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John Turnpenny

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REVIEWING ORGANISATIONAL USE OF SCENARIOS: CASE STUDY - EVALUATING UK ENERGY POLICY OPTIONS

Dr John Turnpenny

Tyndall Centre for Climate Change Research, School of Environmental Sciences, University of East Anglia, Norwich, NR4 7TJ
email: j.turnpenny@uea.ac.uk

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PART 1: BACKGROUND AND AIMS

The challenge

In 2000, the Royal Commission on Environmental Pollution (RCEP) published a major report on the long-term implications of climate change on UK environmental policy. Perhaps the most high-profile of its 87 recommendations is Recommendation 5:

"The Government should now adopt a strategy which puts the UK on a path to reducing carbon dioxide emissions by some 60% from [1997] levels by about 2050. This would be in line with a global agreement based on contraction and convergence which set an upper limit for the carbon dioxide concentration in the atmosphere of some 550 ppmv and a convergence date of 2050".

The report presents four potential combinations of demand and supply relative to 1998 which would achieve this reduction.

In order to assist the government with its response to the RCEP report, an *inter-departmental analysts' group (IAG)* was formed, consisting of representatives from the Department for Environment, Food and Rural Affairs (DEFRA), the Department of Trade and Industry (DTI) and the Performance and Innovation Unit (PIU) in the Cabinet Office (since renamed as the Strategy Unit). The role of the IAG was as a 'technical working group' whose broad aims (DTI, 2001) were to estimate :

a) the scale of emission reduction implied by the RCEP's recommended 60% cut;

b) the options available to fill this gap, and their associated costs. These include renewables such as wind, biomass and photovoltaics, energy efficiency and demand-side improvements, capture and storage of emitted carbon and the potential of nuclear power;

c) implications for policy now if the prospect of meeting such a target at minimum or low cost is to be maintained. This includes identifying barriers to change and policy instruments for implementing the options in (b).

These aims were to be addressed in the light of the key government policies on climate change ("Climate Change: the UK Programme", DETR, 2000). These policies were themselves developed in a wider policy framework which includes sustainable development ("A Better Quality of Life: a Strategy for Sustainable Development for the United Kingdom", DETR, 1999) and the Transport and Energy White Papers (2000 and 1998 respectively). The remit of the IAG was to explicitly concentrate on the 60% target and not to consider the adoption of contraction and convergence as a potential policy route.

The Energy Review – security and sustainability

In addition to the need to reduce greenhouse gas emissions, a vital issue for the UK is *security of energy supply*. Simply put, the mix of fuel types used and the geographical source of these fuels is important since over-reliance on one or two types, especially if these have to be imported, increases the vulnerability of the energy supply.

In this context, a comprehensive review of UK energy policy was announced in June 2001, with the broad aim of forming an energy strategy for the next fifty years. It was coordinated by the PIU, which was created to address issues which cut across government departments and to overcome departmental barriers to integrated policy-making. Energy policy was thus a perfect area for the PIU to address. The Energy Review examined several areas of concern including security of supply and the need to reduce greenhouse gas emissions, and reported in February 2002. The final report is available at: **www.cabinet-office.gov.uk/innovation/2002/energy/summary.shtml**

In addition to its role in responding to the RCEP, the IAG used some of its analysis to form a submission to the Energy Review.

Scenarios

How can the questions above be addressed? For many years, governments, academics and companies have used expert judgement and analysis to develop *scenarios*, or "pictures of potential futures", to act as a basis for strategic planning. Scenarios give plausible estimates of possible future changes in, for example, economic performance, population patterns and climate based on the latest scientific insights, allowing a framework for structured thinking about how the future may unfold. Scenarios are already being used in policy formulation. Examples include the Environment Agency's long-term strategy for water resource management (Morris, 2001), and the UKCIP climate change scenarios (Hulme and Jenkins, 1998; Hulme et al., 2002). The IAG work was informed by the scenarios produced by the Foresight Programme of the OST (Berkhout et al., 1999), which defines four contextual scenarios according to the scheme in Figure 1.

