

Should we believe the IEA's scenarios for 2050?

In its report on world strategic energy options for last July's G8 summit in St. Petersburg the International Energy Agency (IEA) used scenarios to describe how energy technologies could develop between now and 2050¹, in support of the G8 Plan of Action (see "Gas demand prospects in the G8's 'clean, clever and competitive future'" *Gas Matters*, September 2006). In this article, Gill Ringland, of SAMI Consulting, considers whether the IEA's scenarios fulfilled the role of exploring qualitatively different futures, or whether they were trapped in the assumptions of the present.

Definitions

One definition of a scenario, that of Harvard's Michael Porter, is: "An internally consistent view of what the future might turn out to be - not a forecast, but one possible future outcome". The real power of scenarios lies not in the quantification of known uncertainty, but in the exploration of possible events. With this in mind, this article puts forward some thoughts on the IEA's scenarios from the perspective of a futurist and strategist rather than an energy expert.

Foresight studies

The evidence of many foresight studies is that a group of experts in a topic finds it hard to anticipate major changes in the rules. When the Japanese Foresight team reviewed 25 years of foresight studies in Japan, they found that the predictions were significantly more accurate if a range of scientists and engineers from neighbouring disciplines were consulted. For instance, a group of chemists was not as successful as a group of chemists, chemical engineers, economists, biologists and mathematicians in predicting developments in chemistry.

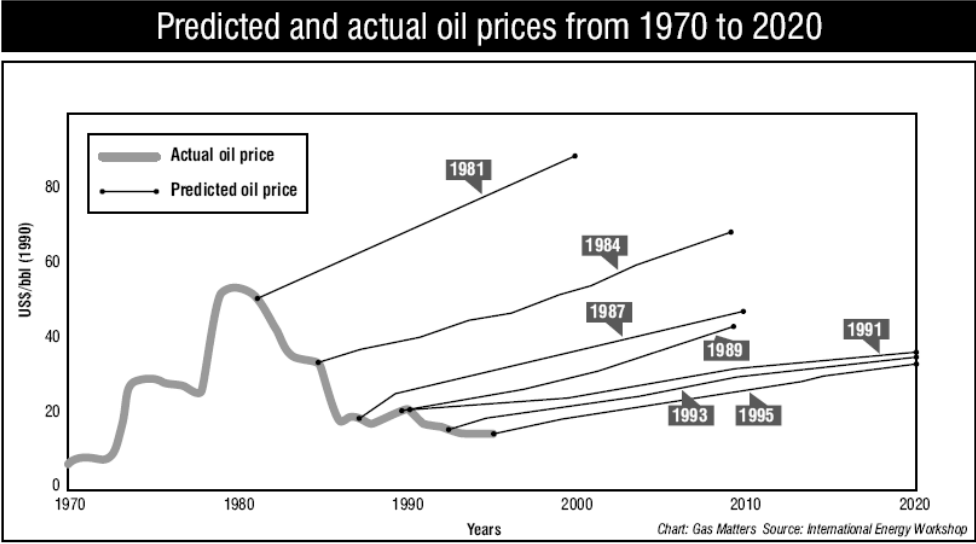
UK energy

Closer to home, a series of scenario planning workshops on "Energy Generation in the UK in 2050" were held – the topic chosen by energy experts, who were focused on the balance between micro-generation, renewables and power stations. But a participant from the National Physical Laboratory pointed out that, by 2050, it was quite possible that the economics of electricity transmission and storage might have changed the variables in the equation, allowing us to rephrase the question as: "How might energy generation for the UK be in 2050?"

More of the same

Scenario thinkers are only too conscious of the famous graph showing the predicted and actual prices of oil over several decades (see chart on page 15), which illustrates the tendency of experts to predict the future as "more of the same," even in a very public, well-researched and competitive market such as oil. The line marked 1981 is the oil price prediction in 1981 for years 1982 to 2000, and so on.

¹Energy Technology Perspectives – Scenarios and Strategies to 2050, IEA, July 2006



Defining events

Furthermore, anticipated trends are likely to be affected by “events dear boy, events,” as Harold Macmillan once famously said. Whether these are natural disasters or man-made, most futurists expect that there will be at least one event causing global changes in attitudes in the next ten years, and certainly within the timescale of the IEA Report.

Changing the rules

Below we consider some ways in which the rules for energy provision might change by 2050. These are intended to provoke discussion rather than be exhaustive or even “right”. They are based on a number of projects looking at longer term futures, and in the expectation that, in this timescale, it is likely that some of the rules will have changed.

India and China

Firstly, will India and China change the rules? India is leapfrogging much of the traditional industrial development route. Will she apply her scientists and engineers to radical solutions for energy provision? Will “village developments” supply power to India’s villages, and if so, what form might that take?

