



# Science in the New Parliament



## Introduction

The Parliamentary Office of Science and Technology (POST) is the UK Parliament's in-house source of briefing and analysis on policy issues with a basis in science and technology. After every general election, POST produces a special briefing highlighting some of the main science-based issues that the new Parliament is likely to encounter. Some have already been covered by POST in its series of regular briefings for parliamentarians (POSTnotes) and others will be the subject of future notes.

## Context

Rapid progress in science and technology continually transforms our lives. It is one of many interconnected drivers of change, along with population trends, competition for resources (water, energy, food and land), climate change and economic challenges. The new Parliament will debate a wide range of issues on which science and technology have an impact, from regulating the internet to tackling poverty.

## Governance Challenges

### Biotechnology, New Drugs and the NHS

Developments in synthetic biology may allow new life-forms to be designed and built. Simple viruses have already been made from their chemical components and the focus has shifted to more complex systems. 'Synthia' – a bacterium containing a synthetic genome – marks the next step in building designer organisms. These developments are likely to raise regulatory issues, such as how to assess the safety of novel, synthetic organisms.

Research into how cells and genes work is paving the way for a new generation of cancer treatments and cell-based therapies. These raise ethical issues, such as the use of embryonic stem cells. They are also complex and often tailored to individual patients, making them expensive. The NHS already struggles to fund existing treatments; it spent £11 billion on prescription medicines in 2009. The new government has pledged to reform the body that assesses the cost-effectiveness of NHS treatments (NICE) and to move towards value-based pricing. The new Parliament is thus likely to see debate on the pros and cons of such a move and its impact on the pharmaceutical sector.

### Global Regulation of Greenhouse Gas Emissions

Global regulation of carbon dioxide (CO<sub>2</sub>) and other greenhouse gas emissions is being negotiated. Policies will need to prevent industries relocating to avoid regulation

(known as carbon leakage). The EU Emissions Trading System could be linked to other systems around the world. To account for emissions 'embedded' within products, and to avoid carbon leakage, the cost of carbon could be included in border tariff agreements on imports and exports.

## Climate Change Adaptation Strategies

Debate will continue about how developed countries, responsible for most historical greenhouse gas emissions, can help developing countries to adapt to impacts such as drought and sea level rise. Another question is how to cope with acidification of the oceans caused by rising CO<sub>2</sub> levels. By damaging marine ecosystems such as coral reefs, this is affecting coastal protection and livelihoods. Geo-engineering options, aimed at sequestering CO<sub>2</sub> or counteracting warming effects in the atmosphere, would be the most radical way of addressing climate change impacts. It would require an international framework to regulate any actions that could have global consequences.

## Intellectual Property

The 2010 Digital Economy Act aimed to protect intellectual property online but some controversial provisions will require further scrutiny. In particular, it allows for 'technical measures', such as internet account disconnection, to be taken against users found to be infringing copyright persistently.

Guidance on gene patenting has changed over the years and some existing patents are facing legal challenges. One issue is whether naturally occurring gene sequences are patentable at all. A recent US case examined the validity of the patents granted on two genes implicated in hereditary breast and ovarian cancer. It ruled that they were products of nature and hence un-patentable. An appeal is likely but the eventual outcome may have widespread implications for UK researchers and the NHS.

## Internet Regulation

The growth in internet use poses regulatory challenges.

- Internet traffic is global but regulations vary between countries. Problems can arise at interfaces: for instance, a user in one country accessing computer resources in another may not know which country's data protection laws apply.
- This could be exacerbated by the shift to 'cloud computing', whereby applications and data storage are outsourced to remote providers.
- Online attacks can be used to gain access to personal information or to commercial or government data.
- The current generation of internet protocol (IP) addresses, which identify devices on the internet, is running out. The replacement system may not be rolled out in time to avoid problems.
- There will be on-going debate over whether to allow some types of internet traffic to be prioritised over others or whether to preserve 'network neutrality'.