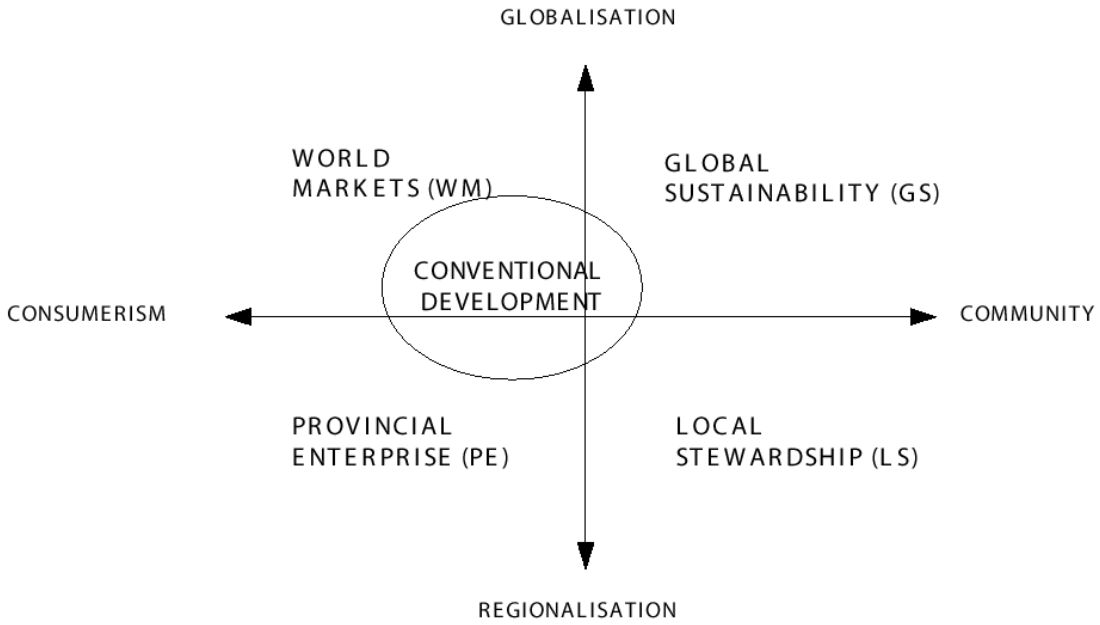

Figure 1: Conceptual scenario framework used by the IAG (Berkhout et al., 1999)

The future is imagined using two different scales: the degree of 'globalisation' and the degree of 'consumerism', with 'regionalisation' and 'community' respectively the opposite ends of each continuum. This classification results in four broad quadrants defining four scenarios:

WORLD MARKETS (WM), a world defined by an emphasis on private consumption and a highly developed and integrated world trading system;

GLOBAL SUSTAINABILITY (GS), a world in which social and ecological values are more pronounced and in which the greater effectiveness of global institutions is manifested through stronger collective action in dealing with environmental problems;

PROVINCIAL ENTERPRISE (PE), a world of private consumption values coupled with a capacity for lower level policy-making systems to assert local, regional and national concerns and priorities;

LOCAL STEWARDSHIP (LS), a world where stronger local and regional governments allow social and ecological values to be demonstrated to a greater degree through the preservation of environments at the local level.

Each scenario quadrant carries a picture of a very different world, with different social, cultural, environmental and economic attitudes, different ways of living and different priorities. By using more detailed elaborations of these futures, the aim was to imagine how energy policy would be carried out, and the likelihood of meeting the 60% reduction target, under each scenario.

The aims of this Working Paper
This paper specifically reports on the use of scenarios by the IAG during the early part of the Energy Review. In July and August 2001, the author was based in the Sustainable Energy Policy (SEP) Division of DEFRA as part of the Whitehall Summer Placement scheme. The remit was to review the IAG's use of scenarios at that time in its contribution to the Energy Review. This included criteria for scenario selection, the types of scenarios used, the interpretation and elaboration process, and the degree of engagement and development of the scenarios. The second aim was to provide recommendations for better use of scenarios in future work, especially in estimating the scope for carbon emission reduction under the different scenarios.

The working paper is *not* intended as a response to the overall PIU Energy Review. It is a 'case study' critique of how a particular group of representatives from different government departments interacted and approached the initial stages of a scenario-use exercise and applied their decisions to a complex real-world situation.