China and S. Korea

Meanwhile, China and South Korea intend to develop a standard replicable nuclear power station design to tackle the pollution from coal-fired power stations. With a standardised approach to building power stations and a controlled economy, could China capture the power station market as Korea did the shipbuilding market? Given the projections of growth in demand from China, based on, for instance, the BRIC (Brazil, Russia, India, China) scenarios², this could radically change the overall picture (see chart on page 17).

Changing balance

Within the time period considered, growth in China and India is expected to have changed the balance of the world economy, with China’s GDP exceeding that of the US in 2045, and India exceeding that of Japan by 2035. Energy usage tracks GDP. In 2000, Asia

²Dreaming with BRICs, the path to 2050, Goldman Sachs Global Economics paper No. 99, October 2003

Pacific, Europe and Eurasia, and North America, had comparable energy consumption. So by 2050, an analysis based – as in the IEA Report – on global trends and occasionally by OECD/non-OECD or developing countries/transition economies/OECD³ may have missed major new trends and culturally different attitudes to energy use.

Technology

Secondly, one of the most important sections in the report is on technology adoption. The report states: “A new energy technology will typically go through several stages to overcome technology”. The relative importance of R&D, demonstration, deployment and competitive stages differs for different technologies, and the report has charts comparing the barriers to new technologies under the headings of technical, cost and other, e.g. regulation. The individual technologies discussed in the IEA Report are very different in their adoption mechanisms. The report discusses power generation from fossil fuels, from renewables, nuclear power, transport, buildings and appliances, and industry, which encourage a focus on existing models of supply. Here it can be argued that the report is too optimistic about take up of new technologies in OECD countries, since for most westerners it is not financially feasible to adopt a new energy technology most of the time.

Solar heating

But consumers are notoriously quick to adopt a technology once it has been found to be useful. The recent report by Britain’s House of Lords on climate change⁴ suggested that solar heating and cooling was a “win-win” technology, since solar panels are ideal components for the application of learning curve pricing. They can be used by a household without government or energy company involvement. They could take off in a similar way to mobile phones, rather than following an industrial diffusion curve reflecting planning concerns as for nuclear power, wind turbines or wave power. This could radically change the patterns of energy sources within a decade, as mobile phones have changed the use and application of telecommunications, catching many of the incumbents by surprise. Are there energy technologies which will obey this type of diffusion model?

Barriers

Thirdly, could some of the barriers to adoption flagged in the IEA report dissolve as public attitudes change? Clearly where more R&D is needed this will remain a cost, but barriers based on assumptions about public attitudes may be less fixed. For instance, Stewart Brand, who has led much US West Coast thinking in the last two decades, has posited that within a decade, attitudes in the OECD countries may be subject to a paradigm shift on

The G8 Plan

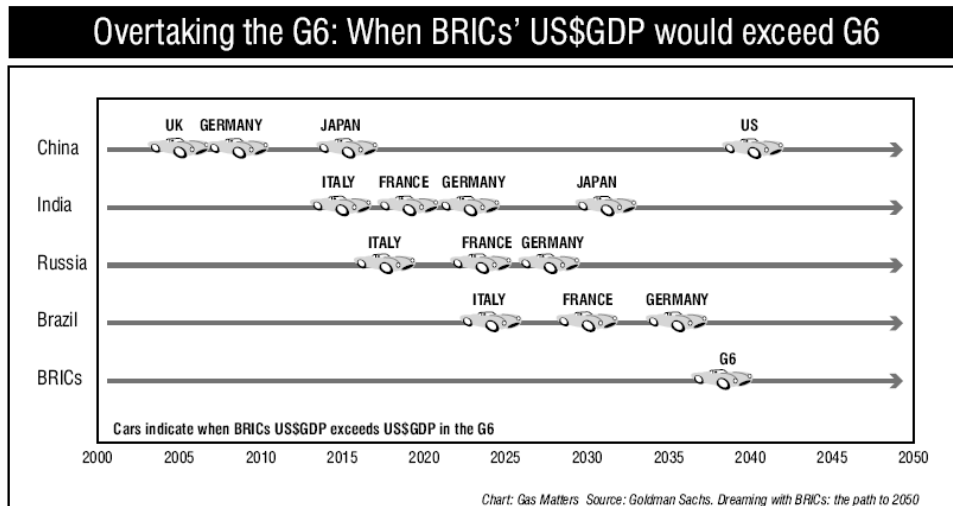
The aim of the G8 Plan is to tackle the serious and long-term challenges of secure and clean energy, climate change, and sustainable development. Using a scenario analysis, the IEA suggests that global CO₂ emissions could be returned to current levels by 2050 and that the growth of demand for gas – more than trebling on current trends – could be nearer to doubling if alternate energy sources are energetically pursued. The agenda of the report is to

encourage governments to pursue alternate and nuclear power generation, to reduce CO₂ emissions.

