
Office of Science and Technology, published 2006.
DTI/Pub81522k/01/06/NP.URN 06/521
Report commissioned by the Foresight Programme of the Office of Science and Technology.
www.foresight.gov.uk
Consultants/Researchers: Henley Centre Headlight Vision with Tony Hodgson and Waverley Management Consultants
Method chosen: 'axes of uncertainty' matrix (augmented with three horizons analysis)

Aim
To explore how science and technology may be applied over the next fifty years to the design and implementation of intelligent infrastructure systems (the physical networks that deliver such services as transport, telecommunications, water and energy) that are robust, sustainable and safe.

Focus
Taking a UK perspective, the project explored how, over the next 50 years, science and technology can be applied to the design and implementation of intelligent infrastructure for robust, sustainable and safe transport, and its alternatives. How robustness, sustainability and safety might vary in different scenarios is explored. Each scenario examines the movement of people and goods in rural areas, in urban areas and between areas.

Methodology
- Experts from the research community, business and the public sector took part in workshops that identified the key drivers and trends, and explored possible futures based on future uncertainties. The key uncertainties used were whether or not low environmental impact transport systems would be developed, and whether or not people will accept intelligent infrastructure.
- Scenarios are based on two axes of uncertainty, degree of acceptance of intelligent infrastructure (accepting of, resistant to), and the availability of transport that has a low environmental impact (high impact transport, low impact transport). Environmental issues were high on the agenda, with consideration given to climate change, global warming. Sixty key drivers were identified that could influence the future direction of intelligent infrastructure.
- A three-horizons approach was taken enabling the 50 year horizon of the project to be broken down into three distinct phases (to 2025; to 2040; and to 2055).

Brief description of future worlds
Four possible worlds:

- **Perpetual motion**
  A very busy city with lots of private car traffic, all running on clean forms of energy. Everyone is plugged into the grid and is 'always on', always in touch and ready, willing and able to travel using clean forms of energy. High density cities, low-density suburbs.

- **Urban colonies**
  High-density (but not necessarily high rise), green city with a lots of locally produced good and efficient public transport systems. Buildings are sustainable and the public realm is active and vibrant. High-density, mixed use, compact cities.
- **Tribal trading**
  A world that has undergone a huge energy crisis and has achieved tranquil equilibrium through simple lifestyles that no longer rely on being supplied power through a national grid. Former city dwellers need to live in communities where they are in close proximity with others. These dense social conditions allow the community to share resources more efficiently and help to preserve the maximum amount of green areas for agricultural use. Empty cities and clustered, compact rural housing.
- **Good intentions**
  Big city where people lifestyles are determined by a strict and enforced scheme of carbon consumption control. Biofuel is the primary alternative form of energy, but the need to reduce energy consumption is now a matter of survival in a rapidly degrading environment. Cars are lighter, smaller and more efficient, and more and more people are cycling, even for long distances.

Implications and application
The technological opportunities and social factors are such that intelligent infrastructure systems can develop in many different ways, the direction depending on the direction society takes. Helping to illustrate the possibilities, the scenarios should help guide thinking and analysis.

Relevance to ScENE
A general set of scenarios with good illustrations of possible population patterns and land use in 2055, with the environment high on the agenda. They provide a more detailed insight around cities. A similar timeframe is utilised.
Perceptions on how might relate to EFF: x-axis - degree of acceptance of intelligent infrastructure (accepting of, resistant to): Relate (technology) and; y-axis - the availability of transport that has a low environmental impact (high/low): Consume (natural resources).
Dimensions: Whilst a focus on how science and technology, might be applied to infrastructure over the next 50 years, placed within wide context of economics, society, environment, safety and robustness.

18. Marine Ecosystems, 2006

'Alternative future scenarios for marine ecosystems' (AFMEC), a partnership study comprising DEFRA, CEFAS, CRU, CSERGE and SPRU
AFMEC is a strategic project funded under Defra's Horizon Scanning initiative.
www.cefas.co.uk
Consultants/Researchers: Academic: Pinnegar, J.K., Viner, D., Hadley, D., Dye, S., Harris. M., Berkout, F. and Simpson, M. representing DEFRA, CEFAS, CRU, CSERGE and SPRU. Scenarios based on *Foresight 2020* (originals authored by team at SPRU, University of Sussex).
Method chosen: 'axes of uncertainty' matrix

Aim
To describe how marine ecosystems might look and activities develop over the next 20-30 years given assumptions about climate change and socio-political development.

Focus
The works draws on earlier scenario exercises, aiming to complement work carried out by the UK Climate Impacts Programme (UKCIP), the Office of Science and Technology (OST) and the UK Environment Agency.

Whilst marine ecosystems around the UK provide the main focus for the project, the study is framed within a wider EU and global perspective. Scenarios were developed against a 20-30 year timeframe.

Methodology
Scenarios were based on two axes of uncertainty - the two drivers of change being on the x-axis societal values (ranging from consumerism to community) and a 'governance' y-axis (ranging from autonomy to interdependence).

Each of the four futures is elaborated with respect to: climate change and hydrography; fisheries and aquaculture; tourism, ports and shipping; nutrients and contaminants; aggregate extraction; oil and gas extraction; offshore renewable energy; flood and coastal defence; biodiversity and conservation.

The scenarios were derived at two stakeholder workshops, with participants drawn from a wide range of marine-related disciplines.

Brief description of future worlds
Four futures were explored:
- **World markets** - assumes the prevalence of materialist and libertarian social values operating within interdependent and globalised governance systems.
- **Fortress Britain** - assumes individualistic and conservative social values, and a reinforcement of a national governance system and identity.
- **Local stewardship** - assumes tolerant, community-orientated social values encouraging co-operative self reliance and regional development.
- **Global commons** - attempts to reconcile growth and global sustainability, including the maintenance of biodiversity, the protection of global commons (atmosphere, oceans and wilderness areas) and fair access to environmental resources.

Implications and application
A series of key messages were provided on the scenarios, including:

- the expectation that sea temperatures will increase under all four scenarios;
- that climate change is anticipated to trigger more extreme weather events; and
- that differences in predicted climate and sea level, whilst relatively small up to 2020, will then become more apparent.

An exploration is provided of how the scenarios might be used in the future, including specific recommendations and suggested steps for their further quantification and elaboration.

Relevance to ScENE
The scenarios provide a more detailed insight around marine. Climate change is integrated within the scenarios via the UKCIP socio-economic scenarios. A global context is similarly provided.
Perceptions on how might relate to EFF: x-axis - societal values (ranging from consumerism to community): Define (social values); y-axis - governance (ranging from autonomy to interdependence): Relate (government).
Dimensions: Whilst a marine focus, they are placed within a broad context (including with respect to climate change and socio-political development).

2005
19. Urban Land Institute, 2005

The Global City 2030
www.uli.org/
Consultants/Researchers: Academic: DIT Futures Academy - John Ratcliffe and staff.
Method chosen: 'axes of uncertainty' matrix

Aim
Cities have undergone many dramatic changes since the 20th century and now, at the start of the third millennium, they are facing many new challenges. The city picture has changed from one of a static island to one of superfluid multilayered entity with undefined boundaries, likened to a 'moving picture'. This study is designed to stimulate thinking and encourage informed discussions concerning the future direction of cities globally.

Focus
This briefing document:

- sets out a contextual background of the challenges, driving forces, issues and trends shaping the evolution of the global city in the next 25 years;
- provides a framework for discussion about how issues such as liveability, economic and demographic changes, the environment, urban design and civic leadership will influence cities;
- elucidates how cities might position themselves in order to move towards a 'preferred' urban future; and
- incorporates the findings of the Global City 2030 questionnaire disseminated to conference delegates, as well as the outcomes of the 'futures workshop' held in London in May 2005.

Methodology
Key driving forces of change were identified and main issues and trends and level of impact and degree of uncertainty determined. A standard two by two matrix provided the framework for creating four scenarios, although the critical uncertainties chosen as the primary two axes were not formally identified.

Driving forces were characterised against a six-sector approach, including: economy, environment, society, technology, demography and governance.

Brief description of future worlds
Four possible worlds:

- **Scenario 1: Profit with Principle** (US: Bullfrog, EU: Golden Goose, Asia: White Elephant; MENA: Smart Asp).
  2030 - the best of times, the worst of times. Transition to a new precedent of flexible and alliance driven capitalism, representing a fundamental shift in the fabric of urban dynamics. The resultant dissolution of global 'hubs' of international immigrants has led to a significant reduction in fear, racial tension and polarisation, especially in megacities. Rapid global market integration, driven by unprecedented advances in globalised business communications, biotechnology and telematics, the spread of democracy and rising literacy rates. The subsequent mass movement of people, technology, knowledge, goods, trades, services and wealth has revolutionised the spatial organisation of urban life and has precipitated new patterns of infrastructure and connectivity.

- **Scenario 2: Gone with the Wind** (US: Collateral Damage, EU: Alice in Wonderland, Asia: Planet Bollywood; MENA: Out of Africa).
  2030 - increasingly the concept of 'the global city' is dissolving as cities have evolved in many different ways. In many global cities, not only has the scope of elements such as work, family and urban structure changed dramatically, but there have also been unprecedented changes in terms of scale. Power-house cities continue to dominate global economic affairs, perpetuating unevenness in development between cities in the former 'West' and 'East'. Disparities between cities also evident on a regional scale with characteristics differing greatly between the four major global regions of Europe, US, Asia and the emerging Middle East North African (MENA) region - changes culminating from unstable international relations.
- **Scenario 3: With or Without You** US; Dirge, EU: Cacophony, Asia: Electronica, MENA: Tribal Blues).
  2030 - in many parts of the world, urbanisation is rapidly gaining momentum, driven by a new global economy. Economic growth is influenced by increasing global integration, and the struggle for countries and individual cities to become competitive in the global marketplace. Asian cities receiving capital and technology have become world cities with influential global connections - in accepting global integration, they have witnessed massive social, cultural and political change. Jakarta and Bangkok have become the new global economic powers. Mass migration of high-skilled human capital from the US and the EU has precipitated rapid population growth and urbanisation, exacerbating the growth of megacities. This growth has led to rural-to-urban conversion of large areas surrounding the cities, uncontrolled development of the urban regions, housing shortages, and growth in the number of squatter settlement. The dark side of global capitalism is evident - as states and civil society assert their status, they are subjugated to the economic powers of transnational corporations - many cities coming to embody battlegrounds of cultural conflict.
- **Scenario 4: Oh My Gosh! *Worst Case Scenario*** (Oh My Gosh!!).
  Social unrest is widespread; public mistrust and disillusionment with failing political and governing structures; policing efforts have mounted and military presence on the streets has increased; cities differ greatly in fundamental values, beliefs and ethics and therefore systems of governance; cultural identity a key priority of countries and cities with closed inward-looking attitudes and anti-immigrant sentiment, racism is on the rise, particularly in a failing Europe; age fascism; increasing old age poverty and marginalisation of the elderly; demographic imbalances; high personal taxation exacerbating the gap between rich and poor; pressures on physical infrastructure: housing stock in particular and affordability as major issues of concern; ghettoisation common in most cities - little progress being made in addressing; environmental issues left on back burner - priority issues instead are those relating to the 'TEC' sector; shelving of the green agenda; society has lost all belief in the sustainability agenda - short-termism prevails as people struggle; the ethos being 'survival of the smartest'; law and order has become an issue of personal responsibility; mass surveillance of society; society ceding to the 'powers'; individualism and the freedom of speech are long forgotten values; people more socially isolated; crime at an all-time high in city centres, and intelliterrorists playing an ever-increasing role in financial fraud; terrorist threats have moved into the food chain.

Implications and application

What is clear is that the 21st century will be the century of cities when the world as a whole, will for the first time, turn predominantly urban in the sense that this terms is understood today. In an effort to conceptualise and formulate long-term strategies for

smarter and more sustained urban growth, there is consequently a growing need for alternative and imaginative planning aproaches which tackle the inherent short-termism of traditional policy-making frameworks.

Relevance to ScENE
The scenarios provide insight into the future of cities and urban areas. A global context is similarly provided.
Perceptions on how might relate to EFF: Profit with Principle: Relate (economy); Gone with the wind: Relate (community); With or Without You: Relate (economy/labour); Oh My Gosh!: Relate (political and social).
Dimensions: Whilst a global city focus, placed upon broad context of economic, environmental, social, technological, demographic and governance issues and trends.

20. European Commission, Published March 2005

'European Real Estate Scenarios: Nirvana or Nemesis?'
www.kingsturge.com
Consultants/Researchers: Academic: King Sturge and the DIT Futures Academy
Method chosen: 'axes of uncertainty' matrix

Aim
What will the world of European property be like in the year 2020? - Perfect Bliss or divine retribution? - Nirvana or Nemesis? And how can we prepare for the ever changing strive towards environmental sustainability and promotion of economic growth whilst balancing the needs of global climate change, renewable energy sources and government directives?

Today, various strands are being woven across the tapestry that portrays the future picture of property towards 2020. To envisage a preferred future for the real estate industry, there needs to be an understanding of the various issues and trends - cultural, demographic, economic, environmental, governmental and technology – which are driving these forces of change. Ultimately, it is these driving forces that shape and propel the story lines described in the four scenarios. A number of issues and trends must be considered that affect the shape of the world in which property investment and development decisions can be made.

Focus
The strategic question was set as:

- 'What are the major forces of change affecting the European real estate industry and how should the property community prepare itself now to face a future of uncertainty and complexity'.

Methodology
- A number of focus groups were convened to identify the drivers of change affecting Europe over the coming years and to build a number of scenarios for the future of European real estate. Participants took part in several exercises, such as brainstorming for drivers of change, clustering issues and trends for alternative scenario creation. In addition a number of 'strategic conversations' were conducted with leading figures in and around the real estate industry.
- Each of the scenarios is based upon 15 themes such as the concept of sustainability, the movement towards corporate social responsibility, internationalisation of markets, growth of ethic investments, competitiveness of European cities and the challenge of access and affordability in housing markets.

- A standard two by two matrix provided the framework for the scenarios, the axes representing two key uncertainties: the x-axis representing sustainability (ranging from severe to moderate sustainability pressures), the y-axis representing political cohesion (weak to strong).

Brief description of future worlds
Four worlds were depicted:

- **Empyrean: fear & trepidation – the rise of the super-state**
  This scenario assumes a United States of Europe is complete, but controlled by technology. Big Brother is alive and well and dominant.
- **Principia Ethica – the moral imperative**
  This scenario assumes a period of global metamorphosis. Further integration is a success in geographical terms as well as economic and political. Europe enjoys un-paralleled economic growth through legal certainty and market transparency.
- **Titans of Avarice – market forces on the march**
  This scenario assumes steady economic growth, the further opening-up of markets and rapid technological advances. EU enlargement is primarily based on economic integration, at the expense of further political unification.
- **Belshazzar's Feast – federal fragmentation**
  This scenario assumes stagnant economic growth in many parts of Europe, brought on by worldwide instability. Further integration is abandoned, while protectionist policies dominate the political agenda.

Implications and application
Whilst envisioning a preferred future for the property industry in Europe requires deeper consideration, the exercise concluded by posing fifteen challenges facing the property professions over the next decade and beyond, clustered under five headings, philosophy, framework, location, form and function.

Relevance to ScENE
The scenarios provide an insight on real estate at an European level; they contain a geographical dimension.

Perceptions on how might relate to EFF: x axis - sustainability (ranging from severe to moderate sustainability pressures): Relate (environment); y axis - political cohesion (weak to strong): Relate (government).

Dimensions: Whilst a real estate focus, placed upon broad context of forces driving change - cultural, demographic, economic, environmental, governmental and technological.

21. Millennium Ecosystem Assessment Scenarios (set against a range of short, medium and long-term timelines), 2005

Millennium Ecosystem Assessment
Consultants/Researchers: In-house (produced by the Scenarios Working Group of the Millennium Assessment of the United Nations)
Method chosen: 'axes of uncertainty' matrix plus (+ varied spatial / temporal scales)

Aim
To explore the consequences of ecosystem change for human well-being - in order to share understanding of the diverse trajectories that the world's ecosystems may take in future decades.