PART 2 – THE REVIEW

2.1 Decisions taken within the IAG

The choice of scenarios
These were chosen for a number of reasons including their direct relevance to the UK, their explicit assessment of likely energy consumption, security, costs, system and technological change and their source as an 'in house' development. It was found that the Foresight axes of "community/consumerism, globalisation/regionalisation" seem fairly robust when compared with several other scenarios with many different framing axes (such as those reported in van Asselt et al., 1998). The Foresight scenarios are also comparable to many other scenarios which widens their scope for application and use. The Foresight scenarios provide descriptions of 'idealised extremes' and represent a wide range of possible futures. They are by no means prescriptive: indeed the future may lie somewhere in between these scenarios, in other words, a 'mix' of various characteristics of the Foresight scenarios.

Methodology
The general approach of the IAG was to address energy use across different sectors of society to explore the potential of various demand-side measures to reduce carbon emissions. A baseline was constructed which represents a 'business-as-usual' (BaU) future where current trends are continued (within limits) without such demand-side measures. Assessment was made of the different features which may occur in each of the four Foresight scenarios (referred to as WM, PE, GS, LS), such as technology, demand for energy, household size and organisational/institutional framework. Hence the 2050 carbon emissions for a range of possible futures was presented. These varied according to the assumed 'behaviour' of key sectors[1] under the different scenarios.

Industry
- Followed the RCEP in dividing industrial energy use into electricity, high grade and low grade heat. Assessed possible demand-side measures and compares the resulting energy use with RCEP Scenario 1 (no demand change from 1998, more renewables/nuclear to achieve 57% carbon emission reduction). The difference was classed as 'demand side saving'.

[1] Analysis of the Services sector had not been completed by DEFRA during the period of this review.

- Sub-sector share of industry varied little with scenario, and total industry carbon emissions in 2050 under LS were found to be only 12% below WM. This was mainly due to a combination of increased growth and higher investment for efficiency (WM) or vice versa (LS).

Transport
- Began with National Road Traffic Forecast for baseline construction based on economic growth, fuel types and road capacities to 2031. The growth 2026 – 2031 was assumed to continue to 2050.
- For each of the scenarios, assumptions were made about demand relative to BaU, incorporating behavioural patterns such as increased environmental awareness, need for travel etc. Assumptions were also made about the penetration and efficiency of engines and these were clearly laid out.
- Rail – some scenarios were assumed to have more reliance on rail/less cars.
- Transport sector carbon-emissions under PE were about three times those under GS and LS.

Domestic
- Estimated energy demand under four scenarios plus BaU
- Approach was that conventional improvements affect energy required per unit energy service provided (e.g. low-energy fridges). However, changes in energy service per household such as changing internal temperature, behaviour such as switching off lights, drawing curtains etc. also feature as these are potentially dependent on different scenarios.
- Assumptions were clearly laid out, including such factors as a lower internal temperature under LS and efficiency of heating appliances.
- Domestic energy use was found to be about double under WM compared with LS.

Coordination
Work following from the above assessed the economics of different demand-side measures to reduce carbon emissions. The aim was to produce approximate energy and carbon balances for 2050 for each scenario across all sectors, and as wide a range of potential futures as possible was considered. This allows consideration of policies which are robust over a wide range of possible futures. To this end, PIU developed 'system infrastructure examples' (e.g. Decentralised, Remote Renewables, Current Trends) which describe different ways of delivering energy in any future world. Initially, carbon emissions and the economics of demand-side measures to reduce these emissions were to be assessed for the baseline scenario.

2.2 Critical analysis of the IAG approach (including feedback from Tyndall colleagues)

It was not clear whether the aim of the IAG was to use scenarios to the full (see *Storyline Interpretation* and *General Comments* below) or to use selected aspects such as GDP and household size without considering any wider societal changes. The full potential of the scenarios is enormous and only a small part of this potential was tapped by concentrating on the quantitative and modelling aspects. However, there were very different views across departments as to which approach was appropriate for this use.

Scenarios
- The Foresight scenarios were intended as a way of getting people to think creatively about the future and abandon existing ways of thinking (F. Berkhout, pers. comm.). They were not intended as a planning tool to provide projections of very specific variables.
- The idea of Foresight was to picture a range of alternatives and then examine policies which would be robust across as wide a range of these futures as possible. For this reason it is important to choose as extreme a set of futures as the imagination allows.
- Hence the scenarios are a starting point to develop details of how a particular sector might respond to each scenario and how the sector might look under each scenario's description.
- The quantitative indicators (e.g. GDP) *illustrate* the storylines rather than the other way round. They are not intended as solid figures to guide investment decisions, for example.