The scenarios were produced after wide consultation among energy technology experts, from the IEA’s network and the OECD Nuclear Agency, and draw on the IEA’s Committee on Energy Research and Technology. The scenarios are based on the OECD models of world population and economic development.

³Scenario working paper, Challenge Forum. <http://www.chforum.org/scenarios/new/energy1.html>

⁴The Economics of Climate Change, Volume I: Report. House of Lords Select Committee on Economic Affairs. 2nd Report of Session 2005-06.



four major topics – population growth, urbanisation, genetically modified organisms and nuclear power⁵. This could pave the way for higher growth of nuclear power for electricity generation than the 200% growth envisaged in the most bullish (TECH Plus) scenario modelled by the IEA, and for work on bioscience as below.

Bioscience

Fourth, will bioscience allow us to capture more of the sun's energy than current solar panels? Bacteria have been modified to aid in waste disposal – could they change the rules in energy generation, transmission and storage? At a recent meeting of the American Society for Microbiology some new research was presented which suggested this could be possible⁶. According to lead researcher, Derek Lovley: "Microbial fuel cells show promise for conversion of organic wastes and renewable biomass to electricity, but further optimisation is required for most applications." Lovley's caveat is, according to most observers, an understatement, but 50 years is a long time, and the drive for secure energy sources could ensure high priority for R&D in biosciences.

Stern Report

On a more immediate timescale, might the Stern Report⁷ lead to containment exercises by governments which modify the demand for energy by changing people's behaviour? Small changes in behaviour over 40 years have a very large cumulative effect. In fact, the Stern Report suggests that the sacrifice of 1% of global GDP in the short term could head off global warming, which could shrink the global economy by 20% "in our lifetime". As the Financial Times⁸ pointed out, "The real test of the IEA analysis will be whether it

⁵Environmental Heresies, Stewart Brand, Technology Review, May 2005
⁶http://www.biotech-weblog.com/50226711/american_society_for_microbiology_meeting_highlights_energyproducing_bacteria.php
⁷The Economics of Climate Change, The Stern Review, Cambridge University Press, February 2007
⁸Spend now, save later on energy efficiency, Financial Times leader, November 8, 2006

changes behaviour in the big energy users: the US (which belongs to the IEA), but also in China and India (which do not) . . . It is time the world grew serious about energy savings and remembered that the most energy efficient power plant of all is the one that does not get built.” However, there is enormous drag in the building and transport infrastructure in OECD countries, which means that it is hard to see consumers, businesses or governments effecting rapid change through dramatic new measures. Where there is extensive new building and construction of infrastructure, change can be more rapid.

Transport

Finally, consider the modelling in the IEA scenarios on energy usage from transport. Clearly the transport demand would – along with that from buildings – be subject to pressure and taxes arising from governments with a desire to be seen to “do something about climate change”. And on the supply side, if there is a shift from air to shipping for freight as a result of government taxes on airline fuel, could we see nuclear power used widely to power shipping well before 2050? Nuclear power is particularly suitable for vessels which need to be at sea for long periods without refuelling. Over 150 ships, including ice-breakers, submarines and aircraft carriers, are already powered by more than 220 small nuclear reactors and more than 12,000 reactor years of marine operation have been accumulated⁹. This would have a double effect: reduction of demand for aircraft fuel, which for a number of reasons is likely to remain oil based, through increased use of shipping; and reduction in use of oil for shipping.


2050 timeframe

So, in summary, from the point of view of a futurist and scenario thinker, in the timescale of the IEA report it is important to consider ways in which the rules might change, in addition to the effect of the technology advances flagged by the IEA. We have highlighted three ways in which the rules might change:

- Changes in the world order: the roles of China and India cannot be ignored in the 2050 timeframe, and could accelerate the rate of penetration of new technologies and energy supply systems;
- Changes in consumer, and hence political, attitudes that cannot be ignored as a source of future uncertainty;
- And in the longer term, the potential effect of biotechnology.

The consumer

But, that said, would the author have written a different report at the behest of the G8 with their agenda? The core might have been the same, but the report would certainly have also included the view from the consumer. It would have attempted to provide trend data for China, in particular, and, separately, to explore the sensitivity of the demand curves to assumptions about China. However, this report represents an attempt to capture the energy options for the globe based on current perspectives.

Since 2002 Gill Ringland has written and consulted widely as Fellow and Chief Executive of St Andrews Management Institute Consulting on using scenarios to make more robust management decisions. She has recently published the second edition of “Scenario Planning” and edited “Scenarios in Marketing” with Laurie Young. 

⁹Nuclear-powered ships, World Nuclear Association, March 2005
<http://www.world-nuclear.org/info/inf34.htm>