## Managing Public and Personal Data

The last Parliament saw progress on opening up non-personal public sector data, such as crime statistics, for use by the public. The new government has pledged to increase the amount of data released. Decisions will have to be taken about how to standardise these data. It has also proposed an online "Public Reading" stage for proposed laws to give the public an opportunity to comment on them.

Debate will continue over management of personal data. For instance, the government has announced that the DNA profile of suspects not convicted of an offence will no longer be retained on the National DNA Database (unless the suspected offence was sexual or violent). Other measures include halting plans for the next generation of biometric passports and preventing schools fingerprinting pupils without parental permission. Some measures will require legislation. There is likely to be debate over how to regulate data held by the private sector, such as CCTV footage.

Another key question is whether personal data should be held by the government in large, centralised databases or in distributed systems over which individuals have more control. Electronic privacy is a growing issue more generally, as shown by the recent controversy over changes in Facebook privacy settings. Government IT projects have been attacked as large, bureaucratic and wasteful. Critics have argued for smaller, more flexible projects, and wider use of open-source software in government.

## Health Inequalities

In 2010, the last government commissioned a review of health inequalities in England and found that the lower people's social position, the poorer their health. It estimated that each year inequalities cost £31-33 billion in productivity losses, £20-32 billion in lost taxes and higher welfare payments and £5.5 billion in NHS healthcare costs. It recommended that health inequalities should be a key, cross-cutting policy area.

## People

### Behaviour and Policy

Understanding why people make the decisions they do, and applying that knowledge to encourage behaviour change, is an increasingly important feature of policy-making. Sexually transmitted infections and health problems caused by obesity, alcohol consumption and chronic disease are largely preventable through changes in lifestyle. Several strategies have been used to encourage behaviour change, with varying success. They can involve carefully targeted incentives or disincentives, or restricting or enabling choice. Such strategies may have relevance for pension policy, to encourage people to make greater provision for old age at an earlier stage of their lives, and for environmental policies achieved by altering patterns of consumption. Those who take action are not always the main beneficiaries: for example, future generations will gain most when it comes to addressing climate change.

### Health, Ageing and Long-term Care

Pandemic diseases for which there are limited treatments (such as H1N1 influenza) have widespread social, health and economic repercussions. It is uncertain which infections may emerge in future, and there is particular concern about inter-species disease transfer. Global responses are necessary to meet these challenges.

Nationally, an ageing population will result in increased numbers of people with long-term health conditions that require continuous treatment, such as dementia and diabetes. Debate about providing care for those with the greatest needs is likely to feature prominently in the new Parliament. The previous government introduced the Personal Care at Home Bill, to offer free personal care at home for those with the highest needs, but it cannot be implemented without further votes in both Houses. The Bill was intended as a first step towards creating a new National Care Service. A key issue for the new Parliament is whether this will go ahead and how social care will be funded, for example through a voluntary insurance scheme. The projected cost of providing social care to older people is expected to rise to £29.5 billion by 2026.

### Poverty Reduction

Debate will continue over how to accelerate progress towards the Millennium Development Goals (MDGs). Many of these, such as reducing maternal mortality, are not on track to be met by the target date of 2015, in spite of significant advances since they were originally set. In September 2010, world leaders will attend a summit in New York to stimulate progress. Science and technology can play a key role in achieving MDGs. For example, deaths of children under five have steadily declined worldwide from 12.6 million in 1990 to 9 million in 2007, due largely to immunisation campaigns and the increased use of insecticide-treated mosquito nets to prevent malaria. The new government has pledged to spend 0.7% of Gross National Income on overseas aid from 2013, and to enshrine this commitment in law.

## Resource Availability

Demographic factors such as the increase in world population and the trend towards city living (over 50% now live in urban areas), and rapid expansion in developing economies will place pressure on food, water, energy, land and other natural resources.

## Environmental Security

Increased consumption of natural resources (Box 1) results in both immediate effects such as high commodity prices and long-term, cumulative effects like biodiversity loss. In October 2010, the Convention on Biological Diversity will set new international targets and trigger debate on how to stem rates of biodiversity loss. "Reducing Emissions from Deforestation and Degradation" is a proposed scheme that involves paying developing countries to maintain their tropical forests. Another key approach is to determine the full costs of the impacts of natural resource use on the environment. The economic value of these impacts, such as biodiversity loss, can then be included in the price of products and services.