- Inconsistency occurs when individuals decide on assumptions alone. For consistency and balance there is a need to be consultative and transparent. A visual check on the final results together is essential.

Quantification

- The approach of obtaining rough C-balances for 2050 is the right one for policy resilience. There is a precedent in, for example, the IPCC work on quantifying global emissions using descriptive storylines to produce the Special Report on Emissions Scenarios.
- PIU's intention was that numbers are used to get a feel for the scale of the challenge rather than as definite predictions. However, there was a tendency to over-interpret the figures (e.g. specific growth rates in specific years).
- One danger with concentrating on BaU is that it is easier to get more 'precise' (but not accurate) numbers when projecting past trends with the possibility of misuse. Numbers which appear precise will be used as such even if there are 'caveats' attached - especially if they confirm vested interests.
- Mathematical models are useful tools in elaborating the scenario description which should balance and inform the discursive elements. However, there needs to be careful examination of the assumptions and output.
- In general, the quantitative aspects of the scenarios has been emphasised by the IAG while more imaginative thinking about future possible worlds has received little attention.

Storyline interpretation

- Specific figures have been produced from the scenarios without building an intermediate qualitative discussion of what the scenarios might mean. This includes the implications of different Foresight scenarios for lifestyles, changes required in transport use, energy generation and energy use and social indicators such as the acceptability of change. Interpretation of each scenario could be much more radical (e.g. unrest, unemployment insecurity across all scenarios, especially WM and LS) and how these feed back into economic growth/population growth etc.
- There has hence been little idea of how different groups within society will interact – e.g. the impacts of more home working (more likely in some scenarios) on domestic, transport and industrial energy demand.
- There have hence been significant differences in figures between DTI, PIU and DEFRA since there is no consistent interpretation of how each scenario will actually look in the UK. For example, a Local Stewardship scenario could exist with either technology development (for example fuel cell vehicles), or with more of a need to grow food due to lower trade and hence lower technology development (no fuel cell vehicles). The numbers will not agree except by discussion and iteration.

Assumptions in elaborating on the scenarios

- Assumptions were made using expert judgement, with some liaison between PIU and DEFRA on the results relating to each sector.
- Discussion on assumptions about energy demand in the scenarios was missing. It was hoped that the IAG would provide a discussion forum for this. However, there was a sense that each person working on their part of the project was the 'expert' and hence a reluctance to challenge their expertise, and also workloads meant that time to read and digest other peoples' parts was very limited. However, this is an extremely important component of the scenario use process.
- It matters less whether the assumptions are 'right' or 'match' the original scenarios than that there is debate and clarity on all the assumptions made.
- It is necessary to have clear documentation of assumptions and an indication of what process was gone through to reach these.

General comments

- The results of the initial IAG approach to scenario use were a range of forecasts of future energy use assuming little change from current conditions, rather than a range of descriptions

(quantitative and qualitative) of radically different futures. The distinction between scenarios and trends was not made. (In the trend analysis, however, considerations were made of sensible limits such as demand limited by the number of cars that can be driven at once, for example.) This observation is confirmed by one of the concluding paragraphs of the initial IAG working paper, which shows that the future was considered to be today's world with adjustments [highlight mine]:

"a prime consideration must be to create the right framework which will reward the best, most cost-effective technologies and encourage their development. ***This means a policy that is not primarily about picking winners, but which allows the market to provide appropriate incentives.*** *That means using the market to promote the achievement of regulated standards or targets (as with the renewables obligation or the energy efficiency commitment). Given our objective is carbon reduction it means moving towards a structure, whether by emissions trading or a carbon tax, whereby a value is placed on carbon, and with coverage that, subject to the constraints which will inevitably arise from other policy considerations, is a wide as possible."*

- Work is being done within PIU in the Strategic Futures Group 'to make stronger links between work within and outside Government on strategic futures'. There is also futures work in progress in the Science and Technology Policy Division at DTLR under Alan Apling, whose output includes a comprehensive website on using futures in policy-making. However, there was little or no contact between these groups and the work of the IAG.
- There is also a danger in using current tools (e.g. market behaviour) to analyse the 2050 worlds. The resulting output will not be as wide a range of scenarios as is necessary for robust policymaking.
- The range of futures considered may be limited by possible negative public perception of 'the government' considering radical ideas. However, it is more important to be prepared for an uncertain world than to be cautious and conservative.