Focus
The Millennium Ecosystem Assessment was called for by United Nations Secretary-General Kofi Annan in 2000 in his report to the UN General Assembly, *We the Peoples: The Role of the United Nations in the 21st Century.* Governments subsequently supported the establishment of the assessment through decisions taken by three international conventions, and the MA was initiated in 2001. The MA was conducted under the auspices of the United Nations, with the secretariat coordinated by the United Nations Environment Programme, and it was governed by a multi-stakeholder board that included representatives of international institutions, governments, business, NGOs, and indigenous peoples. The objective of the MA was to assess the consequences of ecosystem change for human wellbeing and to establish the scientific basis for actions needed to enhance the conservation and sustainable use of ecosystems and their contributions to human wellbeing.

The scenarios explore contexts under which sustainable development will be pursued; spanning globalisation and localisation, and approaches to sustainable development, with an emphasis on economic growth/promotion of public goods and proactive management of ecosystems and their services. The scenarios examined changes in ecosystems, in the supply of and demand for ecosystem services, and in the consequent changes in human wellbeing. Drivers included globalization, leadership, poverty and inequality, technology, local flexibility, and surprises.

Methodology
Analysis was undertaken at a range of spatial and temporal scales (2000-15, 2015-2030, 2030-50 and beyond 2050), with appraisal of the implications for biodiversity, ecosystem services and well-being explored in each scenario, together with the implications for different institutions (including national governments, communities and NGOs, the private sector, international structures - particularly the Convention on Biological diversity, the Ramsar Convention and the Desertification Convention). The two key drivers identified were: x-axis: focus on ecosystem management versus economic growth and public goods; y-axis: globalisation versus regional focus.

From 2001 to 2005, the study involved the work of more than 1,360 experts worldwide, involving political and other societal stakeholders.

The scenarios were selected to explore contrasting transitions of global society up to the year 2050.

Brief description of future worlds
Four possible worlds:

- **Technogarden** - globalisation with emphasis on green technology.
- **Global orchestration** - globalisation with emphasis on economic growth and public goods.
- **Adapting mosaic** - regional focus with emphasis on local adaptation and flexible governance.
- **Order from strength** - regional focus, with emphasis on national security and economic growth.

Implications and application
The study's findings provide a scientific appraisal of the conditions and trends in the world's ecosystems and the services they provide, as well as the scientific basis for action to conserve and use them sustainably.

Relevance to ScENE
The process brought together for the first time socio-economic scenarios with ecosystem science, bringing an explicit ecological focus, building on what had been done before. The focus on alternative approaches to sustaining ecosystem services distinguishes the scenarios from previous global scenario exercises. Findings provide a scientific appraisal of the condition and trends in the world's ecosystems and the services they provide, as well as the scientific basis. Similar long-term timeframe (2030-50, beyond 2050) utilised.
Perceptions on how might relate to EFF: x-axis - ecosystem management versus economic growth and public goods: Create (wealth); y-axis: globalisation versus regional focus: Relate (government).
Dimensions: In exploring contexts under which sustainable development will be pursued, the scenarios have a broad evidence base with a strong ecological focus.

22. Shell International Ltd, 2005

The Shell Global Scenarios to 2025 'The Future business environment: trends, trade-offs and choices'
ISBN 0-88132-383-7
www.shell.com/scenarios
Consultants/Researchers: In-house
Method chosen: trilemma triangle

Aim
Shell has developed a range of global scenarios over the last three decades to help think about the future of energy. This is one of the two most recent (the second precedes this as item 9).

Focus
Placing future business relevance first and, based on trends, trade-offs and choices, the scenarios emphasise the importance of security concerns, legal and capital market cultures and regulation.

Methodology
Utilising a trilemma triangle, one of the three 'two wins, one loss' approach, the scenarios explore the complex interplay between three forces - market incentives (efficiency), the force of community (social cohesion, justice - aspirations to conform and be listened to) and, forces of regulation and coercion by the state (security). These factors shape how different societies, and the global community, strive towards all three objectives of efficiency, social justice and security. The triangle embodies a methodology to monitor the implications of these forces year after year. Key drivers: investors, civil society, national stakeholders and national champions.

Climate change, specifically implementation of the Kyoto Protocol, is a constituent of all scenarios, as are different types of policy for biodiversity. The concept of ecosystem services could be expected in 'open doors', which, providing specific resources such as freshwater and protection of natural barriers, could be among the 'win-wins', that would put market forces more effectively at the service of human development and aspirations.

Brief description of future worlds
Three worlds were depicted:

- **Low trust globalisation:** a legalistic 'prove it to me world'.
- **Open doors:** a pragmatic' know me world'.
- **Flags:** a dogmatic, 'follow me world'.

Implications and application
Addressing a broad range of strategic and planning needs across a spectrum of relevant time horizons and contexts, the scenarios will help cast light on the context in which the Royal Dutch/Shell Group operates, including identification of critical risks and opportunities.

Relevance to ScENE
Energy (demand and supply), forms one of ScENE's underpinning global drivers of change to 2060. A global context is similarly provided. Innovative trilemma triangle approach taken.
Perceptions on how might relate to EFF: x-axis, market incentives (efficiency): Create (wealth); y-axis, the force of community (social cohesion, justice - aspirations to conform and be listened to): Define (social values and attitudes); z-axis, forces of regulation and coercion by the state (security): Relate (government).
Dimensions: whilst focused on energy supply and demand, the scenarios are placed upon a wider market incentives (efficiency), community, and, security context.

2004
23. Foresight Project, Office of Science and Technology, 2004
Flood and Coastal Defence Project
'UK flood risk 2030 to 2100: Responding to the challenge'
www.foresight.gov.uk
Consultants/Researchers: In-house - scenarios recycled from *Foresight 2020* (originals authored by team at SPRU, University of Sussex).
Method chosen: 'axes of uncertainty' matrix plus (+ systems modelling)

Aim
To produce a challenging and long-term (30-100 years) vision for the future of flood and coastal defence in the whole of the UK that takes account of the many uncertainties, is robust, and can be used as a basis to inform policy and its delivery.

Focus
The report looks at the risks of flooding and coastal erosion - today and in the future under the assumption that current levels of expenditure and approaches to flood management remain unchanged. The risks analysed were made in relation to current spending, economic risks (annual losses), urban environment, coastal erosion, people, the environment and how quickly the risks might grow. Key drivers identified were climate and hydrography; fisheries and aquaculture; tourism and leisure; ports and shipping; inputs and runoff; aggregate extraction; oil and gas; offshore energy and construction; coastal geomorphology and defence.

The scenarios utilise the Foresight 2020 scenarios, based on two axes of uncertainty - social values and systems of governance. The scenarios however embody different approaches to governance and different values held by society (consumerism, community). Each socio-economic futures was also associated with a different climate change scenario for example, a high growth socio-economic scenario is matched with high greenhouse gas emissions (World Markets).

Methodology
- The project had two elements: i. to create a range of risk-based scenarios and ii. to review possible responses to the threats and implications.
- A combination of literature search, interviews and workshops were used to gather information - looking at already identified threats as well as possible "wild-card" events. Risk-based scenarios were developed and tested closely with experts (in statistics, socio-economics, environmental science and engineering).

- In parallel, a similar approach to gather information on scientific developments and international best practice in flood and coastal defence, and to explore approaches that we might adopt in the UK in the future was taken. Wide debate was facilitated on the interaction between environmental habitats, socio-economic development and flood risk management; the threat to national infrastructure from flooding considered; and responses with beneficial spin-off identified - for example, in future rural land use management and its implications for the rural economy. Also explored were areas from which other practice and technology could be transferred to flood defence and areas of developing science that might produce fruit in 30 to 100 years time.
- Finally, a broad consultation to critically test and explore a range of responses to the scenarios was undertaken.

Brief description of future worlds
Four possible worlds:

- **National Enterprise:** medium/high emissions.
- **Local stewardship:** medium/low emissions.
- **World markets:** high emissions.
- **Global sustainability:** low emissions.

Implications and application
Having produced scenarios for the future extent, risk and impact of flooding, there is now a need to identify and investigate how the UK might respond to those challenges; a key issue will be whether incremental changes to existing responses will be sufficient, or whether a step change in approach will be required in certain cases.

Relevance to ScENE
The scenarios provide a UK-wide insight into future flooding and coastal erosion. Climate change is integrated within the scenarios via the UKCIP socio-economic scenarios. A long-term timeframe (extending beyond the current ScENE work, to 2100) is utilised.
Perceptions on how might relate to EFF: x-axis - nature of society (individual/community): Define (values); y-axis - nature of governance (interdependence vs. autonomy): Relate (government).
Dimensions: Whilst a flood and coastal erosion focus, placed within a wide socio-economic, including people context.

24. Rural Economy and Land Use Programme (RELU), 2004

The Economic and Social Research Council (ESRC), the Natural Environment Research Council (NERC) and the Biotechnology and Biological Sciences Research Council (BBSRC), who jointly manage the Rural Economy and Land Use Programme, commissioned the project:
Rural Futures: Scoping Social Science Research Needs, Final report June 2004: Rural Futures Scenarios, 2020
The work was prepared formally for the Economic and Social Research Council (ESRC)
www.relu.ac.uk
Consultants/Researchers: Institute for Alternative Futures and The Institute for Innovation Research, Manchester University - who also engaged the Centre for Agriculture, Food and Resource Economics (CAFRE), and the Centre for Urban and Rural Ecology (CURE) at the University of Manchester to assist in the project

Scenarios based on Countryside Agency's study *State of the Countryside 2020* (originals authored by Tomorrow Project).
Method chosen: 'axes of uncertainty' matrix plus (+ forecasting)

Aim
The project's central objective was to develop recommendations on priorities for long-term economic and social research to support a process of rural development where economic growth, environmental sustainability and social cohesion come together in a mutually reinforcing way. Another objective was to recommend improvements in how such research should be carried out and how the research can be communicated and utilized most effectively.

The wider objective of the rural economy and land use programme is to enable researchers to work together to investigate the social, economic, environmental and technological challenges faced by rural areas. The programme will encourage social and economic vitality of rural areas and promote the protection and conservation of the rural environment.

Focus
Exploring widely different ways in which rural development might proceed over the next twenty years, the project used alternative scenarios of the rural future to serve as a framework for discussions of research priorities. The approach was based on the assumption that looking at a wide "possibility space" of plausible future conditions provides a more creative perspective than thinking that remains confined to current conditions, outlooks and assumptions.

The aspiration for a modern, competitive and sustainable rural economy and land use were identified, combined with scientific and social challenge. Financial, political, institutional, civil, community, consumer and individual sustainability were reflected. All were placed within the context of Research Councils UK.

Methodology
After a review of previous rural scenario studies, a general typology for the project's scenarios was adopted based on the Countryside Agency's study *State of the Countryside 2020*. The detailed character of the scenarios was created by developing alternative forecasts of how key driving forces shaping the future of rural areas might play out in the alternative scenarios. The resulting scenarios were used to structure discussions of social research priorities and methods at a scenario workshop held in February 2004. Participants were drawn from a wide range of organisations and disciplines, the use of a groupware tool enabling participants to state their views anonymously, encouraging an open expression of ideas and, visualization of ideas used to stimulate discussion.

To identify and forecast the driving forces on which the scenarios were based, a meeting of project advisors was held in November 2003 and, interviews conducted with over thirty experts in the field of rural development. The drivers that participants considered most important were: CAP and agricultural policy reform; regulation and governance structures; transport issues; climate change, ecology and pollution; diverse rural economies; urbanisation, planning, housing and rural demographics; consumer demand and lifestyle choices; demographics; energy; IT applications in rural life. Alternative forecasts for these drivers were developed which were built into the detailed scenarios.

The scenarios produced by forecasting these drivers combine differing degrees of economic growth, environmental sustainability, and social cohesion to produce four images of change between now and 2020.

The scenarios drew on the general character for the scenario set and typology used in the Countryside Agency's study *State of the Countryside 2020.*

Based on a standard two by two matrix, four scenarios for the future of rural England are outlined. All assume sustained economic growth and are constructed around the extent to which the countryside becomes environmentally sustainable and socially cohesive. The x-axis reflects the former (environmentally sustainable, unsustainable), the y-axis the latter (fragmentation, cohesion).

Brief description of future worlds
Four possible worlds:

- **Scenario 1: Growing On**
  High economic growth at the expense of social cohesion and environmental sustainability. General context: rapid growth and change in the global economy impact deeply on the countryside. Business decisions play the dominant role in shaping rural development.
- **Scenario 2: Growing Together**
  Rapid growth done in a way that maintains social cohesion, but at the expense of environmental sustainability. General context: many factors come together to counter the social fragmentation that often accompanies rapid growth and change. Key developments include labour shortages - largely addressed by training and retraining rather than by migration and immigration - a crisis in traffic congestion that encourages many people to work from home or local office centres, and a growing commitment by all political parties to promote social cohesion.
- **Scenario 3: Green and In Pieces**
  The countryside becomes more environmentally sustainable, but also more economically divided and socially fragmented. General context: global water resource management issues and sobering new evidence of the long-term health hazards posed by chemical residues in UK foods and water supplies make the environment a high priority for citizens and government.
- **Scenario 4: Green Together**
  Economic growth, social cohesion, and environmental sustainability come together and prove mutually reinforcing. General context: a new scientific consensus emerges that climate change is likely to be more extreme and to occur much more quickly than previously expected. A few years later, global oil demand begins to exceed global production capacity, driving prices upward. Public anxiety is fed by pundits who say that the environmental "prophets of doom" of a generation ago were right and that decline is inevitable. To counter this pessimism, progressive leaders in government, business, and the environmental community cooperate to rally public support around a positive vision of change. Their specific, central goal is to galvanize support for investing heavily in a new generation of environmentally advanced technologies for producing energy and using it more efficiently – the key to meeting both the climate and energy challenges. Their broader goal is to apply the concept of sustainable development more fully than ever before in order to simultaneously pursue economic growth, social cohesion and environmental sustainability.

Implications and application
Whilst the main points of each scenario apply to large portions of the UK, in view of the UK countryside being remarkably diverse in terrain, climate, and patterns of agricultural and other land uses, it is important to keep territorial and regional differences in mind.

Among the key findings of the project was that the priority social science research needs for supporting sustainable rural development are exceptionally broad, touching on economic and social change, technology, the environment, policy and governance, values, preferences and aspirations. Pursuing this ambitious agenda will require significant changes in research methods and styles, including major initiatives to encourage interdisciplinary research, more emphasis on foresight and deliberate experimentation, greater involvement of potential users in the research process, and attention to territorial and regional differences.

Relevance to ScENE
The scenarios provide insight on the rural economy and land use.
Perceptions on how might relate to EFF: x-axis - extent to which the countryside becomes environmentally sustainable: Consume (natural resources); y-axis - extent to which the countryside becomes socially cohesive: Relate (community).
Dimensions: Whilst a rural economy and land use focus, placed within a broad socio-economic and environmental context.

25. The Commission of Architects and the Built Environment (CABE) and The Royal Institute of British Architects (RIBA), Building Futures 2004

Housing Futures 2024
www.buildingfutures.org.uk
Consultants/Researchers: Academic team
Method chosen: expert assessment

Aim
Housing Futures formed a major element of the Building Futures programme in 2003/04, a joint initiative between CABE and RIBA, its aim being to scan over the horizon to seek out opportunities and potential barriers to help formulate current policy and stimulate debate.

Focus
The project arose from the context set by the Sustainable Communities Plan published by the Office of the Deputy Prime Minister in February 2003, proposing an expansion in and renewal of housing over a twenty year period. It is also placed within the context of the Barker Report ‘Review of Housing Supply’ published in March 2004 which outlined a number of concerns surrounding the failure to provide an adequate supply of housing in the UK, and the adverse effects an unresponsive housing supply can bring about.

Important questions to ask included where these homes will be built, who will build them, what they will be like and whether they will meet the needs of future generations. The question of the existing housing stock and its capacity to meet future needs was also key.

Methodology
The initiative comprises a provocative series of papers written by academics, built environment professionals and construction industry representatives. The papers were based around six drivers of change, social, technological, economical, environmental, political and delivery factors, together with a paper giving a contextual opinion.

The first type of paper provided an exploration of a possible scenario for housing in 2024 from a particular perspective, developing a narrative about what may drive change in the next two decades (for example a shift in culture, governance or climate), and exploring at first hand the experience of living in the resultant housing

environment. The 'urban renaissance' is a strong implicit underlying theme; issues of where people might choose to live and the motives behind these choices (and the extent to which these motives may be shaped by different policy interventions) are explored through a number of standpoints.