Technology can help people to conserve or reclaim natural resources and to use them more efficiently. This will deliver more resilient systems of production. For example, genetically modified crops can increase yields and withstand harsher conditions. 'Synthetic meat' could reduce requirements for fertiliser, land and freshwater. However these technologies raise issues of public acceptability. This is also an issue for measures such as green taxation, aimed at reducing levels of consumption.

### Box 1. Natural Resource Issues

- Land availability affects the provision of food, timber, and other goods, as well as services such as housing, transport, energy, recreation and tourism.
- The buying or leasing of land in developing countries by developed countries for food production may impact on indigenous populations and their environment.
- Increased demand for agricultural products will place a greater reliance on fertilisers and pesticides, which are likely to increase in cost and have negative environmental impacts.
- There will be increased pressure on the supply of fresh water. Globally, people now use over half of all renewable and accessible fresh water. In the UK, limits are being reached in southern and eastern England.
- Water use embedded within products will become an issue for goods imported from areas of water scarcity.
- Global fish catches have declined despite increased fishing effort. The European Commission is reforming the Common Fisheries Policy to protect fish populations.
- The availability of rare minerals and metal ores, such as indium, niobium, titanium, cobalt and copper is a key geopolitical issue. These are critical to the manufacture of strategic goods, including renewable energy and military technologies.

## Energy Supply and Security

Energy policy must take into account affordability for consumers, security of supply and the environment.

- The UK has a 2020 target to reduce its greenhouse gas emissions by 34% from 1990 levels.

- Use of renewable sources will need to increase to meet the UK target of supplying 15% of its energy (for heat, transport and electricity) from such resources by 2020. The new government seeks to increase this target.
- Any decision to build new nuclear power plants in the UK will have to take into account long-term storage of nuclear waste and global non-proliferation issues
- Nearly half of UK electricity is generated from gas, and dependence on imports is likely to increase over the next decade. Geo-political issues may arise over new gas pipelines between Russia and Germany (2011) and the Caspian and Europe (2015).
- New drilling technologies could make previously inaccessible UK gas supplies commercially viable.
- Carbon capture and storage technologies are under development. New coal power stations are currently required to capture 25% of their emissions and this percentage is expected to increase.

## Infrastructure Communications

The state of the UK's broadband infrastructure has moved up the political agenda. There are two related goals:

- universal access. More public services are being delivered online. The last government set a target of broadband access for all by 2012 and the EU is considering a universal broadband obligation. The minimum speed offered remains to be decided.
- increased speed. The UK's broadband is slower than many other developed countries. Communications providers are upgrading their networks but this could lead to a new 'digital divide' as urban areas are likely to receive faster services first.

Issues include how such a fast, universal network should be funded and whether government intervention will be necessary. Mobile and wireless broadband will play an increasing role. The digital switchover will release radio spectrum by 2012. Ofcom, the communications regulator, has yet to finalise how to allocate this spectrum, given competing demands, including high-definition television.

## Transport

Transport accounts for just over a third of the UK's energy use, and a quarter of its greenhouse gas emissions, with the majority coming from passenger cars and HGVs. Nearly two-thirds of CO<sub>2</sub> emissions from household car journeys are from journeys of less than 40km.

If combined with an increase in low-carbon electricity generation, electric vehicles could play a role in reducing greenhouse gas emissions. For significant take-up, the necessary infrastructure would have to be in place, including standardised batteries, recharging points across cities, and a modified electricity network. The government has mandated the creation of a national recharging network for electric and plug-in hybrid vehicles. High speed rail offers an alternative to roads for longer journeys. Proposals for a network of high-speed lines from London to the north would

increase capacity and reduce journey times, leading to lower greenhouse gas emissions compared with new motorways or increased domestic aviation.