"The Netherlands in different worlds"

In a similar exercise, the Dutch Ministry of Economic Affairs produced visions for four 'worlds' very similar to the Foresight ones. Their study followed this broad process:

- Initially present the four worlds as possible pictures of 2050 without considering the pathways to reach them.
- Take the global scenarios and interpret them qualitatively for the Netherlands. Important ideas are explored about how the Netherlands would be limited in its action in each of the 'worlds', such as power to impose environmental regulations.
- Assesses potential changes in technology, electricity infrastructure and consumer behaviour in the various worlds. Issues such as the movement of industry abroad, which improves the Netherlands' carbon intensity but may not improve the global picture, may arise from this stage.
- Detailed examination of Dutch energy mix under each world, including the role of biomass, fossil fuel, nuclear, transport and renewables and the relative amount of energy in electricity. These are derived from descriptions of society in each world, not just from projections of economic growth.
- Set out criteria (e.g. security of supply, economic efficiency, sustainability) and test whether these are met in different worlds.
- Clearly set out reasoning leading to assumptions of, for example, economic growth, energy intensity changes under each world, allowing transparency.

Generally, the links between sectors are initially made qualitatively, and a detailed picture of each world is built up before numbers are used to gauge the scales. The resulting worlds therefore have more depth about the implications for the national level *before* individual sectors were analysed.

Recommendations

In the light of the above analysis, the following recommendations about embarking on a scenario exercise were made to, and accepted by, the IAG:

Key recommendations:

- **It is first vital to clarify whether the study aims to use scenarios to the full or should only use selected aspects such as GDP and household size without considering any wider societal changes. There are currently significant inter-departmental differences on this issue. 'Defining the problem' is very important, and this includes understanding inter-departmental culture and language differences early in the process.**
- **If the decision is taken to use scenarios in a more involved way, there would be enormous benefit from building detailed qualitative descriptions for each scenario along similar lines to the Dutch study, especially describing the societal fabric in each case. This will help the scenarios to be used more rigorously and should also ensure fewer disagreements on method and style. More radical views may emerge, giving a wider range of futures and potentially more robust policies for the future. An appropriate forum might be a one-day workshop.**
- **It would make the process far more transparent by having one page for each sector with a summary of assumptions and a sensitivity analysis identifying the most influential assumptions, as has been done by the DTI. Presenting uncertainty ranges on the 2050 carbon emissions is vital, and will make some of the apparent departmental differences disappear.**

Other considerations in future analysis:

- Particular attention should be paid to the impact on analysis of cost-effectiveness of carbon reduction measures in the face of severe potential costs from impacts of climate change.
- In future work on the effects of different abatement measures: make sure that methods used (e.g. cost-supply curves) have had their assumptions carefully examined for robustness over a range of possible futures scenarios; for example, they may not work under LS. Under some scenarios GDP may not be used as an indicator in 2050, or the inclusion of externalities may turn the costs of carbon reductions into savings. Under some scenarios (e.g. LS) society may be willing to pay much more than others (e.g. PE) for environmental improvement.
- Feedback and discussion with outside (i.e. non-governmental) institutions and individuals should continue, to allow transfer of a range of viewpoints.
- There needs to be a more structured forum for discussing qualitative rather than quantitative issues. This could be achieved in part by forging explicit links with PIU's Strategic Futures project and the DTLR's Futures group.
- Clearly state the end use of any scenarios used. For example this could be inter-departmental framing of focus for the next 10-20 or 50 years, or be informing government policy formulation.

Conclusions

The main conclusion from the study of the IAG is that communication is the key issue when embarking on a scenario planning project. This includes a firm initial decision about exactly what the role of scenarios will be in the project. Once this is established, there needs to be an agreed set of principles as to how these scenarios will be interpreted, concentrating less on whether the interpretations are 'right' and more on consistency across the members of the team. It is hoped that the analysis and recommendations outlined here may help other organisations starting out on a scenario exercise.

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