The second type of paper is firmly grounded within an examination of the mechanisms governing housing today, and the specific trends and driving forces that are likely to act upon the housing sector within the next twenty years. Alongside discussion of what the future is likely to hold, the papers propose a series of broad-brush policy and governance interventions in response, that seek to foster the best possible housing outcomes within the constraints identified.

Brief description of future worlds
The seven papers and authors are:

- ***Housing Vistas*:** A contextual overview by Kathryn Firth and Roger Zogolovitch, Cities Programme, LSE.
- ***Back to the Future: Staying with the Suburban Ideal*:** A social perspective from Sean Griffiths, FAT.
- ***The Brave New World of the 21st Century Home*:** A technological perspective from Andy Gillespie and Jonathan Rutherford, CURDS, University of Newcastle.
- ***The Economic Framework for Housing*:** An economic perspective from Christine Whitehead, Department of Sociology, LSE.
- ***Housing in a Changed Climate*:** An environmental perspective from Roger Levitt, Levett-Therivel.
- ***Future Involvements: Governing Housing*:** A political perspective from Duncan MacLennan and John McLaren, Department of Urban Studies, University of Glasgow.
- ***Charting the Regeneration Future*:** A delivery perspective from John Callcutt, Crest Nicholson.

Implications and application
The papers reflect a range of cross-cutting themes and in conclusion, pose seven key questions. The prevailing context for housing in 2020 is concluded to be one characterised by important issues in affordability and supply; it being certain that fundamental change is required.

Relevance to ScENE
The papers include an environmental and land use perspective.
Perceptions on how might relate to EFF: Categorisation not accomplished as work does not represent true scenarios.
Dimensions: Whilst a housing focus, placed within a broad social, technological, economical, environmental, political and delivery context.

26. Tyndall Centre for Climate Change Research, February 2004

UK Hydrogen Futures to 2050
Jim Watson, Alison Tetteh, Geoff Dutton, Abigail Bristow, Charlotte Kelly, and Matthew Page
www.tyndall.ac.uk
Consultants/Researchers: In-house; scenarios recycled from *Foresight 2020* (originals authored by team at SPRU, University of Sussex).
Method chosen: 'axes of uncertainty' scenario matrix plus (+ hydrogen energy and transport modelling).

Aim
This working paper summarises the results of a scenario development exercise by team members of the Tyndall Centre research project: *The Hydrogen Energy Economy: Its Long Term Role in Greenhouse Gas Reduction*. The project's aim is to develop and assess alternative transition paths to the widespread use of hydrogen in the UK in 2050. It develops four alternative energy scenarios.

Focus
The scenarios used in the exercise were adapted from a framework developed for the Intergovernmental Panel on Climate Change, and summarised in its *Special Report on Emissions Scenarios.* The adapted scenarios were originally established for the UK Foresight programme, and applied widely within government over various timescales to 2050. They include an analysis of alternative pathways for hydrogen to 2050.

Methodology
Scenarios were based on two axes of uncertainty - the two drivers of change being social values (x-axis individuals/consumers vs. community - consumerism to community) and systems of governance (y-axis autonomy vs. interdependence - globalisation to regionalisation). The study builds on these previous uses, and elaborates each scenario with a specific focus on the consequences for hydrogen production, transmission and use. It also quantifies UK energy demand growth and estimates hydrogen's contribution to demand for 2050. This quantification process also draws on previous work, particularly that by the Performance and Innovation Unit (PIU) within the Cabinet Office.

The four scenarios for 2050 are the result of two in-depth discussion meetings by the project team held in late 2002 and early 2003. They were refined further during 2003 to reflect the needs of the hydrogen energy and transport models being developed for the project by team members within the Rutherford Appleton Laboratory and the Institute for Transport Studies.

Brief description of future worlds
Four future worlds:

- Under **World Markets**, electricity supply would be dominated by gas and possibly coal-fired generation. Some of the cheapest renewables might make small contributions, and nuclear power would be phased out.
- For **Provincial Enterprise**, there might be a policy of maintaining a diverse mix of technologies that use accessible resources. This suggests that electricity could be generated from roughly equal amounts of nuclear, renewables and coal.
- Under **Global Sustainability,** the mix would be dominated by renewables and nuclear (though this would depend on consent and solutions being developed to problems of radioactive waste management). Fossil generation might be used to balance out some of the intermittent renewables.
- For **Local Stewardship**, generation would be renewables-based. However, there might be a continued role for coal in areas which have local resources, and for balancing intermittent renewables.

Implications and application
The results include a wide range of possibilities for the future of hydrogen within the UK: from a World Markets scenario in which there are no explicit drivers for hydrogen to a Global Sustainability scenario in which hydrogen becomes a central component of the UK energy system. The results are being used within the project to model a set of transition pathways from the present energy system to alternative possibilities for

2050. Critical examination of these pathways will help the project team to identify the technology breakthroughs and policy decisions that are necessary features of each pathway.

Relevance to ScENE
The scenarios provide insight on the use of hydrogen in a future energy economy, focusing on its long-term role in greenhouse gas reduction. They have a similar long-term timeframe. Energy (demand and supply), forms one of ScENE's underpinning global drivers of change to 2060.
Perceptions on how might relate to EFF: x-axis - nature of society (individual/community): Define (values); y-axis - nature of governance (interdependence vs. autonomy): Relate (government).
Dimensions: Core hydrogen energy focus.

27. The East of England Development Agency (EEDA) with the support of the East of England Regional Assembly, 2004

'SCENARIO PLANNING: developing a shared understanding of the influences on the economic development of the East of England'
www.eeda.org.uk
Consultants/Researchers: Henley Centre Headlight Vision
Method chosen: 'axes of uncertainty' matrix

Aim
A scenario planning approach was to used to help inform the review of the regional economic strategy (RES) for the East of England. The scenarios that emerged were a series of divergent but plausible views about how the future might play out in the East of England over the period to 2020. They will help to determine the future economic development of the region.

Specifically, the scenarios were developed:

- to enable the region to identify what can be called 'strategic imperatives'.
- to enable the region to identify the risks and opportunities associated with each of the scenarios.
- on the back of such analysis, they enable the region to assess its 'strategic preferences'.
- to enable the region over time to 'future proof' its strategy, by assessing it against the underlying drivers of the sustainable economic development of the region.

Focus
To build understanding of the key drivers that could impact on the region's economic development. The scenarios were explored and their implications for the region analysed to help identify the key issues for the regional economic strategy.

Methodology
A highly participative process was conducted with stakeholders who were involved from the outset - assembling and reviewing drivers, through to the development of the scenarios and the assessment of their implications. The project was in three key phases, with workshops taking place at each stage:

- driver development and analysis
- scenario development and testing
- strategy development and action planning

Through a series of regional workshops, more than fifty organisations made a contribution to the development of the regional economic strategy.

A series of seventeen prioritised drivers were identified as being important in determining the future economic development of the region. Following further analysis, the drivers were clustered and synthesised to generate two axes or dimensions to create a framework on which the scenarios could be developed. The two dimensions that developed were based on key clusters of linked issues that emerged from the process:

- **The relative balance of the region's economic focus**, picking up issues around development of globalisation, skills development, rise of the knowledge economy and changing nature of manufacturing and associated skills, workforce and cultural issues. One of the x-axis was labelled 'exporting ideas', the opposite extreme of this axis, labelled building businesses'.
- **Relative pace and quality of infrastructure development**, picking up issues relating to the development of international gateways, high speed data connections, and the relative connectability of the region, both internally and with other parts of the UK and international markets. The poles of this y-axis were labelled as 'minimal growth in infrastructure' to 'rapid growth in infrastructure'.

Brief description of future worlds
Four futures were explored:

- Scenario 1: ***Who wants to be a Millionaire?*** Rapid growth in infrastructure, building businesses.
- Scenario 2: ***Going for Gold***. Rapid growth in infrastructure, exporting ideas.
- Scenario 3: ***The Crystal Maze***. Minimal growth in infrastructure, building businesses.
- Scenario 4: ***University Challenge***. Minimal growth in infrastructure, exporting ideas.

Implications and application
Building on the work emerging from the scenario process, EEDA produced a consultation document on the high level issues facing the region at the end of January 2004. Entitled 'Sharing the challenge - playing your part in reviewing the regional economic strategy', this set out a draft vision, a set of strategic goals and underpinning priorities. It asked for views on their relevance and appropriateness for the region, which were used to inform the RES.

Relevance to ScENE
With a focus on a region, the scenarios provide a sense of place, highlighting regional identity and distinctiveness, a perspective which might be missing from UK-wide scenario projects. The scenarios take a broad look at the influences on economic development within a region, including underpinning environmental drivers. Perceptions on how might relate to EFF: x-axis: The relative balance of the region's economic focus (ranging from exporting ideas to building businesses): Create – manufacturing vs. innovative; y-axis: Relative pace and quality of infrastructure development (ranging from minimal to rapid growth in infrastructure): Connect – infrastructure.
Dimensions: Core economic focus through placed within broad social, technological, economic, environmental, political, organisational context.

2003
28. The Countryside Agency, 2003

The State of the Countryside, 2020
Consultants/Researchers: Tomorrow Project
Method chosen: 'axes of uncertainty' matrix

Aim
The study examined the future of the English countryside; It asked: what will shape the future and with what possible outcomes? Answering these questions helps us to identify what we need to do now to achieve the most desirable countryside in the future.

Focus
The study focuses on 'people and the countryside'. It explores three questions:

- who will live in the countryside;
- how will rural people earn a living; and
- what will be their quality of life?

The report also addresses the big issues of sustainability, asking whether or not, and how, environmental, economic and social sustainability of the countryside can be combined. It shows how we can achieve this combination, but it also points to the obstacles that will need to be overcome.

Methodology
A range of stakeholders were consulted in the preparation of their report to the Countryside Agency, either through one-to-ones or in the context of group consultations.

Key drivers of change against the global economy were identified and the influence of England's history considered.

Based on a standard two by two matrix, four scenarios for the future of rural England are outlined. All assume sustained economic growth and are constructed around the extent to which the countryside becomes environmentally sustainable and socially cohesive. The x-axis reflects the former (environmentally sustainable, unsustainable), the y-axis the latter (fragmentation, cohesion).

Brief description of future worlds
Four worlds are explored:

- In ***'The countryside means business'*** rural England develops in an environmentally unsustainable direction and is socially fragmented.
- ***'Go for green!'*** describes a more environmentally sustainable future, but one in which the countryside is also more socially fragmented.
- ***'All on board!'*** is a scenario in which greater social cohesion combines with less environmental sustainability.
- In ***'The triple whammy'***, environmental, social and economic sustainability are combined.

Implications and application
The scenarios show how current trends and future developments might impact on rural areas and communities over the next 20 years. The study needs to be used and deepened, including by stakeholders.

Relevance to ScENE
The scenarios provide a core people and countryside focus.
Perceptions on how might relate to EFF: x-axis - extent to which the countryside becomes environmentally sustainable: Consume (natural resources); y-axis - extent to which the countryside becomes socially cohesive: Relate (family / lifestyle groups/community).
Dimensions: Whilst this study focuses on 'people and the countryside', it addresses the big issues of sustainability including how environmental, economic and social sustainability of the countryside can be combined.

2002
29. Foresight 2020 scenarios

Office for Science and Technology, published 2002
www.foresight.gov.uk
Consultants/Researchers: team at SPRU Science and Technology Policy Research, University of Sussex who wrote the original scenarios, *Environmental Futures*, for the Office of Science and Technology DTI in 1998, and subsequently revised and updated them.
Method chosen: 'axes of uncertainty' matrix

Aim
To describe what the UK could be like in the period 2010-2030, focusing on social and economic trends.

Focus
The scenarios are presented as storylines which set out trends and provide more detail in five areas: economic and sectoral; employment and social; regional development; health; welfare and education; the environment.

Methodology
Scenarios were based on two axes of uncertainty - the two drivers of change being social values (individual, community) and systems of governance (autonomy where power remains at a national level, to interdependence where power increasingly moves to other institutions eg up to the EU, down to regional government). Social values take account of social and political priorities and the pattern of resultant economic activity. Systems of governance deals with the structure of government and the decision-making process.

Brief description of future worlds
- **World markets:** materialistic, wealth driven, high proportion private sector, high growth, rape and pillage trade, regulator driven world, international dimension - brokering role internationally, eg US.
- **National enterprise:** national focus/identity, liberalised markets, quite a lot of protection, quite active participation, low growth, constrained trade, utilisation of environment for economic prosperity (eg tourism), eg Scotland.
- **Global sustainability:** people foregoing own interest for common good (eg carbon offsetting, social values), regulatory driven, good markets, fair trade, nice to live in but very bureaucratic, slow, consensual building (don't be seduced), get what given.

- **Local stewardship:** small unit, no global trade, low growth, fish from local beach eg Cuba.

Implications and application
Published in 2002, the underlying framework is still useful for analysis of issues within the UK. The scenarios have been tailored to suit a number of further specific sets of scenarios, including the Tyndall Centre's UK Hydrogen Future scenarios to 2050.

Relevance to ScENE
The environment and sustainability is a constituent of all scenarios, others include regional development, energy, transport, agriculture and food. Climate change is integrated within the scenarios via the UKCIP socio-economic scenarios.
Perceptions on how might relate to EFF: x-axis - nature of society (individual/community): Define (values); y-axis - nature of governance (interdependence vs. autonomy): Relate (government).
Dimensions: Broad focus - economic and sectoral; employment and social; regional development; health; welfare and education; the environment.

30. Stockholm Environment Institute, 2002

'Great Transition. The Promise and Lure of the Times Ahead'.
Consultants/Researchers: the Global Scenario Group in-house at the Stockholm Environment Institute – Paul Rasking, Tariq Banuri, Gilberto Gallopín, Pablo Gutman, Al Hammond, Robert Kates, Rob Swart.
Method chosen: expert assessment (involving research and modelling)

Aim
The essay is the culmination of the work of the Global Scenario Group, convened in 1995 by the Stockholm Environment Institute to examine the requirements for a transition to sustainability. Its focus is the Great Transition, regarded as a historical opportunity to shape an equitable world of peace, freedom, and sustainability.

Focus
The report focuses on humanity in the midst of a new historical transition - a long process of increasing social complexity, accelerating change and expanding spatial scale. It highlights that a global transition has begun - a planetary society will take place over the coming decades, the nature of which, including our journey to it, will be influenced by how environmental and social conflicts are resolved. The critical question is: 'What form will it take? Whilst it is easy to envision a dismal future of impoverished people, cultures and nature, humanity has the power to foresee, to choose and to act - with a transition to a future of enriched lives, human solidarity and a healthy planet being a possibility. It is a work of analysis, imagination and engagement. As analysis, it describes the historic roots, current dynamics and future perils of world development. As imagination, it offers narrative accounts of alternative long-range global scenarios, and considers their implications. As engagement, it aims to advance one of these scenarios - **Great Transition** - by identifying strategies, agents for change and values for a new global agenda.

Methodology
The report provides chapters on where we are, where we are headed; where do we want to go, how do we get there, history of the future, and, the shape of the transition.

The report considers and is underpinned by a series of driving forces - demographics, economics, social issues, culture, technology, environment and governance, which provide the context for a series of narratives.

Three classes of scenarios are considered: **Conventional Worlds, Barbarization** and **Great Transitions**. These scenarios are distinguished by respectively, essential continuity, fundamental but undesirable social change, and fundamental and favourable social transformation. They have different patterns according to underlying differences around population, economy, environment, equity, technology and conflict.

Great Transitions envisions a sustainable and desirable future emerging from new values, a revised model of development and the active engagement of civil society.

Brief description of future worlds
Three classes of scenarios:

- **Conventional Worlds** assume the global system in the twenty first century evolves without major surprise, sharp discontinuity, or fundamental transformation in the basis of human civilization. The dominant forces and values currently driving globalization shape the future. Incremental market and policy adjustments are able to cope with social, economic and environmental problems as they arise.
- **Barbarization** foresees the possibilities that these problems are not managed. Instead, they cascade into self-amplifying crises that overwhelm the coping capacity of conventional institutions. Civilization descends into anarchy or tyranny.
- **Great Transitions,** envisions profound historical transformations in the fundamental values and organizing principles of society. New values and development paradigms ascend that emphasise the quality of life and material sufficiency, human solidarity and global equity, and affinity with nature and environmental sustainability.