CO<sub>2</sub> emissions from aviation are expected to triple from 2005 levels by 2050. This is largely due to increased air traffic. Aviation produces around 2% of global CO<sub>2</sub> emissions. Forecasts from the Department for Transport suggest that it could account for around 25% of the UK's greenhouse gas emissions in 2030. In the short term, emissions savings from improved aircraft technology are not likely to offset growth from increased traffic. From 2012, greenhouse gas emissions from aviation will be included in the EU Emissions Trading System. There is likely to be increased attention on emissions from shipping, which account for 3-4% (and rising) of global CO<sub>2</sub> emissions.

### **Defence**

A Strategic Defence Review will take place in 2010. A Green Paper produced by the last government highlighted the critical role of cyberspace and satellite capabilities. It suggested that reliance on these technologies makes the UK vulnerable, particularly given the military's dependence on civilian infrastructure that it does not control. The paper also argued that the UK has tended to rely on technological superiority in military operations, but that this would be hard to maintain in future. Combined with budget pressures, this will mean that the balance between expenditure on people and on equipment could be a key area of debate.

Given the growing number of countries acquiring nuclear technology and material, measures to prevent the spread of nuclear weapons will remain high on the agenda. In April 2010, 47 countries agreed to take steps to improve the security of nuclear material (including securing all vulnerable nuclear material within 4 years) to reduce the threat of nuclear terrorism.

### **Built Environment**

The need for more buildings must be balanced against requirements to minimise environmental impacts of development. For example, energy use in buildings accounts for nearly half, and domestic buildings more than a quarter, of UK CO<sub>2</sub> emissions. Challenges include:

- balancing land availability for development against other demands for land;
- maximising the quality of the built environment, for the health and well-being of the population;
- introducing green infrastructure strategies to reduce air pollution, water pollution and flood risks, and to enhance urban biodiversity;
- demonstrating the effectiveness of sustainable building technologies on a large scale, such as technologies for reducing CO<sub>2</sub> emissions and water usage or novel construction techniques and materials;
- developing cost-effective and acceptable ways to increase resilience of buildings to flooding.

### **Resilience of Infrastructure**

A range of hazards potentially threatens UK infrastructure, from extreme weather to terrorism. Events such as recent flooding and the 2010 volcanic eruption in Iceland highlight the importance of accurate risk assessment and preparedness. Interdependency is a key area of concern, as failure of one infrastructure asset can have unexpected consequences across the network. For example, in the Cumbrian floods of 2009, a collapsing bridge severed communication cables serving 40,000 people. A new responsibility was given to Ofcom in 2010 to report on the resilience of the UK's communications infrastructure. Resilient space-based infrastructure is also crucial, as an increasing range of services relies on satellites for communication and navigation. Threats to this infrastructure include space debris and solar activity.

Future climate change may have consequences for UK infrastructure. Changing weather patterns and periods of drought could place extra pressure on water supplies and more frequent spells of heavy rain increase the risk of flooding. The Department of Environment, Food and Rural Affairs, which heads the cross-departmental "Adapting Infrastructure to Climate Change" programme, is developing climate change risk assessments to identify vulnerabilities.

### **Delivering Science**

#### **The UK Science Base**

Maintaining the UK science base in the face of economic stringency will be an issue. A number of reports in 2010 highlighted key questions:

- how best to measure the economic and social impact of research. The House of Lords Science and Technology Committee recently argued that a fair way of assessing impact has not yet been found;
- how much weight to give to impact in funding decisions. The Research Excellence Framework (REF) is the proposed new system for assessing the quality of research in UK higher education institutions, taking into account its wider impact. The new government has delayed the introduction of the REF;
- the relative roles of the science community and government in setting priorities for research;
- how to improve the quality of science teaching and maintain numbers of students in science subjects.

#### **Scientific Advice to Government**

The relationship between scientific advisers and government ministers came under scrutiny in the last Parliament, particularly following debate on the relative harm of illegal drugs. The government published its "Principles of Scientific Advice to Government", which have now been incorporated into the ministerial code, but some scientists are concerned that the requirement that "government and its advisers should not act to undermine mutual trust" will be hard to define. The science community has also called for a Chief Scientific Adviser to be appointed to the Treasury to advise on science funding.