Implications and application
Analysis suggests that the momentum towards an unsustainable future can be reversed - though with difficulty. **The Great Transition** assumes fundamental shifts in desired lifestyles, values and technology. Yet, even under these assumptions, it takes many decades to realign human activity with a healthy environment, make poverty obsolete, and ameliorate the deep fissures that divide people. Some climate change is irrevocable, water stress will persist in many places, extinct species will not return, and lives will be lost to deprivation. Nevertheless, a planetary transition toward a humane, just and ecological future is possible. But the curve of development must be bent twice. A radical revision of technological means begins the transition, a reconsideration of human goals completes it. This is the promise and the lure of the global future.

Relevance to ScENE
The scenarios explore the big meta question central to our whole mindset: business as usual vs. business collapse vs. transformational. Their global context and similar timeframe are also common features.
Conventional Worlds **assumes incremental policy and market adjustments - focus is on relations between policy and the economy:** Relate (government and economy).
Barbarization**:** Relate (government).
Great Transitions **assumes fundamental shifts in desired lifestyles, values and technology:** Define (social values).

Dimensions: Whilst a social, humanity focus, placed within wide economic, cultural, technological, social and environmental context.

31. The Countryside Agency, 2002

Is this the Future we want? Land Management scenarios in the South West
Consultants/Researchers: Land Use Consultants
Method chosen: these are vision statements rather than scenarios

Aim
To stimulate debate and to encourage a forward look beyond the next three to five years. The audience was anyone concerned with the future of the land-based economy in the South West of England.

Focus
To develop a range of future scenarios for land-based enterprises in the South West of England. In particular, the study was asked to address:

- what combinations of land uses will be appropriate in the rural areas of the South West in the future, recognising the fundamental changes that are now taking place in agriculture?; and
- are there scenarios for the future of the land-based enterprises which could exploit the distinctiveness and environmental strengths of the South West whilst being more broadly based and thus potentially more economically robust?

The study focuses on four discrete Countryside Character Areas in the South West region: The Cornish Killas; The Culm; The Forest of Dean; Cranborne Chase.

Methodology
For each of the Character Areas, a brief description was provided of the existing characteristics of the area, followed by a vision and strategy for the land-based economy. This is translated into:

- key actions that could be taken at the group parish level to help implement this strategy (written in 2008).
- how individual farms (total 2-3) might have responded to the strategy by 2012, written from the standpoint of the farmer or other commentator close to the farm.

The farm case studies are entirely fictitious aiming to illustrate the real decisions that farmers might need to take to respond to the strategy over the next 10 years within the area. The aim was to develop an overall strategy that reflected the key characteristics of each of the four areas.

Brief description of future worlds
Detail provided in report.

Implications and application
The study attempted to provide visions (and perhaps at times contentious views) on the future development of land-based enterprises in areas of the South West of England following the trauma of Foot and Mouth disease. It draws together some of the key themes that have been developed. The study overall demonstrates that if the same sustainability questions are asked of different areas, subtly different strategies for the future emerge, which are clearly grounded in the character and capability of individual areas.

Relevance to ScENE
The scenarios provide insight on the land-based economy within specific areas of the South West region.
Perceptions on how might relate to EFF: Not accomplished as these are vision statements.
Dimensions**:** Whilst their core focus is the land-based economy in the South West, scenarios are placed within a broader socio-economic and environmental context.

2001
32. King Sturge, January 2001

The work is based on a research project undertaken by Professor John Ratcliffe at DIT over the last two years.
Global Real Estate Scenarios
www.kingsturge.com
Consultants/Researchers: Academic: DIT Futures Academy
Method chosen: 'axes of uncertainty' matrix

Aim
In an era of significant global change, with questions posed about demography, natural resources, the environment and human culture, the real estate industry cannot be exempted from looking around and ahead. Success will depend on being prepared for the unexpected.

Focus
The strategic question set for the study was:

- What are the major forces of change affecting the global real estate industry, and how should the property profession position itself now to face the future?

Methodology
More than one hundred leading real estate practionners and academics were involved across the scenario programme. Participants in opening workshops and interviews were asked to identify one or two vital issues that would affect the nature and direction of the real estate industry. Two things they would most wish to know were:

- The level of government intervention in city planning and development.
- The relative degree of economic prosperity prevailing internationally, regionally and locally.

These factors were used to form the scenario matrix within which the scenarios were developed. A time horizon of 2015 was established.

Driving forces of change were identified, with main uses and trends determined and clarity given on their level of impact and degree of uncertainty. A set of three scenarios were constructed against two axes - the x-axis representing government/public intervention (ranging from low to high), the y-axis representing economic growth (low, high).

Following the presentation of the scenarios, the policy proposals (formulated from an analysis of the issues and trends, the scenario construction process and the selective interviews), were tested against each vision of the future.

Brief description of future worlds
Three worlds were explored:

- **Lords of Misrule -** relating to social reaction to rapid change.
- **Bazaar -** relating to complexity managed by 'marketising' decision processes.
- **Socratic Systems -** relating to harnessing the knowledge economy.

Implications and application
The scenarios raise a key issue: will these scenarios replace more than 200 years of cultural heritage across different countries of the globe? A series of conclusions are identified from the study; it is suggested that the world may be increasingly divided into zones.

Relevance to ScENE
The scenarios provide insight on real estate at a global scale.
Perceptions on how might relate to EFF: x-axis - government/public intervention (ranging from low to high): Relate - government; y-axis - economic growth (low, high): Create - wealth.
Dimensions: Whilst a real estate focus, placed with a broad context of cultural, demographic, economic, environmental, governmental and technological change.

2000
33. Foresight: the US Environment Protection Agency (EPA), 2000
Environmental Protection Agency
www.epa.gov
Consultants/Researchers: Institute for Alternative Futures
Method chosen: 'axes of uncertainty' matrix

Aim
In 1995, the EPA's science advisory board urged the EPA to establish an ongoing early-warning system to identify potential future environmental risks, and to change its priorities over time so that eventually, as much attention should be given to avoiding future environmental problems as to controlling current ones.

Focus
Combining the outputs from interviews involving senior executives, the research team applied three selection criteria to be addressed in developing scenarios:

- Agency-wide relevance.
- High potential impact on human health and/or the environment.
- A high level of uncertainty about what the future holds.
- A number of topics were identified for further research.
- Aquifer depletion/water quality.
- Sprawl (including non-point source pollution and biodiversity loss).
- Biotechnology and nanotechnology.
- Chemicals in the environment (specifically, chemicals or sets of chemicals for which associations between exposure and effects are difficult to ascertain, and where there may be synergistic and cumulative effects of low exposures).
- Existing persistent environmental problems that may surprise the EPA as a result of changes in societal drivers; for example, an ageing population leading to mass migrations resulting in areas currently in compliance being in violation of national air quality standards.
- Climate change.

Methodology
Issue papers were developed for the above topics, each describing the general nature of the problem, trend data, the range of views on how the problem might change between now and 2020, and environmental and human health implications. The most important findings fed into the scenarios.

The scenario team then selected two axes to serve as a framework for building the scenarios. The chosen axes, economic growth and social cohesion, were selected to highlight social dynamics that have a profound effect on the environment but are often not considered in EPA policies and decision making. The economy x-axis was defined in terms of growth or decline in the total production and consumption of goods and services, whilst the social cohesion y-axis was defined in terms of the extent of shared values, mutual trust, inclusiveness of participation and willingness to face common challenges and co-operate in meeting them.

Brief description of future worlds
Four future worlds were described:

- **Eco-efficiency revolution:** high economic growth and high social cohesion;
- **Full speed ahead:** high economic growth and low social cohesion;
- **Soft landing:** low economic growth and high social cohesion; and
- **A darker age**.

Implications and application
In October 2000, in conjunction with a meeting of the EDA's reinvention action council, EPA senior career executives met to engage in a 'strategic conversation' based on the scenarios. The goal of the meeting was to encourage an open, honest exchange of ideas and opinions about possible future scenarios and to examine the agency's current directions in the light of these potential futures.

Progress has been made towards developing a capacity for better environmental foresight within the EPA; it is believed that the strategy of developing a futures network that reaches throughout the agency and has strong links to its senior career executives is highly worthwhile. Proponents of environmental foresight in the agency will need to work with senior leadership to gain their support and appreciation for the value of futures thinking, strive to secure sufficient resources for the agency to seriously engage in futures work, and promote the development of a culture of incentives and consequences to encourage foresight in planning.

Relevance to ScENE
The scenarios provide insight on the environment, placed within a US context. Perceptions on how might relate to EFF: x-axis - economy, defined in terms of growth or decline in the total production and consumption of goods and services: Create (wealth); y-axis - social cohesion, defined in terms of the extent of shared values, mutual trust, inclusiveness of participation and willingness to face common challenges and co-operate in meeting them: Define (social values and attitudes). Dimensions: Whilst an environmental focus, placed within a strong socio-economic context.

1999
34. DETR / UKCIP, 20 October 1999

Socio-Economic Futures Scenarios for Climate Impact Assessment
Consultants/Researchers: Centre for Social and Economic Research on the Global Environment (CSERGE), Climatic Research Unit (CRU), Policy Studies Institute (PSI). Precursors to Foresight 2020 scenarios.

The study was funded by the Global Atmosphere division of DETR as part of the work of UKCIP. It was conducted by a team of researchers from SPRU-Science and Technology Policy Research at the University of Sussex, the Centre for Social and Economic Research on the Global Environment (CSERGE) and the Climate Research Unit both at the University of East Anglia, and the Policy Studies Institute.
Method chosen: 'axes of uncertainty' matrix plus (+ systems modelling)

Aim
Four 'socio-economic futures scenarios' were developed which could be used to form a context for conducting assessments under the UK Climate Impacts Programme (UKCIP). The scenarios portray distinct pictures of the social, political and economic background against which adaptation to climate change might take place in the UK in the 2020s and 2050s. Taken together with climate scenarios developed by the Climate Research Unit at the University of East Anglia, the scenarios offer the opportunity to take a consistent approach in the conduct of UK impact studies co-ordinated by UKCIP.

Focus
The aim was to develop a scenario framework through which stakeholders could reflect on possible alternative futures and make sense of what this means for them in the context of climate change impacts. An inclusive approach enabled stakeholders to build a set of internally-consistent and plausible pictures of the future, constructed around a series of simple propositions about how society and the economy could develop.

Methodology
The starting point for the scenarios was a set of environmental futures scenarios developed for the Natural Resources and Environment Panel of the UK Foresight Programme. To sharpen their relevance to climate impact assessment, the Foresight scenarios were further developed. Scenario development involved an iterative process of consultation and research, involving interviews and workshops with climate impact researchers, policymakers at the national and regional level, and stakeholders in the business and NGO sectors. Significant effort was put into developing quantitative indicators to illustrate scenario storylines, and to provide numerical inputs for integrated climate impact modelling.

A review was conducted of global futures literature to identify five main dimensions of change highlighted in previous scenario planning exercises. The choice, made on analytical grounds, follows a similar set of dimensions chosen in the IPCC/Special Report Emissions Scenarios (SRES) socio-economic scenarios. It was decided to make the more qualitative dimensions of socio-economic change the basis of scenario construction. Social and political values (x-axis) and the nature of governance (y-axis) were taken to be foundational and independent determinants of future change, subsequently placed central stage.

Brief description of future worlds
Four 'socio-economic scenarios' intended for use in conducting assessments under the UK Climate Impacts Programme (UKCIP). The scenarios portray distinct pictures of the social, political and economic background against which adaptation to climate change might take place in the UK in the 2020s and 2050s.

Four possible worlds, summarising climate change vulnerability:

- **National Enterprise**
  Biodiversity is under pressure from habitat fragmentation, industrial/housing development and weak environmental controls. Ecosystems are vulnerable to climate impacts. The policy to combat biodiversity loss is also unambitious. The capacity to adapt to climate change in the agricultural sector is constrained by poor economic conditions in the sector and low levels of investment. Water systems are stressed, especially in the South-East, because of a failure to curb demand and constraints on the financial resources available for investment in water supply. Water quality is also poor. The economic and organisational capacity to protect coastal zones, where there is continued investment, is also weak. In the latter part of this scenario, in the 2050s, the climate signal is also strong because of a failure to curb greenhouse gas emissions.
- **Local Stewardship**
  There is both the will and the capacity to protect biodiversity from the impacts of climate change. Economic development is controlled so that fragile ecosystems are protected, although there is some threat from the expansion of agricultural areas. Housing developments on the edges of smaller towns may also have local impacts on the countryside. Extensive agriculture focused on small-scale, diversified and organic production provides an alternative route to high adaptive capacity in the sector. There is less pressure on water resources due to lower demand, but local difficulties continue where there is resistance to the development of new water resources. The vulnerability of coastal zones will be decreased because resources are made available for protection. There is a willingness to contemplate managed retreat where protection is too expensive.
- **World markets**
  This is a scenario in which biodiversity is vulnerable as a result of fragmented habitats, particularly under pressure from housing development, high-intensity farming and leisure industry uses of the countryside. There is little public concern about biodiversity loss. Conversely, the capacity to adapt in the agriculture sector is high because technology offers the opportunity to introduce new varieties and techniques in response to climatic changes. Pressure on water resources is very high, especially in the South-East, but prices provide incentives to use water efficiently and cut leakage. The vulnerability of coastal regions increases because of continued investment in housing and infrastructure. There is a demand to protect these investments from coastal flooding.
- **Global Sustainability**
  In this scenario, natural ecosystems are considerably less vulnerable than in the ‘world markets’ scenario but are less well protected than under ‘local stewardship’. Demand for access to the countryside increases while, on the other hand, pollution levels are lower. Technology allows agriculture to adapt to climate change, but there are tighter controls on the use of genetically modified crops for example than under the ‘world markets’ scenario. More efficient end use means that there is less pressure on water resources. Existing coastal infrastructure continues to be vulnerable to sea-level rise but new developments are strictly controlled.

Implications and application

In practice, the scenarios need to be combined with climate change scenarios describing variables such as temperature, precipitation and sea level rise. A number of climate change scenarios may need to be considered. There are for example four UKCIP climate scenarios. Combining these with the socio-economic scenarios leads to sixteen possible permutations - too many for meaningful assessment. Strategies are therefore needed for selecting from the basic set of four socio-economic scenarios. There are two elements to this choice:

- selecting socio-economic scenarios which are coherent with the climate scenarios; and
- selecting the best subset of socio-economic scenarios.

Whilst the scenarios describe gradual socio-economic change, drawing out tendencies within our current system, for some purposes it might be appropriate to consider 'surprises' or 'sideswipes' which imply more dramatic and less predictable system changes.

Relevance to ScENE
The scenarios provide insight on climate change impacts at a UK level, placed within a socio-economic context. A similar long-term timeframe (to 2020's, 2050's) is utilised.
Perceptions on how might relate to EFF: x-axis - nature of society (individual/community): Define (values); y-axis - nature of governance (interdependence vs. autonomy): Relate (government).
Dimensions: Whilst a socio-economic focus, five main dimensions of change underpin the work: demography and settlement patterns; the composition and rate of economic growth; the rate and direction of technological change; the nature of governance; and, social and political values.

1996
35. The Intergovernmental Panel on Climate Change (IPCC), 1996

The Intergovernmental Panel on Climate Change (IPCC) scenarios - Special Report on Emissions Scenarios (SRES)
www.ipcc.ch/pdf/special-reports/spm/sres-en.pdf
Consultants/Researchers: In-house
Method chosen: morphological analysis

Aim
The Intergovernmental Panel on Climate Change (IPCC) developed long-term emissions scenarios in 1990 and 1992. These scenarios have been widely used in the analysis of possible climate change, its impacts, and options to mitigate climate change. In 1995, following an evaluation of the IPCC 1992 scenarios, it was recommended that significant changes (since 1992) in the understanding of driving forces of emissions and methodologies should be addressed. These changes in understanding relate to for example, the carbon intensity of energy supply, the income gap between developed and developing countries, and to sulphur emissions. This led to a decision by the IPCC Plenary in 1996 to develop a new set of scenarios.

Focus
Future greenhouse gas (GHG) emissions are the product of very complex dynamic systems, determined by driving forces such as demographic development, socio-economic development, and technological change. Their future evolution is highly uncertain. Scenarios were used to analyse how driving forces may influence future emission outcomes and to assess the associated uncertainties. They assist in climate change analysis, including climate modelling and the assessment of impacts, adaptation, and mitigation. The possibility that any single emissions path will occur as described in scenarios is highly uncertain.

Methodology
The scenarios are based on an extensive assessment of driving forces and emissions in the scenario literature, alternative modelling approaches, and an "open process" that solicited wide participation and feedback. Four different narrative storylines were developed to describe consistently the relationships between

emission driving forces and their evolution, adding context for scenario quantification. Each storyline represents different demographic, social, economic, technological, and environmental developments, which may be viewed positively by some people and negatively by others. Due to the long-term nature and uncertainty of climate change and its driving forces, these climate change scenarios extend to the end of the 21st century.

For each storyline several different scenarios were developed using different modelling approaches to examine the range of outcomes arising from a range of models that use similar assumptions about driving forces. Six models were used which are representative of integrated assessment frameworks in the literature. One advantage of a multi-model approach is that the resultant 40 SRES scenarios together encompass the current range of uncertainties of future GHG emissions arising from different characteristics of these models, in addition to the current knowledge of and uncertainties that arise from scenario driving forces such as demographic, social and economic, and broad technological developments that drive the models, as described in the storylines. Thirteen of these 40 scenarios explore variations in energy technology assumptions. Expert scientists for specific disciplines provide inputs.

Brief description of future worlds
Four qualitative storylines yield four sets of scenarios called “families”: A1, A2, B1, and B2. Altogether 40 SRES scenarios have been developed by six modelling teams. All are equally valid with no assigned probabilities of occurrence. The set of scenarios consists of six scenario groups drawn from the four families: one group each in A2, B1, B2, and three groups within the A1 family, characterizing alternative developments of energy technologies: A1FI (fossil fuel intensive), A1B (balanced), and A1T (predominantly non-fossil fuel).

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).

The A2 storyline and 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 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 B1 storyline and scenario family describes a convergent world with the same global population that peaks in midcentury and declines thereafter, as in the A1 storyline, but with rapid changes in economic structures toward a service and information economy, with reductions in material intensity, and 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 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 A2, intermediate levels of economic development, and less rapid and more diverse technological change than in the B1 and A1 storylines. While the scenario is also oriented toward environmental protection and social equity, it focuses on local and regional levels.

Implications and application
The results of this work show that different social, economic and technological developments have a strong impact on emission trends, without assuming explicit climate policy interventions. The new scenarios also provide important insights about the interlinkages between environmental quality and development choices and will certainly be a useful tool for experts and decision-makers.
It is recommended that a range of SRES scenarios with a variety of assumptions regarding driving forces be used in any analysis.

Relevance to ScENE
The ScENE scenarios explicitly incorporate the IPPC SRES scenarios.
The IPCC models-based scenarios all begin with the assumption that strong feedback loops exist between the environment and the economy and our infrastructure.
Perceptions on how might relate to EFF: Relate (ecosystems).
Dimensions: Whilst a climate change focus, scenarios are placed across wide underpinning demographic, social, economic, technological, and environmental developments context.

Appendix 4 "Lessons learnt"

Overview

The Scenarios Compendium creates a context for Natural England's own scenarios work. As a literature review, it highlights ScENE's unique contributions to the foresight policy dialogue within the UK. The Compendium's annotated inventory of scenario projects and processes is descriptive, rather than prescriptive. For the second edition, selected scenario project sponsors and consultants were interviewed as an aid to others who may embark on scenarios work.

These interviews provided material for short "lessons learnt" sidebars adding to the annotation of selected scenario projects. They focus on identifying unexpected (for the better or the worse) outcomes either *during* the process (participation) or *after* the process (engagement), and drawing insights for future scenario projects. The 'sidebar' summary text is provided below.

Scenario projects chosen and relevant contacts

Twelve candidate scenario projects were chosen as interesting examples at different scales of investment and topic scope. They are listed in the following table. For each project, both a sponsor and a lead consultant was identified as a potential interview respondent.

Project	***Contact(s)***
B. BIS Land Use Futures, 2060	Alister Wilson, Waverley Management Consultants
2. Food Ethics 2022	Tom McMillan, Food Ethics Council
7. DIUS SEMBE 2050	Andrew Curry, The Futures Company
9. Shell Energy 2050	No contact available
10. Carnegie Civil Society 2025	Erin Van Der Maas, Carnegie UK Foundation Andrew Curry, The Futures Company
11. Health and Safety 2017	Elizabeth Hoult, Health and Safety Executive
13. CIPFA 2030	Gill Ringland, SAMI Consulting
14. UNEP Environment 2050	No contact available
15. European EA Prelude 2050	Teresa Ribeiro, Director, Strategic Futures, EEA
16. UK EA Environment 2030	Robert Willows, Environment Agency Andrew Curry, The Futures Company
17. DIUS IIS 2055	Alister Wilson, Waverley Management Consultants
20. EC Property 2020	No contact available
21. Millennium Ecosystem Assessment 2050	No contact available

One immediate finding of this activity is that it can be quite difficult to locate a contact person who could speak to the scenario project's development, and subsequent use of any project products. For this reason, the *Shell Energy Scenarios*, the *UNEP Environment 2050* scenarios, the *EC Property 2020* scenarios, and the *Millennium Ecosystem Assessment 2050* – arguably four of the most significant projects – cannot be represented in the 'lessons learnt' survey. The interviews did, however, gain an additional 'lessons learnt' perspective from the *BIS Land Use Futures* project as part of a conversation with Waverley Management Consultants.

QUESTIONS

The interviews were kept short. Essentially, the 'lessons learnt' survey asked "was it a success? why, or why not?" for each scenarios project. Each interview took between 20-30 minutes, and respondents were sent transcripts to review and approve. Where scheduling difficulties precluded interviews, respondents were offered the option of completing an interview form and returning it by email.

1. What was your goal in building and using scenarios for your organisation?

2. Do you think the scenarios project was a success?
    a. if YES, why? for example,
        i. how did the method chosen contribute to the success – did it enhance thinking / discussion / participation?
        ii. how did the output format – story, illustrations, media, etc. – contribute to the success?
        iii. what was the application / dissemination strategy? did it engage stakeholders and a wider audience or more users after project completion?
    b. if NO, why? for example,
        i. how did the approach and method chosen get in the way of achieving your goals?
        ii. how did the presentation – story, illustrations, media, etc. – hamper success?
        iii. what constrained application / dissemination / stakeholder engagement? what could have been improved?

3. To what extent did the time horizon chosen contribute to the success (or lack of it) of the project? In hindsight, would you chose a different time horizon for this topic?

4. What was the most unexpected outcome from this scenario work (either good or bad, at any stage in the process)?

5. 3 key pieces of advice you would offer to someone beginning a scenarios project:

Key lessons learnt by the project

B. BIS Land Use Futures, 2060

Objective(s): to capture, communicate, and highlight difficult issues that could impact on the future; to present the future as a neutral space; to use scenarios as a communications tool to help the user think about the future of a complex issue.

Contributions to success: a very participative process with a wide range of contributions; a timescale (fifty years) that allowed the team to really explore the scenarios; the synopsis in story form captured the breadth of contributions but was also easy for the user to understand.

Presenting the scenarios: the storyline narratives, while long, are an engaging and enjoyable read, interspersed with 12-14 illustrations apiece – primarily newspaper images from the future. The scenarios can be told through these graphics alone, a technique that works well and has been used with a small number of groups successfully.

Time horizon(s): the big potential challenges facing the land use system – for example, climate change – dictated a long-term (fifty year) time horizon. This allowed time to develop some reasonably optimistic scenarios, but also posed the challenge that scenarios so 'far out' are more easily dismissed as not relevant now. Be aware that using a long timeline can make it more difficult to communicate the relevance of the resulting scenarios to the users.

Key advice:

- **Involve people who have an in-depth understanding of their field, but use your intuition and judgement more than evidence:** story-telling and imagination offers the value, as the stories create the space for decision-makers to explore and rehearse decisions they may have to make.
- **To develop the most useful process and products, know from the outset who will use them and what for:** help the client clarify what they want from the process.
- **Make sure that those who have commissioned the work understand scenarios and scenario planning:** people can get confused about what scenarios and their benefits are, so take the time at the start to explain.

2. Food Ethics 2022

Objective(s): to make sure our analysis of food distribution and its future was based on well-thought-through understanding of futures uncertainties, that it wasn't too stuck in the present and the past; to engage a broad group of stakeholders so that they could both contribute a lot to the project, but also take away a lot; and to offer a novel approach to creating food policy (at the time, only one other scenario process focused on food; subsequent projects have created stakeholder 'workshop fatigue').

Contributions to success: it worked well as a way of getting people interested in the project, appealing to those in the logistics industry who might not otherwise turn up at events organised by non-profit organisations. Many insights from the scenario process as a whole were gained. Additional legitimacy of the process was provided by alerting stakeholders both to oncoming changes and to processes for monitoring those changes.

Presenting the scenarios: the scenarios were written up in a lively format featuring a 'cast of characters' incorporating detail in a series of vignettes; the scenarios were accompanied by a simple toolkit enabling even a single reader to use the scenarios as a thought experiment. The write-up ensured that other small organisations could

have this experience without expense and time. The 'borrowing' of our output meant that stakeholder goodwill was secured. As a result, the toolkit has been widely disseminated as a resource for capacity building and policy discussions in the sector and in local government: some council members regard it as our most popular report.

Time horizon(s): we learned how difficult it is to think beyond about five years – even some of the details we thought were outrageous during the workshop actually emerged as issues in policy discussions over the subsequent eighteen months.

Unexpected outcomes: 'emerging issues' come around very quickly: things that seemed quite radical, for example, around resource pressures, during the workshop have since become precisely the strategic issues. Truly future-proofing may be an unrealistic benefit – the real outcome was creating a safe space for people to talk about ideas that may seem quite radical and heretical but can be discussed in the context of a long-term future. That is, the industry could talk about resource depletion and social issues in the safe 'future space' of the scenarios – could say things in the workshop they couldn't normally raise or discuss – and then when those issues arose subsequently, it proved the value of the process.

Key advice:

- **Do you really need to do it?** Many other organisations have now completed food futures projects that could usefully be recycled as thought experiments. Recycling food scenarios could also help avoid generating more stakeholder workshop fatigue.
- **Think carefully about how the scenarios work fits into the larger project** – what the connections can and should be to your other research and policy work. We struggled to link our scenarios to our vision process, and the vision output to the overall process – a clearer sense of that at the outset would have helped.
- **In writing up your project, consider how to make it useful to others:** a lot of scenario reports are a record of what went on, but quite difficult to use if you are coming to them cold – make your project output more interactive.

7. DIUS SEMBE 2050

Objective(s): to help the SEMBE expert group structure their thinking more clearly – to create some order out of a myriad of issues; to have a common conversation - and one on common ground, rather than one splintered through disciplinary lenses.

Contributions to success: it included an evaluation of some of the prevailing policy ideas and demonstrated how futures work could be used to test policy, producing a set of policy prescriptions for policy-making in areas of uncertainty.

Presenting the scenarios: each scenario was presented in overview, as a vivid coloured sketch, and as an evocative 'pen portrait' – in addition to several pages of cross comparison on specific indicators. Since publication, various individual academic experts have used the scenarios; uncertain how widely the output has been used.

Time horizons: the time horizon was fifty years, and the process used a 'three horizons" framework to structure long-term thinking about the evolution of, and competition among, waves of change – that worked well given the infrastructure issues the project was considering.

Unexpected outcomes: in terms of the scenarios, there were some perfectly viable scenarios that involved fossil fuel - though used more carefully over a long period of time – one doesn't see that possible future surfacing much in the energy literature

(either pro or con). Second, using wind-tunnelling against the scenarios to test policy robustness was surprisingly effective. Rather than asking how policy works across all the scenarios, ask instead how does the policy warp each scenario (change the narrative) to bend it closer to the desired outcome?

Key advice:

- **As long as you know why you are stretching or breaking the 'rules' of scenarios, the process is remarkably fungible.** The one unbreakable rule? Do not discard a scenario because "you don't like it."
- **Caution: scenarios widely used may be widely utilised because they have over-simplified or over-aggregated concepts on axes,** resulting in stories too generic to be useful, for example, kill off "open vs. closed" as a social or economic axis.
- **Once specific issues are "collapsed" to create an axis, and renamed, you lose the nuance for future readers and over-simplify in ways that may be inaccurate** (this is also a compelling case for accurate and complete recording of group discussions in exploring potential axes).
- **Be faithful to your material:** both the evidence base of the trends and drivers, and the evidence base of the discussion.

10. Carnegie Civil Society 2025

Objective(s): to gauge how stakeholders prioritised drivers of change and how they thought they might play out, relative to civil society – it was a kind of scoping project; to build an agreed evidence base for deciding the key issues to focus in on as part of a wider Commission of Enquiry; to engage people across the five jurisdictions (England, Scotland, Wales, Northern Ireland, and the Republic of Ireland).

Contributions to success: in the context of a futures workshop participants are liberated from the 'day-to-day'; they are able to look forward strategically and think about issues without being clouded by the present. The Commission specifically chose Causal Layered Analysis (CLA) as the scenario method as it felt the 'axes of uncertainty' approach was less suited to a fluid political and social context. This was risky, as we were using a new method with large groups of people without having used it before. While that unfamiliarity did not affect the output very much, it perhaps rendered the workshop experience uneven. But the risk bore fruit, as CLA did produce insights based on cross-cultural perspectives that might not have arisen with more conventional approaches. The use of metaphors and images in the warm-up exercise also helped bridge cultural and disciplinary boundaries.

Presenting the scenarios: the drivers report and scenarios helped to show how the inquiry had arrived at the four key themes and to inform a wider group of stakeholders what the key issues were for civil society going forward. Carnegie also developed supplementary materials to help organisations plan a workshop around the scenarios so they could tailor the scenarios to their organisation and / or sector.

Time horizons: the twenty-year time horizon was appropriate for civil organisations and their evolution: it has to be far enough in the future to remove the inclination to relate present daily issues to futures thinking – but too far and becomes a bit abstract. What helped was a warm-up exercise to identify major changes over the past twenty years to remind people of the kinds of change and scope of change that can happen in two decades.

Unexpected outcomes: distinct, diverse voices were heard much more clearly: a real richness in the conversation was produced by the diversity of voices coupled with a method that emphasised them. The effectiveness of images as warm-up and as

illustrations: using pictures to stimulate metaphors and drawing pictures of the metaphors that arose during discussion proved very successful. A number of organisations picked up the output with whom we previously had had no contact: the Swedish trade union movement; a theatre company in Bristol; the NUS. All of them approached us to help them design their own scenarios process – these were not core stakeholders for Carnegie.

Key advice:

- **The futures toolkit contains more scenario methods than the 'axes of uncertainty' 2x2 matrix:** understand what the different methods deliver, and why.
- **Keep the processes for participants simple and understandable:** the workshops worked best when participants not only understand the task in front of them, but also understood how it fitted into the wider process.
- **Make the workshop sessions as enjoyable as possible:** it can be fun, and that atmosphere allows for more creative thinking. One warm-up exercise we used started with hundreds of postcards spread out over a table and asked participants to choose one that best represented their idea of civil society. Images really help: they add a whole additional layer of depth.
- **Provide enough time and space for ideas to be developed properly:** the sessions need to be long enough to explore the issues and drivers in some depth and to hear a range of voices; focus on the tensions and differences of opinion, for these indicate that a driver is uncertain – and exploration of the future is more fruitful when you focus on the uncertain drivers.

11. Health and Safety 2017

Objective(s): to consider how a variety of emerging changes and their impacts – for example, innovations in input devices, in energy generation, in obesity, in human performance enhancement, etc. – might affect work or the work environment, and to help consider them in a wider world context. HSE wanted a sounding board for ideas: if you are looking at a change in policy, you could consider how that might play out in the future, and test how robust the policy or strategy is. The scenarios also helped put Health & Safety into the policy agenda as an important driver: to raise issues, stimulate debate, and get people talking.

Contributions to success: the 'interesting people' interviews using the '7 questions' technique were critical in gaining access to people and engaging them and their networks in support of the project. The biggest challenge was in choosing truly relevant and strategic axes to create the scenarios: a combination of discipline and a certain element of serendipity helps.

Presenting the scenarios: first, having someone really skilled to write a clear, succinct scenario set was invaluable – the scenarios must walk a tightrope between realistic, sensational, or dull, and offer something energising and inspiring. Then articles in in-house journals and in other organisations' journals helped share insights and encourage others in futures thinking, and also encouraged further requests for specific research commissions, for example, looking at how nanotechnology might develop vis-à-vis Health & Safety.

Time horizons: we considered how change could occur over the next ten years (published in 2007; time horizon to 2017); we felt that this pushed thinking far enough out without being open to speculation. You should have a clear rationale for setting your time horizon: it will differ according to topic or industry. Much is going on, for example, in energy and informatics, with a big impact on Health & Safety. Things do happen quickly, so that time span can potentially reflect a lot of change.

Unexpected outcomes: the scenarios were very well reviewed initially, but then one senior executive decided that it was not worth looking at the future for a couple of years, and that mindset was not susceptible to logic. It was an unexpected challenge in an otherwise supportive environment. It's important to get all senior decision-makers on board with your initiative, but that can be difficult when opinions change and you have limited access. The rising conviction about the importance of futures thinking among others helped offset this one mindset.

Key advice:

- **It's important to engage widely – you need representatives from external stakeholders as well as internal stakeholders:** in this, Foresight's FAN Club was a tremendous help in securing acceptance externally, as was the support of their chief executive internally.
- **Consider your audience carefully:** at one of their events someone stood up to say that the people present were the wrong people (for example, white, educated, middle-aged) to judge the changes depicted and their impacts. The speaker suggested that they really needed to engage with younger people who know and understand new technologies and new ways of working, because however hard the participants tried, their reference points differed from the next generation.
- **Suspend reality / disbelief whilst you are developing scenarios:** using scenarios helps you to understand that 'any policy can be made to work' into the future.

13. CIPFA 2030

Objective(s): to help CIPFA (Chartered Institute for Public Finance Accountants) think about the changes in the public sector – they were concerned that major changes were occurring that would catch the sector by surprise, and wished to explore them with a consortium of related organisations: CIPFA, ICAEW, TUC, National Housing Federation, Housing Corporation, Learning and Skills Council, and Local Government Analysis and Research.

Contributions to success: as with most consortium projects, it was underfunded, so we recycled the Foresight 2020 scenarios – obviously a win in project budget savings. But it was also a win because we could point out that the scenarios had previously been used by many different government departments – it takes a lot of the "what are these scenarios anyway?" off the table, because they've been previously found to be useful. They are also perceived as effectively neutral, with no specific stakeholder agenda.

Presenting the scenarios: the Foresight 2020 scenarios have a simple scenario framework amenable to neat summary and characterization to which people can relate easily. We further tailored them to each sponsor's interests, for example, what did it look like in the housing market, or in learning and skills. We worked with the consortium members separately to ask "what are the implications for this sector?", and then held a joint conference and report launch by CIPFA. The report is available on both the CIPFA and SAMI Consulting websites, and is used at the National School of Government in the strategy seminars.

Time horizons: the sponsors were surprised by the insights gained in thinking about the long-term for activities in the short-term. We were flexible about the time framing – the Foresight 2020 scenarios aren't anchored to specific technological innovations or events, but to attitudes, so they have a great deal of give – could easily be 2030 scenarios. They involve good questions about people's attitudes and Britain's relationship with the rest of the world: almost timeless questions, but valuable.

Unexpected outcomes: all the sponsors were from the public sector, and they all instinctively thought that the Netherlands provided a really nice example model, where they wanted to be: it was a gut response. In contrast, they didn't like the USA as a model. But the more they worked with the project, and worked through it, the more they realised that the Netherlands model has so many layers of bureaucracy, where they felt that the [American] free market model allowed for quicker and more transparent decision-making.

Key advice:

- **Regard a scenario project like any other project:** where do you want to get? when do you want to get there? who should be involved?
- **Have a look at existing scenarios, and quite seriously consider using them instead of starting from scratch and drafting your own:** it saves time, money, and a lot of grief (in terms of people questioning who thought the scenarios up), and gets you much more quickly to the key point, which is exploring and questioning the decisions for the organisation.
- **It is quite possible to do quick and dirty scenarios that have a big impact on people's thinking, exploring, and strategy:** go straight from brainstorming big issues, to exploring scenarios around them, in half an hour. Don't be too wedded to a large-scale scenarios process: it's a tool that you can revise to fit different scales. It's the mental model that is important and useful – something you can share with someone else and use as a basis of discussion.

15. European EA Prelude 2050

Objective(s): creating scenarios as a tool for strategic conversations, to get away from a purely numbers focus; capacity-building within the European Environmental Agency, within the team, with colleagues, and in the wider network of academics and external stakeholders; encouraging others as agents of change in their own worlds, seeking to change mindsets, and thinking about things in new ways. Officially, to consider possible futures for the environment, land use, and biodiversity in Europe.

Contributions to success: created understanding and in-house acceptance among colleagues, stakeholders (for example, individuals from government, business, bankers), and developed an expert group; provide and secure ownership in those involved – people who facilitated the process, who provided the funding, created the political context, etc. – emphasise that the scenarios are theirs, ie, that they are staff/stakeholder scenarios, not the EEA's.

This project galvanised a lot of conversations, for example, with the EEA Board, Brussels, NGOs, Friends of Europe – and stimulated change. It also developed a wide network (EEA has a reference centre in each country) for each of the issues. Individuals and organisations involved in the EEA's scenario process have in turn used their insights and experience to develop their own scenarios.

Presenting the scenarios: Prelude used a story and simulation approach that was expert driven. We did much to ensure the story narrative was kept central, but would have preferred less precision, for example, wanted the maps drawn by hand so as not to be so precise – we battled against the desire for precision, which is not actually what you want. In addition, five scenarios is a high number of scenarios to handle and communicate - if there had been more time and resources, it would have been spent working with stakeholders to eventually have less with some branching points. There would also have been more discussion of their potential strategic implications. Further work would also have been undertaken of an EEA version of PRELUDE.

Time horizons: Prelude was published in 2005 with a time horizon out to 2030/2035 – we did not want to model the next fifty years set in stone. Half a century is a good time frame for looking back and looking forwards, and we were advised to look beyond 25/30 years – a generation – in looking to the future.

Unexpected outcomes: the prizes and awards (and the envy); the number of published articles and papers produced in relation to this work; presentation of *Prelude* at a very high level: *Prelude* output was requested for use at the first ever informal Council between Agriculture and the Environment when the UK held the EU Presidency.

Key advice:

- **Good scenarios are those where insights have been derived from stakeholders with whom we are not normally engaged:** new perspectives generate new insights, so you need a completely different mix of people to participate.
- **Give ownership to others, including the stakeholders:** empower stakeholders and participants, for example, by asking them to write the first draft of the scenarios at a workshop.
- **Do not impose ideas or lock in messages or process: do get excellent process facilitation.**
- **Design in enough time at the outset,** ensuring sufficient time and space is given for ideas to be developed properly, relationships to be forged with others (including within the project team), and potential strategic implications of your scenarios to be considered.
- **Generate a genuinely creative atmosphere** before you actually start the work and the exercises.
- **Identify your main purpose clearly:** include the decision mechanisms, the time, budget, geographical scale, etc: be more interested in the process than the product.
- **It generally becomes more difficult to handle and communicate scenarios as their number increases:** consider having fewer with more branching points.

16. UK EA Environment 2030

Objective(s): to improve an early scenarios set that was not sufficiently focused on drivers of environmental change or detailed in their description of environmental consequences, and thus not suited for use across a wide range of environmental management issues; to develop an in-depth scenarios planning exercise across the organisation that would develop more robust strategies considering possible futures, especially of water and waste industry outcomes.

Contributions to success: wide support from across the organisation and also from Defra during the scenarios development; availability of funding to hire expert scenario facilitators; early engagement of high-level decision-makers: it's key to get the 'big fish' to these workshops to get their judgment on the pressures for the natural environment; subsequent workshops with sectoral experts and decision-makers further elaborated the scenarios and applied them to develop and analyse strategic risks and management options. Their success can also be attributed to a champion who understood the scenarios and their use in policy formulation and wind-tunnelling, and who wanted to apply them as a resource.

Presenting the scenarios: the team used stories to bring the four scenarios to life. While a detailed report exists, it is the stories that seem to be used initially, as they provide a way into scenario planning without putting users off with lots to read. Most

importantly, they also contain indicators of environmental pressures and consequences, with each scenario specifying values for each indicator that were based on consensus expert judgement. They have been used in external and internal workshops to evaluate strategies, and consequently EA's strategic options are much wider than before and they have produced new innovative strategies.

Time horizons: the original timeline was linked to policy mandates to produce sustainability strategies to 2030. The recent update to 2050 was more sensible, given the extent of infrastructure necessary for water.

Unexpected outcomes: this work contributed more to the organisation than originally anticipated, giving a much richer analyses of the future and how it could impact the business.

Key advice:

- **Factor in time to build support for the work:** to find funding and most importantly people who will take part in it – of whom, the most important is a champion who understands the work and how you use it.
- **Generate quantitative estimates (ie, indicators or future benchmarks) of what the future may be like (for example, population, water demand). These should represent drivers of environmental change or possibly the impacts of those drivers, and should be relevant to today's strategic choices.** This helps the adoption of scenarios across the business, making them more usable by providing the information users needed to help them plan for the future.
- **Communicate the scenarios clearly and have a simple approach to do that:** the agency can now do more sophisticated work with these scenarios because they understand them so clearly, and have built them up over time with potential population statistics, variations in water use, etc.
- **Continue to build your base knowledge community:** continually add new expertise every time you use the scenarios as a basis for discussion – when new people arrive at quite senior levels, the organisational culture expects that they will seriously engage with this body of work.
- **Consider upgrading existing scenarios rather than completely renovating:** persistence is valuable and creates extended engagement.

17. DIUS IIS 2055

Objective(s): aside from the general goal of visualising possibilities, to introduce systemic thinking into the notion of transport infrastructure (Tony Hodgson did the systems work); to explore the consequences of emerging technology via a timeline of emergence and deployment; and to answer the question: how do we use emerging technologies well?

Contributions to success: the cross-fertilisation of different tools and techniques was particularly valuable in terms of the insights produced. That was possible because the people running the project already had a lot of futures expertise (Miles Yarrington, Andrew Jackson, Claire Craig): they were extremely well-informed clients, and that showed in their confidence and risk-taking.

There was a lot of argument about the scenarios at first, especially 'Tribal Trading' – initially people were quite negative about it, despite its having emerged from a robust analysis of trends and drivers. But then Hurricane Katrina hit New Orleans, illustrating how simple it might be for Tribal Trading to occur. The Director had asked for one quite negative scenario to alert people to the dangers of not acting, and this set of scenarios may be useful precisely because it contains an overshoot-and-collapse scenario.

Presenting the scenarios: the pastel diagrams that convey the essence of the scenarios pack quite a lot of key ideas into a visual; the 'day in the life' vignettes are also quite engaging. But they might benefit from even more effort into the presentational aspects of the scenarios. However, they were quite successful in the follow-up with the Department for Transport: the Chief Scientist wanted to know how to use the scenarios within DfT and a scenarios handbook was produced for them to use in-house. Eighteen months after the project was completed, DfT was still working with the scenarios, and wanted them updated, combined with the transport model, and simplified slightly.

Time horizons: the long time horizon worked very well, especially broken down into three segments via the 'three horizons' framework, which eases people out into the future as technologies evolved and obsolesced. 'Three horizons' broke each scenario down into three segments, almost creating twelve different scenarios: you can pull the segments out and play with them separately.

Unexpected outcomes: the combination of technologies and the potential that could create intelligence within the system; the systems thinking / systems analysis was quite ground-breaking, and Tony's visualization of it quite engaging; and the project's de-coupling of transport and economic growth, which flies in the face of conventional wisdom. The scenarios started to play with that de-coupling notion, and allowed a difficult conversation to take place.

Key advice:

- **Be absolutely clear what you want the futures work to deliver:** policy recommendations? or systemic thinking amongst your client group?
- **Do everything you can to bring together people with different perspectives in the problem,** because that's where you get genuine insights IF you can enable them to bridge perspectives and communicate with each other.
- **Keep all parts of the process as transparent as possible to participants:** if any part of the process is accomplished *in camera*, it may be perceived as a *fait accompli* or an executive fiat by participants, and they will rebel.
- **Don't worry if the scenarios need to highlight unpalatable messages:** that's what they're for. *Corollary*: **don't be frightened of your material:** it is telling you something. You must be honest with it.

Summary: Common Themes

Please see section 4.2 in the main body of the report for the concluding summary of common themes from the "Lessons Learnt" interviews.

Appendix 5 Timeline exploration

Overview

How can we leverage change in the direction we want? Where will opportunities arise to do that? Scenario explorations help to challenge assumptions of 'life as usual', but are most useful when they offer ideas for concrete strategy formulation to further policy. Looking for potential leverage points among emerging changes is one way to use horizon scanning data in conjunction with scenarios. Where do the patterns of change suggested by the various ScENE scenarios match up with actual changes we observe emerging? How might we use that conjunction to further policy goals? This annex resulted from an experiment in connecting the ScENE scenarios to an emerging issues timeline.

Figure A Timeline process: layering and comparing scenario timelines

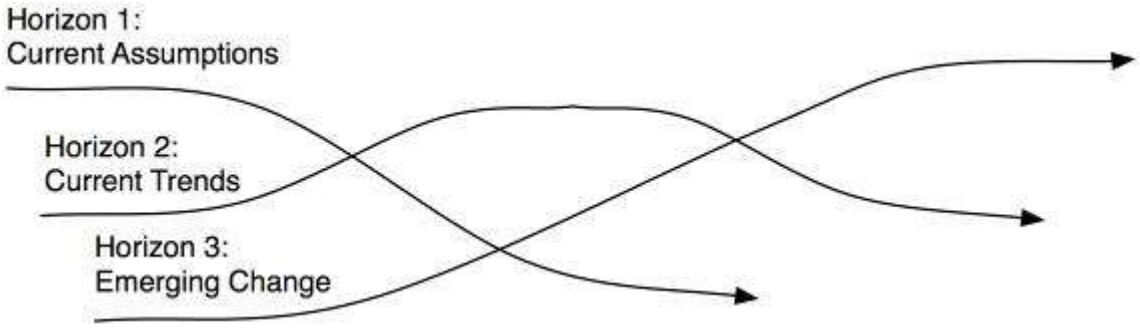


Figure A illustrates the basic 'three horizons framework' for thinking through change over extended periods. Each of the ScENE scenarios has different relations with current working assumptions, and evolves from slightly different patterns of current trends and emerging issues of change. The following pages offer an initial attempt to connect critical points within each scenario to a baseline map of emerging trends for the next fifty years. Those emerging trends derive from horizon scanning research contributed by Infinite Futures that incorporates scanning data from a variety of sources including the UK Foresight Horizon Scanning Centre.

Baseline potential for change: emerging issues

The following two pages display potential emerging issues with regard to values, paradigms, economic systems, and innovations. The individual issues have been clustered thematically against a timeline. As an illustrative baseline the list is indicative, not exhaustive, focusing primarily on paradigm shifts and innovations. The issues are presented as a mosaic of tiles parsed out over the timeline according to analysts' suggestions of when the changes might occur. Please note these are not forecasts, but expressions of potential based on current evidence; the dates are approximations only.

Figure B Emerging issues clustered by themes and arranged by forecast emergence date [Culture, Values, Generations; Science and Technology Innovation; Economy; Food and Agriculture]

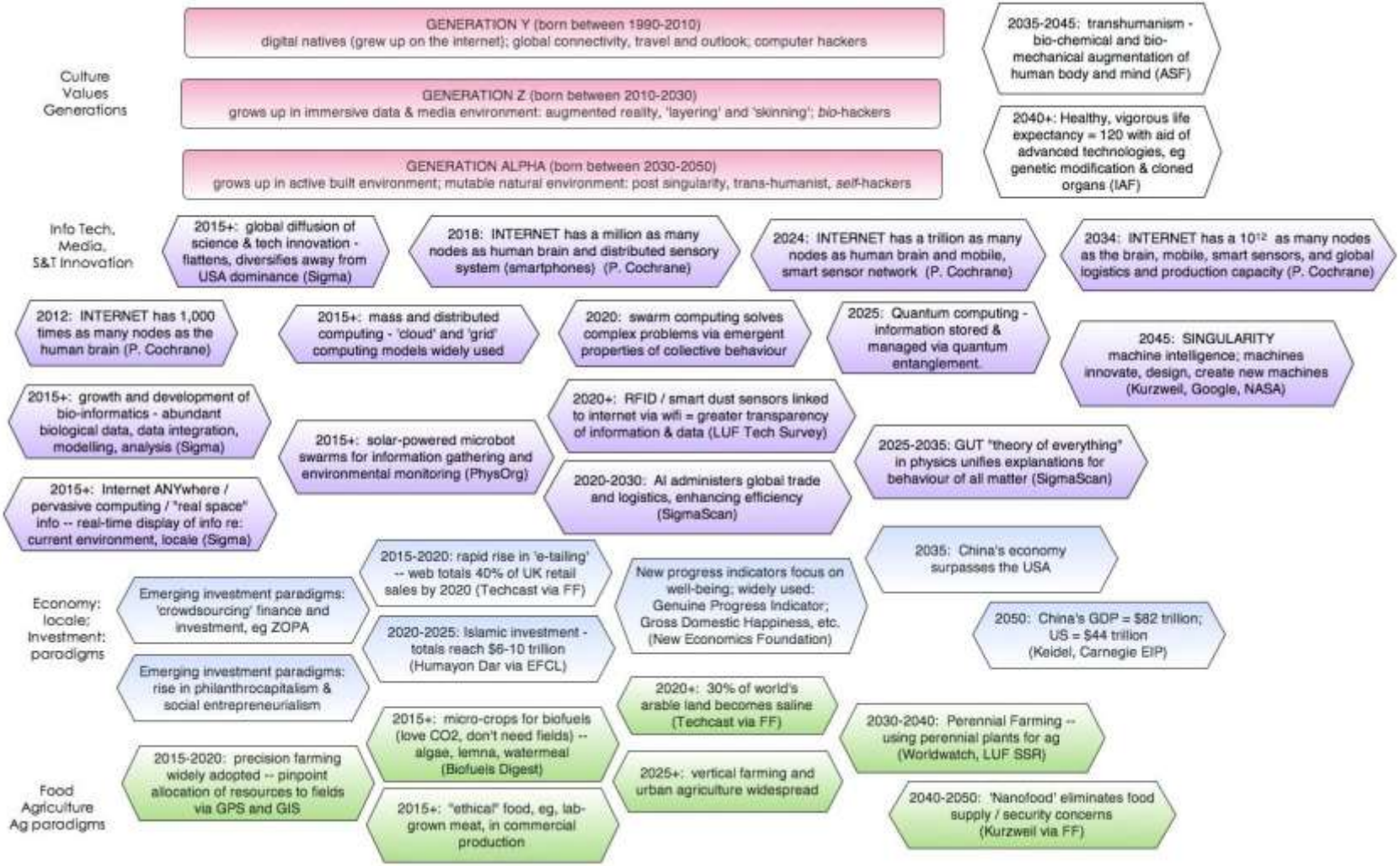
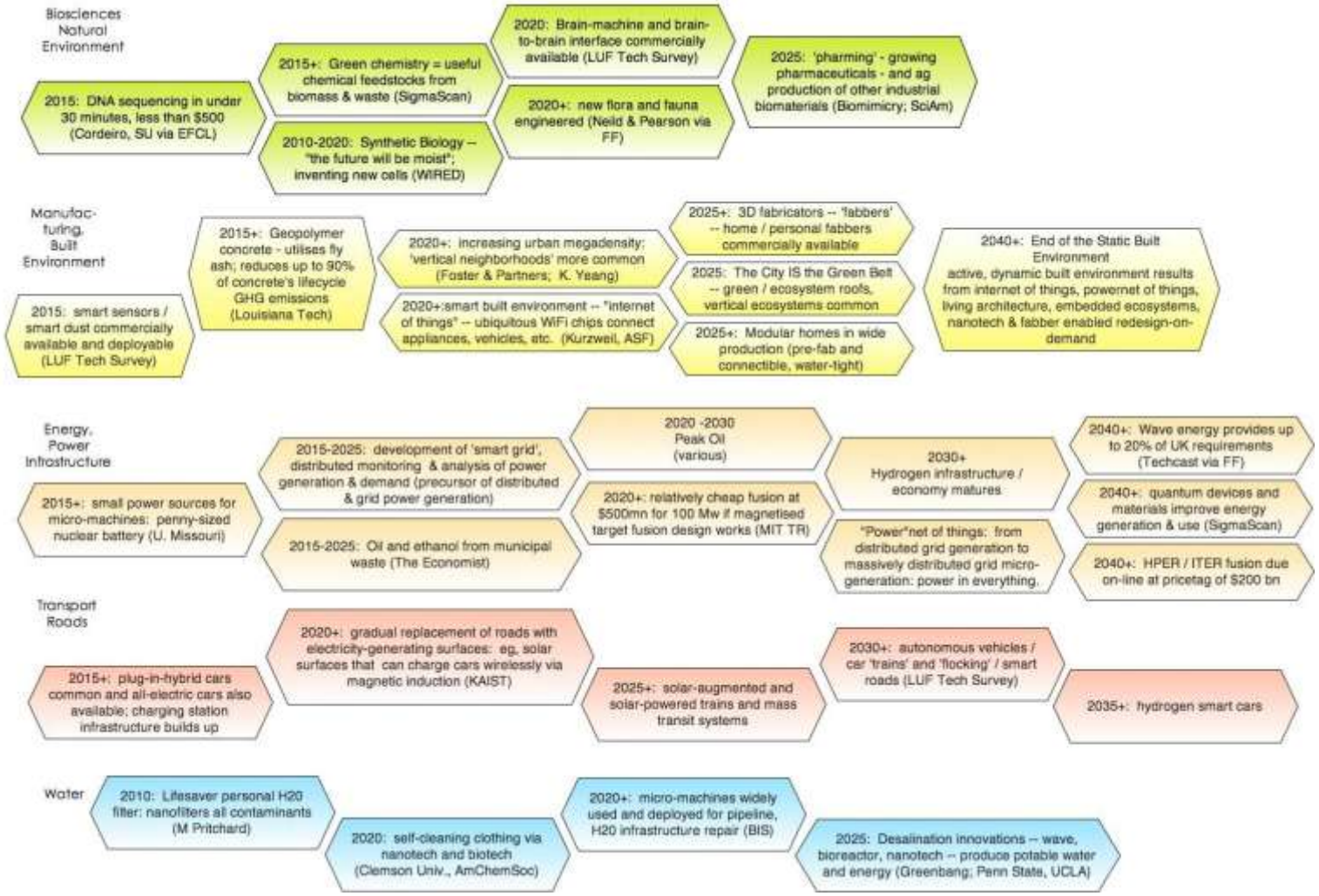


Figure C Emerging issues clustered by themes and arranged by forecast emergence date [Bioscience, Natural Environment; Manufacturing, Built Environment; Energy; Transport; Water]



This ‘baseline’ timeline depicts a few over-arching stories about patterns of potential change:

- *Generational shifts in worldview*: over the next fifty years three successive generations will take their turn as primary movers and shakers – Gen Y (born between 1990 and 2010), Gen Z (born between 2010 and 2030), and Gen Alpha (born between 2030 and 2050) – and each may expand upon its predecessor’s assumptions of what is possible, from hacking software to hacking biology to hacking self and the planet.
- *Scientific paradigm shifts*: systems science matured in the latter half of the 20th century and over the course of the 21st will embed itself as deeply in the global worldview as the Newtonian reductionism that preceded it (which in the usual pattern of scientific advance will be subsumed, not dismissed) and drove scientific inquiry with a strategy of isolating elements from the whole to study them. Chaos and complexity theories may be commonly applied not just to understanding systems but also to designing them – and to educating people about them: the 20th century’s calls for increasing multidisciplinarity and transdisciplinarity in academia, research, governance, and other organisations may finally be met.
- *Economic paradigm shifts*: uncertainties are rife regarding the future of global economic systems:
    - the form they will take post-recession;
    - their geographic shift East and South towards India, China, and Brazil; and
    - even underlying values and paradigms: the end of materialist consumerism? shifting notions of investment (crowdsourcing, microfinancing, Islamic investment), ownership (individual, community, open source), and wealth (for example, gross domestic happiness)?
- *Technological generations*: technological generations turn over faster than human generations do, and by the 2030s the Internet may not only have trillions upon trillions upon trillions as many nodes as the human brain has synapses, but also a mobile, smart sensor network, and global logistics and production capacity. This brings Kurzweil’s notion of the technological ‘singularity’ (see **http://www.singularity.com/**) – the age when intelligent machines redesign themselves and help people transcend our biological limitations – much closer to a possibility. It also implies an increasingly intelligent, interactive, and adaptive (ie, self-managing) built environment.
- *Blurring boundaries:* the intersection of these changes may increasingly blur boundaries, for example, as multidisciplinarity blurs boundaries in academia and research; as the biomimicry paradigm blurs boundaries between nanotechnology and synthetic biology, and between the living and built environments; as changes in architecture, planning, and agriculture blur the boundaries between the urban and the rural (for example, vertical farms and vertical ecologies); and as changes in materials science and engineering blur the boundaries between structures and devices that consume energy and structures and devices that generate it.
- *Increasing constraints*: system limits will increasingly create a context of constraints and crises, ie, Beddington’s “perfect storm,” as growing populations stress ecosystem services generally and water and energy resources in particular, and climate changes amplify those stresses.

Each of these over-arching stories includes significant uncertainties, not just in terms of the extent to which they will emerge, and how fast, but also where and who their impacts will hit hardest, and what tensions and conflicts they might generate as well as opportunities.

Exploring ScENE scenario timelines against the baseline

A small group of Natural England staff met on 2 March 2010 for a facilitated discussion exploring the connections between the ScENE scenarios and the emerging issues baseline. In the process of completing the ScENE project, Natural England staff had added detail to the scenarios, including simple timelines suggesting key events critical to the evolution of each scenario. These timelines and the scanning baseline provided a foundation for the facilitated discussion. The aim was to connect the scenarios with the scanning and identify points of potential leverage for policy and action in the coming years.

Participants considered the scenario stories and related timelines one by one, pointing out where they intersected with the baseline. The following summarises the main points of the discussion. Emerging issues are specified first in italics, followed by the specific case for that scenario. Emerging issues that connect to more than one scenario are in bold, with the related scenarios identified by initials in parentheses. General comments are in plain type.

Go for Growth

- **“ethical” food (for example, lab-grown meat) in commercial production and micro-crops for bio-fuels and ‘pharming’: further industrialisation of farming as economy emerges from credit crunch [GfG, StS]**
- gradual replacement of roads with energy-generating surfaces and autonomous vehicles that can self-coordinate to form ’car trains’ or move together in ‘flocking’ behaviour in communication with ‘smart roads’: government acts on its 2020 pledge to double road capacity
- ***global diffusion of innovation* (it flattens, moves away from the USA): as a result, by 2042 I.U. wins a Nobel [GfG, CfL]**
- *personal 3D fabricators (‘fabbers’) commercially available*: anything that heightens productivity is popular: ‘sweat your assets’
- *China’s economy surpasses the USA*: do the ‘assets’ being sweated for highest productivity become part-owned by a new investor mix?
- ***water shortages*: in a context of global water shortages, the UK still holds a comparative advantage (for a while) [GfG, KIL]**
- ***micro-machines widely used and deployed for pipeline and water infrastructure repair*: retrofitting old buildings and repairing national water grid for precision water allocation [StS, GfG]**
- ***geo-hacking*: engineering global-scale responses to adapt to climate change rather than ameliorate it [GfG, StS]**

Keep It Local

- mercantile Britain is still an open system, but more conflictual, and trade is more local to local: this scenario assumes that globalisation is fragmenting and new patterns are emerging
- economic activity is smaller in scale and technology, more protectionist but not completely autonomous from the world markets, because comparative advantage can and does work
- *smart built environment* and *smart sensors / smart dust*: tagging produce is common in order to monitor trade and exports

- ***Desertec on-line (Middle East solar farm)*: European Power Grid takes energy feed from Sahara solar farm [StS, GfG]**
- ***vertical farming and metropolitan agriculture / urban agriculture are widespread*: everyone is responsible for some food production, and small gardens and allotments are everywhere – even in the cities [KIL, CfL]**
- *synthetic biology (inventing new cells, new proteins):* local genetic design (either via local genetically engineered organisms, or through artisan heritage species breeding) a source of economic strength; a current example comes from Kenya's banana farms, which feature local virus-free clones that are outside Monsanto's control
- ***"powernet of things" local micro-generation* and *quantum devices improve energy generation*: communities want to preserve their local energy autonomy and establish control BY building in their back yards [KIL, StS, CfL]**
- ***water shortages*: in the UK, the north flogs water to the south [KIL, GfG]**

Succeed through Science

- *precision farming widely adopted*: investment in new approaches to save resources and render productivity more efficient and durable
- increasing urban 'megadensity' and the city IS the green belt: increasing creation of the zero-carbon built environment
- **"ethical" food (for example, lab-grown meat) in commercial production and micro-crops for bio-fuels and 'pharming': industrial technology for food production [GfG, StS]**
- **Desertec on-line (Middle East solar farm): UN Forum for Ecological Innovation supports use of Sahara as a power farm [StS, GfG]**
- **micro-machines widely used and deployed for pipeline and water infrastructure repair: retrofitting old buildings and repairing national water grid for precision water allocation [StS, GfG]**
- *solar-augmented and solar-powered trains and mass transit*: increasing deployment of big infrastructure innovation, especially connected to a global carbon deal
- **modular homes in wide production (pre-fab and connectible, water-tight) and floating, offshore airports, cities: increase in design and deployment of floating buildings and creation of artificial land [StS, CfL]**
- **"powernet of things" local micro-generation and quantum devices improve energy generation: development of nanotech-scale energy generation: massively distributed down to level of individual devices [KIL, StS, CfL]**
- **geo-hacking: carbon capture to ameliorate climate change [GfG, StS]**
- *perennial farming* and *end of the static built environment*: increase in eco-hacking for productivity, for example, Dales eco-tech park
- *wave energy provides up to 20% of UK requirements*: Severn barrage produces energy

Connect for Life

- small-town, open-space living coupled with medium-scale food production infrastructure
- *swarm computing(complex problems solved via emergent collective behaviour)* and *emerging investment paradigms (for example, 'crowdsourcing'):* Business Awards focus on collaboration and innovation
- *Internet anywhere (pervasive computing / "real space" info)*: Net TWO goes live

- ***global diffusion of innovation*** **(it flattens, moves away from the USA): diversity of innovation and experimentation amplified by open source connectivity [GfG, CfL]**
- ***vertical farming and metropolitan agriculture / urban agriculture are widespread*****: food skyscrapers are built in London, Birmingham, and Liverpool; urban greening becomes widespread not only for food production, but for heat management – cities are using a mosaic of approaches, seeing diversity and experimentation as enhancing robust adaptability [KIL, CfL]**
- ***"powernet of things" local micro-generation*** **and** ***quantum devices improve energy generation*****: development of nanotech-scale energy generation: massively distributed down to level of individual devices [KIL, StS, CfL]**
- ***modular homes in wide production (pre-fab and connectible, water-tight)*** **and** ***floating, offshore airports, cities*****: Transition Cities Global Virtual Congress says floating buildings and artificial land are the way forward [StS, CfL]**
- green chemistry and "nanofood" eliminates food supply/security concerns: 'risk-free' GMO produce is widely available and consumed

Common intersections

In reviewing these intersections for common nodes, three key sectors emerge – water, food, and energy – and two paradigms – the old mindset of technological fix, and the new model of open-source innovation. The 'technological fix' mindset emerges in suggestions to 'geo-hack' our way out of climate crises, both in *Go for Growth* and in *Succeed through Science*. These suggestions attempt to sidestep the issue of real behavioural or value changes as a solution to climate change induced problems. The new model of open-source, collaborative innovation evolves, albeit in different styles, in both *Go for Growth* and *Connect for Life*.

With regard to water, common intersections occur in terms of its availability – and the comparative advantage that creates in both *Go for Growth* and *Keep It Local* – and also its infrastructural requirements. Both *Go for Growth* and *Succeed through Science* might address retrofitting aging pipelines and water grids by deploying micro-machines to repair old, hard-to-reach infrastructure. In terms of living with floods, two scenarios opt for adaptation as well as flood control: floating, modular homes, airports, and cities might emerge in both *Succeed through Science* and *Connect for Life*.

In addressing food and food production, *Go for Growth* and *Succeed through Science* see the future of food as industrial, with lab-grown meat common commercially. Both *Keep It Local* and *Connect through Life* emphasise instead the ability of even city consumers to grow their own food nearby – or at least see it grown nearby – by developing vertical agriculture and metropolitan agriculture in urban areas.

In producing energy, big infrastructure and transnational projects – for example, the proposed Desertec solar farm in the Sahara – are popular in the context of *Go for Growth* and *Succeed through Science*. In contrast, the micro-scale distributed connectivity of the 'powernet of things' fits better with both the connectivity paradigm of *Connect for Life* and the protectionist 'keep it IN my backyard where I can see who's using it' paradigm of *Keep It Local* – although *Succeed through Science* also appreciates the efficiency and flexibility it provides.

Comparing ScENE scenario timelines with Foresight Land Use Futures scenario timelines

The Land Use Futures scenarios encompass very detailed timelines, describing as they do the evolution of land use patterns over the next five decades. These scenarios, however, take both climate change and technological innovations as given. Thus they address them less as events than they do the political, social, economic, and diplomatic shifts that create their possible worlds of 2060.

Competition Rules

Competition Rules, like ScENE's *Go for Growth*, presents a future defined in large part by institutional and social resistance to change. The concern over how values drive change, and how values might evolve to the benefit or detriment of the environment, is critical to both projects. Where *Go for Growth* depicts a society squeezing every last resource for productivity to delay the crash into system limits, *Competition Rules* depicts the crash. Consequently, like *Go for Growth* it turns to maximized production, particularly in the agricultural sector. Average farm sizes increase and in the end turn decidedly industrial, connecting to emerging issues like industrial meat production, and industrial agriculture producing energy feedstocks and new materials – but unlike *Go for Growth*, in *Competition Rules* domestic fiscal resources never improved, so those agricultural expansions only occur with the benefit of international investors and owners.

Leading the Way

Leading the Way, like ScENE's *Succeed through Science*, presents a future wherein the UK is a world leader in biotechnology and environmental innovation and uses these resources to address many environmental problems. But both scenarios raise the issue of how long 'technological fixes' can stave off increasing pressures on the environment. Like *Succeed through Science*, *Leading the Way* leverages the emerging issues of innovations agriculture, including genetically modified crops and bioenergy crops. Synthetic meat is the UK's top export. Innovative wind, wave, and solar installations are built in the transition to a low-carbon economy.

Valued Service

Valued Service offers a more transformational future in which people recognise the need to ensure economic growth is achieved within environmental limits – this value shift echoes the shift in perspective found in ScENE's *Connect for Life*, with its whole systems perspective. With its "Green Grid" initiative, this scenario echoes the blurring of urban and rural best exemplified in ScENE's *Connect for Life*, which leverages emerging issues like "*vertical farming and metropolitan agriculture / urban agriculture are widespread*: food skyscrapers are built in London, Birmingham, and Liverpool; urban greening becomes widespread not only for food production, but for heat management – cities are using a mosaic of approaches, seeing diversity and experimentation as enhancing robust adaptability". *Valued Service* also intersects with *Connect for Life* in exploring emerging approaches to community ownership and financing, and more decentralised and collaborative approaches to decision-making and management.

Conclusions

The baseline timeline was biased towards science and technology developments for several reasons: they are easier to track and parse into time horizons; they are powerful drivers of change; they are reasonable amenable to policy formulation and regulation (unlike, for example, paradigm shifts and value shifts). At first glance, the participants reflected that the entire baseline looked like an elaborated timeline for the "Succeed

through Science" scenario. Upon further reflection and discussion, points of leverage and connection for all the scenarios emerged, as indicated above: science, technology, and new models for thinking can be levers in any context.

One unexpected outcome for participants was a clearer understanding of the scenario dynamics: how each scenario's outcomes actually evolved. This was particularly true of *Connect for Life*, where increased connectivity had been misidentified as the underlying driver of the profound transformational shift to a systemic worldview and values. Instead, increased connectivity, social media and social networking, and open source approaches to business, research, and even governance are the concrete operationalisations of the paradigm shift to complex adaptive systems theory and chaos theory. These concrete manifestations create a technological milieu that includes hyper-connectivity, open source innovation and production, and an expectation of and reliance on social media and social networking. That milieu in turn influences the expectations, aspirations, and values of the generation that grows up in it.

Participants found the process and discussion useful. Connecting scenario events and characteristics back to a detailed emerging issues scan updated and expanded the original scenario drivers deck. As an ongoing activity, it could provide advanced monitoring of emerging points of leverage for policy and strategy. A complete baseline timeline of emerging change could also be more evenly weighted across the social, economic, political, environmental, and technological arenas: this example was weighted more towards technology and innovation.

In addition, a greater investment in graphic representation and visualization of the baseline and scenario timelines would produce more nuanced output more immediately applicable for policy. That is, it would be useful to start with a more sophisticated graphic roadmap of emerging change, and then layer each scenario's map of connections onto that roadmap, in succession. Such layering would also immediately highlight where decision points *among* scenarios might intersect at a single point of emerging change. A more sophisticated graphic roadmap of emerging change would also allow adding layers of *other* projects' scenario timelines – such as those from Land Use Futures – for comparison.

Footnotes

The data on this emerging issues baseline is drawn from Infinite Futures' in-house scanning database, compiled over the course of a year. It includes, but is not limited to, data drawn from sources such as the UK Foresight Programme's Horizon Scanning Centre's Sigma and Delta scans; Shaping Tomorrow; Trendwatching; and Future Scanner, in addition to individual articles from scientific journals, newspapers, magazines, and research centre websites.

Peter Cochrane, personal communication.

Appendix 6 Glossary of terms

Archetypes: Formally, an archetype is the original pattern or model from which all things of the same kind are copied or on which they are based; a model or first form; a prototype. In futures, the word more often refers to overarching narrative themes or patterns that emerge from clusters of scenarios with similar storylines. In this sense, the model is derived from individual examples, rather than the reverse.

Axes of uncertainty (2x2 matrix): popularised by Peter Schwartz in *The Art of the Long View*, also associated with Shell Oil and the Global Business Network. The core process chooses two highly important but highly uncertain trends or emerging issues as "drivers" of change. These in turn create a 2X2 matrix by expressing each driver as a continuum between two antithetical outcomes. The scenarios are created in the four spaces defined by the opposite ends of the two continua. See also *scenario building*.

Causal Layered Analysis (CLA): a post-structuralist foresight perspective and analytic tool developed by Sohail Inayatullah. For any given issue, CLA creates a four-level analysis: 1) exploring the "litany" – the events, trends, problems, "word on the street," media spin, and official positions; 2) exploring the "causes" – structures, interrelationships, systems, policy and technical analyses, role of the state and interest groups; 3) exploring the "worldview(s)" – culture, values, and how language frames and constrains the issue; and 4) exploring the "myths and metaphors" – collective archetypes, gut level or emotional responses, media and artistic images. The explorations allow the issue to be perceived and forecast with a transformed, and transformational, perspective. The transformed perspectives can also create scenario narratives. See *The Causal Layered Analysis Reader: Theory and Case Studies of an Integrative and Transformative Methodology*, by Sohail Inayatullah (2005, Taipei: Tamkang University Press).
http://www.metafuture.org/Books/causal_layered_analysis_reader.htm See also *scenario building*.

Confirming hit: a scan hit which provides additional evidence that an original scan hit could develop into a full-blown trend (see *scan hit*).

Critical uncertainties: those trends and emerging issues that are perceived as simultaneously highly relevant to the focus question of the scenario process, and also highly uncertain (ie, considered near 50-50 probability).

Dialogue scenario process: an approach used by Sociovision and refined by Joop de Vries that explores potential outcomes of drivers, trends, and emerging issues by means of a facilitated dialogue, resulting in group mapping of potential outcomes and expression of the metaphors and future images which provide organising motifs for clusters of outcomes. See also *scenario building*.

DPSIR Framework: "DPSIR is a general framework for organising information and reporting about state of the environment covering Driving forces, Pressures, State of the environment, Impacts and Responses. The idea of the framework was however originally derived from social studies and only then widely applied internationally, in particular for organising systems of indicators in the context of environment and, later, sustainable development." **http://maps.grida.no/go/graphic/the_dpsir_framework**

Driver: development producing major change; may be an emerging issue, a trend, or a megatrend (see *megatrend*).

Effects: this term loosely encompasses all the linked changes that change itself causes: mapping the effects of change in essence looks not just at the result of the cue ball striking the racked balls, but at the subsequent results of the balls in motion as they rebound off the table walls and each other. As differentiated from ***impacts***: this term, on the other hand, loosely encompasses how all the players involved feel about the effects of the cue ball striking the racked balls. The "impacts" of change are individual evaluations of all the effects of change - and thus vary from person to person.

Ethnographic Futures Framework (EFF): The Ethnographic Futures Framework (EFF), devised by Bowman and Lum, categorises change by how it affects how we *Define* ourselves and our environment, how we *Relate* to others and our environment, how we *Connect* to others and our environment, how we *Create* new goods, services, and knowledge within our environment, and how we *Consume* goods, services, and knowledge – and dispose of it – within our environment. Originally developed as a taxonomy for environmental (horizon) scanning, its use has spread to assessing impacts and framing the internal structures of scenarios and vision statements.

Emerging issue: a source of change -- the first case; the original idea or invention; the watershed event; the social outlier expressing a new value - that is, a sign of change that exists presently in only a few scattered instances, which might multiply into enough data points to constitute a trend. Essentially, an emerging issue is a trend with only one or two cases.

Environmental scanning: see *horizon scanning*.

Foresight: see *futures studies*.

Future present: a term for the time described in images of the future: the present-day of the future any image describes, or the future considered as if we were living in it now, with our present as its past.

Futures studies: a transdisciplinary, systems-science-based approach to analysing patterns of change in the past; identifying trends of change in the present; and extrapolating alternative scenarios of possible outcomes in the future; in order to help people create the future they most desire.

Horizon scanning: the research strategy of reviewing a broad range of information sources across all fields of investigation (STEEP / EPISTLE / PESTLEC) in order to glean data about emerging sources of change; also known as environmental scanning.

Image of the future: an imaginary description (in any format or media) of a possible future outcome for a given item of interest: a person, a community, an organization, nation, society, bioregion, planet, etc. An infinite number of possible images of the future exist. This futures concept is related to the notion in physics of alternate universes.

Manoa (difference / diversity) scenario process: an approach developed at the Hawai'i Research Center for Futures Studies that focuses on creating scenarios depicting medium- to long-term futures (at least one generation out). Three to five emerging issues from different STEEP categories are used to generate potential impacts

and cross-impacts; these details are woven into a narrative depicting a possible future which is maximally diverse from the present. See also *scenario building*.

Megatrend / metatrend: commonly used to indicate a widespread (i.e., more than one country) trend of major impact, composed of subtrends which in themselves are capable of major impacts. More precisely, a cluster of related trends which reinforce each other and together form a 'super-trend', of which the best example is perhaps globalisation: the cluster of related trends in production, infrastructure development and linkage, labour mobility, capital mobility, worldwide IT capabilities, etc., all of which tend to reinforce each other's growth through a complex system of interrelationships allowing feedback and feedforward.

Morphological analysis (FAR (field anomaly relaxation)/futures table): Initially developed by Rhyne (1981) as FAR, and elaborated by Ritchey and others as morphological analysis, this approach to generating futures chooses relevant trends and emerging issues of change, forecasts a range of potential outcome values for each, and then allows the creation of internally consistent scenarios by creating a comparative table which enables checking the potential outcome of each variable against all the others, scoring for contradiction. Scenarios are generated by choosing those clusters of trend outcomes that do not contradict each other. See also *scenario building*.

Paradigm, paradigm shift: a paradigm is a mental model, or a foundation concept. With the publication of Thomas Kuhn's *The Structure of Scientific Revolutions* in 1962, paradigms are understood as the prevailing conceptual model of understanding accepted in science at any given time. Paradigm shifts occur when new discoveries, insights, or innovations challenge the model, providing new evidence that creates new theoretical understandings and new models.

Parameter matrix scenario process: developed at SRI International and documented by Thomas Mandel, this approach assumes four archetypal scenario outcomes – upside, downside, transformational, and wildcard – and creates scenarios by extrapolating possible upside, downside, transformational, and wildcard outcomes for each trend or emerging issue chosen as relevant. See also *scenario building*.

Scan source: a documentable source of information about change; may be published (newsletter, journal, magazine, conference proceedings, book, newspaper); online (website, weblog, e-journal, bulletin board, discussion group); broadcast (TV, radio); or live (focus group, conference, interview, personal conversation), as long as it is documentable.

Scan hit: a datum (fact) providing information about an emerging issue, trend, or driver of change. Ideally, a scan hit identifies an emerging issue that is objectively new even to experts, confirms or is confirmed by additional scan hits, and that has been identified in time for social dialogue, impact assessment, and policy formation.

Scenario: a technical term usually used to describe an image of the future deliberately crafted for planning or foresight purposes. It should be rooted in identifiable trends or emerging issues data extrapolated and organized using an explicit theory of social change. It should describe how changes created the particular future present out of the past, and offer a vivid, provocative, accessible picture of how the future present differs from today. Scenarios are often evaluated in terms of plausibility and probability; they

should contain both opportunities and threats – they are statements of possible future outcomes for purposes of strategic exploration. Scenarios are not predictions.

Scenario Building: the process of combining data about change – trends, drivers, emerging issues, and their potential impacts – into a coherent, logically consistent narrative describing the world at a specified future time. Many different approaches exist, of which the following are a few examples: axes of uncertainty; causal layered analysis (CLA); dialogue; Manoa (difference / diversity); morphological analysis; SRI's parameter matrix; and trilemma analysis.

Seed(s) of change: see *emerging issue*.

Three horizons analysis: this analytic framework considers how newly emergent innovations, values, and paradigms compete for societal dominance over time. It helps explain patterns of long term change in complex social, technological, economic, and political systems. Devised by Bill Sharpe and Anthony Hodgson and refined by Hodgson and Andrew Curry, it was first used in Foresight's Intelligent Infrastructure project. (See also *emerging issue*, *horizon scanning*, and *trend*.)

Trend: a pattern of change over time in some variable of interest. Having trend data for some variable implies multiple instances of that variable. For example, people using Twitter to report civil protests in one country is an event; people in two or three countries using Twitter to report civil protests would call for comparative case studies; fifteen cases of Twitter used to comment on (or organise) civil protests indicates a growing trend. One of the most obvious, and largest trends, is the increase in world population. A potentially even larger trend, but much less obvious -- or even agreed upon -- would be the gradual warming of the Earth's atmosphere. Another is the continuing decline in the cost of microchips and consequently of computers.

Trilemma Triangle scenario process: a scenario building approach devised by the strategic foresight planners in Shell that explores the interplay of three dilemmas: a trilemma – by mapping critical uncertainties onto a triangle. The analysis develops new scenarios not at the apexes but in the areas of the *Trilemma Triangle* that capture the most plausible trade-offs between diverse, complex objectives, namely the "two wins—one loss" areas in which forces combine to achieve more of two objectives. Each of these areas embodies trade-offs acceptable to broader coalitions of actors than in the utopian worlds at the apexes. **http://www-static.shell.com/static/aboutshell/downloads/our_strategy/shell_global_scenarios/exsum_23052005.pdf** (See also scenario building.)

Weak signal: see *emerging issue*.

Wild cards: low probability but high impact changes – like a global plague, or the invention of table-top fusion – usually described as events rather than gradually unfolding changes. NOTE: they may be very positive, very negative, or mixed in effects and impacts.

Variable: a quantifiable subject of study, the value of which can change over time.

Vision: a technical term used to describe an image of the future which articulates an individual's or group's most closely held values, most cherished ideals, and most preferred goals in a positive statement of a preferred future outcome.